

**Assessment of the Georges Bank
Atlantic Cod Stock for 2005**

**by Loretta O'Brien, Nina Shepherd,
and Laurel Col**

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**U.S. DEPARTMENT OF COMMERCE
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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 1978-2004 based on analysis of USA and Canadian commercial landings data and research vessel survey data through 2004. Estimates of 2004 fishing mortality and spawning stock biomass, 2005 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 2004 were estimated at a record low 4,583 mt, a 42% decrease from the 7,963 mt landed in 2003. The USA fleet landed 76% of the total, and the Canadian fleet landed the remaining 24%. Fishery-independent surveys conducted by the Northeast Fisheries Science Center show similar trends in both biomass and numbers of cod since 1982. The 2004 indices remain below the long term average. Autumn recruitment indices of age 1 cod have been below the time series average since 1989 and among the lowest in the time series.

Spawning stock biomass declined from about 93,000 mt in 1980 to a record low of 17,340 mt in 1995, and had increased to 30,000 mt by 2001 primarily due to the growth of the 1996 and 1998 year classes. The 2004 estimate of SSB was 22,564 mt, a decrease of 25% from 2001. Fishing mortality doubled between 1979 and 1985, increased to a record high of 1.5 (72% exploitation rate) in 1994, and has since declined to 0.24 (19% exploitation rate) in 2004. The 2004 year class (10.4 million age 1 fish) was strong, but below the time series average (14.7 million age 1 fish). The 2003 year class (21.2 million age 1 fish), however, is the first above average year class since 1989. This year class, and continued low exploitation with minimal discarding, offer a realistic opportunity for the stock to recover toward the SSB_{MSY} of 217,000 mt.

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 1978-2004 based on analysis of commercial landings and research vessel survey data through 2004. This stock was last assessed and peer reviewed in October 2002 (O'Brien *et al.* 2002). Landings were 12,769 mt in 2001 and fully recruited F (ages 4-8, unweighted average) was estimated to be 0.38 in 2001, the second lowest F in the time series (1978-2001). Spawning stock biomass was 29,170 mt in 2001 and continued the increasing trend from the record low estimate of 17,375 mt in 1995. Since 1991, recruiting year classes were all below the long term average and the 2000 and 2001 year classes were the lowest in the time series. The NEFSC spring and autumn bottom trawl survey indices continued to remain near record low values. Autumn recruitment indices for age 2 fish from the 1994 through 1998 year classes were all below the time series (1963-2000) average. The most recent above average autumn recruitment index occurred in 1993.

The current assessment presented here is considered an update and the methodology has remained the same as in the 2002 assessment (O'Brien *et al.* 2002). The life history of Georges Bank cod and the history of the commercial fishery are described in O'Brien (1999). An outline of the history of management is provided in Appendix 1, Tables 1 and 2.

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). 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 1997-2004 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). In May 2004, dealers started submitting the dealer report electronically.

Total commercial landings of Georges Bank cod in 2004 were estimated to be a record-low 4,583 mt, 42% lower than in 2003 (Table 1, Figure 1). The USA fleet landed 76% (3,471 mt) of the total, and the Canadian fleet landed the remaining 24% (1,112 mt).

USA cod landings are generally highest in the second calendar quarter (April-June) and are taken predominantly from the western part (statistical areas [SA] 521-522, 525-526, 537-539, and Subarea 6) of Georges Bank throughout the year (Figures 2 and 3). The majority of the landings from the eastern part (SA 561-562) of Georges Bank are taken in the first and second calendar quarter (January to June; Table 2). 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 (69%) and gillnet gear (16%) during 2000-2003. In 2004, otter trawl gear accounted for the majority (80%) of the USA landings (Table 3). Canadian landings were taken primarily by the longline (53%) and otter trawl (34%) fisheries during 2000-2003. In 2004, otter trawl gear accounted for 55% and longline gear accounted for 30% of the Canadian landings (Hunt *et al.* 2006).

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 (63%) and number (69%) in 2000 (Table 4). Historically, 'market' cod have accounted for 37-67% of the landings by weight.

Commercial Discards

Preliminary estimates of the weight of fish discarded on otter trawl and gillnet trips were derived for 1989-2004 using the Sea Sampling Database. Discard ratios were estimated as the amount of cod discarded to the amount kept for catch taken for all of Georges Bank (SA 521-522, 525-526, 537-539, 561-562). Discard to kept ratios ranged from 0.001 to 0.12 in the otter trawl fishery and from 0.001 to 0.193 in the gillnet fishery, but were predominantly less than 0.10 in both fisheries (Appendix 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 300 and 8,600 mt, accounting for 1-19% of the total landings (Table 5). Recreational landings were 346 mt in 2004 and accounted for 2.6% of the total (total commercial + recreational) landings.

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) there was a 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 (Northeast Fisheries Science Center 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 6 and 7. Sampling intensity was very high in 2004 with 1 sample per 27 mt for the USA (Table 7) and 1 sample per 9 mt for the Canadian fishery. The average number in each length sample was 70 fish for the USA and 141 fish for Canada during 2004. 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 'scrod' market category, and the third and fourth quarter for the 'medium' and 'large' market category.

Recreational Landings

During 1981-2003, the number of fish sampled ranged from 0.01 to 0.06% of the total number landed. In 2004, 0.11% of the fish landed were sampled (a total of 190 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 landed at age. Annual estimates of landings at age were obtained by summing values over market category and quarter (Table 8). 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 disaggregated 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 1997-2004 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 gillnet samples were pooled, and the handline and longline samples were pooled and then applied to the corresponding combined landings. The 1994-2004 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 8). The USA eastern Georges Bank landings-at-age was included in the Canadian assessment of cod in area 5Zj,m (Hunt *et al.* 2006).

Canadian landings-at-age data (Table 9) from the Northeast Peak of Georges Bank (SA 551-552) were provided by J. Hunt (DFO, St. Andrews, NB, pers. comm) for 2004. Canadian and USA data were combined to produce a total landings-at-age matrix for 1978-2004 (Table 10). The USA fishery accounted for 75% and 76% of the total landings by number and weight, respectively in 2004.

Total commercial landings and USA landings in 2004 were dominated in numbers by age 3 fish from the 2001 year class and in weight by age 6 fish from the 1998 year class (Table 11, Figure 4). In the Canadian fishery the landings were dominated by the 1998 year class in both weight and numbers of fish (Table 11, 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 8-10. 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 2003 and 2004 are the highest in the time series and may be due to the increase in mesh size in 2002 and the high sampling

intensity. Variability in mean weight of the older fish in recent years may be due to fewer older fish (age 10+) being landed. Beginning year stock mean weights at age, derived from catch mean weights at age (Rivard 1980) are presented in Table 12 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. Total standardized or 'raised' effort was calculated by dividing total USA landings by the standardized LPUE (O'Brien and Munroe 2001)

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, effort data collected since 1994 may no longer be equivalent to the historic 1978-1993 effort series. Additionally, the effort estimated since 1994 has been derived from provisional data. Given these uncertainties the effort data was not analyzed for 2001-2004. The LPUE series has not been used as an index of abundance in the calibration of the VPA since 1993.

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 Georges Bank cod (strata 13-25) during 1963-2004 (Table 13). All surveys were conducted with a Yankee #36 trawl except for spring surveys during 1973-1981, when a Yankee #41 trawl was employed. No adjustments were made for gear changes; 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 (Northeast Fisheries Science Center 1991). The entire time series for both spring and autumn was re-estimated in 2001 (O'Brien and Munroe 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 3, Tables 1 and 2.

NEFSC spring and autumn catch-per-tow biomass and abundance indices show similar trends throughout the time series (Table 13, Figures 6 and 7). Survey biomass indices were relatively stable between 1963 and 1971, 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 indices have improved slightly since 1994 and have fluctuated with no trend. Both the spring and autumn biomass and abundance indices remained below average in 2004. 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 3, Table 2; Figures 8 and 9). The 2003 year class at age 1 is the strongest year class since the 1992 year class (Figure 10). The magnitude of an above-average year class has been declining over time, particularly noticeable in the recruits at age 1 (Figure 10).

Canadian Surveys

Canadian research vessel bottom trawl surveys have been conducted during February on Georges Bank since 1986. Survey abundance indices for age 1 indicate a strong year class in 1996 and above average year classes in 1998 and 2003. Age 2 indices have fluctuated and generally declined during 1990-2003 (Appendix 3, Table 3; Figure 11). Indices for 2005 were not available due to vessel problems encountered during the survey (J. Hunt. pers. comm.). Abundance indices for ages 1 and 2 indicate above-average recruitment of the 1985, 1988, and 1990 year classes (Figure 11). In 1993, 1994, and 2005, 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 3, Tables 1 and 2). Total mortality was estimated using Heincke's method (Ricker 1975) with spring data as:

$$\ln (\Sigma \text{ age } 4+ \text{ for years } i \text{ to } j / \Sigma \text{ age } 5+ \text{ for years } i+1 \text{ to } j+1) ,$$

and with autumn data as:

$$\ln (\Sigma \text{ age } 3+ \text{ for years } i-1 \text{ to } j-1 / \Sigma \text{ age } 4+ \text{ for years } i \text{ to } j) .$$

A three-year moving average was fit to each survey series (Figure 12a-12b) and also to the sequential spring and autumn mortality estimates (Figure 12c). 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 in a Virtual Population Analysis (VPA) to derive estimates of instantaneous fishing mortality (F) in 2004 and beginning-year stock sizes in 2005. The landings at age data used in the VPA consisted of combined USA and Canadian commercial landings from 1978-2004 for ages 1-9 with a 10+ age group (Table 10). The indices of abundance used to calibrate the VPA included the NEFSC 1978-2005 spring survey indices for ages 1-8, the Canadian 1986-1992 and 1995-2004 spring survey indices for ages 1-8, and the NEFSC 1977-2004 autumn survey indices for ages 0-6 (Appendix 3). The NEFSC spring survey was disaggregated 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 1982-2005 for the #36 trawl. The autumn survey indices were shifted forward one age and one year to match cohorts in the spring survey in the subsequent year. The transformed (ln) observed survey indices, standardized to the mean, generally show similar trends between surveys (Figure 13).

Comparative VPA Calibrations

Since the last assessment in 2002 (O'Brien *et al.* 2002), modifications have been made to the VPA software. In addition, revisions occurred in the USA 2000 and 2001 age samples and the Canadian commercial catch at age for 2001. The VPA from the 2002 assessment (O'Brien *et al.* 2002) was recalibrated with each of these modifications to determine any effects on the estimates of F and stock size in 2001. The VPA was first run using the new NFT software, then each change was sequentially added to the next VPA calibration (Table 13). Comparison of the new NFT software results vs. FACT software results did not show any substantial change in the original estimates, and neither did the upgraded age data, or the revised Canadian catch-at-age data (Table 14). Based on these results, the revised NFT software and the updated data were used for the final VPA calibration for terminal year 2004.

Final VPA

The base ADAPT formulation provided stock size estimates for ages 1-8 in 2005 and corresponding F estimates for ages 1-7 in 2004. Assuming full recruitment at age 4, the F on ages 8 and 9 in the terminal year was estimated as the average of the F on ages 4-7. The F on age 9 in all years prior to the terminal year was derived from weighted estimates of Z for ages 4-8. For all years, the 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, 1990-1994,

1995-1997, 1998-2000, 2001-2002, and 2003-2004 (Table 15) derived from NEFSC spring research survey data using methodology described in O'Brien (1990). Due to insufficient numbers of fish at age in annual 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 4 for estimates of F , stock size, and SSB at age, and are summarized in Table 15. Estimates of stock size were more precise for ages 2-8, with CVs ranging from 0.29 to 0.46, than for age 1 (CV=0.57). The residual patterns of the indices did not show any strong trends for the four surveys (Figure 14).

Average fully-recruited fishing mortality (ages 4-8) in 2004 was estimated at 0.24 (19% exploitation), a decrease from the 2003 estimate of 0.39 (30% exploitation; Table 15, Figure 15). In the terminal year, fishing mortality estimates from the VPA do not indicate a pronounced domed partial recruitment as observed in previous assessments (O'Brien *et al.* 2002, O'Brien and Munroe 2001). The pattern of domed partial recruitment that had started in 1994 in previous assessments is not as apparent in the present assessment. This may be due to the improved sampling of the 'large' market category during 2001-2004 compared to the minimal samples taken during 1994-1999 (Table 7). The lack of samples during 1994-1999 may have caused a biased characterization of the landings to the smaller 'market' and 'scrod' fish in the catch at age.

Spawning stock biomass declined from about 93,000 mt in 1980 to a record low of 17,340 mt in 1995. SSB slowly increased to 30,000 mt in 2001 primarily due to the growth of the 1996 and 1998 year classes.

The 2004 estimate of SSB was 22,564 mt, a decrease of 25% from 2001 -- the last year the 1996 year class dominated the SSB. The 2004 estimate is an increase, however, of 30% from the record low 1995 estimate (Table 15, Figure 16).

Since 1978, recruitment at age 1 has ranged from 2 million (2002 year class) to 43 million (1985 year class). The 2004 year class is estimated to be about 10.4 million fish at age 1, below the long term (1978-2004) average of 14.7 million age 1 fish. The 2003 year class, however, is estimated to be 21.2 million age 1 fish, well above the long term average. The previous above average year class occurred in 1990 (17.8 million age 1 fish). The 1998 year class (12.8 million age 1 fish), although below average, was the strongest since 1990. The 1994, 2001, and 2002 year classes are the poorest of the 28-year time series (Table 15, Figure 16). The survival ratio of recruits to spawning stock biomass initially indicates a trend similar to the estimates of recruits at age 1; however, after 1991 the relationship is not as apparent (Figure 17). In the last decade, low recruitment at age 1 has generally been associated with low SSB in contrast to the earlier time period (1978-1990) when higher recruitment was realized from higher SSB (Figure 18).

Precision of F and Stock Biomass Estimates

A conditional non-parametric bootstrap procedure (Efron 1983) 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 2005, the catchability estimates (q) for each index of abundance used in calibrating the VPA, and the F at ages 1-7 in 2004 (Appendix 5).

The bootstrap results indicate that stock sizes were well estimated for ages 2-8 with coefficients of variation (CVs) varying between 0.27 and 0.45. Stock size for age 1 was not well estimated with a CV of 0.90. The CVs for the catchability coefficients for all indices ranged between 0.09 and 0.83. The fully recruited F for ages 4+ was well estimated with a CV=0.18. The distribution of the 2004 F estimates, derived from 1,000 bootstrap iterations, ranged from 0.13 to 0.35 (Figure 19). The spawning stock biomass was reasonably well estimated (CV=0.13) and slightly higher than the NLLS estimate of 22,564 mt (Appendix 5). The distribution of the 2004 spawning stock biomass estimates, derived from the 1000 bootstrap iterations, ranged from 15,000 mt to 33,000 mt (Figure 19).

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 five years prior to the current assessment, 1999-2003. Convergence of the estimates generally occurs after about six years (Figures 20a-c). The retrospective analysis indicates a pattern of overestimating the recruits at age 1 in the recent years, and then underestimating the recruits in the earlier years (Figure 20a). There is no retrospective pattern for SSB estimates in the recent years, but there was a pattern of overestimation for 1996-1999 (Figure 20b). Estimates of fishing mortality (F) are consistently underestimated (Figure 20c). Factors influencing the retrospective pattern may include mis-reporting of catch, immigration or emigration; an unrepresentative estimate of natural mortality; mis-specification of the model; and inadequate sampling that does not properly characterize the landings.

BIOLOGICAL REFERENCE POINTS

Yield and Spawning Stock Biomass per Recruit Biological Reference Points

Yield and spawning stock biomass biological reference points (BRPs) were not re-estimated during this assessment. The Working Group on Re-Evaluation of Biological Reference Points did, however, re-estimate the BRPs with input data (Table 16) derived in the 2001 assessment using the methods of Thompson and Bell (1934) (NEFSC 2002). Input data for catch weights (ages 1-10+) and stock weights (ages 1-9) were derived from the long term average weight during 1978-2000 (O'Brien and Munroe 2001). Stock mean weights for ages 10+ were derived from an expanded age structure out to age 18 (oldest age observed in survey) at $F = F_{40\%} = 0.167$ and $M = 0.2$. The mean weights for ages 10 to 18 were estimated from the length- weight equation (O'Brien and Munroe 2001): $\ln \text{Weight (kg, live)} = -11.7231 + 3.0521 \ln \text{Length (cm)}$. The mean length at ages 10-18 were derived from the linear regression of length vs. $\ln(\text{age})$ using the 1978-1997 commercial length sample data. The partial recruitment (PR) was based on a normalized

geometric mean of 1996-1999 fishing mortality and the maturity ogive was from the 2001 assessment (O'Brien and Munroe 2001).

The newly estimated biological reference points for $F_{0.1}=0.169$, $F_{max} = 0.331$, and $F_{40\%} = 0.167$ (Table 16, Figure 21) are slightly lower than those reported in O'Brien and Munroe (2001). These BRPs were applied in the 2002 GARM assessment (O'Brien *et al.* 2002) , and in the current assessment.

Age-structured Production Model Reference Points

Maximum sustainable yield (MSY) reference points were derived from an age-structured production model (Sissenwine and Shepherd 1987) using data and results from the 2001 assessment (O'Brien and Munroe 2001). The Working Group on Re-Evaluation of Biological Reference Points developed the reference points using a Beverton-Holt stock recruit relationship with an assumed prior for the unfished recruitment and yield- and spawning stock-per-recruit information (NEFSC 2002.). The model provided the following reference points:

$F_{MSY} = 0.175$,
MSY = 35,200 mt and
 $SSB_{MSY} = 217,000$ mt.

The MSY includes commercial landings only and does not include recreational landings or discards.

Projections

Short term projections will not be presented in this assessment. These analyses will be conducted by Plan Development Team (PDT) of the New England Fisheries Management Council. A comparison of the projections conducted for Amendment 13 and the current bootstrap estimates of F and SSB are presented in Figure 22.

CONCLUSIONS

Georges Bank Atlantic cod are overfished, and overfishing is occurring. Biomass indices derived from research surveys indicate that the stock remains below the long-term average of the 43-year time series. Fishing mortality has been steadily declining since 1997, except for a slight increase in 2001, and is currently at the lowest exploitation in the time series. Spawning stock biomass reached a record low in 1995 and slowly increased, due to the growth of the 1996 and 1998 year classes; however, since 2001 SSB has been declining. The 2002-2004 F trajectory is less than that projected for A13 and the SSB is slightly higher than the A13 projection. Catch during 2002-2004 was also less than the A13 projection. Retrospective analysis indicates a pattern in which estimates of F in the last year of the VPA are less than the converged estimates of F.

The 1999 and 1998 year classes account for the majority of the USA catch and the 1998 year class accounts for the majority of the Canadian catch in 2004. The 1998 (12.8 million age 1 fish) year class, while below the long term average (14.7 million age 1 fish), represents the strongest year class since the last above-average year class that occurred in 1990 (17.8 million age 1 fish). The 1994, 2000, 2001, and 2002 year classes are the lowest in the time series. The 2003 (21.2 million age 1 fish) year class is the first above average year class since 1990, and recruited to the fishery during 2005.

The NEFSC and DFO survey biomass and abundance indices fluctuated during 2002 to 2005; however, all the indices continue to remain below the long term average. The most recent NEFSC surveys indicate that the 2003 year class may be similar in size to the 1998 year class, and the DFO spring survey indicates that the year class is above average.

The lack of strong recruitment in the last decade suggests that recovery of this stock will be largely dependent on maintaining reduced fishing mortality in the near term and husbanding the strong 2003 year class -- and potentially the 2004 year class -- to increase SSB.

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LITERATURE CITED

- Azarovitz, T.R. 1981. A brief historical review of the Woods Hole Laboratory trawl survey time series. *Can. Spec. Publ. Fish.. Aq. Sci.* 58: 62-67.
- Conser, R.J. and J.E. Powers. 1990. Extensions of the ADAPT VPA tuning method designed to facilitate assessment work on tuna and swordfish stocks. *Int. Comm. Conserv. Atlantic Tunas. Coll. Vol. Sci. Pap.* 32: 461-467.
- Efron, B. 1983. *The jackknife, the bootstrap and other resampling plans.* Bristol, England: J.W. Arrowsmith; 92 p.
- Gavaris, S. 1988. An adaptive framework for the estimation of population size. *CAFSAC Res. Doc.* 88/29; 12 p.
- Hunt, J.J., L. O'Brien, and B. Hatt. 2006. Population status of eastern Georges Bank cod (Unit areas 5Zj,m) for 1978-2006. *Transboundary Resource Assessment Committee 2006/xx*: 47 p.
- Mayo, R.K., T.E. Helser, L. O'Brien, K.A. Sosebee, B.F. Figuerido, and D. Hayes. 1994. Estimation of standardized otter trawl effort, landings per unit effort, and landings at age for Gulf of Maine and Georges Bank cod. *NEFSC Ref. Doc.* 94-12; 17 p.
- Minet, J.P. 1978. Dynamics and yield assessment of the northeastern Gulf of St. Lawrence cod stock. *Int. Comm. Northw. Atlant. Fish. Selected Papers* 3: 7-16.
- Northeast Fisheries Science Center. 2002. Working group on re-evaluation of biological reference points for New England groundfish. *NEFSC Ref. Doc.* 02-04; 254 p.
- Northeast Fisheries Science Center. 1991. Report of the 12th NE Regional Stock Assessment Workshop (12th SAW). Spring 1991. *NEFSC Ref. Doc.* 91-03; 187 p.

- Northeast Fisheries Science Center. 1997. 24th Northeast Regional Stock Assessment Workshop (24th SAW) Stock Assessment Review Committee (SARC) consensus summary of assessments. *NEFSC Ref. Doc.* 97-12; 291 p.
- O'Brien, L. 1990. Effects of fluctuations in stock abundance upon life history parameters of Atlantic cod *Gadus morhua* L., for the 1970-1987 year classes from Georges Bank and the Gulf of Maine. Masters of Science Thesis, University of Washington; 95 p.
- O'Brien, L. 1999. Assessment of the Georges Bank cod stock for 1997. *NEFSC Ref. Doc.* 99-02; 122 p.
- O'Brien, L. and N.J. Munroe. 2001. Assessment of the Georges Bank Atlantic cod stock for 2001. *NEFSC Ref. Doc.* 01-10; 126 p.
- O'Brien, L., N.J. Munroe, and L. Col. 2002. Georges Bank Atlantic Cod *in*: Assessment of 20 Northeast groundfish stocks through 2001. A report of the groundfish assessment review meeting (GARM), Northeast Fisheries Science Center, Woods Hole, Massachusetts, October 8-11, 2002. *NEFSC Ref. Doc.* 02-16; 522 p.
- Paloheimo, J.E. and A.C. Koehler. 1968. Analysis of the southern Gulf of St. Lawrence cod populations. *J. Fish. Res. Board Can.* 25: 555-578.
- Parrack, M.L. 1986. A method of analyzing catches and abundance indices from a fishery. *Int. Comm. Conserv. Atlantic Tunas. Coll. Vol. Sci. Pap.* 24: 209-221.
- Pinhorn, A.T. 1975. Estimates of natural mortality of the cod stock complex in ICNAF Division 2J, 3K and 3L. *Int. Comm. Northw. Atlant. Fish. Res. Bull.* 11: 31-36.
- Power, G., K. Wilhelm, K. McGrath, and T. Theriault. 1997. Commercial fisheries dependent data collection in the Northeastern United States. *SAW-24 Working Paper Gen.* 3.
- Ricker, W.E. 1975. Computation and interpretation of biological statistics of fish populations. *Bull. Fish. Res. Board Canada*; 382 p.
- Rivard, D. 1980. APL programs for stock assessment. *Can. Tech. Rep. Fish. Aquat. Sci.* 953; 103 p.
- Sissenwine, M.P., and J.G. Shepherd. 1987. An alternative perspective on recruitment overfishing and biological reference points. *Can. J. Fish. Aquat. Sci.* 44: 913-918.
- Thompson, W.F. and F.H. Bell. 1934. Biological statistics of the Pacific halibut fishery. (2) Effect of changes in intensity upon total yield and yield per unit of gear. *Rep. Inter. Fish. Comm.* No. 8; 49 p.
- Wigley, S.E., M. Terceiro, A. DeLong, and K. Sosebee. 1998. Proration of 1994-1996 USA commercial landings of Atlantic cod, haddock, and yellowtail flounder to unit stock areas. *NEFSC Ref. Doc.* 98-02; 32 p.

Table 1. Commercial landings (metric tons, live) of Atlantic cod from the Georges Bank and South (NAFO Division 5Z and Subarea 6) stock, 1960-2004 (* = Provisional data).

Year	Country						Total
	USA	Canada	USSR	Spain	Poland	Other	
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	8504	-	-	-	-	25901
1987	19035	11844	-	-	-	-	30880
1988	26310	12741	-	-	-	-	39242
1989	25097	7895	-	-	-	-	33098
1990	28193	14364	-	-	-	-	42503
1991	24175	13462	-	-	-	-	37630
1992	16855	11673	-	-	-	-	28567
1993	14594	8524	-	-	-	-	23113
1994	9893	* 5278	-	-	-	-	15169
1995	6759	* 1100	-	-	-	-	7859
1996	7020	* 1926	-	-	-	-	8905
1997	7537	* 2919	-	-	-	-	10435
1998	6959	* 1908	-	-	-	-	8832
1999	8061	* 1819	-	-	-	-	9880
2000	7617	* 1572	-	-	-	-	9189
2001	10635	* 2143	-	-	-	-	12778
2002	8998	* 1276	-	-	-	-	10274
2003	6646	* 1317	-	-	-	-	7963
2004	3471	* 1112	-	-	-	-	4583

Table 2. 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, 1978-2004 (SA=statistical area).

Year	Georges Bank (Division 5Z and Subarea 6)				Georges Bank West SA 521-522, 525-526, 537-539 & Subarea 6				Georges Bank East SA 561-562						
	Quarter				Quarter				Quarter						
	1	2	3	4	TOTAL	1	2	3	4	TOTAL	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	2825	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
2001	2330	3776	2401	2128	10635	2119	2740	2348	2040	9247	211	1036	53	88	1388
2002	2568	3681	1602	1147	8998	2328	2712	1475	1100	7615	249	953	126	54	1382
2003	1703	2800	1263	880	6646	1237	3074	404	62	4777	331	1342	190	6	1869
2004	925	1541	502	502	3471	687	840	478	486	2491	238	701	24	16	980

Table 2 - continued. Distribution of USA commercial Atlantic cod landings by quarter and area (Georges Bank, Georges Bank West, Georges Bank East, East) in metric tons and percentage of total landings, 1978-2004 (SA=statistical area)

Year	Percentage of Annual Landings														
	Georges Bank (Div. 5Z and 6)				Georges Bank West SA 521-522, 525-526, 537-539 and Div. 6				Georges Bank East SA 561-562				TOTAL		
	1	2	3	4	1	2	3	4	1	2	3	4			
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
2001	21.9	35.5	22.6	20.0	100.0	19.9	25.8	22.1	19.2	86.9	2.0	9.7	0.5	0.8	13.1
2002	28.5	40.9	17.8	12.7	100.0	25.9	30.1	16.4	12.2	84.6	2.8	10.6	1.4	0.6	15.4
2003	25.6	42.1	19.0	13.2	100.0	18.6	46.3	6.1	0.9	71.9	5.0	20.2	2.9	0.1	28.1
2004	26.7	44.4	14.5	14.5	100.0	19.8	24.2	13.8	14.0	71.8	6.9	20.2	0.7	0.4	28.2

Table 3. Distribution of USA commercial landings (metric tons, live) of Atlantic cod from Georges Bank (Division 5Z), and the percentage of total USA commercial landings of Atlantic cod from Georges Bank, by gear type, 1965-2004. Data only reflect Georges Bank cod landings that could be identified by gear type.

Year	Landings (metric tons, live)						Percentage of Annual Landings					
	Otter trawl	Sink Gillnet	Line Trawl	Hand-line	Other gear	Total	Otter trawl	Sink Gillnet	Line Trawl	Hand-line	Other gear	Total
1965	10251	0	582	505	9	11347	90.3	-	5.1	4.5	0.1	100
1966	10206	0	787	757	19	11769	86.7	-	6.7	6.4	0.2	100
1967	10915	0	894	704	9	12522	87.2	-	7.1	5.6	0.1	100
1968	12084	0	936	524	<1	13544	89.2	-	6.9	3.9	-	100
1969	13194	0	1371	387	<1	14952	88.2	-	9.2	2.6	-	100
1970	11270	0	1676	404	<1	13350	84.4	-	12.6	3	-	100
1971	12436	0	2334	230	2	15002	82.9	-	15.6	1.5	-	100
1972	10179	0	2071	217	10	12477	81.6	-	16.6	1.7	0.1	100
1973	12431	3	2185	206	21	14846	83.7	-	14.7	1.4	0.2	100
1974	14078	3	2548	11	9	16649	84.6	-	15.3	0.1	-	100
1975	12069	0	2435	84	4	14592	82.7	-	16.7	0.6	-	100
1976	12257	4	1519	153	5	13938	88	-	10.9	1.1	-	100
1977	18529	30	912	83	22	19576	94.7	0.2	4.7	0.4	0.1	100
1978	20862	81	1569	1180	59	23751	87.8	0.3	6.6	5	0.3	100
1979	26562	620	2707	860	159	30908	85.9	2	8.8	2.8	0.5	100
1980	32479	4491	1102	0	273	38345	84.7	11.7	2.9	-	0.7	100
1981	27694	3515	120	584	197	32110	86.2	10.9	0.4	1.8	0.6	100
1982	33371	2935	385	624	210	37525	88.9	7.8	1	1.7	0.6	100
1983	30981	1812	831	441	81	34146	90.7	5.3	2.4	1.3	0.3	100
1984	26161	2573	366	753	197	30050	87.1	8.6	1.2	2.5	0.6	100
1985	21444	2482	436	284	163	24809	86.4	10	1.8	1.1	0.7	100
1986	13576	1679	692	305	95	16347	83	10.3	4.2	1.9	0.6	100
1987	13711	1522	1636	222	71	17162	79.9	8.9	9.5	1.3	0.4	100
1988	20296	1864	1950	232	116	24458	83	7.6	8	0.9	0.5	100
1989	17946	3150	1583	119	91	22889	78.4	13.8	6.9	0.5	0.4	100
1990	21707	2316	1252	395	133	25803	84.1	9	4.9	1.5	0.5	100
1991	17892	2171	1919	286	180	22448	79.7	9.7	8.5	1.3	0.8	100
1992	11696	1747	1709	186	114	15452	75.7	11.3	11.1	1.2	0.7	100
1993	10893	1321	1316	62	78	13670	79.7	9.7	9.6	0.4	0.6	100
1994	7139	1318	1372	-	21	9850	72.5	13.4	13.9	-	0.2	100
1995	3780	1300	1660	-	18	6758	55.9	19.2	24.6	-	0.3	100
1996	4047	1552	1413	-	6	7018	57.7	22.1	20.1	-	0.1	100
1997	4583	1595	1331	-	28	7537	60.8	21.2	17.7	-	0.3	100
1998	4083	858	1995	-	23	6959	58.6	12.3	28.7	-	0.4	100
1999	4760	1452	1831	-	18	8061	59.1	18	22.7	-	0.2	100
2000	4727	1635	1238	-	18	7617	62.1	21.5	16.3	-	0.2	100
2001	7079	1532	1980	-	44	10635	66.6	14.4	18.6	-	0.4	100.0
2002	6406	1201	1347	-	43	8997	71.2	13.3	15.0	-	0.5	100.0
2003	5039	1021	566	-	20	6646	75.8	15.4	8.5	-	0.3	100.0
2004	2799	380	248	-	44	3471	80.6	10.9	7.1	-	1.3	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 4. 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, 1964-2004. Percent values, by number, are only available from 1978 onwards.

Year	Percentage by Weight				Percentage by Number			
	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
2001	18	58	25	100	7	52	41	100
2002	22	60	18	100	10	58	32	100
2003	24	67	9	100	12	71	17	100
2004	29	63	8	100	16	69	15	100

[a] Includes landings of 'mixed' cod.

Table 5. 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 1979-2004.^{1,2}

Year	Total Cod Caught		Total Cod Retained (excluding those caught and released)			
	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	262	1047	168	670	3.129	4.2
1995	456	1510	353	1170	2.387	13.0
1996	174	687	123	486	3.339	5.2
1997	404	1099	308	836	2.521	7.4
1998	377	485	209	269	2.935	3.0
1999	116	368	91	289	2.314	2.8
2000	298	890	213	636	3.214	6.5
2001	619	681	339	373	2.191	2.8
2002	366	1031	235	663	3.471	6.1
2003	469	632	230	311	4.939	3.8
2004	333	684	168	346	3.342	2.6

- 1) 1981 to present derived from new expanded catch methodology from Marine Recreational Fishery Statistics Survey (MRFSS) methodology (1 January 1997).
- 2) 1994-2001 estimates re-calculated based on sampling design change in ports sampled (July 2004).

Table 6. USA and Canadian sampling of commercial Atlantic cod landings from the Georges Bank and South cod stock (NAFO Division 5Z and Subarea 6), 1978-2001.

Year	USA				Canada			
	Length Samples		Age Samples		Length Samples		Age Samples	
	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	154	12421	154	3043	107	20782	107	1436
2001	108	8389	108	2421	108	18190	108	1509
2002	86	6400	86	2179	91	18974	91	1264
2003	92	6116	90	2135	94	20199	94	1070
2004	125	8749	107	2755	127	17859	127	1370

Table 7. USA sampling of commercial Atlantic cod landings, by market category, for the Georges Bank and South cod stock (NAFO Division 5Z and Subarea 6), 1978-2004.

Year	Number of Samples, by Market Category & Quarter												Annual Sampling Intensity						
	Scrod				Market				Large				No. of Tons Landed/Sampled		Lge	Σ			
	Q1	Q2	Q3	Q4	Σ	Q1	Q2	Q3	Q4	Σ	Q1	Q2	Q3	Q4			Σ	Scrd	Mkt
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	3	21	7	14	10	7	38	2	5	2	0	9	80	118	205	118
2000	21	19	16	27	83	20	14	13	16	63	2	2	2	2	8	18	72	192	49
2001	11	9	13	3	36	9	10	8	10	37	6	12	6	10	34	72	163	55	98
2002	5	7	7	1	20	8	10	11	6	35	14	8	6	3	31	80	153	63	104
2003	4	8	6	10	28	7	16	10	6	39	5	11	10	4	30	21	113	52	68
2004	8	11	4	10	33	13	9	7	14	43	24	12	2	11	49	8	50	20	27

Table 8. 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), 1978-2004.

Year	Age										Total
	1	2	3	4	5	6	7	8	9	10+	
<u>USA Commercial Landings in Numbers (000's) at Age</u>											
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	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	0.4	2812
2000	14	722	658	831	192	51	27	29	2	0	2495
2001	-	675	2185	529	388	105	27	14	9	1	3932
2002	-	49	929	1197	276	256	53	12	6	3	2781
2003	-	66	305	674	610	96	84	15	4	1	1855
2004	-	28	259	157	211	157	32	22	5	3	873
<u>USA Commercial Landings in Weight (Tons) at Age</u>											
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	13	1232	1564	3042	1086	314	224	258	17	0.3	7617
2001	-	1024	5149	1691	1753	606	189	113	85	14	10635
2002	-	87	2104	3673	1197	1391	359	103	56	41	8998
2003	-	132	733	2074	2491	493	537	126	36	16	6646
2004	-	56	705	524	899	823	194	184	52	34	3471

Table 8 - 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), 1978-2004.

Year	Age										Total
	1	2	3	4	5	6	7	8	9	10+	
<u>USA Commercial Landings Mean Weight (kg) at Age</u>											
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	1.705	2.492	3.661	4.973	6.225	8.263	8.975	8.746	12.206	3.053
2001	-	1.516	2.357	3.199	4.552	5.743	7.083	8.316	9.940	11.153	2.705
2002	-	1.787	2.265	3.067	4.288	5.431	6.769	8.485	10.055	12.735	3.235
2003	-	1.983	2.404	3.078	4.095	5.124	6.399	8.521	10.170	12.139	3.583
2004	-	2.005	2.719	3.347	4.268	5.247	6.178	8.242	9.450	13.428	3.976
<u>USA Commercial Landings Mean Length (cm) at Age</u>											
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	45.4	55.0	62.1	70.3	77.6	83.6	92.3	95.2	94.8	105.4	65.1
2001	-	53.1	60.9	67.1	75.3	81.4	87.3	91.7	97.9	101.3	62.7
2002	-	56.1	60.2	66.2	73.8	79.7	85.5	92.2	97.5	106.6	66.6
2003	-	58.0	61.6	66.5	72.9	78.1	84.4	93.1	98.6	105.2	69.2
2004	-	58.3	64.0	68.4	74.1	79.2	83.4	92.1	95.9	108.4	71.5

Table 9. 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), 1978-2004.

Year	Age										Total
	1	2	3	4	5	6	7	8	9	10+	
<u>Canadian Commercial Landings in Numbers (000's) at Age</u>											
1978	2	61	1977	654	201	76	56	12	12	7	3058
1979	0	371	328	763	302	55	18	9	4	3	1853
1980	1	776	1122	214	420	125	32	11	14	10	2725
1981	2	146	611	506	135	382	87	51	21	16	1957
1982	6	1287	1362	1108	744	164	222	97	21	26	5038
1983	27	744	2505	1212	201	54	10	17	12	3	4784
1984	0	26	118	376	341	123	72	19	18	39	1133
1985	4	2147	904	383	497	139	45	38	9	11	4178
1986	19	238	1298	369	145	218	29	19	9	3	2347
1987	14	2596	602	741	91	79	117	22	15	6	4283
1988	10	229	2330	320	416	68	60	110	29	29	3599
1989	0	314	281	908	123	177	31	23	37	18	1911
1990	7	340	1776	619	802	95	102	8	14	30	3794
1991	11	493	512	1242	585	516	74	47	15	20	3516
1992	70	1784	899	291	544	186	175	25	21	7	4003
1993	4	252	1069	594	171	244	91	69	17	15	2526
1994	2	140	340	594	213	34	47	22	16	2	1411
1995	0	39	164	64	54	10	2	1	1	0	335
1996	1	25	163	269	52	36	9	2	1	0	558
1997	3	90	129	251	230	60	26	7	4	1	801
1998	0	58	202	97	91	74	13	7	3	2	547
1999	1	30	236	170	48	28	23	7	1	3	547
2000	0	30	59	231	93	25	15	9	2	1	465
2001	0.1	10	197	114	210	61	18	9	3	0	622
2002	0	3	38	150	42	75	14	5	2	1	330
2003	0.2	5	67	80	141	28	38	9	2	1	371
2004	0	3	60	65	54	73	18	19	4	2	296
<u>Canadian Commercial Landings in Weight (Tons) at Age</u>											
1978	1	83	4816	1911	787	474	371	120	111	105	8778
1979	0	509	525	2842	1398	342	169	105	47	42	5978
1980	1	1042	2722	693	2101	810	228	133	177	157	8063
1981	2	198	1432	1780	702	2635	805	499	221	225	8499
1982	4	1859	3166	4230	3861	1077	2025	917	267	419	17824
1983	24	1084	5519	3853	876	335	80	176	147	37	12130
1984	0	38	293	1426	1619	745	623	202	195	621	5763
1985	3	3018	1776	1389	2371	895	368	369	94	160	10443
1986	14	373	3734	1459	809	1561	253	182	90	28	8504
1987	9	4184	1556	3303	557	596	1113	243	189	93	11844
1988	8	296	5866	1249	2375	456	557	1173	330	431	12741
1989	0	412	662	3770	671	1208	228	244	427	273	7895
1990	5	617	5020	2292	4189	633	879	85	188	456	14364
1991	12	866	1426	4280	2594	2887	527	451	127	291	13462
1992	80	2769	2300	1039	2493	1103	1248	240	264	138	11673
1993	3	393	2486	1853	767	1432	635	623	150	180	8524
1994	2	203	818	2269	1024	243	370	196	128	23	5278
1995	0	57	411	240	285	61	20	14	12	0	1100
1996	1	38	386	898	275	230	64	18	14	2	1926
1997	3	139	292	819	979	351	215	62	43	16	2919
1998	0	87	480	310	387	433	96	63	29	24	1908
1999	1	46	541	600	202	175	154	54	8	39	1819
2000	0	43	126	710	392	122	93	64	14	8	1572
2001	0	15	445	338	839	310	96	71	25	5	2143
2002	0	4	86	461	181	379	94	38	18	16	1276
2003	0.1	6	141	214	530	121	217	60	15	12	1317
2004	0	4	121	183	182	334	97	138	37	17	1112

Table 9 - 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), 1978-2004.

Year	Age										Total
	1	2	3	4	5	6	7	8	9	10+	
<u>Canadian Commercial Landings Mean Weight (kg) at Age</u>											
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
2001	0.880	1.468	2.261	2.963	4.001	5.119	5.219	7.967	9.218	14.938	3.447
2002	0.551	1.421	2.265	3.073	4.301	5.054	6.721	8.277	8.790	10.755	3.872
2003	0.524	1.344	2.119	2.658	3.755	4.363	5.693	6.902	7.610	9.391	3.550
2004	0.704	1.360	2.014	2.818	3.391	4.571	5.527	7.354	9.040	10.329	3.753
<u>Canadian Commercial Landings Mean Length (cm) at Age</u>											
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	42.7	51.2	58.4	65.9	73.4	77.1	83.4	88.5	92.6	108.0	67.3
2001	43.0	51.2	59.2	64.9	72.0	78.2	78.2	90.9	96.4	112.3	67.5
2002	37.0	50.6	59.1	65.7	73.8	77.9	85.9	91.3	94.0	100.4	70.2
2003	36.5	49.3	58.0	62.5	70.4	74.1	81.2	86.8	90.1	95.1	68.1
2004	40.1	49.8	56.9	64.0	67.9	75.1	80.3	88.6	95.0	99.3	69.0

Table 10. 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), 1978-2004.

Year	Age										Total	% of Total Landings	
	1	2	3	4	5	6	7	8	9	10+		USA	Canada
	Total Commercial Landings in Numbers (000's) at Age												
1978	2	392	7708	2290	826	129	344	47	40	15	11793	74.1	26.4
1979	34	1989	900	4870	1212	458	77	253	4	48	9845	81.2	18.8
1980	89	3778	5829	500	2308	1076	445	87	167	10	14289	80.9	19.1
1981	27	3206	4224	2466	236	1408	417	123	130	62	12299	84.1	15.8
1982	331	9142	3828	2790	2002	281	674	213	71	83	19416	74.1	25.9
1983	108	4286	8062	2456	1055	776	95	235	100	65	17237	72.2	27.8
1984	81	1307	3423	3337	841	516	458	44	171	121	10300	89.0	11.0
1985	134	6427	2443	1368	1885	412	218	203	21	97	13209	68.4	31.6
1986	156	1329	4588	801	482	630	87	72	47	29	8221	71.5	28.2
1987	26	7474	1406	2121	279	252	270	63	38	24	11953	64.2	35.8
1988	10	1574	7992	1008	1492	243	160	196	50	47	12770	71.8	28.6
1989	0	2084	2919	4145	330	539	82	43	50	18	10209	81.3	18.9
1990	7	4943	5049	1884	2267	229	245	36	17	38	14716	74.2	25.7
1991	52	1525	3243	3282	1458	1088	126	70	23	23	10891	67.7	32.3
1992	70	4171	2167	1037	1480	403	308	34	33	10	9714	58.8	41.3
1993	4	1033	4247	1115	440	472	159	143	32	17	7662	67.0	33.0
1994	2	398	1526	1826	394	96	137	46	38	6	4470	68.4	31.5
1995	0	393	1059	693	291	45	26	15	2	1	2525	86.7	13.1
1996	1	208	907	1240	242	124	15	2	4	0	2743	79.7	19.9
1997	3	517	640	884	795	132	84	15	10	4	3084	74.0	25.8
1998	0	740	1191	424	326	239	39	13	7	5	2984	81.7	18.0
1999	1	286	1926	706	201	97	119	17	2	3	3359	83.7	16.3
2000	14	752	687	1062	284	75	42	37	4	1	2958	84.5	15.5
2001	0	685	2382	643	597	166	45	22	11	2	4554	86.4	13.6
2002	0	51	967	1347	318	331	67	17	8	5	3111	89.4	10.6
2003	0.2	71	371	754	751	124	122	23	6	3	2226	83.3	16.7
2004	0	31	319	222	264	230	49	41	10	4	1170	74.7	25.3

Table 10 - 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), 1978-2004.

Year	Age										Total	% of Total Landings	
	1	2	3	4	5	6	7	8	9	10+		USA	Canada
	<u>Total Commercial Landings in Weight (Tons) at Age</u>												
1978	1	513	18975	7952	3581	750	2539	394	467	186	35357	75.2	24.8
1979	30	2971	1936	20504	5923	3285	710	2612	47	606	38623	84.5	15.5
1980	75	5517	14385	1834	13038	7185	3732	790	1404	157	48116	83.2	16.8
1981	24	4790	9960	8424	1226	10167	3578	1215	1849	1115	42348	79.9	20.1
1982	253	12819	10198	10695	10717	1832	6306	2117	891	1330	57157	68.8	31.2
1983	104	6387	19166	8124	4891	4963	759	2420	1122	951	48886	75.2	24.8
1984	85	2137	8389	12076	4274	3400	4079	448	1934	1855	38678	85.1	14.9
1985	121	9112	5096	5319	9590	2641	1765	2076	242	1309	37271	72.0	28.0
1986	145	1959	11232	2934	2701	4525	781	719	597	400	25994	67.3	32.4
1987	19	11072	3509	8884	1620	1945	2419	635	431	344	30879	61.6	38.4
1988	8	2394	18847	3537	8052	1613	1405	1949	556	690	39051	67.4	33.1
1989	0	3370	6626	15631	1777	3611	667	453	584	273	32992	76.1	24.3
1990	5	7711	12431	6638	11091	1450	2072	382	223	554	42557	66.2	33.6
1991	59	2481	8266	11223	6956	6413	933	736	223	346	37637	64.2	35.7
1992	80	6432	5340	3988	6963	2482	2318	333	401	192	28528	59.1	41.1
1993	3	1585	9567	3718	2184	3013	1195	1315	316	220	23118	63.1	36.9
1994	2	581	3309	6676	1892	716	1096	430	364	102	15171	65.2	34.8
1995	0	572	2221	2652	1599	328	273	175	21	20	7859	86.0	13.8
1996	1	313	2209	4201	1190	823	128	21	59	2	8946	78.5	21.0
1997	3	817	1484	3120	3263	792	676	135	112	53	10456	72.1	27.7
1998	0	1098	2743	1483	1539	1417	325	118	82	61	8867	78.5	21.1
1999	1	446	4283	2437	986	622	874	160	26	45	9880	81.6	18.4
2000	13	1275	1690	3752	1345	436	317	322	30	8	9189	82.9	17.1
2001	0	1036	5594	2029	2604	915	284	183	110	18	12778	83.2	16.8
2002	0	91	2189	4134	1364	1771	453	141	74	57	10274	87.6	12.4
2003	0.1	138	874	2287	3029	615	754	186	51	28	7963	83.5	16.5
2004	0	60	826	707	1082	1157	291	322	90	51	4583	75.7	24.3

Table 10 - 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), 1978-2004.

Year	Age										Mean
	1	2	3	4	5	6	7	8	9	10+	
	<u>Total Commercial Landings Mean Weight (kg) at Age</u>										
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	0.956	1.696	2.461	3.533	4.731	5.797	7.530	8.596	8.817	12.831	3.107
2001	0.880	1.516	2.349	3.157	4.356	5.516	6.323	8.178	9.766	11.951	2.806
2002	0.551	1.768	2.265	3.068	4.290	5.345	6.759	8.428	9.711	12.127	3.303
2003	0.524	1.941	2.353	3.034	4.031	4.954	6.178	7.924	9.239	10.793	3.577
2004	0.704	1.950	2.586	3.192	4.090	5.032	5.945	7.838	9.273	12.219	3.920

Table 10 - 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), 1978-2004.

Year	Age										Mean
	1	2	3	4	5	6	7	8	9	10+	
	<u>Total Commercial Landings Mean Length (cm) at Age</u>										
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	0.0	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	45.4	54.9	61.8	69.4	76.3	81.5	89.2	93.7	93.8	107.9	65.4
2001	43.0	53.1	60.8	66.7	74.1	80.2	83.6	91.4	97.5	103.6	63.4
2002	37.0	55.8	60.1	66.2	73.8	79.3	85.6	92.0	96.5	104.2	67.0
2003	36.5	57.4	61.0	66.1	72.4	77.2	83.4	90.8	95.5	100.3	69.0
2004	40.1	57.6	62.7	67.1	72.8	77.9	82.3	90.5	95.5	104.8	70.9

Table 11. Summary of USA and Canadian 2004 commercial landings of Atlantic cod from the Georges Bank and South (NAFO Division 5Z and Subarea 6).

Age	USA Catch at Age				Canadian Catch at Age				Total 2004 Catch at 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	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2	28	3.2	56	1.6	3	0.9	4	0.3	31	2.6	60	1.3
3	259	29.7	705	20.3	60	20.2	121	10.9	319	27.3	826	18.0
4	157	17.9	524	15.1	65	21.9	183	16.4	222	18.9	707	15.4
5	211	24.1	899	25.9	54	18.1	182	16.4	264	22.6	1081	23.6
6	157	17.9	823	23.7	73	24.6	334	30.0	230	19.6	1157	25.2
7	31	3.6	194	5.6	18	5.9	97	8.7	49	4.2	291	6.3
8	22	2.6	184	5.3	19	6.3	138	12.4	41	3.5	322	7.0
9	5	0.6	52	1.5	4	1.4	37	3.4	10	0.8	89	2.0
10+	3	0.3	34	1.0	2.0	0.7	17	1.5	5	0.4	51	1.1
Total	874	100.0	3471	100.0	297	100.0	1113	100.0	1170	100.0	4584	100.0
	Mean Weight Per Fish (kg)	3.973	Mean Weight Per Fish (kg)	3.749	Mean Weight Per Fish (kg)	3.916						

Table 12. Mean weight at age (kg, January 1) for Georges Bank and South cod stock (NAFO Division 5Z and Subarea 6), 1978-2002. Values derived from landings mean weights at age using the method described by Rivard (1980).

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
1	0.486	0.694	0.625	0.700	0.548	0.748	0.907	0.711	0.736	0.502	0.548	0.583	0.594	0.947
2	1.023	1.028	1.139	1.118	1.112	1.068	1.260	1.222	1.157	1.173	1.051	1.127	1.123	1.163
3	1.881	1.678	1.920	1.855	1.996	1.826	1.911	1.847	1.863	1.918	1.869	1.857	1.995	1.994
4	2.922	3.219	2.808	2.903	3.007	2.969	2.933	3.087	2.763	3.201	2.960	2.983	2.827	2.902
5	3.370	4.118	4.876	4.373	4.275	4.216	4.101	4.291	4.667	4.611	4.755	4.353	4.296	4.098
6	4.594	5.579	5.713	6.386	5.826	5.849	5.525	5.709	6.048	6.579	6.214	6.013	5.846	5.368
7	6.235	7.290	7.760	7.562	8.223	7.201	7.547	7.300	7.561	8.022	8.234	7.393	7.524	6.850
8	7.235	8.721	9.136	9.108	9.207	9.814	8.970	9.550	8.978	9.448	9.454	9.699	9.357	9.432
9	10.004	9.967	9.325	11.349	11.119	10.541	10.783	10.741	11.396	10.660	10.563	10.793	11.612	10.156
10+	13.200	12.625	15.400	18.565	16.723	14.554	15.356	13.494	14.104	15.000	15.298	17.111	14.526	15.373

Age	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1	0.993	0.674	0.711	0.703	0.660	0.765	0.352	0.581	0.759	0.621	0.294	0.272	0.490	0.487
2	1.311	1.327	1.128	1.154	1.169	1.179	1.189	0.952	1.187	1.204	1.247	1.034	1.011	1.137
3	2.002	1.864	1.824	1.748	1.893	1.870	1.905	1.816	1.963	1.996	1.853	2.040	2.243	2.019
4	3.129	2.866	2.870	2.882	2.664	2.933	2.849	2.819	2.803	2.787	2.685	2.622	2.746	2.728
5	4.011	4.369	4.002	4.482	4.337	3.728	4.090	4.136	4.041	3.924	3.680	3.517	3.524	3.737
6	5.418	5.478	6.076	5.956	6.031	5.437	4.934	5.514	5.325	5.108	4.827	4.610	4.504	4.875
7	6.651	6.799	7.150	8.924	7.861	7.301	7.019	6.600	6.954	6.054	6.106	5.746	5.436	6.059
8	8.542	8.319	8.388	9.648	9.509	8.499	8.325	8.904	7.944	7.847	7.300	7.318	6.944	7.471
9	11.263	9.772	9.454	9.863	12.234	10.008	10.463	10.229	9.082	9.162	8.912	8.824	8.506	8.897
10+	19.025	13.236	16.659	14.953	12.002	12.795	14.606	13.735	12.831	11.951	12.127	10.744	12.176	11.966

Table 13. 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), 1963-2005^{1,2,3}.

Year	Spring		Autumn	
	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
2001	1.86	5.5	1.05	2.1
2002	2.08	5.0	4.70	11.3
2003	1.98	4.2	1.25	2.1
2004	5.38	14.3	4.21	5.9
2005	1.96	4.5		
1963-2004 Average	7.3	18.7	4.30	9.0

[1] During 1963-1984, BMV oval doors used in spring and autumn surveys; since 1985, Portuguese polyvalent doors 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 used in this standardization (NEFC 1991).

[2] Spring surveys during 1980-1982, 1989-1991 and 1994 and autumn surveys during 1977-1981, 1989-1991, and 1993 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 14. Comparison of VPA formulations to the base FACT software run from the 2002 GARM (A) vs. NFT software (B), updated age data (C) and updated Canadian catch at age (D).

A				B				C				D			
FACT		New Canadian CAA 2001		NFT		Updated age data for 2000,2001		NFT		Updated age data for 2000,2001		NFT		New Canadian CAA 2001	
GARM	Mean Sq. residual : 0.589	F	SSB	VPA	Mean Sq. residual : 0.551	F	SSB	VPA	Mean Sq. residual : 0.548	F	SSB	VPA	Mean Sq. residual : 0.548	F	SSB
2002	Sum Squares: 252.01	Stock Numbers	mean 4-8	2.3.2	Sum Squares: 252.26	Stock Numbers	mean 4-8	2.3.2	Sum Squares: 250.96	Stock Numbers	mean 4-8	2.3.2	Sum Squares: 250.84	Stock Numbers	mean 4-8
2001 TY	Stock Numbers	F	SSB	2001 TY	Stock Numbers	F	SSB	2001 TY	Stock Numbers	F	SSB	2001 TY	Stock Numbers	F	SSB
1978	71127	0.542	80484	1978	71158	0.540	80628	1978	71158	0.540	80639	1978	71158	0.540	80639
1979	71052	0.348	89318	1979	71082	0.347	89516	1979	71082	0.347	89512	1979	71082	0.347	89512
1980	69317	0.490	92581	1980	69336	0.488	92763	1980	69336	0.488	92771	1980	69336	0.488	92771
1981	85166	0.466	86551	1981	85171	0.465	86618	1981	85171	0.465	86622	1981	85171	0.465	86622
1982	75953	0.652	89751	1982	75959	0.648	89854	1982	75959	0.648	89852	1982	75959	0.648	89852
1983	54244	0.580	78309	1983	54252	0.580	78434	1983	54252	0.580	78426	1983	54252	0.580	78427
1984	56341	0.644	67286	1984	56344	0.644	67334	1984	56344	0.644	67335	1984	56344	0.644	67335
1985	45370	0.738	55506	1985	45370	0.739	55517	1985	45371	0.739	55513	1985	45371	0.739	55513
1986	67920	0.490	57423	1986	67920	0.490	57438	1986	67920	0.490	57432	1986	67920	0.490	57432
1987	64543	0.480	68318	1987	64542	0.478	68326	1987	64542	0.478	68326	1987	64543	0.478	68326
1988	65484	0.786	73693	1988	65484	0.786	73696	1988	65485	0.786	73702	1988	65485	0.786	73703
1989	57655	0.598	72041	1989	57655	0.596	72052	1989	57657	0.596	72056	1989	57657	0.596	72056
1990	47154	0.658	68226	1990	47154	0.655	68244	1990	47157	0.655	68250	1990	47157	0.655	68250
1991	43147	0.842	52488	1991	43147	0.843	52502	1991	43149	0.843	52503	1991	43149	0.843	52503
1992	32080	0.808	39239	1992	32079	0.810	39249	1992	32109	0.809	39256	1992	32109	0.809	39257
1993	25642	1.162	29305	1993	25613	1.161	29305	1993	25693	1.160	29331	1993	25698	1.160	29332
1994	19384	1.492	19012	1994	19359	1.492	19004	1994	19439	1.489	19064	1994	19448	1.489	19066
1995	15755	0.660	17375	1995	15728	0.662	17342	1995	15806	0.657	17461	1995	15812	0.657	17468
1996	17501	0.462	18744	1996	17478	0.463	18695	1996	17522	0.457	18858	1996	17528	0.457	18871
1997	22317	0.932	19961	1997	22353	0.936	19906	1997	22409	0.917	20094	1997	22421	0.916	20110
1998	19800	0.748	21585	1998	19817	0.753	21546	1998	19812	0.718	21747	1998	19818	0.716	21768
1999	23776	0.644	23970	1999	23792	0.657	23950	1999	23719	0.564	24147	1999	23732	0.562	24173
2000	21392	0.346	26078	2000	21405	0.358	26076	2000	21349	0.402	26045	2000	21362	0.398	26074
2001	16361	0.380	29170	2001	16372	0.379	29187	2001	16357	0.379	28976	2001	16366	0.380	28960
2002	10931			2002	10940			2002	10935			2002	10931		
age	N	Std Err	CV	age	N	Std Err	CV	age	N	Std Err	CV	age	N	Std Err	CV
1	1650	756.00	0.46	1	1651	727.94	0.44	1	1650	725.83	0.44	1	1651	725.73	0.44
2	1270	451.00	0.35	2	1274	434.28	0.34	2	1274	433.05	0.34	2	1274	432.99	0.34
3	2710	814.00	0.3	3	2709	784.15	0.29	3	2705	781.78	0.29	3	2705	781.67	0.29
4	2870	969.00	0.34	4	2875	933.35	0.32	4	2886	931.37	0.32	4	2885	931.27	0.32
5	651	227.00	0.35	5	645	217.56	0.34	5	642	215.96	0.34	5	642	215.65	0.34
6	1020	339.00	0.33	6	1036	331.03	0.32	6	1018	326.55	0.32	6	1016	326.21	0.32
7	471	158.00	0.34	7	471	152.43	0.32	7	479	153.50	0.32	7	478	153.44	0.32
8	216	74.20	0.34	8	214	71.15	0.33	8	215	71.40	0.33	8	216	71.38	0.33

Table 15. Estimates of beginning year stock size (thousands of fish), instantaneous fishing mortality (F), 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, 1978-2004.

Stock Numbers (Jan 1) in thousands		1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Age															
1		27713	23513	20104	41392	17471	9615	27391	8669	42747	16376	23446	15673	9184	17849
2		4268	22688	19220	16380	33865	14004	7774	22353	6977	34857	13384	19187	12832	7513
3		25526	3139	16776	12319	10510	19458	7588	5182	12486	4512	21777	9531	13819	6034
4		7947	13888	1755	8461	6266	5145	8635	3115	2032	6085	2422	10571	5159	6752
5		2878	4422	6964	985	4698	2609	1990	4051	1312	943	3063	1067	4895	2521
6		1124	1605	2524	3613	594	2037	1181	869	1611	640	519	1153	574	1959
7		1434	802	900	1093	1686	232	965	500	339	752	296	205	455	263
8		67	862	587	334	517	772	104	376	212	199	371	97	93	151
9		146	12	477	402	162	231	419	45	124	109	106	126	40	44
10+		55	149	29	192	189	150	297	209	77	69	99	45	90	44
Total		71158	71082	69336	85171	75959	54252	56344	45370	67918	64541	65483	57654	47142	43129
Age															
1		6641	8183	5252	3248	5928	10096	4577	12809	7928	3436	3352	2283	21220	10398
2		14566	5374	6696	4298	2659	4852	8263	3747	10486	6478	2813	2745	1869	17373
3		4771	8147	3465	5122	3165	1990	3505	6097	2810	7904	4684	2257	2183	1502
4		2006	1943	2828	1456	3236	1774	1051	1795	3248	1679	4316	2960	1512	1499
5		2559	703	582	664	566	1533	655	478	831	1698	793	2315	1741	1037
6		745	755	178	120	281	245	537	243	209	423	850	361	1216	1187
7		620	244	191	58	58	119	82	225	111	103	196	397	184	787
8		101	228	56	32	24	34	21	32	77	53	44	100	214	106
9		60	52	57	4	13	17	13	5	12	29	24	21	61	139
10+		18	28	9	2	0	2	9	7	3	5	15	10	21	53
Total		32088	25656	19313	15005	15930	20662	18714	25438	25713	21810	17087	13448	30220	34081

Table 15 - continued. Estimates of beginning year stock size (thousands of fish), instantaneous fishing mortality (F), 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, 1978-2004.

Fishing Mortality		1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Age															
1		0.00	0.00	0.00	0.00	0.02	0.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00
2		0.11	0.10	0.24	0.24	0.35	0.41	0.21	0.38	0.24	0.27	0.14	0.13	0.55	0.25
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	0.90
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
5		0.38	0.36	0.46	0.31	0.64	0.59	0.63	0.72	0.52	0.40	0.78	0.42	0.72	1.02
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
7		0.31	0.11	0.79	0.55	0.58	0.60	0.74	0.66	0.33	0.51	0.92	0.59	0.91	0.75
8		1.48	0.39	0.18	0.52	0.61	0.41	0.63	0.91	0.47	0.43	0.88	0.68	0.56	0.72
9		0.36	0.43	0.48	0.44	0.65	0.64	0.59	0.71	0.53	0.48	0.72	0.57	0.62	0.85
10+		0.36	0.43	0.48	0.44	0.65	0.64	0.59	0.71	0.53	0.48	0.72	0.57	0.62	0.85
Total		0.54	0.35	0.49	0.47	0.65	0.58	0.64	0.74	0.49	0.48	0.79	0.60	0.65	0.84
		1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	
Age															
1		0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2		0.38	0.24	0.07	0.11	0.09	0.13	0.10	0.09	0.08	0.12	0.02	0.03	0.02	0.02
3		0.70	0.86	0.67	0.26	0.38	0.44	0.47	0.43	0.31	0.41	0.26	0.20	0.18	0.18
4		0.85	1.01	1.25	0.74	0.55	0.80	0.59	0.57	0.45	0.55	0.42	0.33	0.18	0.18
5		1.02	1.18	1.38	0.66	0.64	0.85	0.79	0.63	0.47	0.49	0.59	0.44	0.18	0.18
6		0.91	1.18	0.91	0.52	0.66	0.89	0.67	0.58	0.50	0.57	0.56	0.48	0.23	0.23
7		0.80	1.27	1.58	0.68	0.34	1.52	0.74	0.88	0.54	0.66	0.47	0.42	0.35	0.35
8		0.46	1.18	2.37	0.72	0.15	0.73	1.29	0.80	0.76	0.61	0.56	0.29	0.24	0.24
9		0.91	1.09	1.27	0.71	0.56	0.84	0.67	0.61	0.46	0.53	0.46	0.39	0.24	0.24
10+		0.91	1.09	1.27	0.71	0.56	0.84	0.67	0.61	0.46	0.53	0.46	0.39	0.24	0.24
Total		0.81	1.16	1.50	0.67	0.47	0.96	0.82	0.69	0.55	0.58	0.52	0.39	0.24	0.24

Table 15 - continued. Estimates of beginning year stock size (thousands of fish), instantaneous fishing mortality (F), 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, 1978-2004.

SSB at start of spawning season		1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Age															
1		913	1104	850	1960	1200	903	3123	773	8512	2224	3479	2473	633	1961
2		1410	7539	6913	5782	16137	6344	4303	11650	5027	25329	8902	13721	6610	4211
3		33845	3729	22417	15928	15642	26058	10500	6878	18776	7101	32836	14540	22024	9011
4		20219	38255	4297	21379	15793	12648	21655	8075	4842	17024	6128	27180	12814	16501
5		8798	16585	30442	3958	17473	9639	7110	14906	5434	3937	12377	4189	18051	8432
6		4882	8130	12541	20322	2957	10520	5655	4242	8582	3704	2764	5937	2947	8681
7		8215	5550	5918	7296	12172	1460	6226	3166	2345	5361	2024	1327	2845	1537
8		367	6810	5034	2696	4165	6840	811	2985	1705	1691	2930	811	769	1218
9		1331	112	3967	4100	1564	2116	3961	417	1252	1034	958	1193	409	373
10+		659	1698	392	3199	2750	1899	3992	2422	956	919	1304	681	1143	565
Total		80639	89512	92771	86621	89852	78426	67335	55513	57432	68324	73700	72053	68245	52490
Age															
1		764	640	72	44	76	971	203	935	175	62	29	42	705	
2		9011	3447	2817	1839	1155	3090	5325	1938	5222	3251	1488	929	619	
3		7401	11456	5195	7881	5166	3078	5495	9169	4808	13550	7638	3402	3633	
4		5218	4508	6375	3584	7612	4406	2625	4450	8169	4129	10444	6818	3743	
5		8375	2442	1788	2578	2136	4798	2271	1721	3000	5938	2559	7313	5756	
6		3351	3286	896	632	1469	1112	2292	1177	990	1901	3614	1488	5093	
7		3488	1300	1013	451	418	652	494	1241	685	543	1071	2056	911	
8		775	1504	307	266	219	248	139	242	518	364	283	674	1383	
9		561	411	422	37	137	145	121	43	96	237	188	165	483	
10+		287	296	117	28	0	21	113	87	34	56	160	100	237	
Total		39229	29289	19003	17340	18387	18521	19078	21003	23697	30033	27474	22987	22564	

Table 15 - continued. Estimates of beginning year stock size (thousands of fish), instantaneous fishing mortality (F), 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, 1978-2004.

Percent mature (females)		1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Age															
1		7	7	7	7	13	13	13	13	28	28	28	28	28	12
2		34	34	34	34	47	47	47	47	67	67	67	67	67	52
3		78	78	78	78	84	84	84	84	91	91	91	91	91	90
4		96	96	96	96	97	97	97	97	98	98	98	98	98	99
5+		100	100	100	100	100	100	100	100	100	100	100	100	100	100
Percent mature (females)		1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	
Age															
1		12	12	12	2	2	2	13	13	13	3	3	7	7	
2		52	52	52	39	39	39	57	57	57	44	44	34	34	
3		90	90	90	95	95	95	92	92	92	95	95	79	79	
4		99	99	99	100	100	100	100	100	100	100	100	96	96	
5+		100	100	100	100	100	100	100	100	100	100	100	100	100	

Table 16. Yield and SSB per Recruit for Georges Bank cod based on data from O'Brien and Munroe (2001).
 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: 21-2-2002; Time: 14:26:43.51
 Cod Georges Bank 2002 -10+ from 18+mean wt, 78-2000 weights, 96-99 P
 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: ==> GBYPR102.DAT

 Age-specific Input data for Yield per Recruit Analysis

Age	Fish Mort Pattern	Nat Mort Pattern	Proportion Mature	Average Catch	Weights Stock
1	0.0001	1.0000	0.1300	0.8880	0.6820
2	0.1900	1.0000	0.5700	1.5140	1.1460
3	0.6600	1.0000	0.9200	2.3610	1.8820
4	1.0000	1.0000	1.0000	3.6340	2.9260
5	1.0000	1.0000	1.0000	5.0240	4.2450
6	1.0000	1.0000	1.0000	6.5880	5.7160
7	1.0000	1.0000	1.0000	8.3340	7.3870
8	1.0000	1.0000	1.0000	9.7420	8.9630
9	1.0000	1.0000	1.0000	11.3660	10.4890
10+	1.0000	1.0000	1.0000	14.7360	15.2310

 Summary of Yield per Recruit Analysis for:
 Cod Georges Bank 2002 -10+ from 18+ mean wt, 78-2000 weights, 96-99 PR

 Slope of the Yield/Recruit Curve at F=0.00: --> 25.9200
 F level at slope=1/10 of the above slope (F0.1): -----> .169
 Yield/Recruit corresponding to F0.1: -----> 1.6768
 F level to produce Maximum Yield/Recruit (Fmax): -----> .331
 Yield/Recruit corresponding to Fmax: -----> 1.8234
 F level at 40 % of Max Spawning Potential (F40): -----> .167
 SSB/Recruit corresponding to F40: -----> 10.7691

 Listing of Yield per Recruit Results for:
 Cod Georges Bank 2002 - 10+ from 18+ mean wt, 78- 2000 weights,96- 99 PR

	FMORT	TOTCTHN	TOTCTHW	TOTSTKN	TOTSTKW	SPNSTKN	SPNSTKW	% MSP
	0.000	0.00000	0.00000	5.5167	28.9398	4.1019	26.9291	100.00
	0.050	0.13176	0.92201	4.8605	21.2025	3.4448	19.2924	71.64
	0.100	0.22012	1.38404	4.4213	16.4507	3.0046	14.6204	54.29
	0.150	0.28367	1.62149	4.1061	13.3248	2.6884	11.5583	42.92
F0.1	0.169	0.30318	1.67679	4.0095	12.4235	2.5914	10.6776	39.65
F40%	0.167	0.30112	1.67136	4.0197	12.5172	2.6016	10.7691	39.99
	0.200	0.33169	1.74194	3.8684	11.1619	2.4498	9.4469	35.08
	0.250	0.36936	1.79889	3.6825	9.6051	2.2629	7.9321	29.46
	0.300	0.39976	1.82056	3.5327	8.4480	2.1123	6.8094	25.29
Fmax	0.331	0.41593	1.82339	3.4532	7.8716	2.0324	6.2514	23.21
	0.350	0.42489	1.82243	3.4093	7.5643	1.9881	5.9543	22.11
	0.400	0.44604	1.81326	3.3057	6.8737	1.8837	5.2876	19.64
	0.450	0.46412	1.79810	3.2173	6.3229	1.7946	4.7570	17.66
	0.500	0.47980	1.77992	3.1409	5.8757	1.7175	4.3270	16.07
	0.550	0.49355	1.76043	3.0741	5.5069	1.6501	3.9729	14.75
	0.600	0.50572	1.74066	3.0152	5.1984	1.5905	3.6773	13.66
	0.650	0.51659	1.72119	2.9627	4.9371	1.5374	3.4272	12.73
	0.700	0.52637	1.70234	2.9155	4.7133	1.4896	3.2132	11.93
	0.750	0.53524	1.68430	2.8729	4.5197	1.4465	3.0283	11.25
	0.800	0.54332	1.66712	2.8342	4.3506	1.4072	2.8670	10.65
	0.850	0.55073	1.65084	2.7988	4.2017	1.3713	2.7251	10.12
	0.900	0.55755	1.63544	2.7663	4.0696	1.3383	2.5993	9.65
	0.950	0.56386	1.62088	2.7363	3.9517	1.3078	2.4871	9.24
	1.000	0.56972	1.60712	2.7086	3.8457	1.2796	2.3863	8.86

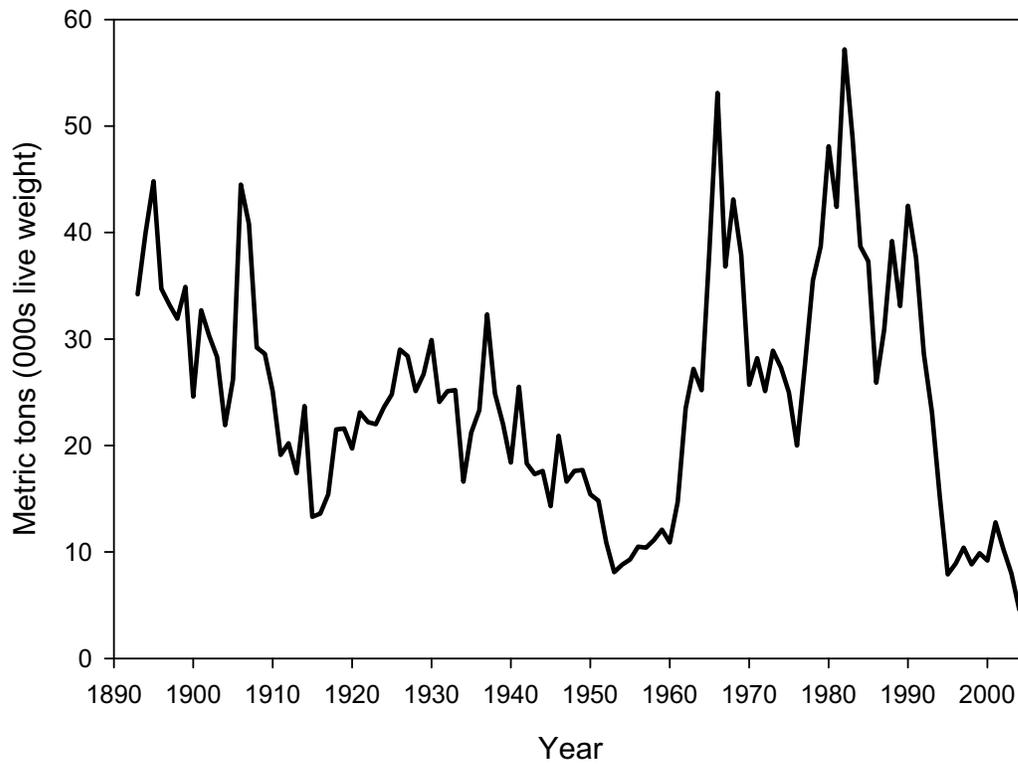


Figure 1a. Total commercial landings of Georges Bank cod, 1893-2004

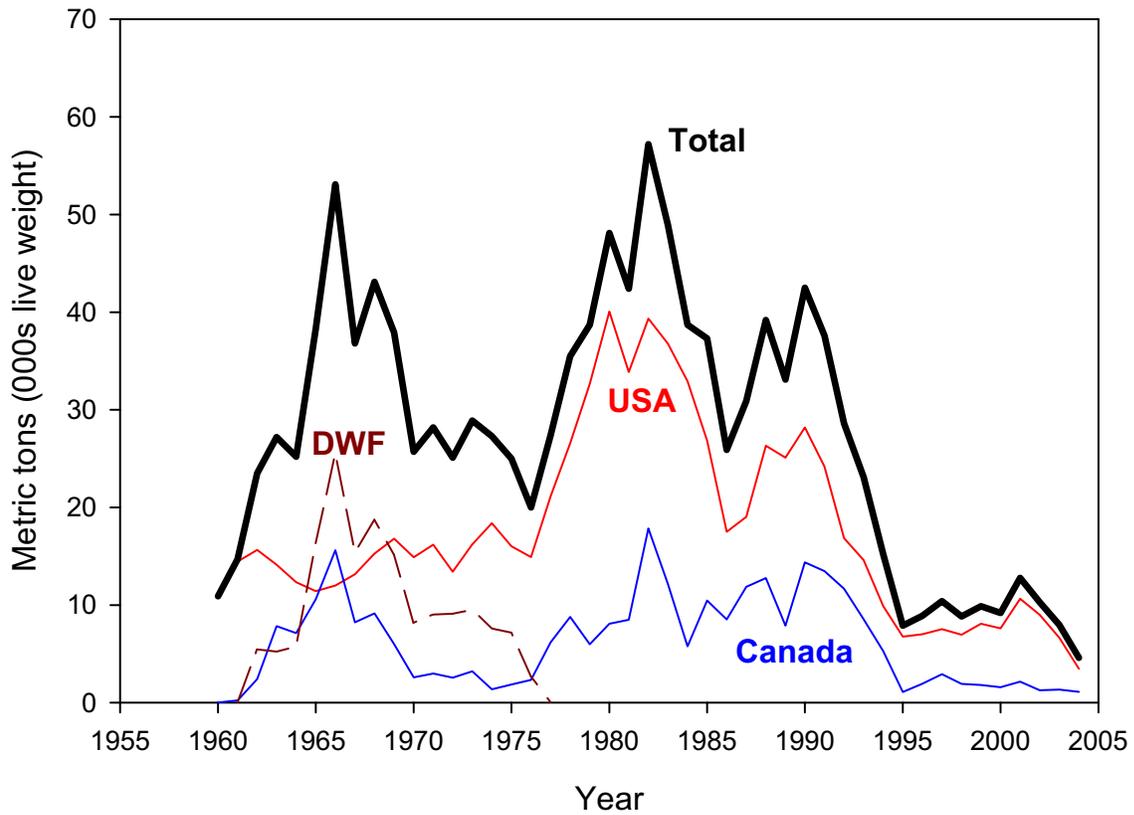


Figure 1b. Total commercial landings of Georges Bank cod (NAFO Division 5Z and Subarea 6), 1960-2004.

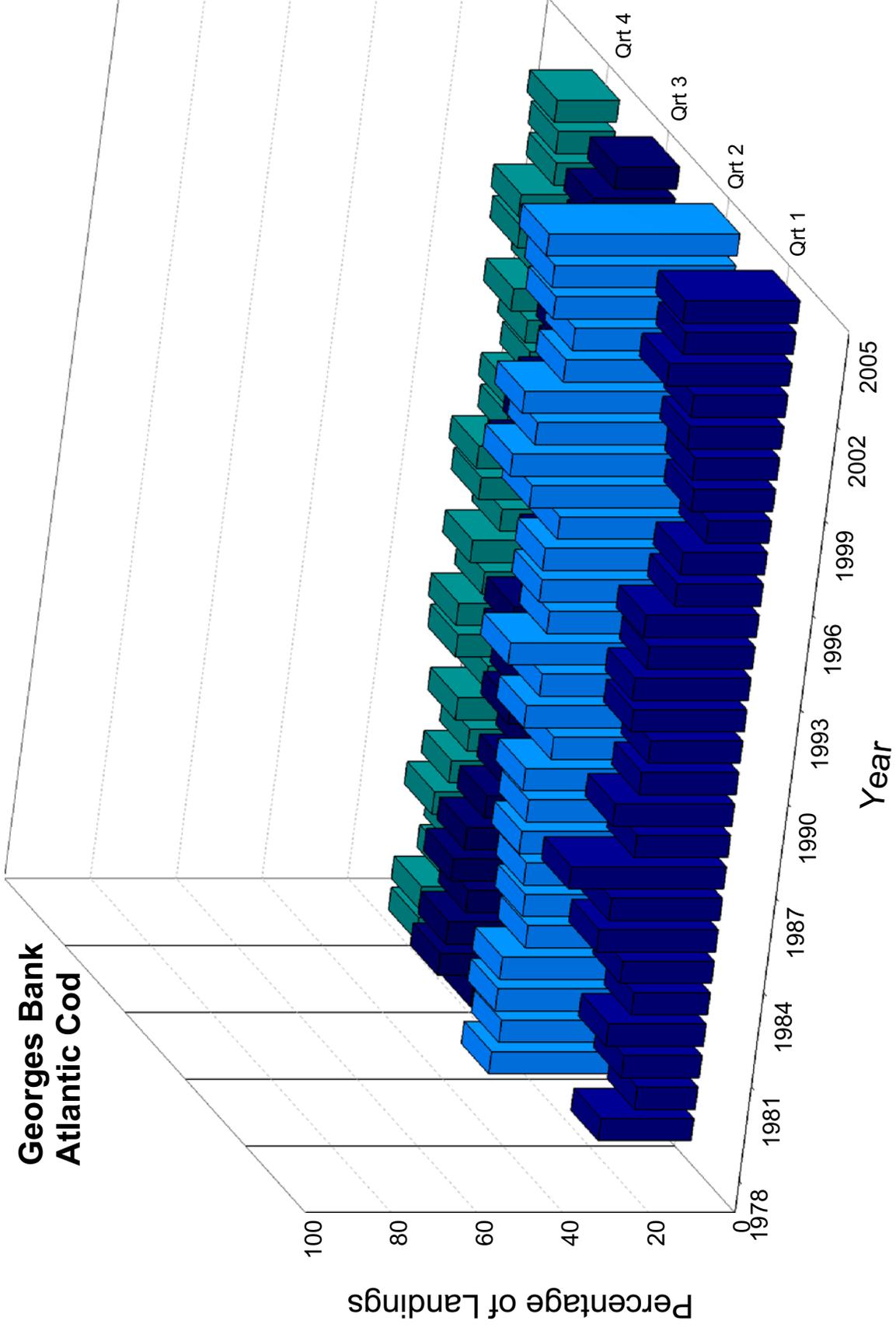


Figure 2. USA commercial landings of Georges Bank cod (NAFO Division 5Z and Subarea 6) by quarter, 1978-2004.

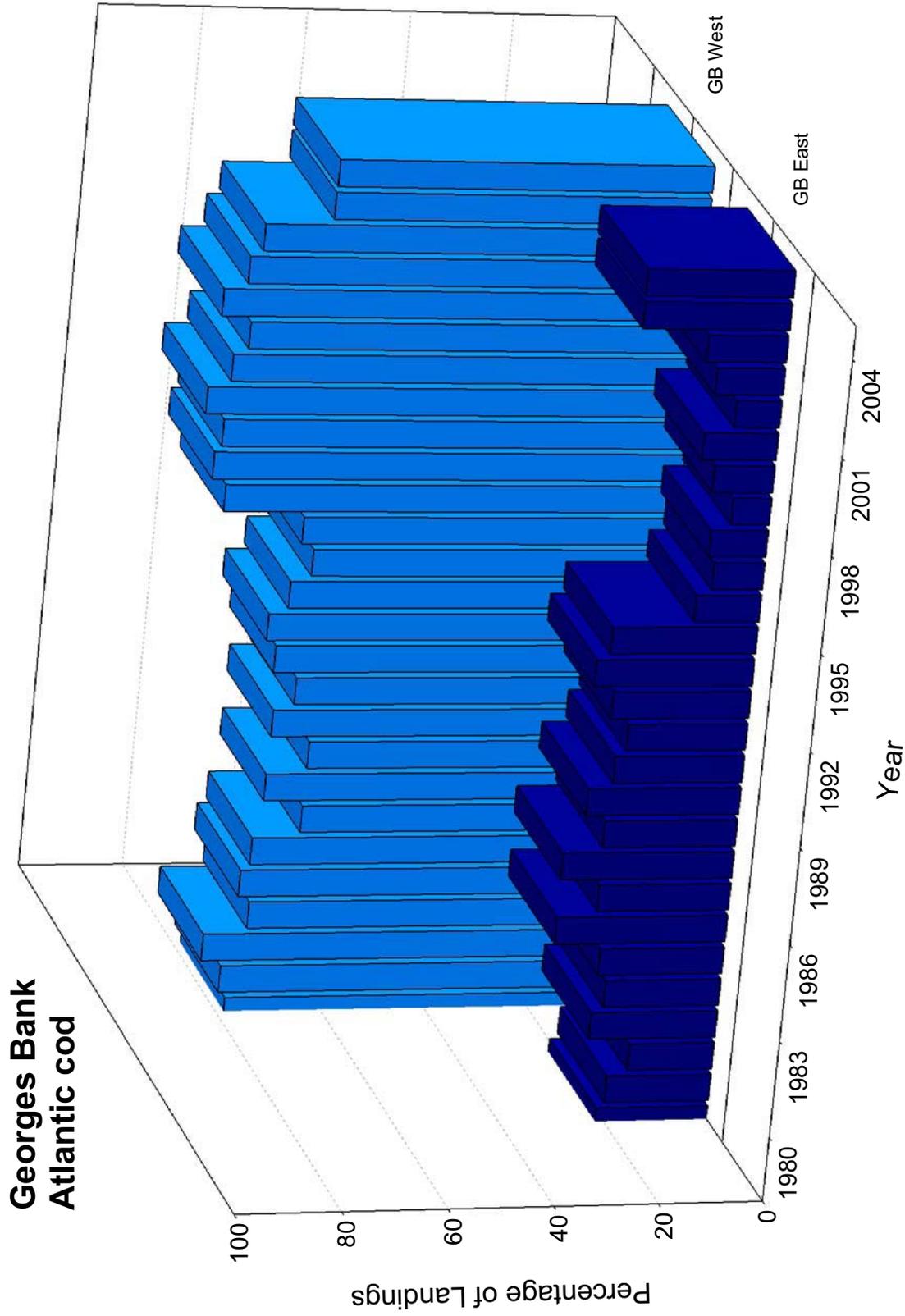


Figure 3. USA commercial landings of Georges Bank cod (NAFO Division 5Z and Subarea 6) for Eastern Georges Bank (SA 561-562) and Western Georges Bank (SA 521-522, 525-526, 537-539, and Subarea 6), 1978-2004.

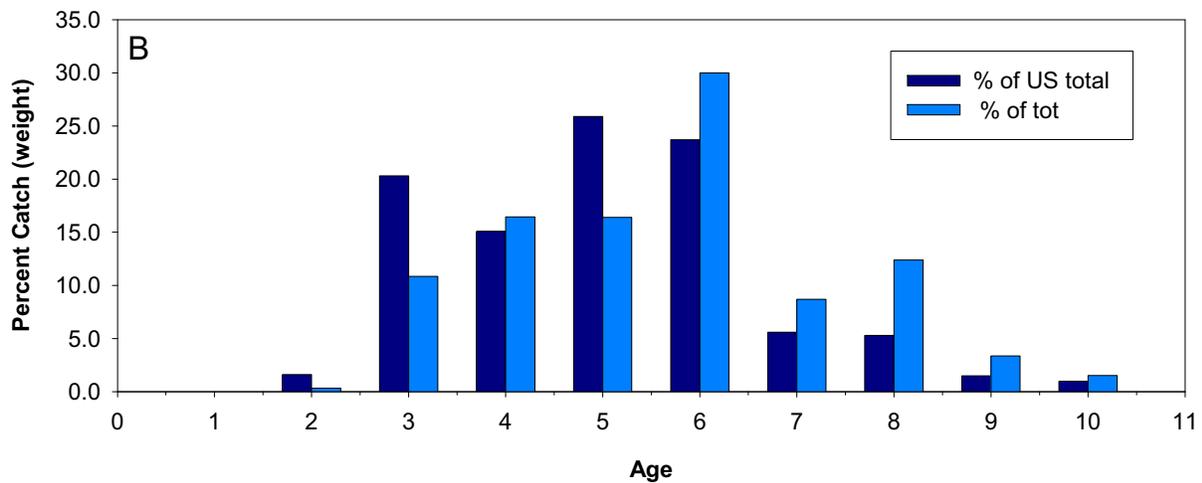
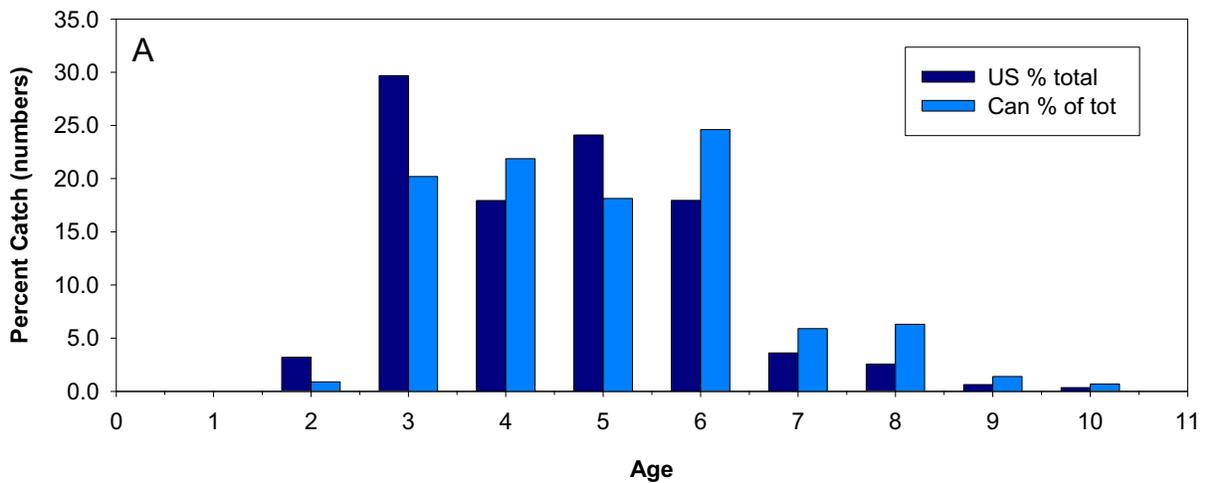


Figure 4. Percentage of Georges Bank cod catch in numbers (A) and weight (B) for USA and Canada for 2004.

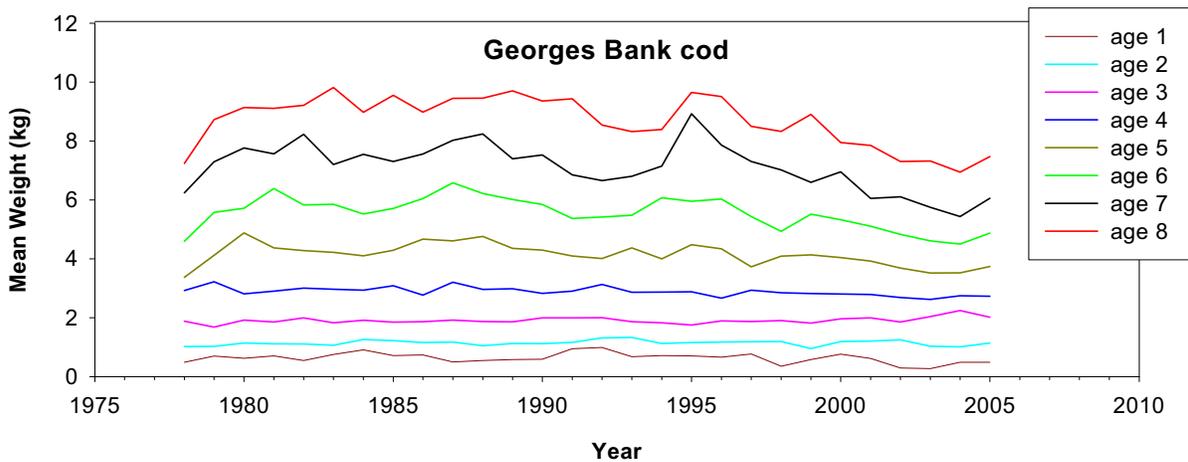


Figure 5. Beginning year mean weight at age for ages 1-8 for Georges Bank cod, 1978-2005.

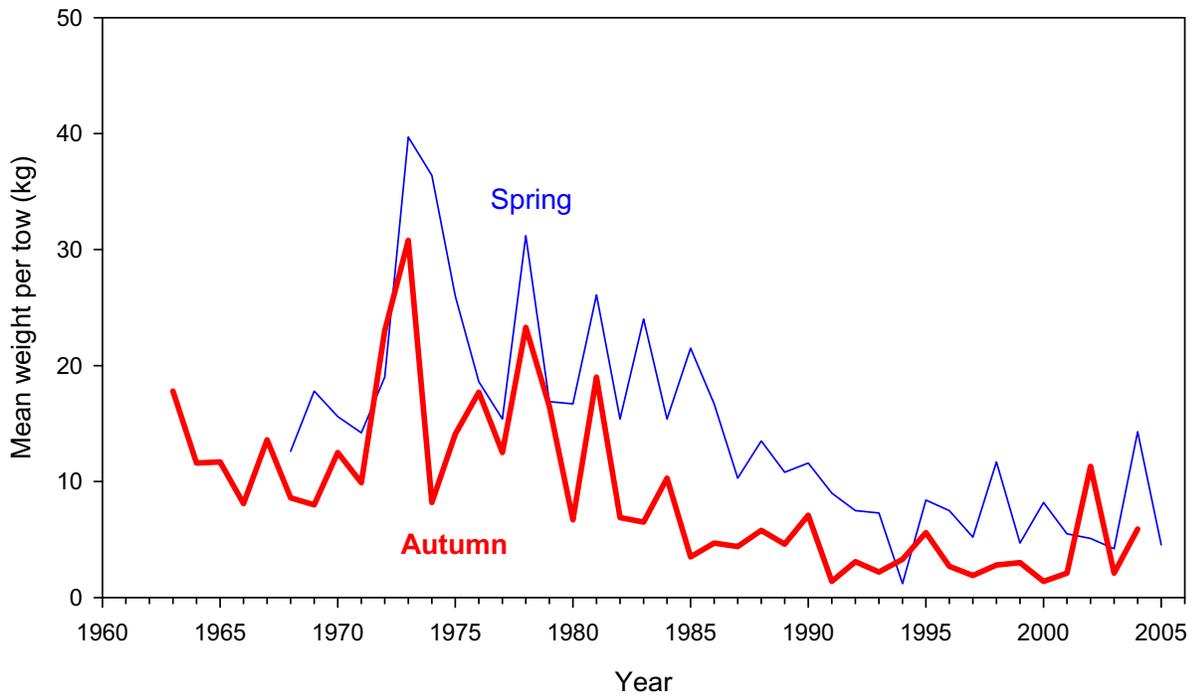


Figure 6. Standardized stratified mean catch per tow (kg) of Atlantic cod in NEFSC spring and autumn research vessel bottom trawl surveys on Georges Bank, 1963-2005.

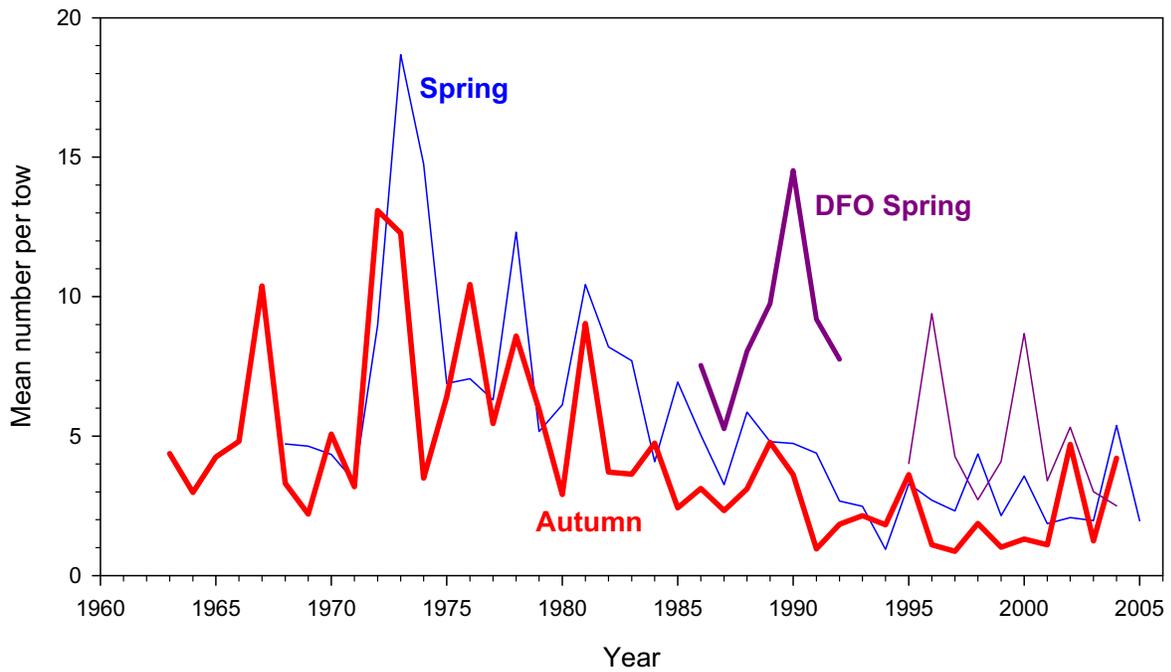


Figure 7. Standardized stratified mean number per tow of Atlantic cod in NEFSC and DFO spring and NEFSC autumn research vessel bottom trawl surveys on Georges Bank, 1963-2005.

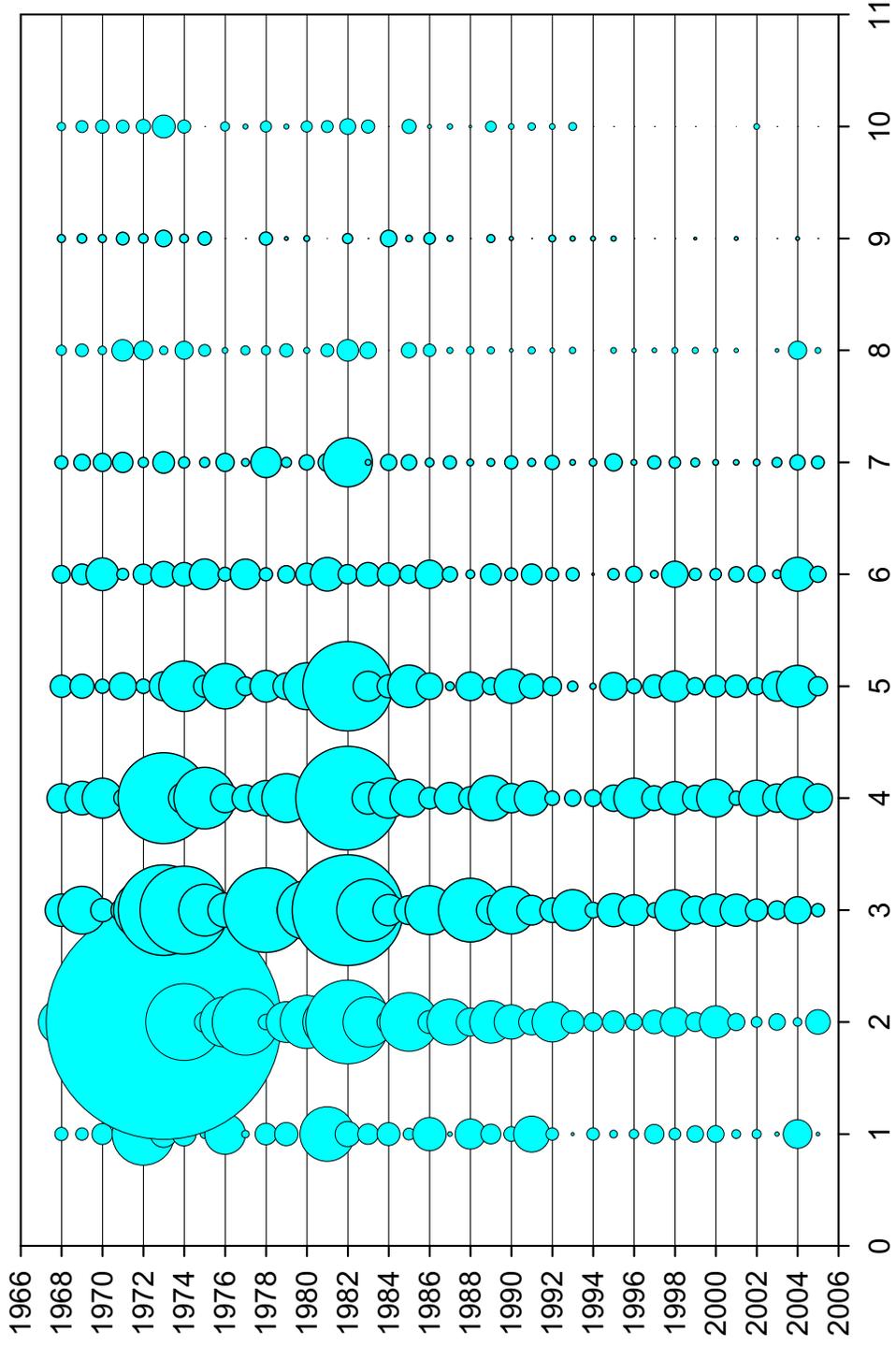


Figure 8. Standardized stratified mean catch per tow at age (numbers) of Atlantic cod in NEFSC offshore spring bottom trawl surveys on Georges Bank, 1968-2005.

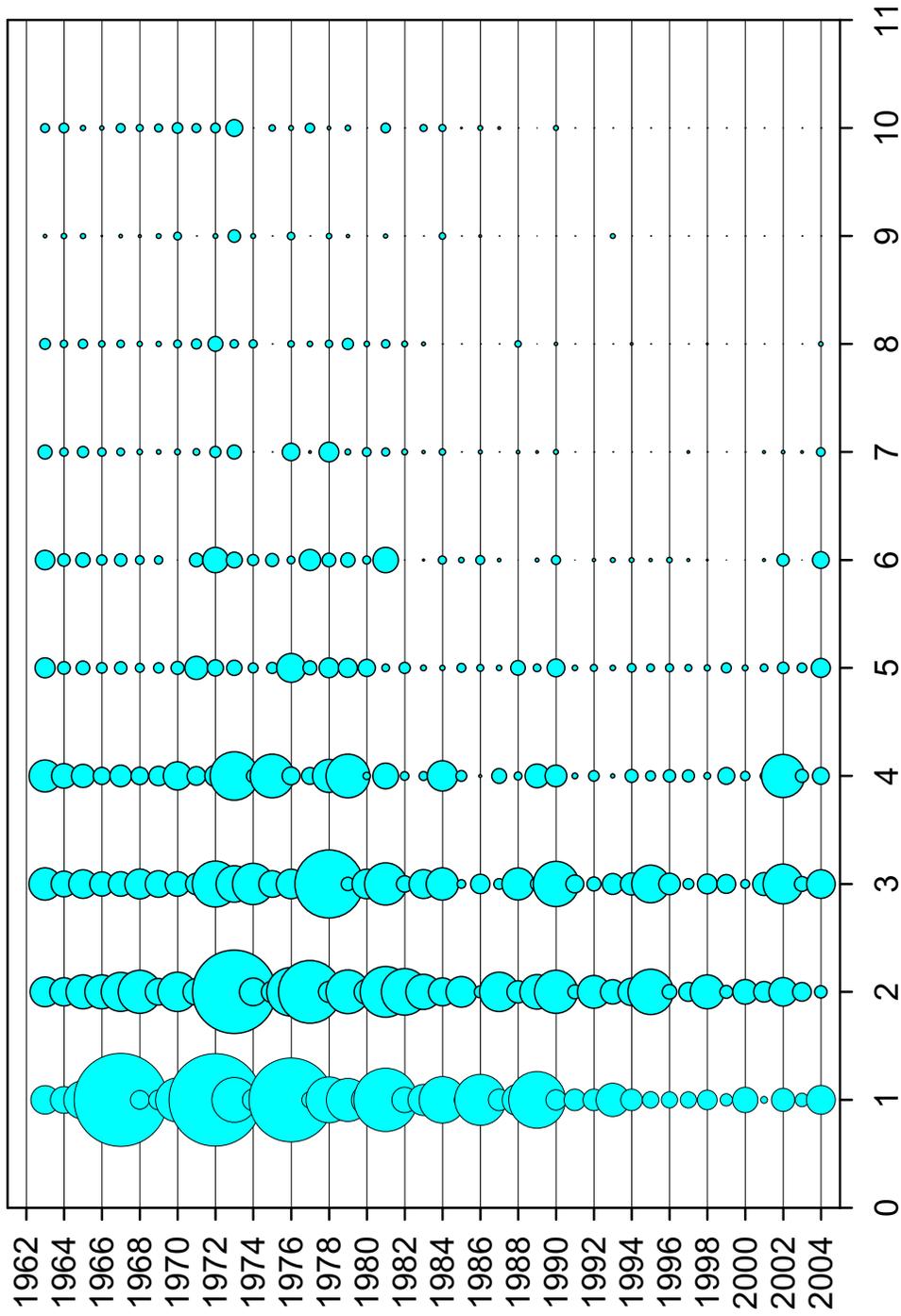


Figure 9. Standardized stratified mean catch per tow at age (numbers) of Atlantic cod in NEFSC offshore autumn bottom trawl surveys on Georges Bank, 1963-2004.

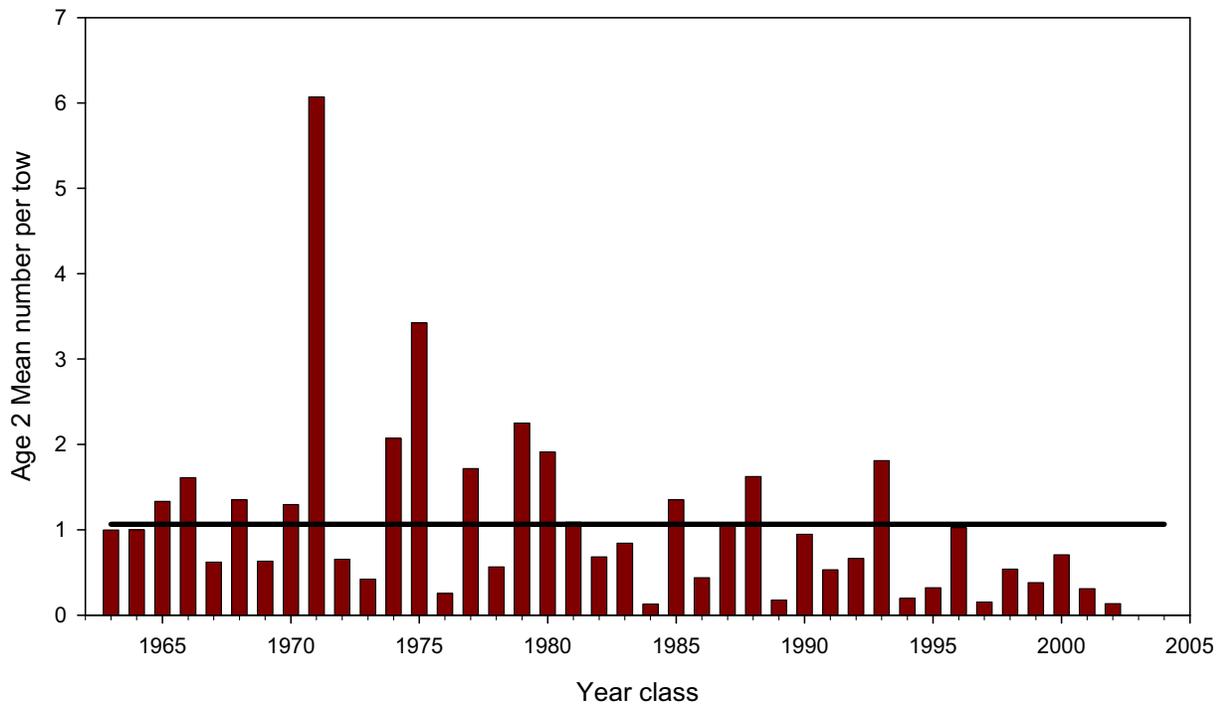
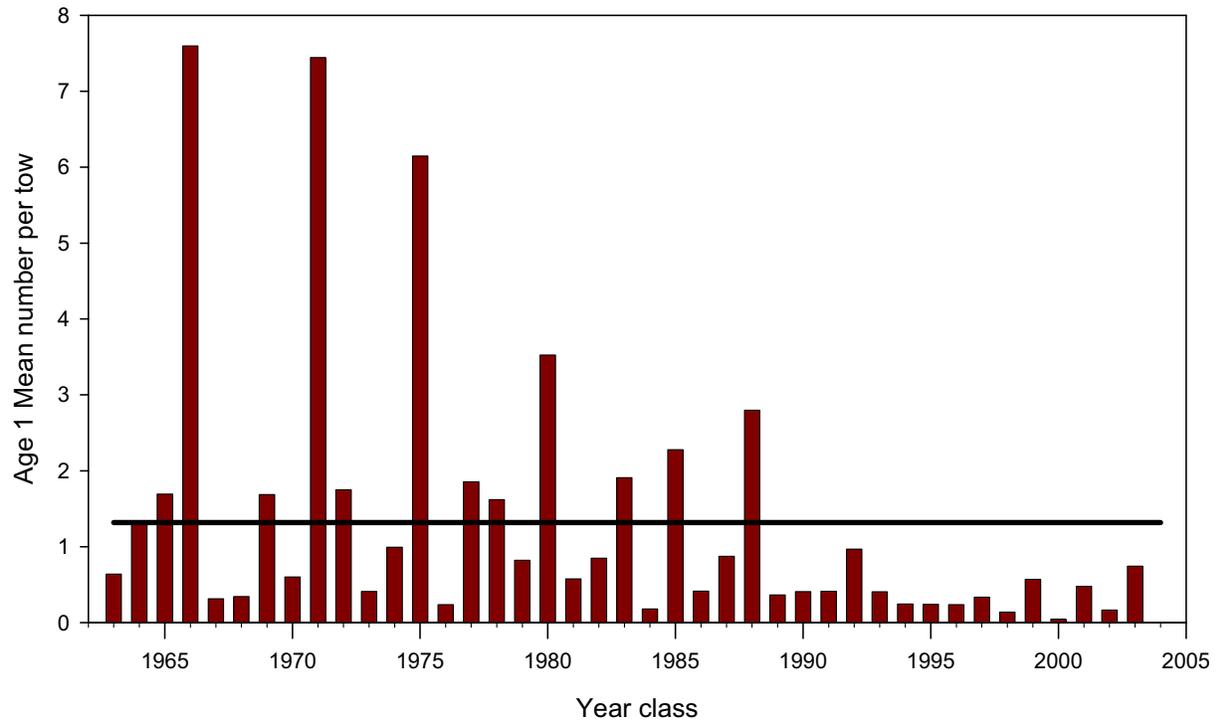


Figure 10. Relative year class strength of age 1 and age 2 Georges Bank cod based on standardized catch (number) per tow indices from NEFSC autumn research vessel bottom trawl surveys, 1963-2004. Horizontal line represents the time series average.

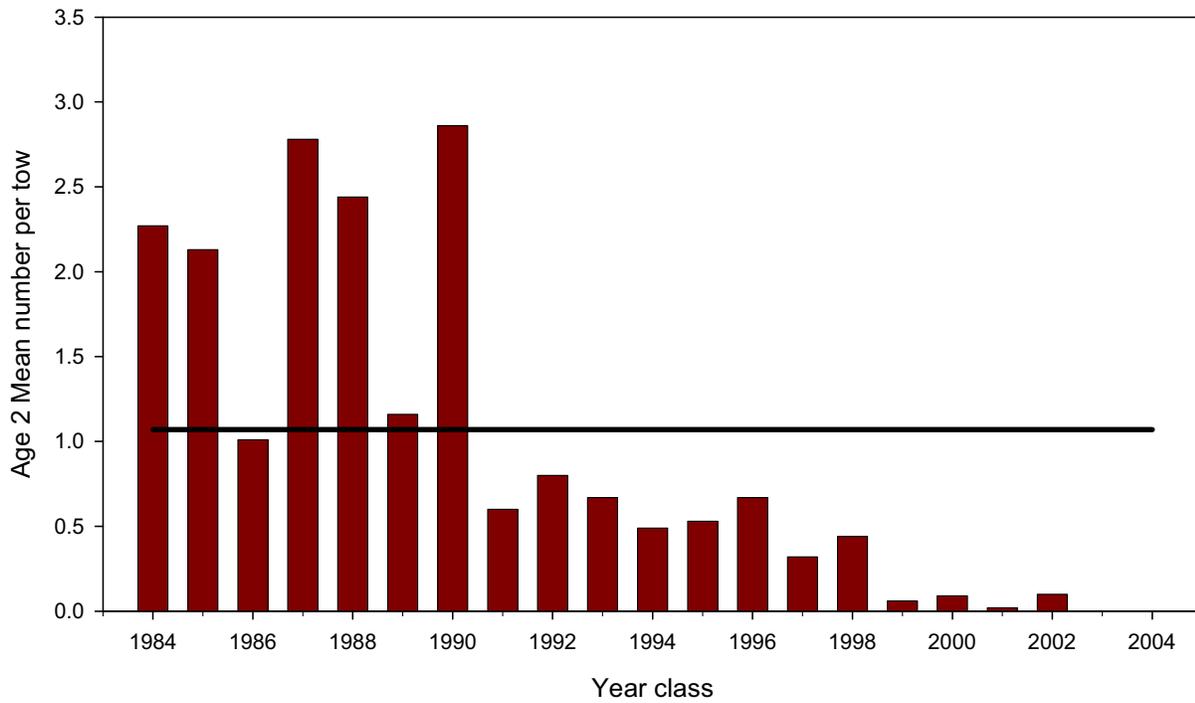
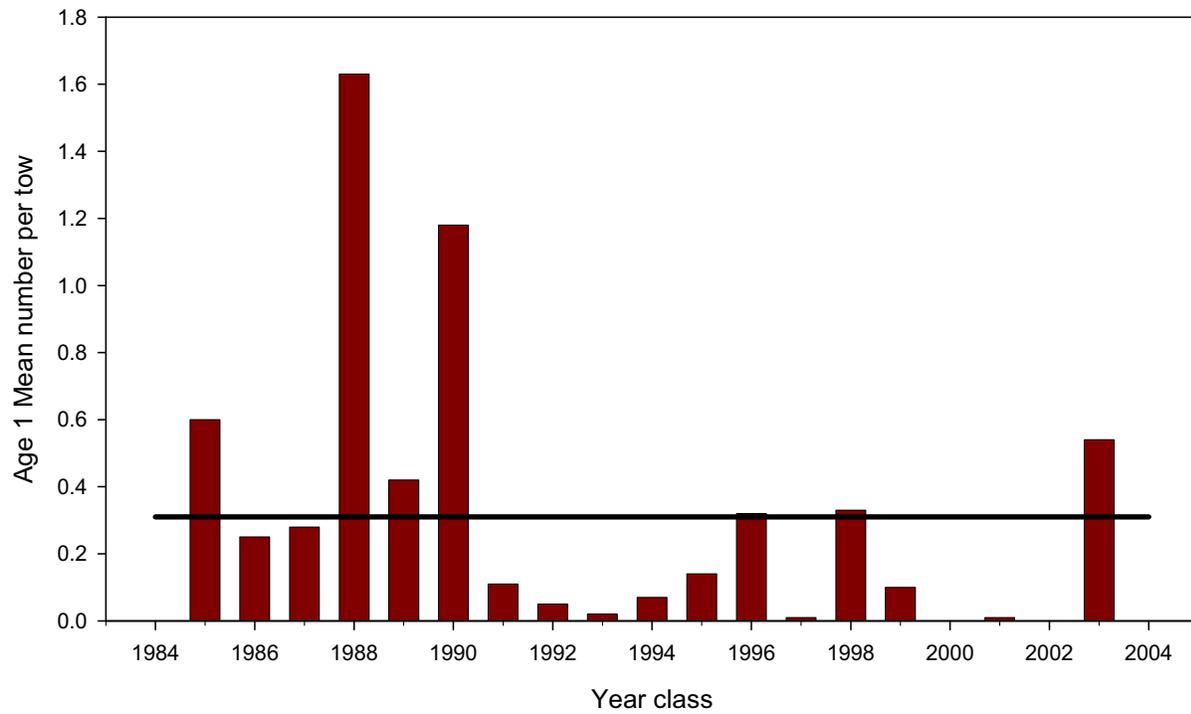


Figure 11. Relative year class strength of age 1 and age 2 Georges Bank cod based on standardized catch (number) per tow indices from DFO spring research vessel bottom trawl surveys, 1986-2004. Horizontal line represents the time series average.

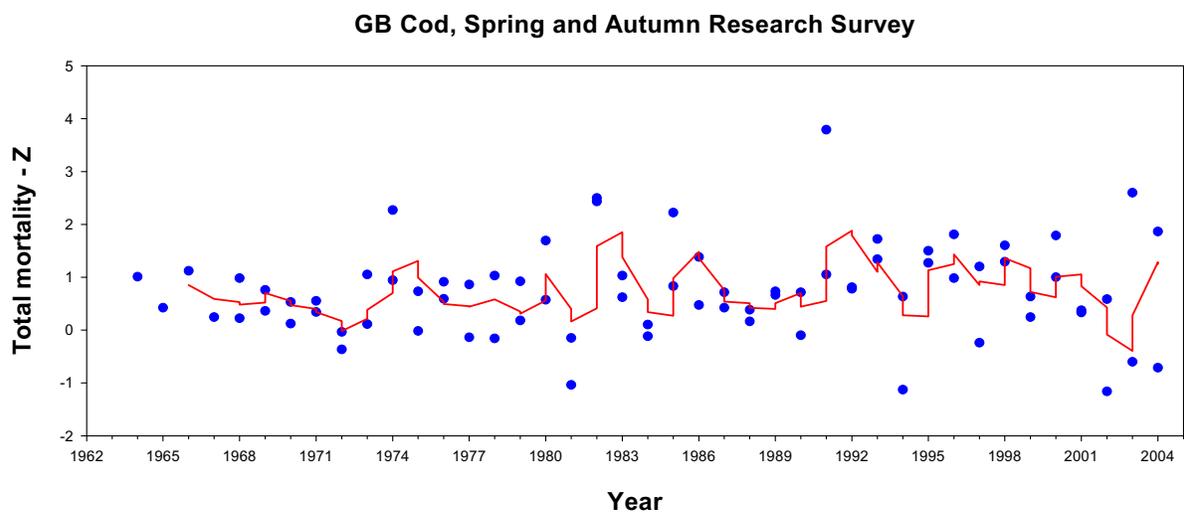
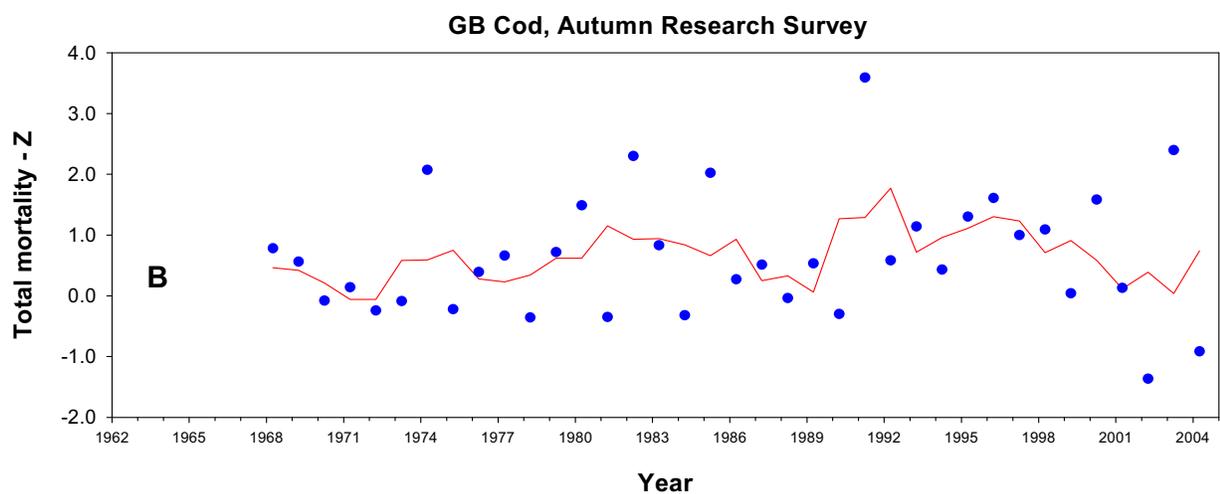
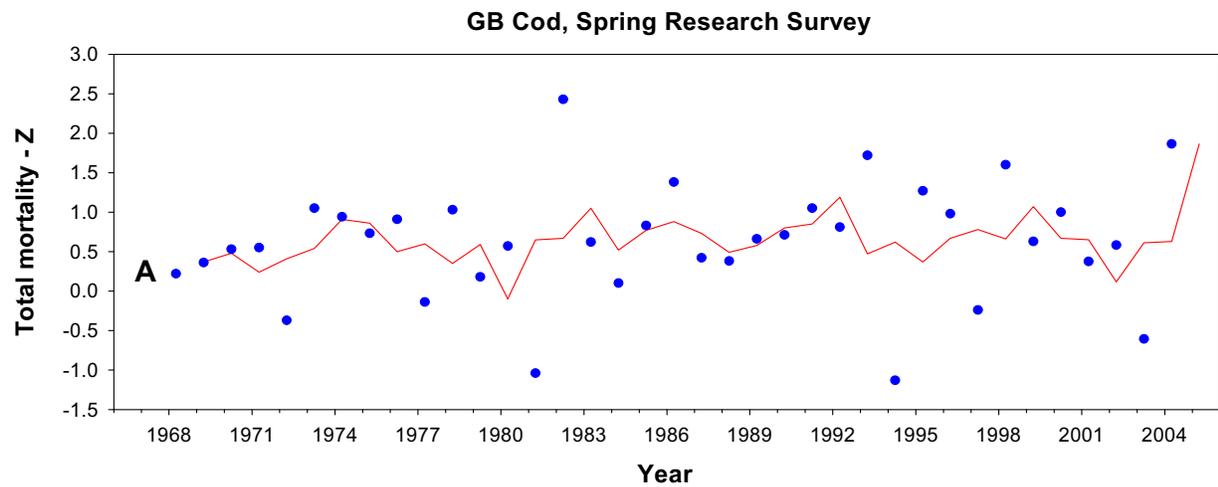


Figure 12. Estimates of instantaneous total mortality (Z) derived from spring (A) and autumn (B) research surveys fit with a 3-year moving average over the time series and sequential spring and autumn estimates (C) fit with a 3-year moving average for Georges Bank Atlantic cod, 1963-2005.

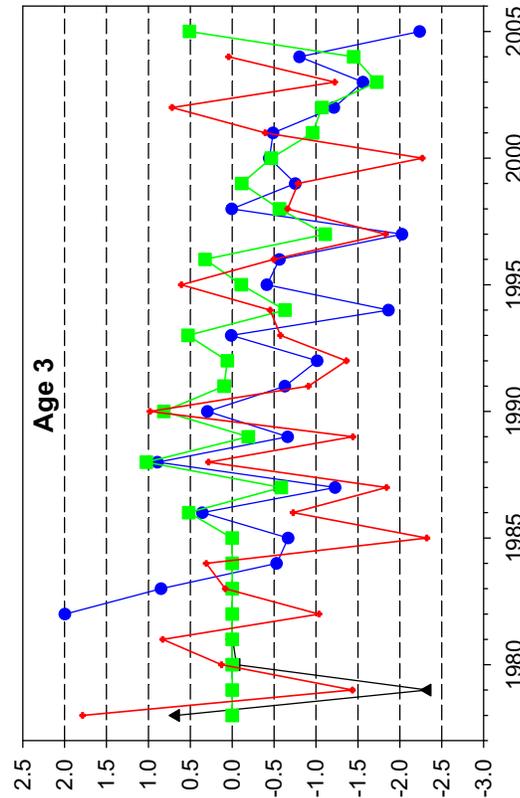
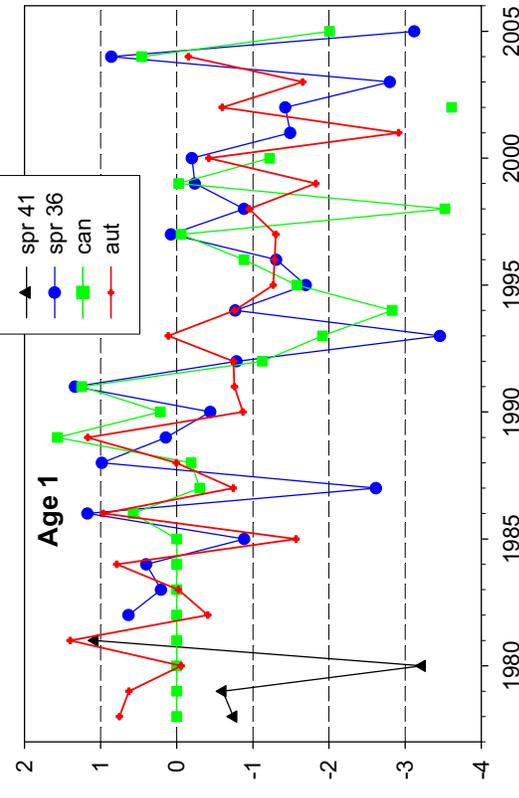
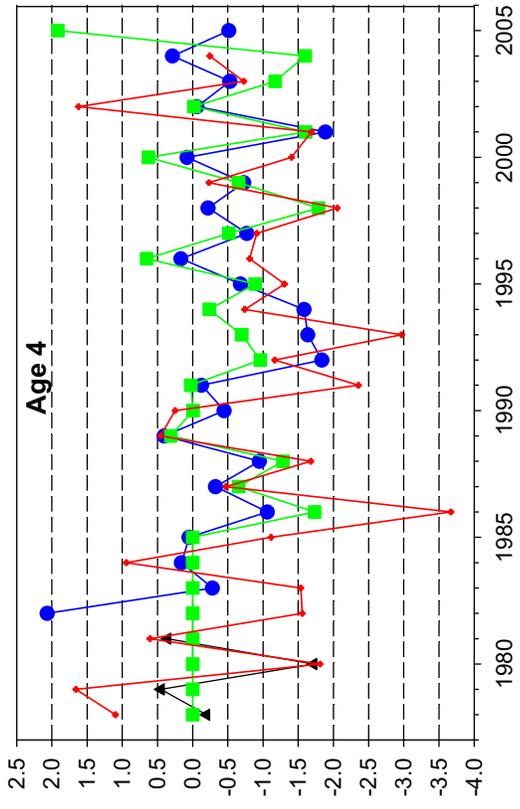
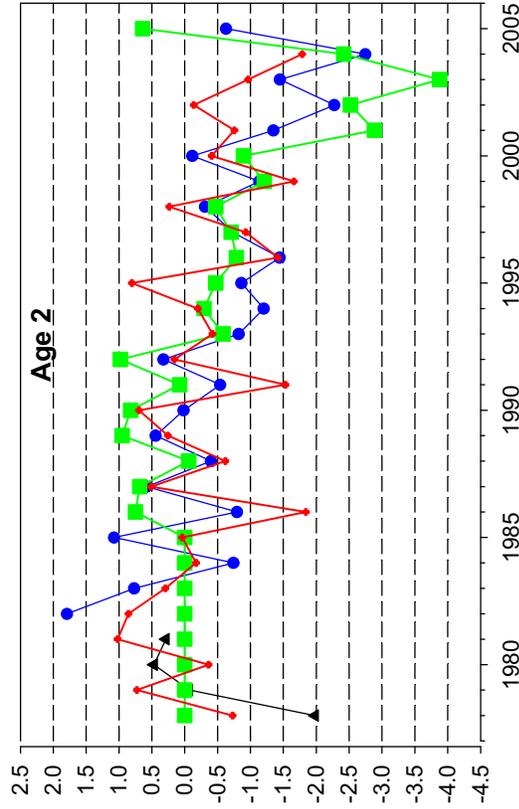


Figure 13. Scaled observed indices ($\ln[\text{index}/\text{mean}]$) for ages 1-8 for the USA #41 Yankee (1978-1981), #36 Yankee (1982-2005), and Canadian spring (1986-2004) surveys and ages 1-6 for the USA autumn (1978-2004) survey.

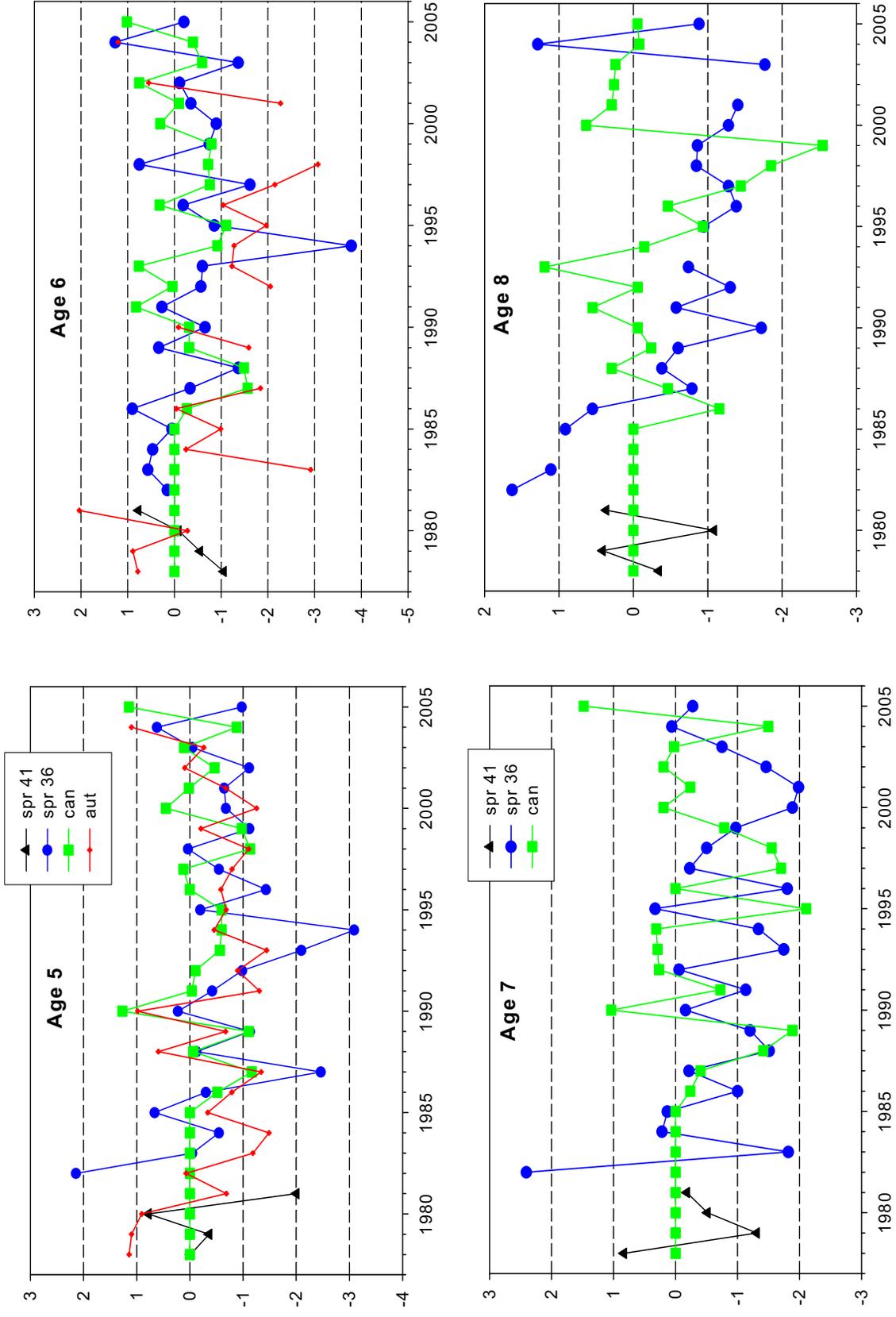


Figure 13 -continued. Scaled observed indices (ln[index/mean]) for ages 1-8 for the USA #41 Yankee (1978-1981), #36 Yankee (1982-2005), and Canadian (1986-2004) spring surveys and ages 1-6 for the USA autumn (1963-2004) survey.

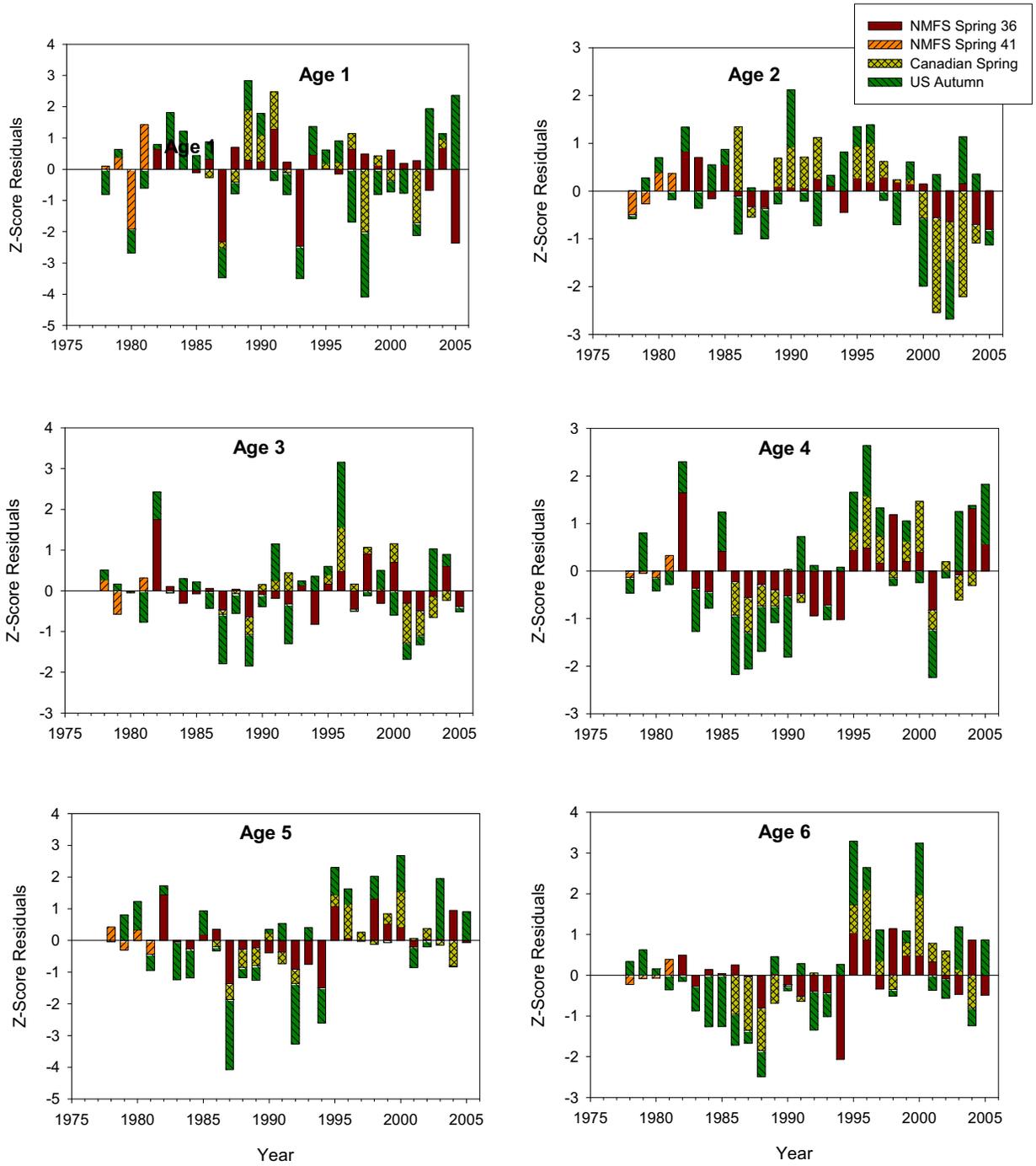


Figure 14. Residual plots (Z score: $(\text{obs}-\text{mean}) / \text{se}$) of abundance indices for ages 1-8 from the USA spring #41 Yankee (1978-1981) and #36 Yankee (1982-2004) trawl and Canadian spring (1986-2004), and ages 1-6 for the USA autumn (1978-2004) research surveys.

Georges Bank Cod Calculated Residuals

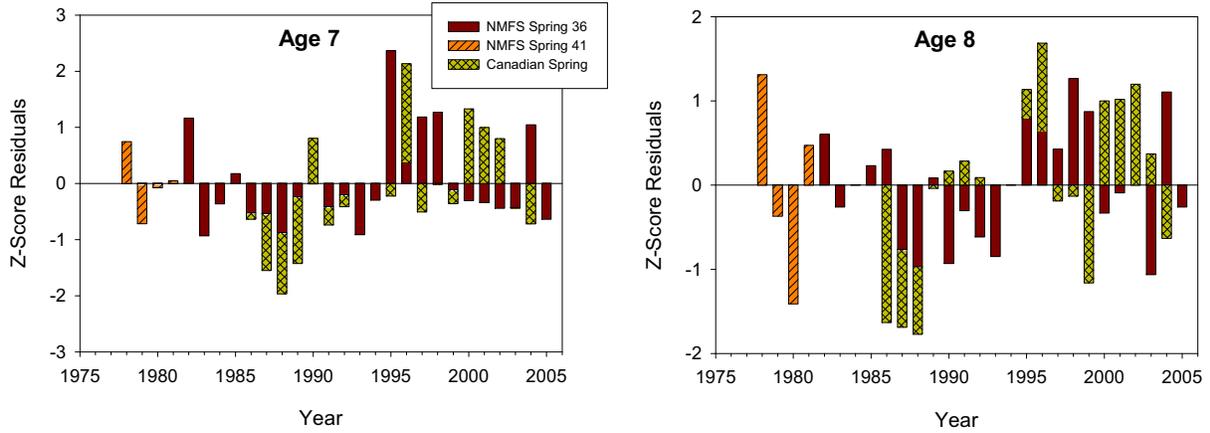


Figure 14 continued. Residual plots (Z score: $(\text{obs}-\text{mean} / \text{se})$) of abundance indices for ages 1-8 from the USA spring #41 Yankee (1978-1981) and #36 Yankee (1982-2004) trawl and Canadian spring (1986-2004), and ages 1-6 for the USA autumn (1978-2004) research surveys.

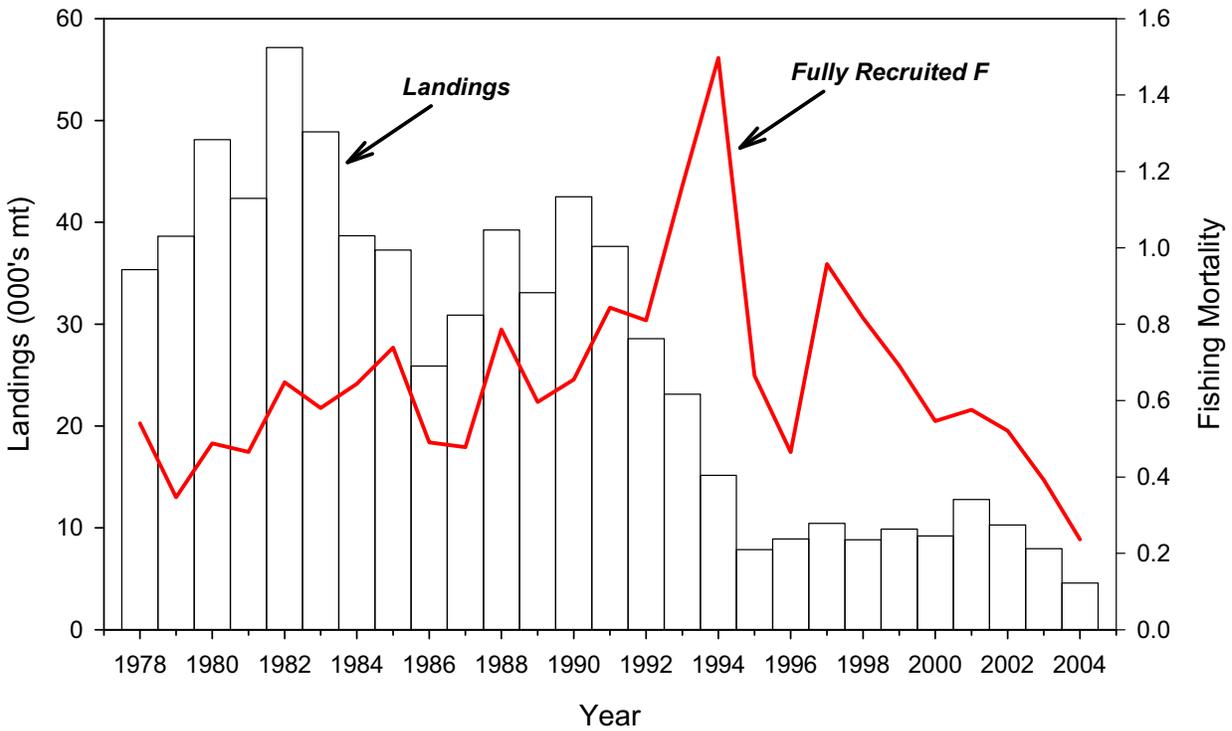


Figure 15. Trends in total commercial landings and fishing mortality for Georges Bank cod, 1978-2005.

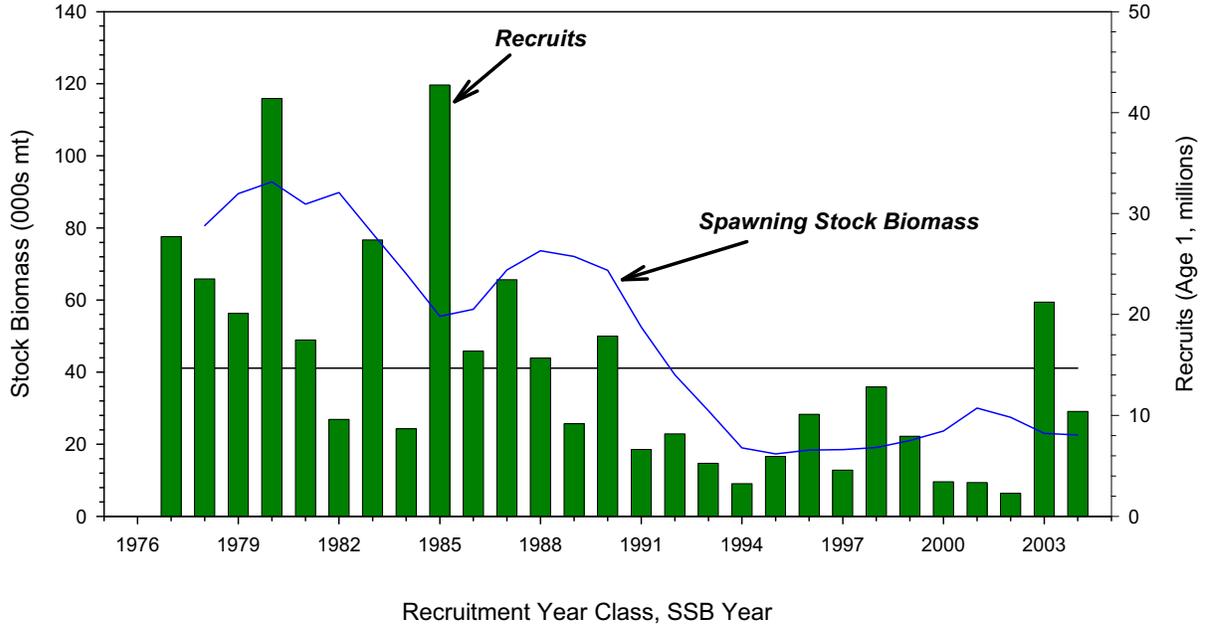


Figure 16. Trends in stock biomass and recruitment for Georges Bank Atlantic cod, 1978-2004. Horizontal line is the average recruitment for the time series.

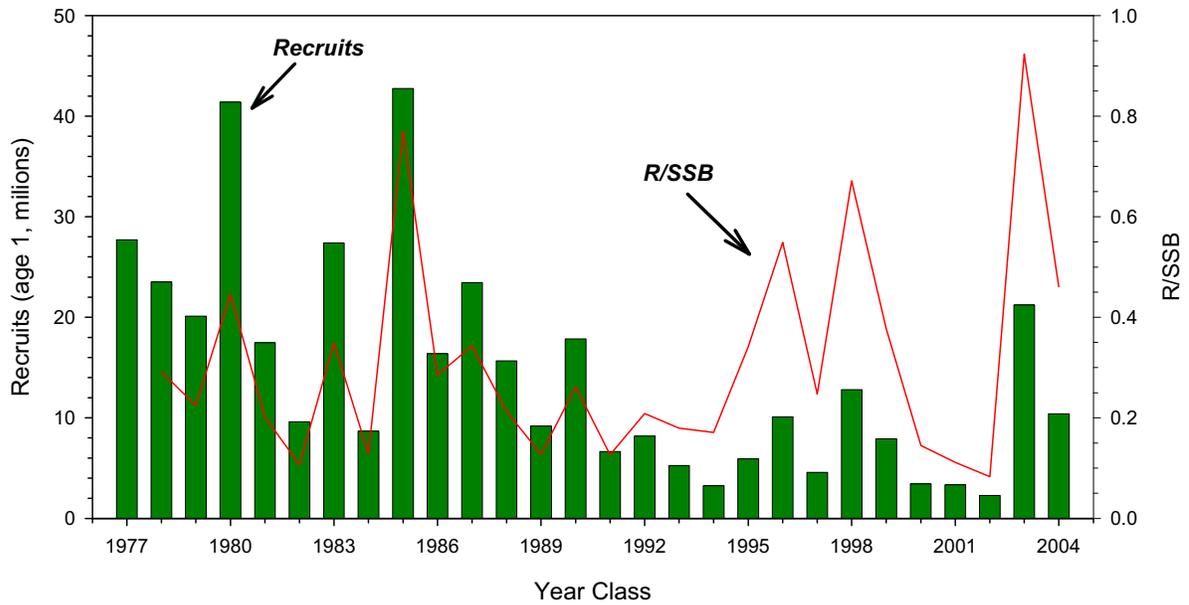


Figure 17. Trends in recruitment and recruitment/SSB survival ratio for Georges Bank cod, 1978-2004.

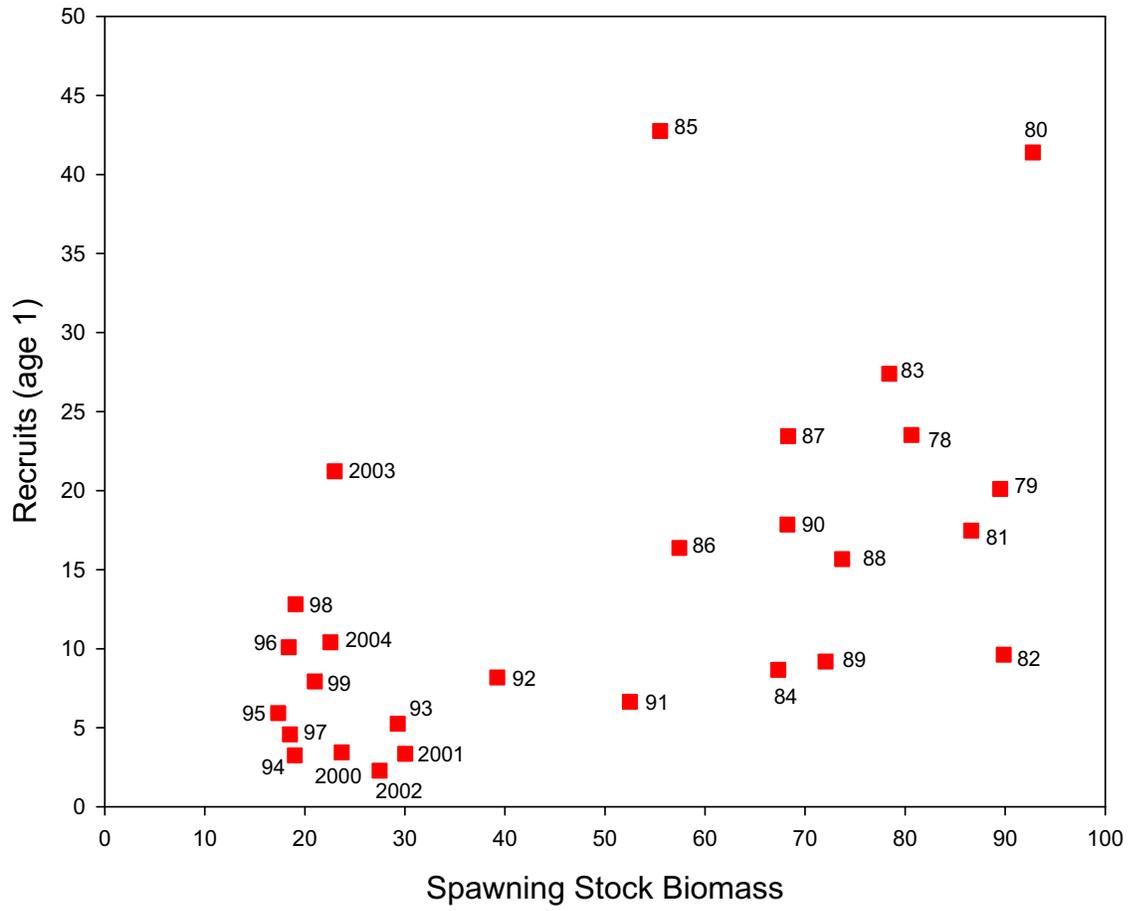


Figure 18. Spawning stock and recruits at age 1 for Georges Bank Atlantic cod, 1978-2004.

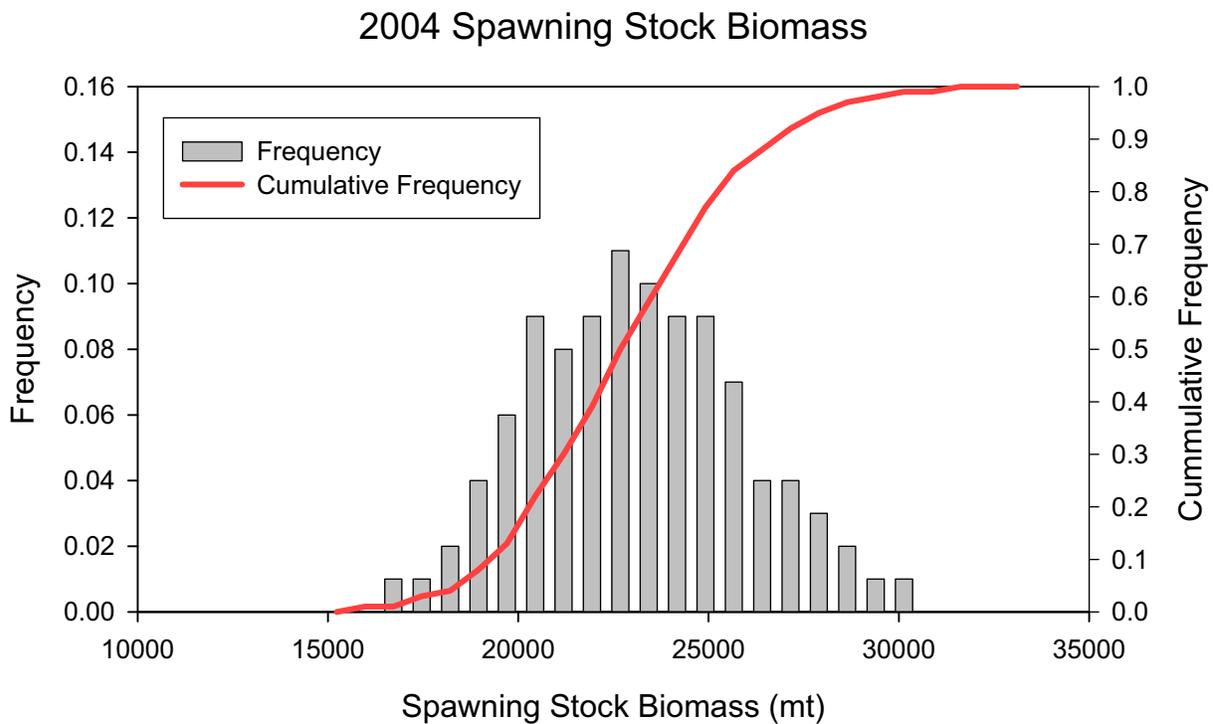
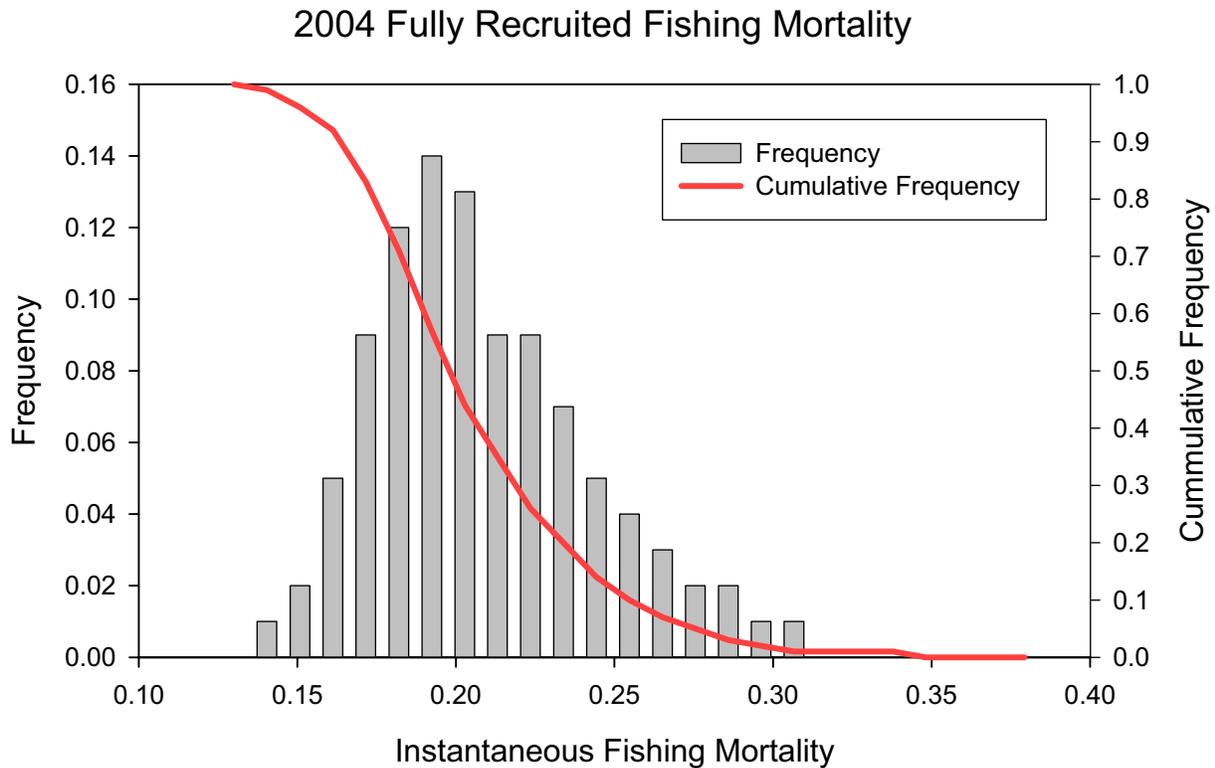


Figure 19. Precision of the estimates of fishing mortality (F) on the fully recruited ages (4-8) and spawning stock biomass at the beginning of the spawning season for Georges Bank cod, 2004. The bar height indicates the probability of values within that range. The solid line gives the probability that F is greater than, or SSB is less than any value on the x-axis.

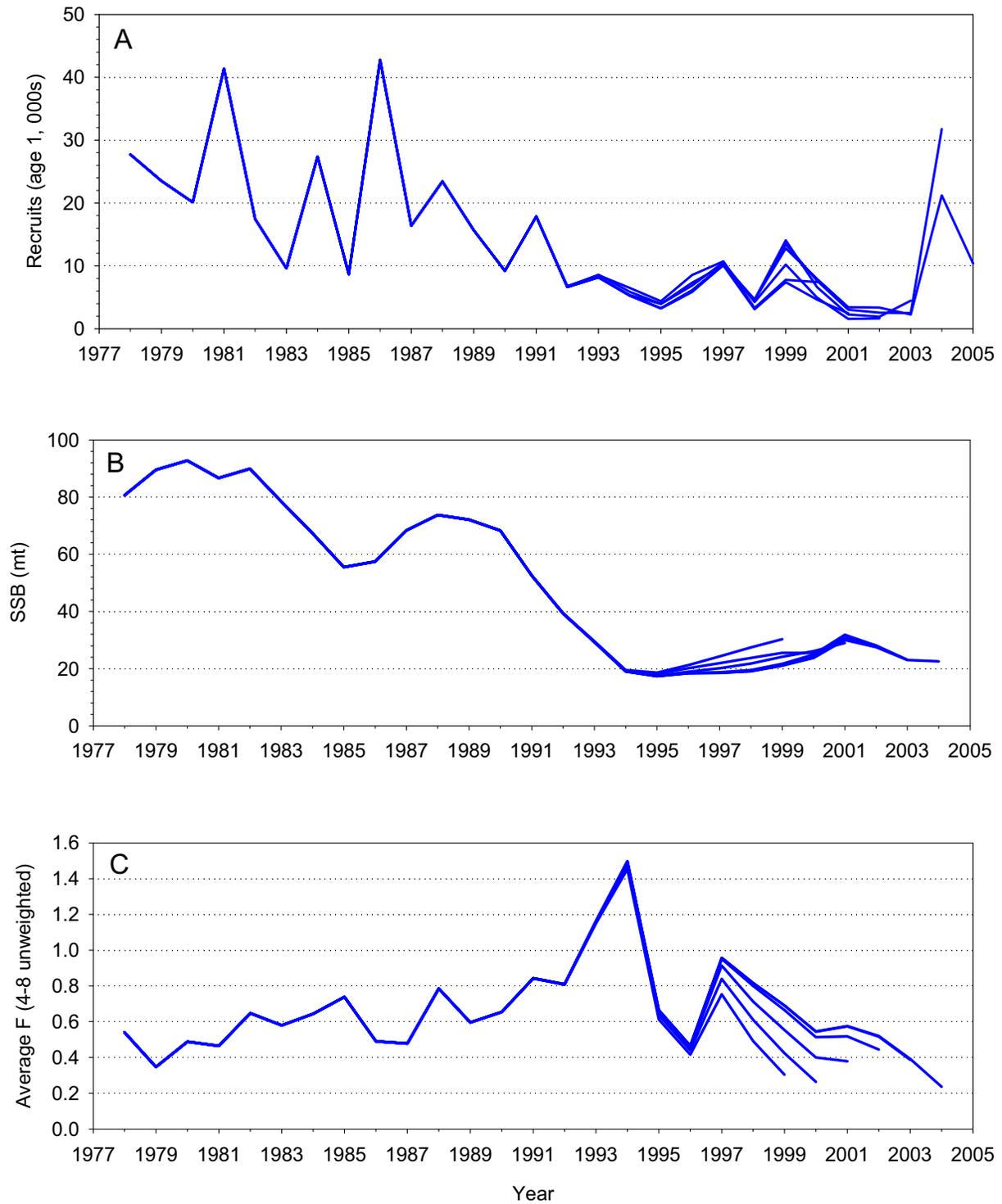


Figure 20. Retrospective analysis of Georges Bank cod recruits at age 1(A), spawning stock biomass (B), and fishing mortality (C) (average F, aged 4-8, unweighted), based on the final ADAPT VPA formulation, 2005-1995.

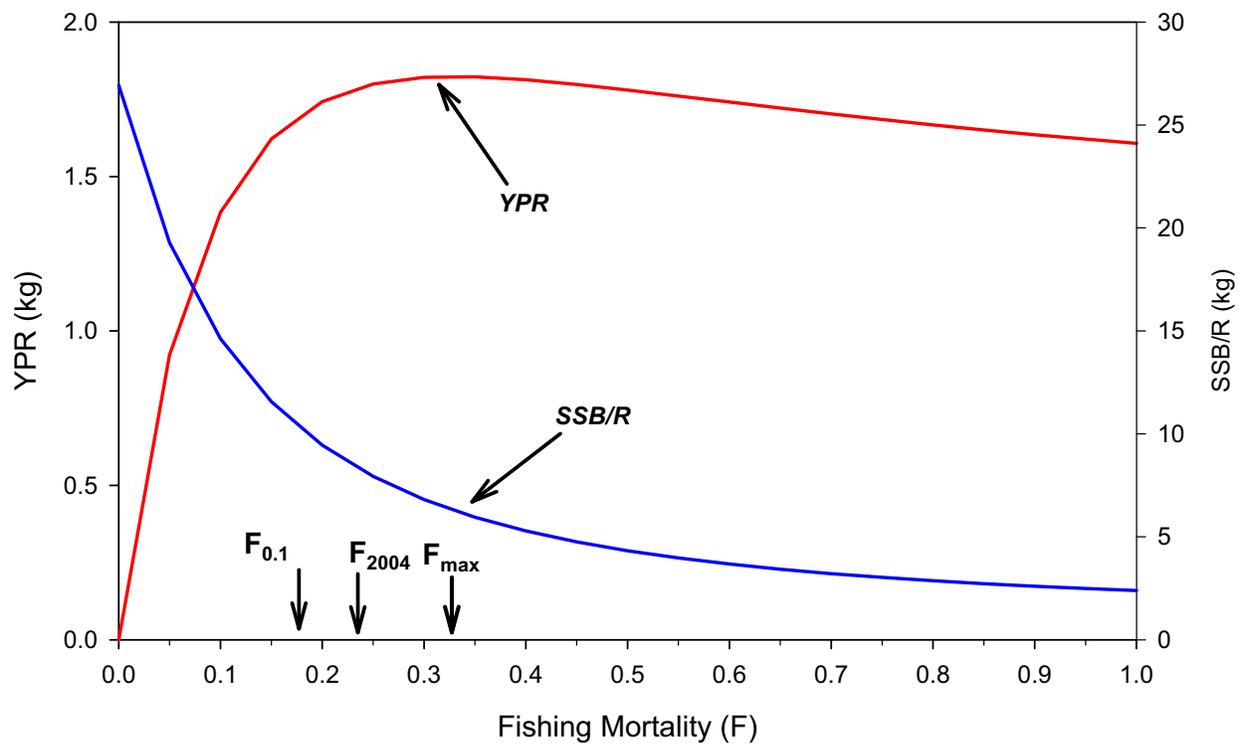
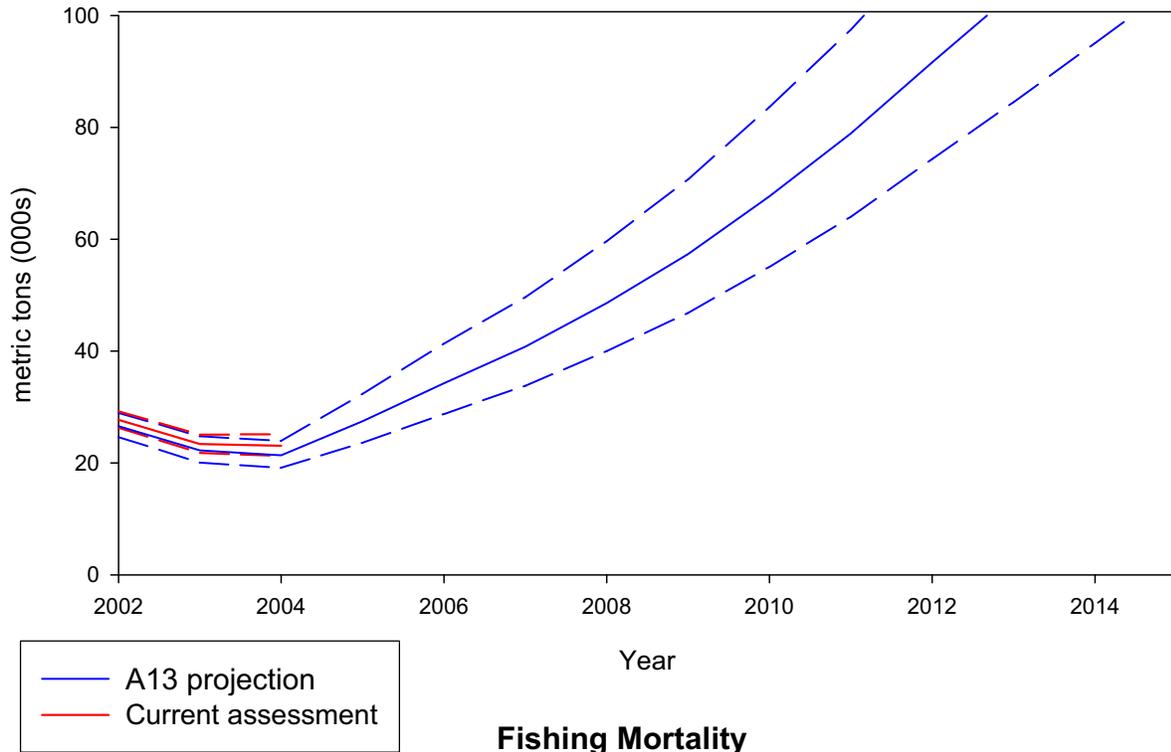


Figure 21. Yield per recruit (YPR) and spawning stock per recruit (SSB/R) for Georges Bank based on data from O'Brien and Munroe (2001).

GB Cod Spawning Stock Biomass



Fishing Mortality

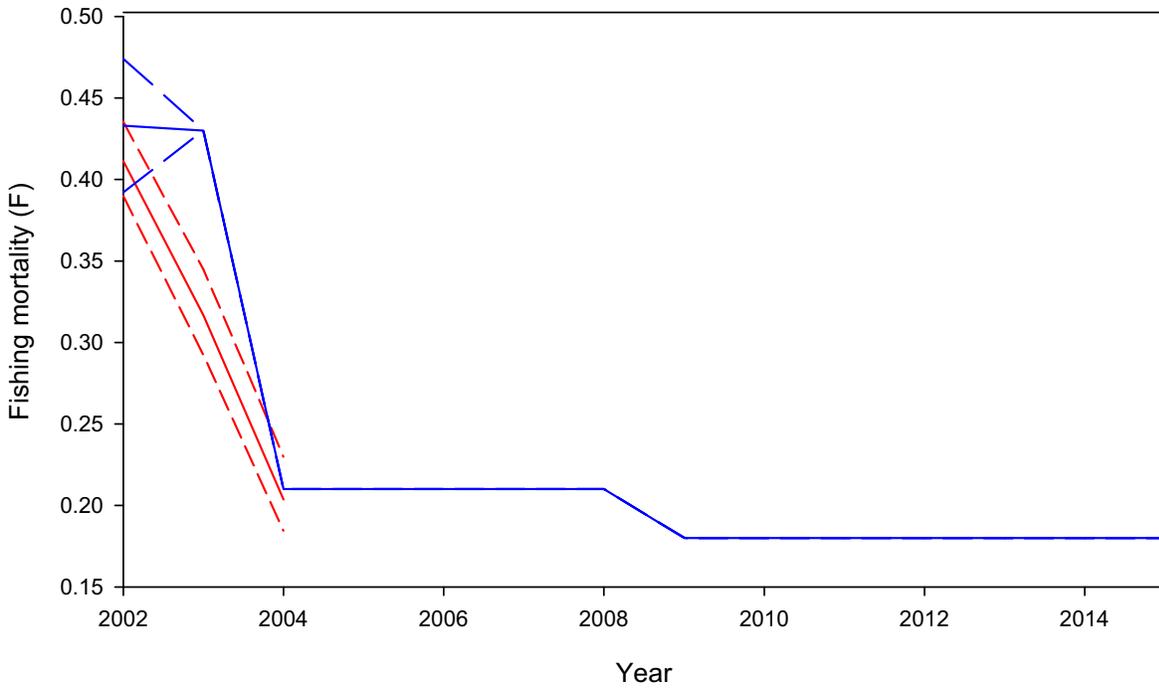


Figure 22. Comparison of A13 projections and current assessment bootstrap estimates of spawning stock biomass (SSB) and fishing mortality (F) , 2002-2004.

APPENDIX 1

History of Management Measures for Georges Bank cod fishery.

Table 1. Brief listing of USA management measures for Atlantic cod, 1953-2000

Table 2. Brief listing of USA management measures for Atlantic cod, 2001-2005.

Appendix 1: Table 1. Brief listing of USA management measures for Atlantic cod, 1953-2000.

<u>1953-1977</u>	<u>ICNAF Era</u>
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
<u>1977-Present</u>	<u>Extended Jurisdiction and National Management</u>
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 <i>further notice</i> .

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

Appendix 1: Table 2. Brief listing of USA management measures for Atlantic cod, 2001-2005.

2001
January 9 - March 17 April 16 - April 30 Northern Shrimp season (61 days)
November 6: Daily haddock possession limit removed (maximum 50,000 lbs.-trip).
2002
February 15-March 11: Northern Shrimp season (25 days with days off)
May 1: Interim rule as a result of FW 33 lawsuit settlement agreement. Continuation of most measures from previous frameworks. <u>DAS</u> : 15 hour minimum charged for all trips over 3 hours. Vessels limited to 25 percent of allocation May 1 through July 31, 2002 (only). Prohibition on front-loading DAS <u>Minimum size</u> : Cod 22 in. <u>Gear</u> : GOM Regulated Mesh Area (RMA): 6.5 in. diamond or square codend minimum, 6.5 inch mesh for trip gillnets, 6.5 inch mesh standup (roundfish) or 7 inch mesh tiedown (flatfish) for day gillnets. All areas: day gillnets limited to 50 standup/100 tiedown nets. <u>Hook gear</u> : de-hooking devices with spacing of less than six inches prohibited <u>Closures</u> : WGOM year round closure extended (was to sunset May 1); Cashes Ledge Closed Area (year round); year round Cashes Ledge East and West closure added; add blocks 124/125 May, blocks 132/133 June <u>Recreational</u> : Cod minimum size 23 in., GOM party/charter limited to 10 fish combined cod/haddock, all areas private recreational limited to 10 cod <u>Possession limits</u> : Remain the same. Haddock possession limit of 3,000 lbs.-DAS/30,000 lbs.-trip through September 30.
June 1: Revised interim rule <u>Minimum size</u> : Cod 19 in. <u>Closures</u> : Year-round Cashes Ledge east and west closures removed <u>Gear</u> : <u>Hook</u> : Requirement for six-inch spacing for de-hooking gear removed
July 4: Haddock daily limit suspended. Possession limit of 30,000 lbs.-trip until September 30, 50,000 lbs.-trip thereafter.
August 1: Emergency rule implementing FW 33 lawsuit settlement agreement. <u>DAS</u> : DAS allocation for each permit reduced 20 percent from maximum used FY 1996-2000 (est 71,218 allocated, including carry-over). DAS counted by the minute, except for day gillnet vessels (15 hour minimum). (This change reverted to DAS counting in effect in FY 2001). Prohibition on front-loading DAS clock. <u>Minimum size</u> : Cod 22 in. <u>Gear</u> : <u>Trawl</u> : GOM/GB RMAs: 6.5 in. diamond or square codend minimum; Southern New England RMA changed to 70W to 74W (vice 72-30W). 6.5 in. square, 7 in. diamond codend in SNE RMA. <u>Gillnet</u> : GOM: Trip gillnets - 6.5 in. mesh/150 nets; Day - 6.5 in./50 standup nets, 7 in./100 tiedown nets (prohibited March-June); GB - 6.5 in./50 nets, SNE - 6.5 in./75 nets; Mid-Atlantic: Trip - 5.5 in. diamond/6 in. square, Day - 5.5 in. diamond/6 in. square. <u>Hook</u> : no de-hookers with less than 6 in/. spacing, 12/0 circle hooks or larger; GOM: 2,000 rigged hooks, GB: 3,600 rigged hooks <u>Closures</u> : Add GB seasonal closure areas, May - Blocks 80, 81, 118, 119, 120 (south of 42-20N) <u>Possession limits</u> : <u>Yellowtail flounder</u> : SNE/MA: landing/possession of yellowtail flounder prohibited south of 40N. Mar 1 - May 31: 250 lbs./trip, June 1 - February 28: 500 lbs.-DAS/4,000 lbs. - trip. <u>Cod</u> : GOM: 500 lbs.-DAS/4,000 lbs./trip. Open access commercial permits limited to 200 lbs. regulated groundfish. <u>Recreational</u> : Cod/haddock: 23 in. minimum size. Party/charter: GOM RMA: April-November, 10 cod/haddock combined per person, Dec-Mar - 10 cod/haddock combined, no more than 5 cod per person per trip. Private: GOM RMA: December-March - 10 cod/haddock combined, no more than 5 cod.

2003
January 15-February 27: Northern Shrimp season (38 days with days off)
March 13: Haddock possession limit suspended until May 1.
May 1: Haddock possession limit of 3,000 lbs-DAS/30,000 lbs.-trip
May 1: Framework Adjustment 37 Modifications to whiting management measures: extension of Cultivator Shoal whiting fishery by one month (June 15-October 31), changes to default measures, minor changes to Cape Cod Bay Raised Footrope Trawl exemption area.
May 13: Haddock possession limit revised to 30,000 lbs./trip (no daily limit).
July 9: Framework Adjustment 38 Raised footrope trawl whiting fishery in the inshore GOM, July 1 - November 30 each year.
July 28: Final emergency rule implementing FW 33 lawsuit settlement agreement <u>Recreational</u> : Haddock, 21 in. minimum size. Party/charter: GOM: Apr-Nov, 10 cod per person, December-March, 5 cod per person. Private: GOM: December-March, 10 cod/haddock combined, no more than 5 cod. Other areas: 10 cod/haddock combined.
October 7: Haddock possession limit suspended for the remainder of the fishing year.
2004
January 19-March 12: Northern Shrimp season (40 days with days off)
May 1: Implementation of Amendment 13. Measures based on emergency rule and measures in effect prior to interim rule. <u>DAS</u> : DAS for each permit re-categorized. Category 1: 60% of maximum DAS used FY 1996-2001 in years that permit landed 5,000 pounds regulated groundfish (est. 43,000 allocated). Category B: 40% of maximum DAS used FY 1996-2001 in years that permit landed 5,000 pounds regulated groundfish; can only be used in specific programs. DAS leasing and transfer programs allow DAS exchanges between vessels under limited conditions. (200 lbs. of winter flounder can be retained by vessels fishing for fluke west of 72-30 W without using a DAS). <u>Minimum Size</u> : No change from emergency rule <u>Gear</u> : <u>Trawl</u> : No change from emergency rule. <u>Gillnet</u> : GOM/GB: Day-6.5 in./50 standup nets, no seasonal restriction on tie-down nets; Trip: 6.5 in. mesh/150 nets. SNE/MA: 6.5 in. in. mesh/75 nets. <u>Hook</u> : GOM: 2,000 hooks. GB: 3,600 hooks <u>Closures</u> : Same as emergency rule, with addition of habitat closed areas; all except Jeffrey Bank and NLCA habitat closed area are within existing year-round closed areas. <u>Possession limits</u> : GOM cod: 800 lbs-DAS/4,000 lbs.-trip. GB cod: 1,000 lbs.-DAS/10,000 lbs.-trip. CC/GOM yellowtail flounder: April, May, October, November - 250 lbs. trip, other months 750 lbs.-DAS/3,000 lbs.-trip. SNE/MA yellowtail flounder: March -June, 250 lbs. trip, other months 750 lbs.-DAS/3,000 lbs.-trip. Haddock: 3,000 lbs.-DAS/30,000 lbs.-trip. <u>Special Management Programs</u> : US/Canada Area: hard TAC on cod, haddock (SAs 561, 562), yellowtail flounder (SAs 522, 525, 561, 562). Cod possession limit: 500 lbs-DAS/5,000 lbs-trip, not more than 5 percent of catch. No DAS charged to/from SAs 561, 562. <u>Exempted Fisheries</u> : Northern Shrimp fishery area restriction removed; General Category scallop fishery exemption in SAs 537, 538, 539, and 613.
May 14: Haddock possession limit suspended for remainder of the fishing year.
June 1: CAII Yellowtail Flounder Special Access Program Access to CAII south of 41-30N by trawl vessels targeting yellowtail flounder. Limited to 320 trips (total), two trips per vessel per month, yellowtail flounder limited to 30,000 lbs./trip. Authorized use of Category B DAS.
June 23: Amendment 10 to the Atlantic Sea Scallop FMP. 10-in. square mesh twine top required for all scallop dredge vessels in all areas.
September 3: CAII Yellowtail Flounder SAP ends (no trips can begin after this

date)
<p>November 2: Framework Adjustment 39 (Scallop Framework Adjustment 16) Scallop dredge vessel access to portions of groundfish mortality CAII and NLCA in 2004, CAI and CAII in 2005, and CAI and NLCA in 2006. Season: June 15 through January 31. Possession limits: 1,000 lbs. regulated groundfish, no more than 100 lbs. cod. In NLCA, limited to 250 lbs.-trip yellowtail flounder in June. (Outside of access program, scallop vessels continue to be limited to 300 lbs. regulated groundfish per trip). Yellowtail flounder catch capped at 10 percent of target TAC for the stock.</p>
<p>October 1: Closure of SAs 561 and 562 to all fishing on a multispecies DAS. Prohibition on the possession of yellowtail flounder from SAs 522, 525, 561, 562.</p>
<p>November 19: Framework Adjustment 40A <i>Closed Area I Haddock SAP</i> Access to small area of CAI to target haddock using longlines. Limited to 1,000 mt haddock TAC. Season ends December 31. <i>Eastern US/CA Area Haddock SAP Pilot Program</i> Access to northern corner of CAII and adjacent area to target haddock using separator trawl. Season: May 1 through December 31. Authorized use of Category B DAS. <i>Category B (regular) DAS Pilot Program</i> Vessels can use Category B (regular) DAS to target healthy stocks. Catch (kept and discarded) limited to 100 lbs. of cod, American plaice, white hake, witch flounder, ocean pout, SNE/MA winter flounder and windowpane flounder, 25 lbs.-DAS/250 lbs.-trip of yellowtail flounder. Maximum of 1,000 DAS can be used in each of four quarters from November 1, 2004 through October 31, 2005.</p>
2005
<p>January 14: Eastern US/CA reopened, yellowtail flounder daily poundage limit lifter (maximum remains 15,000 lbs./trip). Cod trip limit of 5,000 lbs./trip in Eastern US/CA area. Vessels fishing in Eastern US/CA area must use haddock separator trawl.</p>
<p>February 9: GB yellowtail flounder trip limit reduced to 5,000 lbs./trip in (entire) US/CA Management Area.</p>
<p>April 1: Eastern US/CA area closed until April 30, 2005, possession of GB yellowtail flounder prohibited in entire US/CA Management Area.</p>
<p>May 1: Eastern US/CA Area reopens at beginning of fishing year. Measures revert to those implemented May 1, 2004.</p>
<p>May 3: Haddock trip limit removed for remainder of the fishing year.</p>
<p>May 26: FW 40B implemented. Changes DAS leasing and transfer program, modifies GB Hook Sector provisions, adopts reporting requirements for herring vessels, modifies trip gillnet provisions. <i>CAII Yellowtail Flounder SAP</i> Changes starting date to July 1, reduces trip limit to 10,000 lbs, number of trips per vessel per month is one, process established for adjusting the total number of trips.</p>
<p>June 8: Emergency action to control bycatch of haddock in the herring fishery establishes trip limit and overall TAC.</p>
<p>June 15: Implementation of FW 16 to the Sea Scallop FMP authorizes General Category Scallop vessel participation in scallop access areas. Scallop access areas in CAI and CAII open for all vessels on this date.</p>
<p>June 27: Announcement that no trips will be allowed in the CAII Yellowtail Flounder SAP in FY 2005.</p>
<p>July 12: NE multispecies DAS vessels are limited to one trip per month in the Eastern US/CA area.</p>
<p>July 18: Multispecies DAS vessels are prohibited from fishing in the Category B (regular) DAS program in the GB cod stock area through July 31.</p>
<p>July 27: NE multispecies trawl vessels are required to use a haddock separator trawl when fishing in the Eastern US/CA area.</p>
<p>August 26: Eastern US/CA area is closed to all limited access multispecies DAS vessels because 90 percent of the GB cod TAC for the area is projected to be harvested.</p>

September 6: CAI scallop access area is closed to General Category scallop vessels.
September 13: <i>CAI Hook Gear Haddock SAP</i> FW 41 to the Northeast Multispecies FMP implemented. This action allows non-sector longline vessels to participate in the CAI Hook Gear Haddock SAP. The October 1 - December 31 season is divided in half, with sector vessels fishing in the first half and non-sector vessels in the second.
October 6: Participation in the Category B (regular) DAS Pilot Program is prohibited because the quarterly allocation of 1,000 DAS is used. The program ends for FY 2005.
October 31: Boundaries of the sea scallop access areas within CAI and the NLCA access areas are adjusted.
December 12: Northern shrimp fishery opens and will remain open through April 30, 2006.
December 21: The trip limit for NE multispecies vessels fishing for GB yellowtail flounder is changed from unlimited to 15,000 lbs per trip. The quota for the second period of the CAI Hook Gear Haddock SAP is increased to 536.6 mt.

APPENDIX 2

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

Appendix 2: Table 1. Discard to Kept ratio (D_K), number of tows observed, and total discards (mt) of Atlantic cod in the USA otter trawl and gill net fleet in NAFO Division 52, 53, and 56 as estimated from Domestic Sea Sample Observations, 1989-2004. (italics-value borrowed from adjacent cell)

Otter trawl					Otter trawl						Discarded mt in otter trawl fleet					
D_K ratio	Qrt 1	Qrt 2	Qrt 3	Qrt 4	mt landed	Qrt 1	Qrt 2	Qrt 3	Qrt 4	Total	year	Qrt 1	Qrt 2	Qrt 3	Qrt 4	total
1989	0.027	0.046	0.070	0.054	1989	4535	7043	3737	3612	18927	1989	122.4	324.0	261.6	195.0	903.1
1990	0.041	0.052	0.019	0.021	1990	4957	7661	4941	5340	22899	1990	203.2	398.4	93.9	112.1	807.6
1991	0.010	0.032	0.020	0.078	1991	5245	8036	2431	2870	18582	1991	52.5	257.2	48.6	223.9	582.1
1992	0.018	0.003	0.053	0.035	1992	3599	4259	1519	2931	12308	1992	64.8	12.8	80.5	102.6	260.7
1993	0.031	0.018	0.088	0.029	1993	2864	4136	1485	2722	11207	1993	88.8	74.4	130.7	78.9	372.9
1994	0.006	0.008	0.002	0.003	1994	2118	2781	1118	1122	7139	1994	12.7	22.2	2.2	3.4	40.6
1995	0.003	0.029	0.009	0.010	1995	669	1398	934	779	3780	1995	2.0	40.5	8.4	7.8	58.7
1996	0.010	0.001	0.009	0.008	1996	779	1915	869	484	4047	1996	7.8	1.9	7.8	3.9	21.4
1997	0.008	0.001	0.004	0.013	1997	713	2432	852	620	4617	1997	5.7	2.4	3.4	8.1	19.6
1998	0.012	0.001	0.005	0.013	1998	518	2167	702	696	4083	1998	6.2	2.2	3.5	9.0	20.9
1999	0.012	0.006	0.008	0.018	1999	764	2543	781	673	4760	1999	9.2	15.3	6.2	12.1	42.8
2000	0.020	0.028	0.022	0.011	2000	1152	2537	1399	1274	6362	2000	23.0	71.0	30.8	14.0	138.9
2001	0.121	0.018	0.017	0.003	2001	1365	2734	1252	1705	7057	2001	165.1	49.2	21.3	5.1	240.7
2002	0.010	0.009	0.026	0.031	2002	1504	3193	904	816	6417	2002	15.0	28.7	23.5	25.3	92.6
2003	0.022	0.057	0.022	0.040	2003	1332	2535	502	670	5039	2003	29.3	144.5	11.1	26.8	211.6
2004	0.033	0.047	0.082	0.056	2004	784	1358	232	424	2799	2004	25.9	63.8	19.0	23.8	132.5

Gill net					Gill net						Discarded mt in gill net fleet					
D_K ratio	Qrt 1	Qrt 2	Qrt 3	Qrt 4	mt landed	Qrt 1	Qrt 2	Qrt 3	Qrt 4	Total	year	Qrt 1	Qrt 2	Qrt 3	Qrt 4	total
1989	0.017	0.001	0.011	0.067	1989	325	997	1901	312	3535	1989	5.5	1.0	20.9	20.9	48.3
1990	0.017	0.017	0.072	0.142	1990	311	861	1294	186	2652	1990	5.3	14.6	93.2	26.4	139.5
1991	0.115	0.01	0.032	0.101	1991	185	746	1235	392	2558	1991	21.3	7.5	39.5	39.6	107.8
1992	0.033	0.045	0.029	0.044	1992	277	462	1134	297	2170	1992	9.1	20.8	32.9	13.1	75.9
1993	0.059	0.073	0.004	0.055	1993	131	561	579	275	1546	1993	7.7	41.0	2.3	15.1	66.1
1994	0.118	0.028	0.043	0.07	1994	102	325	611	280	1318	1994	12.0	9.1	26.3	19.6	67.0
1995	0.193	0.028	0.029	0.081	1995	120	366	627	187	1300	1995	23.2	10.3	18.2	15.1	66.8
1996	0.016	0.08	0.146	0.05	1996	89	547	634	283	1552	1996	1.4	43.7	92.5	14.1	151.8
1997	0.068	0.049	0.02	0.093	1997	59	776	589	177	1601	1997	4.0	38.0	11.8	16.5	70.3
1998	0.111	0.111	0.08	0.046	1998	110	342	257	148	858	1998	12.3	37.9	20.6	6.8	77.6
1999	0.046	0.037	0.044	0.04	1999	131	664	472	185	1452	1999	6.0	24.6	20.8	7.4	58.8
2000	0.021	0.022	0.064	0.089	2000	503	251	291	193	1238	2000	10.6	5.5	18.7	17.2	51.9
2001	0.047	0.005	0.037	0.152	2001	500	1284	947	304	3035	2001	23.5	6.4	35.0	46.3	111.2
2002	0.012	0.097	0.123	0.062	2002	284	289	482	148	1204	2002	3.4	28.0	59.3	9.2	100.0
2003	0.098	0.097	0.038	0.102	2003	130	171	594	126	1021	2003	12.7	16.6	22.6	12.8	64.8
2004	0.071	0.167	0.113	0.118	2004	81	113	160	26	380	2004	5.7	18.9	18.1	3.1	45.8

Otter trawl - Number of Tows observed					Gill net - Number of tows observed					Discarded Landed Total Final					
year	Qrt 1	Qrt 2	Qrt 3	Qrt 4	No.Tows	Qrt 1	Qrt 2	Qrt 3	Qrt 4	Catch	Catch	landings	bumpup	Discards	
1989	133	335	238	175	1989		3	58	36	1989	951.4	22462	25097	1.12	1063.0
1990	240	150	130	207	1990	8	37	15	21	1990	947.1	25551	28193	1.10	1045.1
1991	268	173	167	214	1991	4	218	486	129	1991	689.9	21140	24175	1.14	789.0
1992	241	181	67	121	1992	29	355	250	199	1992	336.5	14478	16855	1.16	391.8
1993	59	240	70	138	1993	84	145	14	196	1993	439.0	12753	14594	1.14	502.3
1994	286	209	55	60	1994	90		24	112	1994	107.6	8458	9893	1.17	125.8
1995	284	252	130	135	1995	53	67	71	60	1995	125.5	5080	6759	1.33	167.0
1996	148	306		58	1996	33	25	6	50	1996	173.2	5599	7020	1.25	217.1
1997	152	1	158	100	1997	28	23	22	26	1997	89.9	6219	7537	1.21	109.0
1998	66		71		1998	58	34	12	87	1998	98.5	4941	6959	1.41	138.8
1999	1	81	69	118	1999	56	79	56	28	1999	101.5	6212	8061	1.30	131.8
2000	188	182	129	195	2000	24	65	54	53	2000	190.8	7600	7617	1.00	191.2
2001	286	267	269	198	2001	60	35	17	27	2001	352.0	10092	10635	1.05	370.9
2002	133	257	700	1121	2002	39	18	31	14	2002	192.5	7620	8997	1.18	227.3
2003	885	1008	653	669	2003	6	100	148	107	2003	276.4	6060	6646	1.10	303.1
2004	840	931	486	1190	2004	35	280	185	112	2004	178.3	3179	3471	1.09	194.7

APPENDIX 3

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), 1963-2005.

Table 2. Stratified mean catch per tow at age (numbers) of Atlantic cod in Canadian spring bottom trawl surveys on Eastern Georges Bank, 1986-2005.

Appendix 3: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 - 2005.

Year	AGE											No./tow
	0	1	2	3	4	5	6	7	8	9	10+	
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
2001	0.000	0.061	0.235	0.794	0.160	0.383	0.177	0.023	0.018	0.012	0.000	1.862
2002	0.018	0.065	0.093	0.383	0.993	0.239	0.225	0.039	0.000	0.000	0.028	2.083
2003	0.000	0.016	0.213	0.271	0.623	0.696	0.064	0.080	0.012	0.000	0.000	1.975
2004	0.000	0.637	0.058	0.579	1.407	1.354	0.893	0.179	0.261	0.013	0.000	5.380
2005	0.0614	0.0119	0.4838	0.1378	0.631	0.2744	0.2053	0.1274	0.0298	0		1.9628
average	0.289	0.427	2.297	1.752	1.196	0.730	0.321	0.190	0.099	0.066	0.096	7.294

Appendix 3: 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), 1963-2004.

Year	AGE											No./tow
	0	1	2	3	4	5	6	7	8	9	10+	
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
2001	0.028	0.047	0.381	0.459	0.059	0.055	0.008	0.008	0.000	0.000	0.000	1.045
2002	0.234	0.478	0.707	1.396	1.627	0.118	0.131	0.012	0.000	0.000	0.000	4.703
2003	0.327	0.166	0.309	0.201	0.156	0.082	0.000	0.007	0.000	0.000	0.000	1.248
2004	1.6853	0.7448	0.1358	0.7101	0.252	0.3215	0.2524	0.0647	0.0195	0.000	0.000	4.186
average	0.360	1.318	1.066	0.728	0.421	0.146	0.126	0.063	0.051	0.029	0.056	4.364

Appendix 3: Table 2. Stratified mean catch per tow at age (numbers) of Atlantic cod in Canadian spring bottom trawl survey

Year	AGE										No./ tow
	1	2	3	4	5	6	7	8	9	10+	
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
2002	0.01	0.09	0.57	2.05	0.68	1.22	0.40	0.17	0.05	0.08	5.32
2003	0.00	0.02	0.30	0.65	1.21	0.32	0.34	0.16	0.01	0.00	3.01
2004	0.54	0.10	0.39	0.42	0.45	0.39	0.07	0.12	0.02	0.01	2.50
*2005	0.05	2.04	2.78	14.18	3.42	1.59	1.45	0.12	0.15	0.02	25.80
average	0.31	1.07	1.67	2.09	1.09	0.58	0.33	0.13	0.06	0.06	6.41

* R/V Needler indices not included in VPA calibration (entire GB not surveyed)

2005											
R/V Teleost	0.02	1.34	0.47	2.91	1.13	0.51	0.41	0.01	0.05	0.01	6.86

APPENDIX 4
Full Listing of ADAPT VPA Calibration Output and Diagnostics for Georges Bank Cod

VPA Version 2.3.1

Model ID: Georges Bank Cod - 2001 Assessment 2001 TY

Input File: C:\LOB\GBCOD\ASSESS_2005\VPA\TY2004\TY2004_GRPED_MAT.DAT

Date of Run: 11-AUG-2005

Time of Run: 11:58

Levenburg-Marquardt Algorithm Completed 5 Iterations
Residual Sum of Squares = 324.636

Number of Residuals = 523
Number of Parameters = 8
Degrees of Freedom = 515
Mean Squared Residual = 0.630361
Standard Deviation = 0.793953

Number of Years = 27
Number of Ages = 10
First Year = 1978
Youngest Age = 1
Oldest True Age = 9

Number of Survey Indices Available = 30
Number of Survey Indices Used in Estimate = 30

VPA Classic Method - Auto Estimated Q's

Stock Numbers Predicted in Terminal Year Plus One (2005)

Age	Stock Predicted	Std. Error	CV
1	10398.156	0.595969E+04	0.573148E+00
2	17373.054	0.632078E+04	0.363826E+00
3	1502.088	0.467500E+03	0.311233E+00
4	1498.629	0.429089E+03	0.286321E+00
5	1037.229	0.299127E+03	0.288390E+00
6	1186.622	0.364641E+03	0.307293E+00
7	787.359	0.301170E+03	0.382507E+00
8	105.995	0.492835E+02	0.464961E+00

Catchability Values for Each Survey Used in Estimate

INDEX	Catchability	Std. Error	CV
1	0.144671E-04	0.315442E-05	0.218041E+00
2	0.658076E-04	0.615660E-05	0.935545E-01
3	0.138672E-03	0.172033E-04	0.124058E+00
4	0.228568E-03	0.353337E-04	0.154587E+00
5	0.283697E-03	0.457353E-04	0.161212E+00
6	0.292377E-03	0.442526E-04	0.151354E+00
7	0.318676E-03	0.575268E-04	0.180518E+00
8	0.373921E-03	0.628297E-04	0.168029E+00
9	0.120505E-04	0.901928E-05	0.748457E+00
10	0.760932E-04	0.182309E-04	0.239586E+00
11	0.162350E-03	0.356721E-04	0.219723E+00
12	0.140752E-03	0.165648E-04	0.117688E+00
13	0.172199E-03	0.403401E-04	0.234265E+00

14	0.160600E-03	0.229899E-04	0.143150E+00
15	0.224100E-03	0.717176E-04	0.320025E+00
16	0.238894E-03	0.148723E-03	0.622548E+00
17	0.186510E-04	0.487676E-05	0.261474E+00
18	0.773206E-04	0.195865E-04	0.253315E+00
19	0.231101E-03	0.284388E-04	0.123058E+00
20	0.387317E-03	0.557697E-04	0.143990E+00
21	0.614360E-03	0.874400E-04	0.142327E+00
22	0.759648E-03	0.155481E-03	0.204675E+00
23	0.868003E-03	0.193330E-03	0.222730E+00
24	0.107767E-02	0.230349E-03	0.213747E+00
25	0.129290E-04	0.267327E-05	0.206766E+00
26	0.607287E-04	0.768718E-05	0.126582E+00
27	0.104068E-03	0.129460E-04	0.124399E+00
28	0.124037E-03	0.186995E-04	0.150757E+00
29	0.923788E-04	0.171431E-04	0.185573E+00
30	0.107259E-03	0.157744E-04	0.147068E+00

-- Non-Linear Least Squares Fit --

Default Tolerances Used

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

VPA Method Options

- Catchability Values Estimated as an Analytic Function of N
- Pope Approximation Used in Cohort Solution
- Plus Group Backward Calculation Method Used
- Rivard Weights Used for JAN-1 Biomass
- Rivard Weights Used for SSB Biomass
- Rivard Weights Calculation Used 5 Years for Terminal Year Plus One

- Heincke Rule Used in F-Oldest Calculation
- F-Oldest Calculation in Years Prior to Terminal Year
Uses Stock Sizes in Ages 4 to 9
- Calculation of Population of Age 1 In Year 2005
= Stock Estimate

Stock Estimates

Age 1
Age 2
Age 3
Age 4
Age 5
Age 6
Age 7
Age 8

Full F in Terminal Year = 0.2361

F in Oldest True Age in Terminal Year = 0.2361

Full F Calculated Using Classic Method

Age	Input Partial Recruitment	Calc Partial Recruitment	Fishing Mortality	Used In Full F	Comments
1	0.000	0.000	0.0000	NO	Stock Estimate in T+1
2	0.150	0.053	0.0185	NO	Stock Estimate in T+1
3	0.600	0.504	0.1761	NO	Stock Estimate in T+1
4	1.000	0.507	0.1770	YES	Stock Estimate in T+1
5	1.000	0.525	0.1834	YES	Stock Estimate in T+1
6	1.000	0.671	0.2345	YES	Stock Estimate in T+1
7	1.000	1.000	0.3495	YES	Stock Estimate in T+1
8	1.000	0.676	0.2361	NO	Input PR * Full F
9	1.000	0.676	0.2361		Input PR * Full F

Catch At Age - Input Data

AGE	1978	1979	1980	1981	1982
1	2.0	34.0	89.0	27.0	331.0
2	393.0	1989.0	3777.0	3205.0	9138.0
3	7748.0	900.0	5828.0	4221.0	3824.0
4	2303.0	4870.0	500.0	2464.0	2787.0
5	830.0	1212.0	2308.0	235.0	2000.0
6	131.0	458.0	1076.0	1406.0	281.0
7	345.0	77.0	445.0	417.0	673.0
8	47.0	253.0	87.0	123.0	213.0
9	40.0	4.0	167.0	130.0	71.0
10	15.0	48.0	10.0	62.0	83.0
AGE	1983	1984	1985	1986	1987
1	108.0	81.0	134.0	156.0	26.0
2	4286.0	1307.0	6426.0	1326.0	7473.0
3	8063.0	3423.0	2443.0	4573.0	1406.0
4	2456.0	3336.0	1368.0	797.0	2121.0
5	1055.0	840.0	1885.0	480.0	279.0
6	776.0	516.0	412.0	627.0	252.0
7	95.0	458.0	218.0	87.0	270.0
8	235.0	44.0	203.0	72.0	63.0
9	100.0	171.0	21.0	47.0	38.0
10	65.0	121.0	97.0	29.0	24.0
AGE	1988	1989	1990	1991	1992
1	10.0	0.0	7.0	52.0	70.0
2	1577.0	2088.0	4942.0	1525.0	4177.0
3	8022.0	2922.0	5042.0	3243.0	2170.0
4	1012.0	4155.0	1882.0	3281.0	1038.0
5	1497.0	331.0	2264.0	1458.0	1482.0
6	244.0	541.0	229.0	1088.0	404.0
7	161.0	82.0	245.0	126.0	309.0
8	197.0	43.0	36.0	70.0	34.0
9	50.0	50.0	17.0	23.0	33.0
10	47.0	18.0	38.0	23.0	10.0

Catch At Age - Input Data

AGE	1993	1994	1995	1996	1997
1	4.0	2.0	0.1	1.0	3.0
2	1033.0	398.0	392.0	207.0	517.0
3	4246.0	1526.0	1058.0	903.0	639.0
4	1115.0	1825.0	692.0	1234.0	881.0
5	440.0	394.0	290.0	241.0	794.0
6	472.0	96.0	44.0	123.0	131.0
7	159.0	137.0	26.0	15.0	84.0
8	143.0	46.0	15.0	3.0	16.0
9	32.0	38.0	2.0	5.0	9.0
10	17.0	6.0	1.0	0.0	1.0
AGE	1998	1999	2000	2001	2002
1	0.2	2.0	14.0	0.1	0.0
2	739.0	285.0	752.0	685.0	51.0
3	1188.0	1927.0	687.0	2382.0	967.0
4	423.0	706.0	1062.0	643.0	1347.0
5	324.0	201.0	284.0	597.0	318.0
6	237.0	97.0	75.0	166.0	331.0
7	39.0	119.0	42.0	45.0	67.0
8	14.0	16.0	37.0	22.0	17.0
9	6.0	2.0	4.0	11.0	8.0
10	4.0	3.0	1.0	2.0	5.0
AGE	2003	2004			
1	0.2	0.0			
2	71.0	31.0			
3	371.0	319.0			
4	754.0	222.0			
5	751.0	264.0			
6	124.0	230.0			
7	122.0	49.0			
8	23.0	41.0			
9	6.0	10.0			
10	3.0	4.0			

Weight At Age - Input Data

AGE	1978	1979	1980	1981	1982
1	0.7070	0.8890	0.8360	0.8820	0.7650
2	1.3100	1.4940	1.4600	1.4950	1.4020
3	2.4610	2.1490	2.4680	2.3580	2.6640
4	3.4690	4.2110	3.6680	3.4150	3.8340
5	4.3360	4.8880	5.6470	5.2130	5.3520
6	5.7870	7.1780	6.6760	7.2220	6.5110
7	7.3740	9.1830	8.3900	8.5650	9.3630
8	8.4920	10.3130	9.0890	9.8880	9.8970
9	11.7850	11.6990	8.4320	14.1700	12.5030
10	13.2000	12.6250	15.4000	18.5650	16.7230
AGE	1983	1984	1985	1986	1987
1	0.9710	1.0530	0.9070	0.9290	0.7260
2	1.4900	1.6350	1.4180	1.4750	1.4810
3	2.3770	2.4510	2.0860	2.4470	2.4950
4	3.3090	3.6190	3.8870	3.6600	4.1870
5	4.6370	5.0830	5.0870	5.6030	5.8100
6	6.3930	6.5820	6.4120	7.1910	7.7260
7	7.9640	8.9090	8.0970	8.9150	8.9490
8	10.2860	10.1040	10.2360	9.9550	10.0130
9	11.2270	11.3030	11.4180	12.6870	11.4140
10	14.5540	15.3560	13.4940	14.1040	15.0000
AGE	1988	1989	1990	1991	1992
1	0.7860	0.8090	0.8310	1.1140	1.1480
2	1.5200	1.6170	1.5600	1.6270	1.5420
3	2.3590	2.2690	2.4620	2.5480	2.4640
4	3.5110	3.7720	3.5220	3.4200	3.8430
5	5.4010	5.3960	4.8920	4.7690	4.7040
6	6.6470	6.6940	6.3330	5.8910	6.1560
7	8.7760	8.2220	8.4560	7.4100	7.5090
8	9.9870	10.7180	10.6480	10.5200	9.8460
9	11.1430	11.6650	12.5800	9.6860	12.0590
10	15.2980	17.1110	14.5260	15.3730	19.0250

Weight At Age - Input Data

AGE	1993	1994	1995	1996	1997
1	0.8720	0.9060	0.9060	0.8820	0.9540
2	1.5340	1.4590	1.4710	1.5070	1.5770
3	2.2530	2.1680	2.0950	2.4350	2.3210
4	3.3330	3.6570	3.8300	3.3870	3.5320
5	4.9670	4.8040	5.4920	4.9120	4.1030
6	6.3790	7.4320	7.3840	6.6220	6.0190
7	7.5100	8.0130	10.7150	8.3690	8.0500
8	9.2170	9.3680	11.6170	8.4380	8.6310
9	9.6990	9.6980	10.3830	12.8830	11.8700
10	13.2360	16.6590	14.9530	12.0020	12.7950
AGE	1998	1999	2000	2001	2002
1	0.5790	0.8300	0.9560	0.8800	0.5510
2	1.4830	1.5650	1.6960	1.5160	1.7680
3	2.3020	2.2230	2.4610	2.3490	2.2650
4	3.4970	3.4520	3.5330	3.1570	3.0680
5	4.7350	4.8910	4.7310	4.3590	4.2900
6	5.9340	6.4220	5.7970	5.5160	5.3450
7	8.1850	7.3410	7.5300	6.3230	6.7590
8	8.6100	9.6850	8.5960	8.1780	8.4280
9	12.6840	12.1530	8.5170	9.7660	9.7110
10	14.6060	13.7350	12.8310	11.9510	12.1270
AGE	2003	2004			
1	0.5240	0.7040			
2	1.9410	1.9500			
3	2.3530	2.5860			
4	3.0340	3.1920			
5	4.0310	4.0900			
6	4.9540	5.0320			
7	6.1780	5.9450			
8	7.9240	7.8380			
9	9.2390	9.2730			
10	10.7440	12.2190			

JAN-1 Weights at Age - Input Data

AGE	1978	1979	1980	1981	1982
1	0.4864	0.6937	0.6252	0.6996	0.5481
2	1.0228	1.0277	1.1393	1.1180	1.1120
3	1.8814	1.6779	1.9202	1.8554	1.9957
4	2.9224	3.2192	2.8076	2.9031	3.0068
5	3.3700	4.1178	4.8764	4.3728	4.2752
6	4.5940	5.5789	5.7125	6.3861	5.8260
7	6.2354	7.2899	7.7604	7.5617	8.2231
8	7.2350	8.7206	9.1359	9.1083	9.2069
9	10.0039	9.9673	9.3252	11.3486	11.1189
10	13.2000	12.6250	15.4000	18.5650	16.7230
AGE	1983	1984	1985	1986	1987
1	0.7483	0.9074	0.7112	0.7358	0.5017
2	1.0676	1.2600	1.2219	1.1566	1.1730
3	1.8255	1.9110	1.8468	1.8628	1.9184
4	2.9690	2.9330	3.0866	2.7631	3.2009
5	4.2164	4.1012	4.2907	4.6668	4.6114
6	5.8494	5.5246	5.7090	6.0482	6.5794
7	7.2009	7.5469	7.3003	7.5606	8.0220
8	9.8137	8.9704	9.5495	8.9781	9.4481
9	10.5410	10.7825	10.7409	11.3958	10.6596
10	14.5540	15.3560	13.4940	14.1040	15.0000
AGE	1988	1989	1990	1991	1992
1	0.5480	0.5826	0.5939	0.9469	0.9931
2	1.0505	1.1274	1.1234	1.1628	1.3106
3	1.8691	1.8571	1.9953	1.9937	2.0022
4	2.9597	2.9830	2.8269	2.9017	3.1292
5	4.7554	4.3526	4.2957	4.0983	4.0109
6	6.2144	6.0128	5.8458	5.3683	5.4183
7	8.2343	7.3927	7.5236	6.8504	6.6510
8	9.4538	9.6985	9.3567	9.4317	8.5416
9	10.5629	10.7934	11.6117	10.1556	11.2632
10	15.2980	17.1110	14.5260	15.3730	19.0250

JAN-1 Weights at Age - Input Data

AGE	1993	1994	1995	1996	1997
1	0.6741	0.7110	0.7025	0.6596	0.7652
2	1.3270	1.1279	1.1544	1.1685	1.1794
3	1.8639	1.8237	1.7483	1.8926	1.8702
4	2.8657	2.8704	2.8816	2.6638	2.9326
5	4.3690	4.0015	4.4815	4.3374	3.7278
6	5.4778	6.0758	5.9559	6.0306	5.4374
7	6.7994	7.1495	8.9238	7.8611	7.3012
8	8.3193	8.3877	9.6482	9.5086	8.4990
9	9.7722	9.4544	9.8625	12.2336	10.0080
10	13.2360	16.6590	14.9530	12.0020	12.7950
AGE	1998	1999	2000	2001	2002
1	0.3522	0.5806	0.7592	0.6208	0.2936
2	1.1894	0.9519	1.1865	1.2039	1.2473
3	1.9053	1.8157	1.9625	1.9960	1.8530
4	2.8490	2.8190	2.8025	2.7874	2.6845
5	4.0895	4.1357	4.0412	3.9243	3.6802
6	4.9343	5.5144	5.3248	5.1084	4.8269
7	7.0189	6.6001	6.9540	6.0543	6.1060
8	8.3253	8.9035	7.9438	7.8473	7.3000
9	10.4631	10.2292	9.0822	9.1623	8.9116
10	14.6060	13.7350	12.8310	11.9510	12.1270
AGE	2003	2004	2005		
1	0.2717	0.4904	0.4871		
2	1.0342	1.0106	1.1365		
3	2.0396	2.2430	2.0188		
4	2.6215	2.7457	2.7283		
5	3.5167	3.5244	3.7374		
6	4.6101	4.5038	4.8748		
7	5.7464	5.4360	6.0593		
8	7.3184	6.9440	7.4707		
9	8.8242	8.5057	8.8972		
10	10.7440	12.1760	11.9658		

SSB Weight At Age - Input Data

AGE	1978	1979	1980	1981	1982
1	0.4864	0.6937	0.6252	0.6996	0.5481
2	1.0228	1.0277	1.1393	1.1180	1.1120
3	1.8814	1.6779	1.9202	1.8554	1.9957
4	2.9224	3.2192	2.8076	2.9031	3.0068
5	3.3700	4.1178	4.8764	4.3728	4.2752
6	4.5940	5.5789	5.7125	6.3861	5.8260
7	6.2354	7.2899	7.7604	7.5617	8.2231
8	7.2350	8.7206	9.1359	9.1083	9.2069
9	10.0039	9.9673	9.3252	11.3486	11.1189
10	13.2000	12.6250	15.4000	18.5650	16.7230
AGE	1983	1984	1985	1986	1987
1	0.7483	0.9074	0.7112	0.7358	0.5017
2	1.0676	1.2600	1.2219	1.1566	1.1730
3	1.8255	1.9110	1.8468	1.8628	1.9184
4	2.9690	2.9330	3.0866	2.7631	3.2009
5	4.2164	4.1012	4.2907	4.6668	4.6114
6	5.8494	5.5246	5.7090	6.0482	6.5794
7	7.2009	7.5469	7.3003	7.5606	8.0220
8	9.8137	8.9704	9.5495	8.9781	9.4481
9	10.5410	10.7825	10.7409	11.3958	10.6596
10	14.5540	15.3560	13.4940	14.1040	15.0000
AGE	1988	1989	1990	1991	1992
1	0.5480	0.5826	0.5939	0.9469	0.9931
2	1.0505	1.1274	1.1234	1.1628	1.3106
3	1.8691	1.8571	1.9953	1.9937	2.0022
4	2.9597	2.9830	2.8269	2.9017	3.1292
5	4.7554	4.3526	4.2957	4.0983	4.0109
6	6.2144	6.0128	5.8458	5.3683	5.4183
7	8.2343	7.3927	7.5236	6.8504	6.6510
8	9.4538	9.6985	9.3567	9.4317	8.5416
9	10.5629	10.7934	11.6117	10.1556	11.2632
10	15.2980	17.1110	14.5260	15.3730	19.0250

SSB Weight At Age - Input Data

AGE	1993	1994	1995	1996	1997
1	0.6741	0.7110	0.7025	0.6596	0.7652
2	1.3270	1.1279	1.1544	1.1685	1.1794
3	1.8639	1.8237	1.7483	1.8926	1.8702
4	2.8657	2.8704	2.8816	2.6638	2.9326
5	4.3690	4.0015	4.4815	4.3374	3.7278
6	5.4778	6.0758	5.9559	6.0306	5.4374
7	6.7994	7.1495	8.9238	7.8611	7.3012
8	8.3193	8.3877	9.6482	9.5086	8.4990
9	9.7722	9.4544	9.8625	12.2336	10.0080
10	13.2360	16.6590	14.9530	12.0020	12.7950
AGE	1998	1999	2000	2001	2002
1	0.3522	0.5806	0.7592	0.6208	0.2936
2	1.1894	0.9519	1.1865	1.2039	1.2473
3	1.9053	1.8157	1.9625	1.9960	1.8530
4	2.8490	2.8190	2.8025	2.7874	2.6845
5	4.0895	4.1357	4.0412	3.9243	3.6802
6	4.9343	5.5144	5.3248	5.1084	4.8269
7	7.0189	6.6001	6.9540	6.0543	6.1060
8	8.3253	8.9035	7.9438	7.8473	7.3000
9	10.4631	10.2292	9.0822	9.1623	8.9116
10	14.6060	13.7350	12.8310	11.9510	12.1270
AGE	2003	2004			
1	0.2717	0.4904			
2	1.0342	1.0106			
3	2.0396	2.2430			
4	2.6215	2.7457			
5	3.5167	3.5244			
6	4.6101	4.5038			
7	5.7464	5.4360			
8	7.3184	6.9440			
9	8.8242	8.5057			
10	10.7440	12.1760			

Natural Mortality - Input Data

AGE	1978	1979	1980	1981	1982
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
10	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1983	1984	1985	1986	1987
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
10	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1988	1989	1990	1991	1992
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
10	0.2000	0.2000	0.2000	0.2000	0.2000

Natural Mortality - Input Data

AGE	1993	1994	1995	1996	1997
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
10	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	1998	1999	2000	2001	2002
1	0.2000	0.2000	0.2000	0.2000	0.2000
2	0.2000	0.2000	0.2000	0.2000	0.2000
3	0.2000	0.2000	0.2000	0.2000	0.2000
4	0.2000	0.2000	0.2000	0.2000	0.2000
5	0.2000	0.2000	0.2000	0.2000	0.2000
6	0.2000	0.2000	0.2000	0.2000	0.2000
7	0.2000	0.2000	0.2000	0.2000	0.2000
8	0.2000	0.2000	0.2000	0.2000	0.2000
9	0.2000	0.2000	0.2000	0.2000	0.2000
10	0.2000	0.2000	0.2000	0.2000	0.2000
AGE	2003	2004			
1	0.2000	0.2000			
2	0.2000	0.2000			
3	0.2000	0.2000			
4	0.2000	0.2000			
5	0.2000	0.2000			
6	0.2000	0.2000			
7	0.2000	0.2000			
8	0.2000	0.2000			
9	0.2000	0.2000			
10	0.2000	0.2000			

Proportion of Natural Mortality Before Spawning = 0.1667
 Proportion of Fishing Mortality Before Spawning = 0.1667

Maturity - Input Data

AGE	1978	1979	1980	1981	1982
1	0.0700	0.0700	0.0700	0.0700	0.1300
2	0.3400	0.3400	0.3400	0.3400	0.4700
3	0.7800	0.7800	0.7800	0.7800	0.8400
4	0.9600	0.9600	0.9600	0.9600	0.9700
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1983	1984	1985	1986	1987
1	0.1300	0.1300	0.1300	0.2800	0.2800
2	0.4700	0.4700	0.4700	0.6700	0.6700
3	0.8400	0.8400	0.8400	0.9100	0.9100
4	0.9700	0.9700	0.9700	0.9800	0.9800
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1988	1989	1990	1991	1992
1	0.2800	0.2800	0.1200	0.1200	0.1200
2	0.6700	0.6700	0.5200	0.5200	0.5200
3	0.9100	0.9100	0.9000	0.9000	0.9000
4	0.9800	0.9800	0.9900	0.9900	0.9900
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000

Maturity - Input Data

AGE	1993	1994	1995	1996	1997
1	0.1200	0.0200	0.0200	0.0200	0.1300
2	0.5200	0.3900	0.3900	0.3900	0.5700
3	0.9000	0.9500	0.9500	0.9500	0.9200
4	0.9900	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	1998	1999	2000	2001	2002
1	0.1300	0.1300	0.0300	0.0300	0.0300
2	0.5700	0.5700	0.4400	0.4400	0.4400
3	0.9200	0.9200	0.9500	0.9500	0.9500
4	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000
AGE	2003	2004			
1	0.0700	0.0700			
2	0.3400	0.3400			
3	0.7900	0.7900			
4	0.9600	0.9600			
5	1.0000	1.0000			
6	1.0000	1.0000			
7	1.0000	1.0000			
8	1.0000	1.0000			
9	1.0000	1.0000			
10	1.0000	1.0000			

Input Partial Recruitment

AGE

1	0.0000
2	0.1500
3	0.6000
4	1.0000
5	1.0000
6	1.0000
7	1.0000
8	1.0000
9	1.0000

Input F-Plus Ratio

YEAR

1978	1.0000
1979	1.0000
1980	1.0000
1981	1.0000
1982	1.0000
1983	1.0000
1984	1.0000
1985	1.0000
1986	1.0000
1987	1.0000
1988	1.0000
1989	1.0000
1990	1.0000
1991	1.0000
1992	1.0000
1993	1.0000
1994	1.0000
1995	1.0000
1996	1.0000
1997	1.0000
1998	1.0000
1999	1.0000
2000	1.0000
2001	1.0000
2002	1.0000
2003	1.0000
2004	1.0000

SURVEY - INPUT DATA

INDEX	1	2	3	4	5
SURVEY TAG	spr_36	spr_36	spr_36	spr_36	spr_36
AGE	1	2	3	4	5
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1978	0.0000	0.0000	0.0000	0.0000	0.0000
1979	0.0000	0.0000	0.0000	0.0000	0.0000
1980	0.0000	0.0000	0.0000	0.0000	0.0000
1981	0.0000	0.0000	0.0000	0.0000	0.0000
1982	0.5079	5.4354	9.5019	8.3244	6.2080
1983	0.3315	1.9518	3.0170	0.7962	0.6970
1984	0.4022	0.4310	0.7607	1.2382	0.4223
1985	0.1111	2.6531	0.6633	1.1103	1.4123
1986	0.8715	0.4090	1.8444	0.3652	0.5400
1987	0.0197	1.6125	0.3784	0.7633	0.0621
1988	0.7202	0.6088	3.1496	0.4088	0.6435
1989	0.3104	1.4104	0.6664	1.5831	0.2351
1990	0.1734	0.9215	1.7371	0.6742	0.9119
1991	1.0266	0.5278	0.6887	0.9289	0.4788
1992	0.1227	1.2524	0.4682	0.1681	0.2729
1993	0.0085	0.3988	1.3061	0.2053	0.0895
1994	0.1248	0.2724	0.2000	0.2165	0.0332
1995	0.0495	0.3817	0.8539	0.5340	0.5990
1996	0.0730	0.2139	0.7362	1.2472	0.1742
1997	0.2908	0.4371	0.1702	0.4886	0.4223
1998	0.1113	0.6652	1.2980	0.8478	0.7549
1999	0.2123	0.2909	0.6090	0.5097	0.2382
2000	0.2207	0.8066	0.8298	1.1411	0.3703
2001	0.0610	0.2350	0.7940	0.1600	0.3830
2002	0.0650	0.0930	0.3830	0.9930	0.2390
2003	0.0160	0.2130	0.2710	0.6230	0.6960
2004	0.6370	0.0580	0.5790	1.4070	1.3540
2005	0.0120	0.4840	0.1380	0.6310	0.2740

SURVEY - INPUT DATA

INDEX	6	7	8	9	10
SURVEY TAG	spr_36	spr_36	spr_36	spr_41	spr_41
AGE	6	7	8	1	2
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1978	0.0000	0.0000	0.0000	0.3717	0.1918
1979	0.0000	0.0000	0.0000	0.4283	1.2977
1980	0.0000	0.0000	0.0000	0.0312	2.2170
1981	0.0000	0.0000	0.0000	2.3022	1.8522
1982	0.2929	1.8657	0.3685	0.0000	0.0000
1983	0.4431	0.0272	0.2186	0.0000	0.0000
1984	0.4004	0.2088	0.0000	0.0000	0.0000
1985	0.2654	0.1919	0.1799	0.0000	0.0000
1986	0.6179	0.0617	0.1251	0.0000	0.0000
1987	0.1794	0.1355	0.0328	0.0000	0.0000
1988	0.0640	0.0370	0.0492	0.0000	0.0000
1989	0.3511	0.0505	0.0395	0.0000	0.0000
1990	0.1304	0.1431	0.0129	0.0000	0.0000
1991	0.3281	0.0541	0.0406	0.0000	0.0000
1992	0.1424	0.1587	0.0196	0.0000	0.0000
1993	0.1382	0.0293	0.0344	0.0000	0.0000
1994	0.0057	0.0441	0.0000	0.0000	0.0000
1995	0.1067	0.2336	0.0280	0.0000	0.0000
1996	0.2085	0.0277	0.0181	0.0000	0.0000
1997	0.0498	0.1339	0.0201	0.0000	0.0000
1998	0.5326	0.1016	0.0309	0.0000	0.0000
1999	0.1193	0.0636	0.0305	0.0000	0.0000
2000	0.1024	0.0255	0.0201	0.0000	0.0000
2001	0.1770	0.0230	0.0180	0.0000	0.0000
2002	0.2250	0.0390	0.0000	0.0000	0.0000
2003	0.0640	0.0800	0.0120	0.0000	0.0000
2004	0.8930	0.1790	0.2610	0.0000	0.0000
2005	0.2050	0.1270	0.0300	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	11	12	13	14	15
SURVEY TAG	spr_41	spr_41	spr_41	spr_41	spr_41
AGE	3	4	5	6	7
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1978	5.5309	0.9715	0.7776	0.1416	0.7123
1979	0.2751	1.8515	0.5466	0.2355	0.0836
1980	2.6896	0.2123	1.7050	0.3737	0.1855
1981	2.8108	1.6849	0.1059	0.8786	0.2582
1982	0.0000	0.0000	0.0000	0.0000	0.0000
1983	0.0000	0.0000	0.0000	0.0000	0.0000
1984	0.0000	0.0000	0.0000	0.0000	0.0000
1985	0.0000	0.0000	0.0000	0.0000	0.0000
1986	0.0000	0.0000	0.0000	0.0000	0.0000
1987	0.0000	0.0000	0.0000	0.0000	0.0000
1988	0.0000	0.0000	0.0000	0.0000	0.0000
1989	0.0000	0.0000	0.0000	0.0000	0.0000
1990	0.0000	0.0000	0.0000	0.0000	0.0000
1991	0.0000	0.0000	0.0000	0.0000	0.0000
1992	0.0000	0.0000	0.0000	0.0000	0.0000
1993	0.0000	0.0000	0.0000	0.0000	0.0000
1994	0.0000	0.0000	0.0000	0.0000	0.0000
1995	0.0000	0.0000	0.0000	0.0000	0.0000
1996	0.0000	0.0000	0.0000	0.0000	0.0000
1997	0.0000	0.0000	0.0000	0.0000	0.0000
1998	0.0000	0.0000	0.0000	0.0000	0.0000
1999	0.0000	0.0000	0.0000	0.0000	0.0000
2000	0.0000	0.0000	0.0000	0.0000	0.0000
2001	0.0000	0.0000	0.0000	0.0000	0.0000
2002	0.0000	0.0000	0.0000	0.0000	0.0000
2003	0.0000	0.0000	0.0000	0.0000	0.0000
2004	0.0000	0.0000	0.0000	0.0000	0.0000
2005	0.0000	0.0000	0.0000	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	16	17	18	19	20
SURVEY TAG	spr_41	sp_can	sp_can	sp_can	sp_can
AGE	8	1	2	3	4
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1

1978	0.0651	0.0000	0.0000	0.0000	0.0000
1979	0.1386	0.0000	0.0000	0.0000	0.0000
1980	0.0310	0.0000	0.0000	0.0000	0.0000
1981	0.1321	0.0000	0.0000	0.0000	0.0000
1982	0.0000	0.0000	0.0000	0.0000	0.0000
1983	0.0000	0.0000	0.0000	0.0000	0.0000
1984	0.0000	0.0000	0.0000	0.0000	0.0000
1985	0.0000	0.0000	0.0000	0.0000	0.0000
1986	0.0000	0.6000	2.2700	2.8100	0.3700
1987	0.0000	0.2500	2.1300	0.9300	1.0900
1988	0.0000	0.2800	1.0100	4.6600	0.5800
1989	0.0000	1.6300	2.7800	1.3800	2.8500
1990	0.0000	0.4200	2.4400	3.7800	2.0800
1991	0.0000	1.1800	1.1600	1.8400	2.1500
1992	0.0000	0.1100	2.8600	1.7700	0.8000
1993	0.0000	0.0000	0.0000	0.0000	0.0000
1994	0.0000	0.0000	0.0000	0.0000	0.0000
1995	0.0000	0.0700	0.6700	1.5000	0.8600
1996	0.0000	0.1400	0.4900	2.3100	4.0200
1997	0.0000	0.3200	0.5300	0.5500	1.2500
1998	0.0000	0.0100	0.6700	0.9500	0.3500
1999	0.0000	0.3300	0.3200	1.4900	1.0900
2000	0.0000	0.1000	0.4400	1.0500	3.9200
2001	0.0000	0.0000	0.0600	0.6400	0.4200
2002	0.0000	0.0100	0.0900	0.5700	2.0500
2003	0.0000	0.0000	0.0200	0.3000	0.6500
2004	0.0000	0.5356	0.0956	0.3920	0.4232
2005	0.0000	0.0000	0.0000	0.0000	0.0000

SURVEY - INPUT DATA

INDEX	21	22	23	24	25
SURVEY TAG	sp_can	sp_can	sp_can	sp_can	us0aut
AGE	5	6	7	8	1
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1

1978	0.0000	0.0000	0.0000	0.0000	0.1516
1979	0.0000	0.0000	0.0000	0.0000	0.3953
1980	0.0000	0.0000	0.0000	0.0000	0.1145
1981	0.0000	0.0000	0.0000	0.0000	0.2797
1982	0.0000	0.0000	0.0000	0.0000	0.2610
1983	0.0000	0.0000	0.0000	0.0000	0.3620
1984	0.0000	0.0000	0.0000	0.0000	1.2829
1985	0.0000	0.0000	0.0000	0.0000	0.1791
1986	0.6500	0.4400	0.2600	0.0400	1.0019
1987	0.3400	0.1200	0.2200	0.0800	0.0761
1988	1.0200	0.1300	0.0800	0.1700	0.2037
1989	0.3600	0.4200	0.0500	0.1000	0.5495
1990	3.8700	0.4200	0.9300	0.1200	0.2508
1991	1.0500	1.3100	0.1600	0.2200	0.1571
1992	0.9800	0.6000	0.4300	0.1200	0.0405
1993	0.0000	0.0000	0.0000	0.0000	0.0351
1994	0.0000	0.0000	0.0000	0.0000	0.1784
1995	0.6000	0.1900	0.0400	0.0500	0.0668
1996	1.0900	0.7900	0.3300	0.0800	0.1599
1997	1.2300	0.2700	0.0600	0.0300	0.0216
1998	0.3500	0.2800	0.0700	0.0200	0.0064
1999	0.4100	0.2600	0.1500	0.0100	0.0701
2000	1.7100	0.7800	0.4000	0.2400	0.0701
2001	1.1100	0.5200	0.2600	0.1700	0.0195
2002	0.6800	1.2200	0.4000	0.1700	0.0280
2003	1.2100	0.3200	0.3400	0.1600	0.2340
2004	0.4509	0.3876	0.0738	0.1175	0.3269
2005	0.0000	0.0000	0.0000	0.0000	1.6853

SURVEY - INPUT DATA

INDEX	26	27	28	29	30
SURVEY TAG	us1aut	us2aut	us3aut	us4aut	us5aut
AGE	2	3	4	5	6
TIME	JAN-1	JAN-1	JAN-1	JAN-1	JAN-1
TYPE	NUMBERS	NUMBERS	NUMBERS	NUMBERS	NUMBERS
RETRO FLAG	1	1	1	1	1
1978	0.2368	3.4335	0.6908	0.2528	0.1731
1979	1.8454	0.3912	4.0577	0.9636	0.3355
1980	1.6251	1.6770	0.1621	1.6865	0.3206
1981	0.8199	0.5636	0.7739	0.0525	0.2648
1982	3.5250	2.2500	1.5590	0.5890	0.0540
1983	0.5773	1.9095	0.2418	0.0678	0.1152
1984	0.8495	1.0893	0.7402	0.0691	0.0328
1985	1.9091	0.6818	0.9287	0.8251	0.0242
1986	0.1813	0.8426	0.0667	0.1055	0.0766
1987	2.2789	0.1285	0.3290	0.0082	0.0487
1988	0.4137	1.3528	0.1080	0.2003	0.0280
1989	0.8747	0.4370	0.9038	0.0600	0.1937
1990	2.7984	1.0464	0.1611	0.5071	0.0547
1991	0.3636	1.6244	1.8141	0.4124	0.2855
1992	0.4076	0.1752	0.2742	0.0305	0.0290
1993	0.4124	0.9489	0.1743	0.1000	0.0437
1994	0.9699	0.5316	0.3826	0.0165	0.0253
1995	0.4056	0.6643	0.4334	0.1534	0.0679
1996	0.2447	1.8106	1.2485	0.0872	0.0541
1997	0.2399	0.1958	0.4144	0.1430	0.0597
1998	0.2362	0.3209	0.1093	0.1292	0.0486
1999	0.3355	1.0262	0.3518	0.0411	0.0354
2000	0.1397	0.1542	0.3096	0.2549	0.0871
2001	0.5710	0.5378	0.0705	0.0788	0.0306
2002	0.0470	0.3810	0.4590	0.0590	0.0550
2003	0.4780	0.7070	1.3960	1.6270	0.1180
2004	0.1663	0.3092	0.2005	0.1556	0.0824
2005	0.7448	0.1358	0.7101	0.2520	0.3215

Additional Output Files

Population File C:\LOB\GBCOD\ASSESS_2005\VPA\TY2004\TY2004_GRPED_MAT.PP2
 Auxilliary File C:\LOB\GBCOD\ASSESS_2005\VPA\TY2004\TY2004_GRPED_MAT.AUX
 Covariance File C:\LOB\GBCOD\ASSESS_2005\VPA\TY2004\TY2004_GRPED_MAT.CV
 Residuals File C:\LOB\GBCOD\ASSESS_2005\VPA\TY2004\TY2004_GRPED_MAT.RSD
 Log File C:\LOB\GBCOD\ASSESS_2005\VPA\TY2004\TY2004_GRPED_MAT.LOG

Estimation Results

JAN-1 Population Numbers

AGE	1978	1979	1980	1981	1982
1	27713.	23513.	20104.	41392.	17471.
2	4268.	22688.	19220.	16380.	33865.
3	25526.	3139.	16776.	12319.	10510.
4	7947.	13888.	1755.	8461.	6266.
5	2878.	4422.	6964.	985.	4698.
6	1124.	1605.	2524.	3613.	594.
7	1434.	802.	900.	1093.	1686.
8	67.	862.	587.	334.	517.
9	146.	12.	477.	402.	162.
10	55.	149.	29.	192.	189.
Total	71158.	71082.	69336.	85171.	75959.
AGE	1983	1984	1985	1986	1987
1	9615.	27391.	8669.	42747.	16376.
2	14004.	7774.	22353.	6977.	34857.
3	19458.	7588.	5182.	12486.	4512.
4	5145.	8635.	3115.	2032.	6085.
5	2609.	1990.	4051.	1312.	943.
6	2037.	1181.	869.	1611.	640.
7	232.	965.	500.	339.	752.
8	772.	104.	376.	212.	199.
9	231.	419.	45.	124.	109.
10	150.	297.	209.	77.	69.
Total	54252.	56344.	45370.	67918.	64541.
AGE	1988	1989	1990	1991	1992
1	23446.	15673.	9184.	17849.	6641.
2	13384.	19187.	12832.	7513.	14566.
3	21777.	9531.	13819.	6034.	4771.
4	2422.	10571.	5159.	6752.	2006.
5	3063.	1067.	4895.	2521.	2559.
6	519.	1153.	574.	1959.	745.
7	296.	205.	455.	263.	620.
8	371.	97.	93.	151.	101.
9	106.	126.	40.	44.	60.
10	99.	45.	90.	44.	18.
Total	65483.	57654.	47142.	43129.	32088.

JAN-1 Population Numbers

AGE	1993	1994	1995	1996	1997
1	8183.	5252.	3248.	5928.	10096.
2	5374.	6696.	4298.	2659.	4852.
3	8147.	3465.	5122.	3165.	1990.
4	1943.	2828.	1456.	3236.	1774.
5	703.	582.	664.	566.	1533.
6	755.	178.	120.	281.	245.
7	244.	191.	58.	58.	119.
8	228.	56.	32.	24.	34.
9	52.	57.	4.	13.	17.
10	28.	9.	2.	0.	2.
Total	25656.	19313.	15005.	15930.	20662.
AGE	1998	1999	2000	2001	2002
1	4577.	12809.	7928.	3436.	3352.
2	8263.	3747.	10486.	6478.	2813.
3	3505.	6097.	2810.	7904.	4684.
4	1051.	1795.	3248.	1679.	4316.
5	655.	478.	831.	1698.	793.
6	537.	243.	209.	423.	850.
7	82.	225.	111.	103.	196.
8	21.	32.	77.	53.	44.
9	13.	5.	12.	29.	24.
10	9.	7.	3.	5.	15.
Total	18714.	25438.	25713.	21810.	17087.
AGE	2003	2004	2005		
1	2283.	21220.	10398.		
2	2745.	1869.	17373.		
3	2257.	2183.	1502.		
4	2960.	1512.	1499.		
5	2315.	1741.	1037.		
6	361.	1216.	1187.		
7	397.	184.	787.		
8	100.	214.	106.		
9	21.	61.	139.		
10	10.	21.	53.		
Total	13448.	30220.	34081.		

Fishing Mortality Calculated

AGE	1978	1979	1980	1981	1982
1	0.0001	0.0016	0.0049	0.0007	0.0212
2	0.1073	0.1019	0.2448	0.2437	0.3541
3	0.4087	0.3811	0.4844	0.4759	0.5143
4	0.3861	0.4903	0.3780	0.3884	0.6763
5	0.3839	0.3608	0.4561	0.3061	0.6358
6	0.1378	0.3789	0.6370	0.5622	0.7404
7	0.3091	0.1122	0.7911	0.5476	0.5818
8	1.4850	0.3921	0.1789	0.5227	0.6068
9	0.3573	0.4336	0.4835	0.4375	0.6504
10	0.3573	0.4336	0.4835	0.4375	0.6504
AGE	1983	1984	1985	1986	1987
1	0.0125	0.0033	0.0172	0.0040	0.0018
2	0.4129	0.2056	0.3823	0.2358	0.2704
3	0.6124	0.6903	0.7360	0.5188	0.4222
4	0.7498	0.5568	0.6643	0.5681	0.4865
5	0.5923	0.6282	0.7220	0.5178	0.3961
6	0.5466	0.6593	0.7418	0.5623	0.5710
7	0.6032	0.7430	0.6571	0.3336	0.5057
8	0.4104	0.6317	0.9080	0.4697	0.4311
9	0.6400	0.5903	0.7067	0.5344	0.4825
10	0.6400	0.5903	0.7067	0.5344	0.4825
AGE	1988	1989	1990	1991	1992
1	0.0005	0.0000	0.0008	0.0032	0.0117
2	0.1395	0.1281	0.5545	0.2540	0.3811
3	0.5227	0.4137	0.5162	0.9013	0.6985
4	0.6195	0.5699	0.5161	0.7701	0.8484
5	0.7768	0.4197	0.7157	1.0193	1.0214
6	0.7321	0.7308	0.5810	0.9512	0.9150
7	0.9184	0.5853	0.9052	0.7539	0.8010
8	0.8832	0.6754	0.5561	0.7213	0.4635
9	0.7243	0.5707	0.6169	0.8476	0.9129
10	0.7243	0.5707	0.6169	0.8476	0.9129

Fishing Mortality Calculated

AGE	1993	1994	1995	1996	1997
1	0.0005	0.0004	0.0000	0.0002	0.0003
2	0.2388	0.0679	0.1062	0.0900	0.1253
3	0.8581	0.6669	0.2591	0.3789	0.4384
4	1.0060	1.2491	0.7449	0.5471	0.7961
5	1.1764	1.3810	0.6592	0.6359	0.8494
6	1.1755	0.9104	0.5214	0.6606	0.8918
7	1.2710	1.5801	0.6759	0.3354	1.5173
8	1.1843	2.3661	0.7249	0.1463	0.7324
9	1.0928	1.2733	0.7053	0.5598	0.8405
10	1.0928	1.2733	0.7053	0.5598	0.8405
AGE	1998	1999	2000	2001	2002
1	0.0001	0.0002	0.0020	0.0000	0.0000
2	0.1041	0.0878	0.0826	0.1243	0.0202
3	0.4693	0.4297	0.3150	0.4050	0.2590
4	0.5886	0.5705	0.4484	0.5504	0.4230
5	0.7909	0.6257	0.4746	0.4919	0.5858
6	0.6692	0.5812	0.5047	0.5685	0.5626
7	0.7412	0.8778	0.5393	0.6560	0.4739
8	1.2899	0.7995	0.7631	0.6112	0.5582
9	0.6702	0.6051	0.4627	0.5301	0.4633
10	0.6702	0.6051	0.4627	0.5301	0.4633
AGE	2003	2004			
1	0.0001	0.0000			
2	0.0290	0.0185			
3	0.2005	0.1761			
4	0.3306	0.1770			
5	0.4440	0.1834			
6	0.4769	0.2345			
7	0.4156	0.3495			
8	0.2933	0.2361			
9	0.3852	0.2361			
10	0.3852	0.2361			

Average Fishing Mortality For Ages 2- 8

Year	Average F	N Weighted	Biomass Wtd	Catch Wtd
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1978	0.4597	0.3644	0.3702	0.3908
1979	0.3168	0.2731	0.3503	0.3742
1980	0.4529	0.3919	0.4508	0.4310
1981	0.4352	0.3762	0.4337	0.4061
1982	0.5871	0.4534	0.5278	0.4804
1983	0.5611	0.5575	0.5773	0.5748
1984	0.5878	0.5119	0.5730	0.5769
1985	0.6874	0.5122	0.6015	0.5525
1986	0.4580	0.4436	0.4811	0.4775
1987	0.4404	0.3229	0.3763	0.3426
1988	0.6560	0.4329	0.5451	0.5274
1989	0.5033	0.3325	0.4311	0.4385
1990	0.6207	0.5608	0.5904	0.5676
1991	0.7673	0.6862	0.7926	0.7880
1992	0.7327	0.5686	0.6854	0.6381
1993	0.9872	0.7200	0.8581	0.8485
1994	1.1745	0.5500	0.8201	0.9682
1995	0.5274	0.2920	0.3925	0.4266
1996	0.3992	0.3782	0.4493	0.4680
1997	0.7644	0.4379	0.6154	0.6456
1998	0.6647	0.2897	0.4092	0.4539
1999	0.5675	0.3675	0.4642	0.4641
2000	0.4468	0.2153	0.3003	0.3329
2001	0.4868	0.3330	0.3963	0.4041
2002	0.4118	0.3034	0.3709	0.3986
2003	0.3128	0.2609	0.3262	0.3501
2004	0.1965	0.1576	0.1894	0.1948

Average Fishing Mortality For Ages 3- 8

Year	Average F	N Weighted	Biomass Wtd	Catch Wtd
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1978	0.5184	0.3926	0.3822	0.4006
1979	0.3526	0.4303	0.4143	0.4439
1980	0.4876	0.4877	0.4969	0.4996
1981	0.4672	0.4572	0.4741	0.4648
1982	0.6259	0.5918	0.6076	0.5985
1983	0.5858	0.6244	0.6070	0.6295
1984	0.6516	0.6283	0.6304	0.6332
1985	0.7382	0.7183	0.7242	0.7200
1986	0.4950	0.5241	0.5214	0.5258
1987	0.4687	0.4623	0.4734	0.4654
1988	0.7421	0.5710	0.6247	0.5824
1989	0.5658	0.5058	0.5347	0.5187
1990	0.6317	0.5640	0.5978	0.5743
1991	0.8529	0.8698	0.8771	0.8759
1992	0.7913	0.8214	0.8508	0.8356
1993	1.1119	0.9351	0.9982	0.9443
1994	1.3589	0.9922	1.1088	1.0572
1995	0.5976	0.3992	0.4729	0.4857
1996	0.4507	0.4827	0.5067	0.4991
1997	0.8709	0.7043	0.7791	0.7512
1998	0.7582	0.5519	0.5995	0.5701
1999	0.6474	0.4856	0.5275	0.4991
2000	0.5075	0.4063	0.4326	0.4189
2001	0.5472	0.4470	0.4662	0.4539
2002	0.4771	0.3766	0.4136	0.4050
2003	0.3601	0.3368	0.3598	0.3607
2004	0.2261	0.1945	0.2034	0.1997

Average Fishing Mortality For Ages 4- 8

Year	Average F	N Weighted	Biomass Wtd	Catch Wtd
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1978	0.5404	0.3621	0.3554	0.3835
1979	0.3469	0.4375	0.4163	0.4521
1980	0.4882	0.4921	0.5030	0.5197
1981	0.4654	0.4412	0.4734	0.4547
1982	0.6482	0.6511	0.6397	0.6526
1983	0.5804	0.6460	0.6029	0.6594
1984	0.6438	0.5918	0.6123	0.5956
1985	0.7386	0.7080	0.7214	0.7105
1986	0.4903	0.5362	0.5237	0.5413
1987	0.4781	0.4833	0.4858	0.4857
1988	0.7860	0.7284	0.7589	0.7362
1989	0.5962	0.5728	0.5817	0.5782
1990	0.6548	0.6230	0.6497	0.6371
1991	0.8432	0.8535	0.8704	0.8622
1992	0.8099	0.9187	0.9077	0.9266
1993	1.1626	1.0972	1.1286	1.1016
1994	1.4973	1.2862	1.3179	1.2956
1995	0.6653	0.7070	0.6925	0.7104
1996	0.4651	0.5615	0.5635	0.5663
1997	0.9574	0.8470	0.8737	0.8561
1998	0.8160	0.6753	0.6953	0.6854
1999	0.6909	0.6085	0.6341	0.6165
2000	0.5460	0.4636	0.4760	0.4665
2001	0.5756	0.5308	0.5326	0.5329
2002	0.5207	0.4655	0.4802	0.4728
2003	0.3921	0.3869	0.3954	0.3942
2004	0.2361	0.2028	0.2107	0.2090

Average Fishing Mortality For Ages 5- 8

Year	Average F	N Weighted	Biomass Wtd	Catch Wtd
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1978	0.5789	0.3275	0.3260	0.3792
1979	0.3110	0.3422	0.3347	0.3593
1980	0.5158	0.5104	0.5131	0.5377
1981	0.4847	0.5155	0.5275	0.5296
1982	0.6412	0.6299	0.6233	0.6316
1983	0.5381	0.5514	0.5331	0.5566
1984	0.6655	0.6631	0.6737	0.6652
1985	0.7572	0.7315	0.7399	0.7337
1986	0.4708	0.5175	0.5114	0.5244
1987	0.4759	0.4755	0.4849	0.4839
1988	0.8276	0.7905	0.8010	0.7925
1989	0.6028	0.5852	0.6084	0.6131
1990	0.6895	0.7147	0.7177	0.7192
1991	0.8614	0.9686	0.9521	0.9725
1992	0.8002	0.9538	0.9270	0.9631
1993	1.2018	1.1890	1.1920	1.1894
1994	1.5594	1.3906	1.4244	1.4217
1995	0.6453	0.6439	0.6439	0.6468
1996	0.4446	0.6118	0.5928	0.6282
1997	0.9977	0.8939	0.9228	0.9077
1998	0.8728	0.7456	0.7478	0.7522
1999	0.7211	0.6784	0.6974	0.6914
2000	0.5704	0.5036	0.5189	0.5103
2001	0.5819	0.5164	0.5241	0.5193
2002	0.5451	0.5630	0.5579	0.5645
2003	0.4074	0.4394	0.4346	0.4412
2004	0.2509	0.2144	0.2206	0.2212

Average Fishing Mortality For Ages 6- 8

Year	Average F	N Weighted	Biomass Wtd	Catch Wtd
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1978	0.6440	0.2658	0.2876	0.3719
1979	0.2944	0.3169	0.3135	0.3571
1980	0.5357	0.6045	0.5854	0.6549
1981	0.5442	0.5564	0.5552	0.5566
1982	0.6430	0.6201	0.6120	0.6245
1983	0.5200	0.5163	0.5023	0.5225
1984	0.6780	0.6939	0.6989	0.6957
1985	0.7690	0.7533	0.7653	0.7601
1986	0.4552	0.5173	0.5086	0.5285
1987	0.5026	0.5226	0.5168	0.5258
1988	0.8445	0.8258	0.8394	0.8313
1989	0.6638	0.7066	0.7018	0.7093
1990	0.6808	0.7103	0.7232	0.7350
1991	0.8088	0.9147	0.9016	0.9193
1992	0.7265	0.8356	0.8196	0.8473
1993	1.2103	1.1962	1.1983	1.1968
1994	1.6189	1.4038	1.4591	1.4793
1995	0.6407	0.5955	0.6145	0.6046
1996	0.3808	0.5741	0.5483	0.6151
1997	1.0472	1.0649	1.0912	1.1082
1998	0.9001	0.6992	0.7139	0.7089
1999	0.7528	0.7286	0.7428	0.7484
2000	0.6024	0.5642	0.5784	0.5762
2001	0.6119	0.5880	0.5912	0.5894
2002	0.5316	0.5465	0.5435	0.5481
2003	0.3952	0.4271	0.4183	0.4334
2004	0.2734	0.2478	0.2492	0.2523

Back Calculated Partial Recruitment

AGE	1978	1979	1980	1981	1982
1	0.0001	0.0033	0.0062	0.0013	0.0286
2	0.0723	0.2079	0.3095	0.4334	0.4783
3	0.2752	0.7773	0.6123	0.8466	0.6946
4	0.2600	1.0000	0.4778	0.6908	0.9134
5	0.2585	0.7359	0.5766	0.5446	0.8587
6	0.0928	0.7728	0.8052	1.0000	1.0000
7	0.2081	0.2288	1.0000	0.9741	0.7857
8	1.0000	0.7998	0.2261	0.9299	0.8195
9	0.2406	0.8845	0.6111	0.7783	0.8784
10	0.2406	0.8845	0.6111	0.7783	0.8784
AGE	1983	1984	1985	1986	1987
1	0.0167	0.0044	0.0190	0.0071	0.0031
2	0.5506	0.2767	0.4210	0.4151	0.4736
3	0.8168	0.9291	0.8106	0.9132	0.7394
4	1.0000	0.7494	0.7316	1.0000	0.8520
5	0.7899	0.8455	0.7952	0.9116	0.6937
6	0.7289	0.8873	0.8169	0.9898	1.0000
7	0.8044	1.0000	0.7236	0.5872	0.8857
8	0.5473	0.8503	1.0000	0.8268	0.7550
9	0.8536	0.7945	0.7783	0.9407	0.8450
10	0.8536	0.7945	0.7783	0.9407	0.8450
AGE	1988	1989	1990	1991	1992
1	0.0005	0.0000	0.0009	0.0032	0.0115
2	0.1519	0.1753	0.6125	0.2492	0.3731
3	0.5692	0.5662	0.5702	0.8842	0.6838
4	0.6745	0.7798	0.5701	0.7555	0.8305
5	0.8459	0.5743	0.7906	1.0000	1.0000
6	0.7971	1.0000	0.6419	0.9332	0.8957
7	1.0000	0.8009	1.0000	0.7397	0.7842
8	0.9616	0.9242	0.6144	0.7076	0.4537
9	0.7886	0.7810	0.6815	0.8316	0.8938
10	0.7886	0.7810	0.6815	0.8316	0.8938

Back Calculated Partial Recruitment

AGE	1993	1994	1995	1996	1997
1	0.0004	0.0002	0.0000	0.0003	0.0002
2	0.1879	0.0287	0.1426	0.1362	0.0826
3	0.6751	0.2819	0.3479	0.5735	0.2889
4	0.7915	0.5279	1.0000	0.8282	0.5247
5	0.9256	0.5836	0.8849	0.9627	0.5598
6	0.9249	0.3847	0.7000	1.0000	0.5878
7	1.0000	0.6678	0.9074	0.5078	1.0000
8	0.9318	1.0000	0.9731	0.2215	0.4827
9	0.8598	0.5381	0.9468	0.8474	0.5539
10	0.8598	0.5381	0.9468	0.8474	0.5539
AGE	1998	1999	2000	2001	2002
1	0.0000	0.0002	0.0026	0.0000	0.0000
2	0.0807	0.1000	0.1082	0.1894	0.0346
3	0.3639	0.4896	0.4128	0.6174	0.4421
4	0.4563	0.6499	0.5877	0.8390	0.7221
5	0.6132	0.7128	0.6219	0.7498	1.0000
6	0.5188	0.6621	0.6614	0.8666	0.9605
7	0.5746	1.0000	0.7067	1.0000	0.8090
8	1.0000	0.9108	1.0000	0.9317	0.9530
9	0.5196	0.6893	0.6063	0.8080	0.7910
10	0.5196	0.6893	0.6063	0.8080	0.7910
AGE	2003	2004			
1	0.0002	0.0000			
2	0.0608	0.0529			
3	0.4204	0.5040			
4	0.6933	0.5066			
5	0.9310	0.5249			
6	1.0000	0.6711			
7	0.8714	1.0000			
8	0.6150	0.6756			
9	0.8077	0.6756			
10	0.8077	0.6756			

JAN-1 Biomass

AGE	1978	1979	1980	1981	1982
1	13480.	16311.	12569.	28958.	9576.
2	4365.	23316.	21898.	18312.	37658.
3	48025.	5267.	32213.	22856.	20976.
4	23223.	44709.	4929.	24564.	18842.
5	9698.	18210.	33960.	4307.	20085.
6	5165.	8954.	14419.	23076.	3459.
7	8942.	5847.	6982.	8264.	13866.
8	486.	7517.	5362.	3041.	4764.
9	1461.	124.	4446.	4560.	1802.
10	723.	1887.	440.	3558.	3169.
=====					
Total	115568.	132142.	137217.	141497.	134196.
AGE	1983	1984	1985	1986	1987
1	7195.	24855.	6166.	31454.	8216.
2	14951.	9795.	27313.	8069.	40888.
3	35520.	14500.	9571.	23260.	8656.
4	15276.	25326.	9614.	5616.	19478.
5	10999.	8162.	17382.	6125.	4348.
6	11914.	6526.	4963.	9745.	4212.
7	1669.	7286.	3652.	2563.	6031.
8	7572.	931.	3591.	1906.	1879.
9	2434.	4519.	485.	1415.	1158.
10	2185.	4554.	2817.	1080.	1029.
=====					
Total	109716.	106454.	85554.	91232.	95895.
AGE	1988	1989	1990	1991	1992
1	12848.	9131.	5454.	16901.	6595.
2	14060.	21631.	14415.	8736.	19091.
3	40703.	17699.	27574.	12030.	9552.
4	7168.	31533.	14584.	19593.	6277.
5	14566.	4645.	21028.	10332.	10266.
6	3228.	6934.	3357.	10518.	4036.
7	2438.	1512.	3421.	1802.	4121.
8	3509.	939.	873.	1420.	865.
9	1117.	1356.	468.	445.	675.
10	1521.	774.	1309.	673.	345.
=====					
Total	101160.	96155.	92484.	82449.	61823.

JAN-1 Biomass

AGE	1993	1994	1995	1996	1997
1	5516.	3734.	2282.	3910.	7725.
2	7131.	7553.	4962.	3107.	5723.
3	15184.	6319.	8955.	5989.	3721.
4	5567.	8117.	4196.	8621.	5202.
5	3072.	2327.	2975.	2455.	5715.
6	4133.	1079.	713.	1696.	1334.
7	1661.	1363.	522.	457.	868.
8	1894.	471.	310.	232.	289.
9	510.	539.	43.	156.	172.
10	367.	150.	32.	0.	24.
Total	45036.	31652.	24990.	26623.	30775.
AGE	1998	1999	2000	2001	2002
1	1612.	7437.	6019.	2133.	984.
2	9828.	3567.	12441.	7799.	3509.
3	6678.	11069.	5514.	15777.	8679.
4	2994.	5059.	9102.	4680.	11587.
5	2679.	1975.	3357.	6664.	2917.
6	2649.	1341.	1114.	2161.	4103.
7	578.	1486.	774.	626.	1198.
8	178.	286.	609.	417.	321.
9	140.	49.	107.	268.	211.
10	131.	99.	38.	64.	179.
Total	27467.	32369.	39075.	40589.	33688.
AGE	2003	2004	2005		
1	620.	10406.	5065.		
2	2839.	1889.	19744.		
3	4603.	4896.	3032.		
4	7759.	4152.	4089.		
5	8141.	6136.	3877.		
6	1666.	5476.	5785.		
7	2279.	998.	4771.		
8	732.	1488.	792.		
9	182.	519.	1233.		
10	111.	255.	634.		
Total	28931.	36216.	49021.		

Mean Biomass

AGE	1978	1979	1980	1981	1982
1	17758.	18931.	15197.	33077.	11990.
2	4814.	29257.	22651.	19777.	36451.
3	47055.	5116.	29981.	21114.	20010.
4	20860.	42241.	4890.	21843.	16002.
5	9451.	16546.	28839.	4029.	17042.
6	5521.	8746.	11415.	18261.	2505.
7	8287.	6326.	4789.	6592.	10954.
8	276.	6708.	4441.	2351.	3515.
9	1319.	108.	2912.	4210.	1365.
10	554.	1398.	319.	2631.	2134.
=====					
Total	115897.	135377.	125434.	133886.	121969.
AGE	1983	1984	1985	1986	1987
1	8411.	26100.	7068.	35923.	10766.
2	15601.	10449.	24026.	8341.	41181.
3	31665.	12313.	7020.	21792.	8382.
4	10991.	21919.	8106.	5192.	18433.
5	8355.	6879.	13462.	5247.	4127.
6	9174.	5217.	3611.	8107.	3448.
7	1269.	5569.	2720.	2342.	4826.
8	5940.	712.	2327.	1540.	1476.
9	1754.	3274.	339.	1116.	899.
10	1478.	3148.	1852.	765.	746.
=====					
Total	94638.	95580.	70530.	90366.	94285.
AGE	1988	1989	1990	1991	1992
1	16699.	11492.	6914.	17994.	6871.
2	17250.	26449.	14055.	9825.	17035.
3	36576.	16161.	24294.	9320.	7756.
4	5804.	27809.	12975.	14782.	4776.
5	10559.	4292.	15685.	6947.	6951.
6	2246.	5024.	2524.	6855.	2764.
7	1564.	1165.	2327.	1256.	2940.
8	2264.	691.	697.	1035.	729.
9	769.	1022.	347.	263.	436.
10	993.	540.	895.	417.	208.
=====					
Total	94724.	94645.	80712.	68692.	50466.

Mean Biomass

AGE	1993	1994	1995	1996	1997
1	6466.	4312.	2667.	4738.	8728.
2	6673.	8570.	5446.	3478.	6532.
3	11325.	5024.	8605.	5850.	3413.
4	3761.	5461.	3608.	7722.	3967.
5	1897.	1404.	2447.	1884.	3896.
6	2615.	797.	630.	1249.	899.
7	961.	714.	417.	377.	457.
8	1136.	189.	244.	174.	191.
9	284.	289.	29.	115.	127.
10	206.	78.	21.	0.	15.
=====					
Total	35324.	26838.	24114.	25587.	28226.
AGE	1998	1999	2000	2001	2002
1	2402.	9635.	6863.	2741.	1674.
2	10566.	5096.	15492.	8387.	4464.
3	5882.	10056.	5404.	13931.	8508.
4	2542.	4320.	8443.	3728.	9856.
5	1968.	1590.	2858.	5343.	2355.
6	2128.	1084.	870.	1629.	3179.
7	437.	1011.	593.	439.	965.
8	96.	197.	423.	298.	259.
9	114.	40.	74.	203.	168.
10	87.	68.	28.	45.	131.
=====					
Total	26222.	33097.	41047.	36743.	31559.
AGE	2003	2004			
1	1084.	13539.			
2	4762.	3274.			
3	4376.	4705.			
4	6969.	4021.			
5	6880.	5915.			
6	1301.	4962.			
7	1829.	840.			
8	625.	1361.			
9	144.	459.			
10	84.	207.			
=====					
Total	28054.	39284.			

Spawning Stock Biomass

AGE	1978	1979	1980	1981	1982
1	913.	1104.	850.	1960.	1200.
2	1410.	7538.	6913.	5782.	16137.
3	33845.	3729.	22417.	15928.	15642.
4	20219.	38255.	4297.	21379.	15793.
5	8798.	16585.	30442.	3958.	17473.
6	4882.	8130.	12541.	20322.	2957.
7	8215.	5550.	5918.	7296.	12172.
8	367.	6810.	5034.	2696.	4165.
9	1331.	112.	3967.	4100.	1564.
10	659.	1698.	392.	3199.	2750.
=====					
Total	80639.	89512.	92771.	86621.	89852.
AGE	1983	1984	1985	1986	1987
1	903.	3123.	773.	8512.	2224.
2	6344.	4303.	11649.	5027.	25329.
3	26058.	10500.	6878.	18776.	7101.
4	12648.	21655.	8075.	4842.	17024.
5	9639.	7110.	14906.	5434.	3937.
6	10520.	5655.	4242.	8582.	3704.
7	1460.	6226.	3166.	2345.	5361.
8	6840.	811.	2985.	1705.	1691.
9	2116.	3961.	417.	1252.	1034.
10	1899.	3992.	2422.	956.	919.
=====					
Total	78426.	67335.	55513.	57432.	68324.
AGE	1988	1989	1990	1991	1992
1	3479.	2473.	633.	1961.	764.
2	8902.	13721.	6610.	4211.	9011.
3	32836.	14540.	22024.	9011.	7401.
4	6128.	27180.	12814.	16501.	5218.
5	12377.	4189.	18051.	8432.	8375.
6	2764.	5937.	2947.	8681.	3351.
7	2024.	1327.	2845.	1537.	3488.
8	2930.	811.	769.	1218.	775.
9	958.	1193.	409.	373.	561.
10	1304.	681.	1143.	565.	287.
=====					
Total	73700.	72053.	68245.	52490.	39229.

Spawning Stock Biomass

AGE	1993	1994	1995	1996	1997
1	640.	72.	44.	76.	971.
2	3447.	2817.	1839.	1155.	3090.
3	11456.	5195.	7881.	5166.	3078.
4	4508.	6375.	3584.	7612.	4406.
5	2442.	1788.	2578.	2136.	4798.
6	3286.	896.	632.	1469.	1112.
7	1300.	1013.	451.	418.	652.
8	1504.	307.	266.	219.	248.
9	411.	422.	37.	137.	145.
10	296.	117.	28.	0.	21.
Total	29289.	19003.	17340.	18387.	18521.
AGE	1998	1999	2000	2001	2002
1	203.	935.	175.	62.	29.
2	5325.	1938.	5222.	3251.	1488.
3	5495.	9169.	4808.	13550.	7638.
4	2625.	4450.	8169.	4129.	10444.
5	2271.	1721.	3000.	5938.	2559.
6	2292.	1177.	990.	1901.	3614.
7	494.	1241.	685.	543.	1071.
8	139.	242.	518.	364.	283.
9	121.	43.	96.	237.	188.
10	113.	87.	34.	56.	160.
Total	19078.	21003.	23697.	30033.	27474.
AGE	2003	2004			
1	42.	705.			
2	929.	619.			
3	3402.	3633.			
4	6818.	3743.			
5	7313.	5756.			
6	1488.	5093.			
7	2056.	911.			
8	674.	1383.			
9	165.	483.			
10	100.	237.			
Total	22987.	22564.			

Catch Biomass

AGE	1978	1979	1980	1981	1982
1	1.	30.	74.	24.	253.
2	515.	2972.	5514.	4791.	12811.
3	19068.	1934.	14384.	9953.	10187.
4	7989.	20508.	1834.	8415.	10685.
5	3599.	5924.	13033.	1225.	10704.
6	758.	3288.	7183.	10154.	1830.
7	2544.	707.	3734.	3572.	6301.
8	399.	2609.	791.	1216.	2108.
9	471.	47.	1408.	1842.	888.
10	198.	606.	154.	1151.	1388.
Total	35543.	38624.	48109.	42343.	57156.
AGE	1983	1984	1985	1986	1987
1	105.	85.	122.	145.	19.
2	6386.	2137.	9112.	1956.	11068.
3	19166.	8390.	5096.	11190.	3508.
4	8127.	12073.	5317.	2917.	8881.
5	4892.	4270.	9589.	2689.	1621.
6	4961.	3396.	2642.	4509.	1947.
7	757.	4080.	1765.	776.	2416.
8	2417.	445.	2078.	717.	631.
9	1123.	1933.	240.	596.	434.
10	946.	1858.	1309.	409.	360.
Total	48879.	38667.	37270.	25904.	30884.
AGE	1988	1989	1990	1991	1992
1	8.	0.	6.	58.	80.
2	2397.	3376.	7710.	2481.	6441.
3	18924.	6630.	12413.	8263.	5347.
4	3553.	15673.	6628.	11221.	3989.
5	8085.	1786.	11075.	6953.	6971.
6	1622.	3621.	1450.	6409.	2487.
7	1413.	674.	2072.	934.	2320.
8	1967.	461.	383.	736.	335.
9	557.	583.	214.	223.	398.
10	719.	308.	552.	354.	190.
Total	39246.	33113.	42504.	37632.	28559.

Catch Biomass

AGE	1993	1994	1995	1996	1997
1	3.	2.	0.	1.	3.
2	1585.	581.	577.	312.	815.
3	9566.	3308.	2217.	2199.	1483.
4	3716.	6674.	2650.	4180.	3112.
5	2185.	1893.	1593.	1184.	3258.
6	3011.	713.	325.	815.	788.
7	1194.	1098.	279.	126.	676.
8	1318.	431.	174.	25.	138.
9	310.	369.	21.	64.	107.
10	225.	100.	15.	0.	13.
=====					
Total	23115.	15168.	7850.	8905.	10393.
AGE	1998	1999	2000	2001	2002
1	0.	2.	13.	0.	0.
2	1096.	446.	1275.	1038.	90.
3	2735.	4284.	1691.	5595.	2190.
4	1479.	2437.	3752.	2030.	4133.
5	1534.	983.	1344.	2602.	1364.
6	1406.	623.	435.	916.	1769.
7	319.	874.	316.	285.	453.
8	121.	155.	318.	180.	143.
9	76.	24.	34.	107.	78.
10	58.	41.	13.	24.	61.
=====					
Total	8825.	9869.	9191.	12778.	10281.
AGE	2003	2004			
1	0.	0.			
2	138.	60.			
3	873.	825.			
4	2288.	709.			
5	3027.	1080.			
6	614.	1157.			
7	754.	291.			
8	182.	321.			
9	55.	93.			
10	32.	49.			
=====					
Total	7964.	4585.			

Catch Numbers

AGE	1978	1979	1980	1981	1982
1	2.0	34.0	89.0	27.0	331.0
2	393.0	1989.0	3777.0	3205.0	9138.0
3	7748.0	900.0	5828.0	4221.0	3824.0
4	2303.0	4870.0	500.0	2464.0	2787.0
5	830.0	1212.0	2308.0	235.0	2000.0
6	131.0	458.0	1076.0	1406.0	281.0
7	345.0	77.0	445.0	417.0	673.0
8	47.0	253.0	87.0	123.0	213.0
9	40.0	4.0	167.0	130.0	71.0
10	15.0	48.0	10.0	62.0	83.0
Total	11854.0	9845.0	14287.0	12290.0	19401.0
AGE	1983	1984	1985	1986	1987
1	108.0	81.0	134.0	156.0	26.0
2	4286.0	1307.0	6426.0	1326.0	7473.0
3	8063.0	3423.0	2443.0	4573.0	1406.0
4	2456.0	3336.0	1368.0	797.0	2121.0
5	1055.0	840.0	1885.0	480.0	279.0
6	776.0	516.0	412.0	627.0	252.0
7	95.0	458.0	218.0	87.0	270.0
8	235.0	44.0	203.0	72.0	63.0
9	100.0	171.0	21.0	47.0	38.0
10	65.0	121.0	97.0	29.0	24.0
Total	17239.0	10297.0	13207.0	8194.0	11952.0
AGE	1988	1989	1990	1991	1992
1	10.0	0.0	7.0	52.0	70.0
2	1577.0	2088.0	4942.0	1525.0	4177.0
3	8022.0	2922.0	5042.0	3243.0	2170.0
4	1012.0	4155.0	1882.0	3281.0	1038.0
5	1497.0	331.0	2264.0	1458.0	1482.0
6	244.0	541.0	229.0	1088.0	404.0
7	161.0	82.0	245.0	126.0	309.0
8	197.0	43.0	36.0	70.0	34.0
9	50.0	50.0	17.0	23.0	33.0
10	47.0	18.0	38.0	23.0	10.0
Total	12817.0	10230.0	14702.0	10889.0	9727.0

Catch Numbers

AGE	1993	1994	1995	1996	1997
1	4.0	2.0	0.1	1.0	3.0
2	1033.0	398.0	392.0	207.0	517.0
3	4246.0	1526.0	1058.0	903.0	639.0
4	1115.0	1825.0	692.0	1234.0	881.0
5	440.0	394.0	290.0	241.0	794.0
6	472.0	96.0	44.0	123.0	131.0
7	159.0	137.0	26.0	15.0	84.0
8	143.0	46.0	15.0	3.0	16.0
9	32.0	38.0	2.0	5.0	9.0
10	17.0	6.0	1.0	0.0	1.0
Total	7661.0	4468.0	2520.1	2732.0	3075.0
AGE	1998	1999	2000	2001	2002
1	0.2	2.0	14.0	0.1	0.0
2	739.0	285.0	752.0	685.0	51.0
3	1188.0	1927.0	687.0	2382.0	967.0
4	423.0	706.0	1062.0	643.0	1347.0
5	324.0	201.0	284.0	597.0	318.0
6	237.0	97.0	75.0	166.0	331.0
7	39.0	119.0	42.0	45.0	67.0
8	14.0	16.0	37.0	22.0	17.0
9	6.0	2.0	4.0	11.0	8.0
10	4.0	3.0	1.0	2.0	5.0
Total	2974.2	3358.0	2958.0	4553.1	3111.0
AGE	2003	2004			
1	0.2	0.0			
2	71.0	31.0			
3	371.0	319.0			
4	754.0	222.0			
5	751.0	264.0			
6	124.0	230.0			
7	122.0	49.0			
8	23.0	41.0			
9	6.0	10.0			
10	3.0	4.0			
Total	2225.2	1170.0			

Surplus Production

Average Adjustment Factor (Delta) = 1.0000

Year	Biomass	Delta Biomass	Catch Biomass	Surplus Production
1978	115567.835	16574.108	35542.710	52116.818
1979	132141.944	5074.845	38624.318	43699.163
1980	137216.788	4279.954	48109.417	52389.371
1981	141496.743	-7300.737	42343.113	35042.376
1982	134196.005	-24480.388	57155.858	32675.470
1983	109715.618	-3261.278	48879.166	45617.888
1984	106454.340	-20900.344	38666.814	17766.470
1985	85553.996	5678.046	37269.609	42947.655
1986	91232.043	4662.638	25903.792	30566.430
1987	95894.681	5265.124	30883.709	36148.833
1988	101159.806	-5004.805	39245.626	34240.821
1989	96155.001	-3671.030	33112.831	29441.801
1990	92483.971	-10034.836	42503.786	32468.950
1991	82449.135	-20625.668	37632.314	17006.646
1992	61823.467	-16787.802	28558.802	11771.000
1993	45035.665	-13383.335	23114.512	9731.177
1994	31652.330	-6662.449	15168.322	8505.873
1995	24989.881	1633.249	7849.733	9482.982
1996	26623.131	4152.354	8904.768	13057.122
1997	30775.485	-3308.894	10393.174	7084.280
1998	27466.591	4902.460	8824.847	13727.306
1999	32369.051	6705.705	9868.593	16574.298
2000	39074.756	1513.960	9191.119	10705.079
2001	40588.716	-6900.238	12777.549	5877.311
2002	33688.478	-4757.192	10280.887	5523.695
2003	28931.286	7284.259	7963.726	15247.985
2004	36215.546	12805.404	4585.425	17390.829
2005	49020.949			

Summary of Survey Indices Used in the Estimate

INDEX	Survey Tag	Age	Time	Type	Catchability	Std. Error	CV
1	spr_36	1	JAN-1	NUMBER	0.1447E-04	0.3154E-05	0.2180E+00
2	spr_36	2	JAN-1	NUMBER	0.6581E-04	0.6157E-05	0.9355E-01
3	spr_36	3	JAN-1	NUMBER	0.1387E-03	0.1720E-04	0.1241E+00
4	spr_36	4	JAN-1	NUMBER	0.2286E-03	0.3533E-04	0.1546E+00
5	spr_36	5	JAN-1	NUMBER	0.2837E-03	0.4574E-04	0.1612E+00
6	spr_36	6	JAN-1	NUMBER	0.2924E-03	0.4425E-04	0.1514E+00
7	spr_36	7	JAN-1	NUMBER	0.3187E-03	0.5753E-04	0.1805E+00
8	spr_36	8	JAN-1	NUMBER	0.3739E-03	0.6283E-04	0.1680E+00
9	spr_41	1	JAN-1	NUMBER	0.1205E-04	0.9019E-05	0.7485E+00
10	spr_41	2	JAN-1	NUMBER	0.7609E-04	0.1823E-04	0.2396E+00
11	spr_41	3	JAN-1	NUMBER	0.1624E-03	0.3567E-04	0.2197E+00
12	spr_41	4	JAN-1	NUMBER	0.1408E-03	0.1656E-04	0.1177E+00
13	spr_41	5	JAN-1	NUMBER	0.1722E-03	0.4034E-04	0.2343E+00
14	spr_41	6	JAN-1	NUMBER	0.1606E-03	0.2299E-04	0.1432E+00
15	spr_41	7	JAN-1	NUMBER	0.2241E-03	0.7172E-04	0.3200E+00
16	spr_41	8	JAN-1	NUMBER	0.2389E-03	0.1487E-03	0.6225E+00
17	sp_can	1	JAN-1	NUMBER	0.1865E-04	0.4877E-05	0.2615E+00
18	sp_can	2	JAN-1	NUMBER	0.7732E-04	0.1959E-04	0.2533E+00
19	sp_can	3	JAN-1	NUMBER	0.2311E-03	0.2844E-04	0.1231E+00
20	sp_can	4	JAN-1	NUMBER	0.3873E-03	0.5577E-04	0.1440E+00
21	sp_can	5	JAN-1	NUMBER	0.6144E-03	0.8744E-04	0.1423E+00
22	sp_can	6	JAN-1	NUMBER	0.7596E-03	0.1555E-03	0.2047E+00
23	sp_can	7	JAN-1	NUMBER	0.8680E-03	0.1933E-03	0.2227E+00
24	sp_can	8	JAN-1	NUMBER	0.1078E-02	0.2303E-03	0.2137E+00
25	us0aut	1	JAN-1	NUMBER	0.1293E-04	0.2673E-05	0.2068E+00
26	us1aut	2	JAN-1	NUMBER	0.6073E-04	0.7687E-05	0.1266E+00
27	us2aut	3	JAN-1	NUMBER	0.1041E-03	0.1295E-04	0.1244E+00
28	us3aut	4	JAN-1	NUMBER	0.1240E-03	0.1870E-04	0.1508E+00
29	us4aut	5	JAN-1	NUMBER	0.9238E-04	0.1714E-04	0.1856E+00
30	us5aut	6	JAN-1	NUMBER	0.1073E-03	0.1577E-04	0.1471E+00

Survey Index: 1 Tag: spr_36 AGE = 1
 Time = JAN-1 Type = NUMBER
 Catchability = 0.144671E-04 % Variance Contribution = 8.0839
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.400933E+00	N/A
1979	N/A	0.340171E+00	N/A
1980	N/A	0.290853E+00	N/A
1981	N/A	0.598827E+00	N/A
1982	0.507900E+00	0.252748E+00	0.697891E+00
1983	0.331500E+00	0.139097E+00	0.868453E+00
1984	0.402200E+00	0.396271E+00	0.148503E-01
1985	0.111100E+00	0.125419E+00	-0.121230E+00
1986	0.871500E+00	0.618430E+00	0.343032E+00
1987	0.197000E-01	0.236907E+00	-0.248705E+01
1988	0.720200E+00	0.339191E+00	0.752966E+00
1989	0.310400E+00	0.226741E+00	0.314053E+00
1990	0.173400E+00	0.132862E+00	0.266290E+00
1991	0.102660E+01	0.258223E+00	0.138018E+01
1992	0.122700E+00	0.960747E-01	0.244616E+00
1993	0.850000E-02	0.118387E+00	-0.263389E+01

1994	0.124800E+00	0.759853E-01	0.496172E+00
1995	0.495000E-01	0.469861E-01	0.521206E-01
1996	0.730000E-01	0.857600E-01	-0.161093E+00
1997	0.290800E+00	0.146057E+00	0.688637E+00
1998	0.111300E+00	0.662123E-01	0.519363E+00
1999	0.212300E+00	0.185314E+00	0.135951E+00
2000	0.220700E+00	0.114691E+00	0.654563E+00
2001	0.610000E-01	0.497096E-01	0.204677E+00
2002	0.650000E-01	0.485004E-01	0.292815E+00
2003	0.160000E-01	0.330272E-01	-0.724742E+00
2004	0.637000E+00	0.306985E+00	0.729971E+00
2005	0.120000E-01	0.150431E+00	-0.252860E+01

Survey Index: 2 Tag: spr_36 AGE = 2
Time = JAN-1 Type = NUMBER
Catchability = 0.658076E-04 % Variance Contribution = 1.4882
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.280872E+00	N/A
1979	N/A	0.149305E+01	N/A
1980	N/A	0.126485E+01	N/A
1981	N/A	0.107790E+01	N/A
1982	0.543540E+01	0.222856E+01	0.891578E+00
1983	0.195180E+01	0.921582E+00	0.750415E+00
1984	0.431000E+00	0.511600E+00	-0.171435E+00
1985	0.265310E+01	0.147098E+01	0.589799E+00
1986	0.409000E+00	0.459110E+00	-0.115575E+00
1987	0.161250E+01	0.229389E+01	-0.352461E+00
1988	0.608800E+00	0.880749E+00	-0.369283E+00
1989	0.141040E+01	0.126263E+01	0.110677E+00
1990	0.921500E+00	0.844435E+00	0.873347E-01
1991	0.527800E+00	0.494391E+00	0.653897E-01
1992	0.125240E+01	0.958585E+00	0.267359E+00
1993	0.398800E+00	0.353636E+00	0.120192E+00
1994	0.272400E+00	0.440662E+00	-0.481006E+00
1995	0.381700E+00	0.282868E+00	0.299656E+00
1996	0.213900E+00	0.174981E+00	0.200831E+00
1997	0.437100E+00	0.319330E+00	0.313936E+00
1998	0.665200E+00	0.543772E+00	0.201558E+00
1999	0.290900E+00	0.246577E+00	0.165305E+00
2000	0.806600E+00	0.690031E+00	0.156091E+00
2001	0.235000E+00	0.426302E+00	-0.595562E+00
2002	0.930000E-01	0.185126E+00	-0.688435E+00
2003	0.213000E+00	0.180626E+00	0.164861E+00
2004	0.580000E-01	0.122989E+00	-0.751651E+00
2005	0.484000E+00	0.114328E+01	-0.859571E+00

Survey Index: 3 Tag: spr_36 AGE = 3
Time = JAN-1 Type = NUMBER
Catchability = 0.138672E-03 % Variance Contribution = 2.6169
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.353973E+01	N/A
1979	N/A	0.435263E+00	N/A
1980	N/A	0.232631E+01	N/A
1981	N/A	0.170827E+01	N/A

1982	0.950190E+01	0.145751E+01	0.187476E+01
1983	0.301700E+01	0.269824E+01	0.111664E+00
1984	0.760700E+00	0.105218E+01	-0.324377E+00
1985	0.663300E+00	0.718643E+00	-0.801378E-01
1986	0.184440E+01	0.173151E+01	0.631588E-01
1987	0.378400E+00	0.625701E+00	-0.502921E+00
1988	0.314960E+01	0.301986E+01	0.420659E-01
1989	0.666400E+00	0.132164E+01	-0.684740E+00
1990	0.173710E+01	0.191636E+01	-0.982125E-01
1991	0.688700E+00	0.836766E+00	-0.194738E+00
1992	0.468200E+00	0.661601E+00	-0.345767E+00
1993	0.130610E+01	0.112969E+01	0.145101E+00
1994	0.200000E+00	0.480496E+00	-0.876501E+00
1995	0.853900E+00	0.710315E+00	0.184106E+00
1996	0.736200E+00	0.438832E+00	0.517385E+00
1997	0.170200E+00	0.275913E+00	-0.483113E+00
1998	0.129800E+01	0.486055E+00	0.982258E+00
1999	0.609000E+00	0.845419E+00	-0.328014E+00
2000	0.829800E+00	0.389648E+00	0.755941E+00
2001	0.794000E+00	0.109612E+01	-0.322450E+00
2002	0.383000E+00	0.649528E+00	-0.528211E+00
2003	0.271000E+00	0.312989E+00	-0.144050E+00
2004	0.579000E+00	0.302718E+00	0.648501E+00
2005	0.138000E+00	0.208297E+00	-0.411713E+00

Survey Index: 4 Tag: spr_36 AGE = 4
Time = JAN-1 Type = NUMBER
Catchability = 0.228568E-03 % Variance Contribution = 4.0634
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.181635E+01	N/A
1979	N/A	0.317440E+01	N/A
1980	N/A	0.401246E+00	N/A
1981	N/A	0.193400E+01	N/A
1982	0.832440E+01	0.143230E+01	0.175991E+01
1983	0.796200E+00	0.117602E+01	-0.390037E+00
1984	0.123820E+01	0.197367E+01	-0.466234E+00
1985	0.111030E+01	0.711962E+00	0.444362E+00
1986	0.365200E+00	0.464545E+00	-0.240613E+00
1987	0.763300E+00	0.139088E+01	-0.600038E+00
1988	0.408800E+00	0.553590E+00	-0.303198E+00
1989	0.158310E+01	0.241617E+01	-0.422797E+00
1990	0.674200E+00	0.117922E+01	-0.559079E+00
1991	0.928900E+00	0.154333E+01	-0.507699E+00
1992	0.168100E+00	0.458496E+00	-0.100339E+01
1993	0.205300E+00	0.444028E+00	-0.771415E+00
1994	0.216500E+00	0.646358E+00	-0.109376E+01
1995	0.534000E+00	0.332819E+00	0.472796E+00
1996	0.124720E+01	0.739746E+00	0.522349E+00
1997	0.488600E+00	0.405442E+00	0.186567E+00
1998	0.847800E+00	0.240185E+00	0.126124E+01
1999	0.509700E+00	0.410226E+00	0.217115E+00
2000	0.114110E+01	0.742343E+00	0.429936E+00
2001	0.160000E+00	0.383741E+00	-0.874793E+00
2002	0.993000E+00	0.986562E+00	0.650466E-02
2003	0.623000E+00	0.676536E+00	-0.824398E-01
2004	0.140700E+01	0.345645E+00	0.140380E+01
2005	0.631000E+00	0.342538E+00	0.610922E+00

Survey Index: 5 Tag: spr_36 AGE = 5
 Time = JAN-1 Type = NUMBER
 Catchability = 0.283697E-03 % Variance Contribution = 4.4191
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.816376E+00	N/A
1979	N/A	0.125461E+01	N/A
1980	N/A	0.197571E+01	N/A
1981	N/A	0.279398E+00	N/A
1982	0.620800E+01	0.133283E+01	0.153854E+01
1983	0.697000E+00	0.740091E+00	-0.599880E-01
1984	0.422300E+00	0.564618E+00	-0.290434E+00
1985	0.141230E+01	0.114930E+01	0.206069E+00
1986	0.540000E+00	0.372333E+00	0.371780E+00
1987	0.621000E-01	0.267483E+00	-0.146031E+01
1988	0.643500E+00	0.868954E+00	-0.300368E+00
1989	0.235100E+00	0.302780E+00	-0.252997E+00
1990	0.911900E+00	0.138873E+01	-0.420616E+00
1991	0.478800E+00	0.715216E+00	-0.401302E+00
1992	0.272900E+00	0.726110E+00	-0.978596E+00
1993	0.895000E-01	0.199471E+00	-0.801430E+00
1994	0.332000E-01	0.165003E+00	-0.160341E+01
1995	0.599000E+00	0.188354E+00	0.115694E+01
1996	0.174200E+00	0.160576E+00	0.814355E-01
1997	0.422300E+00	0.434966E+00	-0.295521E-01
1998	0.754900E+00	0.185859E+00	0.140160E+01
1999	0.238200E+00	0.135493E+00	0.564190E+00
2000	0.370300E+00	0.235643E+00	0.451995E+00
2001	0.383000E+00	0.481758E+00	-0.229406E+00
2002	0.239000E+00	0.224901E+00	0.608037E-01
2003	0.696000E+00	0.656774E+00	0.580097E-01
2004	0.135400E+01	0.493948E+00	0.100839E+01
2005	0.274000E+00	0.294259E+00	-0.713320E-01

Survey Index: 6 Tag: spr_36 AGE = 6
 Time = JAN-1 Type = NUMBER
 Catchability = 0.292377E-03 % Variance Contribution = 3.8952
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.328734E+00	N/A
1979	N/A	0.469263E+00	N/A
1980	N/A	0.737976E+00	N/A
1981	N/A	0.105648E+01	N/A
1982	0.292900E+00	0.173581E+00	0.523190E+00
1983	0.443100E+00	0.595506E+00	-0.295616E+00
1984	0.400400E+00	0.345371E+00	0.147846E+00
1985	0.265400E+00	0.254189E+00	0.431610E-01
1986	0.617900E+00	0.471071E+00	0.271318E+00
1987	0.179400E+00	0.187182E+00	-0.424626E-01
1988	0.640000E-01	0.151886E+00	-0.864250E+00
1989	0.351100E+00	0.337170E+00	0.404840E-01
1990	0.130400E+00	0.167913E+00	-0.252840E+00
1991	0.328100E+00	0.572836E+00	-0.557280E+00
1992	0.142400E+00	0.217766E+00	-0.424782E+00
1993	0.138200E+00	0.220609E+00	-0.467690E+00
1994	0.570000E-02	0.519060E-01	-0.220897E+01

1995	0.106700E+00	0.349919E-01	0.111490E+01
1996	0.208500E+00	0.822092E-01	0.930671E+00
1997	0.498000E-01	0.717337E-01	-0.364945E+00
1998	0.532600E+00	0.156960E+00	0.122178E+01
1999	0.119300E+00	0.711089E-01	0.517430E+00
2000	0.102400E+00	0.611511E-01	0.515538E+00
2001	0.177000E+00	0.123698E+00	0.358308E+00
2002	0.225000E+00	0.248559E+00	-0.995809E-01
2003	0.640000E-01	0.105639E+00	-0.501144E+00
2004	0.893000E+00	0.355494E+00	0.921079E+00
2005	0.205000E+00	0.346942E+00	-0.526147E+00

Survey Index: 7 Tag: spr_36 AGE = 7
Time = JAN-1 Type = NUMBER
Catchability = 0.318676E-03 % Variance Contribution = 5.5409
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.457008E+00	N/A
1979	N/A	0.255579E+00	N/A
1980	N/A	0.286693E+00	N/A
1981	N/A	0.348285E+00	N/A
1982	0.186570E+01	0.537353E+00	0.124474E+01
1983	0.272000E-01	0.738722E-01	-0.999120E+00
1984	0.208800E+00	0.307654E+00	-0.387599E+00
1985	0.191900E+00	0.159411E+00	0.185490E+00
1986	0.617000E-01	0.108031E+00	-0.560135E+00
1987	0.135500E+00	0.239576E+00	-0.569897E+00
1988	0.370000E-01	0.943718E-01	-0.936325E+00
1989	0.505000E-01	0.651819E-01	-0.255209E+00
1990	0.143100E+00	0.144884E+00	-0.123902E-01
1991	0.541000E-01	0.838090E-01	-0.437706E+00
1992	0.158700E+00	0.197458E+00	-0.218512E+00
1993	0.293000E-01	0.778353E-01	-0.977008E+00
1994	0.441000E-01	0.607644E-01	-0.320544E+00
1995	0.233600E+00	0.186379E-01	0.252841E+01
1996	0.277000E-01	0.185385E-01	0.401585E+00
1997	0.133900E+00	0.378943E-01	0.126229E+01
1998	0.101600E+00	0.262393E-01	0.135378E+01
1999	0.636000E-01	0.717282E-01	-0.120271E+00
2000	0.255000E-01	0.354857E-01	-0.330451E+00
2001	0.230000E-01	0.329434E-01	-0.359296E+00
2002	0.390000E-01	0.625186E-01	-0.471902E+00
2003	0.800000E-01	0.126364E+00	-0.457138E+00
2004	0.179000E+00	0.585140E-01	0.111812E+01
2005	0.127000E+00	0.250912E+00	-0.680917E+00

Survey Index: 8 Tag: spr_36 AGE = 8
Time = JAN-1 Type = NUMBER
Catchability = 0.373921E-03 % Variance Contribution = 3.6528
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.251103E-01	N/A
1979	N/A	0.322305E+00	N/A
1980	N/A	0.219474E+00	N/A
1981	N/A	0.124855E+00	N/A
1982	0.368500E+00	0.193498E+00	0.644173E+00

1983	0.218600E+00	0.288514E+00	-0.277500E+00
1984	N/A	0.388243E-01	N/A
1985	0.179900E+00	0.140593E+00	0.246529E+00
1986	0.125100E+00	0.793827E-01	0.454833E+00
1987	0.328000E-01	0.743461E-01	-0.818303E+00
1988	0.492000E-01	0.138800E+00	-0.103714E+01
1989	0.395000E-01	0.361873E-01	0.875930E-01
1990	0.129000E-01	0.348743E-01	-0.994522E+00
1991	0.406000E-01	0.562922E-01	-0.326788E+00
1992	0.196000E-01	0.378817E-01	-0.658939E+00
1993	0.344000E-01	0.851448E-01	-0.906297E+00
1994	N/A	0.209779E-01	N/A
1995	0.280000E-01	0.120219E-01	0.845474E+00
1996	0.181000E-01	0.910802E-02	0.686757E+00
1997	0.201000E-01	0.127342E-01	0.456431E+00
1998	0.309000E-01	0.798330E-02	0.135340E+01
1999	0.305000E-01	0.120120E-01	0.931818E+00
2000	0.201000E-01	0.286446E-01	-0.354244E+00
2001	0.180000E-01	0.198796E-01	-0.993239E-01
2002	N/A	0.164223E-01	N/A
2003	0.120000E-01	0.373907E-01	-0.113652E+01
2004	0.261000E+00	0.801159E-01	0.118105E+01
2005	0.300000E-01	0.396337E-01	-0.278483E+00

Survey Index: 9 Tag: spr 41 AGE = 1
 Time = JAN-1 Type = NUMBER
 Catchability = 0.120505E-04 % Variance Contribution = 2.0707
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.371700E+00	0.333961E+00	0.107064E+00
1979	0.428300E+00	0.283348E+00	0.413147E+00
1980	0.312000E-01	0.242269E+00	-0.204963E+01
1981	0.230220E+01	0.498798E+00	0.152942E+01
1982	N/A	0.210529E+00	N/A
1983	N/A	0.115863E+00	N/A
1984	N/A	0.330078E+00	N/A
1985	N/A	0.104469E+00	N/A
1986	N/A	0.515127E+00	N/A
1987	N/A	0.197334E+00	N/A
1988	N/A	0.282532E+00	N/A
1989	N/A	0.188866E+00	N/A
1990	N/A	0.110669E+00	N/A
1991	N/A	0.215089E+00	N/A
1992	N/A	0.800263E-01	N/A
1993	N/A	0.986116E-01	N/A
1994	N/A	0.632927E-01	N/A
1995	N/A	0.391375E-01	N/A
1996	N/A	0.714346E-01	N/A
1997	N/A	0.121660E+00	N/A
1998	N/A	0.551522E-01	N/A
1999	N/A	0.154359E+00	N/A
2000	N/A	0.955329E-01	N/A
2001	N/A	0.414061E-01	N/A
2002	N/A	0.403989E-01	N/A
2003	N/A	0.275103E-01	N/A
2004	N/A	0.255706E+00	N/A
2005	N/A	0.125303E+00	N/A

Survey Index: 10 Tag: spr_41 AGE = 2
 Time = JAN-1 Type = NUMBER
 Catchability = 0.760932E-04 % Variance Contribution = 0.2122
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.191800E+00	0.324771E+00	-0.526667E+00
1979	0.129770E+01	0.172640E+01	-0.285447E+00
1980	0.221700E+01	0.146254E+01	0.415980E+00
1981	0.185220E+01	0.124638E+01	0.396135E+00
1982	N/A	0.257688E+01	N/A
1983	N/A	0.106562E+01	N/A
1984	N/A	0.591561E+00	N/A
1985	N/A	0.170089E+01	N/A
1986	N/A	0.530868E+00	N/A
1987	N/A	0.265241E+01	N/A
1988	N/A	0.101841E+01	N/A
1989	N/A	0.145997E+01	N/A
1990	N/A	0.976418E+00	N/A
1991	N/A	0.571663E+00	N/A
1992	N/A	0.110841E+01	N/A
1993	N/A	0.408908E+00	N/A
1994	N/A	0.509536E+00	N/A
1995	N/A	0.327079E+00	N/A
1996	N/A	0.202330E+00	N/A
1997	N/A	0.369241E+00	N/A
1998	N/A	0.628762E+00	N/A
1999	N/A	0.285116E+00	N/A
2000	N/A	0.797881E+00	N/A
2001	N/A	0.492931E+00	N/A
2002	N/A	0.214060E+00	N/A
2003	N/A	0.208858E+00	N/A
2004	N/A	0.142212E+00	N/A
2005	N/A	0.132197E+01	N/A

Survey Index: 11 Tag: spr_41 AGE = 3
 Time = JAN-1 Type = NUMBER
 Catchability = 0.162350E-03 % Variance Contribution = 0.1785
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.553090E+01	0.414415E+01	0.288653E+00
1979	0.275100E+00	0.509585E+00	-0.616461E+00
1980	0.268960E+01	0.272353E+01	-0.125375E-01
1981	0.281080E+01	0.199995E+01	0.340345E+00
1982	N/A	0.170638E+01	N/A
1983	N/A	0.315896E+01	N/A
1984	N/A	0.123184E+01	N/A
1985	N/A	0.841352E+00	N/A
1986	N/A	0.202717E+01	N/A
1987	N/A	0.732540E+00	N/A
1988	N/A	0.353550E+01	N/A
1989	N/A	0.154731E+01	N/A
1990	N/A	0.224358E+01	N/A
1991	N/A	0.979644E+00	N/A
1992	N/A	0.774570E+00	N/A
1993	N/A	0.132259E+01	N/A

1994	N/A	0.562541E+00	N/A
1995	N/A	0.831602E+00	N/A
1996	N/A	0.513763E+00	N/A
1997	N/A	0.323026E+00	N/A
1998	N/A	0.569050E+00	N/A
1999	N/A	0.989775E+00	N/A
2000	N/A	0.456181E+00	N/A
2001	N/A	0.128329E+01	N/A
2002	N/A	0.760436E+00	N/A
2003	N/A	0.366433E+00	N/A
2004	N/A	0.354407E+00	N/A
2005	N/A	0.243864E+00	N/A

Survey Index: 12 Tag: spr_41 AGE = 4
Time = JAN-1 Type = NUMBER
Catchability = 0.140752E-03 % Variance Contribution = 0.0512
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.971500E+00	0.111851E+01	-0.140915E+00
1979	0.185150E+01	0.195480E+01	-0.542917E-01
1980	0.212300E+00	0.247088E+00	-0.151743E+00
1981	0.168490E+01	0.119096E+01	0.346949E+00
1982	N/A	0.882015E+00	N/A
1983	N/A	0.724192E+00	N/A
1984	N/A	0.121539E+01	N/A
1985	N/A	0.438427E+00	N/A
1986	N/A	0.286067E+00	N/A
1987	N/A	0.856503E+00	N/A
1988	N/A	0.340901E+00	N/A
1989	N/A	0.148788E+01	N/A
1990	N/A	0.726163E+00	N/A
1991	N/A	0.950387E+00	N/A
1992	N/A	0.282342E+00	N/A
1993	N/A	0.273433E+00	N/A
1994	N/A	0.398028E+00	N/A
1995	N/A	0.204951E+00	N/A
1996	N/A	0.455537E+00	N/A
1997	N/A	0.249671E+00	N/A
1998	N/A	0.147906E+00	N/A
1999	N/A	0.252617E+00	N/A
2000	N/A	0.457136E+00	N/A
2001	N/A	0.236308E+00	N/A
2002	N/A	0.607526E+00	N/A
2003	N/A	0.416612E+00	N/A
2004	N/A	0.212849E+00	N/A
2005	N/A	0.210936E+00	N/A

Survey Index: 13 Tag: spr_41 AGE = 5
Time = JAN-1 Type = NUMBER
Catchability = 0.172199E-03 % Variance Contribution = 0.2029
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.777600E+00	0.495525E+00	0.450595E+00
1979	0.546600E+00	0.761524E+00	-0.331604E+00
1980	0.170500E+01	0.119922E+01	0.351893E+00
1981	0.105900E+00	0.169589E+00	-0.470884E+00

1982	N/A	0.809001E+00	N/A
1983	N/A	0.449222E+00	N/A
1984	N/A	0.342713E+00	N/A
1985	N/A	0.697602E+00	N/A
1986	N/A	0.225999E+00	N/A
1987	N/A	0.162357E+00	N/A
1988	N/A	0.527439E+00	N/A
1989	N/A	0.183782E+00	N/A
1990	N/A	0.842934E+00	N/A
1991	N/A	0.434123E+00	N/A
1992	N/A	0.440735E+00	N/A
1993	N/A	0.121075E+00	N/A
1994	N/A	0.100154E+00	N/A
1995	N/A	0.114328E+00	N/A
1996	N/A	0.974667E-01	N/A
1997	N/A	0.264016E+00	N/A
1998	N/A	0.112813E+00	N/A
1999	N/A	0.822418E-01	N/A
2000	N/A	0.143031E+00	N/A
2001	N/A	0.292418E+00	N/A
2002	N/A	0.136511E+00	N/A
2003	N/A	0.398650E+00	N/A
2004	N/A	0.299817E+00	N/A
2005	N/A	0.178610E+00	N/A

Survey Index: 14 Tag: spr_41 AGE = 6
Time = JAN-1 Type = NUMBER
Catchability = 0.160600E-03 % Variance Contribution = 0.0757
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.141600E+00	0.180570E+00	-0.243112E+00
1979	0.235500E+00	0.257761E+00	-0.903224E-01
1980	0.373700E+00	0.405362E+00	-0.813282E-01
1981	0.878600E+00	0.580313E+00	0.414763E+00
1982	N/A	0.953460E-01	N/A
1983	N/A	0.327105E+00	N/A
1984	N/A	0.189709E+00	N/A
1985	N/A	0.139623E+00	N/A
1986	N/A	0.258754E+00	N/A
1987	N/A	0.102817E+00	N/A
1988	N/A	0.834296E-01	N/A
1989	N/A	0.185204E+00	N/A
1990	N/A	0.922329E-01	N/A
1991	N/A	0.314653E+00	N/A
1992	N/A	0.119617E+00	N/A
1993	N/A	0.121178E+00	N/A
1994	N/A	0.285114E-01	N/A
1995	N/A	0.192207E-01	N/A
1996	N/A	0.451567E-01	N/A
1997	N/A	0.394026E-01	N/A
1998	N/A	0.862167E-01	N/A
1999	N/A	0.390594E-01	N/A
2000	N/A	0.335897E-01	N/A
2001	N/A	0.679460E-01	N/A
2002	N/A	0.136531E+00	N/A
2003	N/A	0.580264E-01	N/A
2004	N/A	0.195269E+00	N/A
2005	N/A	0.190571E+00	N/A

Survey Index: 15 Tag: spr_41 AGE = 7
 Time = JAN-1 Type = NUMBER
 Catchability = 0.224100E-03 % Variance Contribution = 0.3786
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.712300E+00	0.321378E+00	0.795882E+00
1979	0.836000E-01	0.179729E+00	-0.765405E+00
1980	0.185500E+00	0.201609E+00	-0.832737E-01
1981	0.258200E+00	0.244921E+00	0.527968E-01
1982	N/A	0.377878E+00	N/A
1983	N/A	0.519485E-01	N/A
1984	N/A	0.216349E+00	N/A
1985	N/A	0.112101E+00	N/A
1986	N/A	0.759697E-01	N/A
1987	N/A	0.168475E+00	N/A
1988	N/A	0.663643E-01	N/A
1989	N/A	0.458373E-01	N/A
1990	N/A	0.101886E+00	N/A
1991	N/A	0.589363E-01	N/A
1992	N/A	0.138857E+00	N/A
1993	N/A	0.547355E-01	N/A
1994	N/A	0.427308E-01	N/A
1995	N/A	0.131066E-01	N/A
1996	N/A	0.130366E-01	N/A
1997	N/A	0.266481E-01	N/A
1998	N/A	0.184521E-01	N/A
1999	N/A	0.504408E-01	N/A
2000	N/A	0.249543E-01	N/A
2001	N/A	0.231665E-01	N/A
2002	N/A	0.439644E-01	N/A
2003	N/A	0.888617E-01	N/A
2004	N/A	0.411483E-01	N/A
2005	N/A	0.176447E+00	N/A

Survey Index: 16 Tag: spr_41 AGE = 8
 Time = JAN-1 Type = NUMBER
 Catchability = 0.238894E-03 % Variance Contribution = 1.4326
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.651000E-01	0.160427E-01	0.140067E+01
1979	0.138600E+00	0.205917E+00	-0.395880E+00
1980	0.310000E-01	0.140219E+00	-0.150922E+01
1981	0.132100E+00	0.797687E-01	0.504428E+00
1982	N/A	0.123624E+00	N/A
1983	N/A	0.184328E+00	N/A
1984	N/A	0.248044E-01	N/A
1985	N/A	0.898235E-01	N/A
1986	N/A	0.507167E-01	N/A
1987	N/A	0.474989E-01	N/A
1988	N/A	0.886780E-01	N/A
1989	N/A	0.231196E-01	N/A
1990	N/A	0.222808E-01	N/A
1991	N/A	0.359644E-01	N/A
1992	N/A	0.242022E-01	N/A
1993	N/A	0.543980E-01	N/A
1994	N/A	0.134026E-01	N/A

1995	N/A	0.768066E-02	N/A
1996	N/A	0.581901E-02	N/A
1997	N/A	0.813571E-02	N/A
1998	N/A	0.510044E-02	N/A
1999	N/A	0.767435E-02	N/A
2000	N/A	0.183007E-01	N/A
2001	N/A	0.127009E-01	N/A
2002	N/A	0.104920E-01	N/A
2003	N/A	0.238885E-01	N/A
2004	N/A	0.511851E-01	N/A
2005	N/A	0.253215E-01	N/A

Survey Index: 17 Tag: sp_can AGE = 1
Time = JAN-1 Type = NUMBER
Catchability = 0.186510E-04 % Variance Contribution = 4.4226
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.516884E+00	N/A
1979	N/A	0.438550E+00	N/A
1980	N/A	0.374969E+00	N/A
1981	N/A	0.772010E+00	N/A
1982	N/A	0.325844E+00	N/A
1983	N/A	0.179325E+00	N/A
1984	N/A	0.510875E+00	N/A
1985	N/A	0.161691E+00	N/A
1986	0.600000E+00	0.797283E+00	-0.284280E+00
1987	0.250000E+00	0.305422E+00	-0.200234E+00
1988	0.280000E+00	0.437287E+00	-0.445799E+00
1989	0.163000E+01	0.292316E+00	0.171850E+01
1990	0.420000E+00	0.171286E+00	0.896919E+00
1991	0.118000E+01	0.332902E+00	0.126542E+01
1992	0.110000E+00	0.123860E+00	-0.118671E+00
1993	N/A	0.152625E+00	N/A
1994	N/A	0.979606E-01	N/A
1995	0.700000E-01	0.605747E-01	0.144618E+00
1996	0.140000E+00	0.110562E+00	0.236064E+00
1997	0.320000E+00	0.188298E+00	0.530297E+00
1998	0.100000E-01	0.853612E-01	-0.214431E+01
1999	0.330000E+00	0.238907E+00	0.323017E+00
2000	0.100000E+00	0.147860E+00	-0.391097E+00
2001	N/A	0.640858E-01	N/A
2002	0.100000E-01	0.625269E-01	-0.183301E+01
2003	N/A	0.425788E-01	N/A
2004	0.535600E+00	0.395766E+00	0.302563E+00
2005	N/A	0.193936E+00	N/A

Survey Index: 18 Tag: sp_can AGE = 2
Time = JAN-1 Type = NUMBER
Catchability = 0.773206E-04 % Variance Contribution = 5.3764
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.330010E+00	N/A
1979	N/A	0.175425E+01	N/A
1980	N/A	0.148613E+01	N/A
1981	N/A	0.126648E+01	N/A
1982	N/A	0.261844E+01	N/A

1983	N/A	0.108281E+01	N/A
1984	N/A	0.601104E+00	N/A
1985	N/A	0.172833E+01	N/A
1986	0.227000E+01	0.539431E+00	0.143702E+01
1987	0.213000E+01	0.269520E+01	-0.235350E+00
1988	0.101000E+01	0.103484E+01	-0.242922E-01
1989	0.278000E+01	0.148353E+01	0.628030E+00
1990	0.244000E+01	0.992168E+00	0.899861E+00
1991	0.116000E+01	0.580885E+00	0.691623E+00
1992	0.286000E+01	0.112629E+01	0.931894E+00
1993	N/A	0.415504E+00	N/A
1994	N/A	0.517755E+00	N/A
1995	0.670000E+00	0.332355E+00	0.701074E+00
1996	0.490000E+00	0.205594E+00	0.868503E+00
1997	0.530000E+00	0.375197E+00	0.345426E+00
1998	0.670000E+00	0.638904E+00	0.475229E-01
1999	0.320000E+00	0.289716E+00	0.994213E-01
2000	0.440000E+00	0.810752E+00	-0.611187E+00
2001	0.600000E-01	0.500883E+00	-0.212203E+01
2002	0.900000E-01	0.217513E+00	-0.882449E+00
2003	0.200000E-01	0.212227E+00	-0.236192E+01
2004	0.956000E-01	0.144506E+00	-0.413146E+00
2005	N/A	0.134330E+01	N/A

Survey Index: 19 Tag: sp can AGE = 3
 Time = JAN-1 Type = NUMBER
 Catchability = 0.231101E-03 % Variance Contribution = 1.2688
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.589907E+01	N/A
1979	N/A	0.725379E+00	N/A
1980	N/A	0.387687E+01	N/A
1981	N/A	0.284687E+01	N/A
1982	N/A	0.242898E+01	N/A
1983	N/A	0.449669E+01	N/A
1984	N/A	0.175348E+01	N/A
1985	N/A	0.119764E+01	N/A
1986	0.281000E+01	0.288562E+01	-0.265536E-01
1987	0.930000E+00	0.104275E+01	-0.114432E+00
1988	0.466000E+01	0.503268E+01	-0.769370E-01
1989	0.138000E+01	0.220255E+01	-0.467534E+00
1990	0.378000E+01	0.319368E+01	0.168552E+00
1991	0.184000E+01	0.139449E+01	0.277234E+00
1992	0.177000E+01	0.110258E+01	0.473330E+00
1993	N/A	0.188266E+01	N/A
1994	N/A	0.800760E+00	N/A
1995	0.150000E+01	0.118376E+01	0.236770E+00
1996	0.231000E+01	0.731326E+00	0.115014E+01
1997	0.550000E+00	0.459818E+00	0.179088E+00
1998	0.950000E+00	0.810025E+00	0.159397E+00
1999	0.149000E+01	0.140891E+01	0.559566E-01
2000	0.105000E+01	0.649359E+00	0.480559E+00
2001	0.640000E+00	0.182672E+01	-0.104881E+01
2002	0.570000E+00	0.108246E+01	-0.641353E+00
2003	0.300000E+00	0.521606E+00	-0.553130E+00
2004	0.392000E+00	0.504488E+00	-0.252282E+00
2005	N/A	0.347133E+00	N/A

Survey Index: 20 Tag: sp_can AGE = 4
 Time = JAN-1 Type = NUMBER
 Catchability = 0.387317E-03 % Variance Contribution = 1.7371
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.307788E+01	N/A
1979	N/A	0.537914E+01	N/A
1980	N/A	0.679926E+00	N/A
1981	N/A	0.327723E+01	N/A
1982	N/A	0.242709E+01	N/A
1983	N/A	0.199280E+01	N/A
1984	N/A	0.334445E+01	N/A
1985	N/A	0.120645E+01	N/A
1986	0.370000E+00	0.787189E+00	-0.754965E+00
1987	0.109000E+01	0.235689E+01	-0.771166E+00
1988	0.580000E+00	0.938079E+00	-0.480806E+00
1989	0.285000E+01	0.409429E+01	-0.362274E+00
1990	0.208000E+01	0.199823E+01	0.401073E-01
1991	0.215000E+01	0.261524E+01	-0.195887E+00
1992	0.800000E+00	0.776938E+00	0.292507E-01
1993	N/A	0.752422E+00	N/A
1994	N/A	0.109528E+01	N/A
1995	0.860000E+00	0.563975E+00	0.421922E+00
1996	0.402000E+01	0.125353E+01	0.116532E+01
1997	0.125000E+01	0.687036E+00	0.598512E+00
1998	0.350000E+00	0.407003E+00	-0.150887E+00
1999	0.109000E+01	0.695143E+00	0.449815E+00
2000	0.392000E+01	0.125793E+01	0.113662E+01
2001	0.420000E+00	0.650263E+00	-0.437122E+00
2002	0.205000E+01	0.167177E+01	0.203959E+00
2003	0.650000E+00	0.114642E+01	-0.567424E+00
2004	0.423200E+00	0.585709E+00	-0.324978E+00
2005	N/A	0.580444E+00	N/A

Survey Index: 21 Tag: sp can AGE = 5
 Time = JAN-1 Type = NUMBER
 Catchability = 0.614360E-03 % Variance Contribution = 1.6973
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.176790E+01	N/A
1979	N/A	0.271692E+01	N/A
1980	N/A	0.427850E+01	N/A
1981	N/A	0.605050E+00	N/A
1982	N/A	0.288630E+01	N/A
1983	N/A	0.160270E+01	N/A
1984	N/A	0.122271E+01	N/A
1985	N/A	0.248886E+01	N/A
1986	0.650000E+00	0.806306E+00	-0.215490E+00
1987	0.340000E+00	0.579247E+00	-0.532783E+00
1988	0.102000E+01	0.188176E+01	-0.612406E+00
1989	0.360000E+00	0.655686E+00	-0.599578E+00
1990	0.387000E+01	0.300737E+01	0.252190E+00
1991	0.105000E+01	0.154884E+01	-0.388713E+00
1992	0.980000E+00	0.157243E+01	-0.472823E+00
1993	N/A	0.431964E+00	N/A
1994	N/A	0.357321E+00	N/A

1995	0.600000E+00	0.407891E+00	0.385931E+00
1996	0.109000E+01	0.347736E+00	0.114249E+01
1997	0.123000E+01	0.941940E+00	0.266828E+00
1998	0.350000E+00	0.402487E+00	-0.139729E+00
1999	0.410000E+00	0.293417E+00	0.334563E+00
2000	0.171000E+01	0.510297E+00	0.120926E+01
2001	0.111000E+01	0.104327E+01	0.620006E-01
2002	0.680000E+00	0.487034E+00	0.333759E+00
2003	0.121000E+01	0.142228E+01	-0.161638E+00
2004	0.450900E+00	0.106967E+01	-0.863858E+00
2005	N/A	0.637232E+00	N/A

Survey Index: 22 Tag: sp_can AGE = 6
Time = JAN-1 Type = NUMBER
Catchability = 0.759648E-03 % Variance Contribution = 3.5100
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.854107E+00	N/A
1979	N/A	0.121923E+01	N/A
1980	N/A	0.191739E+01	N/A
1981	N/A	0.274492E+01	N/A
1982	N/A	0.450993E+00	N/A
1983	N/A	0.154723E+01	N/A
1984	N/A	0.897334E+00	N/A
1985	N/A	0.660427E+00	N/A
1986	0.440000E+00	0.122392E+01	-0.102304E+01
1987	0.120000E+00	0.486331E+00	-0.139940E+01
1988	0.130000E+00	0.394628E+00	-0.111041E+01
1989	0.420000E+00	0.876027E+00	-0.735142E+00
1990	0.420000E+00	0.436268E+00	-0.380013E-01
1991	0.131000E+01	0.148833E+01	-0.127626E+00
1992	0.600000E+00	0.565795E+00	0.586979E-01
1993	N/A	0.573181E+00	N/A
1994	N/A	0.134861E+00	N/A
1995	0.190000E+00	0.909152E-01	0.737097E+00
1996	0.790000E+00	0.213594E+00	0.130796E+01
1997	0.270000E+00	0.186377E+00	0.370652E+00
1998	0.280000E+00	0.407811E+00	-0.376013E+00
1999	0.260000E+00	0.184753E+00	0.341660E+00
2000	0.780000E+00	0.158881E+00	0.159114E+01
2001	0.520000E+00	0.321389E+00	0.481177E+00
2002	0.122000E+01	0.645801E+00	0.636115E+00
2003	0.320000E+00	0.274469E+00	0.153484E+00
2004	0.387600E+00	0.923635E+00	-0.868343E+00
2005	N/A	0.901415E+00	N/A

Survey Index: 23 Tag: sp_can AGE = 7
Time = JAN-1 Type = NUMBER
Catchability = 0.868003E-03 % Variance Contribution = 4.1565
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.124479E+01	N/A
1979	N/A	0.696141E+00	N/A
1980	N/A	0.780888E+00	N/A
1981	N/A	0.948651E+00	N/A
1982	N/A	0.146363E+01	N/A

1983	N/A	0.201212E+00	N/A
1984	N/A	0.837981E+00	N/A
1985	N/A	0.434200E+00	N/A
1986	0.260000E+00	0.294253E+00	-0.123757E+00
1987	0.220000E+00	0.652551E+00	-0.108726E+01
1988	0.800000E-01	0.257048E+00	-0.116724E+01
1989	0.500000E-01	0.177541E+00	-0.126718E+01
1990	0.930000E+00	0.394632E+00	0.857230E+00
1991	0.160000E+00	0.228277E+00	-0.355386E+00
1992	0.430000E+00	0.537833E+00	-0.223763E+00
1993	N/A	0.212006E+00	N/A
1994	N/A	0.165509E+00	N/A
1995	0.400000E-01	0.507656E-01	-0.238340E+00
1996	0.330000E+00	0.504947E-01	0.187722E+01
1997	0.600000E-01	0.103216E+00	-0.542476E+00
1998	0.700000E-01	0.714702E-01	-0.207852E-01
1999	0.150000E+00	0.195372E+00	-0.264270E+00
2000	0.400000E+00	0.966552E-01	0.142032E+01
2001	0.260000E+00	0.897305E-01	0.106387E+01
2002	0.400000E+00	0.170287E+00	0.853981E+00
2003	0.340000E+00	0.344187E+00	-0.122394E-01
2004	0.738000E-01	0.159379E+00	-0.769927E+00
2005	N/A	0.683430E+00	N/A

Survey Index: 24 Tag: sp can AGE = 8
Time = JAN-1 Type = NUMBER
Catchability = 0.107767E-02 % Variance Contribution = 3.8280
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	N/A	0.723701E-01	N/A
1979	N/A	0.928909E+00	N/A
1980	N/A	0.632541E+00	N/A
1981	N/A	0.359844E+00	N/A
1982	N/A	0.557678E+00	N/A
1983	N/A	0.831522E+00	N/A
1984	N/A	0.111895E+00	N/A
1985	N/A	0.405202E+00	N/A
1986	0.400000E-01	0.228788E+00	-0.174391E+01
1987	0.800000E-01	0.214272E+00	-0.985219E+00
1988	0.170000E+00	0.400035E+00	-0.855753E+00
1989	0.100000E+00	0.104295E+00	-0.420514E-01
1990	0.120000E+00	0.100511E+00	0.177229E+00
1991	0.220000E+00	0.162239E+00	0.304558E+00
1992	0.120000E+00	0.109178E+00	0.945094E-01
1993	N/A	0.245395E+00	N/A
1994	N/A	0.604602E-01	N/A
1995	0.500000E-01	0.346481E-01	0.366779E+00
1996	0.800000E-01	0.262501E-01	0.111436E+01
1997	0.300000E-01	0.367009E-01	-0.201605E+00
1998	0.200000E-01	0.230086E-01	-0.140134E+00
1999	0.100000E-01	0.346197E-01	-0.124184E+01
2000	0.240000E+00	0.825560E-01	0.106716E+01
2001	0.170000E+00	0.572948E-01	0.108759E+01
2002	0.170000E+00	0.473305E-01	0.127864E+01
2003	0.160000E+00	0.107763E+00	0.395238E+00
2004	0.117500E+00	0.230901E+00	-0.675550E+00
2005	N/A	0.114228E+00	N/A

Survey Index: 25 Tag: us0aut AGE = 1
 Time = JAN-1 Type = NUMBER
 Catchability = 0.129290E-04 % Variance Contribution = 9.9559
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.151600E+00	0.358307E+00	-0.860144E+00
1979	0.395300E+00	0.304005E+00	0.262602E+00
1980	0.114500E+00	0.259930E+00	-0.819838E+00
1981	0.279700E+00	0.535161E+00	-0.648850E+00
1982	0.261000E+00	0.225877E+00	0.144531E+00
1983	0.362000E+00	0.124309E+00	0.106887E+01
1984	0.128290E+01	0.354141E+00	0.128718E+01
1985	0.179100E+00	0.112085E+00	0.468688E+00
1986	0.100190E+01	0.552680E+00	0.594874E+00
1987	0.761000E-01	0.211720E+00	-0.102322E+01
1988	0.203700E+00	0.303129E+00	-0.397511E+00
1989	0.549500E+00	0.202634E+00	0.997605E+00
1990	0.250800E+00	0.118736E+00	0.747750E+00
1991	0.157100E+00	0.230769E+00	-0.384536E+00
1992	0.405000E-01	0.858603E-01	-0.751420E+00
1993	0.351000E-01	0.105800E+00	-0.110335E+01
1994	0.178400E+00	0.679068E-01	0.965893E+00
1995	0.668000E-01	0.419907E-01	0.464255E+00
1996	0.159900E+00	0.766422E-01	0.735400E+00
1997	0.216000E-01	0.130529E+00	-0.179890E+01
1998	0.640000E-02	0.591728E-01	-0.222416E+01
1999	0.701000E-01	0.165612E+00	-0.859722E+00
2000	0.701000E-01	0.102497E+00	-0.379914E+00
2001	0.195000E-01	0.444246E-01	-0.823378E+00
2002	0.280000E-01	0.433440E-01	-0.436963E+00
2003	0.234000E+00	0.295158E-01	0.207039E+01
2004	0.326900E+00	0.274347E+00	0.175260E+00
2005	0.168530E+01	0.134438E+00	0.252860E+01

Survey Index: 26 Tag: uslaut AGE = 2
 Time = JAN-1 Type = NUMBER
 Catchability = 0.607287E-04 % Variance Contribution = 3.7314
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.236800E+00	0.259194E+00	-0.903623E-01
1979	0.184540E+01	0.137781E+01	0.292197E+00
1980	0.162510E+01	0.116723E+01	0.330936E+00
1981	0.819900E+00	0.994712E+00	-0.193270E+00
1982	0.352500E+01	0.205656E+01	0.538845E+00
1983	0.577300E+00	0.850456E+00	-0.387410E+00
1984	0.849500E+00	0.472115E+00	0.587425E+00
1985	0.190910E+01	0.135745E+01	0.341021E+00
1986	0.181300E+00	0.423677E+00	-0.848818E+00
1987	0.227890E+01	0.211685E+01	0.737654E-01
1988	0.413700E+00	0.812774E+00	-0.675312E+00
1989	0.874700E+00	0.116518E+01	-0.286751E+00
1990	0.279840E+01	0.779263E+00	0.127845E+01
1991	0.363600E+00	0.456235E+00	-0.226954E+00
1992	0.407600E+00	0.884603E+00	-0.774852E+00
1993	0.412400E+00	0.326343E+00	0.234045E+00

1994	0.969900E+00	0.406652E+00	0.869235E+00
1995	0.405600E+00	0.261036E+00	0.440708E+00
1996	0.244700E+00	0.161476E+00	0.415675E+00
1997	0.239900E+00	0.294685E+00	-0.205684E+00
1998	0.236200E+00	0.501804E+00	-0.753532E+00
1999	0.335500E+00	0.227547E+00	0.388267E+00
2000	0.139700E+00	0.636776E+00	-0.151692E+01
2001	0.571000E+00	0.393400E+00	0.372561E+00
2002	0.470000E-01	0.170838E+00	-0.129057E+01
2003	0.478000E+00	0.166686E+00	0.105350E+01
2004	0.166300E+00	0.113497E+00	0.382019E+00
2005	0.744800E+00	0.105504E+01	-0.348221E+00

Survey Index: 27 Tag: us2aut AGE = 3
Time = JAN-1 Type = NUMBER
Catchability = 0.104068E-03 % Variance Contribution = 3.6038
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.343350E+01	0.265643E+01	0.256596E+00
1979	0.391200E+00	0.326648E+00	0.180336E+00
1980	0.167700E+01	0.174581E+01	-0.402105E-01
1981	0.563600E+00	0.128199E+01	-0.821821E+00
1982	0.225000E+01	0.109380E+01	0.721270E+00
1983	0.190950E+01	0.202492E+01	-0.586895E-01
1984	0.108930E+01	0.789617E+00	0.321742E+00
1985	0.681800E+00	0.539314E+00	0.234439E+00
1986	0.842600E+00	0.129943E+01	-0.433191E+00
1987	0.128500E+00	0.469565E+00	-0.129588E+01
1988	0.135280E+01	0.226629E+01	-0.515966E+00
1989	0.437000E+00	0.991841E+00	-0.819629E+00
1990	0.104640E+01	0.143816E+01	-0.318006E+00
1991	0.162440E+01	0.627960E+00	0.950417E+00
1992	0.175200E+00	0.496506E+00	-0.104167E+01
1993	0.948900E+00	0.847790E+00	0.112671E+00
1994	0.531600E+00	0.360593E+00	0.388140E+00
1995	0.664300E+00	0.533063E+00	0.220093E+00
1996	0.181060E+01	0.329326E+00	0.170436E+01
1997	0.195800E+00	0.207062E+00	-0.559259E-01
1998	0.320900E+00	0.364765E+00	-0.128125E+00
1999	0.102620E+01	0.634454E+00	0.480854E+00
2000	0.154200E+00	0.292415E+00	-0.639925E+00
2001	0.537800E+00	0.822597E+00	-0.424979E+00
2002	0.381000E+00	0.487446E+00	-0.246379E+00
2003	0.707000E+00	0.234886E+00	0.110193E+01
2004	0.309200E+00	0.227178E+00	0.308255E+00
2005	0.135800E+00	0.156319E+00	-0.140716E+00

Survey Index: 28 Tag: us3aut AGE = 4
Time = JAN-1 Type = NUMBER
Catchability = 0.124037E-03 % Variance Contribution = 5.2927
Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.690800E+00	0.985685E+00	-0.355487E+00
1979	0.405770E+01	0.172266E+01	0.856747E+00
1980	0.162100E+00	0.217745E+00	-0.295111E+00
1981	0.773900E+00	0.104953E+01	-0.304651E+00

1982	0.155900E+01	0.777271E+00	0.696010E+00
1983	0.241800E+00	0.638191E+00	-0.970527E+00
1984	0.740200E+00	0.107105E+01	-0.369477E+00
1985	0.928700E+00	0.386362E+00	0.877012E+00
1986	0.667000E-01	0.252096E+00	-0.132960E+01
1987	0.329000E+00	0.754790E+00	-0.830381E+00
1988	0.108000E+00	0.300418E+00	-0.102304E+01
1989	0.903800E+00	0.131119E+01	-0.372080E+00
1990	0.161100E+00	0.639928E+00	-0.137933E+01
1991	0.181410E+01	0.837524E+00	0.772895E+00
1992	0.274200E+00	0.248813E+00	0.971570E-01
1993	0.174300E+00	0.240962E+00	-0.323859E+00
1994	0.382600E+00	0.350760E+00	0.868869E-01
1995	0.433400E+00	0.180612E+00	0.875311E+00
1996	0.124850E+01	0.401440E+00	0.113464E+01
1997	0.414400E+00	0.220022E+00	0.633105E+00
1998	0.109300E+00	0.130342E+00	-0.176063E+00
1999	0.351800E+00	0.222618E+00	0.457605E+00
2000	0.309600E+00	0.402849E+00	-0.263281E+00
2001	0.705000E-01	0.208245E+00	-0.108310E+01
2002	0.459000E+00	0.535380E+00	-0.153926E+00
2003	0.139600E+01	0.367138E+00	0.133563E+01
2004	0.200500E+00	0.187572E+00	0.666512E-01
2005	0.710100E+00	0.185886E+00	0.134027E+01

Survey Index: 29 Tag: us4aut AGE = 5
 Time = JAN-1 Type = NUMBER
 Catchability = 0.923788E-04 % Variance Contribution = 8.0197
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.252800E+00	0.265832E+00	-0.502661E-01
1979	0.963600E+00	0.408531E+00	0.858107E+00
1980	0.168650E+01	0.643341E+00	0.963736E+00
1981	0.525000E-01	0.909789E-01	-0.549814E+00
1982	0.589000E+00	0.434001E+00	0.305379E+00
1983	0.678000E-01	0.240992E+00	-0.126820E+01
1984	0.691000E-01	0.183854E+00	-0.978585E+00
1985	0.825100E+00	0.374239E+00	0.790609E+00
1986	0.105500E+00	0.121241E+00	-0.139068E+00
1987	0.820000E-02	0.870990E-01	-0.236291E+01
1988	0.200300E+00	0.282953E+00	-0.345464E+00
1989	0.600000E-01	0.985928E-01	-0.496654E+00
1990	0.507100E+00	0.452205E+00	0.114572E+00
1991	0.412400E+00	0.232892E+00	0.571419E+00
1992	0.305000E-01	0.236439E+00	-0.204797E+01
1993	0.100000E+00	0.649526E-01	0.431512E+00
1994	0.165000E-01	0.537290E-01	-0.118059E+01
1995	0.153400E+00	0.613328E-01	0.916733E+00
1996	0.872000E-01	0.522876E-01	0.511446E+00
1997	0.143000E+00	0.141636E+00	0.958634E-02
1998	0.129200E+00	0.605203E-01	0.758383E+00
1999	0.411000E-01	0.441199E-01	-0.709025E-01
2000	0.254900E+00	0.767312E-01	0.120056E+01
2001	0.788000E-01	0.156872E+00	-0.688518E+00
2002	0.590000E-01	0.732333E-01	-0.216113E+00
2003	0.162700E+01	0.213862E+00	0.202916E+01
2004	0.155600E+00	0.160842E+00	-0.331314E-01
2005	0.252000E+00	0.958180E-01	0.966979E+00

Survey Index: 30 Tag: us5aut AGE = 6
 Time = JAN-1 Type = NUMBER
 Catchability = 0.107259E-03 % Variance Contribution = 5.0369
 Residual = LN(Observed) - LN(Predicted)

Year	Observed	Predicted	Residual
1978	0.173100E+00	0.120596E+00	0.361420E+00
1979	0.335500E+00	0.172150E+00	0.667257E+00
1980	0.320600E+00	0.270727E+00	0.169082E+00
1981	0.264800E+00	0.387571E+00	-0.380923E+00
1982	0.540000E-01	0.636783E-01	-0.164859E+00
1983	0.115200E+00	0.218462E+00	-0.639944E+00
1984	0.328000E-01	0.126700E+00	-0.135139E+01
1985	0.242000E-01	0.932495E-01	-0.134893E+01
1986	0.766000E-01	0.172813E+00	-0.813613E+00
1987	0.487000E-01	0.686679E-01	-0.343603E+00
1988	0.280000E-01	0.557198E-01	-0.688130E+00
1989	0.193700E+00	0.123691E+00	0.448521E+00
1990	0.547000E-01	0.615992E-01	-0.118785E+00
1991	0.285500E+00	0.210146E+00	0.306441E+00
1992	0.290000E-01	0.798879E-01	-0.101333E+01
1993	0.437000E-01	0.809308E-01	-0.616246E+00
1994	0.253000E-01	0.190418E-01	0.284168E+00
1995	0.679000E-01	0.128368E-01	0.166572E+01
1996	0.541000E-01	0.301586E-01	0.584365E+00
1997	0.597000E-01	0.263156E-01	0.819170E+00
1998	0.486000E-01	0.575811E-01	-0.169572E+00
1999	0.354000E-01	0.260864E-01	0.305298E+00
2000	0.871000E-01	0.224334E-01	0.135651E+01
2001	0.306000E-01	0.453788E-01	-0.394044E+00
2002	0.550000E-01	0.911843E-01	-0.505550E+00
2003	0.118000E+00	0.387538E-01	0.111346E+01
2004	0.824000E-01	0.130413E+00	-0.459124E+00
2005	0.321500E+00	0.127276E+00	0.926639E+00

Retrospective Summary

Average Fishing Mortality

Ages = 4 - 8

	1978	1979	1980	1981	1982
1996	0.5404	0.3468	0.4882	0.4654	0.6482
1997	0.5404	0.3468	0.4882	0.4654	0.6482
1998	0.5404	0.3468	0.4882	0.4654	0.6482
1999	0.5404	0.3469	0.4882	0.4654	0.6482
2000	0.5404	0.3469	0.4882	0.4654	0.6482
2001	0.5404	0.3469	0.4882	0.4654	0.6482
2002	0.5404	0.3469	0.4882	0.4654	0.6482
2003	0.5404	0.3469	0.4882	0.4654	0.6482
2004	0.5404	0.3469	0.4882	0.4654	0.6482
	1983	1984	1985	1986	1987
1996	0.5804	0.6437	0.7384	0.4900	0.4776
1997	0.5804	0.6437	0.7385	0.4901	0.4778
1998	0.5804	0.6438	0.7386	0.4902	0.4780
1999	0.5804	0.6438	0.7386	0.4903	0.4780
2000	0.5804	0.6438	0.7386	0.4903	0.4780
2001	0.5804	0.6438	0.7386	0.4903	0.4780
2002	0.5804	0.6438	0.7386	0.4903	0.4781
2003	0.5804	0.6438	0.7386	0.4903	0.4781
2004	0.5804	0.6438	0.7386	0.4903	0.4781
	1988	1989	1990	1991	1992
1996	0.7844	0.5940	0.6507	0.8323	0.7942
1997	0.7851	0.5950	0.6524	0.8371	0.7950
1998	0.7857	0.5958	0.6539	0.8408	0.8039
1999	0.7858	0.5960	0.6544	0.8420	0.8069
2000	0.7859	0.5961	0.6545	0.8424	0.8081
2001	0.7860	0.5962	0.6547	0.8429	0.8094
2002	0.7860	0.5962	0.6548	0.8431	0.8098
2003	0.7860	0.5962	0.6548	0.8432	0.8098
2004	0.7860	0.5962	0.6548	0.8432	0.8099
	1993	1994	1995	1996	1997
1996	1.0902	1.1886	0.4538	0.2157	
1997	1.1059	1.2918	0.4562	0.2649	0.3530
1998	1.1385	1.4130	0.5705	0.3727	0.5883
1999	1.1500	1.4532	0.6130	0.4166	0.7541
2000	1.1550	1.4719	0.6364	0.4392	0.8399
2001	1.1604	1.4883	0.6561	0.4557	0.9137
2002	1.1624	1.4963	0.6641	0.4638	0.9510
2003	1.1626	1.4972	0.6650	0.4649	0.9569
2004	1.1626	1.4973	0.6653	0.4651	0.9574

	1998	1999	2000	2001	2002
1996					
1997					
1998	0.3334				
1999	0.4924	0.3043			
2000	0.6107	0.4244	0.2638		
2001	0.7127	0.5542	0.4000	0.3788	
2002	0.8002	0.6656	0.5134	0.5181	0.4442
2003	0.8161	0.6911	0.5445	0.5741	0.5168
2004	0.8160	0.6909	0.5460	0.5756	0.5207

	2003	2004
1996		
1997		
1998		
1999		
2000		
2001		
2002		
2003	0.3874	
2004	0.3921	0.2361

Spawning Stock Biomass

	1978	1979	1980	1981	1982
1996	80640.	89513.	92773.	86624.	89856.
1997	80639.	89512.	92772.	86623.	89854.
1998	80639.	89512.	92772.	86622.	89853.
1999	80639.	89512.	92772.	86622.	89852.
2000	80639.	89512.	92772.	86622.	89852.
2001	80639.	89512.	92771.	86622.	89852.
2002	80639.	89512.	92771.	86621.	89852.
2003	80639.	89512.	92771.	86621.	89852.
2004	80639.	89512.	92771.	86621.	89852.

	1983	1984	1985	1986	1987
1996	78433.	67345.	55526.	57472.	68410.
1997	78430.	67340.	55521.	57453.	68366.
1998	78428.	67337.	55516.	57440.	68339.
1999	78427.	67336.	55514.	57435.	68331.
2000	78427.	67336.	55514.	57434.	68328.
2001	78427.	67335.	55513.	57432.	68326.
2002	78426.	67335.	55513.	57432.	68324.
2003	78426.	67335.	55513.	57432.	68324.
2004	78426.	67335.	55513.	57432.	68324.

	1988	1989	1990	1991	1992
1996	73848.	72262.	68530.	53108.	40960.
1997	73771.	72168.	68426.	52861.	40068.
1998	73725.	72094.	68313.	52633.	39521.

1999	73711.	72071.	68277.	52559.	39365.
2000	73707.	72064.	68265.	52533.	39304.
2001	73703.	72056.	68250.	52503.	39257.
2002	73700.	72053.	68245.	52491.	39233.
2003	73700.	72053.	68245.	52490.	39230.
2004	73700.	72053.	68245.	52490.	39229.

1993 1994 1995 1996 1997

1996	32966.	25262.	28239.	35078.	
1997	31066.	22225.	24004.	30055.	33363.
1998	29858.	20038.	19869.	23551.	26177.
1999	29554.	19491.	18584.	21239.	24274.
2000	29425.	19281.	18144.	20117.	21898.
2001	29335.	19072.	17471.	18863.	20114.
2002	29295.	19014.	17363.	18443.	18736.
2003	29290.	19005.	17346.	18400.	18507.
2004	29289.	19003.	17340.	18387.	18521.

1998 1999 2000 2001 2002

1996					
1997					
1998	27732.				
1999	27430.	30298.			
2000	23722.	25512.	25466.		
2001	21768.	24178.	26096.	28986.	
2002	19496.	21691.	24924.	31813.	28041.
2003	19073.	21107.	24089.	30860.	28061.
2004	19078.	21003.	23697.	30033.	27474.

2003 2004

1996		
1997		
1998		
1999		
2000		
2001		
2002		
2003	23087.	
2004	22987.	22564.

Total Population Numbers

1978 1979 1980 1981 1982

1996	71159.	71082.	69338.	85174.	75963.
1997	71158.	71082.	69337.	85172.	75961.
1998	71158.	71082.	69337.	85171.	75960.
1999	71158.	71082.	69336.	85171.	75960.
2000	71158.	71082.	69336.	85171.	75959.
2001	71158.	71082.	69336.	85171.	75959.
2002	71158.	71082.	69336.	85171.	75959.
2003	71158.	71082.	69336.	85171.	75959.
2004	71158.	71082.	69336.	85171.	75959.

	1983	1984	1985	1986	1987
1996	54256.	56350.	45390.	68014.	64634.
1997	54254.	56350.	45382.	67959.	64582.
1998	54253.	56346.	45376.	67932.	64554.
1999	54252.	56345.	45373.	67924.	64547.
2000	54252.	56345.	45372.	67922.	64544.
2001	54252.	56344.	45371.	67920.	64543.
2002	54252.	56344.	45370.	67919.	64541.
2003	54252.	56344.	45370.	67918.	64541.
2004	54252.	56344.	45370.	67918.	64541.

	1988	1989	1990	1991	1992
1996	65600.	57719.	47575.	45057.	35037.
1997	65542.	57794.	47358.	43862.	33524.
1998	65503.	57711.	47246.	43347.	32484.
1999	65492.	57682.	47204.	43203.	32289.
2000	65490.	57671.	47180.	43173.	32136.
2001	65485.	57657.	47157.	43149.	32116.
2002	65484.	57654.	47143.	43132.	32092.
2003	65483.	57654.	47142.	43129.	32088.
2004	65483.	57654.	47142.	43129.	32088.

	1993	1994	1995	1996	1997
1996	30919.	28346.	22779.	22709.	23740.
1997	28730.	26392.	21516.	22377.	23185.
1998	26707.	22575.	18555.	20319.	22625.
1999	26154.	20963.	17477.	20561.	25078.
2000	26096.	20293.	16526.	18577.	22799.
2001	25697.	19442.	15808.	17527.	22426.
2002	25665.	19340.	15060.	16194.	20980.
2003	25658.	19323.	15017.	15853.	20727.
2004	25656.	19313.	15005.	15930.	20662.

	1998	1999	2000	2001	2002
1996					
1997	17368.				
1998	18068.	22785.			
1999	21039.	22294.	22659.		
2000	18978.	20262.	18171.	14669.	
2001	19827.	23740.	21369.	16372.	10937.
2002	19031.	26961.	25657.	20600.	14650.
2003	18829.	26151.	26021.	21644.	16141.
2004	18714.	25438.	25713.	21810.	17087.

	2003	2004	2005
1996			
1997			
1998			
1999			
2000			
2001			

2002	13642.			
2003	12894.	40314.		
2004	13448.	30220.	34081.	

Age 1 Population

	1978	1979	1980	1981	1982
1996	27714.	23514.	20105.	41395.	17471.
1997	27714.	23514.	20105.	41393.	17471.
1998	27713.	23513.	20105.	41393.	17471.
1999	27713.	23513.	20105.	41392.	17471.
2000	27713.	23513.	20105.	41392.	17471.
2001	27713.	23513.	20104.	41392.	17471.
2002	27713.	23513.	20104.	41392.	17471.
2003	27713.	23513.	20104.	41392.	17471.
2004	27713.	23513.	20104.	41392.	17471.
	1983	1984	1985	1986	1987
1996	9616.	27393.	8685.	42826.	16390.
1997	9615.	27395.	8677.	42777.	16383.
1998	9615.	27393.	8673.	42756.	16378.
1999	9615.	27392.	8672.	42750.	16377.
2000	9615.	27392.	8671.	42749.	16376.
2001	9615.	27391.	8670.	42748.	16376.
2002	9615.	27391.	8669.	42747.	16376.
2003	9615.	27391.	8669.	42747.	16376.
2004	9615.	27391.	8669.	42747.	16376.
	1988	1989	1990	1991	1992
1996	23486.	15643.	9563.	19423.	8012.
1997	23471.	15765.	9285.	18405.	7478.
1998	23454.	15715.	9240.	17982.	6858.
1999	23450.	15694.	9222.	17872.	6782.
2000	23449.	15685.	9207.	17862.	6653.
2001	23446.	15675.	9196.	17857.	6654.
2002	23446.	15673.	9185.	17850.	6643.
2003	23446.	15673.	9184.	17849.	6641.
2004	23446.	15673.	9184.	17849.	6641.
	1993	1994	1995	1996	1997
1996	11030.	9978.	3639.	6346.	7618.
1997	10082.	9815.	3968.	7046.	7343.
1998	8910.	7654.	4128.	7411.	8465.
1999	8517.	6495.	4369.	8535.	10720.
2000	8583.	5872.	3967.	7329.	10066.
2001	8201.	5347.	3946.	6867.	10553.
2002	8190.	5271.	3280.	6147.	10197.
2003	8186.	5260.	3251.	5841.	10224.
2004	8183.	5252.	3248.	5928.	10096.

	1998	1999	2000	2001	2002
1996					
1997	1169.				
1998	2325.	10684.			
1999	3286.	7768.	7444.		
2000	3091.	7420.	4626.	2467.	
2001	4244.	10202.	4976.	1556.	1651.
2002	4634.	14073.	6624.	2273.	1906.
2003	4640.	13429.	7650.	3019.	2541.
2004	4577.	12809.	7928.	3436.	3352.
	2003	2004	2005		
1996					
1997					
1998					
1999					
2000					
2001					
2002	4464.				
2003	2506.	31771.			
2004	2283.	21220.	10398.		

In the Retrospective Analysis
The Following Survey Indices Have Predicted
Index Value Set to Zero in Terminal Year + 1

--- None ---

Plus Group Diagnostic Report

Calculation Method Selected = Backward

Year	Population Backward	Population Forward	F Forward	F Backward	Ratio
1978	55.	55.	0.357261	0.357261	1.000000
1979	149.	115.	0.608523	0.433611	0.712563
1980	29.	58.	0.210783	0.483479	2.293732
1981	192.	279.	0.279688	0.437513	1.564290
1982	189.	385.	0.270101	0.650345	2.407783
1983	150.	310.	0.261847	0.639963	2.444036
1984	297.	295.	0.594380	0.590152	0.992887
1985	209.	324.	0.398449	0.706447	1.772992
1986	77.	196.	0.177569	0.534122	3.007966
1987	69.	194.	0.146344	0.482293	3.295608
1988	100.	192.	0.312576	0.722555	2.311616
1989	45.	157.	0.134713	0.567701	4.214138
1990	91.	171.	0.279681	0.613108	2.192170
1991	44.	124.	0.228322	0.840457	3.681023
1992	18.	96.	0.121488	0.904399	7.444325
1993	29.	90.	0.233378	0.985927	4.224600
1994	12.	75.	0.092100	0.835984	9.076949
1995	4.	82.	0.013544	0.356673	26.335142
1996	0.	70.	0.000100	0.215676	2156.755751
1997	14.	71.	N/A	N/A	

APPENDIX 5

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

Bootstrap Summary Report

Number of Bootstrap Repetitions Requested = 1000
 Number of Bootstrap Repetitions Completed = 1000
 Bootstrap Output Variable: Stock Estimates (2005)

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
N 1	10398.	13876.	12503.	0.9011
N 2	17373.	18527.	7365.	0.3975
N 3	1502.	1571.	518.	0.3296
N 4	1499.	1542.	426.	0.2760
N 5	1037.	1076.	293.	0.2720
N 6	1187.	1235.	353.	0.2860
N 7	787.	817.	307.	0.3758
N 8	106.	114.	52.	0.4542

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
N 1	3477.	410.	33.4432	6921.	1.8066
N 2	1154.	236.	6.6438	16219.	0.4541
N 3	69.	17.	4.6165	1433.	0.3616
N 4	44.	14.	2.9266	1455.	0.2926
N 5	39.	9.	3.7562	998.	0.2933
N 6	48.	11.	4.0619	1138.	0.3102
N 7	29.	10.	3.7174	758.	0.4048
N 8	8.	2.	7.2164	98.	0.5248

	LOWER 80. % CI	UPPER 80. % CI
N 1	3893.	28439.
N 2	10833.	28543.
N 3	972.	2296.
N 4	1049.	2111.
N 5	715.	1468.
N 6	820.	1702.
N 7	454.	1217.
N 8	54.	181.

Bootstrap Output Variable: Catchability Estimates

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
Q 1	0.144671E-04	0.148001E-04	0.316453E-05	0.2138
Q 2	0.658076E-04	0.662967E-04	0.626041E-05	0.0944
Q 3	0.138672E-03	0.139767E-03	0.175997E-04	0.1259
Q 4	0.228568E-03	0.231321E-03	0.355624E-04	0.1537
Q 5	0.283697E-03	0.289040E-03	0.460105E-04	0.1592
Q 6	0.292377E-03	0.296437E-03	0.451728E-04	0.1524
Q 7	0.318676E-03	0.320289E-03	0.574064E-04	0.1792
Q 8	0.373921E-03	0.379418E-03	0.623997E-04	0.1645
Q 9	0.120505E-04	0.158337E-04	0.131129E-04	0.8282
Q 10	0.760932E-04	0.778246E-04	0.185121E-04	0.2379
Q 11	0.162350E-03	0.166903E-03	0.357235E-04	0.2140
Q 12	0.140752E-03	0.141576E-03	0.157057E-04	0.1109
Q 13	0.172199E-03	0.175700E-03	0.421321E-04	0.2398
Q 14	0.160600E-03	0.161957E-03	0.224483E-04	0.1386
Q 15	0.224100E-03	0.236172E-03	0.718476E-04	0.3042
Q 16	0.238894E-03	0.283751E-03	0.174718E-03	0.6157
Q 17	0.186510E-04	0.195373E-04	0.503195E-05	0.2576
Q 18	0.773206E-04	0.801053E-04	0.199239E-04	0.2487
Q 19	0.231101E-03	0.232282E-03	0.276387E-04	0.1190
Q 20	0.387317E-03	0.390023E-03	0.553730E-04	0.1420
Q 21	0.614360E-03	0.620050E-03	0.878750E-04	0.1417
Q 22	0.759648E-03	0.769242E-03	0.157862E-03	0.2052
Q 23	0.868003E-03	0.885629E-03	0.198989E-03	0.2247
Q 24	0.107767E-02	0.110541E-02	0.232435E-03	0.2103
Q 25	0.129290E-04	0.130015E-04	0.262257E-05	0.2017
Q 26	0.607287E-04	0.610046E-04	0.772794E-05	0.1267
Q 27	0.104068E-03	0.103882E-03	0.126655E-04	0.1219
Q 28	0.124037E-03	0.125548E-03	0.187420E-04	0.1493
Q 29	0.923788E-04	0.940081E-04	0.167459E-04	0.1781
Q 30	0.107259E-03	0.107856E-03	0.158238E-04	0.1467

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
Q 1	0.3330E-06	0.1006E-06	2.3018	0.1413E-04	0.2239
Q 2	0.4890E-06	0.1986E-06	0.7431	0.6532E-04	0.0958
Q 3	0.1095E-05	0.5576E-06	0.7899	0.1376E-03	0.1279
Q 4	0.2753E-05	0.1128E-05	1.2044	0.2258E-03	0.1575
Q 5	0.5343E-05	0.1465E-05	1.8832	0.2784E-03	0.1653
Q 6	0.4060E-05	0.1434E-05	1.3885	0.2883E-03	0.1567
Q 7	0.1613E-05	0.1816E-05	0.5061	0.3171E-03	0.1811
Q 8	0.5497E-05	0.1981E-05	1.4702	0.3684E-03	0.1694
Q 9	0.3783E-05	0.4316E-06	31.3949	0.8267E-05	1.5861
Q 10	0.1731E-05	0.5880E-06	2.2754	0.7436E-04	0.2489
Q 11	0.4553E-05	0.1139E-05	2.8042	0.1578E-03	0.2264
Q 12	0.8236E-06	0.4973E-06	0.5851	0.1399E-03	0.1122
Q 13	0.3501E-05	0.1337E-05	2.0333	0.1687E-03	0.2497
Q 14	0.1357E-05	0.7112E-06	0.8447	0.1592E-03	0.1410
Q 15	0.1207E-04	0.2304E-05	5.3871	0.2120E-03	0.3389
Q 16	0.4486E-04	0.5704E-05	18.7769	0.1940E-03	0.9004
Q 17	0.8863E-06	0.1616E-06	4.7518	0.1776E-04	0.2833

Q 18	0.2785E-05	0.6362E-06	3.6014	0.7454E-04	0.2673
Q 19	0.1182E-05	0.8748E-06	0.5113	0.2299E-03	0.1202
Q 20	0.2706E-05	0.1753E-05	0.6987	0.3846E-03	0.1440
Q 21	0.5690E-05	0.2785E-05	0.9262	0.6087E-03	0.1444
Q 22	0.9594E-05	0.5001E-05	1.2629	0.7501E-03	0.2105
Q 23	0.1763E-04	0.6317E-05	2.0307	0.8504E-03	0.2340
Q 24	0.2774E-04	0.7402E-05	2.5741	0.1050E-02	0.2214
Q 25	0.7249E-07	0.8296E-07	0.5607	0.1286E-04	0.2040
Q 26	0.2759E-06	0.2445E-06	0.4543	0.6045E-04	0.1278
Q 27	-0.1856E-06	0.4006E-06	-0.1783	0.1043E-03	0.1215
Q 28	0.1511E-05	0.5946E-06	1.2178	0.1225E-03	0.1530
Q 29	0.1629E-05	0.5321E-06	1.7637	0.9075E-04	0.1845
Q 30	0.5968E-06	0.5008E-06	0.5564	0.1067E-03	0.1484

	LOWER	UPPER
	80. % CI	80. % CI
Q 1	0.110443E-04	0.189925E-04
Q 2	0.583807E-04	0.740809E-04
Q 3	0.118145E-03	0.162577E-03
Q 4	0.188824E-03	0.278088E-03
Q 5	0.233381E-03	0.347879E-03
Q 6	0.242964E-03	0.358108E-03
Q 7	0.250553E-03	0.394579E-03
Q 8	0.308422E-03	0.466027E-03
Q 9	0.486982E-05	0.305899E-04
Q 10	0.559348E-04	0.102815E-03
Q 11	0.124636E-03	0.216247E-03
Q 12	0.122178E-03	0.161203E-03
Q 13	0.125686E-03	0.230855E-03
Q 14	0.134517E-03	0.191336E-03
Q 15	0.153277E-03	0.339872E-03
Q 16	0.118146E-03	0.505220E-03
Q 17	0.136597E-04	0.261733E-04
Q 18	0.564799E-04	0.106128E-03
Q 19	0.197950E-03	0.269440E-03
Q 20	0.322103E-03	0.461610E-03
Q 21	0.512654E-03	0.737677E-03
Q 22	0.578601E-03	0.976539E-03
Q 23	0.646020E-03	0.115038E-02
Q 24	0.833471E-03	0.141668E-02
Q 25	0.991880E-05	0.163575E-04
Q 26	0.513507E-04	0.712519E-04
Q 27	0.882458E-04	0.120281E-03
Q 28	0.102311E-03	0.150755E-03
Q 29	0.740039E-04	0.115863E-03
Q 30	0.887696E-04	0.127931E-03

Bootstrap Output Variable: Fishing Mortality (2004)

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
AGE 1	0.0000	0.0000	0.000001	0.3947
AGE 2	0.0185	0.0196	0.006344	0.3240
AGE 3	0.1761	0.1827	0.046906	0.2567
AGE 4	0.1770	0.1827	0.049352	0.2702
AGE 5	0.1834	0.1898	0.052752	0.2780
AGE 6	0.2345	0.2562	0.099677	0.3890
AGE 7	0.3495	0.3834	0.158900	0.4144
AGE 8	0.2361	0.2530	0.050548	0.1998
AGE 9	0.2361	0.2530	0.050548	0.1998
AGE 10	0.2361	0.2530	0.050548	0.1998

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
AGE 1	0.000000	0.000000	8.2925	0.0000	0.4661
AGE 2	0.001078	0.000203	5.8247	0.0174	0.3641
AGE 3	0.006595	0.001498	3.7444	0.1695	0.2767
AGE 4	0.005632	0.001571	3.1816	0.1714	0.2879
AGE 5	0.006347	0.001680	3.4605	0.1771	0.2979
AGE 6	0.021704	0.003226	9.2542	0.2128	0.4683
AGE 7	0.033967	0.005138	9.7200	0.3155	0.5037
AGE 8	0.016913	0.001686	7.1631	0.2192	0.2306
AGE 9	0.016913	0.001686	7.1631	0.2192	0.2306
AGE 10	0.016913	0.001686	7.1631	0.2192	0.2306

	LOWER 80. % CI	UPPER 80. % CI
AGE 1	0.000001	0.000003
AGE 2	0.012138	0.028296
AGE 3	0.128175	0.242519
AGE 4	0.128181	0.247387
AGE 5	0.131308	0.255150
AGE 6	0.157216	0.375770
AGE 7	0.218046	0.599771
AGE 8	0.196532	0.321178
AGE 9	0.196532	0.321178
AGE 10	0.196532	0.321178

Bootstrap Output Variable: Average F (2004) AGES 2 - 8

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
AVG F	0.1965	0.2096	0.036940	0.1762
N WTD	0.1576	0.1562	0.021582	0.1381
B WTD	0.1894	0.1885	0.026348	0.1398
C WTD	0.1948	0.2056	0.031109	0.1513

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
AVG F	0.013177	0.001240	6.7072	0.1833	0.2016
N WTD	-0.001417	0.000684	-0.8986	0.1591	0.1357
B WTD	-0.000909	0.000834	-0.4800	0.1903	0.1384
C WTD	0.010738	0.001041	5.5113	0.1841	0.1690

	LOWER 80. % CI	UPPER 80. % CI
AVG F	0.168030	0.259579
N WTD	0.130735	0.184598
B WTD	0.156975	0.222903
C WTD	0.168907	0.243918

Bootstrap Output Variable: Biomass

JAN-1 Biomass (2005) Mean Biomass & SSB (2004)

	NLLS Estimate	Bootstrap Mean	Bootstrap Std Error	C.V. For NLLS Soln.
JAN-1	49021.	52864.	10985.	0.2078
MEAN	39284.	40989.	6662.	0.1625
SSB	22564.	23223.	2921.	0.1258

	Bias Estimate	Bias Std. Error	Per Cent Bias	NLLS Estimate Corrected For Bias	C.V. For Corrected Estimate
JAN-1	3843.	368.	7.8398	45178.	0.2431
MEAN	1705.	217.	4.3401	37579.	0.1773
SSB	660.	95.	2.9236	21904.	0.1333

	LOWER 80. % CI	UPPER 80. % CI
JAN-1	40686.	67365.
MEAN	33230.	49781.
SSB	19704.	27122.

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