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Assessment of the Georges Bank Haddock Stock for 1994

by

Loretta O'Brien
and
Russell W. Brown

Report of the 20th SAW

NOAA/National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, MA 02543-1026

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This report is a product of the 20th Northeast Regional Stock Assessment Workshop (20th SAW). Proceedings and products of the 20th SAW are scheduled to be documented and released in the following CRD's:

CRD 95-13	Assessment of the Georges Bank haddock stock for 1994. By L. O'Brien and R.W. Brown.
CRD 95-14	An examination of the influence of environmental conditions on spring survey catches of Atlantic mackerel. By J.K.T. Brodziak and S.-W. Ling.
CRD 95-15	A comparison of some biological reference points for fisheries management By J.K.T. Brodziak and W.J. Overholtz.
CRD 95-16	Assessment for sea scallop in Mid-Atlantic and Georges Bank. By H.-L. Lai, P. Rago, S. Wigley, L.C. Hendrickson, and J. Idoine.
CRD 95-17	Assessment of black sea bass north of Cape Hatteras, North Carolina. By G.R. Shepherd and M.C. Lambert.
CRD 95-18	Report of the 20th Northeast Regional Stock Assessment Workshop (20th SAW): Stock Assessment Review Committee (SARC) consensus summary of assessments.
CRD 95-19	Report of the 20th Northeast Regional Stock Assessment Workshop (20th SAW): SAW Public Review Workshop.

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ABSTRACT

The current status of Georges Bank haddock is reviewed, estimates of fishing mortality in 1994 and stock size and spawning stock biomass in 1995 are presented, as are forecasts of landings in 1995 and 1996 and spawning stock biomass in 1996-1997. The assessment is based on catch at age data from USA and Canadian commercial landings, and age specific indices of abundance from USA and Canadian research vessel surveys.

Total commercial landings of Georges Bank haddock for 1994 were estimated at 2,900 mt, 34% lower than in 1993 (4,400 mt). USA landings data were unavailable for 1994 and were expected to decline from the 1993 value of 700 mt to 500 mt due to the expansion of closed Area II and the imposition of a 500 lb trip limit. The Canadian fleet landed 2,400 mt in 1994.

NEFSC research vessel survey indices of abundance show a declining trend from record high levels in the early 1960's to low levels in the early 1970's. Indices increased from 1973-1985 as stronger year classes recruited but have subsequently declined to record low levels in recent years. The strongest year class occurred in 1963, followed by the strong 1975, 1978, 1980, and 1985 year classes. Since 1985, year classes have been weak. The 1991 and 1992 year classes are stronger than adjacent year classes, but well below the long-term average.

Fishing mortality (ages 4+) in 1994 was estimated at 0.29, a decline of 54% from 1993. The estimate of SSB at the beginning of 1994 was 15,000 mt, the third lowest on record, although 50% higher than the record-low 1993 level (10,000 mt).

The Georges Bank haddock stock is currently at a low biomass level. Although the current estimate of F (F_{94}=0.29) is below the overfishing definition ($F_{30\%}$=0.35), the stock remains in an overfished condition. The estimate of SSB at the beginning of 1995 was 21,200 mt. Fishing mortality in 1995 was projected to be 0.18, based on expected total landings of 3,000 mt (500 mt from the USA and 2,500 mt of Canadian TAC). The SSB at the beginning of 1996 was projected to be 25,800 mt. Assuming that the F in 1996 will be equal to F_{95} of 0.18, landings will increase to 4,100 mt in 1996 and SSB will increase to 28,200 mt in 1997. Any management actions that alter the status quo treatment of haddock imply different future landings and spawning stock size predictions, however.

INTRODUCTION

Haddock, *Melanogrammus aeglefinus*, are distributed off the coast of the USA from the Gulf of Maine to Cape Hatteras and comprise two major stocks within Northwest Atlantic Fisheries Organization (NAFO) Subareas 5 and 6 (Clark et al. 1982). The Gulf of Maine stock is delineated by Northeast Fisheries Science Center (NEFSC) statistical areas 511-515 and the Georges Bank stock is delineated by NEFSC statistical areas 521-526,537-539,561-562 and Subarea 6 (Figure 1).

Historically, the Georges Bank haddock fishery experienced record high landings in 1930 and again in 1965 (Figure 2). Total landings declined rapidly from a record-high in 1965 (150,000 mt) to a record low in 1976 (4,300 mt). Subsequently, landings increased until 1980 (27,000 mt) then gradually declined to near record low levels in 1993. Landings are currently not available for 1994.

Haddock are currently managed under the New England Fishery Management Council's Northeast Multispecies Fishery Management Plan. Historical management of the USA fishery is outlined in Table 1. Management restrictions, in 1994, included expansion and extended temporal closure of Area II from 1 January-30 June and, in 1995, a year round closure of Areas I, II, and the Nantucket Lightship Area (Figure 1). A six-inch minimum mesh size regulation and a 500 lb trip limit are also currently in effect.

The current assessment of haddock is based on catch-at-age data from 1963-1993 and reported Canadian and estimated USA catch-at-age in 1994. Terminal fishing mortality was estimated for 1994 and beginning year stock sizes for 1995. The variability and bias in estimation of these parameters are also provided.

THE FISHERY

Commercial Landings

Total commercial landings of Georges Bank haddock in 1993 were estimated at 4,400 mt, 27% lower than in 1992 (Table 2, Figure 2). The USA fleet landed 16% (700 mt) of the total and the Canadian fleet landed the remaining 84% (3,700 mt). The 1993 USA landings were 66% lower than in 1992, and Canadian landings were 8% lower than in 1992. The Canadian fleet landed 2,400 mt in 1994. USA landings in 1994 were assumed to be 500 mt for this assessment, based on an expected reduction from the 700 mt landed in 1993 due to the expansion of closed Area II and the imposition of a 500 lb trip limit. Total landings for 1994 were, therefore, estimated to be 2,900 mt.

In 1993, haddock were primarily caught by otter trawl gear (96%) in the USA fishery and by both otter trawl (67%) and longline gear (31%) in the Canadian fishery (Table 3). Historically,

haddock landings in the USA and Canadian fisheries have primarily been caught by the otter trawl fleet; however, the proportion of haddock taken by the Canadian long-line fleet has increased from about 17% in the mid-1980s to about 30% in the early 1990's.

Discards

Estimates of discards were not derived for this analysis. The most recent year class of any c onsequence occurred in 1987, and that has now passed through the fishery. Except for the 1992 year class, recent year classes have been weak, and discarding would have been minimal.

Sampling Intensity

The numbers of samples taken to determine length and age compositions of the USA commercial haddock landings for Georges Bank are summarized in Table 4. Quarterly samples were aggregated by market category within eastern Georges Bank (statistical area 523-524, 561-562) and western Georges Bank (statistical area 521-522,525-526, 537-539 and Subarea 6;Figure 1). The annual sampling intensity from 1982-1993 ranged from 9 to 338 mt landed per sample. In 1993, the sampling intensity ranged from one sample per 13 mt landed of large haddock from western Georges Bank to one sample per 30 mt landed of scrod from eastern Georges Bank. This higher sampling intensity in 1993 was due to lower landings rather than increased sampling coverage.

Catch at Age

The age composition of the 1991-1993 USA landings from Georges Bank was estimated by applying commercial and research survey age-length keys to semi-annual commercial numbers at length, by market category. Due to the lack of quarterly samples, eastern and western Georges Bank were combined as one unit area and both age and length samples were aggregated to six month periods (Table 4). Catch at age data from 1963-1991 were taken from Hayes and Buxton (1992). Total numbers landed for each six month period were estimated by applying the mean weights to the semi-annual landings, by market category, and prorating the total numbers by the corresponding sample length frequency.

Due to the lack of sufficient samples, commercial age-length keys were supplemented with survey age data from corresponding areas (Hayes and Buxton 1992). Fisher's Exact tests were performed to detect differences in proportion at age within a length group between the survey and commercial data (Hayes 1993). No differences were detected for almost all the length groups, and the few significant differences detected were primarily associated with data outliers in the survey data and were excluded (Table 5). Final age-length keys were formed by pooling commercial and survey age-length data (Table 6). Although only a small percentage of the available survey ages were used to augment the commercial samples, mean weights at age were

more consistent with the inclusion of survey age data. The semi-annual pooled age-length keys were then applied to the semi-annual numbers at length, and numbers at age were summed over market category within each half-year. Annual estimates of catch at age were obtained by summing values over the semi-annual periods.

Because 1994 USA landings data were not available, the number of fish landed at age was estimated as 21% of the 1994 Canadian landings at age, based on the ratio of assumed USA landings/Canadian reported landings (500/2411 mt). The total catch at age for 1994 was derived by multiplying the Canadian catch at age by 1.21.

Mean Weights at Age

Mean weights at age are summarized for USA, Canadian, and total landings in Tables 7-9. Stock mean weights at age for the beginning of the year, derived from catch mean weights at age as described by Rivard (1980), are presented in Table 10. USA mean weights at age for 1991-1993 were estimated by applying the length-weight equation for landed weight to the semi-annual length frequency samples by market category. The length-weight equation for June was applied to all samples from the first half of the year and the length-weight equation for December was applied to samples from the last half of the year:

Areas	Months	Equation
521, 522, 525, 526	1-6	$W_{lb} = 0.000020\ L_{cm}^{2.990}$
521, 522, 525, 526	7-12	$W_{lb} = 0.000017\ L_{cm}^{3.045}$
561, 562	1-6	$W_{lb} = 0.000042\ L_{cm}^{2.796}$
561, 562	7-12	$W_{lb} = 0.000041\ L_{cm}^{2.830}$

The landed mean weights at age were converted to live weight by applying the ratio of landed weight to live weight (1.14). In the Canadian assessment the length-weight equation used to estimate live mean weight was $W_{kg} = 0.0000158\ L_{cm}^{2.91612}$ (S. Gavaris, pers. comm.).

In the USA fishery, there has been a declining trend in landed mean weight for age 6 fish and older since 1991 (Table 7). The 1993 mean weight at age for fish ages 6-8 and older are the lowest in the time series. Since similar trends are not evident in the Canadian mean weights at age (Table 8), the apparent trends may be due more to seasonal shifts in fishing effort than to a real change in growth rates. The 1989 year class, however, shows an increase in weight at age compared to previous year classes in both USA and Canadian estimates. Subsequent year classes show a similar trend, but not as strongly as the 1989 year class. As noted above, this

increase could be due to changes in either growth rate or seasonality of the fishery.

STOCK ABUNDANCE AND BIOMASS INDICES

Commercial Catch Rates

USA commercial landings per unit effort (LPUE) were derived for all interviewed otter trawl trips landing haddock from Georges Bank and south. Indices were estimated for all vessels greater than 5 GRT that landed any amount of haddock from 1964-1993. Standardized fishing effort and LPUE were also estimated based on a five factor general linear main effects model that included year, area, tonnage class, quarter, and depth (Appendix 1) using methodology similar to that used by Mayo et al. (1994). Standards chosen for the analysis were 1964, statistical area 521, quarter 2, depth 3 (112-183 m) and tonnage class 33 (105-150 GRT). Model coefficients were re-transformed to the linear scale after correcting for bias (Granger and Newbold 1977). Standardized effort was calculated by multiplying nominal effort by the re-transformed coefficients for area, quarter, tonnage class, and depth. Total USA effort was then derived by dividing total USA landings by standardized LPUE. Preliminary analyses using a GLM model with interaction terms indicated significant interaction between the main effects, however, the interactions terms explained only a small percentage of the overall variation (< 2%) and therefore were not included in the final analysis.

Nominal LPUE declined between 1964 and 1974, then gradually increased until 1981 (Table 11, Figure 3). Subsequently, LPUE declined and has generally remained low with the lowest value in the time series occurring in 1993. Estimates of standardized and total USA effort follow similar trends over the time period (Table 11, Figure 3). Total USA effort declined from the mid-1960's to the mid-1970's, gradually increased to a peak in the mid-1980's, and subsequently declined. Total effort increased 8% between 1991 and 1992 and remained stable in 1993, declining by 3% from 1992.

The haddock fishery has historically been subjected to total allowable catches, trip limits, and seasonal and areal closures (Table 1). Under such management restrictions the haddock fishery has effectively become a by-catch fishery, thus the effort series may not be representative of stock abundance. Therefore, the LPUE series was not used as an index of abundance in the subsequent VPA calibration.

Research Vessel Survey Indices

USA Surveys

Research vessel survey indices of abundance (stratified mean number per tow) and biomass (stratified mean weight (kg) per tow) were estimated from both the NEFSC spring and autumn bottom trawl surveys from 1963-1994 (Table 12, Figure 4). The indices were adjusted for

differences in fishing power of the *Albatross IV* and the *Delaware II*, and for differences in the catchability of BMV doors and the polyvalent doors introduced in 1985. Fishing power coefficients of 0.82 and 0.79 and door conversion coefficients of 1.49 and 1.51 were applied to abundance and biomass indices, respectively (NEFSC 1991). Hayes and Buxton (1992) calculated fishing power coefficients for abundance indices only, to determine if there were different catchability coefficients by length class. Since the results were inconclusive and fishing power coefficients were not estimated for biomass indices, the SARC approved estimates given above were applied.

The spring and autumn indices of abundance and biomass exhibit similar trends throughout the time period, 1963-1994 (Tables 13-15 and Figure 4). Indices declined from record high levels in the early 1960's to low levels in the early 1970's. Stock indices fluctuated sharply from 1973-1985 as stronger year classes recruited but subsequently declined to record low levels in recent years. The autumn time series for age 0 abundance indicates that the strongest year class occurred in 1963, followed by the strong 1975, 1978, 1980, and 1985 year classes (Table 14, Figure 5). Since 1985, year classes have been weak, but, the 1991 and 1992 year classes have a higher abundance of age 1 and 2 fish than adjacent year classes, although they remain well below the long-term average number of fish per tow of 9.5 for age 1 and 6.5 for age 2 (Table 14).

Canadian Surveys

Indices of abundance for Canadian surveys (S. Gavaris, pers. comm.) are summarized as stratified mean number per tow from 1986-1995 (Table 16, Figure 4). In 1993 and 1994, the Canadian research survey did not sample the western part of Georges Bank in strata 5Z5-5Z7 (Gavaris and Van Eeckhaute 1990). The indices for 1993-1994 were therefore re-estimated by raising the total number per stratum by a factor of 1.068, derived by using the ratio estimator (Mendenhall et al. 1971):

$$r = \sum_{y} \left[\frac{\sum_{i=1,8} w_i \overline{x_{iy}}}{\sum_{i=1-4,8} w_i \overline{x_i}} \right]$$

where
w = strata area;
x = stratified mean number per tow;
i = strata;
y = 1987-1992 and 1995.

The quotient of the raised total number to the total area resulted in a lower stratified mean number per tow, which was then prorated among ages 1-9. Bias could be introduced into the estimate if the distribution of juveniles and adults differed between the eastern and western parts of the Bank. However, a review of the haddock distribution data did not suggest differential distributions of juveniles and adults.

The abundance indices of age 1 fish indicate that the 1991, 1992, and 1993 year classes are above average for this survey series. The 1992 year class is the strongest year class at age 2 and is above average at age 3 (Table 16).

MORTALITY and MATURATION

Natural Mortality

Instantaneous natural mortality (M) of Georges Bank haddock is assumed to be 0.2. This value has been used in previous assessments (Hayes and Buxton 1992; Gavaris and Van Eeckhaute 1995).

Total Mortality

Pooled estimates of instantaneous total mortality (Z) were estimated for eight time periods from both spring and autumn catch per tow at age indices (Table 17). Estimates were derived as the ln ratio of 3+/4+ indices in the autumn and 4+/5+ indices in the spring (Table 15). Estimates in the spring are less than those in the autumn in all time periods except 1987-1990. Estimates of high total mortality occurred in the periods from 1963-1967, as indicated by the autumn value and in 1980-1983 and 1991-1993 as indicated by the geometric mean of spring and autumn estimates.

Maturity

Maturation ogives presented in Table 18 were obtained from the literature for 1963-1967 (Clark 1959), 1968-1976 (Clark et al. 1982), 1977-1983 (Overholtz 1987), and 1984-1989 (O'Brien et al. 1993). Annual maturity estimates derived for 1977-1983 (Overholtz 1987) were averaged to reduce the annual variability of the estimates (Table 18); the average maturation for age 2 and 3 female fish was 0.33% and 0.81%, respectively. The percentage of mature female haddock at age for 1990-1994 was estimated using the NEFSC spring research survey maturity data. Annual maturity ogives were derived using logistic regression, and adjacent years that exhibited similar maturity at age were then aggregated. Pooled ogives were thus derived for 1990-1992 and 1993-1994.

ESTIMATES of STOCK SIZE and FISHING MORTALITY

Virtual Population Analysis Calibration

The ADAPT VPA calibration method (Parrack 1986, Gavaris 1988, Conser and Powers 1990) was used to derive age-specific estimates of fishing mortality in 1994 and beginning year stock sizes in 1995. The catch-at-age in the VPA consisted of combined USA, Canadian and distant water fleet (DWF) landings from 1963-1994 for ages 1-8 with a 9+ age group. The indices used to calibrate the VPA included both the USA and Canadian spring research vessel survey catch at age (ages 1-8) in numbers and the USA autumn survey catch at age (0-7) in numbers, lagged forward one age and one year. A separable VPA for 1980-1994 with a terminal F=0.3 on age 4 did not indicate any change in the exploitation pattern (Table 19). A preliminary ADAPT calibration indicated a high coefficient of variation (CV) on stock size at age 7 in 1995 and a very high F estimate for the corresponding age 6 in 1994. This year class was, therefore, excluded from the final calibration run.

The final ADAPT formulation provided F estimates for ages 1-5, and 7 in 1994 and corresponding stock size estimates for ages 1-6, and 8 in 1995. The F estimate for age 6 in 1994 and the corresponding stock size estimate for age 7 in 1995 were estimated from a smoothed partial recruitment vector, assuming full recruitment at age 4. The F on ages 8 and 9+ in the terminal year were estimated as the average of the F on ages 4, 5, and 7. The F on age 8 in all years prior to the terminal year was derived from weighted estimates of Z for ages 4 through 8. For all years, the F on age 8 was applied to the 9+ age group. Spawning stock biomass estimates were derived by applying pooled maturity ogives for 1963-1967, 1968-1972, 1973-1976, 1977-1983 (arithmetic average), 1984, 1985-1989, 1990-1992, 1993-1994 (Table 18) to stock biomass estimates.

The final ADAPT calibration results are presented in Table 20 (see Appendix 2 for detailed output). Stock size estimates of ages 2-6, and 8 were well estimated with relatively low CVs ranging from 0.31 (age 3) to 0.39 (age 8); however, the CV on age 1 was high (.60). The residual patterns for most indices did not show any strong trends with the exception of the age 2 spring Canadian index which had a strong positive trend in the residuals.

Average fishing mortality (ages 4-5, 7) in 1994 was estimated at 0.29, a decline of 54% from 1993 (Table 20, Figure 6). The 1994 estimate of SSB was 15,000 mt, a 46% increase from the 1993 estimate (10,000 mt) which was the lowest in the time series (Table 20, Figure 7). Recruitment of the 1988-1990 year classes (1.2-2.5 million fish) was poor, whereas the 1991, 1993, and 1994 year classes (7.5-8.4 million fish) were about equal to the long-term (1963-1993) geometric mean (7.9 million fish). The 1992 year class (14 million fish) was estimated to be slightly less than twice the long-term mean (Table 20, Figure 7).

Precision Estimates of F and SSB

A bootstrap procedure (Efron 1982) was used to evaluate the uncertainty associated with the estimates of fishing mortality and spawning stock biomass derived from the VPA. Five hundred bootstrap iterations were performed to estimate standard errors, coefficients of variation (CVs) and bias estimates for the age 1-7 F's in 1994 and age 1-8 stock size estimates at the start of 1995 (Appendix 3).

The bias corrected stock size estimates for ages 2-6, and 8 were well estimated with CVs that ranged from 0.29-0.42, however, the age 1 stock size was not well estimated with a CV of 0.77 (Appendix 3:Table 1). Catchability coefficients for the USA spring and autumn indices of abundance had CVs ranging between 0.14-0.18 whereas the Canadian spring indices ranged from 0.25-0.27. The higher CVs for the Canadian coefficients may be due to the shorter time series (Appendix 3: Table 2). Age-specific F estimates were well estimated, with CVs ranging from 0.22-0.43, except for age 1 (CV=.49) (Appendix 3: Table 3). The mean F (0.277) was also well estimated with a CV of 0.22 and was slightly lower than the VPA point estimate of 0.293. The 500 bootstrap replications resulted in a distribution of F values for 1994 that ranged between 0.18 and 0.54. Cumulative probability curves of the distribution show that there is an 80% probability that the 1994 F is between 0.24 and 0.39 (Figure 8).

The bootstrap mean SSB estimate of 14,080 mt was well estimated with a CV of 0.16 and is slightly lower than the VPA point estimate of 14,650 mt (Appendix 3: Table 5). The SSB values estimated by the 500 bootstrap replications ranged between 8,000 mt and 23,000 mt. Based on the cumulative probability curves there is an 80% probability that the 1994 SSB was between 12,500 mt and 18,500 mt (Figure 9).

Retrospective Analyses

Retrospective analyses of the Georges Bank haddock VPA were performed from 1994 back to 1987. The ADAPT procedure was formulated to estimate ages 1-8 in the terminal year. This differed from the final assessment formulation where age 7 was not estimated. The mean F was based on ages 4-7 as in the final assessment formulation. The retrospective patterns indicate a consistent over estimation of F and a consistent under estimation of SSB, for all years (Table 21). For both F and SSB, estimates start to converge at about 3-4 years from the terminal year (Figure 10).

BIOLOGICAL REFERENCE POINTS

Yield and Spawning Stock Biomass per Recruit

Yield per recruit (YPR) and spawning stock biomass per recruit were estimated using methodology of Thompson and Bell (1934). The estimates were derived based on a partial recruitment vector calculated as the geometric mean of 1993-1994 F estimates from the final VPA (Table 20, Figure 6), arithmetic means of the 1984-1993 catch and stock weights at age (Tables 9 and 10), and the 1968-1994 average maturity at age (Table 18). Results of the analysis are provided in Table 22 and Figure 11. The resulting biological reference points were $F_{0.1}$=0.24, $F_{30\%}$=0.35, and F_{max}=1.18. The estimate of F_{max} is considered to be unreliable because of the asymptotic nature of the YPR curve at high F levels.

PROJECTIONS

Short-term Projections

An initial deterministic projection was performed to obtain a starting F value for 1995, based on total landings of 3,000 mt. We assumed that the Canadian fishery would land the TAC of 2,500 mt and the USA fishery would land 500 mt. The projection was based on a partial recruitment vector derived from the geometric mean of the 1993-1994 F's from the final VPA, arithmetic mean catch and stock mean weights at age for 1990-1993, and the pooled median maturity at age estimates for 1993-1994. Recruitment in 1995 was obtained from the VPA calibration based on NEFSC autumn 1994 and Canadian 1995 spring research vessel survey indices. The projection indicated that F = 0.18 would result in landings of 3,000 mt in 1995.

Short term stochastic projections (Brodziak and Rago, unpublished) were then carried out for 1995, 1996, and 1997 under four F scenarios of F = 0.0 (closure), F_{95} =0.18, $F_{0.1}$ = 0.24, and $F_{30\%}$=0.35 (Table 23). Data inputs were the same as in the deterministic projection except that recruitment in 1996 and 1997 was estimated as the median outcome by resampling the distribution of the 1979-1992 year classes at age 1.

In 1995, spawning stock biomass and landings are projected to be 21,200 mt and 3,100 mt, respectively under all four scenarios. Under the F_{95} = 0.18, landings increase to 4,100 mt in 1996 and SSB increases to 25,800 mt in 1996 and to 28,200 mt in 1997 (Table 23, Figure 12).

Long-term Projections

Projections up to 20 years were executed to determine the probabilities of SSB increasing to a threshold of 80,000 mt; levels of 80,000 mt and greater were observed prior to the late 1960's. The stochastic projection model incorporating the bootstrapped estimates of 1995 abundance at

age was used with recruitment determined by random sampling of the 1969-1995 recruitment values from the final ADAPT calibration. Additional data provided to the model included partial recruitment estimated from the geometric mean of the 1993-1994 F values from the final ADAPT calibration, catch and stock weights at age estimated as the mean of the 1984-1993 values, and maturity at age estimated as the mean of the 1968-1994 values (Table 24).

Using the F scenarios of $F_{closure}$=0.0, F_{95}=0.18, $F_{0.1}$=0.24 and $F_{30\%}$=0.35, the probability of SSB exceeding 80,000 mt in 10 years is 50%, 23%, 16%, and 8%, respectively and the probability of exceeding the SSB in 20 years is 76%, 26%, 18%, and 9%, respectively. Under F_{95} = 0.18, SSB is projected to increase to 44,000 mt by 2004 and to 50,000 mt by 2014, and landings are projected to increase to 7,000 mt by 2004 and to 7,800 mt by 2014 (Table 24, Figures 13-14).

DISCUSSION

Lack of adequate sampling for age and length composition from the commercial fishery in recent years has led to supplementing age keys with survey age data. Combining the survey with the commercial age-length data resulted in smoother mean weights at age, but there is a lack of age data for larger fish in the survey data base. Inclusion of additional age data, available from the Canadian research survey, would help in characterizing the age structure of the larger fish in the stock.

The pooled 1993-1994 maturity ogive derived from NEFSC research survey data reflects a shift in the maturation schedule from previous years. The relatively strong 1992 year class may be causing the delayed maturation observed in age 1 and age 2 females in 1993 and 1994. The low number of samples available in recent years could be supplemented with maturation data from the Canadian spring research survey in future assessments.

The apparent decline in mean weight at age for older fish in the USA fishery in recent years may be due to actual changes in growth or to changes associated with lower stock biomass. At the current low stock biomass levels, the faster growing fish in the older age classes may have been selectively fished out, or as the range of the stock contracts (Hayes and Hendrickson 1994), the same segment of the population may no longer be available to the USA fishery. As the stock contracts, the USA fleet may be fishing in the less abundant fringe area rather than in the more abundant center of the range of the stock distribution.

Recent data are available from NEFSC research surveys to calculate current length-weight equations to determine if there has been any change in mean weight. The differences detected in mean weight at age between USA and Canadian fleets appear to be due to the different timing of the respective fisheries.

In the current assessment some modifications were made to data presented by Hayes and Buxton (1992). The USA research survey indices were adjusted using the fishing power coefficients

accepted by the SARC (NEFSC 1991). Some of the Canadian research survey indices have been re-calculated and the preliminary 1990 Canadian catch at age estimates were adjusted to reflect finalized catch statistics (S. Gavaris, pers. comm.).

CONCLUSIONS

The Georges Bank haddock stock is currently at low levels of stock biomass and is fully exploited. Fishing mortality on fully recruited ages (4-7) increased in 1992 and 1993, but declined in 1994 and is projected to decline further in 1995. Although the current estimate of F, $F_{94}=0.29$, is below the overfishing definition ($F_{30\%}=0.35$), the stock remains in an overfished condition. Recruitment was poor between 1989-1991, but was about equal to the long-term mean in 1992, 1994, and 1995. The 1992 year class, recruiting in 1993, was about twice the long-term mean. Spawning biomass was the lowest on record in 1993 but increased in 1994 and 1995 and is expected to increase further in 1996 due to slightly improved recruitment.

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Table 1. History of USA management of haddock.

1953-1977		ICNAF Era
1953		Minimum mesh in body and codend - 4 1/2".
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 Subarea 5 haddock on an annual basis beginning in 1972; set at 6,000 t per year.
1975		Areas 1(A) and 2(B) closure extended to February through May; haddock TAC declared for incidental catches only
1977-Present		Extended Jurisdiction and National Management
1977		USA 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 5 1/2 " minimum landing size - 17" commercial, 15" recreational.
1984	October	Implementation of the 'Hague' line establishing separate fishing zones for USA and Canada in the Gulf of Maine and on Georges Bank.
1985		Fishery Management Plan for the Northeast Multispecies Fishery. 5 1/2" mesh size, areas 1 and 2 closed during February-May.
1991		Amendment 4 established overfishing definitions for haddock in terms of F_{med} (F20%) replacement levels.
1993		Area 2 closure in effect from Jan 1-June 30.
1994	January	Amendment 5 implemented - expanded Area 2, Area 1 closure not in effect.
	May	6" mesh restriction implemented (delayed from March 1).
	June 22	500 lb trip limit requirement implemented.
	Dec	Both Area 1,2 and Nantucket Lightship Area closed year-round until further notice.

Table 2. Commercial landings (metric tons, live) of haddock from Georges Bank and South (NAFO) Division 5Z and Subarea 6), 1960-1994.[1]

Year	USA	Canada	USSR	Spain	Other	Total
1960	40800	77	0	0	0	40877
1961	46384	266	0	0	0	46650
1962	49409	3461	1134	0	0	54004
1963	44150	8379	2317	0	0	54846
1964	46512	11625	5483	2	464	64086
1965	52823	14889	81882	10	758	150362
1966	52918	18292	48409	1111	544	121274
1967	34728	13040	2316	1355	30	51469
1968	25469	9323	1397	3014	1720	40923
1969	16456	3990	65	1201	540	22252
1970	8415	1978	103	782	22	11300
1971	7306	1630	374	1310	242	10862
1972	3869	609	137	1098	20	5733
1973	2777	1563	602	386	3	5331
1974	2396	462	109	764	559	4290
1975	3989	1358	8	61	4	5420
1976	2904	1361	4	46	9	4324
1977	7934	2909	0	0	0	10843
1978	12160	10179	0	0	0	22339
1979	14279	5182	0	0	0	19461
1980	17470	10017	0	0	0	27487
1981	19176	5658	0	0	0	24834
1982	12625	4872	0	0	0	17497
1983	8682	3208	0	0	0	11890
1984	8807	1463	0	0	0	10270
1985	4273	3484	0	0	0	7757
1986	3339	3415	0	0	0	6754
1987	2156	4703	0	0	0	6859
1988	2492	4046[2]	0	0	0	6538
1989	1430	3059	0	0	0	4489
1990	2001	3340	0	0	0	5284
1991	1395	5446	0	0	0	6841
1992	2005	4058	0	0	0	6063
1993	687	3727	0	0	0	4414
1994	500[3]	2411	0	0	0	2911[3]

[1] All landings 1960-1979 are from Clark et al. (1982); USA landings 1980-1981 are from Overholtz et al. (1983); USA landings 1982-1993 are from NMFS, NEFSC Detailed Weighout Files and Canvass data; Canadian landings 1980-1994 from Gavaris and Van Eeckhaute (1995).

[2] 1895 tons were excluded because of suspected misreporting (Gavaris and Van Eeckhaute 1995).

[3] Assumed

Table 3. USA and Canadian commercial landings (metric tons, live) of haddock from Georges Bank and South (NAFO Division 5Z and Subarea 6) by major gear type, 1964-1994.

	United States				Canada			
	Otter Trawl	Long Line	Other	Total	Otter Trawl	Long Line	Other	Total
1964	45617	742	153	46512	11624	1	0	11625
1965	52034	716	73	52823	14862	22	5	14889
1966	51686	1127	105	52918	17905	63	324	18292
1967	33825	814	89	34728	12923	96	21	13040
1968	24930	495	44	25469	9201	111	11	9323
1969	15494	950	12	16456	3955	22	13	3990
1970	7979	430	6	8415	1900	76	2	1978
1971	7004	300	2	7306	1475	154	1	1630
1972	3674	190	5	3869	411	198	0	609
1973	2675	100	2	2777	1461	102	0	1358
1974	2308	80	8	2396	374	87	1	462
1975	3839	143	7	3989	1247	111	0	1358
1976	2840	51	13	2904	1192	154	15	1361
1977	7842	36	56	7934	2814	94	1	2909
1978	11962	63	135	12160	9716	171	292	10179
1979	14138	30	111	14279	4907	274	1	5182
1980	17170	30	270	17470	9510	590	1	10101
1981	19031	3	142	19176	4644	1015	0	5659
1982	12484	2	139	12625	4222	709	0	4931
1983	8588	35	59	8682	2396	813	3	3212
1984	8661	79	67	8807	624	838	1	1463
1985	4194	43	36	4273	2745	626	41	3484
1986	3298	24	17	3339	2734	594	35	3415
1987	2124	21	11	2156	3521	1046	89	4703
1988	2408	32	52	2492	3183	695	97	4046
1989	1356	24	50	1430	1976	977	106	3059
1990	1949	15	37	2001	2411	853	76	3340
1991	1340	28	27	1395	4018	1309	119	5446
1992	1974	17	14	2005	2583	1384	90	4058
1993	659	16	12	687	2490	1144	94	3727
1994	n/a	n/a	n/a		1597	714	100	2411

Other includes: scallop dredge, handline, gillnet, midwater trawl

Table 4. USA sampling of commercial haddock landings for length composition from Georges Bank and South (NAFO Division 5Z and Subarea 6), 1982-1993 for eastern Georges (areas 561, 562, 523 and 524) and western Georges (521, 522, 525, 526, 541, 542, 537, 538, 539 and Subarea 6). Q1, Q2, Q3, Q4, denote quarters 1, 2, 3, and 4, respectively.

Number of Samples				Number of Samples by Market Category, Area, and Quarter																		Annual Sampling Intensity			
				Scrod										Large								No. of Tons Landed/Sample			
				Eastern Georges					Western Georges					Eastern Georges					Western Georges							
Year	No.	# Fish Meas.	# Fish Aged	Q1	Q2	Q3	Q4	Σ	Q1	Q2	Q3	Q4	Σ	Q1	Q2	Q3	Q4	Σ	Q1	Q2	Q3	Q4	Σ	East Scrod	West Scrod	East Large	West Large
1982	89	7851	1788	6	7	6	3	**22**	1	4	15	4	**24**	3	9	8	4	**24**	1	4	7	7	**19**	96	54	172	264
1983	104	8955	2000	3	9	4	4	**20**	2	5	8	2	**17**	7	9	6	5	**27**	2	12	17	5	**38**	54	35	139	95
1984	57	4762	1142	11	4	2	1	**18**	0	1	2	3	**6**	9	7	1	5	**22**	3	3	2	3	**11**	56	65	122	299
1985	32	2528	627	7	4	2	0	**13**	0	1	2	1	**4**	7	1	1	0	**9**	1	0	4	1	**6**	18	136	161	338
1986	30	2276	571	2	3	1	0	**6**	0	1	2	1	**4**	4	2	3	2	**11**	1	2	3	3	**9**	186	77	98	92
1987	36	2573	837	2	7	0	1	**10**	0	0	3	1	**4**	3	4	1	3	**11**	2	1	6	2	**11**	51	41	168	52
1988	34	2542	1096	2	4	2	4	**12**	1	2	2	0	**5**	5	4	1	4	**14**	1	1	1	0	**3**	61	47	69	186
1989	23	1548	856	4	1	1	1	**7**	0	1	7	1	**9**	2	2	0	1	**5**	1	1	0	0	**2**	50	29	87	189
1990	27	2001	945	5	5	1	2	**13**	1	1	1	1	**4**	1	5	0	1	**7**	2	0	1	0	**3**	46	77	84	167
1991	32	1065	439	3	3	0	3	**9**	0	0	7	0	**7**	0	9	0	3	**12**	4	0	0	0	**4**	56	48	35	31
1992	54	2456	922	7	10	5	0	**22**	3	4	0	0	**7**	3	8	2	0	**11**	3	4	5	0	**12**	46	38	56	9
1993	31	1140	533	3	3	0	0	**6**	2	3	3	2	**10**	0	11	0	0	**11**	0	0	2	2	**4**	30	27	13	20

Table 5. Results of Fisher's Exact test to detect differences between the survey and commercial age keys for haddock from 1991-1993. Commercial age keys pooled for quarters 1 and 2 were compared to the NEFSC spring bottom trawl survey age key, while commercial age keys pooled for quarters 3 and 4 were compared to the NEFSC autumn bottom trawl survey age key.

Lngth	1991 - Spring			1991- Autumn			1992 - Spring			1992 - Autumn			1993 - Spring			1993 - Autumn		
Class	N_{surv}	N_{comm}	P	N_{surv}	N_{comm}	P	N_{surv}	N_{comm}	P	N_{surv}	N_{comm}	P	N_{surv}	N_{comm}	P	N_{surv}	N_{comm}	P
44	5	3	1.000	0	1	----	1	0	----	1	4	1.000	0	0	1.000	5	8	1.000
46	4	8	0.758	0	0	----	0	10	----	0	22	----	1	4	1.000	4	54	1.000
48	9	13	0.485	0	0	----	0	18	----	0	25	----	0	12	----	4	53	1.000
50	10	34	0.310	1	2	1.000	2	37	0.059	0	32	----	2	12	0.165	4	48	1.000
52	9	26	1.000	0	3	----	1	56	1.000	1	29	0.467	3	45	0.276	1	43	0.365
54	6	33	1.000	1	12	0.462	1	64	1.000	0	18	----	1	53	0.407	2	24	1.000
56	2	35	1.000	0	13	----	2	69	1.000	0	17	----	1	55	0.446	0	11	----
58	2	24	1.000	0	19	----	0	84	----	0	14	----	3	53	0.408	0	26	----
60	3	25	1.000	0	20	----	2	61	0.446	1	12	0.308	4	47	1.000	1	38	----
62	4	24	0.163	0	14	----	4	64	0.142	0	4	----	2	32	0.262	0	34	----
64	1	10	0.455	0	22	----	1	57	0.034	0	3	----	2	25	1.000	0	31	----
66	0	12	----	0	15	----	0	43	----	0	5	----	3	20	0.616	0	17	----
68	0	6	----	0	9	----	0	36	----	0	3	----	2	9	0.726	0	17	----
70	1	9	0.200	0	14	----	0	29	----	0	4	----	1	16	0.118	0	6	----
72	0	6	----	0	9	----	1	33	0.647	0	2	----	0	6	----	0	10	----
74	2	4	1.000	1	2	0.333	0	23	----	0	4	----	1	8	1.000	0	8	----
76	0	2	----	0	2	----	0	14	----	0	2	----	0	5	----	0	2	----
78	1	3	1.000	0	2	----	0	14	----	0	0	----	0	3	----	0	0	----
80	0	0	----	0	1	----	0	4	----	0	0	----	0	3	----	0	0	----

Table 6. Available age samples from commercial USA landings and NEFSC bottom trawl surveys, and sample sizes used to form age-length keys for commercial landings of haddock from Georges Bank and South (NAFO Division 5Z and Subarea 6), 1982-1993. Age length keys from 1982-1990 were formed by pooling quarters 1 and 2, and forming separate age keys for quarters 3 and 4. Age-length keys from 1991-1993 were formed semi-annually by pooling quarters 1 and 2, and quarters 3 and 4.

Year	Available Age Samples			Sample Size used in Age Keys
	Commercial	Survey	Total	
1982	1788	574	2075	NA[1]
1983	2000	582	2582	NA[1]
1984	1142	505	1647	NA[1]
1985	627	554	1181	NA[1]
1986	571	440	1011	NA[1]
1987	837	426	1263	NA[1]
1988	1096	216	1312	NA[1]
1989	856	135	991	NA[1]
1990	945	107	1052	NA[1]
1991	439	160	599	495
1992	922	228	1150	938
1993	533	116	649	568

[1] Sample size used in age keys not available for 1982-1990.

Table 7. USA landings at age in numbers (000's) and weight (tons), mean weight (kg) and mean length (cm) at age of haddock landed from Georges Bank and South (NAFO Division 5Z and Subarea 6), 1982-1994[1].

Year	1	2	3	4	5	6	7	8	9+	TOTAL
					USA Commercial Landings in Numbers (000's) at Age					
1982	1	852	1164	2333	298	463	924	97	105	6237
1983	0	53	454	432	1560	196	152	711	72	3630
1984	0	81	259	664	345	1310	173	234	439	3506
1985	0	384	245	80	372	173	439	56	90	1839
1986	0	16	1109	137	76	121	121	226	39	1845
1987	0	9	39	525	63	41	59	78	67	881
1988	0	1	506	53	541	96	48	48	20	1313
1989	0	131	18	254	79	156	33	20	8	699
1990	0	5	375	117	367	84	55	17	10	1030
1991	0	19	30	340	52	113	45	31	15	644
1992	0	17	83	70	507	97	111	24	8	917
1993	0	44	31	54	35	108	31	16	7	324
1994[1]	0	44	148	29	10	7	22	3	8	271
					USA Commercial Landings in Weight (tons) at Age					
1982	0	794	1641	4325	708	1275	3063	389	430	12625
1983	0	53	611	794	3452	527	508	2423	308	8676
1984	0	75	338	1203	756	3483	515	801	1632	8803
1985	0	458	380	149	942	458	1323	219	342	4271
1986	0	14	1352	227	169	340	339	751	147	3339
1987	0	11	59	965	141	109	181	298	287	2051
1988	0	1	727	80	1043	244	143	175	79	2492
1989	0	154	29	459	174	393	113	76	31	1429
1990	0	5	571	212	719	218	163	68	42	1998
1991	0	21	44	579	121	304	143	114	63	1390
1992	0	23	125	128	1029	250	328	82	36	2000
1993	0	53	46	101	74	257	78	50	26	685
1994	0	50	247	65	27	17	62	10	32	510
					USA Commercial Landings Mean Weight (kg) at Age					
1982	0.225	0.932	1.410	1.854	2.375	2.753	3.315	4.015	4.091	
1983	-	0.996	1.345	1.839	2.213	2.691	3.345	3.408	4.275	
1984	-	0.924	1.305	1.812	2.191	2.659	2.979	3.425	3.718	
1985	-	1.194	1.553	1.861	2.532	2.649	3.013	3.909	3.798	
1986	-	0.846	1.219	1.656	2.230	2.807	2.798	3.325	3.781	
1987	-	1.182	1.515	1.838	2.239	2.662	3.074	3.817	4.287	
1988	-	1.065	1.436	1.510	1.927	2.545	2.972	3.643	3.963	
1989	-	1.174	1.603	1.806	2.200	2.519	3.415	3.783	3.818	
1990	-	0.981	1.523	1.809	1.959	2.597	2.960	4.005	4.164	
1991	-	1.143	1.505	1.704	2.338	2.685	3.169	3.669	4.337	
1992	-	1.336	1.503	1.833	2.030	2.584	2.947	3.458	4.267	
1993	-	1.220	1.496	1.877	2.132	2.376	2.251	3.037	4.014	
1994[2]	-	1.141	1.669	2.246	2.664	2.439	2.835	3.240	4.014	
					USA Commercial Landings Mean Length (cm) at Age					
1982	27.0	44.4	51.5	56.8	61.9	65.3	69.7	74.8	74.8	
1983	-	45.5	50.7	56.6	60.7	64.6	69.5	70.4	75.7	
1984	-	44.7	50.3	56.1	60.4	64.4	67.7	70.5	72.7	
1985	-	48.7	53.4	57.1	63.8	65.1	67.6	73.9	73.4	
1986	-	43.5	49.3	54.5	60.5	65.7	66.1	70.2	73.1	
1987	-	48.6	53.3	57.1	60.7	65.1	68.5	74.0	76.8	
1988	-	46.8	51.9	53.3	58.3	64.2	67.9	72.5	74.3	
1989	-	48.4	53.6	56.6	60.7	64.0	71.1	74.4	74.9	
1990	-	44.9	52.4	56.9	58.6	64.7	67.8	75.4	76.4	
1991	-	47.9	52.9	55.5	61.9	65.2	69.8	73.6	78.4	
1992	-	49.6	53.1	57.1	59.1	64.8	68.0	72.3	77.6	
1993	-	48.1	53.5	57.7	60.0	62.9	64.1	68.8	75.0	
1994[2]	32.5	46.5	52.6	56.5	57.8	55.7	58.6	70.1	—	

[1]1994 U.S. commercial landings estimated as 21% of Canadian Landings.
[2]1994 mean weight (kg) and mean length (cm) taken from Canadian data.

Table 8. Canadian landings at age in numbers (000's) and weight (tons), mean weight (kg) and mean length (cm) at age of haddock landed from Georges Bank and South (NAFO Division 5Z and Subarea 6), 1982-1994 (Gavaris and Eeckhaute 1995).

Year	1	2	3	4	5	6	7	8	9+	TOTAL
					Canadian Commercial Landings in Numbers (000's) at Age					
1982	0	313	469	1400	93	106	195	9	5	2590
1983	0	161	359	258	679	76	34	89	4	1660
1984	0	12	38	63	52	172	61	33	104	535
1985	0	2022	305	114	89	55	87	22	62	2756
1986	6	38	1701	86	70	52	29	40	21	2043
1987	0	1986	90	1088	59	32	30	28	68	3381
1988	4	51	1878	81	390	53	7	16	86	2566
1989	0	1132	68	623	64	202	13	8	37	2147
1990	2	6	1070	55	501	14	122	29	34	1833
1991	6	429	62	1809	50	297	28	123	57	2861
1992	7	230	237	62	1020	14	212	3	86	1871
1993	7	246	319	245	69	551	7	143	69	1656
1994	0	210	703	137	49	33	107	13	37	1289
					Canadian Commercial Landings in Weight (mt) at Age					
1982	0	331	730	2681	218	297	567	31		
1983	0	166	503	470	1494	193	96	268		
1984	0	11	53	127	117	476	178	110		
1985	0	1917	386	236	193	162	286	71		
1986	3	37	2480	181	204	151	106	170		
1987	0	1652	125	2255	133	83	87	101		
1988	2	50	2470	145	871	120	21	49		
1989	0	975	99	1115	142	526	36	24		
1990	1	6	1563	94	1118	32	334	69		
1991	3	517	76	3325	101	781	66	356		
1992	4	267	400	105	2309	29	631	8		
1993	5	285	558	548	146	1475	21	448		
1994	0	240	1173	308	131	80	303	42		
					Canadian Commercial Landings Mean Weight (kg) at Age					
1982	-	1.056	1.556	1.915	2.348	2.801	2.909	3.414		
1983	-	1.031	1.401	1.822	2.200	2.543	2.821	3.007		
1984	-	0.883	1.401	2.010	2.257	2.770	2.918	3.326		
1985	-	0.948	1.264	2.068	2.169	2.942	3.289	3.238		
1986	0.452	0.981	1.458	2.104	2.913	2.899	3.646	4.248		
1987	-	0.832	1.391	2.073	2.253	2.598	2.906	3.623		
1988	0.421	0.974	1.315	1.787	2.234	2.264	2.978	3.036		
1989	-	0.861	1.449	1.789	2.215	2.604	2.795	3.014		
1990	0.639	0.956	1.461	1.711	2.232	2.281	2.736	2.396		
1991	0.581	1.204	1.220	1.838	2.023	2.63	2.341	2.891		
1992	0.538	1.163	1.687	1.694	2.264	2.073	2.977	2.633		
1993	0.659	1.160	1.750	2.236	2.113	2.677	2.987	3.133		
1994	0.405	1.141	1.669	2.246	2.664	2.439	2.835	3.240		
					Canadian Commercial Landings Mean Length (cm) at Age					
1982	-	44.92	51.26	55.14	59.16	62.62	63.53	67.37		
1983	-	44.52	49.45	54.11	57.77	60.69	62.94	64.32		
1984	-	44.19	51.13	57.09	59.64	64.26	65.04	68.22		
1985	-	43.24	47.58	56.13	56.79	63.57	66.34	65.78		
1986	33.65	43.81	50.11	56.24	63.43	62.75	68.67	72.33		
1987	-	41.38	49.25	56.58	57.51	60.23	62.87	68.24		
1988	32.84	43.67	48.45	53.69	58.11	58.06	64.10	64.07		
1989	-	41.81	49.66	53.79	57.77	61.23	62.29	64.14		
1990	37.89	43.47	50.15	52.86	57.95	57.79	62.04	59.30		
1991	36.22	47.03	47.05	54.21	55.99	61.45	59.91	63.23		
1992	35.70	46.41	52.66	52.63	58.14	56.31	63.98	61.20		
1993	38.31	46.38	53.36	58.11	56.89	61.60	64.01	65.10		
1994	32.50	46.45	52.59	56.49	57.79	55.72	58.59	70.07		

Table 9. Total landings[1] at age in numbers (000's) and mean weight (kg) of haddock landed from Georges Bank and South (NAFO Division 5Z and Subarea 6), 1963-1994.

	Age									
Year	1	2	3	4	5	6	7	8	9+	TOTAL
				Total Commercial Landings in Numbers (000's) at Age						
1963	2910	4047	7418	11152	8198	2205	1405	721	1096	39152
1964	10101	15935	4554	4776	8722	5794	2082	1028	1332	54324
1965	9601	125818	44496	5356	4391	6690	3772	1094	1366	202584
1966	114	6843	100810	19167	2768	2591	2332	1268	867	136760
1967	1150	168	2891	20667	10338	1209	993	917	698	39031
1968	8	2994	709	1921	14519	3499	667	453	842	25612
1969	2	11	1698	448	654	5954	1574	225	570	11136
1970	46	158	16	570	186	214	2308	746	464	4708
1971	1	1375	223	40	289	246	285	1469	928	4856
1972	156	2	450	81	32	120	78	66	1236	2221
1973	2560	2075	3	386	53	30	77	15	447	5646
1974	46	4320[2]	657	2	70	2	2	53	249	5401
1975	192	1034	1864	375	4	42	4	4	88	3607
1976	144	473	550	880	216	0	23	4	112	2402
1977	1	19585[3]	187	680	515	357	4	39	111	21479
1978	1	761	14395[4]	305	567	517	139	14	67	16766
1979	1	26	1726	7169	525	410	315	96	46	10314
1980	8	31000[5]	347	975	6054	594	546	153	81	39758
1981	1	1743	10998	831	937	2572	331	158	94	17665
1982	1	1165	1633	3733	391	569	1119	106	110	8827
1983	0	214	813	690	2239	272	186	800	76	5290
1984	0	93	297	727	397	1482	234	267	543	4041
1985	0	2406	550	194	461	228	526	78	152	4596
1986	6	54	2810	223	146	173	150	266	60	3888
1987	0	1995	129	1613	122	73	89	106	135	4262
1988	4	52	2384	134	931	149	55	64	106	3879
1989	0	1263	86	877	143	358	46	28	45	2846
1990	2	11	1445	172	868	98	177	46	44	2863
1991	6	448	91	2149	102	410	73	154	72	3505
1992	7	247	320	132	1527	111	323	27	94	2788
1993	7	290	350	299	104	659	38	159	76	1980
1994[6]	0	254	851	166	59	40	129	16	45	1560

Table 9. (continued)

Year	Age 1	2	3	4	5	6	7	8	9+
				Total Commercial Landings Mean Weight (kg) at Age					
1963	0.57	0.87	1.18	1.47	1.68	2.15	2.35	3.04	3.10
1964	0.50	0.83	1.12	1.43	1.64	2.01	2.40	2.64	2.97
1965	0.58	0.69	1.03	1.35	1.67	1.99	2.26	2.66	3.11
1966	0.58	0.73	0.89	1.26	1.70	2.07	2.28	2.87	3.18
1967	0.66	0.70	0.95	1.18	1.42	2.05	2.31	2.66	3.10
1968	0.59	0.81	1.05	1.32	1.57	2.10	2.32	2.62	2.86
1969	0.52	0.78	1.10	1.69	1.75	1.99	2.52	2.99	3.63
1970	0.71	1.27	1.22	1.93	2.19	2.39	2.58	3.23	3.75
1971	(0.67)	1.03	1.31	1.74	2.39	2.81	2.92	3.10	3.72
1972	0.62	1.03	1.74	2.04	2.42	2.92	3.06	3.44	3.66
1973	0.60	1.03	1.58	2.13	2.41	3.29	3.42	3.86	3.94
1974	0.72	1.06	1.82	2.32	2.83	3.76	4.05	3.92	4.26
1975	0.62	0.98	1.63	2.21	2.20	2.94	4.00	4.05	4.33
1976	0.50	0.99	1.39	1.99	2.66	(3.08)	3.69	4.67	4.94
1977	(0.53)	1.07	1.44	2.17	2.73	3.21	4.15	4.00	4.99
1978	(0.53)	0.94	1.50	2.04	2.79	3.19	3.37	3.61	5.11
1979	(0.53)	1.00	1.28	2.02	2.51	3.14	3.78	3.79	4.87
1980	0.55	0.94	1.21	1.73	2.17	2.82	3.60	3.56	3.87
1981	0.39	0.87	1.24	1.83	2.30	2.72	3.71	4.04	4.44
1982	0.22	0.97	1.45	1.88	2.37	2.76	3.24	3.96	4.09
1983	(0.33)	1.02	1.37	1.83	2.21	2.65	3.25	3.36	4.27
1984	(0.33)	0.92	1.32	1.83	2.20	2.67	2.96	3.41	3.72
1985	(0.33)	0.99	1.39	1.98	2.46	2.72	3.06	3.72	3.80
1986	0.45	0.94	1.36	1.83	2.56	2.83	2.96	3.46	3.78
1987	(0.43)	0.83	1.43	2.00	2.25	2.63	3.02	3.77	4.29
1988	0.42	0.98	1.34	1.68	2.06	2.45	2.97	3.49	3.96
1989	(0.53)	0.89	1.48	1.79	2.21	2.57	3.24	3.56	3.82
1990	0.64	0.97	1.48	1.78	2.12	2.55	2.81	2.99	4.16
1991	0.58	1.20	1.31	1.82	2.18	2.65	2.85	3.05	4.34
1992	0.54	1.18	1.64	1.77	2.19	2.52	2.97	3.37	4.27
1993	0.66	1.17	1.73	2.17	2.12	2.63	2.65	3.12	4.01
1994[7]	0.41	1.14	1.67	2.25	2.66	2.44	2.84	3.24	4.01

[1] Data 1963-1979 from Clark et al. (1982); Data 1980-1981 from Overholtz et al. (1983); Data 1982-1990 Hayes and Buxton (1992); Data 1991-1994 current assessment and Gavaris and Van Eekhaute (1995).

[2] Of this total, approximately 1 million fish were added to the catch at age to account for high discards that occurred during 1974 (W. Overholtz, personal communication).

[3] Of this total, approximately 12.8 million fish were added to the catch at age to account for high discards that occurred during 1977 (W. Overholtz, personal communication).

[4] Of this total, approximately 5 million fish were added to the catch at age to account for high discards that occurred during 1978 (W. Overholtz, personal communication).

[5] Of this total, approximately 20 million fish were added to the catch at age to account for high discards that occurred during 1980 (W. Overholtz, personal communication).

[6] 1994 U.S. commercial landings estimated as 21% of Canadian Landings.

[7] Canadian mean weight only (Gavaris and Van Eekhaute 1995)

Table 10. Mean weight (kg) at age at 1 January for Georges Bank haddock, calculated from mean weight at capture in the commercial catch using the procedures described by Rivard (1980).

Year	Age 1	2	3	4	5	6	7	8	9+
1963	0.472	0.767	1.072	1.392	1.536	2.035	2.217	2.673	3.100
1964	0.426	0.688	0.987	1.299	1.553	1.838	2.272	2.491	2.970
1965	0.517	0.587	0.925	1.230	1.545	1.807	2.131	2.527	3.110
1966	0.528	0.651	0.784	1.139	1.515	1.859	2.130	2.547	3.180
1967	0.596	0.637	0.833	1.025	1.338	1.867	2.187	2.463	3.100
1968	0.513	0.731	0.857	1.120	1.361	1.727	2.181	2.460	2.860
1969	0.333	0.678	0.944	1.332	1.520	1.768	2.300	2.634	3.630
1970	0.589	0.813	0.975	1.457	1.924	2.045	2.266	2.853	3.750
1971	0.540	0.855	1.290	1.457	2.148	2.481	2.642	2.828	3.720
1972	0.481	0.831	1.339	1.635	2.052	2.642	2.932	3.169	3.660
1973	0.451	0.799	1.276	1.925	2.217	2.822	3.160	3.437	3.940
1974	0.617	0.797	1.369	1.915	2.455	3.010	3.650	3.661	4.260
1975	0.491	0.840	1.314	2.006	2.259	2.884	3.878	4.050	4.330
1976	0.342	0.783	1.167	1.801	2.425	2.603	3.294	4.322	4.940
1977	0.398	0.731	1.194	1.737	2.331	2.922	3.575	3.842	4.990
1978	0.386	0.706	1.267	1.714	2.461	2.951	3.289	3.871	5.110
1979	0.398	0.728	1.097	1.741	2.263	2.960	3.472	3.574	4.870
1980	0.437	0.706	1.100	1.488	2.094	2.660	3.362	3.668	3.870
1981	0.247	0.692	1.080	1.488	1.995	2.429	3.235	3.814	4.440
1982	0.102	0.615	1.123	1.527	2.083	2.520	2.969	3.833	4.090
1983	0.198	0.474	1.153	1.629	2.038	2.506	2.995	3.299	4.270
1984	0.191	0.551	1.160	1.583	2.006	2.429	2.801	3.329	3.720
1985	0.196	0.572	1.131	1.617	2.122	2.446	2.858	3.318	3.800
1986	0.331	0.557	1.160	1.595	2.251	2.639	2.837	3.254	3.780
1987	0.285	0.611	1.159	1.649	2.029	2.595	2.923	3.341	4.290
1988	0.289	0.649	1.055	1.550	2.030	2.348	2.795	3.247	3.960
1989	0.392	0.611	1.204	1.549	1.927	2.301	2.817	3.252	3.820
1990	0.467	0.717	1.148	1.622	1.947	2.375	2.685	3.113	4.160
1991	0.409	0.877	1.128	1.640	1.970	2.366	2.698	2.924	4.337
1992	0.365	0.826	1.403	1.522	1.993	2.345	2.801	3.098	4.267
1993	0.501	0.793	1.425	1.886	1.936	2.397	2.583	3.044	4.014
1994	0.189	0.867	1.397	1.970	2.405	2.273	2.730	2.930	4.014
1995	0.369	0.867	1.501	1.994	2.561	2.951	2.617	2.945	4.014

Table 11. USA commercial landings per unit effort (LPUE) indices derived from a General Linear Model (GLM) analysis for Georges Bank haddock, 1964-1993, (Intv=Interviewed, DF=days fished, Std=Standardized).

	USA Landings				Standardized		
Year	Total Landings	Interviewed Landings	Nominal Days Fished	Nominal LPUE (IntvLnd/DF)	Std Days Fished	Std LPUE (IntvLnd/StdDF)	Total Days Fished (TotLnd/StdLPUE)
1964	46512	40870	13121	3.115	8314	4.916	9461
1965	52823	46215	15712	2.941	8900	5.193	10172
1966	52918	45008	16920	2.660	9110	4.940	10712
1967	34728	29443	13074	2.252	7593	3.878	8956
1968	25469	20970	10584	1.981	6295	3.332	7645
1969	16456	13515	9177	1.473	5331	2.535	6491
1970	8415	6639	7731	0.859	3926	1.691	4977
1971	7306	5751	7563	0.760	4014	1.433	5099
1972	3869	2943	6251	0.471	3152	0.933	4145
1973	2777	2278	5188	0.439	2779	0.820	3387
1974	2396	1913	5548	0.345	2890	0.662	3620
1975	3989	3119	5683	0.549	3028	1.030	3872
1976	2904	2421	5278	0.459	2959	0.818	3549
1977	7934	6306	6812	0.926	3286	1.919	4133
1978	12160	9841	6696	1.470	3718	2.647	4594
1979	14279	11614	7842	1.481	4790	2.425	5889
1980	17470	14072	8484	1.659	5079	2.771	6305
1981	19176	14033	7973	1.760	5352	2.622	7314
1982	12625	8835	8230	1.074	5351	1.651	7647
1983	8682	6372	8740	0.729	5928	1.075	8077
1984	8807	6389	11259	0.568	7513	0.850	10356
1985	4273	3400	11380	0.299	7403	0.459	9304
1986	3339	2959	7913	0.374	5768	0.513	6509
1987	2156	1936	8363	0.231	6052	0.320	6740
1988	2492	2322	9196	0.252	6628	0.350	7115
1989	1430	1190	7713	0.154	5350	0.222	6428
1990	2001	1734	7943	0.218	5322	0.326	6143
1991	1395	1158	6423	0.180	4651	0.249	5604
1992	2005	1455	5924	0.246	4410	0.330	6077
1993	687	451	5003	0.090	3871	0.116	5902

Table 12. Mean number and mean weight (kg) per tow of haddock caught in NEFSC spring and autumn bottom trawl surveys from 1963-1994.

Year	Spring Survey		Autumn Survey	
	Number/Tow	Weight (kg)/tow	Number/tow	Weight (kg)/tow
1963	—	—	145.01	79.77
1964	—	—	193.24	96.75
1965	—	—	101.69	72.78
1966	—	—	33.26	29.87
1967	—	—	17.70	25.47
1968	13.84	20.55	7.51	15.40
1969	7.33	16.93	3.38	8.44
1970	6.00	17.12	7.70	13.50
1971	2.79	5.00	4.20	5.59
1972	6.38	7.37	11.35	8.47
1973	37.62	15.37	14.89	9.78
1974	19.01	17.70	4.05	3.99
1975	6.24	8.21	30.95	15.10
1976	83.19	15.72	71.07	35.76
1977	36.86	26.58	23.25	27.52
1978	19.41	31.27	25.29	18.06
1979	45.50	19.77	52.24	31.98
1980	60.06	53.92	30.54	21.98
1981	31.21	38.02	13.45	14.01
1982	8.60	13.11	4.96	7.34
1983	5.60	13.21	7.99	5.75
1984	6.24	7.45	5.38	4.48
1985	8.85	11.14	14.19	3.86
1986	5.85	5.86	6.81	5.10
1987	4.95	5.60	3.62	2.56
1988	3.38	3.43	4.39	4.40
1989	5.35	4.70	4.34	4.70
1990	7.68	7.57	2.92	2.62
1991	3.97	4.38	2.92	0.94
1992	1.18	1.41	6.06	3.17
1993	2.79	2.48	8.09	4.33
1994	4.91	3.63	3.58	2.93

Table 13. Stratified mean catch per tow (numbers) for haddock in NEFSC offshore spring research vessel bottom trawl surveys on Georges Bank (Strata 13-25, 29-30), 1968-1994.

Year	Unadjusted Age group 0	1	2	3	4	5	6	7	8	9+	Total	Total 1+
1968	0.00	0.27	1.90	0.31	0.47	4.51	1.13	0.17	0.30	0.23	9.29	9.29
1969	0.00	0.00	0.05	0.39	0.17	0.28	2.84	0.69	0.19	0.31	4.92	4.92
1970	0.00	0.45	0.17	0.00	0.22	0.31	0.31	1.34	0.66	0.57	4.03	4.03
1971	0.00	0.00	0.78	0.17	0.00	0.08	0.08	0.06	0.55	0.15	1.87	1.87
1972	0.00	2.70	0.06	0.41	0.08	0.02	0.03	0.09	0.02	0.87	4.28	4.28
1973	0.00	20.59	3.25	0.00	0.36	0.06	0.00	0.12	0.01	0.86	25.25	25.25
1974	0.00	1.43	8.92	1.92	0.00	0.16	0.00	0.01	0.07	0.25	12.76	12.76
1975	0.00	0.63	0.65	2.23	0.42	0.00	0.09	0.06	0.01	0.10	4.19	4.19
1976	0.00	54.22	0.20	0.40	0.62	0.29	0.00	0.03	0.00	0.07	55.83	55.83
1977	0.00	0.41	22.42	0.28	0.82	0.40	0.30	0.00	0.03	0.08	24.74	24.74
1978	0.00	0.05	0.65	10.69	0.24	0.63	0.55	0.11	0.04	0.07	13.03	13.03
1979	0.00	24.24	1.06	0.76	3.83	0.22	0.11	0.25	0.04	0.03	30.54	30.54
1980	0.00	3.49	31.34	0.34	0.70	3.27	0.45	0.25	0.31	0.16	40.31	40.31
1981	0.00	2.70	2.69	15.95	1.79	0.62	1.46	0.20	0.09	0.04	25.54	25.54
1982	0.00	0.62	1.25	0.77	3.33	0.34	0.23	0.50	0.00	0.00	7.04	7.04
1983	0.00	0.29	0.37	0.39	0.15	1.62	0.01	0.03	0.78	0.12	3.76	3.76
1984	0.00	1.40	0.79	0.43	0.42	0.39	0.48	0.05	0.03	0.20	4.19	4.19
1985	0.00	0.00	4.96	0.76	0.40	0.87	0.34	1.17	0.10	0.25	8.85	8.85
1986	0.00	2.49	0.18	2.06	0.24	0.11	0.21	0.12	0.33	0.11	5.85	5.85
1987	0.00	0.00	3.62	0.06	0.81	0.08	0.10	0.05	0.22	0.01	4.95	4.95
1988	0.00	1.55	0.04	0.99	0.13	0.32	0.12	0.11	0.12	0.00	3.38	3.38
1989	0.00	0.03	4.26	0.55	0.87	0.17	0.50	0.07	0.06	0.01	6.52	6.52
1990	0.00	1.05	0.00	6.97	0.40	0.71	0.07	0.16	0.00	0.01	9.37	9.37
1991	0.00	0.66	1.30	0.29	2.26	0.11	0.12	0.03	0.05	0.02	4.84	4.84
1992	0.00	0.40	0.18	0.11	0.07	0.33	0.03	0.03	0.03	0.00	1.18	1.18
1993	0.00	1.17	0.65	0.18	0.14	0.12	0.37	0.06	0.02	0.02	2.73	2.73
1994	0.10	0.85	3.27	1.22	0.18	0.12	0.08	0.19	0.02	0.06	6.09	5.99

Table 13. (continued)

Year	0	1	2	3	4	Adjusted 5	6	7	8	9+	Total	Total 1+
1968	0.00	0.40	2.83	0.46	0.70	6.72	1.68	0.25	0.45	0.34	13.84	13.84
1969	0.00	0.00	0.07	0.58	0.25	0.42	4.23	1.03	0.28	0.46	7.33	7.33
1970	0.00	0.67	0.25	0.00	0.33	0.46	0.46	2.00	0.98	0.85	6.00	6.00
1971	0.00	0.00	1.16	0.25	0.00	0.12	0.12	0.09	0.82	0.22	2.79	2.79
1972	0.00	4.02	0.09	0.61	0.12	0.03	0.04	0.13	0.03	1.30	6.38	6.38
1973	0.00	30.68	4.84	0.00	0.54	0.09	0.00	0.18	0.01	1.28	37.62	37.62
1974	0.00	2.13	13.29	2.86	0.00	0.24	0.00	0.01	0.10	0.37	19.01	19.01
1975	0.00	0.94	0.97	3.32	0.63	0.00	0.13	0.09	0.01	0.15	6.24	6.24
1976	0.00	80.79	0.30	0.60	0.92	0.43	0.00	0.04	0.00	0.10	83.19	83.19
1977	0.00	0.61	33.41	0.42	1.22	0.60	0.45	0.00	0.04	0.12	36.86	36.86
1978	0.00	0.07	0.97	15.93	0.36	0.94	0.82	0.16	0.06	0.10	19.41	19.41
1979	0.00	36.12	1.58	1.13	5.71	0.33	0.16	0.37	0.06	0.04	45.50	45.50
1980	0.00	5.20	46.70	0.51	1.04	4.87	0.67	0.37	0.46	0.24	60.06	60.06
1981	0.00	3.30	3.29	19.49	2.19	0.76	1.78	0.24	0.11	0.05	31.21	31.21
1982	0.00	0.76	1.53	0.94	4.07	0.42	0.28	0.61	0.00	0.00	8.60	8.60
1983	0.00	0.43	0.55	0.58	0.22	2.41	0.01	0.04	1.16	0.18	5.60	5.60
1984	0.00	2.09	1.18	0.64	0.63	0.58	0.72	0.07	0.04	0.30	6.24	6.24
1985	0.00	0.00	4.96	0.76	0.40	0.87	0.34	1.17	0.10	0.25	8.85	8.85
1986	0.00	2.49	0.18	2.06	0.24	0.11	0.21	0.12	0.33	0.11	5.85	5.85
1987	0.00	0.00	3.62	0.06	0.81	0.08	0.10	0.05	0.22	0.01	4.95	4.95
1988	0.00	1.55	0.04	0.99	0.13	0.32	0.12	0.11	0.12	0.00	3.38	3.38
1989	0.00	0.02	3.49	0.45	0.71	0.14	0.41	0.06	0.05	0.01	5.35	5.35
1990	0.00	0.86	0.00	5.72	0.33	0.58	0.06	0.13	0.00	0.01	7.68	7.68
1991	0.00	0.54	1.07	0.24	1.85	0.09	0.10	0.02	0.04	0.02	3.97	3.97
1992	0.00	0.40	0.18	0.11	0.07	0.33	0.03	0.03	0.03	0.00	1.18	1.18
1993	0.00	1.17	0.65	0.18	0.14	0.12	0.37	0.06	0.02	0.02	2.73	2.73
1994	0.08	0.70	2.68	1.00	0.15	0.10	0.07	0.16	0.02	0.05	4.99	4.99

Table 14. Stratified mean catch per tow (numbers) for haddock in NEFSC offshore autumn research vessel bottom trawl surveys on Georges Bank (Strata 13-25, 29-30), 1963-1994.

	Unadjusted Age group											
Year	0	1	2	3	4	5	6	7	8	9+	Total	Total 1+
1963	56.33	17.04	6.19	4.57	5.60	3.99	1.37	1.13	0.79	0.31	97.32	40.99
1964	1.59	75.75	42.78	3.91	1.20	2.56	1.05	0.46	0.17	0.22	129.69	128.10
1965	0.22	6.82	51.94	6.51	0.72	0.54	0.61	0.54	0.17	0.18	68.25	68.03
1966	4.12	0.64	1.94	12.34	2.25	0.35	0.33	0.22	0.08	0.05	22.32	18.20
1967	0.02	4.51	0.24	0.67	4.54	1.09	0.33	0.14	0.22	0.12	11.88	11.86
1968	0.06	0.04	0.64	0.09	0.22	2.59	0.85	0.18	0.11	0.26	5.04	4.98
1969	0.26	0.02	0.00	0.19	0.09	0.11	1.02	0.34	0.06	0.18	2.27	2.01
1970	0.03	2.77	0.14	0.01	0.19	0.18	0.34	0.92	0.32	0.27	5.17	5.14
1971	1.63	0.00	0.21	0.05	0.01	0.15	0.02	0.06	0.50	0.19	2.82	1.19
1972	4.53	1.69	0.00	0.35	0.06	0.00	0.06	0.04	0.02	0.87	7.62	3.09
1973	2.17	6.04	1.08	0.00	0.13	0.03	0.00	0.05	0.01	0.48	9.99	7.82
1974	0.50	1.19	0.66	0.21	0.00	0.01	0.00	0.00	0.00	0.15	2.72	2.22
1975	15.76	0.42	0.48	3.26	0.62	0.00	0.02	0.00	0.01	0.20	20.77	5.01
1976	2.90	43.07	0.35	0.36	0.55	0.20	0.00	0.03	0.07	0.17	47.70	44.80
1977	0.11	1.75	15.33	0.46	0.47	0.52	0.28	0.03	0.01	0.07	19.03	18.92
1978	10.82	0.69	0.85	7.59	0.15	0.21	0.37	0.01	0.00	0.01	20.70	9.88
1979	1.08	37.29	0.03	0.74	3.12	0.21	0.23	0.04	0.01	0.00	42.75	41.67
1980	9.56	2.22	10.41	0.37	0.15	1.39	0.39	0.38	0.07	0.05	24.99	15.43
1981	0.31	5.02	1.70	3.03	0.17	0.34	0.43	0.00	0.00	0.01	11.01	10.70
1982	0.91	0.00	0.89	0.23	0.94	0.09	0.05	0.14	0.01	0.07	3.33	2.42
1983	3.89	0.16	0.14	0.18	0.20	0.63	0.08	0.00	0.07	0.01	5.36	1.47
1984	0.02	2.23	0.59	0.16	0.19	0.04	0.30	0.00	0.00	0.08	3.61	3.59
1985	11.35	0.65	1.53	0.22	0.05	0.10	0.07	0.17	0.00	0.05	14.19	2.84
1986	0.00	5.11	0.09	1.21	0.06	0.13	0.13	0.02	0.03	0.03	6.81	6.81
1987	1.80	0.00	0.79	0.10	0.77	0.06	0.06	0.02	0.02	0.00	3.62	1.82
1988	0.07	3.02	0.18	1.30	0.12	0.40	0.12	0.11	0.00	0.03	5.35	5.28
1989	0.57	0.06	3.30	0.24	0.81	0.11	0.16	0.02	0.02	0.00	5.29	4.72
1990	0.94	0.82	0.03	1.45	0.06	0.21	0.05	0.00	0.00	0.00	3.56	2.62
1991	2.63	0.25	0.29	0.06	0.27	0.02	0.02	0.00	0.00	0.02	3.56	0.93
1992	2.85	2.08	0.23	0.24	0.00	0.47	0.02	0.08	0.03	0.06	6.06	3.21
1993	1.85	4.93	2.45	0.37	0.00	0.07	0.18	0.02	0.00	0.00	9.87	8.02
1994	0.91	0.77	0.81	0.67	0.12	0.05	0.02	0.17	0.06	0.00	3.58	2.67

Table 14. (continued)

Year	0	1	2	3	4	Adjusted 5	6	7	8	9+	Total	Total 1+
1963	83.93	25.39	9.22	6.81	8.34	5.95	2.04	1.68	1.18	0.46	145.01	61.08
1964	2.37	112.87	63.74	5.83	1.79	3.81	1.56	0.69	0.25	0.33	193.24	190.87
1965	0.33	10.16	77.39	9.70	1.07	0.80	0.91	0.80	0.25	0.27	101.69	101.36
1966	6.14	0.95	2.89	18.39	3.35	0.52	0.49	0.33	0.12	0.07	33.26	27.12
1967	0.03	6.72	0.36	0.99	6.76	1.62	0.49	0.21	0.33	0.18	17.70	17.67
1968	0.09	0.06	0.95	0.13	0.33	3.86	1.27	0.27	0.16	0.39	7.51	7.42
1969	0.39	0.03	0	0.28	0.13	0.16	1.52	0.51	0.09	0.27	3.38	2.99
1970	0.04	4.13	0.21	0.01	0.28	0.27	0.51	1.37	0.48	0.40	7.70	7.66
1971	2.43	0	0.31	0.07	0.01	0.22	0.03	0.09	0.75	0.28	4.20	1.77
1972	6.75	2.52	0	0.52	0.09	0	0.09	0.06	0.03	1.30	11.35	4.60
1973	3.23	9.00	1.61	0	0.19	0.04	0	0.07	0.01	0.72	14.89	11.65
1974	0.75	1.77	0.98	0.31	0	0.01	0	0	0	0.22	4.05	3.31
1975	23.48	0.63	0.72	4.86	0.92	0	0.03	0	0.01	0.30	30.95	7.46
1976	4.32	64.17	0.52	0.54	0.82	0.30	0	0.04	0.10	0.25	71.07	66.75
1977	0.13	2.14	18.73	0.56	0.57	0.64	0.34	0.04	0.01	0.09	23.25	23.12
1978	13.22	0.84	1.04	9.27	0.18	0.26	0.45	0.01	0	0.01	25.30	12.07
1979	1.32	45.57	0.04	0.90	3.81	0.26	0.28	0.05	0.01	0	52.24	50.92
1980	11.68	2.71	12.72	0.45	0.18	1.70	0.48	0.46	0.09	0.06	30.54	18.86
1981	0.38	6.13	2.08	3.70	0.21	0.42	0.53	0	0	0.01	13.45	13.07
1982	1.37	0	1.33	0.34	1.40	0.13	0.07	0.21	0.01	0.10	4.96	3.61
1983	5.80	0.24	0.21	0.27	0.30	0.94	0.12	0	0.10	0.02	7.99	2.19
1984	0.03	3.32	0.88	0.24	0.28	0.06	0.45	0	0	0.12	5.38	5.35
1985	11.35	0.65	1.53	0.22	0.05	0.1	0.07	0.17	0	0.05	14.19	2.84
1986	0	5.11	0.09	1.21	0.06	0.13	0.13	0.02	0.03	0.03	6.81	6.81
1987	1.8	0	0.79	0.1	0.77	0.06	0.06	0.02	0.02	0	3.62	1.82
1988	0.06	2.48	0.15	1.07	0.10	0.33	0.10	0.09	0	0.03	4.39	4.33
1989	0.47	0.05	2.71	0.20	0.66	0.09	0.13	0.02	0.02	0	4.33	3.87
1990	0.78	0.67	0.03	1.19	0.05	0.17	0.04	0	0	0	2.92	2.15
1991	2.16	0.21	0.24	0.05	0.22	0.02	0.02	0	0	0.02	2.92	0.76
1992	2.85	2.08	0.23	0.24	0	0.47	0.02	0.08	0.03	0.06	6.06	3.21
1993	1.52	4.04	2.01	0.30	0	0.06	0.15	0.02	0	0	8.09	6.58
1994	0.91	0.77	0.81	0.67	0.12	0.05	0.02	0.17	0.06	0	3.58	2.67

Table 15. Adjusted stratified mean catch per tow (numbers) for haddock in the NEFSC offshore spring and autumn bottom trawl surveys on Georges Bank for plus groups 1-6, 1963-1994.

	Spring Survey						Autumn Survey					
Year	1+	2+	3+	4+	5+	6+	1+	2+	3+	4+	5+	6+
1963	-----	-----	-----	-----	-----	-----	53.64	52.15	49.17	44.70	38.74	31.29
1964	-----	-----	-----	-----	-----	-----	61.07	35.68	26.46	19.65	11.31	5.36
1965	-----	-----	-----	-----	-----	-----	190.87	78.00	14.26	8.43	6.64	2.83
1966	-----	-----	-----	-----	-----	-----	101.35	91.19	13.80	4.10	3.03	2.23
1967	-----	-----	-----	-----	-----	-----	27.11	26.16	23.27	4.88	1.53	1.01
1968	13.83	13.43	10.60	10.14	9.44	2.72	17.67	10.95	10.59	9.59	2.83	1.21
1969	7.32	7.32	7.25	6.67	6.42	6.00	7.42	7.36	6.41	6.28	5.95	2.09
1970	6.00	5.33	5.08	5.08	4.75	4.29	2.99	2.96	2.96	2.68	2.55	2.39
1971	2.78	2.78	1.62	1.37	1.37	1.25	7.66	3.53	3.32	3.31	3.03	2.76
1972	6.37	2.35	2.26	1.65	1.53	1.50	1.76	1.76	1.45	1.38	1.37	1.15
1973	37.62	6.94	2.10	2.10	1.56	1.47	4.61	2.09	2.09	1.57	1.48	1.48
1974	19.00	16.87	3.58	0.72	0.72	0.48	11.64	2.64	1.03	1.03	0.84	0.80
1975	6.24	5.30	4.33	1.01	0.38	0.38	3.29	1.52	0.54	0.23	0.23	0.22
1976	83.18	2.39	2.09	1.49	0.57	0.14	7.47	6.84	6.12	1.26	0.34	0.34
1977	36.87	36.26	2.85	2.43	1.21	0.61	54.75	2.12	1.69	1.25	0.58	0.34
1978	19.41	19.34	18.37	2.44	2.08	1.14	23.12	20.98	2.25	1.69	1.12	0.48
1979	45.50	9.38	7.80	6.67	0.96	0.63	12.06	11.22	10.18	0.91	0.73	0.47
1980	60.06	54.86	8.16	7.65	6.61	1.74	50.92	5.35	5.31	4.41	0.60	0.34
1981	31.21	27.91	24.62	5.13	2.94	2.18	18.85	16.14	3.42	2.97	2.79	1.09
1982	8.61	7.85	6.32	5.38	1.31	0.89	15.93	8.45	5.92	1.41	1.16	0.65
1983	5.58	5.15	4.60	4.02	3.80	1.39	3.59	3.59	2.26	1.92	0.52	0.39
1984	6.25	4.16	2.98	2.34	1.71	1.13	2.19	1.95	1.74	1.47	1.17	0.23
1985	8.85	8.85	3.89	3.13	2.73	1.86	3.59	1.36	0.77	0.61	0.42	0.38
1986	5.85	3.36	3.18	1.12	0.88	0.77	2.84	2.19	0.66	0.44	0.39	0.29
1987	4.95	4.95	1.33	1.27	0.46	0.38	6.81	1.70	1.61	0.40	0.34	0.21
1988	3.38	1.83	1.79	0.80	0.67	0.35	1.50	1.50	0.85	0.77	0.14	0.09
1989	5.34	5.32	1.83	1.38	0.67	0.53	4.34	1.86	1.71	0.64	0.54	0.21
1990	7.69	6.83	6.83	1.11	0.78	0.20	3.88	3.83	1.12	0.92	0.26	0.17
1991	3.97	3.43	2.36	2.12	0.27	0.18	2.14	1.47	1.45	0.26	0.21	0.04
1992	1.18	0.78	0.60	0.49	0.42	0.09	0.93	0.68	0.39	0.33	0.06	0.04
1993	2.73	1.56	0.91	0.73	0.59	0.47	2.65	0.94	0.75	0.55	0.55	0.16
1994	4.93	4.23	1.55	0.55	0.40	0.30	8.02	3.09	0.64	0.27	0.27	0.20

Table 16. Stratified mean catch per tow (numbers) for haddock in Canadian offshore research vessel spring bottom trawl surveys on Georges Bank, 1986-1995[1].

Year	Age group 0	1	2	3	4	5	6	7	8	9+	Total
1986	0.00	4.06	0.22	6.05	1.07	0.19	0.29	0.34	0.37	0.42	13.01
1987	0.00	0.03	3.04	0.69	2.51	0.67	0.08	0.30	0.10	0.86	8.28
1988	0.00	1.47	0.05	8.53	0.17	2.85	0.18	0.17	0.11	0.50	14.03
1989	0.00	0.03	5.34	0.72	2.12	0.19	0.42	0.03	0.03	0.23	9.11
1990	0.00	0.93	0.11	9.87	0.13	3.36	0.23	1.09	0.13	0.34	16.19
1991	0.00	0.75	1.67	0.14	8.99	0.11	1.60	0.09	0.44	0.21	14.00
1992	0.00	3.30	2.95	1.13	0.17	3.82	0.03	1.06	0.04	0.58	13.08
1993	0.00	3.96	2.16	0.55	0.45	0.04	1.28	0.02	0.32	0.16	8.94
1994	0.00	3.32	11.52	4.08	0.42	0.24	0.02	0.70	0.01	0.27	20.59
1995	0.00	1.94	2.62	4.30	2.22	0.56	0.28	0.00	0.48	0.66	13.06

[1]S. Gavaris, personal communication.

Table 17. Estimates of instantaneous total mortality, Z and fishing mortality, F[1] for the Georges Bank haddock stock for eight time periods, 1963 - 1993, derived from NEFSC offshore spring and autumn bottom trawl survey data[2].

	Spring		Autumn		Geometric Mean	
Time Period	Z	F	Z	F	Z	F
1963-1967	N/A	N/A	1.03	0.83	1.03	0.83
1968-1971	0.50	0.30	0.68	0.48	0.59	0.38
1972-1975	0.53	0.33	0.63	0.43	0.58	0.38
1976-1979	0.18	—	0.73	0.53	0.36	0.16
1980-1983	0.82	0.62	0.84	0.64	0.83	0.63
1984-1986	0.48	0.28	0.64	0.44	0.55	0.35
1987-1990	0.65	0.45	0.58	0.38	0.61	0.41
1991-1993	0.86	0.66	0.97	0.77	0.91	0.71

[1]Instantaneous natural mortality (M) assumed to be 0.20.
[2]Estimates derived from:
Georges Bank Spring: $\ln(\Sigma \text{ age } 4+ \text{ for years } i \text{ to } j \;/\; \Sigma \text{ age } 5+ \text{ for years } i+1 \text{ to } j+1)$
Georges Bank Autumn: $\ln(\Sigma \text{ age } 3+ \text{ for years } i-1 \text{ to } j-1 \;/\; \Sigma \text{ age } 4+ \text{ for years } i \text{ to } j)$

Table 18. Maturation ogives for female Georges Bank haddock presented as percent mature at age, 1963-1994.

Year	Age 1	2	3	4+	Source
1963	0	0	78	100	Clark (1959)
1964	0	0	78	100	Clark (1959)
1965	0	0	78	100	Clark (1959)
1966	0	0	78	100	Clark (1959)
1967	0	0	78	100	Clark (1959)
1968	0	28	76	100	Clark et al. (1982)
1969	0	28	76	100	Clark et al. (1982)
1970	0	28	76	100	Clark et al. (1982)
1971	0	28	76	100	Clark et al. (1982)
1972	0	28	76	100	Clark et al. (1982)
1973	0	34	92	100	Clark et al. (1982)
1974	0	34	92	100	Clark et al. (1982)
1975	0	34	92	100	Clark et al. (1982)
1976	0	34	92	100	Clark et al. (1982)
1977	0	61	100	100	Overholtz (1987)
1978	0	26	99	100	Overholtz (1987)
1979	0	8	71	100	Overholtz (1987)
1980	0	41	100	100	Overholtz (1987)
1981	0	52	94	100	Overholtz (1987)
1982	0	31	67	100	Overholtz (1987)
1983	0	11	39	100	Overholtz (1987)
1984	12	33	94	100	O'Brien (pers. comm.)
1985	26	77	97	100	O'Brien et al. (1993)
1986	26	77	97	100	O'Brien et al. (1993)
1987	26	77	97	100	O'Brien et al. (1993)
1988	26	77	97	100	O'Brien et al. (1993)
1989	26	77	97	100	O'Brien et al. (1993)
1990	16	75	98	100	Current assessment
1991	16	75	98	100	Current assessment
1992	16	75	98	100	Current assessment
1993	06	43	90	100	Current assessment
1994	06	43	90	100	Current assessment

Table 19. Separable VPA analysis for Georges Bank haddock, 1980-1994.

Terminal Year: 1994 At 09:05:52

Separable analysis from 1980 to 1994 on ages 1 to 8 with Terminal F of 0.300 on age 4 and Terminal S of 1.000

Initial sum of squared residuals was 622.259 and final sum of squared residuals is 66.362 after 110 iterations

Matrix of Residuals

Years	1980/81	1981/82	1982/83	1983/84
Ages				
1/ 2	0.230	-1.576	0.135	-0.821
2/ 3	3.479	0.097	0.434	0.260
3/ 4	-1.233	0.628	0.474	0.242
4/ 5	-0.547	0.083	-0.080	0.482
5/ 6	0.154	-0.282	-0.332	0.241
6/ 7	-0.277	-0.113	0.257	-0.180
7/ 8	0.527	0.339	-0.388	-0.559
	0.000	0.000	0.000	0.000
WTS	1.000	1.000	1.000	1.000

Years	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94		WTS
Ages												
1/ 2	-4.357	-0.683	-0.166	-0.256	-0.287	1.222	0.579	2.248	1.955	1.555	-0.221	0.149
2/ 3	-1.489	0.015	-0.656	0.385	-0.473	0.356	-1.582	0.801	-0.198	-1.420	0.009	0.196
3/ 4	0.241	0.604	0.310	0.062	0.559	-0.664	-0.348	-0.424	-0.325	-0.117	0.009	0.452
4/ 5	0.060	-0.224	0.155	0.445	-0.717	-0.164	0.355	0.053	-0.409	0.517	0.009	0.643
5/ 6	0.053	0.366	0.142	-0.407	0.198	0.101	0.474	-0.490	0.065	-0.274	0.009	0.818
6/ 7	0.373	-0.359	-0.051	-0.083	0.252	0.268	-0.136	-0.317	0.143	0.234	0.009	1.000
7/ 8	0.576	0.044	-0.232	0.099	-0.107	-0.301	-0.151	0.590	-0.058	-0.372	0.009	0.653
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.169	
WTS	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000		

Fishing Mortalities (F)

	1980	1981	1982	1983	1984
F-values	0.4039	0.3662	0.2874	0.2266	0.3029

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
F-values	0.3051	0.2700	0.2458	0.3243	0.2485	0.3030	0.4029	0.5356	0.5346	0.3000

Selection-at-age (S)

	1	2	3	4	5	6	7	8
S-values	0.0010	0.3960	0.7612	1.0000	1.1258	1.1710	1.0229	1.0000

Table 20. Stock size, fishing mortality, and spawning stock biomass (SSB) derived from the ADAPT calibration.

STOCK NUMBERS (Jan 1) in thousands - GBHADD5

Age	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
1 ■	190704	471879	33154	4137	12952	422	988	4660	369	8515
2 ■	32266	153502	377202	18457	3284	9564	338	807	3774	301
3 ■	32743	22755	111258	194982	8919	2536	5121	267	518	1845
4 ■	45820	20095	14510	50829	68421	4687	1435	2656	204	222
5 ■	29031	27424	12131	7033	24272	37318	2099	770	1659	131
6 ■	9186	16350	14561	5959	3254	10518	17416	1127	462	1097
7 ■	5595	5526	8144	5868	2534	1570	5445	8872	729	155
8 ■	2794	3309	2640	3255	2694	1177	682	3034	5175	339
9 ■	4217	4251	3258	2201	2031	2163	1712	1874	3244	6308
1+■	352356	725092	576859	292720	128362	69955	35237	24067	16133	18913

Age	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1 ■	19414	10540	7654	103233	13783	6058	83883	10105	7200	2460
2 ■	6830	13579	8588	6093	84389	11284	4959	68676	8266	5894
3 ■	245	3714	7208	6096	4560	51371	8550	4037	28178	5191
4 ■	1104	198	2447	4215	4493	3564	29034	5438	2991	13118
5 ■	109	554	160	1664	2655	3063	2642	17284	3570	1697
6 ■	78	41	391	127	1167	1708	1995	1688	8673	2075
7 ■	789	37	32	282	104	632	930	1262	845	4774
8 ■	57	577	28	22	210	82	392	477	540	392
9 ■	1678	2700	622	623	594	389	186	250	318	404
1+■	30304	31940	27129	122354	111956	78152	132572	109218	60581	36005

Age	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
1 ■	3039	17096	1731	14467	1565	16049	1160	2489	1983	8350
2 ■	2013	2488	13997	1418	11840	1281	13136	950	2036	1618
3 ■	3772	1454	1953	9283	1112	7888	1002	9612	768	1262
4 ■	2772	2352	922	1101	5057	793	4301	742	6562	546
5 ■	7363	1645	1268	579	700	2681	528	2728	452	3428
6 ■	1036	4002	988	621	342	463	1353	303	1448	278
7 ■	1184	602	1936	603	352	214	244	784	160	815
8 ■	2896	801	281	1109	358	208	126	158	481	65
9 ■	273	1614	543	248	452	341	201	150	223	222
1+■	24347	32056	23619	29429	21777	29918	22051	17916	14113	16584

Age	1993	1994	1995
1 ■	14438	7509	7877
2 ■	6830	11815	6148
3 ■	1101	5330	9443
4 ■	743	585	3594
5 ■	328	338	329
6 ■	1425	174	223
7 ■	127	571	106
8 ■	375	70	350
9 ■	177	195	162
1+■	25545	26585	28232

Table 20. (continued)

FISHING MORTALITY - GBHADD5

Age	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
1 ■	0.02	0.02	0.39	0.03	0.10	0.02	0.00	0.01	0.00	0.02	0.16	0.00	0.03	0.00	0.00	0.00
2 ■	0.15	0.12	0.46	0.53	0.06	0.42	0.04	0.24	0.52	0.01	0.41	0.43	0.14	0.09	0.30	0.08
3 ■	0.29	0.25	0.58	0.85	0.44	0.37	0.46	0.07	0.65	0.31	0.01	0.22	0.34	0.11	0.05	0.37
4 ■	0.31	0.30	0.52	0.54	0.41	0.60	0.42	0.27	0.24	0.52	0.49	0.01	0.19	0.26	0.18	0.10
5 ■	0.37	0.43	0.51	0.57	0.64	0.56	0.42	0.31	0.21	0.32	0.78	0.15	0.03	0.15	0.24	0.23
6 ■	0.31	0.50	0.71	0.65	0.53	0.46	0.47	0.24	0.89	0.13	0.55	0.06	0.13	0.00	0.41	0.41
7 ■	0.33	0.54	0.72	0.58	0.57	0.63	0.38	0.34	0.57	0.81	0.11	0.06	0.15	0.09	0.04	0.28
8 ■	0.34	0.42	0.61	0.56	0.47	0.55	0.45	0.32	0.38	0.24	0.35	0.11	0.17	0.22	0.23	0.21
9 ■	0.34	0.42	0.61	0.56	0.47	0.55	0.45	0.32	0.38	0.24	0.35	0.11	0.17	0.22	0.23	0.21
Mean F, ages 4-7	0.33	0.44	0.62	0.59	0.54	0.56	0.42	0.29	0.48	0.45	0.48	0.07	0.13	0.13	0.22	0.26

Age	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1 ■	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	0.00	0.00	0.00
2 ■	0.01	0.69	0.27	0.25	0.12	0.04	0.21	0.04	0.21	0.05	0.11	0.01	0.28	0.18	0.05	0.02
3 ■	0.25	0.10	0.56	0.43	0.27	0.26	0.37	0.41	0.14	0.41	0.10	0.18	0.14	0.33	0.43	0.19
4 ■	0.32	0.22	0.37	0.38	0.32	0.42	0.26	0.25	0.43	0.21	0.26	0.30	0.45	0.31	0.59	0.38
5 ■	0.25	0.49	0.34	0.29	0.41	0.31	0.51	0.33	0.21	0.48	0.36	0.43	0.29	0.68	0.43	0.21
6 ■	0.26	0.49	0.40	0.36	0.34	0.53	0.29	0.37	0.27	0.44	0.35	0.44	0.38	0.58	0.72	0.29
7 ■	0.47	0.65	0.57	0.30	0.19	0.56	0.36	0.32	0.33	0.33	0.23	0.29	0.70	0.58	0.40	0.29
8 ■	0.32	0.44	0.39	0.35	0.36	0.46	0.37	0.31	0.40	0.42	0.28	0.39	0.44	0.62	0.63	0.29
9 ■	0.32	0.44	0.39	0.35	0.36	0.46	0.37	0.31	0.40	0.42	0.28	0.39	0.44	0.62	0.63	0.29
Mean F, ages 4-7	0.33	0.46	0.42	0.33	0.32	0.46	0.36	0.32	0.31	0.37	0.30	0.37	0.46	0.54	0.54	0.29

Table 20. (continued)

SSB AT THE START OF THE SPAWNING SEASON - males & females (MT)

Age	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
1 ■	0	0	0	0	0	0	0	0	0	0
2 ■	0	0	0	0	0	1675	61	164	756	66
3 ■	24230	15656	65967	91729	4933	1433	3118	185	411	1651
4 ■	56089	23010	14887	48135	60257	4293	1636	3441	266	304
5 ■	38627	36347	15695	8787	26342	41983	2730	1303	3213	236
6 ■	16463	25241	20958	8947	5063	15407	26008	2066	873	2669
7 ■	10878	10436	13801	10289	4575	2780	10823	17569	1590	354
8 ■	6533	7058	5445	6849	5609	2397	1525	7607	12672	961
9 ■	11435	10811	8271	5784	5324	5124	5277	6176	10447	20670
1+■	164256	128559	145025	180521	112102	75092	51178	38511	30227	26912

Age	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1 ■	0	0	0	0	0	0	0	0	0	0
2 ■	1594	3143	2251	1510	17992	2452	1132	12803	1680	1070
3 ■	272	4215	7623	6065	4147	45707	6784	3337	20354	4037
4 ■	1789	359	4456	6763	7091	5669	44393	7285	3863	17336
5 ■	189	1247	341	3692	5542	6771	5346	30457	6218	3124
6 ■	183	116	1038	315	2925	4329	5267	3778	18149	4544
7 ■	2306	126	113	862	351	1845	2733	3432	2256	12507
8 ■	170	1955	105	87	724	286	1231	1491	1775	1308
9 ■	5768	10652	2454	2769	2662	1795	798	825	1219	1438
1+■	12271	21813	18381	22063	41434	68854	67683	63406	55515	45365

Age	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
1 ■	0	372	84	1185	110	1145	112	177	123	464
2 ■	290	426	5559	572	5034	602	5720	484	1188	911
3 ■	3130	1416	1856	8976	1149	6934	1086	9827	779	1520
4 ■	3964	3191	1327	1568	7117	1111	5945	1064	9149	732
5 ■	12886	2906	2251	1144	1281	4587	886	4533	789	5486
6 ■	2266	8107	2136	1422	790	926	2715	613	2968	536
7 ■	3217	1393	4814	1500	902	524	617	1863	343	1879
8 ■	8298	2262	809	3178	1029	578	362	425	1201	163
9 ■	1012	5093	1792	827	1669	1157	679	539	825	773
1+■	35062	25166	20627	20373	19080	17563	18122	19525	17365	12463

Age	1993	1994
1 ■	413	81
2 ■	2189	4165
3 ■	1206	6071
4 ■	1152	998
5 ■	542	733
6 ■	2717	350
7 ■	283	1379
8 ■	926	180
9 ■	577	691
1+■	10003	14649

Table 21. Georges Bank haddock retrospective ADAPT analyses for fishing mortality and spawning stock biomass (SSB), 1987-1994.

Fishing Mortality

Year	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1987	0.33	0.44	0.62	0.59	0.53	0.56	0.43	0.29	0.48	0.44	0.48	0.07	0.12	0.13	0.22	0.25	0.32	0.46	0.42	0.33	0.31	0.45	0.35	0.32	0.36							
1988	0.33	0.44	0.62	0.59	0.53	0.56	0.43	0.29	0.48	0.44	0.48	0.07	0.12	0.13	0.22	0.25	0.32	0.46	0.42	0.33	0.32	0.45	0.35	0.31	0.31	0.41						
1989	0.33	0.44	0.62	0.59	0.53	0.56	0.43	0.29	0.48	0.44	0.48	0.07	0.12	0.13	0.22	0.25	0.32	0.46	0.42	0.34	0.32	0.46	0.36	0.33	0.32	0.40	0.32					
1990	0.33	0.44	0.62	0.59	0.53	0.56	0.43	0.29	0.48	0.44	0.48	0.07	0.12	0.13	0.22	0.25	0.32	0.47	0.42	0.34	0.32	0.46	0.37	0.33	0.33	0.40	0.34	0.49				
1991	0.33	0.44	0.62	0.59	0.53	0.56	0.43	0.29	0.48	0.44	0.48	0.07	0.12	0.13	0.22	0.25	0.32	0.47	0.42	0.34	0.32	0.47	0.38	0.34	0.34	0.43	0.36	0.52	0.72			
1992	0.33	0.44	0.62	0.59	0.53	0.56	0.43	0.29	0.48	0.44	0.48	0.07	0.12	0.13	0.22	0.25	0.32	0.46	0.42	0.33	0.32	0.46	0.36	0.32	0.32	0.38	0.32	0.41	0.53	0.86		
1993	0.33	0.44	0.62	0.59	0.53	0.56	0.43	0.29	0.48	0.44	0.48	0.07	0.12	0.13	0.22	0.25	0.32	0.46	0.42	0.33	0.32	0.45	0.36	0.32	0.31	0.36	0.30	0.37	0.46	0.61	0.64	
1994	0.33	0.44	0.62	0.59	0.53	0.56	0.43	0.29	0.48	0.44	0.48	0.07	0.12	0.13	0.22	0.25	0.32	0.46	0.42	0.33	0.32	0.45	0.35	0.31	0.31	0.36	0.29	0.36	0.44	0.55	0.56	0.35

Spawning Stock Biomass

Year	1987	1988	1989	1990	1991	1992	1993	1994
1963	164256	164256	164254	164254	164252	164255	164256	164256
1964	128560	128560	128558	128557	128555	128559	128560	128560
1965	145025	145025	145022	145021	145017	145023	145025	145026
1966	180522	180522	180515	180512	180504	180517	180522	180524
1967	112102	112102	112094	112091	112082	112097	112102	112104
1968	75093	75092	75083	75080	75070	75087	75092	75095
1969	51179	51179	51168	51165	51154	51172	51179	51181
1970	38512	38512	38500	38496	38483	38504	38512	38515
1971	30228	30228	30215	30211	30197	30220	30228	30231
1972	26914	26914	26899	26894	26878	26904	26913	26917
1973	12272	12271	12264	12261	12253	12266	12271	12273
1974	21815	21814	21798	21793	21776	21804	21814	21818
1975	18383	18382	18370	18366	18352	18374	18382	18385
1976	22065	22064	22044	22038	22016	22052	22064	22069
1977	41439	41436	41392	41378	41327	41408	41437	41448
1978	68870	68856	68763	68730	68616	68798	68863	68888
1979	67710	67687	67554	67506	67347	67604	67695	67730
1980	63412	63420	63237	63183	62980	63303	63420	63465
1981	55494	55531	55285	55220	54950	55374	55531	55591
1982	45369	45375	45091	45003	44676	45198	45386	45459
1983	35117	35089	34770	34666	34313	34887	35089	35167
1984	25159	25276	24845	24753	24367	24976	25196	25280
1985	19842	20632	20292	20123	19658	20425	20672	20769
1986	18570	20110	20123	19727	19073	20108	20444	20570
1987	16856	18538	19266	18417	17343	18654	19160	19337
1988		16496	17996	16913	15174	16907	17637	17908
1989			18630	17878	14883	17436	18319	18678
1990				19730	15499	18945	19895	20292
1991					13202	17100	17993	18366
1992						12174	13337	13725
1993							11199	11533
1994								16057

Table 22. Yield and spawning stock biomass per recruit for Georges Bank haddock, 1993.

The NEFC Yield and Stock Size per Recruit Program - PDBYPRC
PC Ver.1.2 [Method of Thompson and Bell (1934)] 1-Jan-1992

Run Date: 4- 6-1995; Time: 13:49:30.57
GEORGE BANK HADDOCK - 1994 RUN 14 AVE WTS, FPAT AND MAT VECTORS

Proportion of F before spawning: .2500
Proportion of M before spawning: .2500
Natural Mortality is Constant at: .200
Initial age is: 1; Last age is: 9
Last age is a PLUS group;
Original age-specific PRs, Mats, and Mean Wts from file:
= = > gbhad.dat

Age-specific Input data for Yield per Recruit Analysis

Age	Fish Mort Pattern	Nat Mort Pattern	Proportion Mature	Average Weights Catch	Stock
1	.0000	1.0000	.0800	.491	.486
2	.0700	1.0000	.4600	1.007	.676
3	.6500	1.0000	.8800	1.448	1.197
4	1.0000	1.0000	1.0000	1.865	1.621
5	1.0000	1.0000	1.0000	2.235	2.021
6	1.0000	1.0000	1.0000	2.622	2.424
7	1.0000	1.0000	1.0000	2.949	2.780
8	1.0000	1.0000	1.0000	3.394	3.192
9+	1.0000	1.0000	1.0000	4.015	4.015

Summary of Yield per Recruit Analysis for:

GEORGE BANK HADDOCK - 1994 RUN 14 AVE WTS, FPAT AND MAT VECTORS

Slope of the Yield/Recruit Curve at F=0.00: --> 8.9523
F level at slope=1/10 of the above slope (F0.1): ----> .240
Yield/Recruit corresponding to F0.1: ----> .7661
F level to produce Maximum Yield/Recruit (Fmax): ----> 1.175
Yield/Recruit corresponding to Fmax: ----> .8980
F level at 30 % of Max Spawning Potential (F30): ----> .349
SSB/Recruit corresponding to F30: -------> 2.7922

Table 22. (continued)

Listing of Yield per Recruit Results for:

GEORGE BANK HADDOCK - 1994 RUN 14 AVE WTS, FPAT AND MAT VECTORS

	FMORT	TOTCTHN	TOTCTHW	TOTSTKN	TOTSTKW	SPNSTKN	SPNSTKW	% MSP
	.000	.00000	.00000	5.5167	10.6281	3.8754	9.3084	100.00
	.100	.21341	.52958	4.4548	6.9420	2.8099	5.6716	60.93
	.200	.32111	.72447	3.9212	5.2504	2.2730	4.0136	43.12
F0.1	.240	.35044	.76609	3.7764	4.8204	2.1269	3.5938	38.61
	.300	.38649	.80964	3.5990	4.3147	1.9476	3.1011	33.32
F30%	.349	.41024	.83355	3.4824	3.9970	1.8295	2.7922	30.00
	.400	.43066	.85101	3.3825	3.7347	1.7281	2.5376	27.26
	.500	.46269	.87259	3.2266	3.3456	1.5692	2.1603	23.21
	.600	.48711	.88442	3.1085	3.0687	1.4484	1.8922	20.33
	.700	.50645	.89107	3.0157	2.8626	1.3529	1.6926	18.18
	.800	.52220	.89481	2.9406	2.7034	1.2753	1.5383	16.53
	.900	.53534	.89683	2.8784	2.5768	1.2108	1.4156	15.21
	1.000	.54650	.89779	2.8260	2.4737	1.1560	1.3154	14.13
	1.100	.55614	.89807	2.7811	2.3880	1.1089	1.2321	13.24
Fmax	1.175	.56253	.89800	2.7515	2.3329	1.0777	1.1784	12.66
	1.200	.56457	.89793	2.7421	2.3156	1.0678	1.1616	12.48
	1.300	.57202	.89751	2.7078	2.2535	1.0315	1.1010	11.83
	1.400	.57868	.89690	2.6774	2.1997	.9991	1.0483	11.26
	1.500	.58467	.89617	2.6503	2.1524	.9700	1.0021	10.77
	1.600	.59011	.89537	2.6258	2.1106	.9437	.9610	10.32
	1.700	.59507	.89453	2.6036	2.0733	.9198	.9243	9.93
	1.800	.59963	.89366	2.5834	2.0398	.8978	.8912	9.57
	1.900	.60384	.89278	2.5648	2.0095	.8776	.8613	9.25
	2.000	.60773	.89191	2.5477	1.9819	.8588	.8340	8.96

Table 23. Short-term forecasts of SSB and landings for Georges Bank haddock under four fishing mortality scenarios, 1995-1997.

Age-specific input data for short-term projections:

Age	Fish Mort Pattern	Nat Mort Pattern	Proportion Mature	Average Weights Catch	Stock
1	0.0000	1.0000	0.0600	0.605	0.436
2	0.0700	1.0000	0.4300	1.130	0.803
3	0.6500	1.0000	0.9000	1.540	1.276
4	1.0000	1.0000	1.0000	1.885	1.668
5	1.0000	1.0000	1.0000	2.152	1.962
6	1.0000	1.0000	1.0000	2.588	2.371
7	1.0000	1.0000	1.0000	2.820	2.692
8	1.0000	1.0000	1.0000	3.132	3.045
9+	1.0000	1.0000	1.0000	4.195	4.194

Short-term forecasts

			Median Landings and SSB				
Option	Basis	F	SSB (95)	Landings (95)	SSB (96)	Landings (96)	SSB (97)
A	Close	0.00	21.2	0.0	26.8	0.0	33.0
B	$F_{(95)}$	0.18	21.2	3.1	25.8	4.1	28.2
C	$F_{0.1}$	0.24	21.2	3.1	25.5	5.4	26.7
D	$F_{30\%}$	0.35	21.2	3.1	24.9	7.4	24.3

Table 24. Long-term forecasts of SSB and landings for Georges Bank haddock under four fishing mortality scenarios, 1995 2014.

Age-specific input data for long-term projections:

Age	Fish Mort Pattern	Nat Mort Pattern	Proportion Mature	Average Weights Catch	Stock
1	0.0000	1.0000	0.0800	0.491	0.343
2	0.0700	1.0000	0.4600	1.007	0.676
3	0.6500	1.0000	0.8800	1.448	1.197
4	1.0000	1.0000	1.0000	1.865	1.621
5	1.0000	1.0000	1.0000	2.235	1.021
6	1.0000	1.0000	1.0000	2.622	2.424
7	1.0000	1.0000	1.0000	2.949	2.780
8	1.0000	1.0000	1.0000	3.394	3.192
9+	1.0000	1.0000	1.0000	4.015	4.015

Long-term forecasts

			Median Landings and SSB			
Option	Basis	F	SSB(2004)	Landings(2004)	SSB(2014)	Landings(2014)
A	Close	0.00	79.8	0.0	120.0	0.0
B	$F_{(95)}$	0.18	44.2	6.9	49.6	7.8
C	$F_{0.1}$	0.24	37.6	7.7	40.2	8.3
D	$F_{30\%}$	0.35	28.9	8.3	29.7	8.6

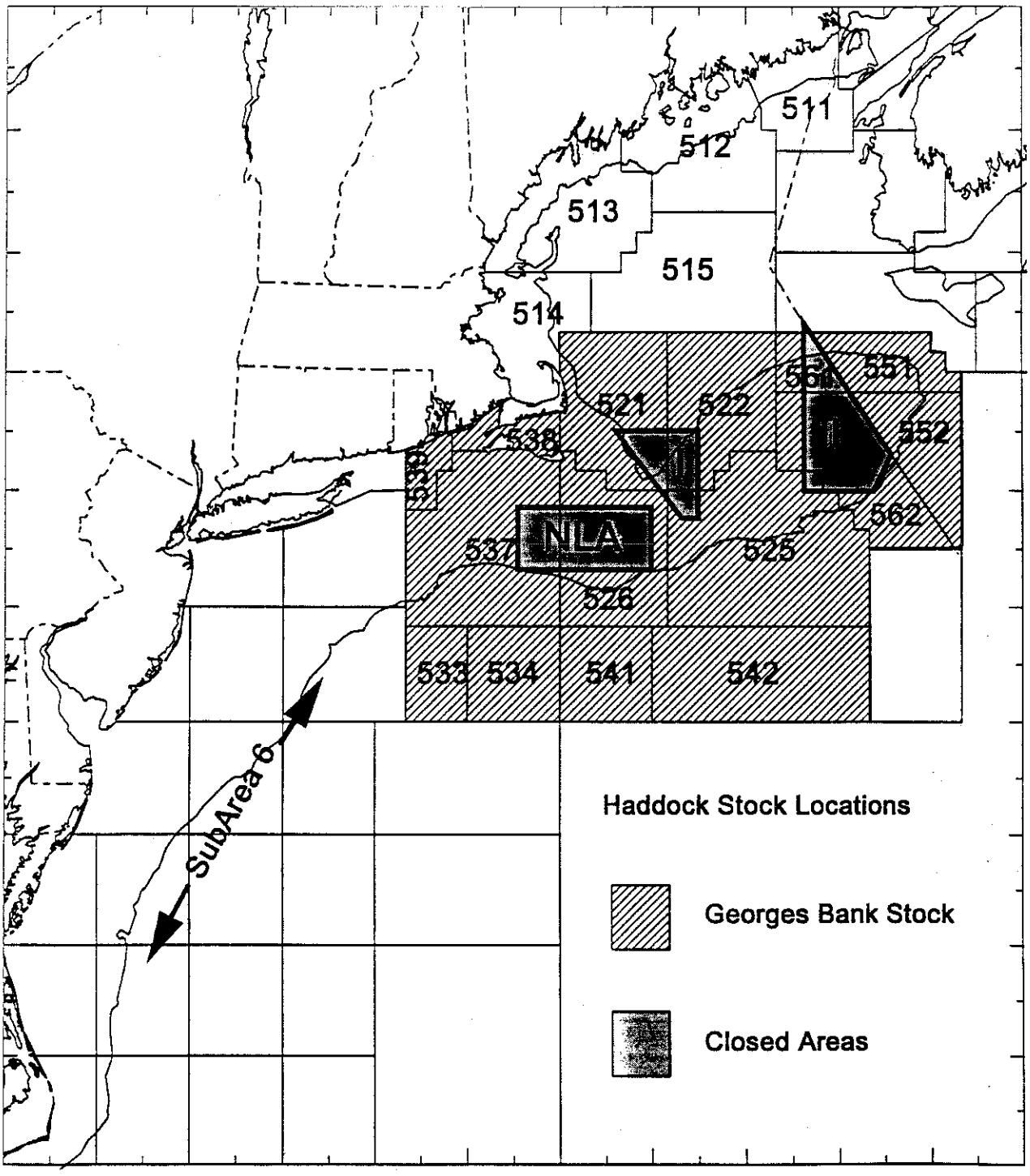


Figure 1. NEFSC statistical areas used in pooling commercial length and age samples, and closed areas I, II, and Nantucket Lightship Area.

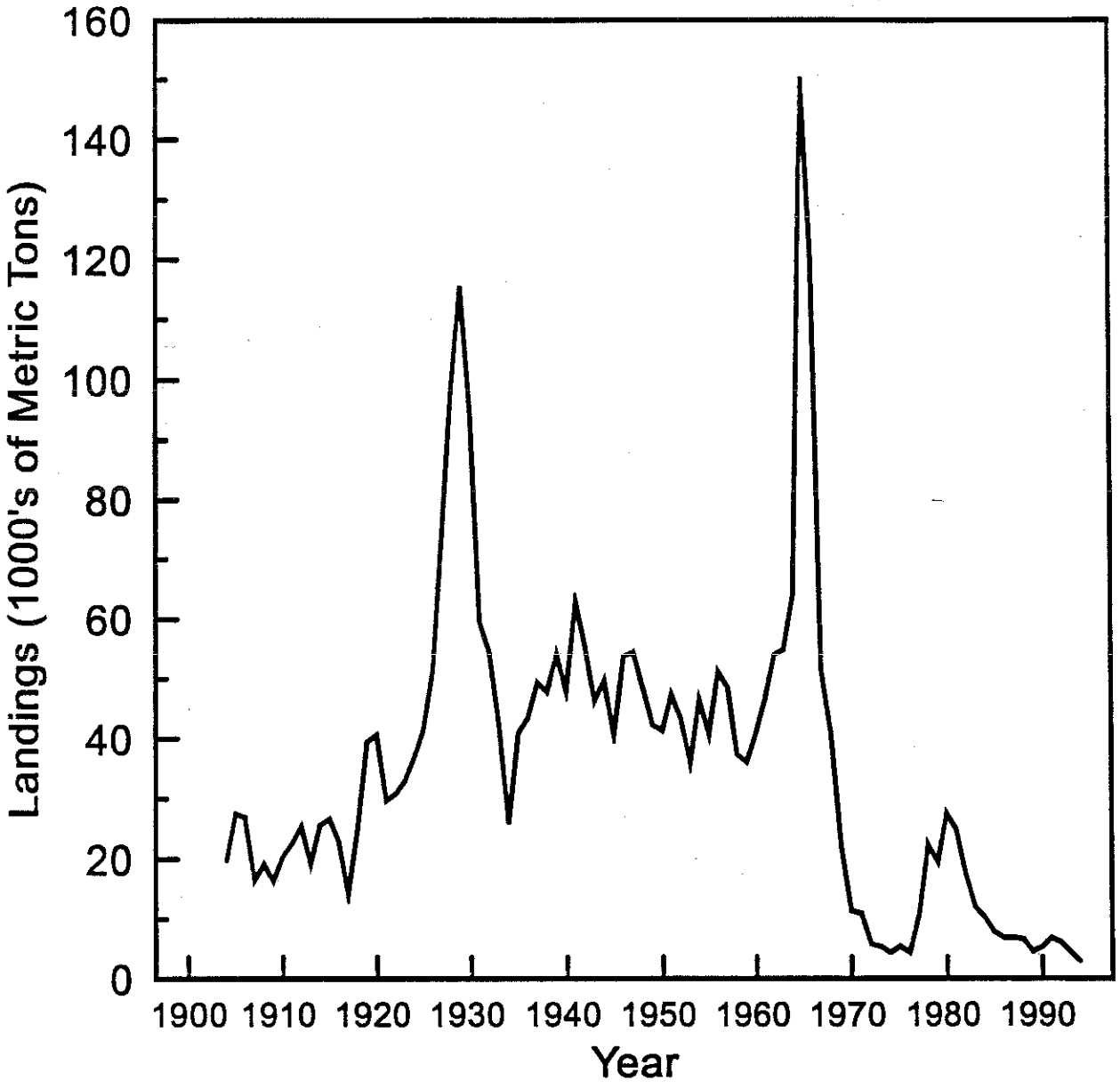


Figure 2. Total commercial landings of haddock from Georges Bank and South, 1904-1994.

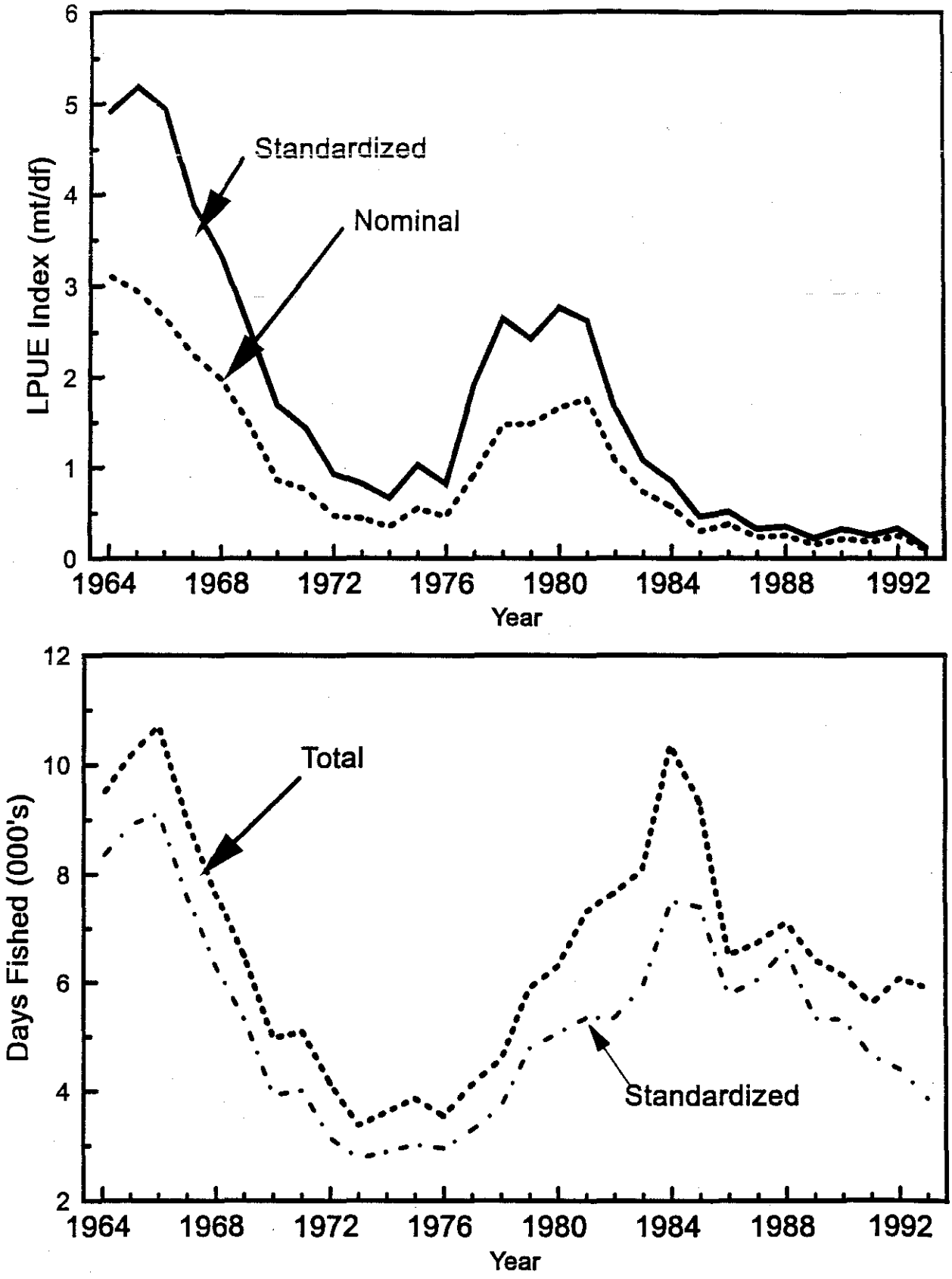


Figure 3. USA standardized and nominal landings per unit effort (LPUE; top panel) and fishing effort (days fished; bottom panel) for Georges Bank haddock, 1964-1993.

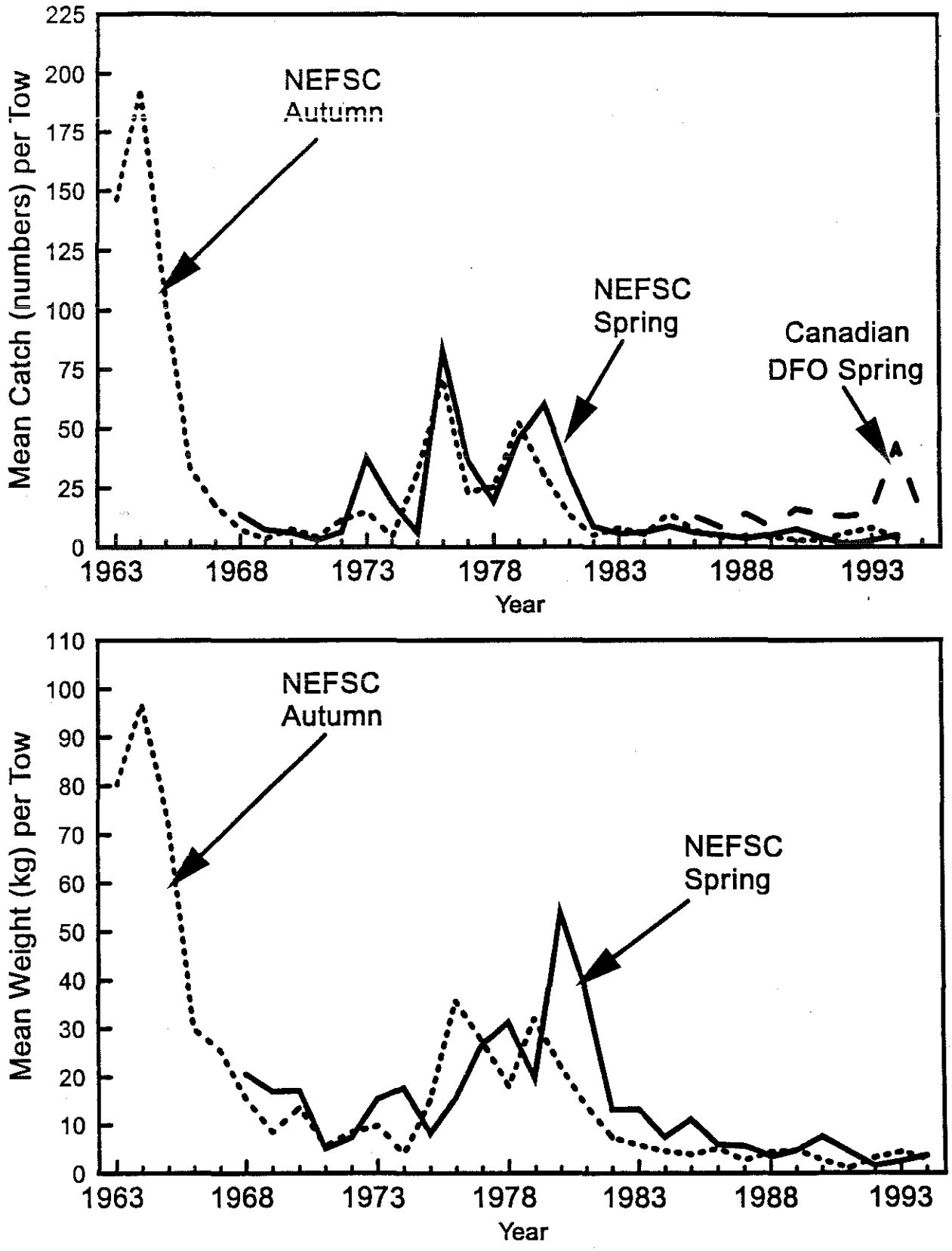


Figure 4. NEFSC and Canadian DFO bottom trawl survey abundance (number per tow; top panel) and biomass (kg per tow; bottom panel) for Georges Bank haddock, 1963-1995.

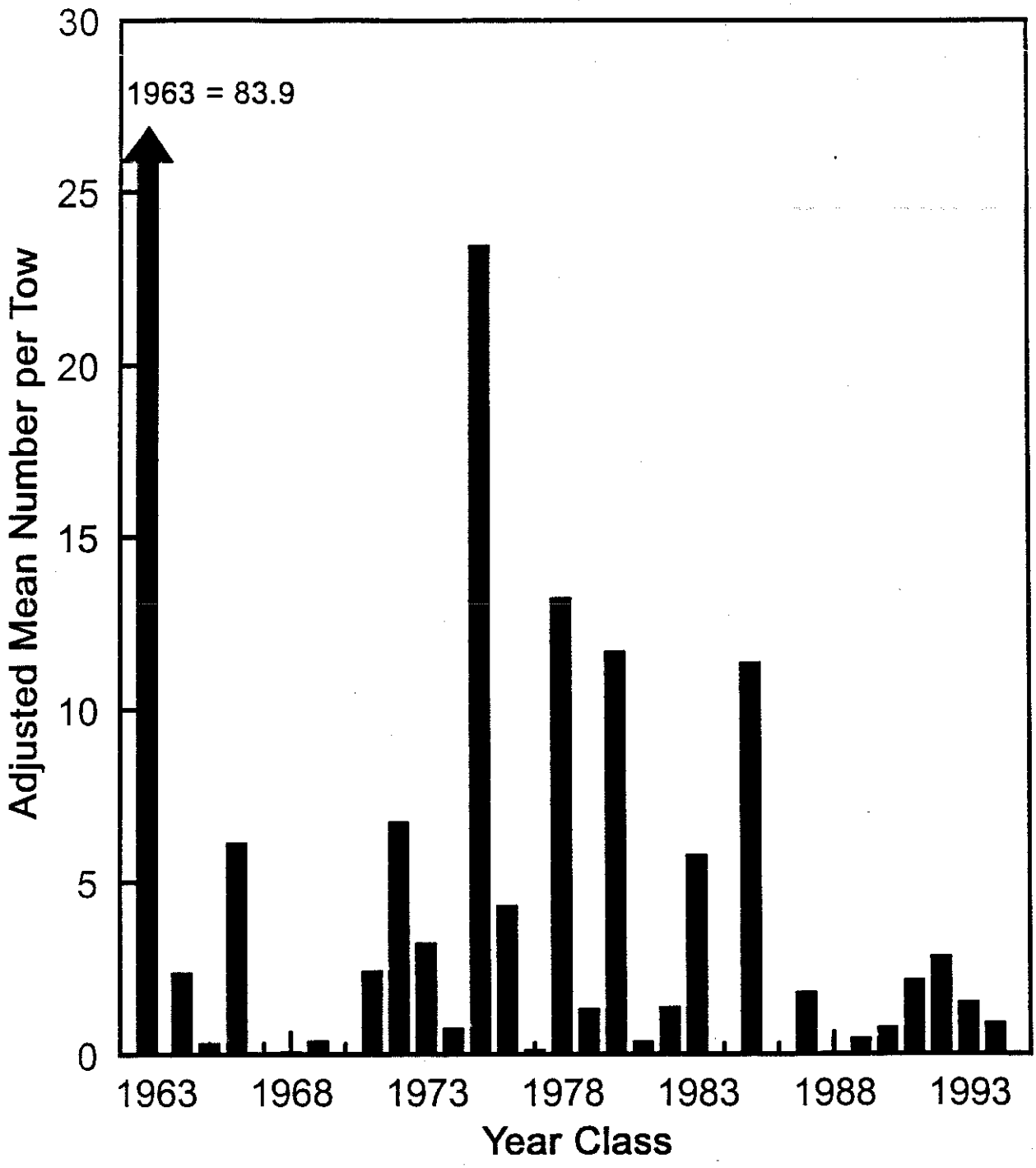


Figure 5. Mean number per tow of age 0 haddock sampled during the NEFSC Autumn research vessel survey from Georges Bank and South.

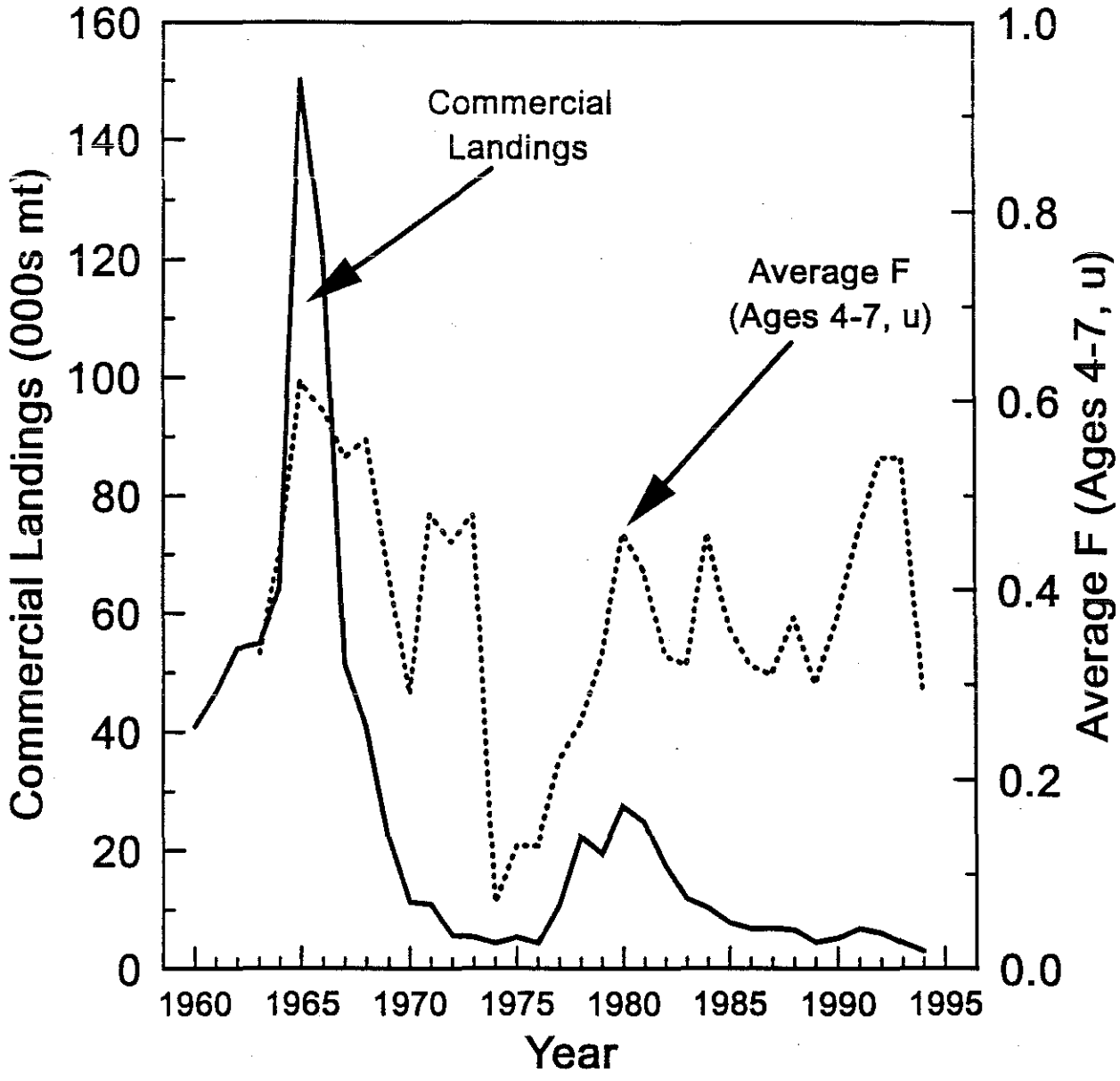


Figure 6. Trends in commercial landings (metric tons, live weight) and fully-recruited fishing mortality (mean F, 4-7, u) for Georges Bank haddock, 1963-1994.

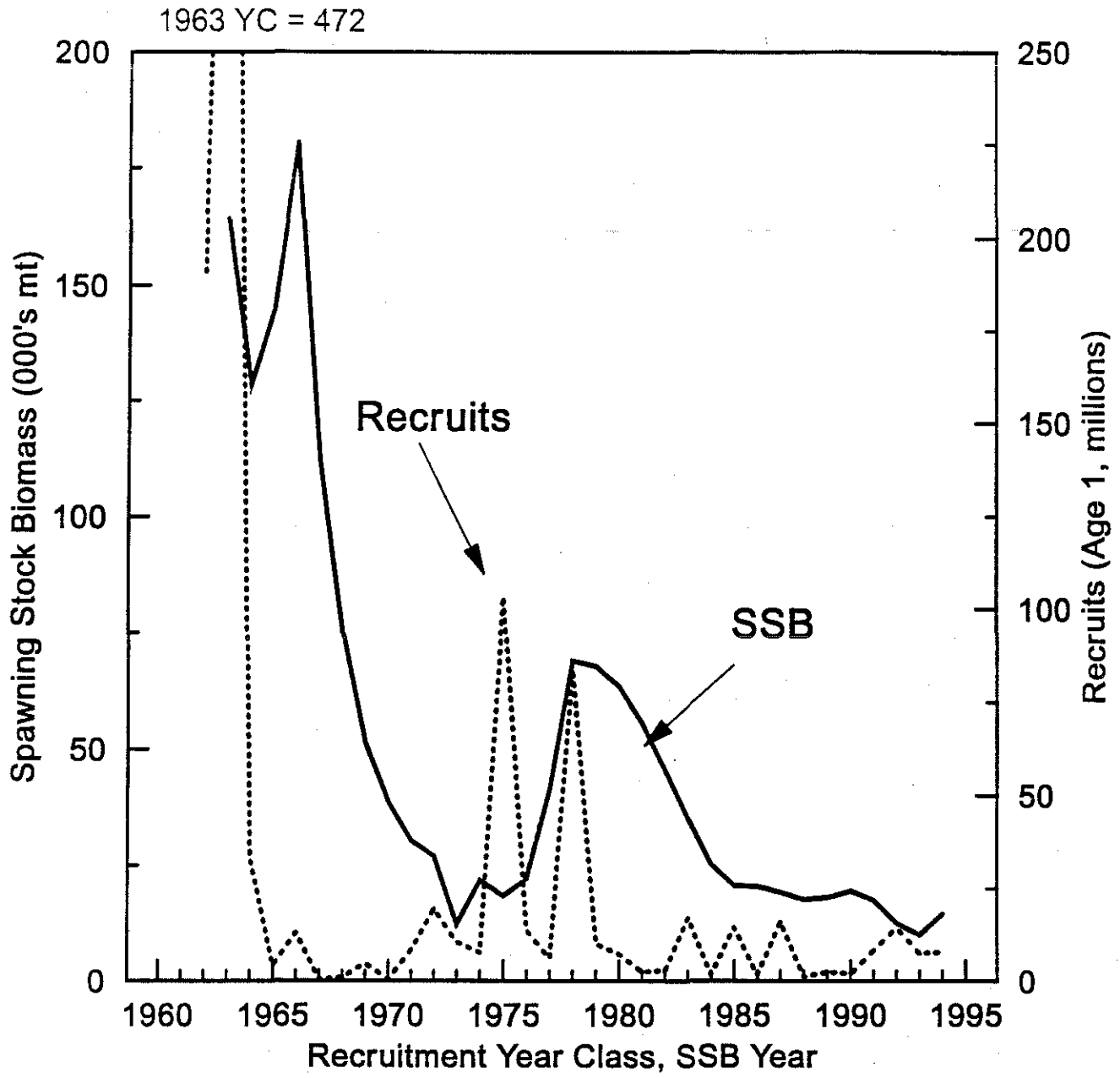


Figure 7. Trends in spawning stock biomass (SSB, 000's mt) and recruitment (Age 1, millions of fish) for Georges Bank haddock, 1962-1994.

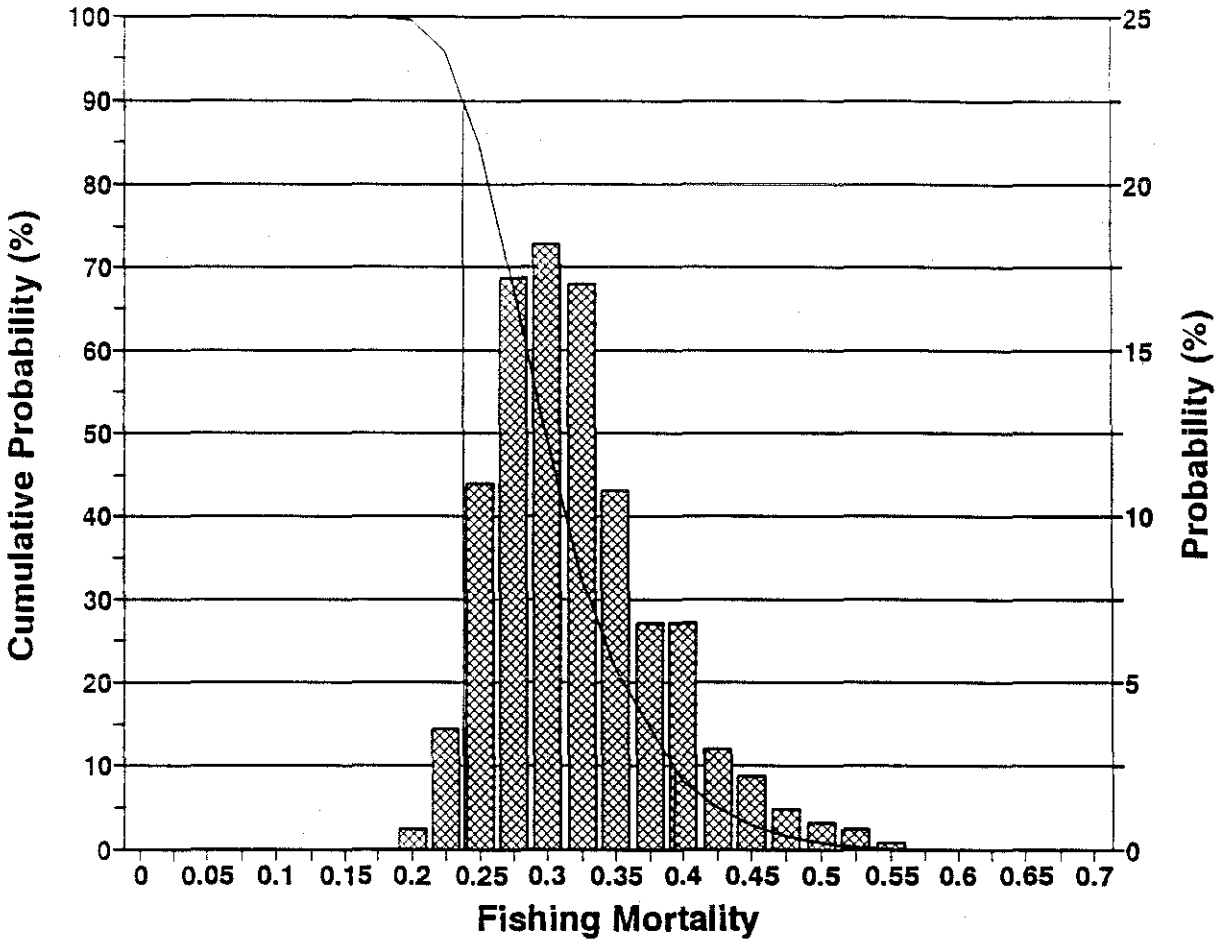


Figure 8. Precision of the estimates of the instantaneous rate of fishing mortality (F) on the fully recruited ages(age 4+) in 1994 for Georges Bank haddock. The vertical bars display both the range of the estimator and the probability of individual values within the range. The solid line gives the probability that F is greater than any selected value on the X-axis. The precision estimates were derived from 500 bootstrap replications of the final ADAPT VPA formulation.

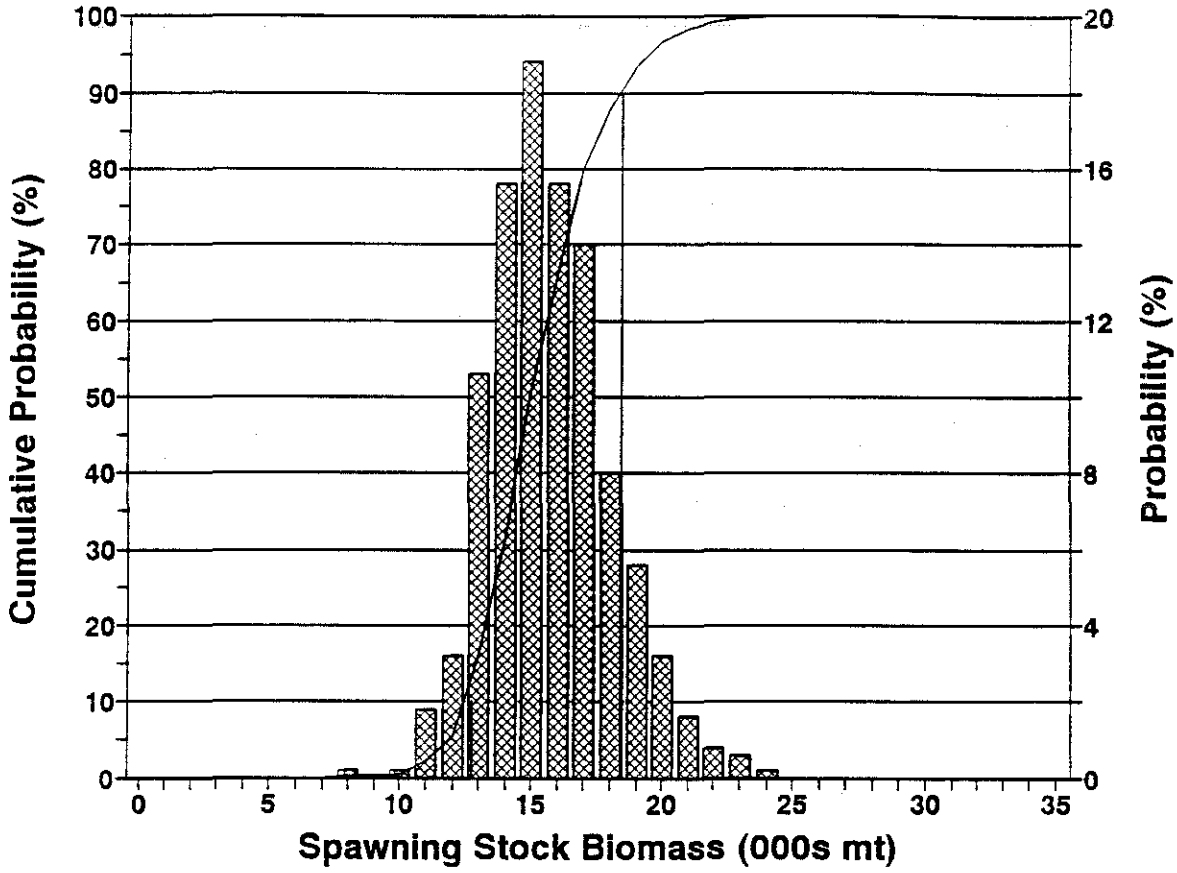
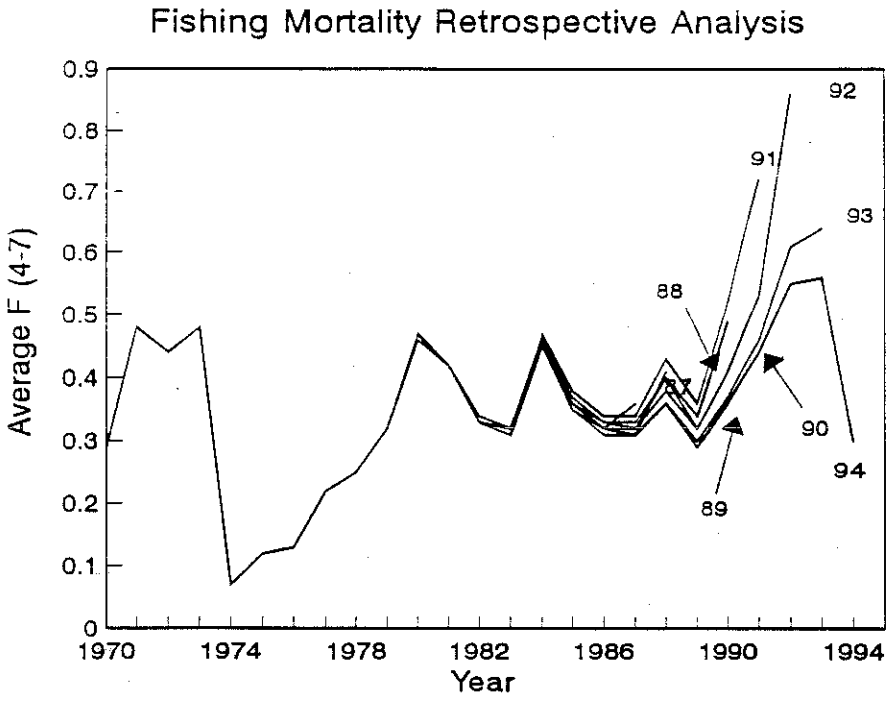


Figure 9. Precision of the estimates of spawning stock biomass (SSB) at the beginning of the spawning season (April 1) for Georges Bank haddock in 1994. The vertical bars display both the range of the estimator and the probability of individual values within the range. The solid line gives the probability that SSB is less than any selected value on the X-axis. The precision estimates were derived from 500 bootstrap replications of the final ADAPT VPA formulation.



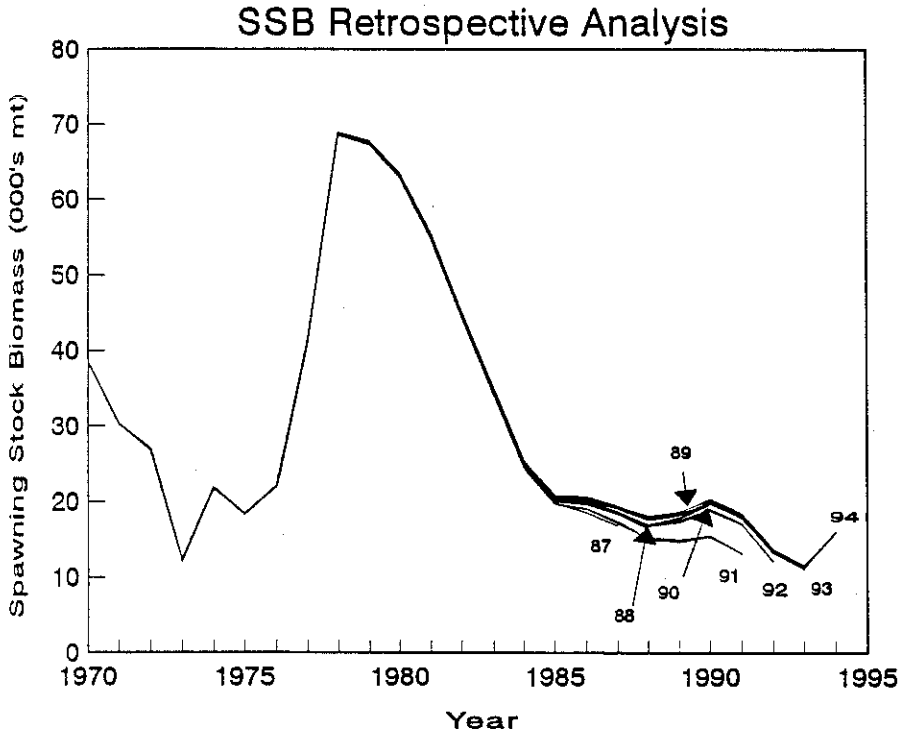


Figure 10. Retrospective analysis of fishing mortality and SSB for Georges Bank haddock, 1994-1987.

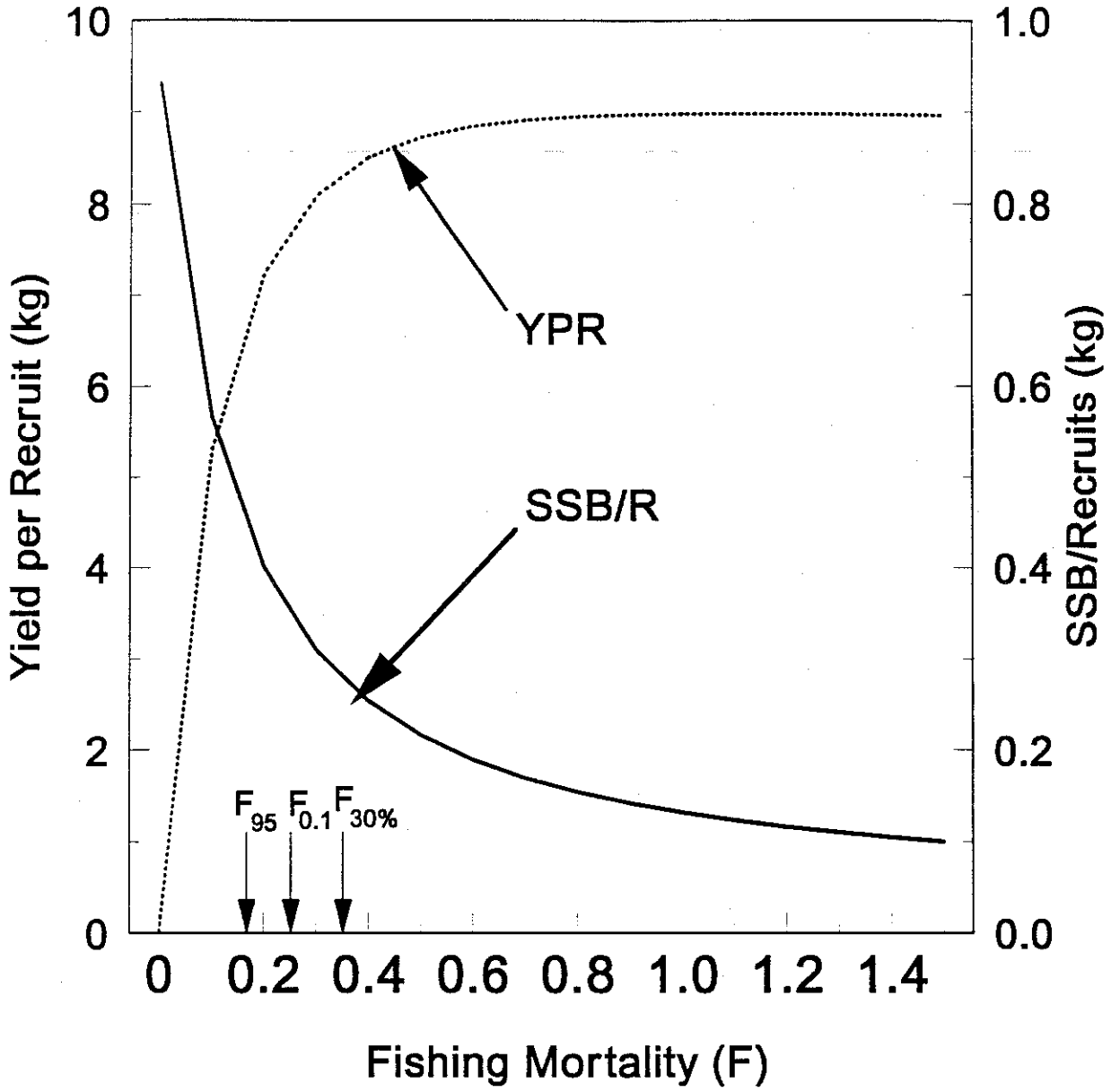


Figure 11. Yield (YPR) and spawning stock biomass (SSB/R) per recruit for Georges Bank haddock.

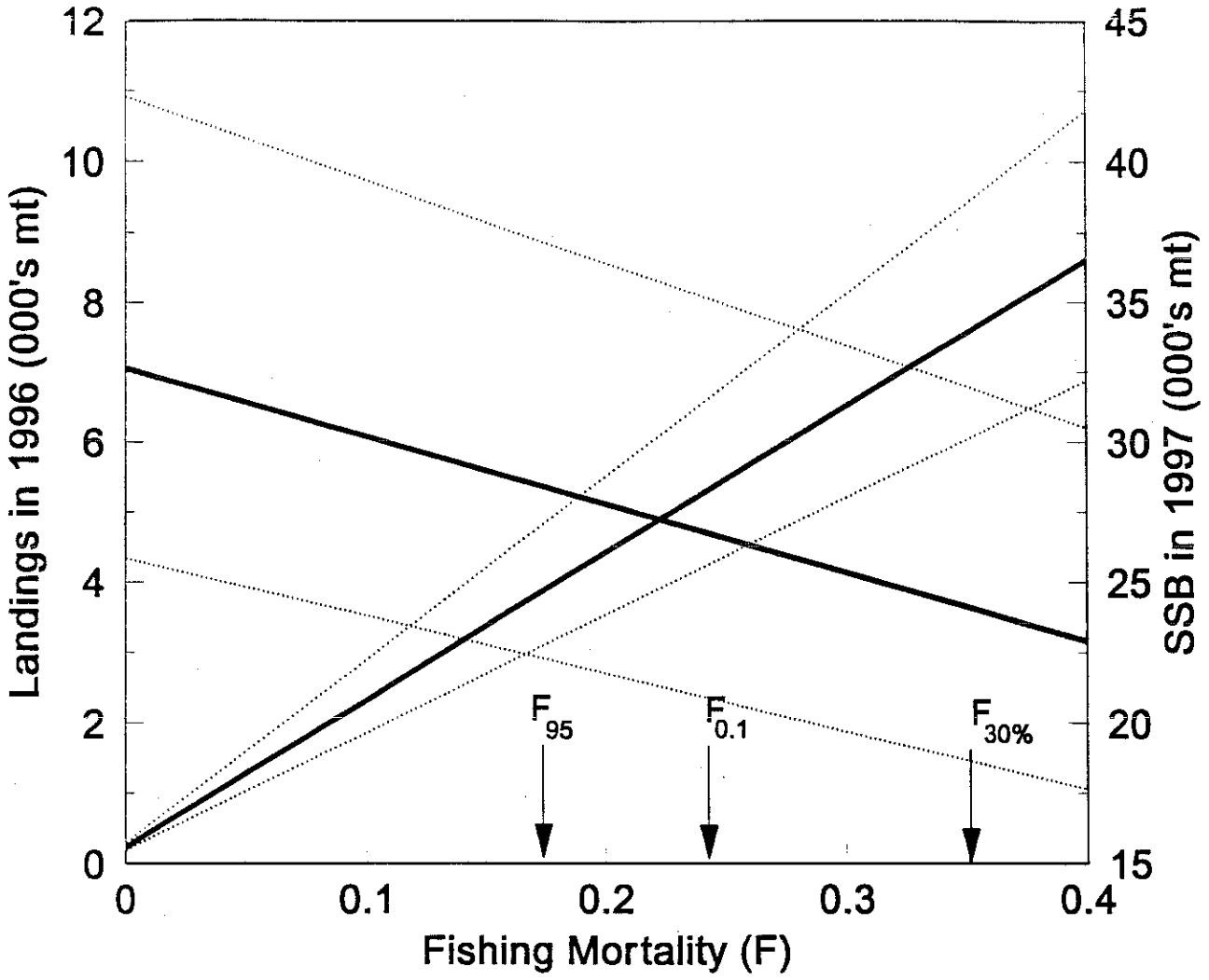
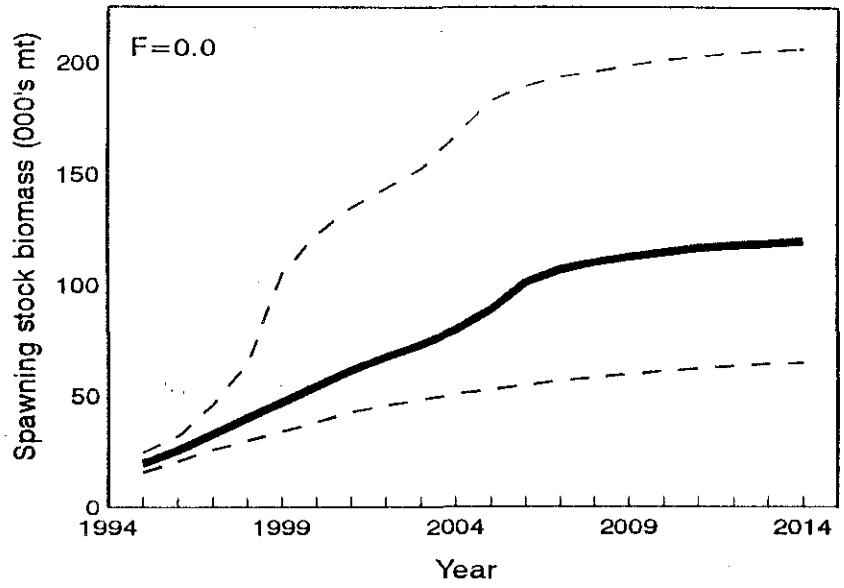
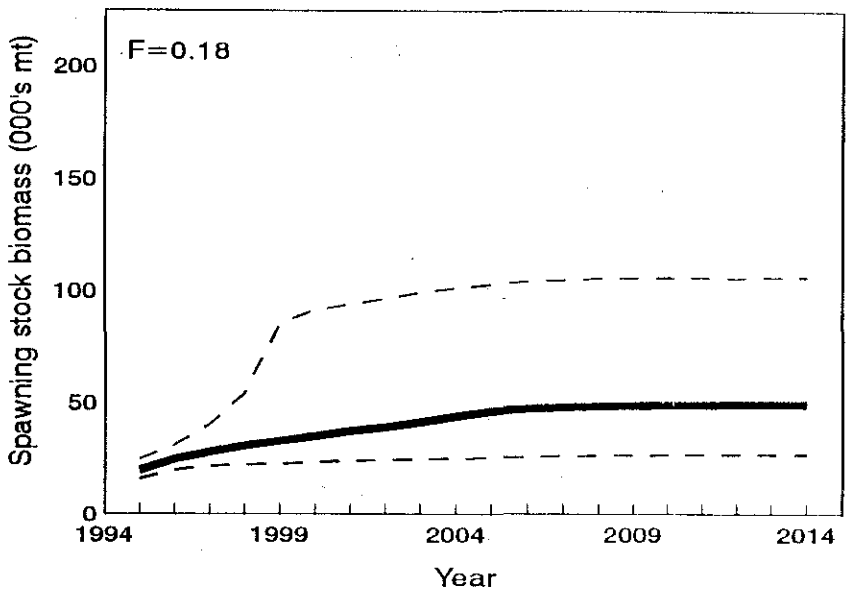


Figure 12. Short-term projections of 1996 landings and 1997 SSB for Georges Bank haddock. Solid lines indicate median values, while dashed lines indicate 10% and 90% probability bounds.





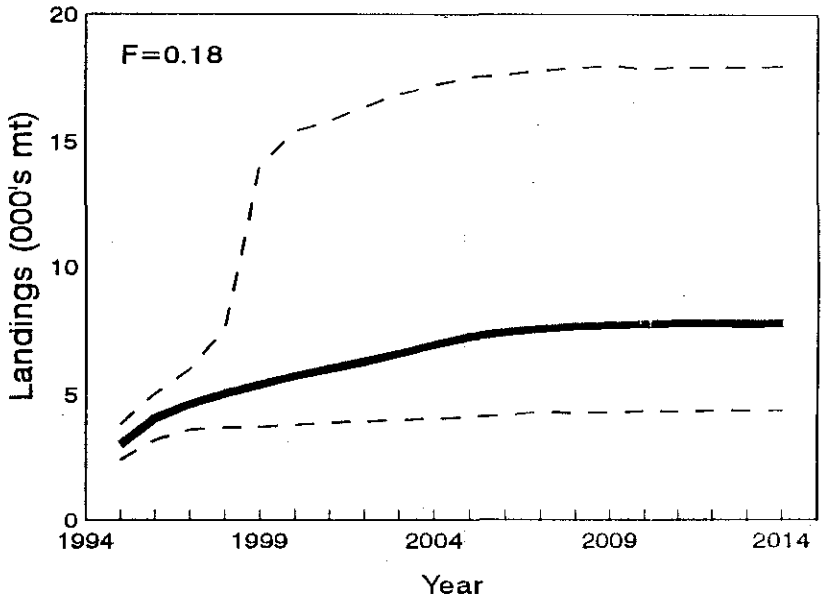


Figure 13. Long-term probabilities of SSB and landings for Georges Bank haddock for F=0.0 and F=0.18 (50%-solid line, 10% and 90%- dashed line).

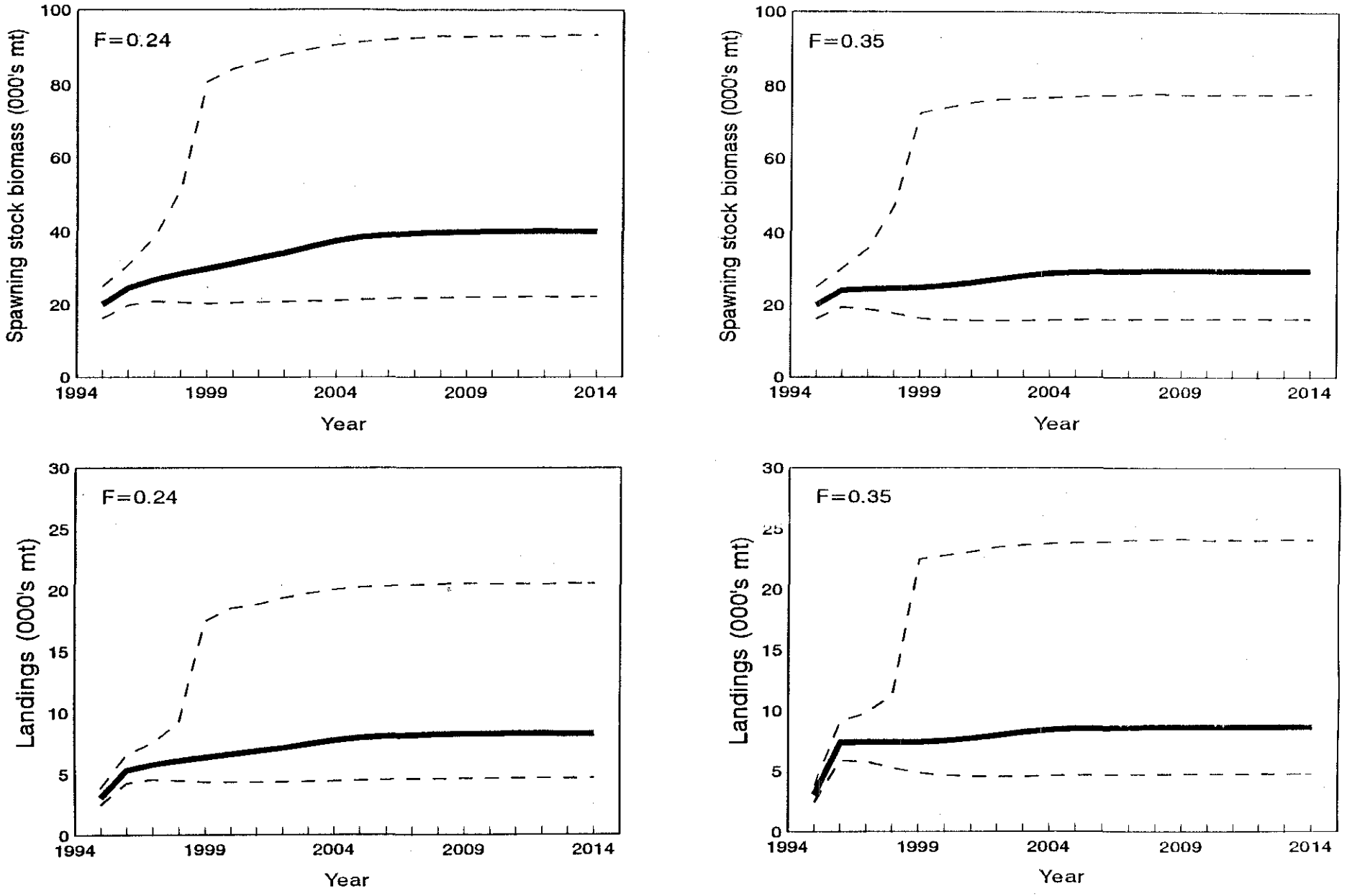


Figure 14. Long-term probabilities of SSB and landings for Georges Bank haddock for F=0.24 and F=0.35 (50%-solid line, 10% and 90%- dashed line).

APPENDIX 1

Listing of the General Linear Model (GLM) Output for Georges Bank Haddock

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GB haddock glm log(cpue) using df 18:26 Thursday, May 25, 1995

Factors are year area qtr tc2 depth

General Linear Models Procedure
Class Level Information

Class	Levels	Values
YEAR	30	65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 99
AREA	10	522 523 524 525 526 537 538 539 600 999
QTR	4	1 3 4 99
TC2	12	21 22 23 24 25 31 32 41 42 43 44 99
DEPTH	5	1 2 4 5 99

Number of observations in data set = 72939

Factors are year area qtr tc2 depth

General Linear Models Procedure

Dependent Variable: LNCPUEDF

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	56	123619.42600548	2207.48975010	1176.38	0.0001
Error	72882	136763.66855892	1.87650817		
Corrected Total	72938	260383.09456440			

R-Square	C.V.	Root MSE	LNCPUEDF Mean
0.474760	-151.6069	1.36985699	-0.90355852

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	29	67918.58335037	2342.02011553	1248.07	0.0001
AREA	9	30405.98829993	3378.44314444	1800.39	0.0001
QTR	3	2732.89587512	910.96529171	485.46	0.0001
TC2	11	21031.66938014	1911.96994365	1018.90	0.0001
DEPTH	4	1530.28909993	382.57227498	203.87	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	29	82757.49102093	2853.70658693	1520.75	0.0001
AREA	9	13004.87339825	1444.98593314	770.04	0.0001
QTR	3	2867.59971175	955.86657058	509.39	0.0001
TC2	11	19648.09988553	1786.19089868	951.87	0.0001
DEPTH	4	1530.28909993	382.57227498	203.87	0.0001

Parameter		Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
INTERCEPT		1.416022412 B	51.29	0.0001	0.02760981
YEAR	65	-0.071915647 B	-2.44	0.0148	0.02951381
	66	-0.144952870 B	-4.97	0.0001	0.02916392
	67	-0.250690083 B	-8.15	0.0001	0.03076418

Factors are year area qtr tc2 depth

General Linear Models Procedure

Dependent Variable: LNCPUEDF

Parameter		Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
YEAR	68	-0.601516922 B	-18.19	0.0001	0.03307562
	69	-0.926382923 B	-26.61	0.0001	0.03481905
	70	-1.350710275 B	-37.00	0.0001	0.03650673
	71	-1.553612224 B	-40.73	0.0001	0.03814003
	72	-1.934134143 B	-48.54	0.0001	0.03984653
	73	-2.187943156 B	-52.82	0.0001	0.04142417
	74	-2.093012515 B	-51.61	0.0001	0.04055830
	75	-1.890294881 B	-47.85	0.0001	0.03950644
	76	-1.981197875 B	-48.63	0.0001	0.04073624
	77	-1.094673929 B	-31.20	0.0001	0.03508124
	78	-0.807000462 B	-23.09	0.0001	0.03495354
	79	-0.798319349 B	-24.80	0.0001	0.03219651
	80	-0.841215562 B	-26.47	0.0001	0.03177674
	81	-0.876708981 B	-26.20	0.0001	0.03346345
	82	-1.612229990 B	-46.33	0.0001	0.03480255
	83	-1.994947285 B	-55.57	0.0001	0.03589733
	84	-2.075030448 B	-60.23	0.0001	0.03445359
	85	-2.634909690 B	-75.44	0.0001	0.03492787
	86	-2.889837150 B	-74.45	0.0001	0.03881487
	87	-3.174052843 B	-82.62	0.0001	0.03841831
	88	-3.318138016 B	-87.71	0.0001	0.03783167
	89	-3.620486890 B	-88.98	0.0001	0.04068929
	90	-3.400765736 B	-85.84	0.0001	0.03961924
	91	-3.715038277 B	-86.27	0.0001	0.04306340
	92	-3.655185541 B	-80.33	0.0001	0.04550060
	93	-4.344489383 B	-88.70	0.0001	0.04897870
	99	0.000000000 B	.	.	.
AREA	522	-0.181034946 B	-12.24	0.0001	0.01479270
	523	0.317013558 B	16.24	0.0001	0.01952597
	524	-0.068485540 B	-4.00	0.0001	0.01710095
	525	-0.404058080 B	-18.96	0.0001	0.02131560
	526	-1.261844231 B	-56.02	0.0001	0.02252502
	537	-2.807270323 B	-46.93	0.0001	0.05982242
	538	-1.905873883 B	-8.16	0.0001	0.23347717

Factors are year area qtr tc2 depth

General Linear Models Procedure

Dependent Variable: LNCPUEDF

Parameter		Estimate	T for H0: Parameter=0	Pr > |T|	Std Error of Estimate
AREA	539	-2.710502909 B	-29.04	0.0001	0.09334856
	600	-2.724714833 B	-18.76	0.0001	0.14523511
	999	0.000000000 B	.	.	.
QTR	1	-0.219900583 B	-15.36	0.0001	0.01431223
	3	-0.463932311 B	-33.25	0.0001	0.01395157
	4	-0.505695655 B	-33.02	0.0001	0.01531293
	99	0.000000000 B	.	.	.
TC2	21	-1.165179617 B	-1.47	0.1427	0.79493017
	22	-1.899862780 B	-6.02	0.0001	0.31539412
	23	-1.418949547 B	-8.96	0.0001	0.15832971
	24	-1.673106406 B	-27.60	0.0001	0.06062218
	25	-1.235307823 B	-45.85	0.0001	0.02694363
	31	-1.198326857 B	-65.48	0.0001	0.01829973
	32	-0.660749455 B	-44.46	0.0001	0.01486121
	41	0.283344846 B	20.34	0.0001	0.01392758
	42	0.773147543 B	25.85	0.0001	0.02991034
	43	0.928381573 B	21.73	0.0001	0.04272407
	44	0.664573753 B	7.57	0.0001	0.08775307
	99	0.000000000 B	.	.	.
DEPTH	1	-0.220431657 B	-13.35	0.0001	0.01650788
	2	-0.285413657 B	-19.66	0.0001	0.01451381
	4	0.309161710 B	13.05	0.0001	0.02368906
	5	0.379046001 B	2.66	0.0078	0.14234777
	99	0.000000000 B	.	.	.

NOTE: The X'X matrix has been found to be singular and a generalized inverse was used to solve the normal equations. Estimates followed by the letter 'B' are biased, and are not unique estimators of the parameters.

Factors are year area qtr tc2 depth

General Linear Models Procedure

Level of YEAR	N	LNCPUEDF Mean	LNCPUEDF SD
65	4480	0.16177556	1.76173539
66	4758	-0.00539817	1.83065919
67	3846	-0.07790527	1.66272477
68	2943	-0.28185171	1.72077226
69	2494	-0.57035911	1.66900698
70	2170	-0.93979655	1.58558691
71	1905	-1.13297566	1.57721478
72	1685	-1.55061841	1.49514771
73	1514	-1.73674295	1.53816674
74	1608	-1.63308555	1.54770858
75	1732	-1.38213747	1.66426039
76	1599	-1.39747541	1.55039064
77	2502	-0.63905299	1.58869552
78	2533	-0.17172785	1.62774858
79	3370	-0.08498225	1.45436531
80	3592	-0.18971896	1.59988136
81	2964	-0.11275800	1.58698473
82	2583	-0.89493775	1.74282186
83	2353	-1.20674271	1.67961172
84	2693	-1.27579157	1.52307322
85	2586	-1.81680327	1.41569952
86	1862	-1.95059819	1.58500538
87	1929	-2.22259909	1.44596402
88	2026	-2.34063520	1.57198331
89	1635	-2.70399247	1.46674744
90	1784	-2.60578226	1.70791190
91	1407	-2.79773798	1.61628791
92	1210	-2.65642850	1.78977664
93	997	-3.32689882	1.54802124
99	4179	0.34986902	1.64110299

Level of AREA	N	LNCPUEDF Mean	LNCPUEDF SD
522	16385	-0.70470848	1.88684433
523	7811	-0.03548566	1.76312460
524	14669	-0.95969048	1.79652932

Factors are year area qtr tc2 depth

General Linear Models Procedure

Level of AREA	N	LNCPUEDF Mean	LNCPUEDF SD
525	6715	-1.15942801	1.81076543
526	5801	-2.05955855	1.77008350
537	554	-3.91952967	1.82468143
538	35	-2.89443517	1.95677884
539	231	-3.86365802	1.49098612
600	90	-3.77852938	1.78289237
999	20648	-0.81193205	1.76870137

Level of QTR	N	LNCPUEDF Mean	LNCPUEDF SD
1	16424	-0.95451921	1.98002890
3	19919	-0.95596760	1.87267328
4	13693	-0.95855432	1.83206827
99	22903	-0.78855297	1.86604266

Level of TC2	N	LNCPUEDF Mean	LNCPUEDF SD
21	3	-2.55603743	2.31375084
22	19	-4.90947112	1.32287309
23	76	-3.41134454	1.85497052
24	557	-2.17686008	1.63226683
25	3248	-1.55322140	1.80490882
31	8637	-1.47992886	1.67136031
32	13358	-1.19278439	1.82950529
41	15930	-0.73893094	1.83474518
42	2545	1.29701216	0.94881688
43	1117	0.58915926	1.30500328
44	250	1.38805698	0.99626082
99	27199	-0.84953647	1.89282031

Level of DEPTH	N	LNCPUEDF Mean	LNCPUEDF SD
1	18591	-1.04493008	1.92456656
2	32246	-1.08972046	1.87488914

GB haddock glm log(cpue) using df 18:26 Thursday, May 25, 1995

Factors are year area qtr tc2 depth

General Linear Models Procedure

Level of DEPTH	N	LNCPUEDF Mean	LNCPUEDF SD
4	4315	-0.00995981	1.75835599
5	94	-0.22042736	1.70693733
99	17693	-0.63728804	1.81585836

APPENDIX 2. Full Listing of ADAPT VPA Calibration Output and Diagnostics for Georges Bank Haddock, 1963-1994.

```
ADAPT        Run Number 19          1995 6 1 18 8 20
HADDOCK:  GEORGES BANK STOCK GBHADD5

Output option selected for input parameters:  full
Output option selected for results:  full


INPUT PARAMETERS AND OPTIONS SELECTED
-------------------------------------

Natural mortality is 0.2

Oldest age (not in the plus group) is 8

For all yrs prior to the terminal year (1994), backcalculated
stock sizes for the following ages used to estimate
total mortality (Z) for age 8:    4 5 6 7 8
This method for estimating F on the oldest age is generally used
when a flat-topped partial recruitment curve is thought to be
characteristic of the stock.

F for age 9+ is then calculated from the following
ratios of F[age 9+] to F[age 8]
      1963    1.0000
      1964    1.0000
      1965    1.0000
      1966    1.0000
      1967    1.0000
      1968    1.0000
      1969    1.0000
      1970    1.0000
      1971    1.0000
      1972    1.0000
      1973    1.0000
      1974    1.0000
      1975    1.0000
      1976    1.0000
      1977    1.0000
      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
Stock size of the 9+ group is then calculated
using the following method:  CATCHEQ

Partial recruitment estimate for 1994
        1    0.0010
        2    0.4100
        3    0.8400
        4    1.0000
```

5	1.0000
6	1.0000
7	1.0000
8	1.0000

Objective function is SUM w*(LOG(OBS) - LOG(PRED))**2

Indices normalized (by dividing by mean observed value)
before tuning to VPA stocksizes

The residuals for years prior to the terminal year are downweighted
using the following algorithm: NONE

Biomass estimates (other than SSB) reflect mean stock sizes.
SSB calculated as in the NEFSC projection program
(see note below SSB table for description of the algorithm).

Initial estimates of parameters for the Marquardt algorithm
and lower and upper bounds on the parameter estimates:

Par.	Initial Est	Lower Bnd	Upper Bnd
N 1	3.8000000E3	0.0000000E0	1.0000000E6
N 2	3.6000000E3	0.0000000E0	1.0000000E6
N 3	2.0000000E2	0.0000000E0	1.0000000E6
N 4	7.5000000E3	0.0000000E0	1.0000000E6
N 5	2.0000000E2	0.0000000E0	1.0000000E6
N 6	1.3000000E3	0.0000000E0	1.0000000E6
N 8	3.0000000E2	0.0000000E0	1.0000000E6
qRV SPR 1	1.0000000E-5	0.0000000E0	1.0000000E0
qRV SPR 2	1.0000000E-5	0.0000000E0	1.0000000E0
qRV SPR 3	1.0000000E-5	0.0000000E0	1.0000000E0
qRV SPR 4	1.0000000E-5	0.0000000E0	1.0000000E0
qRV SPR 5	1.0000000E-5	0.0000000E0	1.0000000E0
qRV SPR 6	1.0000000E-5	0.0000000E0	1.0000000E0
qRV SPR 7	1.0000000E-5	0.0000000E0	1.0000000E0
qRV SPR 8	1.0000000E-5	0.0000000E0	1.0000000E0
qRV FAL 1	1.0000000E-5	0.0000000E0	1.0000000E0
qRV FAL 2	1.0000000E-5	0.0000000E0	1.0000000E0
qRV FAL 3	1.0000000E-5	0.0000000E0	1.0000000E0
qRV FAL 4	1.0000000E-5	0.0000000E0	1.0000000E0
qRV FAL 5	1.0000000E-5	0.0000000E0	1.0000000E0
qRV FAL 6	1.0000000E-5	0.0000000E0	1.0000000E0
qRV FAL 7	1.0000000E-5	0.0000000E0	1.0000000E0
qRV FAL 8	1.0000000E-5	0.0000000E0	1.0000000E0
qCANADA 1	1.0000000E-5	0.0000000E0	1.0000000E0
qCANADA 2	1.0000000E-5	0.0000000E0	1.0000000E0
qCANADA 3	1.0000000E-5	0.0000000E0	1.0000000E0
qCANADA 4	1.0000000E-5	0.0000000E0	1.0000000E0
qCANADA 5	1.0000000E-5	0.0000000E0	1.0000000E0
qCANADA 6	1.0000000E-5	0.0000000E0	1.0000000E0
qCANADA 7	1.0000000E-5	0.0000000E0	1.0000000E0
qCANADA 8	1.0000000E-5	0.0000000E0	1.0000000E0

The following indices of abundance are available:

1	RV SPR 1
2	RV SPR 2
3	RV SPR 3
4	RV SPR 4
5	RV SPR 5
6	RV SPR 6
7	RV SPR 7
8	RV SPR 8
9	RV FAL 1
10	RV FAL 2
11	RV FAL 3
12	RV FAL 4
13	RV FAL 5
14	RV FAL 6

15	RV FAL 7
16	RV FAL 8
17	RV FAL 9
18	CANADA 1
19	CANADA 2
20	CANADA 3
21	CANADA 4
22	CANADA 5
23	CANADA 6
24	CANADA 7
25	CANADA 8

Indices that will be used in this run are: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 18 19 20 21 22 23 24 25

Obs Indices (before transformation) by index & yr; with index means

	1963	1964	1965	1966	1967	1968	1969	1970
1	-999.000	-999.000	-999.000	-999.000	-999.000	0.400	0.000	0.670
2	-999.000	-999.000	-999.000	-999.000	-999.000	2.830	0.070	0.250
3	-999.000	-999.000	-999.000	-999.000	-999.000	0.460	0.580	0.000
4	-999.000	-999.000	-999.000	-999.000	-999.000	0.700	0.250	0.330
5	-999.000	-999.000	-999.000	-999.000	-999.000	6.720	0.420	0.460
6	-999.000	-999.000	-999.000	-999.000	-999.000	1.680	4.230	0.460
7	-999.000	-999.000	-999.000	-999.000	-999.000	0.250	1.030	2.000
8	-999.000	-999.000	-999.000	-999.000	-999.000	0.450	0.280	0.980
9	0.000	83.932	2.369	0.328	6.139	0.030	0.089	0.387
10	0.000	25.390	112.868	10.162	0.954	6.720	0.060	0.030
11	0.000	9.223	63.742	77.391	2.891	0.358	0.954	0.000
12	0.000	6.809	5.826	9.700	18.387	0.998	0.134	0.283
13	0.000	8.344	1.788	1.073	3.352	6.765	0.328	0.134
14	0.000	5.945	3.814	0.805	0.521	1.624	3.859	0.164
15	0.000	2.041	1.565	0.909	0.492	0.492	1.266	1.520
16	0.000	1.684	0.685	0.805	0.328	0.209	0.268	0.507
18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
19	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
21	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
22	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
23	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	1971	1972	1973	1974	1975	1976	1977	1978	1979
1	0.000	4.020	30.680	2.130	0.940	80.790	0.610	0.070	36.120
2	1.160	0.090	4.840	13.290	0.970	0.300	33.410	0.970	1.580
3	0.250	0.610	0.000	2.860	3.320	0.600	0.420	15.930	1.130
4	0.000	0.120	0.540	0.000	0.630	0.920	1.220	0.360	5.710
5	0.120	0.030	0.090	0.240	0.000	0.430	0.600	0.940	0.330
6	0.120	0.040	0.000	0.000	0.130	0.000	0.450	0.820	0.160
7	0.090	0.130	0.180	0.010	0.090	0.040	0.000	0.160	0.370
8	0.820	0.030	0.010	0.100	0.010	0.000	0.040	0.060	0.060
9	0.045	2.429	6.750	3.233	0.745	23.482	4.321	0.134	13.222
10	4.127	0.000	2.518	9.000	1.773	0.626	64.174	2.139	0.843
11	0.209	0.313	0.000	1.609	0.983	0.715	0.521	18.733	1.039
12	0.015	0.074	0.521	0.000	0.313	4.857	0.536	0.562	9.275
13	0.283	0.015	0.089	0.194	0.000	0.924	0.820	0.574	0.183
14	0.268	0.224	0.000	0.045	0.015	0.000	0.298	0.635	0.257
15	0.507	0.030	0.089	0.000	0.000	0.030	0.000	0.342	0.452
16	1.371	0.089	0.060	0.074	0.000	0.000	0.045	0.037	0.012
18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
19	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
21	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
22	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
23	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
1	5.200	3.300	0.760	0.430	2.090	0.000	2.490	0.000	1.550	0.020
2	46.700	3.290	1.530	0.550	1.180	4.960	0.180	3.620	0.040	3.490
3	0.510	19.490	0.940	0.580	0.640	0.760	2.060	0.060	0.990	0.450
4	1.040	2.190	4.070	0.220	0.630	0.400	0.240	0.810	0.130	0.710
5	4.870	0.760	0.420	2.410	0.580	0.870	0.110	0.080	0.320	0.140
6	0.670	1.780	0.280	0.010	0.720	0.340	0.210	0.100	0.120	0.410
7	0.370	0.240	0.610	0.040	0.070	1.170	0.120	0.050	0.110	0.060
8	0.460	0.110	0.000	1.160	0.040	0.100	0.330	0.220	0.120	0.050
9	1.320	11.682	0.379	1.356	5.796	0.030	11.350	0.000	1.800	0.057
10	45.568	2.713	6.134	0.000	0.238	3.323	0.650	5.110	0.000	2.476
11	0.037	12.721	2.077	1.326	0.209	0.879	1.530	0.090	0.790	0.148
12	0.904	0.452	3.703	0.343	0.268	0.238	0.220	1.210	0.100	1.066
13	3.813	0.183	0.208	1.401	0.298	0.283	0.050	0.060	0.770	0.098
14	0.257	1.699	0.415	0.134	0.939	0.060	0.100	0.130	0.060	0.328
15	0.281	0.477	0.525	0.074	0.119	0.447	0.070	0.130	0.060	0.098
16	0.049	0.464	0.000	0.209	0.000	0.000	0.170	0.020	0.020	0.090
18	0.000	0.000	0.000	0.000	0.000	0.000	4.060	0.030	1.470	0.030
19	0.000	0.000	0.000	0.000	0.000	0.000	0.220	3.040	0.050	5.340
20	0.000	0.000	0.000	0.000	0.000	0.000	6.050	0.690	8.530	0.720
21	0.000	0.000	0.000	0.000	0.000	0.000	1.070	2.510	0.170	2.120
22	0.000	0.000	0.000	0.000	0.000	0.000	0.190	0.670	2.850	0.190
23	0.000	0.000	0.000	0.000	0.000	0.000	0.290	0.080	0.180	0.420
24	0.000	0.000	0.000	0.000	0.000	0.000	0.340	0.300	0.170	0.030
25	0.000	0.000	0.000	0.000	0.000	0.000	0.370	0.100	0.110	0.030

	1990	1991	1992	1993	1994	1995********
1	0.860	0.540	0.400	1.170	0.700	-999.000	7.650
2	0.000	1.070	0.180	0.650	2.680	-999.000	4.995
3	5.720	0.240	0.110	0.180	1.000	-999.000	2.396
4	0.330	1.850	0.070	0.140	0.150	-999.000	0.950
5	0.580	0.090	0.330	0.120	0.100	-999.000	0.852
6	0.060	0.100	0.030	0.370	0.070	-999.000	0.557
7	0.130	0.020	0.030	0.060	0.160	-999.000	0.292
8	0.000	0.040	0.030	0.020	0.020	-999.000	0.231
9	0.467	0.771	2.157	2.850	1.517	0.910	6.132
10	0.049	0.672	0.205	2.080	4.043	0.770	10.876
11	2.706	0.025	0.238	0.230	2.009	0.810	6.817
12	0.197	1.189	0.049	0.240	0.303	0.670	2.240
13	0.664	0.049	0.221	0.000	0.000	0.120	1.141
14	0.090	0.172	0.016	0.470	0.057	0.050	0.782
15	0.131	0.041	0.016	0.020	0.148	0.020	0.427
16	0.016	0.000	0.000	0.080	0.016	0.170	0.299
18	0.930	0.750	3.300	3.960	3.320	1.940	1.979
19	0.110	1.670	2.950	2.160	11.520	2.620	2.968
20	9.870	0.140	1.130	0.550	4.080	4.300	3.606
21	0.130	8.990	0.170	0.450	0.420	2.220	1.825
22	3.360	0.110	3.820	0.040	0.240	0.560	1.203
23	0.230	1.600	0.030	1.280	0.020	0.280	0.441
24	1.090	0.090	1.060	0.020	0.700	0.000	0.422
25	0.130	0.440	0.040	0.320	0.010	0.480	0.203

SUMMARY OF WEIGHTING USED IN THE OBJECTIVE FUNCTION

EXOGENOUS WEIGHTS BY INDEX AND YR (omega)

	1963	1964	1965	1966	1967	1968	1969	1970	1971
1	-99.00	-99.00	-99.00	-99.00	-99.00	1.00	-99.00	1.00	-99.00
2	-99.00	-99.00	-99.00	-99.00	-99.00	1.00	1.00	1.00	1.00
3	-99.00	-99.00	-99.00	-99.00	-99.00	1.00	1.00	-99.00	1.00
4	-99.00	-99.00	-99.00	-99.00	-99.00	1.00	1.00	1.00	-99.00
5	-99.00	-99.00	-99.00	-99.00	-99.00	1.00	1.00	1.00	1.00
6	-99.00	-99.00	-99.00	-99.00	-99.00	1.00	1.00	1.00	1.00
7	-99.00	-99.00	-99.00	-99.00	-99.00	1.00	1.00	1.00	1.00
8	-99.00	-99.00	-99.00	-99.00	-99.00	1.00	1.00	1.00	1.00
9	-99.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

10	-99.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
11	-99.00	1.00	1.00	1.00	1.00	1.00	1.00	-99.00	1.00
12	-99.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	-99.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14	-99.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
15	-99.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16	-99.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
18	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
19	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
20	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
21	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
22	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
23	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
24	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
25	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00

	1972	1973	1974	1975	1976	1977	1978	1979	1980
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3	1.00	-99.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4	1.00	1.00	-99.00	1.00	1.00	1.00	1.00	1.00	1.00
5	1.00	1.00	1.00	-99.00	1.00	1.00	1.00	1.00	1.00
6	1.00	-99.00	-99.00	1.00	-99.00	1.00	1.00	1.00	1.00
7	1.00	1.00	1.00	1.00	1.00	-99.00	1.00	1.00	1.00
8	1.00	1.00	1.00	1.00	-99.00	1.00	1.00	1.00	1.00
9	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
10	-99.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
11	1.00	-99.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
12	1.00	1.00	-99.00	1.00	1.00	1.00	1.00	1.00	1.00
13	1.00	1.00	1.00	-99.00	1.00	1.00	1.00	1.00	1.00
14	1.00	-99.00	1.00	1.00	-99.00	1.00	1.00	1.00	1.00
15	1.00	1.00	-99.00	-99.00	1.00	-99.00	1.00	1.00	1.00
16	1.00	1.00	1.00	-99.00	-99.00	1.00	1.00	1.00	1.00
18	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
19	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
20	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
21	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
22	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
23	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
24	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
25	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1	1.00	1.00	1.00	1.00	-99.00	1.00	-99.00	1.00	1.00	1.00
2	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	-99.00
3	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
6	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
7	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
8	1.00	-99.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	-99.00
9	1.00	1.00	1.00	1.00	1.00	1.00	-99.00	1.00	1.00	1.00
10	1.00	1.00	-99.00	1.00	1.00	1.00	1.00	-99.00	1.00	1.00
11	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
12	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
15	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16	1.00	-99.00	1.00	-99.00	-99.00	1.00	1.00	1.00	1.00	1.00
18	-99.00	-99.00	-99.00	-99.00	-99.00	1.00	1.00	1.00	1.00	1.00
19	-99.00	-99.00	-99.00	-99.00	-99.00	1.00	1.00	1.00	1.00	1.00
20	-99.00	-99.00	-99.00	-99.00	-99.00	1.00	1.00	1.00	1.00	1.00
21	-99.00	-99.00	-99.00	-99.00	-99.00	1.00	1.00	1.00	1.00	1.00
22	-99.00	-99.00	-99.00	-99.00	-99.00	1.00	1.00	1.00	1.00	1.00
23	-99.00	-99.00	-99.00	-99.00	-99.00	1.00	1.00	1.00	1.00	1.00
24	-99.00	-99.00	-99.00	-99.00	-99.00	1.00	1.00	1.00	1.00	1.00
25	-99.00	-99.00	-99.00	-99.00	-99.00	1.00	1.00	1.00	1.00	1.00

	1991	1992	1993	1994	1995
1	1.00	1.00	1.00	1.00	-99.00
2	1.00	1.00	1.00	1.00	-99.00
3	1.00	1.00	1.00	1.00	-99.00
4	1.00	1.00	1.00	1.00	-99.00
5	1.00	1.00	1.00	1.00	-99.00
6	1.00	1.00	1.00	1.00	-99.00
7	1.00	1.00	1.00	1.00	-99.00
8	1.00	1.00	1.00	1.00	-99.00
9	1.00	1.00	1.00	1.00	1.00
10	1.00	1.00	1.00	1.00	1.00
11	1.00	1.00	1.00	1.00	1.00
12	1.00	1.00	1.00	1.00	1.00
13	1.00	1.00	-99.00	-99.00	1.00
14	1.00	1.00	1.00	1.00	1.00
15	1.00	1.00	1.00	1.00	1.00
16	-99.00	-99.00	1.00	1.00	1.00
18	1.00	1.00	1.00	1.00	1.00
19	1.00	1.00	1.00	1.00	1.00
20	1.00	1.00	1.00	1.00	1.00
21	1.00	1.00	1.00	1.00	1.00
22	1.00	1.00	1.00	1.00	1.00
23	1.00	1.00	1.00	1.00	1.00
24	1.00	1.00	1.00	1.00	-99.00
25	1.00	1.00	1.00	1.00	1.00

Negative weights in the above table indicate missing values

DOWNWEIGHTS BY YEAR (delta)

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

	1993	1994	1995
	1.0000	1.0000	1.0000

ITERATIVE RE-WEIGHTS BY INDEX (chi)

	1	2	3	4	5	6	7	8	9	10
	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

	11	12	13	14	15	16	18	19	20	21
	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

	22	23	24	25
	1.0000	1.0000	1.0000	1.0000

FINAL SS WEIGHTS BY INDEX NUMBER AND YR - GBHADD5

	1963	1964	1965	1966	1967	1968	1969
1	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	1.0000	-99.0000
2	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	1.0000	1.0000
3	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	1.0000	1.0000
4	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	1.0000	1.0000

5	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	1.0000	1.0000
6	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	1.0000	1.0000
7	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	1.0000	1.0000
8	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	1.0000	1.0000
9	-99.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
10	-99.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
11	-99.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12	-99.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
13	-99.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
14	-99.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
15	-99.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
16	-99.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
18	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
19	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
20	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
21	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
22	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
23	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
24	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
25	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000

	1970	1971	1972	1973	1974	1975	1976
1	1.0000	-99.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3	-99.0000	1.0000	1.0000	-99.0000	1.0000	1.0000	1.0000
4	1.0000	-99.0000	1.0000	1.0000	-99.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000	-99.0000	1.0000
6	1.0000	1.0000	1.0000	-99.0000	-99.0000	1.0000	-99.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	-99.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	-99.0000	1.0000	1.0000	1.0000	1.0000
11	-99.0000	1.0000	1.0000	-99.0000	1.0000	1.0000	1.0000
12	1.0000	1.0000	1.0000	1.0000	-99.0000	1.0000	1.0000
13	1.0000	1.0000	1.0000	1.0000	1.0000	-99.0000	1.0000
14	1.0000	1.0000	1.0000	-99.0000	1.0000	1.0000	-99.0000
15	1.0000	1.0000	1.0000	1.0000	-99.0000	-99.0000	1.0000
16	1.0000	1.0000	1.0000	1.0000	1.0000	-99.0000	-99.0000
18	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
19	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
20	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
21	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
22	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
23	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
24	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
25	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000

	1977	1978	1979	1980	1981	1982	1983
1	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
7	-99.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000	-99.0000	1.0000
9	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	-99.0000
11	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
13	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
14	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
15	-99.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
16	1.0000	1.0000	1.0000	1.0000	1.0000	-99.0000	1.0000
18	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
19	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
20	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000

21	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
22	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
23	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
24	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
25	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000

	1984	1985	1986	1987	1988	1989	1990	1991
1	1.0000	-99.0000	1.0000	-99.0000	1.0000	1.0000	1.0000	1.0000
2	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	-99.0000	1.0000
3	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
5	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
8	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	-99.0000	1.0000
9	1.0000	1.0000	1.0000	-99.0000	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000	-99.0000	1.0000	1.0000	1.0000
11	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
13	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
14	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
15	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
16	-99.0000	-99.0000	1.0000	1.0000	1.0000	1.0000	1.0000	-99.0000
18	-99.0000	-99.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
19	-99.0000	-99.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
20	-99.0000	-99.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
21	-99.0000	-99.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
22	-99.0000	-99.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
23	-99.0000	-99.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
24	-99.0000	-99.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25	-99.0000	-99.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

	1992	1993	1994	1995
1	1.0000	1.0000	1.0000	-99.0000
2	1.0000	1.0000	1.0000	-99.0000
3	1.0000	1.0000	1.0000	-99.0000
4	1.0000	1.0000	1.0000	-99.0000
5	1.0000	1.0000	1.0000	-99.0000
6	1.0000	1.0000	1.0000	-99.0000
7	1.0000	1.0000	1.0000	-99.0000
8	1.0000	1.0000	1.0000	-99.0000
9	1.0000	1.0000	1.0000	1.0000
10	1.0000	1.0000	1.0000	1.0000
11	1.0000	1.0000	1.0000	1.0000
12	1.0000	1.0000	1.0000	1.0000
13	1.0000	-99.0000	-99.0000	1.0000
14	1.0000	1.0000	1.0000	1.0000
15	1.0000	1.0000	1.0000	1.0000
16	-99.0000	1.0000	1.0000	1.0000
18	1.0000	1.0000	1.0000	1.0000
19	1.0000	1.0000	1.0000	1.0000
20	1.0000	1.0000	1.0000	1.0000
21	1.0000	1.0000	1.0000	1.0000
22	1.0000	1.0000	1.0000	1.0000
23	1.0000	1.0000	1.0000	1.0000
24	1.0000	1.0000	1.0000	-99.0000
25	1.0000	1.0000	1.0000	1.0000

Negative weights in the above table indicate missing values

CATCH AT AGE (thousands) - GBHADD5

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
1	2910	10101	9601	114	1150	8	2	46	1	156	2560
2	4047	15935	125818	6843	168	2994	11	158	1375	2	2075
3	7418	4554	44496	100810	2891	709	1698	16	223	450	3
4	11152	4776	5356	19167	20667	1921	448	570	40	81	386
5	8198	8722	4391	2768	10338	14519	654	186	289	32	53
6	2205	5794	6690	2591	1209	3499	5954	214	246	120	30
7	1405	2082	3772	2332	993	667	1574	2308	285	78	77
8	721	1028	1094	1268	917	453	225	746	1469	66	15
9	1096	1332	1366	867	698	842	570	464	928	1236	447
1+	39152	54324	202584	136760	39031	25612	11136	4708	4856	2221	5646

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
1	46	192	144	1	1	1	8	1	1	0	0
2	4320	1034	473	19585	761	26	31000	1743	1165	214	93
3	657	1864	550	187	14395	1726	347	10998	1633	813	297
4	2	375	880	680	305	7169	975	831	3733	690	727
5	70	4	216	515	567	525	6054	937	391	2239	397
6	2	42	0	357	517	410	594	2572	569	272	1482
7	2	4	23	4	139	315	546	331	1119	186	234
8	53	4	4	39	14	96	153	158	106	800	267
9	249	88	112	111	67	46	81	94	110	76	543
1+	5401	3607	2402	21479	16766	10314	39758	17665	8827	5290	4040

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	0	6	0	4	0	2	6	7	7	0
2	2406	54	1995	52	1263	11	448	247	290	254
3	550	2810	129	2384	86	1445	91	320	350	851
4	194	223	1613	134	877	172	2149	132	299	166
5	461	146	122	931	143	868	102	1527	104	59
6	228	173	73	149	358	98	410	111	659	40
7	526	150	89	55	46	177	73	323	38	129
8	78	266	106	64	28	46	154	27	159	16
9	152	60	135	106	45	44	72	94	76	45
1+	4595	3888	4262	3879	2846	2863	3505	2788	1982	1560

CAA summary for ages 2 9 3 9 4 9 5 9 6 9

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
2	36242	44223	192983	136646	37881	25604	11134	4662	4855	2065	3086
3	32195	28288	67165	129803	37713	22610	11123	4504	3480	2063	1011
4	24777	23734	22669	28993	34822	21901	9425	4488	3257	1613	1008
5	13625	18958	17313	9826	14155	19980	8977	3918	3217	1532	622
6	5427	10236	12922	7058	3817	5461	8323	3732	2928	1500	569

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
2	5355	3415	2258	21478	16765	10313	39750	17664	8826	5290	4040
3	1035	2381	1785	1893	16004	10287	8750	15921	7661	5076	3947
4	378	517	1235	1706	1609	8561	8403	4923	6028	4263	3650
5	376	142	355	1026	1304	1392	7428	4092	2295	3573	2923
6	306	138	139	511	737	867	1374	3155	1904	1334	2526

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
2	4595	3882	4262	3875	2846	2861	3499	2781	1975	1560
3	2189	3828	2267	3823	1583	2850	3051	2534	1685	1306
4	1639	1018	2138	1439	1497	1405	2960	2214	1335	455
5	1445	795	525	1305	620	1233	811	2082	1036	289
6	984	649	403	374	477	365	709	555	932	230

WT AT AGE (MID-YR) in kg. - GBHADD5

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
1	0.570	0.500	0.580	0.580	0.660	0.590	0.520	0.710	0.670	0.620
2	0.870	0.830	0.690	0.730	0.700	0.810	0.780	1.270	1.030	1.030
3	1.180	1.120	1.030	0.890	0.950	1.050	1.100	1.220	1.310	1.740
4	1.470	1.430	1.350	1.260	1.180	1.320	1.690	1.930	1.740	2.040
5	1.680	1.640	1.670	1.700	1.420	1.570	1.750	2.190	2.390	2.420
6	2.150	2.010	1.990	2.070	2.050	2.100	1.990	2.390	2.810	2.920
7	2.350	2.400	2.260	2.280	2.310	2.320	2.520	2.580	2.920	3.060
8	3.040	2.640	2.660	2.870	2.660	2.620	2.990	3.230	3.100	3.440
9	3.100	2.970	3.110	3.180	3.100	2.860	3.630	3.750	3.720	3.660

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	0.600	0.720	0.620	0.500	0.530	0.530	0.530	0.550	0.390	0.220
2	1.030	1.060	0.980	0.990	1.070	0.940	1.000	0.940	0.870	0.970
3	1.580	1.820	1.630	1.390	1.440	1.500	1.280	1.210	1.240	1.450
4	2.130	2.320	2.210	1.990	2.170	2.040	2.020	1.730	1.830	1.880
5	2.410	2.830	2.200	2.660	2.730	2.790	2.510	2.170	2.300	2.370
6	3.290	3.760	2.940	3.080	3.210	3.190	3.140	2.820	2.720	2.760
7	3.420	4.050	4.000	3.690	4.150	3.370	3.780	3.600	3.710	3.240
8	3.860	3.920	4.050	4.670	4.000	3.610	3.790	3.560	4.040	3.960
9	3.940	4.260	4.330	4.940	4.990	5.110	4.870	3.870	4.440	4.090

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
1	0.330	0.330	0.330	0.450	0.430	0.420	0.530	0.640	0.581	0.538
2	1.020	0.920	0.990	0.940	0.830	0.980	0.890	0.970	1.201	1.175
3	1.370	1.320	1.390	1.360	1.430	1.340	1.480	1.480	1.311	1.639
4	1.830	1.830	1.980	1.830	2.000	1.680	1.790	1.778	1.817	1.768
5	2.210	2.200	2.460	2.560	2.250	2.060	2.210	2.117	2.183	2.186
6	2.650	2.670	2.720	2.830	2.630	2.450	2.570	2.552	2.645	2.519
7	3.250	2.960	3.060	2.960	3.020	2.970	3.240	2.806	2.852	2.967
8	3.360	3.410	3.720	3.460	3.770	3.490	3.560	2.991	3.048	3.365
9	4.270	3.720	3.800	3.780	4.290	3.960	3.820	4.160	4.337	4.267

	1993	1994
1	0.659	0.405
2	1.169	1.141
3	1.728	1.669
4	2.171	2.246
5	2.119	2.664
6	2.628	2.439
7	2.649	2.835
8	3.123	3.240
9	4.014	4.014

WT AT AGE (JAN 1) in kg. - GBHADD5

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
1	0.472	0.426	0.517	0.528	0.596	0.513	0.333	0.589	0.540	0.481
2	0.767	0.688	0.587	0.651	0.637	0.731	0.678	0.813	0.855	0.831
3	1.072	0.987	0.925	0.784	0.833	0.857	0.944	0.975	1.290	1.339
4	1.392	1.299	1.230	1.139	1.025	1.120	1.332	1.457	1.457	1.635
5	1.536	1.553	1.545	1.515	1.338	1.361	1.520	1.924	2.148	2.052
6	2.035	1.838	1.807	1.859	1.867	1.727	1.768	2.045	2.481	2.642
7	2.217	2.272	2.131	2.130	2.187	2.181	2.300	2.266	2.642	2.932
8	2.673	2.491	2.527	2.547	2.463	2.460	2.634	2.853	2.828	3.169
9	3.100	2.970	3.110	3.180	3.100	2.860	3.630	3.750	3.720	3.660

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	0.451	0.617	0.491	0.342	0.398	0.386	0.398	0.437	0.247	0.102
2	0.799	0.797	0.840	0.783	0.731	0.706	0.728	0.706	0.692	0.615
3	1.276	1.369	1.314	1.167	1.194	1.267	1.097	1.100	1.080	1.123
4	1.925	1.915	2.006	1.801	1.737	1.714	1.741	1.488	1.488	1.527
5	2.217	2.455	2.259	2.425	2.331	2.461	2.263	2.094	1.995	2.083
6	2.822	3.010	2.884	2.603	2.922	2.951	2.960	2.660	2.429	2.520
7	3.160	3.650	3.878	3.294	3.575	3.289	3.472	3.362	3.235	2.969
8	3.437	3.661	4.050	4.322	3.842	3.871	3.574	3.668	3.814	3.833
9	3.940	4.260	4.330	4.940	4.990	5.110	4.870	3.870	4.440	4.090

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
1	0.198	0.191	0.196	0.331	0.285	0.289	0.392	0.467	0.409	0.365
2	0.474	0.551	0.572	0.557	0.611	0.649	0.611	0.717	0.877	0.826
3	1.153	1.160	1.131	1.160	1.159	1.055	1.204	1.148	1.128	1.403
4	1.629	1.583	1.617	1.595	1.649	1.550	1.549	1.622	1.640	1.522
5	2.038	2.006	2.122	2.251	2.029	2.030	1.927	1.947	1.970	1.993
6	2.506	2.429	2.446	2.639	2.595	2.348	2.301	2.375	2.366	2.345
7	2.995	2.801	2.858	2.837	2.923	2.795	2.817	2.685	2.698	2.801
8	3.299	3.329	3.318	3.254	3.341	3.247	3.252	3.113	2.924	3.098
9	4.270	3.720	3.800	3.780	4.290	3.960	3.820	4.160	4.337	4.267

	1993	1994	1995
1	0.501	0.189	0.369
2	0.793	0.867	0.867
3	1.425	1.397	1.501
4	1.886	1.970	1.994
5	1.936	2.405	2.561
6	2.397	2.273	2.951
7	2.583	2.730	2.617
8	3.044	2.930	2.945
9	4.014	4.014	4.014

Weights at age at the start of the spawning season are assumed to be the same as the Jan1 weight at age estimates.

PERCENT MATURE (females) - GBHADD5

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	28	28	28	28	28	34	34	34	34	33
3	78	78	78	78	78	76	76	76	76	76	92	92	92	92	81
4	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
5	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
6	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
7	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
8	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
9	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
1	0	0	0	0	0	0	12	26	26	26	26	26	16	16	16
2	33	33	33	33	33	33	33	77	77	77	77	77	75	75	75
3	81	81	81	81	81	81	94	97	97	97	97	97	98	98	98
4	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
5	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
6	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
7	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
8	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
9	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

	1993	1994
1	6	6
2	43	43
3	90	90
4	100	100
5	100	100
6	100	100
7	100	100
8	100	100
9	100	100

SEX RATIO (Percent Female) - GBHADD5

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
1	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
2	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
3	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
4	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
5	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
6	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
7	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
8	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
9	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
1	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
2	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
3	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
4	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
5	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
6	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
7	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
8	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
9	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50

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   ▪ 1993 1994
---+----------
 1 ▪   50   50
 2 ▪   50   50
 3 ▪   50   50
 4 ▪   50   50
 5 ▪   50   50
 6 ▪   50   50
 7 ▪   50   50
 8 ▪   50   50
 9 ▪   50   50


BEGIN MARQUARDT ALGORITHM
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LAMBDA        1.00000E-2
RSS           5.29649E3
NPHI          5.29649E3

par
   3.80000E3       3.60000E3       2.00000E2       7.50000E3       2.00000E2       1.
      30000E3       3.00000E2       1.00000E-5      1.00000E-5      1.00000E-5      1
      .00000E-5      1.00000E-5      1.00000E-5      1.00000E-5      1.00000E-5
      1.00000E-5      1.00000E-5      1.00000E-5      1.00000E-5      1.00000E-5
       1.00000E-5      1.00000E-5      1.00000E-5      1.00000E-5      1.00000E-5
        1.00000E-5      1.00000E-5      1.00000E-5      1.00000E-5      1.00000E-5
         1.00000E-5


LAMBDA        1.00000E-1
RSS           4.48762E3
NPHI          4.48762E3

par
   4.04724E3       3.76710E3       2.95811E2       6.94192E3       2.03480E2       1.
      14099E3       3.05409E2       1.08966E-5      1.16271E-5      1.22537E-5      1
      .31897E-5      1.33495E-5      1.35564E-5      1.43731E-5      1.47314E-5
      1.10441E-5      1.09475E-5      1.09920E-5      1.22449E-5      1.27670E-5
       1.32243E-5      1.38999E-5      1.42782E-5      1.22890E-5      1.25271E-5
        1.27883E-5      1.33406E-5      1.39211E-5      1.45196E-5      1.49835E-5
         1.55412E-5


LAMBDA        1.00000E0
RSS           3.80624E3
NPHI          3.80624E3

par
   4.30374E3       3.94101E3       4.19212E2       6.50760E3       2.08293E2       1.
      02081E3       3.13882E2       1.17459E-5      1.33054E-5      1.47326E-5      1
      .69850E-5      1.73876E-5      1.79118E-5      2.00689E-5      2.10570E-5
      1.20566E-5      1.18564E-5      1.19696E-5      1.47127E-5      1.59495E-5
       1.70709E-5      1.88006E-5      1.98083E-5      1.47531E-5      1.53160E-5
        1.60131E-5      1.73436E-5      1.88369E-5      2.04487E-5      2.17390E-5
         2.33381E-5


LAMBDA        1.00000E-1
RSS           1.40300E3
NPHI          1.40300E3

par
   7.31562E3       6.07361E3       1.89750E3       4.40335E3       3.46147E2       5.
      54599E2       6.42268E2       1.87567E-5      2.87984E-5      3.89688E-5      5
      .71550E-5      6.06969E-5      6.53224E-5      8.59193E-5      9.61981E-5
      2.07347E-5      1.95560E-5      2.04802E-5      3.88219E-5      4.87020E-5
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      5.77692E-5     7.32759E-5     8.29846E-5     3.75809E-5     4.20150E-5
       4.85678E-5     5.86987E-5     7.18124E-5     8.75404E-5     1.01174E-4
        1.17692E-4


LAMBDA        1.00000E-2
RSS           5.61972E2
NPHI          5.61972E2

par
   7.77186E3      6.08540E3      5.01016E3      3.49167E3      2.13277E2      1.
      92040E2      3.29712E2      2.29106E-5     4.39344E-5     7.32987E-5     1
      .38926E-4     1.53815E-4     1.73530E-4     2.73877E-4     3.30093E-4
      2.64634E-5     2.42416E-5     2.66192E-5     7.29207E-5     1.05464E-4
       1.42066E-4     2.11061E-4     2.59398E-4     6.96561E-5     8.34719E-5
        1.10867E-4     1.50331E-4     2.11783E-4     2.93107E-4     3.66209E-4
         4.72470E-4


LAMBDA        1.00000E-3
RSS           3.41088E2
NPHI          3.41088E2

par
   7.89318E3      6.15995E3      8.22155E3      3.60457E3      3.03229E2      2.
      36618E2      4.02850E2      2.31655E-5     4.82071E-5     9.12497E-5     2
      .13898E-4     2.47990E-4     2.91512E-4     5.57335E-4     7.28380E-4
      2.71158E-5     2.46519E-5     2.74698E-5     9.06626E-5     1.46076E-4
       2.22533E-4     3.84919E-4     5.16819E-4     8.44880E-5     1.06722E-4
        1.60221E-4     2.40687E-4     3.90638E-4     6.30108E-4     8.52781E-4
         1.23811E-3


LAMBDA        1.00000E-4
RSS           3.20399E2
NPHI          3.20399E2

par
   7.86214E3      6.13760E3      9.35023E3      3.58611E3      3.07083E2      2.
      25928E2      3.64865E2      2.32207E-5     4.84877E-5     9.37892E-5     2
      .37515E-4     2.82196E-4     3.39629E-4     7.40395E-4     1.03278E-3
      2.71750E-5     2.47015E-5     2.75504E-5     9.32052E-5     1.55120E-4
       2.49870E-4     4.73097E-4     6.76735E-4     8.65925E-5     1.10729E-4
        1.73467E-4     2.74031E-4     4.87674E-4     8.83382E-4     1.27806E-3
         2.07884E-3


LAMBDA        1.00000E-5
RSS           3.19798E2
NPHI          3.19798E2

par
   7.87522E3      6.14672E3      9.44141E3      3.59291E3      3.20378E2      2.
      25977E2      3.59732E2      2.31986E-5     4.84534E-5     9.37270E-5     2
      .38443E-4     2.84452E-4     3.43512E-4     7.72625E-4     1.10194E-3
      2.71545E-5     2.46829E-5     2.75277E-5     9.31280E-5     1.55142E-4
       2.51460E-4     4.83434E-4     7.03207E-4     8.63891E-5     1.10524E-4
        1.73531E-4     2.75339E-4     4.97840E-4     9.38372E-4     1.39753E-3
         2.41161E-3


LAMBDA        1.00000E-5
RSS           3.19792E2
NPHI          3.19792E2

par
   7.87498E3      6.14648E3      9.44132E3      3.59270E3      3.25130E2      2.
      24073E2      3.53142E2      2.31995E-5     4.84551E-5     9.37333E-5     2
      .38446E-4     2.84627E-4     3.43736E-4     7.73893E-4     1.10464E-3
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      2.71557E-5     2.46839E-5     2.75293E-5     9.31304E-5     1.55110E-4
       2.51658E-4     4.83938E-4     7.04419E-4     8.63911E-5     1.10531E-4
        1.73543E-4     2.75331E-4     4.97960E-4     9.42010E-4     1.40630E-3
         2.44599E-3


LAMBDA         1.00000E-5
RSS            3.19791E2
NPHI           3.19791E2

par
   7.87681E3      6.14774E3      9.44320E3      3.59363E3      3.28689E2      2.
      23408E2      3.50392E2      2.31965E-5     4.84506E-5     9.37223E-5     2
      .38402E-4     2.84679E-4     3.43795E-4     7.74153E-4     1.10483E-3
      2.71531E-5     2.46814E-5     2.75264E-5     9.31160E-5     1.55067E-4
       2.51718E-4     4.84068E-4     7.04713E-4     8.63593E-5     1.10495E-4
        1.73484E-4     2.75190E-4     4.97641E-4     9.42654E-4     1.40763E-3
         2.44912E-3
RELATIVE CHANGE IN RESIDUAL SUM OF SQUARES LESS THAN 0.00001

RESULTS
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APPROXIMATE STATISTICS ASSUMING LINEARITY NEAR SOLUTION

SUM OF SQUARES .............      319.791017
ORTHOGONALITY OFFSET.........        0.009110
MEAN SQUARE RESIDUALS .......        0.664846

             PAR. EST.       STD. ERR.       T-STATISTIC       C.V.
             ---------       ---------       -----------       ----
N 1          7.87681E3       4.73652E3       1.66300E0         0.60
N 2          6.14774E3       2.33749E3       2.63006E0         0.38
N 3          9.44320E3       2.88985E3       3.26772E0         0.31
N 4          3.59363E3       1.09855E3       3.27125E0         0.31
N 5          3.28689E2       1.16483E2       2.82177E0         0.35
N 6          2.23408E2       8.61586E1       2.59298E0         0.39
N 8          3.50392E2       1.38377E2       2.53216E0         0.39
qRV SPR 1    2.31965E-5      4.01511E-6      5.77729E0         0.17
qRV SPR 2    4.84506E-5      7.83400E-6      6.18465E0         0.16
qRV SPR 3    9.37223E-5      1.54386E-5      6.07064E0         0.16
qRV SPR 4    2.38402E-4      3.92779E-5      6.06963E0         0.16
qRV SPR 5    2.84679E-4      4.60448E-5      6.18264E0         0.16
qRV SPR 6    3.43795E-4      5.78470E-5      5.94318E0         0.17
qRV SPR 7    7.74153E-4      1.25485E-4      6.16927E0         0.16
qRV SPR 8    1.10483E-3      1.85733E-4      5.94847E0         0.17
qRV FAL 1    2.71531E-5      4.07500E-6      6.66333E0         0.15
qRV FAL 2    2.46814E-5      3.79475E-6      6.50410E0         0.15
qRV FAL 3    2.75264E-5      4.14746E-6      6.63693E0         0.15
qRV FAL 4    9.31160E-5      1.38003E-5      6.74738E0         0.15
qRV FAL 5    1.55067E-4      2.37036E-5      6.54192E0         0.15
qRV FAL 6    2.51718E-4      3.80643E-5      6.61297E0         0.15
qRV FAL 7    4.84068E-4      7.46182E-5      6.48726E0         0.15
qRV FAL 8    7.04713E-4      1.17055E-4      6.02038E0         0.17
qCANADA 1    8.63593E-5      2.37268E-5      3.63974E0         0.27
qCANADA 2    1.10495E-4      2.95087E-5      3.74448E0         0.27
qCANADA 3    1.73484E-4      4.58792E-5      3.78131E0         0.26
qCANADA 4    2.75190E-4      7.28007E-5      3.78005E0         0.26
qCANADA 5    4.97641E-4      1.32663E-4      3.75116E0         0.27
qCANADA 6    9.42654E-4      2.51785E-4      3.74388E0         0.27
qCANADA 7    1.40763E-3      3.93458E-4      3.57759E0         0.28
qCANADA 8    2.44912E-3      6.62677E-4      3.69579E0         0.27
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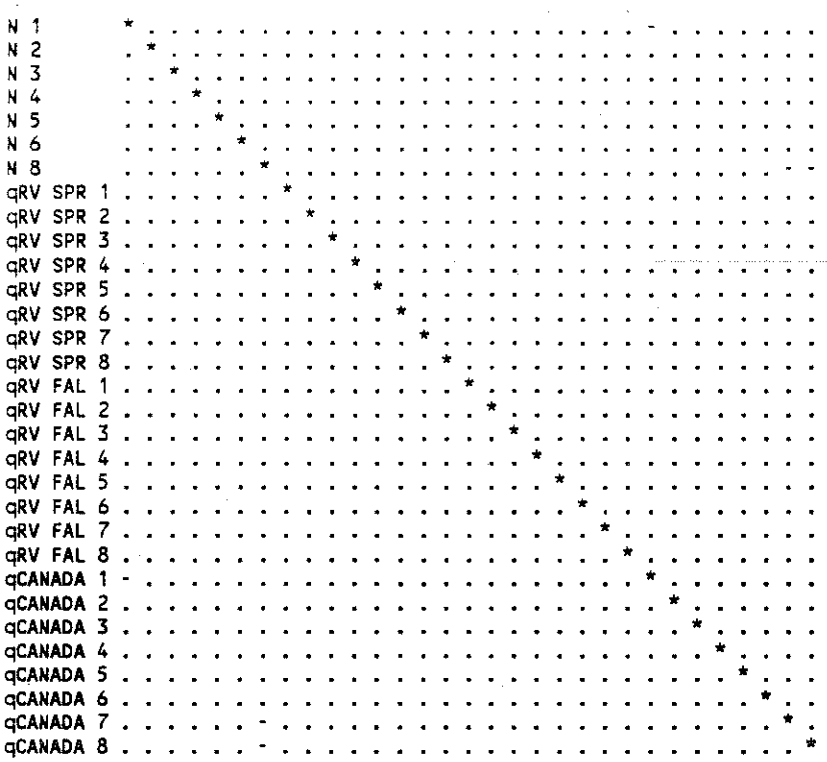
CATCHABILITY ESTIMATES IN ORIGINAL UNITS

	ESTIMATE	STD. ERR.	C.V.
qRV SPR 1	1.77443E-4	3.07139E-5	0.17
qRV SPR 2	2.42029E-4	3.91339E-5	0.16
qRV SPR 3	2.24521E-4	3.69848E-5	0.16
qRV SPR 4	2.26578E-4	3.73297E-5	0.16
qRV SPR 5	2.42634E-4	3.92443E-5	0.16
qRV SPR 6	1.91379E-4	3.22015E-5	0.17
qRV SPR 7	2.25993E-4	3.66321E-5	0.16
qRV SPR 8	2.55031E-4	4.28734E-5	0.17
qRV FAL 1	1.66490E-4	2.49860E-5	0.15
qRV FAL 2	2.68444E-4	4.12730E-5	0.15
qRV FAL 3	1.87642E-4	2.82725E-5	0.15
qRV FAL 4	2.08594E-4	3.09148E-5	0.15
qRV FAL 5	1.76907E-4	2.70421E-5	0.15
qRV FAL 6	1.96771E-4	2.97553E-5	0.15
qRV FAL 7	2.06859E-4	3.18869E-5	0.15
qRV FAL 8	2.10783E-4	3.50116E-5	0.17
qCANADA 1	1.70905E-4	4.69553E-5	0.27
qCANADA 2	3.27949E-4	8.75819E-5	0.27
qCANADA 3	6.25582E-4	1.65441E-4	0.26
qCANADA 4	5.02222E-4	1.32861E-4	0.26
qCANADA 5	5.98662E-4	1.59594E-4	0.27
qCANADA 6	4.15711E-4	1.11037E-4	0.27
qCANADA 7	5.94334E-4	1.66127E-4	0.28
qCANADA 8	4.97171E-4	1.34523E-4	0.27

CORRELATION BETWEEN PARAMETERS ESTIMATED

1.00	0.05	0.04	0.03	0.03	0.02	0.01	-0.01	-0.01	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.14	-0.01	-0.01	-0.01	-0.00	-0.00	-0.00	-0.00	-0.24	-0.02	-0.01	-0.01	-0.01	0.01	-0.00	-0.01
0.05	1.00	0.06	0.05	0.04	0.03	0.02	-0.11	-0.01	-0.01	-0.01	-0.00	-0.00	-0.00	-0.00	-0.10	-0.09	-0.01	-0.01	-0.00	-0.01	-0.01	-0.00	-0.16	-0.16	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01
0.04	0.06	1.00	0.06	0.04	0.03	0.02	-0.09	-0.08	-0.01	-0.01	-0.01	-0.01	-0.00	-0.00	-0.08	-0.08	-0.08	-0.01	-0.01	-0.01	-0.01	-0.01	-0.14	-0.13	-0.13	-0.02	-0.01	-0.01	-0.01	-0.01
0.03	0.05	0.06	1.00	0.06	0.04	0.03	-0.07	-0.07	-0.07	-0.01	-0.01	-0.01	-0.01	-0.01	-0.07	-0.07	-0.07	-0.07	-0.01	-0.01	-0.01	-0.01	-0.12	-0.11	-0.11	-0.13	-0.02	-0.02	-0.01	-0.01
0.03	0.04	0.04	0.06	1.00	-0.04	-0.10	-0.05	-0.04	-0.05	-0.07	-0.02	-0.03	-0.01	-0.02	-0.05	-0.05	-0.05	-0.07	-0.08	-0.02	-0.04	-0.02	-0.09	-0.08	-0.09	-0.12	-0.16	-0.04	-0.02	-0.02
0.02	0.03	0.03	0.04	-0.04	1.00	-0.04	-0.04	-0.03	-0.04	-0.05	-0.09	-0.03	-0.02	-0.04	-0.04	-0.03	-0.04	-0.05	-0.01	-0.11	-0.04	-0.03	-0.06	-0.06	-0.07	-0.09	-0.14	-0.19	-0.03	-0.05
0.01	0.02	0.02	0.03	-0.10	-0.04	1.00	-0.03	-0.02	-0.03	-0.03	-0.05	-0.09	-0.13	-0.08	-0.03	-0.02	-0.03	-0.03	-0.03	-0.08	-0.14	-0.16	-0.04	-0.04	-0.04	-0.05	-0.07	-0.13	-0.20	-0.28
-0.01	-0.11	-0.09	-0.07	-0.05	-0.04	-0.03	1.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.04	0.04	0.03	0.02	0.02	0.01	0.01	0.01
-0.01	-0.01	-0.08	-0.07	-0.04	-0.03	-0.02	0.01	1.00	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01
-0.00	-0.01	-0.01	-0.07	-0.05	-0.04	-0.03	0.01	0.01	1.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01
-0.00	-0.01	-0.01	-0.01	-0.07	-0.05	-0.03	0.01	0.01	0.01	1.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.01	0.02
-0.00	-0.00	-0.01	-0.01	-0.02	-0.09	-0.05	0.01	0.01	0.01	0.01	1.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.02	0.02
-0.00	-0.00	-0.01	-0.01	-0.03	-0.03	-0.09	0.01	0.00	0.01	0.01	0.01	1.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.02	0.02	0.03
-0.00	-0.00	-0.00	-0.01	-0.01	-0.02	-0.13	0.01	0.00	0.01	0.01	0.01	0.01	1.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.04
-0.00	-0.00	-0.00	-0.01	-0.02	-0.04	-0.08	0.01	0.00	0.01	0.01	0.01	0.01	1.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03
-0.14	-0.10	-0.08	-0.07	-0.05	-0.04	-0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	1.00	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.06	0.04	0.02	0.02	0.02	0.01	0.01	0.01	0.01
-0.01	-0.09	-0.08	-0.07	-0.05	-0.03	-0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	1.00	0.01	0.01	0.01	0.01	0.01	0.01	0.04	0.03	0.02	0.02	0.02	0.01	0.01	0.01
-0.01	-0.01	-0.08	-0.07	-0.05	-0.04	-0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	1.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01
-0.01	-0.01	-0.01	-0.07	-0.07	-0.05	-0.03	0.01	0.01	0.01	0.01	0.01	0.01	0 01	0.01	0.01	0.01	0.01	1.00	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.02
-0.00	-0.00	-0.01	-0.01	-0.08	-0.01	-0.03	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	1.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01
-0.00	-0.01	-0.01	-0.01	-0.02	-0.11	-0.08	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	1.00	0.02	0.02	0.01	0.01	0.02	0.02	0.03	0.04	0.02	0.03
-0.00	-0.01	-0.01	-0.01	-0.04	-0.04	-0.14	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.02	1.00	0.03	0.01	0.01	0.01	0.02	0.03	0.03	0.03	0.05
-0.00	-0.00	-0.01	-0.01	-0.02	-0.03	-0.16	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.03	1.00	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.05
-0.24	-0.16	-0.14	-0.12	-0.09	-0.06	-0.04	0.04	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.06	0.04	0.02	0.02	0.01	0.01	0.01	0.01	1.00	0.06	0.04	0.03	0.03	0.02	0.01	0.02
-0.02	-0.16	-0.13	-0.11	-0.08	-0.06	-0.04	0.04	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.06	1.00	0.04	0.03	0.03	0.02	0.01	0.02
-0.01	-0.02	-0.13	-0.11	-0.09	-0.07	-0.04	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.02	0.01	0.01	0.04	0.04	1.00	0.03	0.03	0.03	0.02	0.02
-0.01	-0.01	-0.02	-0.13	-0.12	-0.09	-0.05	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.03	0.03	0.03	1.00	0.04	0.03	0.02	0.03
-0.01	-0.01	-0.01	-0.02	-0.16	-0.14	-0.07	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.02	0.03	0.03	0.03	0.04	1.00	0.05	0.03	0.04
-0.01	-0.01	-0.01	-0.02	-0.04	-0.19	-0.13	0.01	0.01	0.02	0.02	0.03	0.02	0.02	0.02	0.01	0.01	0.02	0.02	0.01	0.04	0.03	0.03	0.02	0.02	0.03	0.03	0.05	1.00	0.04	0.05
-0.00	-0.01	-0.01	-0.01	-0.02	-0.03	-0.20	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.03	0.01	0.01	0.02	0.02	0.03	0.04	1.00	0.06
-0.01	-0.01	-0.01	-0.01	-0.02	-0.05	-0.28	0.01	0.01	0.01	0.02	0.02	0.03	0.04	0.03	0.01	0.01	0.01	0.02	0.01	0.03	0.05	0.05	0.02	0.02	0.02	0.03	0.04	0.05	0.06	1.00

CORRELATION BETWEEN PARAMETERS ESTIMATED (SYMBOLIC FORM)



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

Where R is the estimated correlation, M is 0.2 and L is 0.5

SUMMMARY OF RESIDUALS

Index 1 RV SPR 1
Index is tuned to the sum of Jan1 full stock sizes (in number)
for ages: 1
SORTED BY YEAR

Yr	Observed	Pred	Weight	Wt Res	Std Res	Pred Stocksize
1968	-2.9509	-4.6268	1.0000	1.6759	2.0553	421.875
1970	-2.4351	-2.2248	1.0000	-0.2104	-0.2580	4659.908
1972	-0.6434	-1.6220	1.0000	0.9786	1.2002	8514.566
1973	1.3890	-0.7977	1.0000	2.1867	2.6818	19414.356
1974	-1.2785	-1.4085	1.0000	0.1300	0.1595	10540.312
1975	-2.0965	-1.7286	1.0000	-0.3680	-0.4513	7653.793
1976	2.3572	0.8732	1.0000	1.4840	1.8200	103232.585
1977	-2.5289	-1.1403	1.0000	-1.3886	-1.7031	13783.240
1978	-4.6939	-1.9623	1.0000	-2.7316	-3.3501	6058.356
1979	1.5522	0.6657	1.0000	0.8865	1.0873	83882.727
1980	-0.3860	-1.4507	1.0000	1.0647	1.3058	10105.279
1981	-0.8407	-1.7897	1.0000	0.9489	1.1638	7200.129
1982	-2.3091	-2.8637	1.0000	0.5546	0.6802	2459.716
1983	-2.8786	-2.6522	1.0000	-0.2264	-0.2777	3039.171
1984	-1.2975	-0.9249	1.0000	-0.3726	-0.4569	17095.900
1986	-1.1224	-1.0918	1.0000	-0.0305	-0.0374	14467.496
1988	-1.5964	-0.9881	1.0000	-0.6083	-0.7460	16049.058
1989	-5.9467	-3.6153	1.0000	-2.3314	-2.8592	1160.025
1990	-2.1855	-2.8519	1.0000	0.6664	0.8173	2489.052

1991	-2.6508	-3.0792	1.0000	0.4284	0.5254	1982.893
1992	-2.9509	-1.6415	1.0000	-1.3095	-1.6060	8350.284
1993	-1.8776	-1.0939	1.0000	-0.7838	-0.9612	14438.198
1994	-2.3913	-1.7477	1.0000	-0.6437	-0.7894	7508.864

Partial variance for this index is 1.512382

Index 2 RV SPR 2
Index is tuned to the sum of Jan1 full stock sizes (in number)
for ages: 2
SORTED BY YEAR

Yr	Observed	Pred	Weight	Wt Res	Std Res	Pred Stocksize
1968	-0.5682	-0.7692	1.0000	0.2010	0.2465	9563.832
1969	-4.2678	-4.1114	1.0000	-0.1563	-0.1917	338.163
1970	-2.9948	-3.2415	1.0000	0.2467	0.3026	807.079
1971	-1.4601	-1.6992	1.0000	0.2391	0.2932	3773.588
1972	-4.0165	-4.2278	1.0000	0.2113	0.2591	301.027
1973	-0.0316	-1.1059	1.0000	1.0743	1.3175	6829.982
1974	0.9785	-0.4187	1.0000	1.3972	1.7136	13578.747
1975	-1.6390	-0.8768	1.0000	-0.7621	-0.9347	8588.055
1976	-2.8125	-1.2201	1.0000	-1.5924	-1.9529	6092.667
1977	1.9003	1.4082	1.0000	0.4921	0.6035	84389.395
1978	-1.6390	-0.6038	1.0000	-1.0351	-1.2695	11283.857
1979	-1.1511	-1.4260	1.0000	0.2749	0.3371	4959.257
1980	2.2352	1.2022	1.0000	1.0330	1.2669	68676.464
1981	-0.4176	-0.9150	1.0000	0.4974	0.6100	8266.264
1982	-1.1832	-1.2533	1.0000	0.0700	0.0859	5894.062
1983	-2.2064	-2.3276	1.0000	0.1213	0.1487	2012.940
1984	-1.4430	-2.1156	1.0000	0.6726	0.8249	2488.262
1985	-0.0071	-0.3884	1.0000	0.3813	0.4676	13996.938
1986	-3.3233	-2.6783	1.0000	-0.6450	-0.7911	1417.540
1987	-0.3220	-0.5558	1.0000	0.2337	0.2866	11839.555
1988	-4.8274	-2.7795	1.0000	-2.0479	-2.5115	1281.061
1989	-0.3586	-0.4518	1.0000	0.0932	0.1143	13136.238
1991	-1.5409	-2.3162	1.0000	0.7753	0.9509	2036.054
1992	-3.3233	-2.5460	1.0000	-0.7773	-0.9533	1618.026
1993	-2.0393	-1.1058	1.0000	-0.9335	-1.1448	6830.300
1994	-0.6227	-0.5579	1.0000	-0.0648	-0.0795	11814.663

Partial variance for this index is 0.668823

Index 3 RV SPR 3
Index is tuned to the sum of Jan1 full stock sizes (in number)
for ages: 3
SORTED BY YEAR

Yr	Observed	Pred	Weight	Wt Res	Std Res	Pred Stocksize
1968	-1.6502	-1.4367	1.0000	-0.2135	-0.2618	2536.388
1969	-1.4184	-0.7340	1.0000	-0.6843	-0.8393	5121.120
1971	-2.2599	-3.0256	1.0000	0.7656	0.9390	517.816
1972	-1.3679	-1.7547	1.0000	0.3868	0.4744	1845.401
1974	0.1772	-1.0552	1.0000	1.2324	1.5114	3714.379
1975	0.3263	-0.3922	1.0000	0.7185	0.8812	7208.440
1976	-1.3845	-0.5598	1.0000	-0.8246	-1.0113	6095.703
1977	-1.7411	-0.8500	1.0000	-0.8911	-1.0929	4560.266
1978	1.8946	1.5717	1.0000	0.3229	0.3960	51370.952
1979	-0.7514	-0.2215	1.0000	-0.5299	-0.6499	8549.860
1980	-1.5470	-0.9720	1.0000	-0.5750	-0.7052	4036.771
1981	2.0963	0.9711	1.0000	1.1252	1.3799	28177.573
1982	-0.9355	-0.7205	1.0000	-0.2150	-0.2636	5190.713
1983	-1.4184	-1.0399	1.0000	-0.3784	-0.4641	3771.514
1984	-1.3199	-1.9928	1.0000	0.6729	0.8252	1454.421
1985	-1.1481	-1.6980	1.0000	0.5499	0.6745	1953.067
1986	-0.1509	-0.1393	1.0000	-0.0117	-0.0143	9282.685
1987	-3.6870	-2.2615	1.0000	-1.4255	-1.7483	1111.722
1988	-0.8837	-0.3020	1.0000	-0.5816	-0.7133	7888.257
1989	-1.6721	-2.3656	1.0000	0.6935	0.8505	1001.793
1990	0.8703	-0.1044	1.0000	0.9747	1.1954	9612.233

1991	-2.3008	-2.6319	1.0000	0.3311	0.4061	767.634
1992	-3.0809	-2.1350	1.0000	-0.9459	-1.1600	1261.613
1993	-2.5884	-2.2710	1.0000	-0.3174	-0.3893	1101.233
1994	-0.8736	-0.6941	1.0000	-0.1795	-0.2202	5329.774

Partial variance for this index is 0.532471

Index 4 RV SPR 4
Index is tuned to the sum of Jan1 full stock sizes (in number)
for ages: 4
SORTED BY YEAR

Yr	Observed	Pred	Weight	Wt Res	Std Res	Pred Stocksize
1968	-0.3058	0.1109	1.0000	-0.4167	-0.5111	4686.535
1969	-1.3354	-1.0726	1.0000	-0.2629	-0.3224	1435.089
1970	-1.0578	-0.4568	1.0000	-0.6010	-0.7370	2656.404
1972	-2.0694	-2.9381	1.0000	0.8687	1.0654	222.173
1973	-0.5653	-1.3351	1.0000	0.7698	0.9441	1103.710
1975	-0.4112	-0.5391	1.0000	0.1279	0.1569	2446.598
1976	-0.0325	0.0049	1.0000	-0.0374	-0.0459	4215.155
1977	0.2497	0.0687	1.0000	0.1810	0.2220	4493.079
1978	-0.9708	-0.1628	1.0000	-0.8080	-0.9909	3564.425
1979	1.7931	1.9347	1.0000	-0.1416	-0.1736	29033.844
1980	0.0901	0.2597	1.0000	-0.1696	-0.2080	5438.284
1981	0.8348	-0.3382	1.0000	1.1729	1.4385	2991.050
1982	1.4545	1.1402	1.0000	0.3143	0.3855	13118.444
1983	-1.4633	-0.4142	1.0000	-1.0491	-1.2866	2772.197
1984	-0.4112	-0.5784	1.0000	0.1673	0.2051	2352.222
1985	-0.8654	-1.5150	1.0000	0.6495	0.7966	922.042
1986	-1.3762	-1.3372	1.0000	-0.0390	-0.0478	1101.375
1987	-0.1598	0.1871	1.0000	-0.3469	-0.4255	5057.427
1988	-1.9893	-1.6651	1.0000	-0.3242	-0.3976	793.477
1989	-0.2916	0.0251	1.0000	-0.3167	-0.3884	4301.226
1990	-1.0578	-1.7317	1.0000	0.6739	0.8265	742.382
1991	0.6661	0.4476	1.0000	0.2185	0.2680	6562.340
1992	-2.6084	-2.0387	1.0000	-0.5697	-0.6987	546.146
1993	-1.9152	-1.7304	1.0000	-0.1849	-0.2268	743.373
1994	-1.8462	-1.9701	1.0000	0.1238	0.1519	584.920

Partial variance for this index is 0.292372

Index 5 RV SPR 5
Index is tuned to the sum of Jan1 full stock sizes (in number)
for ages: 5
SORTED BY YEAR

Yr	Observed	Pred	Weight	Wt Res	Std Res	Pred Stocksize
1968	2.0649	2.3631	1.0000	-0.2982	-0.3657	37318.416
1969	-0.7077	-0.5150	1.0000	-0.1927	-0.2363	2098.817
1970	-0.6167	-1.5183	1.0000	0.9016	1.1057	769.584
1971	-1.9605	-0.7501	1.0000	-1.2104	-1.4844	1659.123
1972	-3.3468	-3.2899	1.0000	-0.0568	-0.0697	130.870
1973	-2.2481	-3.4764	1.0000	1.2283	1.5064	108.608
1974	-1.2673	-1.8463	1.0000	0.5790	0.7101	554.374
1976	-0.6842	-0.7473	1.0000	0.0631	0.0774	1663.791
1977	-0.3510	-0.2800	1.0000	-0.0710	-0.0871	2654.820
1978	0.0979	-0.1369	1.0000	0.2348	0.2880	3063.332
1979	-0.9489	-0.2847	1.0000	-0.6641	-0.8145	2642.329
1980	1.7429	1.5934	1.0000	0.1495	0.1834	17284.121
1981	-0.1146	0.0162	1.0000	-0.1309	-0.1605	3570.274
1982	-0.7077	-0.7276	1.0000	0.0199	0.0244	1696.945
1983	1.0394	0.7400	1.0000	0.2994	0.3672	7362.715
1984	-0.3849	-0.7584	1.0000	0.3735	0.4581	1645.345
1985	0.0205	-1.0189	1.0000	1.0395	1.2748	1268.020
1986	-2.0475	-1.8022	1.0000	-0.2453	-0.3008	579.366
1987	-2.3659	-1.6131	1.0000	-0.7528	-0.9232	699.951
1988	-0.9796	-0.2701	1.0000	-0.7095	-0.8701	2681.168
1989	-1.8063	-1.8943	1.0000	0.0880	0.1079	528.396
1990	-0.3849	-0.2528	1.0000	-0.1321	-0.1620	2728.004

1991	-2.2481	-2.0501	1.0000	-0.1981	-0.2429	452.179
1992	-0.9489	-0.0243	1.0000	-0.9245	-1.1339	3428.294
1993	-1.9605	-2.3720	1.0000	0.4116	0.5048	327.708
1994	-2.1428	-2.3409	1.0000	0.1981	0.2430	338.076

Partial variance for this index is 0.338498

Index 6 RV SPR 6
Index is tuned to the sum of Jan1 full stock sizes (in number)
for ages: 6
SORTED BY YEAR

Yr	Observed	Pred	Weight	Wt Res	Std Res	Pred Stocksize
1968	1.1046	1.2854	1.0000	-0.1808	-0.2217	10518.098
1969	2.0280	1.7897	1.0000	0.2383	0.2922	17416.401
1970	-0.1907	-0.9485	1.0000	0.7578	0.9293	1126.603
1971	-1.5345	-1.8404	1.0000	0.3059	0.3752	461.783
1972	-2.6331	-0.9752	1.0000	-1.6578	-2.0332	1096.877
1975	-1.4544	-2.0079	1.0000	0.5535	0.6788	390.544
1977	-0.2127	-0.9135	1.0000	0.7008	0.8594	1166.752
1978	0.3873	-0.5326	1.0000	0.9200	1.1283	1707.591
1979	-1.2468	-0.3771	1.0000	-0.8697	-1.0667	1995.002
1980	0.1853	-0.5440	1.0000	0.7293	0.8944	1688.316
1981	1.1624	1.0925	1.0000	0.0699	0.0857	8673.156
1982	-0.6872	-0.3376	1.0000	-0.3496	-0.4287	2075.260
1983	-4.0194	-1.0328	1.0000	-2.9866	-3.6628	1035.549
1984	0.2573	0.3191	1.0000	-0.0618	-0.0758	4002.150
1985	-0.4930	-1.0799	1.0000	0.5869	0.7198	987.874
1986	-0.9749	-1.5441	1.0000	0.5692	0.6981	621.037
1987	-1.7168	-2.1400	1.0000	0.4232	0.5190	342.238
1988	-1.5345	-1.8384	1.0000	0.3040	0.3728	462.681
1989	-0.3058	-0.7656	1.0000	0.4598	0.5639	1352.751
1990	-2.2276	-2.2610	1.0000	0.0334	0.0409	303.222
1991	-1.7168	-0.6975	1.0000	-1.0193	-1.2501	1448.102
1992	-2.9208	-2.3481	1.0000	-0.5726	-0.7023	277.920
1993	-0.4085	-0.7134	1.0000	0.3050	0.3740	1425.163
1994	-2.0735	-2.8153	1.0000	0.7418	0.9097	174.201

Partial variance for this index is 0.82133

Index 7 RV SPR 7
Index is tuned to the sum of Jan1 full stock sizes (in number)
for ages: 7
SORTED BY YEAR

Yr	Observed	Pred	Weight	Wt Res	Std Res	Pred Stocksize
1968	-0.1550	0.1951	1.0000	-0.3502	-0.4295	1570.094
1969	1.2608	1.4388	1.0000	-0.1780	-0.2183	5445.464
1970	1.9244	1.9269	1.0000	-0.0025	-0.0031	8871.941
1971	-1.1767	-0.5724	1.0000	-0.6043	-0.7411	728.749
1972	-0.8090	-2.1172	1.0000	1.3082	1.6044	155.486
1973	-0.4835	-0.4924	1.0000	0.0089	0.0109	789.466
1974	-3.3739	-3.5563	1.0000	0.1824	0.2236	36.873
1975	-1.1767	-3.7065	1.0000	2.5298	3.1026	31.729
1976	-1.9876	-1.5227	1.0000	-0.4649	-0.5701	281.747
1978	-0.6013	-0.7145	1.0000	0.1132	0.1388	632.229
1979	0.2370	-0.3283	1.0000	0.5653	0.6933	930.257
1980	0.2370	-0.0230	1.0000	0.2600	0.3189	1262.386
1981	-0.1959	-0.4246	1.0000	0.2288	0.2806	844.803
1982	0.7370	1.3071	1.0000	-0.5702	-0.6993	4773.738
1983	-1.9876	-0.0869	1.0000	-1.9007	-2.3311	1184.227
1984	-1.4280	-0.7639	1.0000	-0.6640	-0.8144	601.720
1985	1.3883	0.4045	1.0000	0.9838	1.2065	1935.714
1986	-0.8890	-0.7627	1.0000	-0.1263	-0.1550	602.500
1987	-1.7645	-1.3003	1.0000	-0.4641	-0.5692	351.925
1988	-0.9760	-1.7971	1.0000	0.8211	1.0070	214.148
1989	-1.5821	-1.6666	1.0000	0.0845	0.1036	243.991
1990	-0.8090	-0.4998	1.0000	-0.3091	-0.3791	783.607
1991	-2.6808	-2.0912	1.0000	-0.5896	-0.7231	159.583

1992	-2.2753	-0.4610	1.0000	-1.8143	-2.2251	814.622
1993	-1.5821	-2.3187	1.0000	0.7366	0.9034	127.104
1994	-0.6013	-0.8172	1.0000	0.2158	0.2647	570.537

Partial variance for this index is 0.806037

Index 8 RV SPR 8
Index is tuned to the sum of Jan1 full stock sizes (in number)
for ages: 8
SORTED BY YEAR

Yr	Observed	Pred	Weight	Wt Res	Std Res	Pred Stocksize
1968	0.6676	0.2623	1.0000	0.4053	0.4971	1176.523
1969	0.1931	-0.2831	1.0000	0.4762	0.5840	681.957
1970	1.4459	1.2096	1.0000	0.2362	0.2897	3034.155
1971	1.2676	1.7436	1.0000	-0.4760	-0.5838	5175.366
1972	-2.0405	-0.9827	1.0000	-1.0578	-1.2973	338.771
1973	-3.1391	-2.7699	1.0000	-0.3692	-0.4528	56.724
1974	-0.8365	-0.4508	1.0000	-0.3858	-0.4731	576.688
1975	-3.1391	-3.4624	1.0000	0.3233	0.3965	28.380
1977	-1.7528	-1.4616	1.0000	-0.2912	-0.3571	209.864
1978	-1.3474	-2.4045	1.0000	1.0571	1.2965	81.743
1979	-1.3474	-0.8372	1.0000	-0.5102	-0.6257	391.853
1980	0.6895	-0.6414	1.0000	1.3309	1.6323	476.606
1981	-0.7412	-0.5174	1.0000	-0.2238	-0.2745	539.513
1983	1.6145	1.1630	1.0000	0.4515	0.5537	2895.893
1984	-1.7528	-0.1219	1.0000	-1.6309	-2.0002	801.263
1985	-0.8365	-1.1700	1.0000	0.3335	0.4090	280.915
1986	0.3574	0.2030	1.0000	0.1544	0.1893	1108.884
1987	-0.0481	-0.9288	1.0000	0.8807	1.0801	357.560
1988	-0.6542	-1.4724	1.0000	0.8182	1.0035	207.601
1989	-1.5297	-1.9753	1.0000	0.4456	0.5465	125.564
1991	-1.7528	-0.6314	1.0000	-1.1215	-1.3754	481.407
1992	-2.0405	-2.6398	1.0000	0.5993	0.7350	64.603
1993	-2.4460	-0.8820	1.0000	-1.5640	-1.9181	374.694
1994	-2.4460	-2.5641	1.0000	0.1182	0.1449	69.680

Partial variance for this index is 0.624679

Index 9 RV FAL 1
Index is tuned to the sum of Jan1 full stock sizes (in number)
for ages: 1
SORTED BY YEAR

Yr	Observed	Pred	Weight	Wt Res	Std Res	Pred Stocksize
1964	2.6166	2.5505	1.0000	0.0661	0.0811	471879.348
1965	-0.9509	-0.1051	1.0000	-0.8458	-1.0373	33153.706
1966	-2.9288	-2.1864	1.0000	-0.7424	-0.9105	4136.612
1967	0.0012	-1.0450	1.0000	1.0462	1.2831	12952.237
1968	-5.3267	-4.4693	1.0000	-0.8574	-1.0515	421.875
1969	-4.2281	-3.6184	1.0000	-0.6097	-0.7478	987.979
1970	-2.7617	-2.0673	1.0000	-0.6945	-0.8517	4659.908
1971	-4.9212	-4.6038	1.0000	-0.3174	-0.3893	368.781
1972	-0.9261	-1.4645	1.0000	0.5384	0.6603	8514.566
1973	0.0961	-0.6403	1.0000	0.7363	0.9030	19414.356
1974	-0.6399	-1.2511	1.0000	0.6111	0.7495	10540.312
1975	-2.1078	-1.5711	1.0000	-0.5368	-0.6583	7653.793
1976	1.3428	1.0307	1.0000	0.3121	0.3828	103232.585
1977	-0.3500	-0.9828	1.0000	0.6329	0.7761	13783.240
1978	-3.8202	-1.8048	1.0000	-2.0154	-2.4717	6058.356
1979	0.7684	0.8232	1.0000	-0.0547	-0.0671	83882.727
1980	-1.5360	-1.2932	1.0000	-0.2428	-0.2978	10105.279
1981	0.6446	-1.6322	1.0000	2.2768	2.7923	7200.129
1982	-2.7841	-2.7062	1.0000	-0.0779	-0.0956	2459.716
1983	-1.5090	-2.4947	1.0000	0.9857	1.2089	3039.171
1984	-0.0563	-0.7674	1.0000	0.7112	0.8722	17095.900
1985	-5.3267	-3.0573	1.0000	-2.2693	-2.7832	1731.388
1986	0.6158	-0.9344	1.0000	1.5501	1.9011	14467.496
1988	-1.2257	-0.8306	1.0000	-0.3950	-0.4845	16049.058

1989	-4.6712	-3.4578	1.0000	-1.2133	-1.4881	1160.025
1990	-2.5740	-2.6944	1.0000	0.1203	0.1476	2489.052
1991	-2.0738	-2.9217	1.0000	0.8479	1.0399	1982.893
1992	-1.0449	-1.4840	1.0000	0.4391	0.5385	8350.284
1993	-0.7661	-0.9364	1.0000	0.1703	0.2088	14438.198
1994	-1.3967	-1.5902	1.0000	0.1935	0.2373	7508.864
1995	-1.9078	-1.5423	1.0000	-0.3654	-0.4481	7876.811

Partial variance for this index is 0.913723

Index 10 RV FAL 2
Index is tuned to the sum of Jan1 full stock sizes (in number)
for ages: 2
SORTED BY YEAR

Yr	Observed	Pred	Weight	Wt Res	Std Res	Pred Stocksize
1964	0.8477	1.3320	1.0000	-0.4843	-0.5939	153501.889
1965	2.3396	2.2311	1.0000	0.1085	0.1331	377202.371
1966	-0.0680	-0.7863	1.0000	0.7183	0.8810	18456.615
1967	-2.4341	-2.5128	1.0000	0.0787	0.0965	3283.620
1968	-0.4815	-1.4437	1.0000	0.9622	1.1801	9563.832
1969	-5.2067	-4.7859	1.0000	-0.4208	-0.5160	338.163
1970	-5.8998	-3.9160	1.0000	-1.9838	-2.4330	807.079
1971	-0.9690	-2.3737	1.0000	1.4047	1.7228	3773.588
1973	-1.4631	-1.7804	1.0000	0.3173	0.3891	6829.982
1974	-0.1894	-1.0932	1.0000	0.9038	1.1084	13578.747
1975	-1.8139	-1.5513	1.0000	-0.2625	-0.3220	8588.055
1976	-2.8553	-1.8946	1.0000	-0.9607	-1.1782	6092.667
1977	1.7750	0.7337	1.0000	1.0413	1.2770	84389.395
1978	-1.6265	-1.2783	1.0000	-0.3482	-0.4270	11283.857
1979	-2.5572	-2.1004	1.0000	-0.4567	-0.5601	4959.257
1980	1.4326	0.5277	1.0000	0.9049	1.1098	68676.464
1981	-1.3886	-1.5895	1.0000	0.2009	0.2464	8266.264
1982	-0.5727	-1.9278	1.0000	1.3551	1.6619	5894.062
1984	-3.8204	-2.7901	1.0000	-1.0303	-1.2636	2488.262
1985	-1.1858	-1.0629	1.0000	-0.1229	-0.1508	13996.938
1986	-2.8174	-3.3528	1.0000	0.5354	0.6566	1417.540
1987	-0.7554	-1.2303	1.0000	0.4749	0.5824	11839.555
1989	-1.4798	-1.1263	1.0000	-0.3535	-0.4335	13136.238
1990	-5.3985	-3.7533	1.0000	-1.6452	-2.0177	949.747
1991	-2.7835	-2.9907	1.0000	0.2072	0.2541	2036.054
1992	-3.9713	-3.2205	1.0000	-0.7508	-0.9208	1618.026
1993	-1.6542	-1.7803	1.0000	0.1261	0.1547	6830.300
1994	-0.9897	-1.2324	1.0000	0.2427	0.2976	11814.663
1995	-2.6480	-1.8856	1.0000	-0.7623	-0.9349	6147.737

Partial variance for this index is 0.703106

Index 11 RV FAL 3
Index is tuned to the sum of Jan1 full stock sizes (in number)
for ages: 3
SORTED BY YEAR

Yr	Observed	Pred	Weight	Wt Res	Std Res	Pred Stocksize
1964	0.3023	-0.4678	1.0000	0.7701	0.9445	22755.387
1965	2.2355	1.1192	1.0000	1.1162	1.3689	111258.133
1966	2.4295	1.6803	1.0000	0.7492	0.9188	194982.347
1967	-0.8579	-1.4044	1.0000	0.5465	0.6702	8919.196
1968	-2.9477	-2.6619	1.0000	-0.2859	-0.3506	2536.388
1969	-1.9669	-1.9592	1.0000	-0.0077	-0.0094	5121.120
1971	-3.4867	-4.2507	1.0000	0.7640	0.9370	517.816
1972	-3.0813	-2.9799	1.0000	-0.1014	-0.1243	1845.401
1974	-1.4437	-2.2804	1.0000	0.8367	1.0262	3714.379
1975	-1.9361	-1.6174	1.0000	-0.3188	-0.3910	7208.440
1976	-2.2546	-1.7850	1.0000	-0.4696	-0.5759	6095.703
1977	-2.5704	-2.0752	1.0000	-0.4952	-0.6073	4560.266
1978	1.0109	0.3465	1.0000	0.6644	0.8149	51370.952
1979	-1.8814	-1.4467	1.0000	-0.4347	-0.5332	8549.860
1980	-5.2255	-2.1972	1.0000	-3.0283	-3.7140	4036.771

1981	0.6239	-0.2541	1.0000	0.8779	1.0767	28177.573
1982	-1.1883	-1.9457	1.0000	0.7575	0.9290	5190.713
1983	-1.6371	-2.2651	1.0000	0.6280	0.7702	3771.514
1984	-3.4867	-3.2180	1.0000	-0.2687	-0.3296	1454.421
1985	-2.0482	-2.9232	1.0000	0.8750	1.0731	1953.067
1986	-1.4941	-1.3645	1.0000	-0.1297	-0.1590	9282.685
1987	-4.3273	-3.4867	1.0000	-0.8406	-1.0310	1111.722
1988	-2.1551	-1.5272	1.0000	-0.6279	-0.7700	7888.257
1989	-3.8326	-3.5908	1.0000	-0.2418	-0.2966	1001.793
1990	-0.9239	-1.3296	1.0000	0.4057	0.4975	9612.233
1991	-5.6244	-3.8571	1.0000	-1.7673	-2.1675	767.634
1992	-3.3557	-3.3602	1.0000	0.0045	0.0055	1261.613
1993	-3.3891	-3.4962	1.0000	0.1071	0.1314	1101.233
1994	-1.2218	-1.9193	1.0000	0.6975	0.8555	5329.774
1995	-2.1301	-1.3473	1.0000	-0.7828	-0.9600	9443.199

Partial variance for this index is 0.787054

Index 12 RV FAL 4
Index is tuned to the sum of Jan1 full stock sizes (in number)
for ages: 4
SORTED BY YEAR

Yr	Observed	Pred	Weight	Wt Res	Std Res	Pred Stocksize
1964	1.1117	0.6266	1.0000	0.4852	0.5950	20095.421
1965	0.9558	0.3009	1.0000	0.6548	0.8031	14509.906
1966	1.4656	1.5546	1.0000	-0.0890	-0.1091	50828.809
1967	2.1051	1.8518	1.0000	0.2533	0.3107	68421.384
1968	-0.8082	-0.8292	1.0000	0.0210	0.0257	4686.535
1969	-2.8157	-2.0127	1.0000	-0.8030	-0.9849	1435.089
1970	-2.0685	-1.3969	1.0000	-0.6716	-0.8236	2656.404
1971	-5.0129	-3.9633	1.0000	-1.0496	-1.2873	204.051
1972	-3.4035	-3.8782	1.0000	0.4747	0.5822	222.173
1973	-1.4576	-2.2752	1.0000	0.8176	1.0028	1103.710
1975	-1.9684	-1.4792	1.0000	-0.4892	-0.6000	2446.598
1976	0.7740	-0.9352	1.0000	1.7092	2.0962	4215.155
1977	-1.4294	-0.8714	1.0000	-0.5580	-0.6844	4493.079
1978	-1.3826	-1.1029	1.0000	-0.2797	-0.3430	3564.425
1979	1.4208	0.9946	1.0000	0.4262	0.5227	29033.844
1980	-0.9072	-0.6804	1.0000	-0.2267	-0.2780	5438.284
1981	-1.6003	-1.2783	1.0000	-0.3220	-0.3949	2991.050
1982	0.5025	0.2001	1.0000	0.3024	0.3709	13118.444
1983	-1.8774	-1.3543	1.0000	-0.5232	-0.6416	2772.197
1984	-2.1226	-1.5185	1.0000	-0.6040	-0.7408	2352.222
1985	-2.2403	-2.4551	1.0000	0.2147	0.2633	922.042
1986	-2.3207	-2.2773	1.0000	-0.0433	-0.0531	1101.375
1987	-0.6159	-0.7531	1.0000	0.1371	0.1682	5057.427
1988	-3.1091	-2.6052	1.0000	-0.5039	-0.6180	793.477
1989	-0.7426	-0.9150	1.0000	0.1724	0.2114	4301.226
1990	-2.4321	-2.6718	1.0000	0.2397	0.2940	742.382
1991	-0.6334	-0.4926	1.0000	-0.1409	-0.1728	6562.340
1992	-3.8184	-2.9788	1.0000	-0.8396	-1.0297	546.146
1993	-2.2337	-2.6705	1.0000	0.4368	0.5357	743.373
1994	-1.9992	-2.9102	1.0000	0.9109	1.1172	584.920
1995	-1.2070	-1.0947	1.0000	-0.1123	-0.1377	3593.633

Partial variance for this index is 0.357177

Index 13 RV FAL 5
Index is tuned to the sum of Jan1 full stock sizes (in number)
for ages: 5
SORTED BY YEAR

Yr	Observed	Pred	Weight	Wt Res	Std Res	Pred Stocksize
1964	1.9898	1.4475	1.0000	0.5423	0.6650	27423.708
1965	0.4493	0.6319	1.0000	-0.1826	-0.2239	12131.235
1966	-0.0615	0.0868	1.0000	-0.1483	-0.1818	7033.397
1967	1.0779	1.3254	1.0000	-0.2475	-0.3035	24272.090
1968	1.7799	1.7556	1.0000	0.0243	0.0299	37318.416

1969	-1.2471	-1.1225	1.0000	-0.1246	-0.1528	2098.817
1970	-2.1409	-2.1258	1.0000	-0.0151	-0.0186	769.584
1971	-1.3937	-1.3576	1.0000	-0.0361	-0.0443	1659.123
1972	-4.3382	-3.8975	1.0000	-0.4407	-0.5405	130.870
1973	-2.5464	-4.0839	1.0000	1.5375	1.8856	108.608
1974	-1.7732	-2.4538	1.0000	0.6806	0.8347	554.374
1976	-0.2110	-1.3548	1.0000	1.1438	1.4027	1663.791
1977	-0.3308	-0.8875	1.0000	0.5567	0.6827	2654.820
1978	-0.6863	-0.7444	1.0000	0.0581	0.0712	3063.332
1979	-1.8284	-0.8922	1.0000	-0.9362	-1.1481	2642.329
1980	1.2066	0.9859	1.0000	0.2207	0.2706	17284.121
1981	-1.8284	-0.5913	1.0000	-1.2371	-1.5173	3570.274
1982	-1.7032	-1.3351	1.0000	-0.3682	-0.4515	1696.945
1983	0.2051	0.1325	1.0000	0.0726	0.0890	7362.715
1984	-1.3424	-1.3659	1.0000	0.0235	0.0288	1645.345
1985	-1.3937	-1.6264	1.0000	0.2327	0.2854	1268.020
1986	-3.1275	-2.4097	1.0000	-0.7178	-0.8803	579.366
1987	-2.9452	-2.2206	1.0000	-0.7245	-0.8886	699.951
1988	-0.3931	-0.8776	1.0000	0.4845	0.5942	2681.168
1989	-2.4505	-2.5018	1.0000	0.0513	0.0629	528.396
1990	-0.5409	-0.8603	1.0000	0.3194	0.3917	2728.004
1991	-3.1436	-2.6576	1.0000	-0.4861	-0.5961	452.179
1992	-1.6396	-0.6318	1.0000	-1.0077	-1.2359	3428.294
1995	-2.2520	-2.9765	1.0000	0.7245	0.8886	328.689

Partial variance for this index is 0.392607

Index 14 RV FAL 6
Index is tuned to the sum of Jan1 full stock sizes (in number)
for ages: 6
SORTED BY YEAR

Yr	Observed	Pred	Weight	Wt Res	Std Res	Pred Stocksize
1964	2.0288	1.4148	1.0000	0.6140	0.7531	16350.393
1965	1.5851	1.2989	1.0000	0.2862	0.3510	14560.641
1966	0.0289	0.4055	1.0000	-0.3766	-0.4619	5959.074
1967	-0.4048	-0.1996	1.0000	-0.2052	-0.2516	3253.868
1968	0.7312	0.9737	1.0000	-0.2424	-0.2973	10518.098
1969	1.5967	1.4780	1.0000	0.1187	0.1456	17416.401
1970	-1.5622	-1.2602	1.0000	-0.3020	-0.3704	1126.603
1971	-1.0698	-2.1521	1.0000	1.0824	1.3274	461.783
1972	-1.2521	-1.2870	1.0000	0.0349	0.0428	1096.877
1974	-2.8615	-4.5745	1.0000	1.7130	2.1008	40.965
1975	-3.9601	-2.3197	1.0000	-1.6405	-2.0119	390.544
1977	-0.9644	-1.2252	1.0000	0.2608	0.3199	1166.752
1978	-0.2072	-0.8444	1.0000	0.6372	0.7815	1707.591
1979	-1.1139	-0.6888	1.0000	-0.4251	-0.5213	1995.002
1980	-1.1139	-0.8557	1.0000	-0.2582	-0.3166	1688.316
1981	0.7761	0.7808	1.0000	-0.0047	-0.0058	8673.156
1982	-0.6321	-0.6494	1.0000	0.0173	0.0212	2075.260
1983	-1.7629	-1.3445	1.0000	-0.4184	-0.5131	1035.549
1984	0.1830	0.0074	1.0000	0.1756	0.2154	4002.150
1985	-2.5738	-1.3916	1.0000	-1.1822	-1.4499	987.874
1986	-2.0563	-1.8558	1.0000	-0.2005	-0.2459	621.037
1987	-1.7940	-2.4517	1.0000	0.6577	0.8067	342.238
1988	-2.5671	-2.1502	1.0000	-0.4170	-0.5114	462.681
1989	-0.8685	-1.0773	1.0000	0.2088	0.2561	1352.751
1990	-2.1595	-2.5727	1.0000	0.4133	0.5069	303.222
1991	-1.5128	-1.0092	1.0000	-0.5036	-0.6177	1448.102
1992	-3.8642	-2.6599	1.0000	-1.2043	-1.4770	277.920
1993	-0.5088	-1.0252	1.0000	0.5164	0.6333	1425.163
1994	-2.6114	-3.1270	1.0000	0.5156	0.6323	174.201
1995	-2.7495	-2.8782	1.0000	0.1287	0.1579	223.408

Partial variance for this index is 0.454379

Index 15 RV FAL 7
Index is tuned to the sum of Jan1 full stock sizes (in number)

for ages: 7
SORTED BY YEAR

Yr	Observed	Pred	Weight	Wt Res	Std Res	Pred Stocksize
1964	1.5638	0.9839	1.0000	0.5798	0.7111	5526.024
1965	1.2978	1.3717	1.0000	-0.0740	-0.0907	8143.941
1966	0.7547	1.0440	1.0000	-0.2893	-0.3548	5867.882
1967	0.1403	0.2044	1.0000	-0.0641	-0.0787	2534.444
1968	0.1403	-0.2744	1.0000	0.4147	0.5086	1570.094
1969	1.0864	0.9693	1.0000	0.1172	0.1437	5445.464
1970	1.2688	1.4574	1.0000	-0.1886	-0.2313	8871.941
1971	0.1702	-1.0420	1.0000	1.2121	1.4866	728.749
1972	-2.6631	-2.5867	1.0000	-0.0763	-0.0936	155.486
1973	-1.5644	-0.9619	1.0000	-0.6025	-0.7389	789.466
1976	-2.6631	-1.9923	1.0000	-0.6708	-0.8227	281.747
1978	-0.2223	-1.1840	1.0000	0.9617	1.1795	632.229
1979	0.0564	-0.7978	1.0000	0.8543	1.0477	930.257
1980	-0.4190	-0.4925	1.0000	0.0735	0.0902	1262.386
1981	0.1091	-0.8942	1.0000	1.0033	1.2304	844.803
1982	0.2067	0.8376	1.0000	-0.6309	-0.7737	4773.738
1983	-1.7468	-0.5564	1.0000	-1.1903	-1.4598	1184.227
1984	-1.2768	-1.2335	1.0000	-0.0433	-0.0531	601.720
1985	0.0450	-0.0651	1.0000	0.1100	0.1350	1935.714
1986	-1.8091	-1.2322	1.0000	-0.5769	-0.7075	602.500
1987	-1.1900	-1.7699	1.0000	0.5798	0.7111	351.925
1988	-1.9632	-2.2666	1.0000	0.3034	0.3721	214.148
1989	-1.4685	-2.1362	1.0000	0.6676	0.8188	243.991
1990	-1.1808	-0.9694	1.0000	-0.2115	-0.2593	783.607
1991	-2.3440	-2.5607	1.0000	0.2167	0.2658	159.583
1992	-3.2603	-0.9306	1.0000	-2.3297	-2.8572	814.622
1993	-3.0618	-2.7883	1.0000	-0.2736	-0.3355	127.104
1994	-1.0631	-1.2867	1.0000	0.2236	0.2743	570.537
1995	-3.0618	-2.9658	1.0000	-0.0960	-0.1178	106.430

Partial variance for this index is 0.515889

Index 16 RV FAL 8
Index is tuned to the sum of Jan1 full stock sizes (in number)
for ages: 8
SORTED BY YEAR

Yr	Observed	Pred	Weight	Wt Res	Std Res	Pred Stocksize
1964	1.7280	0.8467	1.0000	0.8812	1.0807	3309.179
1965	0.8292	0.6210	1.0000	0.2082	0.2554	2640.454
1966	0.9896	0.8301	1.0000	0.1594	0.1955	3254.648
1967	0.0916	0.6411	1.0000	-0.5495	-0.6739	2694.135
1968	-0.3604	-0.1874	1.0000	-0.1730	-0.2121	1176.523
1969	-0.1091	-0.7328	1.0000	0.6237	0.7649	681.957
1970	0.5269	0.7600	1.0000	-0.2330	-0.2858	3034.155
1971	1.5224	1.2939	1.0000	0.2284	0.2801	5175.366
1972	-1.2077	-1.4324	1.0000	0.2247	0.2756	338.771
1973	-1.6131	-3.2195	1.0000	1.6064	1.9701	56.724
1974	-1.3900	-0.9004	1.0000	-0.4896	-0.6004	576.688
1977	-1.9008	-1.9113	1.0000	0.0104	0.0128	209.864
1978	-2.0991	-2.8541	1.0000	0.7550	0.9260	81.743
1979	-3.1977	-1.2868	1.0000	-1.9109	-2.3436	391.853
1980	-1.8114	-1.0910	1.0000	-0.7204	-0.8835	476.606
1981	0.4399	-0.9671	1.0000	1.4069	1.7255	539.513
1983	-0.3604	0.7133	1.0000	-1.0737	-1.3168	2895.893
1986	-0.5650	-0.2466	1.0000	-0.3184	-0.3905	1108.884
1987	-2.7051	-1.3784	1.0000	-1.3266	-1.6270	357.560
1988	-2.7051	-1.9221	1.0000	-0.7830	-0.9602	207.601
1989	-1.1988	-2.4249	1.0000	1.2261	1.5038	125.564
1990	-2.9035	-2.1942	1.0000	-0.7093	-0.8699	158.140
1993	-1.3188	-1.3316	1.0000	0.0128	0.0158	374.694
1994	-2.9035	-3.0138	1.0000	0.1103	0.1353	69.680
1995	-0.5650	-1.3987	1.0000	0.8337	1.0224	350.392

Partial variance for this index is 0.742543

Index 18 CANADA 1
Index is tuned to the sum of Jan1 full stock sizes (in number)
for ages: 1
SORTED BY YEAR

Yr	Observed	Pred	Weight	Wt Res	Std Res	Pred Stocksize
1986	0.7186	0.2227	1.0000	0.4959	0.6082	14467.496
1987	-4.1891	-2.0015	1.0000	-2.1876	-2.6829	1564.693
1988	-0.2973	0.3264	1.0000	-0.6237	-0.7650	16049.058
1989	-4.1891	-2.3008	1.0000	-1.8884	-2.3159	1160.025
1990	-0.7552	-1.5373	1.0000	0.7822	0.9593	2489.052
1991	-0.9703	-1.7647	1.0000	0.7944	0.9743	1982.893
1992	0.5113	-0.3269	1.0000	0.8383	1.0281	8350.284
1993	0.6937	0.2206	1.0000	0.4730	0.5801	14438.198
1994	0.5174	-0.4332	1.0000	0.9505	1.1657	7508.864
1995	-0.0199	-0.3853	1.0000	0.3654	0.4481	7876.811

Partial variance for this index is 1.400132

Index 19 CANADA 2
Index is tuned to the sum of Jan1 full stock sizes (in number)
for ages: 2
SORTED BY YEAR

Yr	Observed	Pred	Weight	Wt Res	Std Res	Pred Stocksize
1986	-2.6020	-1.8539	1.0000	-0.7482	-0.9175	1417.540
1987	0.0240	0.2687	1.0000	-0.2447	-0.3001	11839.555
1988	-4.0836	-1.9551	1.0000	-2.1285	-2.6105	1281.061
1989	0.5873	0.3726	1.0000	0.2147	0.2634	13136.238
1990	-3.2952	-2.2543	1.0000	-1.0408	-1.2765	949.747
1991	-0.5751	-1.4918	1.0000	0.9167	1.1243	2036.054
1992	-0.0061	-1.7216	1.0000	1.7155	2.1039	1618.026
1993	-0.3178	-0.2814	1.0000	-0.0364	-0.0446	6830.300
1994	1.3562	0.2666	1.0000	1.0896	1.3364	11814.663
1995	-0.1247	-0.3867	1.0000	0.2620	0.3213	6147.737

Partial variance for this index is 1.299926

Index 20 CANADA 3
Index is tuned to the sum of Jan1 full stock sizes (in number)
for ages: 3
SORTED BY YEAR

Yr	Observed	Pred	Weight	Wt Res	Std Res	Pred Stocksize
1986	0.5175	0.4765	1.0000	0.0410	0.0503	9282.685
1987	-1.6537	-1.6458	1.0000	-0.0079	-0.0097	1111.722
1988	0.8610	0.3137	1.0000	0.5473	0.6712	7888.257
1989	-1.6111	-1.7499	1.0000	0.1388	0.1702	1001.793
1990	1.0069	0.5114	1.0000	0.4955	0.6077	9612.233
1991	-3.2487	-2.0161	1.0000	-1.2326	-1.5117	767.634
1992	-1.1604	-1.5193	1.0000	0.3589	0.4402	1261.613
1993	-1.8804	-1.6552	1.0000	-0.2252	-0.2762	1101.233
1994	0.1235	-0.0784	1.0000	0.2019	0.2476	5329.774
1995	0.1760	0.4936	1.0000	-0.3176	-0.3895	9443.199

Partial variance for this index is 0.276347

Index 21 CANADA 4
Index is tuned to the sum of Jan1 full stock sizes (in number)
for ages: 4
SORTED BY YEAR

Yr	Observed	Pred	Weight	Wt Res	Std Res	Pred Stocksize
1986	-0.5339	-1.1937	1.0000	0.6598	0.8092	1101.375
1987	0.3187	0.3306	1.0000	-0.0119	-0.0145	5057.427
1988	-2.3735	-1.5216	1.0000	-0.8519	-1.0448	793.477
1989	0.1498	0.1686	1.0000	-0.0188	-0.0230	4301.226
1990	-2.6418	-1.5882	1.0000	-1.0536	-1.2922	742.382
1991	1.5945	0.5911	1.0000	1.0035	1.2307	6562.340
1992	-2.3735	-1.8952	1.0000	-0.4784	-0.5867	546.146

1993	-1.4001	-1.5869	1.0000	0.1868	0.2290	743.373
1994	-1.4691	-1.8266	1.0000	0.3575	0.4384	584.920
1995	0.1959	-0.0111	1.0000	0.2071	0.2539	3593.633

Partial variance for this index is 0.426382

Index 22 CANADA 5
Index is tuned to the sum of Jan1 full stock sizes (in number)
for ages: 5
SORTED BY YEAR

Yr	Observed	Pred	Weight	Wt Res	Std Res	Pred Stocksize
1986	-1.8455	-1.2437	1.0000	-0.6019	-0.7381	579.366
1987	-0.5853	-1.0546	1.0000	0.4693	0.5756	699.951
1988	0.8625	0.2884	1.0000	0.5741	0.7041	2681.168
1989	-1.8455	-1.3358	1.0000	-0.5098	-0.6252	528.396
1990	1.0271	0.3057	1.0000	0.7214	0.8848	2728.004
1991	-2.3921	-1.4916	1.0000	-0.9005	-1.1044	452.179
1992	1.1554	0.5342	1.0000	0.6212	0.7619	3428.294
1993	-3.4037	-1.8135	1.0000	-1.5902	-1.9502	327.708
1994	-1.6119	-1.7824	1.0000	0.1704	0.2090	338.076
1995	-0.7646	-1.8105	1.0000	1.0459	1.2827	328.689

Partial variance for this index is 0.751114

Index 23 CANADA 6
Index is tuned to the sum of Jan1 full stock sizes (in number)
for ages: 6
SORTED BY YEAR

Yr	Observed	Pred	Weight	Wt Res	Std Res	Pred Stocksize
1986	-0.4192	-0.5354	1.0000	0.1163	0.1426	621.037
1987	-1.7070	-1.1313	1.0000	-0.5757	-0.7061	342.238
1988	-0.8961	-0.8298	1.0000	-0.0663	-0.0813	462.681
1989	-0.0488	0.2431	1.0000	-0.2919	-0.3580	1352.751
1990	-0.6510	-1.2523	1.0000	0.6014	0.7375	303.222
1991	1.2887	0.3112	1.0000	0.9775	1.1988	1448.102
1992	-2.6878	-1.3395	1.0000	-1.3484	-1.6537	277.920
1993	1.0656	0.2952	1.0000	0.7703	0.9448	1425.163
1994	-3.0933	-1.8066	1.0000	-1.2867	-1.5781	174.201
1995	-0.4543	-1.5578	1.0000	1.1036	1.3534	223.408

Partial variance for this index is 0.808046

Index 24 CANADA 7
Index is tuned to the sum of Jan1 full stock sizes (in number)
for ages: 7
SORTED BY YEAR

Yr	Observed	Pred	Weight	Wt Res	Std Res	Pred Stocksize
1986	-0.2166	-0.1648	1.0000	-0.0518	-0.0636	602.500
1987	-0.3417	-0.7024	1.0000	0.3607	0.4423	351.925
1988	-0.9097	-1.1992	1.0000	0.2894	0.3550	214.148
1989	-2.6443	-1.0687	1.0000	-1.5756	-1.9324	243.991
1990	0.9484	0.0981	1.0000	0.8503	1.0429	783.607
1991	-1.5457	-1.4933	1.0000	-0.0524	-0.0643	159.583
1992	0.9205	0.1369	1.0000	0.7836	0.9610	814.622
1993	-3.0498	-1.7208	1.0000	-1.3290	-1.6299	127.104
1994	0.5055	-0.2193	1.0000	0.7248	0.8889	570.537

Partial variance for this index is 0.821255

Index 25 CANADA 8
Index is tuned to the sum of Jan1 full stock sizes (in number)
for ages: 8
SORTED BY YEAR

Yr	Observed	Pred	Weight	Wt Res	Std Res	Pred Stocksize
1986	0.6003	0.9991	1.0000	-0.3988	-0.4891	1108.884

1987	-0.7080	-0.1327	1.0000	-0.5753	-0.7056	357.560
1988	-0.6127	-0.6764	1.0000	0.0637	0.0781	207.601
1989	-1.9120	-1.1792	1.0000	-0.7328	-0.8987	125.564
1990	-0.4457	-0.9485	1.0000	0.5029	0.6167	158.140
1991	0.7736	0.1647	1.0000	0.6089	0.7467	481.407
1992	-1.6243	-1.8438	1.0000	0.2194	0.2691	64.603
1993	0.4551	-0.0859	1.0000	0.5410	0.6635	374.694
1994	-3.0106	-1.7681	1.0000	-1.2425	-1.5238	69.680
1995	0.8606	-0.1530	1.0000	1.0136	1.2430	350.392

Partial variance for this index is 0.524404

Standardized residuals by index & yr; with row/column/grand means

=	1963	1964	1965	1966	1967	1968	1969
1	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	2.0553	-99.0000
2	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	0.2465	-0.1917
3	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-0.2618	-0.8393
4	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-0.5111	-0.3224
5	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-0.3657	-0.2363
6	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-0.2217	0.2922
7	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-0.4295	-0.2183
8	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	0.4971	0.5840
9	-99.0000	0.0811	-1.0373	-0.9105	1.2831	-1.0515	-0.7478
10	-99.0000	-0.5939	0.1331	0.8810	0.0965	1.1801	-0.5160
11	-99.0000	0.9445	1.3689	0.9188	0.6702	-0.3506	-0.0094
12	-99.0000	0.5950	0.8031	-0.1091	0.3107	0.0257	-0.9849
13	-99.0000	0.6650	-0.2239	-0.1818	-0.3035	0.0299	-0.1528
14	-99.0000	0.7531	0.3510	-0.4619	-0.2516	-0.2973	0.1456
15	-99.0000	0.7111	-0.0907	-0.3548	-0.0787	0.5086	0.1437
16	-99.0000	1.0807	0.2554	0.1955	-0.6739	-0.2121	0.7649
18	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
19	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
20	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
21	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
22	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
23	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
24	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
25	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
**	1.0000	0.5296	0.1949	-0.0029	0.1316	0.0526	-0.1526

=	1970	1971	1972	1973	1974	1975	1976
1	-0.2580	-99.0000	1.2002	2.6818	0.1595	-0.4513	1.8200
2	0.3026	0.2932	0.2591	1.3175	1.7136	-0.9347	-1.9529
3	-99.0000	0.9390	0.4744	-99.0000	1.5114	0.8812	-1.0113
4	-0.7370	-99.0000	1.0654	0.9441	-99.0000	0.1569	-0.0459
5	1.1057	-1.4844	-0.0697	1.5064	0.7101	-99.0000	0.0774
6	0.9293	0.3752	-2.0332	-99.0000	-99.0000	0.6788	-99.0000
7	-0.0031	-0.7411	1.6044	0.0109	0.2236	3.1026	-0.5701
8	0.2897	-0.5838	-1.2973	-0.4528	-0.4731	0.3965	-99.0000
9	-0.8517	-0.3893	0.6603	0.9030	0.7495	-0.6583	0.3828
10	-2.4330	1.7228	-99.0000	0.3891	1.1084	-0.3220	-1.1782
11	-99.0000	0.9370	-0.1243	-99.0000	1.0262	-0.3910	-0.5759
12	-0.8236	-1.2873	0.5822	1.0028	-99.0000	-0.6000	2.0962
13	-0.0186	-0.0443	-0.5405	1.8856	0.8347	-99.0000	1.4027
14	-0.3704	1.3274	0.0428	-99.0000	2.1008	-2.0119	-99.0000
15	-0.2313	1.4866	-0.0936	-0.7389	-99.0000	-99.0000	-0.8227
16	-0.2858	0.2801	0.2756	1.9701	-0.6004	-99.0000	-99.0000
18	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
19	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
20	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
21	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
22	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
23	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
24	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
25	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
**	-0.2418	0.2022	0.1337	0.9516	0.7554	-0.0128	-0.0315

*	1977	1978	1979	1980	1981	1982	1983
1	-1.7031	-3.3501	1.0873	1.3058	1.1638	0.6802	-0.2777
2	0.6035	-1.2695	0.3371	1.2669	0.6100	0.0859	0.1487
3	-1.0929	0.3960	-0.6499	-0.7052	1.3799	-0.2636	-0.4641
4	0.2220	-0.9909	-0.1736	-0.2080	1.4385	0.3855	-1.2866
5	-0.0871	0.2880	-0.8145	0.1834	-0.1605	0.0244	0.3672
6	0.8594	1.1283	-1.0667	0.8944	0.0857	-0.4287	-3.6628
7	-99.0000	0.1388	0.6933	0.3189	0.2806	-0.6993	-2.3311
8	-0.3571	1.2965	-0.6257	1.6323	-0.2745	-99.0000	0.5537
9	0.7761	-2.4717	-0.0671	-0.2978	2.7923	-0.0956	1.2089
10	1.2770	-0.4270	-0.5601	1.1098	0.2464	1.6619	-99.0000
11	-0.6073	0.8149	-0.5332	-3.7140	1.0767	0.9290	0.7702
12	-0.6844	-0.3430	0.5227	-0.2780	-0.3949	0.3709	-0.6416
13	0.6827	0.0712	-1.1481	0.2706	-1.5173	-0.4515	0.0890
14	0.3199	0.7815	-0.5213	-0.3166	-0.0058	0.0212	-0.5131
15	-99.0000	1.1795	1.0477	0.0902	1.2304	-0.7737	-1.4598
16	0.0128	0.9260	-2.3436	-0.8835	1.7255	-99.0000	-1.3168
18	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
19	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
20	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
21	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
22	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
23	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
24	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
25	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000	-99.0000
**	0.0158	-0.1145	-0.3010	0.0418	0.6048	0.1033	-0.5877

*	1984	1985	1986	1987	1988	1989	1990
1	-0.4569	-99.0000	-0.0374	-99.0000	-0.7460	-2.8592	0.8173
2	0.8249	0.4676	-0.7911	0.2866	-2.5115	0.1143	-99.0000
3	0.8252	0.6745	-0.0143	-1.7483	-0.7133	0.8505	1.1954
4	0.2051	0.7966	-0.0478	-0.4255	-0.3976	-0.3884	0.8265
5	0.4581	1.2748	-0.3008	-0.9232	-0.8701	0.1079	-0.1620
6	-0.0758	0.7198	0.6981	0.5190	0.3728	0.5639	0.0409
7	-0.8144	1.2065	-0.1550	-0.5692	1.0070	0.1036	-0.3791
8	-2.0002	0.4090	0.1893	1.0801	1.0035	0.5465	-99.0000
9	0.8722	-2.7832	1.9011	-99.0000	-0.4845	-1.4881	0.1476
10	-1.2636	-0.1508	0.6566	0.5824	-99.0000	-0.4335	-2.0177
11	-0.3296	1.0731	-0.1590	-1.0310	-0.7700	-0.2966	0.4975
12	-0.7408	0.2633	-0.0531	0.1682	-0.6180	0.2114	0.2940
13	0.0288	0.2854	-0.8803	-0.8886	0.5942	0.0629	0.3917
14	0.2154	-1.4499	-0.2459	0.8067	-0.5114	0.2561	0.5069
15	-0.0531	0.1350	-0.7075	0.7111	0.3721	0.8188	-0.2593
16	-99.0000	-99.0000	-0.3905	-1.6270	-0.9602	1.5038	-0.8699
18	-99.0000	-99.0000	0.6082	-2.6829	-0.7650	-2.3159	0.9593
19	-99.0000	-99.0000	-0.9175	-0.3001	-2.6105	0.2634	-1.2765
20	-99.0000	-99.0000	0.0503	-0.0097	0.6712	0.1702	0.6077
21	-99.0000	-99.0000	0.8092	-0.0145	-1.0448	-0.0230	-1.2922
22	-99.0000	-99.0000	-0.7381	0.5756	0.7041	-0.6252	0.8848
23	-99.0000	-99.0000	0.1426	-0.7061	-0.0813	-0.3580	0.7375
24	-99.0000	-99.0000	-0.0636	0.4423	0.3550	-1.9324	1.0429
25	-99.0000	-99.0000	-0.4891	-0.7056	0.0781	-0.8987	0.6167
**	-0.1536	0.2087	-0.0390	-0.2936	-0.3446	-0.2519	0.1505

*	1991	1992	1993	1994	1995*******	
1	0.5254	-1.6060	-0.9612	-0.7894	-99.0000	0.0000
2	0.9509	-0.9533	-1.1448	-0.0795	-99.0000	0.0000
3	0.4061	-1.1600	-0.3893	-0.2202	-99.0000	0.0000
4	0.2680	-0.6987	-0.2268	0.1519	-99.0000	0.0000
5	-0.2429	-1.1339	0.5048	0.2430	-99.0000	0.0000
6	-1.2501	-0.7023	0.3740	0.9097	-99.0000	0.0000
7	-0.7231	-2.2251	0.9034	0.2647	-99.0000	0.0000
8	-1.3754	0.7350	-1.9181	0.1449	-99.0000	0.0000
9	1.0399	0.5385	0.2088	0.2373	-0.4481	0.0000
10	0.2541	-0.9208	0.1547	0.2976	-0.9349	0.0000
11	-2.1675	0.0055	0.1314	0.8555	-0.9600	0.0000

12	-0.1728	-1.0297	0.5357	1.1172	-0.1377	0.0000
13	-0.5961	-1.2359	-99.0000	-99.0000	0.8886	0.0000
14	-0.6177	-1.4770	0.6333	0.6323	0.1579	0.0000
15	0.2658	-2.8572	-0.3355	0.2743	-0.1178	0.0000
16	-99.0000	-99.0000	0.0158	0.1353	1.0224	0.0000
18	0.9743	1.0281	0.5801	1.1657	0.4481	0.0000
19	1.1243	2.1039	-0.0446	1.3364	0.3213	0.0000
20	-1.5117	0.4402	-0.2762	0.2476	-0.3895	0.0000
21	1.2307	-0.5867	0.2290	0.4384	0.2539	0.0000
22	-1.1044	0.7619	-1.9502	0.2090	1.2827	0.0000
23	1.1988	-1.6537	0.9448	-1.5781	1.3534	0.0000
24	-0.0643	0.9610	-1.6299	0.8889	-99.0000	0.0000
25	0.7467	0.2691	0.6635	-1.5238	1.2430	0.0000
**	-0.0366	-0.4955	-0.1303	0.2330	0.2656	0.0000

-99 in the above table indicates a missing value

Percent of total sum of squares by index & yr; with row/column sums

	1963	1964	1965	1966	1967	1968	1969	1970	1971
1	-99.00	-99.00	-99.00	-99.00	-99.00	0.88	-99.00	0.01	-99.00
2	-99.00	-99.00	-99.00	-99.00	-99.00	0.01	0.01	0.02	0.02
3	-99.00	-99.00	-99.00	-99.00	-99.00	0.01	0.15	-99.00	0.18
4	-99.00	-99.00	-99.00	-99.00	-99.00	0.05	0.02	0.11	-99.00
5	-99.00	-99.00	-99.00	-99.00	-99.00	0.03	0.01	0.25	0.46
6	-99.00	-99.00	-99.00	-99.00	-99.00	0.01	0.02	0.18	0.03
7	-99.00	-99.00	-99.00	-99.00	-99.00	0.04	0.01	0.00	0.11
8	-99.00	-99.00	-99.00	-99.00	-99.00	0.05	0.07	0.02	0.07
9	-99.00	0.00	0.22	0.17	0.34	0.23	0.12	0.15	0.03
10	-99.00	0.07	0.00	0.16	0.00	0.29	0.06	1.23	0.62
11	-99.00	0.19	0.39	0.18	0.09	0.03	0.00	-99.00	0.18
12	-99.00	0.07	0.13	0.00	0.02	0.00	0.20	0.14	0.34
13	-99.00	0.09	0.01	0.01	0.02	0.00	0.00	0.00	0.00
14	-99.00	0.12	0.03	0.04	0.01	0.02	0.00	0.03	0.37
15	-99.00	0.11	0.00	0.03	0.00	0.05	0.00	0.01	0.46
16	-99.00	0.24	0.01	0.01	0.09	0.01	0.12	0.02	0.02
18	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
19	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
20	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
21	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
22	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
23	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
24	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
25	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
**	0.00	0.89	0.80	0.60	0.59	1.71	0.79	2.18	2.89

	1972	1973	1974	1975	1976	1977	1978	1979	1980
1	0.30	1.50	0.01	0.04	0.69	0.60	2.33	0.25	0.35
2	0.01	0.36	0.61	0.18	0.79	0.08	0.34	0.02	0.33
3	0.05	-99.00	0.47	0.16	0.21	0.25	0.03	0.09	0.10
4	0.24	0.19	-99.00	0.01	0.00	0.01	0.20	0.01	0.01
5	0.00	0.47	0.10	-99.00	0.00	0.00	0.02	0.14	0.01
6	0.86	-99.00	-99.00	0.10	-99.00	0.15	0.26	0.24	0.17
7	0.54	0.00	0.01	2.00	0.07	-99.00	0.00	0.10	0.02
8	0.35	0.04	0.05	0.03	-99.00	0.03	0.35	0.08	0.55
9	0.09	0.17	0.12	0.09	0.03	0.13	1.27	0.00	0.02
10	-99.00	0.03	0.26	0.02	0.29	0.34	0.04	0.07	0.26
11	0.00	-99.00	0.22	0.03	0.07	0.08	0.14	0.06	2.87
12	0.07	0.21	-99.00	0.07	0.91	0.10	0.02	0.06	0.02
13	0.06	0.74	0.14	-99.00	0.41	0.10	0.00	0.27	0.02
14	0.00	-99.00	0.92	0.84	-99.00	0.02	0.13	0.06	0.02
15	0.00	0.11	-99.00	-99.00	0.14	-99.00	0.29	0.23	0.00
16	0.02	0.81	0.07	-99.00	-99.00	0.00	0.18	1.14	0.16
18	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
19	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
20	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
21	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00

22	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
23	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
24	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
25	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00	-99.00
**	2.58	4.63	2.98	3.58	3.61	1.88	5.61	2.80	4.91

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1	0.28	0.10	0.02	0.04	-99.00	0.00	-99.00	0.12	1.70	0.14
2	0.08	0.00	0.00	0.14	0.05	0.13	0.02	1.31	0.00	-99.00
3	0.40	0.01	0.04	0.14	0.09	0.00	0.64	0.11	0.15	0.30
4	0.43	0.03	0.34	0.01	0.13	0.00	0.04	0.03	0.03	0.14
5	0.01	0.00	0.03	0.04	0.34	0.02	0.18	0.16	0.00	0.01
6	0.00	0.04	2.79	0.00	0.11	0.10	0.06	0.03	0.07	0.00
7	0.02	0.10	1.13	0.14	0.30	0.00	0.07	0.21	0.00	0.03
8	0.02	-99.00	0.06	0.83	0.03	0.01	0.24	0.21	0.06	-99.00
9	1.62	0.00	0.30	0.16	1.61	0.75	-99.00	0.05	0.46	0.00
10	0.01	0.57	-99.00	0.33	0.00	0.09	0.07	-99.00	0.04	0.85
11	0.24	0.18	0.12	0.02	0.24	0.01	0.22	0.12	0.02	0.05
12	0.03	0.03	0.09	0.11	0.01	0.00	0.01	0.08	0.01	0.02
13	0.48	0.04	0.00	0.00	0.02	0.16	0.16	0.07	0.00	0.03
14	0.00	0.00	0.05	0.01	0.44	0.01	0.14	0.05	0.01	0.05
15	0.31	0.12	0.44	0.00	0.00	0.10	0.11	0.03	0.14	0.01
16	0.62	-99.00	0.36	-99.00	-99.00	0.03	0.55	0.19	0.47	0.16
18	-99.00	-99.00	-99.00	-99.00	-99.00	0.08	1.50	0.12	1.12	0.19
19	-99.00	-99.00	-99.00	-99.00	-99.00	0.18	0.02	1.42	0.01	0.34
20	-99.00	-99.00	-99.00	-99.00	-99.00	0.00	0.00	0.09	0.01	0.08
21	-99.00	-99.00	-99.00	-99.00	-99.00	0.14	0.00	0.23	0.00	0.35
22	-99.00	-99.00	-99.00	-99.00	-99.00	0.11	0.07	0.10	0.08	0.16
23	-99.00	-99.00	-99.00	-99.00	-99.00	0.00	0.10	0.00	0.03	0.11
24	-99.00	-99.00	-99.00	-99.00	-99.00	0.00	0.04	0.03	0.78	0.23
25	-99.00	-99.00	-99.00	-99.00	-99.00	0.05	0.10	0.00	0.17	0.08
**	4.54	1.23	5.79	1.99	3.38	1.98	4.32	4.76	5.36	3.33

	1991	1992	1993	1994	1995*******
1	0.06	0.54	0.19	0.13	-99.00	10.27
2	0.19	0.19	0.27	0.00	-99.00	5.17
3	0.03	0.28	0.03	0.01	-99.00	3.95
4	0.01	0.10	0.01	0.00	-99.00	2.17
5	0.01	0.27	0.05	0.01	-99.00	2.62
6	0.32	0.10	0.03	0.17	-99.00	5.83
7	0.11	1.03	0.17	0.01	-99.00	6.23
8	0.39	0.11	0.76	0.00	-99.00	4.44
9	0.22	0.06	0.01	0.01	0.04	8.49
10	0.01	0.18	0.00	0.02	0.18	6.09
11	0.98	0.00	0.00	0.15	0.19	7.07
12	0.01	0.22	0.06	0.26	0.00	3.32
13	0.07	0.32	-99.00	-99.00	0.16	3.40
14	0.08	0.45	0.08	0.08	0.01	4.08
15	0.01	1.70	0.02	0.02	0.00	4.47
16	-99.00	-99.00	0.00	0.00	0.22	5.50
18	0.20	0.22	0.07	0.28	0.04	3.81
19	0.26	0.92	0.00	0.37	0.02	3.54
20	0.48	0.04	0.02	0.01	0.03	0.75
21	0.31	0.07	0.01	0.04	0.01	1.16
22	0.25	0.12	0.79	0.01	0.34	2.05
23	0.30	0.57	0.19	0.52	0.38	2.20
24	0.00	0.19	0.55	0.16	-99.00	1.98
25	0.12	0.02	0.09	0.48	0.32	1.43
**	4.44	7.69	3.42	2.77	1.96	100.00

-99 in the above table indicates a missing value

Partial variance (and proportion of total) by index

	1	2	3	4	5	6
**	1.51238212	0.66882310	0.53247078	0.29237208	0.33849823	0.82133025
**	0.09018015	0.03988051	0.03175011	0.01743353	0.02018393	0.04897419

	7	8	9	10	11	12
**	0.80603740	0.62467868	0.91372266	0.70310628	0.78705388	0.35717715
**	0.04806231	0.03724827	0.05448335	0.04192474	0.04693036	0.02129772

	13	14	15	16	18	19
**	0.39260665	0.45437918	0.51588949	0.74254327	1.40013246	1.29992646
**	0.02341030	0.02709367	0.03076140	0.04427628	0.08348694	0.07751187

	20	21	22	23	24	25
**	0.27634700	0.42638168	0.75111373	0.80804606	0.82125484	0.52440354
**	0.01647799	0.02542424	0.04478732	0.04818208	0.04896969	0.03126907

	**********
**	16.77067695
**	1.00000000

STOCK NUMBERS (Jan 1) in thousands - GBHADD5

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
1	190704	471879	33154	4137	12952	422	988	4660	369	8515
2	32266	153502	377202	18457	3284	9564	338	807	3774	301
3	32743	22755	111258	194982	8919	2536	5121	267	518	1845
4	45820	20095	14510	50829	68421	4687	1435	2656	204	222
5	29031	27424	12131	7033	24272	37318	2099	770	1659	131
6	9186	16350	14561	5959	3254	10518	17416	1127	462	1097
7	5595	5526	8144	5868	2534	1570	5445	8872	729	155
8	2794	3309	2640	3255	2694	1177	682	3034	5175	339
9	4217	4251	3258	2201	2031	2163	1712	1874	3244	6308
1+	352356	725092	576859	292720	128362	69955	35237	24067	16133	18913

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	19414	10540	7654	103233	13783	6058	83883	10105	7200	2460
2	6830	13579	8588	6093	84389	11284	4959	68676	8266	5894
3	245	3714	7208	6096	4560	51371	8550	4037	28178	5191
4	1104	198	2447	4215	4493	3564	29034	5438	2991	13118
5	109	554	160	1664	2655	3063	2642	17284	3570	1697
6	78	41	391	127	1167	1708	1995	1688	8673	2075
7	789	37	32	282	104	632	930	1262	845	4774
8	57	577	28	22	210	82	392	477	540	392
9	1678	2700	622	623	594	389	186	250	318	404
1+	30304	31940	27129	122354	111956	78152	132572	109218	60581	36005

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
1	3039	17096	1731	14467	1565	16049	1160	2489	1983	8350
2	2013	2488	13997	1418	11840	1281	13136	950	2036	1618
3	3772	1454	1953	9283	1112	7888	1002	9612	768	1262
4	2772	2352	922	1101	5057	793	4301	742	6562	546
5	7363	1645	1268	579	700	2681	528	2728	452	3428
6	1036	4002	988	621	342	463	1353	303	1448	278
7	1184	602	1936	603	352	214	244	784	160	815
8	2896	801	281	1109	358	208	126	158	481	65
9	273	1614	543	248	452	341	201	150	223	222
1+	24347	32056	23619	29429	21777	29918	22051	17916	14113	16584

	1993	1994	1995
1	14438	7509	7877
2	6830	11815	6148
3	1101	5330	9443
4	743	585	3594
5	328	338	329
6	1425	174	223
7	127	571	106
8	375	70	350
9	177	195	162
1+	25545	26585	28232

Summaries for ages 2 9 3 9 4 9 5 9 6 9

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
2	161653	253213	543705	288584	115410	69533	34249	19407	15764	10399
3	129386	99711	166503	270127	112126	59969	33911	18600	11991	10098
4	96644	76956	55245	75145	103207	57433	28790	18333	11473	8252
5	50823	56860	40735	24316	34786	52746	27354	15676	11269	8030
6	21793	29436	28603	17283	10514	15428	25256	14907	9610	7899

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
2	10889	21400	19475	19121	98172	72093	48689	99113	53381	33545
3	4059	7821	10887	13029	13783	60809	43730	30437	45115	27651
4	3815	4107	3679	6933	9223	9439	35180	26400	16937	22460
5	2711	3909	1232	2718	4730	5874	6146	20962	13946	9342
6	2602	3355	1072	1054	2075	2811	3504	3677	10376	7645

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
2	21308	14960	21888	14962	20212	13869	20890	15427	12130	8233	11107
3	19295	12472	7891	13544	8372	12588	7754	14478	10094	6615	4276
4	15524	11017	5938	4262	7261	4700	6752	4865	9327	5354	3175
5	12751	8665	5016	3160	2203	3907	2451	4123	2764	4808	2432
6	5389	7020	3748	2581	1503	1225	1923	1395	2312	1379	2104

	1994	1995
2	19077	20355
3	7262	14207
4	1932	4764
5	1347	1170
6	1009	842

FISHING MORTALITY - GBHADD5

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
1	0.02	0.02	0.39	0.03	0.10	0.02	0.00	0.01	0.00	0.02	0.16	0.00	0.03	0.00	0.00
2	0.15	0.12	0.46	0.53	0.06	0.42	0.04	0.24	0.52	0.01	0.41	0.43	0.14	0.09	0.30
3	0.29	0.25	0.58	0.85	0.44	0.37	0.46	0.07	0.65	0.31	0.01	0.22	0.34	0.11	0.05
4	0.31	0.30	0.52	0.54	0.41	0.60	0.42	0.27	0.24	0.52	0.49	0.01	0.19	0.26	0.18
5	0.37	0.43	0.51	0.57	0.64	0.56	0.42	0.31	0.21	0.32	0.78	0.15	0.03	0.15	0.24
6	0.31	0.50	0.71	0.65	0.53	0.46	0.47	0.24	0.89	0.13	0.55	0.06	0.13	0.00	0.41
7	0.33	0.54	0.72	0.58	0.57	0.63	0.38	0.34	0.57	0.81	0.11	0.06	0.15	0.09	0.04
8	0.34	0.42	0.61	0.56	0.47	0.55	0.45	0.32	0.38	0.24	0.35	0.11	0.17	0.22	0.23
9	0.34	0.42	0.61	0.56	0.47	0.55	0.45	0.32	0.38	0.24	0.35	0.11	0.17	0.22	0.23

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
1	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	0.00	0.00
2	0.08	0.01	0.69	0.27	0.25	0.12	0.04	0.21	0.04	0.21	0.05	0.11	0.01	0.28	0.18
3	0.37	0.25	0.10	0.56	0.43	0.27	0.26	0.37	0.41	0.14	0.41	0.10	0.18	0.14	0.33
4	0.10	0.32	0.22	0.37	0.38	0.32	0.42	0.26	0.25	0.43	0.21	0.26	0.30	0.45	0.31
5	0.23	0.25	0.49	0.34	0.29	0.41	0.31	0.51	0.33	0.21	0.48	0.36	0.43	0.29	0.68
6	0.41	0.26	0.49	0.40	0.36	0.34	0.53	0.29	0.37	0.27	0.44	0.35	0.44	0.38	0.58
7	0.28	0.47	0.65	0.57	0.30	0.19	0.56	0.36	0.32	0.33	0.33	0.23	0.29	0.70	0.58
8	0.21	0.32	0.44	0.39	0.35	0.36	0.46	0.37	0.31	0.40	0.42	0.28	0.39	0.44	0.62
9	0.21	0.32	0.44	0.39	0.35	0.36	0.46	0.37	0.31	0.40	0.42	0.28	0.39	0.44	0.62

	1993	1994
1	0.00	0.00
2	0.05	0.02
3	0.43	0.19
4	0.59	0.38
5	0.43	0.21
6	0.72	0.29
7	0.40	0.29
8	0.63	0.29
9	0.63	0.29

Avg F for ages 2 9 3 9 4 9 5 9 6 9

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
2	0.30	0.37	0.59	0.61	0.45	0.52	0.39	0.26	0.48	0.32	0.38	0.14	0.16	0.14	0.21
3	0.33	0.41	0.61	0.62	0.50	0.53	0.44	0.27	0.47	0.37	0.38	0.10	0.17	0.15	0.20
4	0.33	0.44	0.61	0.58	0.51	0.56	0.44	0.30	0.44	0.38	0.44	0.08	0.14	0.16	0.22
5	0.34	0.46	0.63	0.59	0.54	0.55	0.44	0.30	0.48	0.35	0.43	0.10	0.13	0.14	0.23
6	0.33	0.47	0.66	0.59	0.51	0.55	0.44	0.30	0.55	0.36	0.34	0.08	0.15	0.13	0.23

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
2	0.24	0.27	0.44	0.41	0.34	0.30	0.38	0.34	0.29	0.30	0.34	0.25	0.30	0.39	0.49
3	0.26	0.31	0.40	0.43	0.35	0.32	0.43	0.36	0.33	0.31	0.39	0.27	0.35	0.40	0.53
4	0.24	0.32	0.45	0.41	0.34	0.33	0.46	0.36	0.31	0.34	0.38	0.29	0.37	0.45	0.56
5	0.27	0.32	0.50	0.42	0.33	0.33	0.46	0.38	0.33	0.32	0.42	0.30	0.39	0.45	0.62
6	0.28	0.34	0.50	0.44	0.34	0.32	0.50	0.35	0.33	0.35	0.40	0.29	0.38	0.49	0.60

	1993	1994
2	0.49	0.25
3	0.55	0.28
4	0.57	0.29
5	0.56	0.28
6	0.60	0.29

Avg F (weighted by N) for ages 2 9 3 9 4 9 5 9 6 9

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
2	0.29	0.22	0.50	0.75	0.46	0.52	0.45	0.31	0.42	0.25	0.38	0.33	0.22	0.14	0.28
3	0.32	0.38	0.59	0.77	0.47	0.54	0.45	0.31	0.39	0.26	0.33	0.16	0.28	0.17	0.17
4	0.33	0.42	0.61	0.56	0.47	0.55	0.45	0.32	0.38	0.25	0.36	0.11	0.17	0.22	0.23
5	0.35	0.46	0.64	0.59	0.60	0.54	0.45	0.32	0.39	0.24	0.30	0.11	0.14	0.16	0.28
6	0.32	0.49	0.69	0.60	0.51	0.50	0.45	0.32	0.42	0.24	0.28	0.11	0.15	0.16	0.32

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
2	0.30	0.27	0.60	0.46	0.35	0.32	0.37	0.27	0.34	0.27	0.38	0.17	0.24	0.39	0.49
3	0.35	0.30	0.40	0.50	0.37	0.35	0.43	0.37	0.38	0.36	0.41	0.26	0.25	0.41	0.56
4	0.21	0.31	0.44	0.39	0.35	0.36	0.46	0.37	0.31	0.40	0.42	0.28	0.39	0.43	0.62
5	0.28	0.29	0.50	0.39	0.32	0.37	0.47	0.39	0.33	0.31	0.46	0.33	0.40	0.40	0.65
6	0.35	0.32	0.54	0.41	0.32	0.32	0.51	0.34	0.33	0.35	0.41	0.32	0.34	0.42	0.59

	1993	1994
2	0.25	0.10
3	0.58	0.22
4	0.63	0.30
5	0.64	0.27
6	0.67	0.29

Avg F (wt by catch) for ages 2 9 3 9 4 9 5 9 6 9

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
2	0.30	0.30	0.51	0.77	0.48	0.53	0.45	0.31	0.45	0.28	0.41	0.38	0.25	0.17	0.29
3	0.32	0.40	0.59	0.78	0.48	0.55	0.45	0.32	0.43	0.28	0.41	0.18	0.30	0.20	0.23
4	0.34	0.43	0.62	0.56	0.49	0.55	0.45	0.32	0.42	0.28	0.41	0.11	0.18	0.24	0.25
5	0.35	0.46	0.65	0.59	0.60	0.55	0.45	0.33	0.42	0.26	0.36	0.11	0.15	0.17	0.30
6	0.32	0.49	0.69	0.60	0.51	0.50	0.46	0.33	0.44	0.26	0.33	0.11	0.16	0.20	0.36

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
2	0.35	0.31	0.64	0.49	0.35	0.35	0.44	0.29	0.38	0.31	0.41	0.20	0.29	0.41	0.56
3	0.36	0.31	0.45	0.51	0.37	0.36	0.45	0.38	0.38	0.39	0.42	0.28	0.29	0.43	0.59
4	0.26	0.32	0.47	0.39	0.36	0.37	0.47	0.38	0.31	0.41	0.44	0.29	0.40	0.44	0.63
5	0.30	0.31	0.50	0.40	0.32	0.38	0.48	0.40	0.33	0.32	0.46	0.33	0.41	0.41	0.65
6	0.36	0.34	0.55	0.41	0.32	0.34	0.51	0.34	0.33	0.36	0.41	0.33	0.35	0.43	0.59

	1993	1994
2	0.52	0.20
3	0.60	0.24
4	0.64	0.31
5	0.66	0.27
6	0.68	0.29

BACKCALCULATED PARTIAL RECRUITMENT

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
1	0.05	0.04	0.54	0.04	0.16	0.03	0.00	0.03	0.00	0.03	0.20	0.01	0.08	0.01	0.00
2	0.40	0.23	0.64	0.62	0.09	0.67	0.08	0.72	0.58	0.01	0.53	1.00	0.42	0.34	0.72
3	0.77	0.46	0.81	1.00	0.70	0.58	0.96	0.20	0.73	0.39	0.02	0.50	1.00	0.40	0.11
4	0.84	0.57	0.73	0.64	0.64	0.95	0.89	0.80	0.27	0.64	0.63	0.03	0.55	1.00	0.44
5	1.00	0.80	0.71	0.67	1.00	0.89	0.89	0.92	0.24	0.39	1.00	0.35	0.08	0.59	0.58
6	0.82	0.92	0.99	0.77	0.83	0.72	1.00	0.70	1.00	0.16	0.71	0.13	0.38	0.00	1.00
7	0.87	1.00	1.00	0.68	0.89	1.00	0.81	1.00	0.64	1.00	0.15	0.14	0.45	0.36	0.10
8	0.90	0.78	0.85	0.66	0.74	0.87	0.96	0.94	0.42	0.30	0.45	0.25	0.50	0.84	0.56
9	0.90	0.78	0.85	0.66	0.74	0.87	0.96	0.94	0.42	0.30	0.45	0.25	0.50	0.84	0.56

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
1	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	0.00	0.00
2	0.19	0.01	1.00	0.47	0.58	0.31	0.08	0.41	0.11	0.47	0.09	0.32	0.03	0.40	0.27
3	0.91	0.54	0.14	0.99	1.00	0.66	0.46	0.73	1.00	0.32	0.84	0.28	0.41	0.20	0.49
4	0.24	0.68	0.32	0.65	0.88	0.79	0.74	0.52	0.62	1.00	0.43	0.72	0.67	0.64	0.46
5	0.56	0.53	0.71	0.60	0.69	1.00	0.55	1.00	0.80	0.49	1.00	1.00	0.98	0.41	1.00
6	1.00	0.55	0.71	0.70	0.84	0.84	0.94	0.57	0.90	0.62	0.91	0.97	1.00	0.53	0.86
7	0.68	1.00	0.94	1.00	0.70	0.47	1.00	0.70	0.79	0.75	0.69	0.66	0.65	1.00	0.85
8	0.52	0.67	0.63	0.69	0.83	0.89	0.82	0.71	0.76	0.91	0.86	0.80	0.88	0.62	0.91
9	0.52	0.67	0.63	0.69	0.83	0.89	0.82	0.71	0.76	0.91	0.86	0.80	0.88	0.62	0.91

	1993	1994
1	0.00	0.00
2	0.07	0.06
3	0.60	0.52
4	0.82	1.00
5	0.60	0.57
6	1.00	0.78
7	0.56	0.76
8	0.88	0.78
9	0.88	0.78

MEAN BIOMASS (MT)

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
1	97715	211388	14553	2142	7374	223	465	2983	224	4738
2	23694	108937	190539	9574	2026	5761	235	828	2776	280
3	30570	20523	79452	107560	6249	2030	4130	286	458	2511
4	52683	22565	13938	45271	60544	4252	1805	4089	287	324
5	37106	33322	14500	8335	23356	41001	2735	1320	3247	248
6	15484	23666	19034	8292	4737	16182	25208	2183	791	2730
7	10228	9377	12047	9296	4088	2471	10390	17695	1487	300
8	6577	6509	4809	6534	5218	2164	1497	7652	12193	942
9	10122	9407	6938	4896	4586	4344	4562	5488	9171	18657
1+	284179	445694	355811	201900	118176	78430	51027	42522	30633	30728

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	9794	6862	4243	46747	6621	2910	40294	5035	2545	490
2	5268	10663	7125	5237	71176	9263	4482	42732	5750	4611
3	348	5526	9093	7303	5820	58719	8803	4220	24425	5591
4	1699	413	4487	6716	8100	6284	45760	7679	4178	18734
5	167	1324	315	3726	5860	6950	5346	27098	6338	3174
6	181	136	980	355	2800	4083	5027	3436	17763	4384
7	2317	131	107	901	384	1693	2564	3061	2188	12172
8	169	1946	96	85	682	242	1160	1254	1646	1192
9	5095	9904	2250	2512	2409	1632	709	715	1067	1268
1+	25039	36906	28696	73581	103853	91775	114145	95232	65901	51617

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
1	909	5113	518	5899	610	6109	557	1443	1042	4070
2	1753	2033	11364	1183	8076	1113	10042	830	1943	1578
3	4119	1542	2067	9462	1349	7926	1281	11826	853	1606
4	3953	3211	1460	1621	7489	1095	6185	1041	8771	756
5	12183	2835	2230	1153	1290	4000	896	4278	782	4989
6	2118	7596	2120	1341	719	837	2679	571	2913	486
7	3186	1247	4541	1390	826	493	641	1741	300	1681
8	7436	2001	798	3008	1015	541	355	358	1086	148
9	891	4398	1576	736	1459	1008	608	472	716	647
1+	36547	29976	26673	25793	22833	23121	23243	22559	18404	15960

	1993	1994
1	8621	2756
2	7071	12077
3	1410	7352
4	1117	998
5	515	737
6	2453	335
7	253	1280
8	794	178
9	482	617
1+	22717	26332

Summaries for ages 2 9 3 9 4 9 5 9 6 9

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
2	186464	234306	341258	199758	110802	78207	50562	39540	30409	25990
3	162770	125370	150719	190184	108776	72445	50327	38712	27633	25710
4	132200	104846	71266	82624	102528	70415	46197	38426	27175	23199
5	79517	82281	57328	37353	41984	66163	44392	34337	26889	22876
6	42411	48959	42829	29018	18628	25161	41657	33017	23641	22628

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
2	15245	30044	24453	26834	97233	88865	73851	90196	63356	51126
3	9976	19381	17327	21597	26056	79603	69369	47464	57605	46515
4	9628	13854	8234	14295	20236	20884	60566	43244	33180	40924
5	7929	13441	3748	7578	12136	14600	14806	35565	29002	22190
6	7762	12117	3433	3853	6276	7650	9461	8466	22664	19016

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
2	35638	24863	26156	19894	22223	17012	22686	21116	17362	11891
3	33885	22830	14791	18711	14146	15899	12644	20286	15419	10312
4	29766	21288	12725	9249	12797	7974	11363	8460	14566	8707
5	25814	18077	11265	7628	5308	6879	5178	7420	5795	7950
6	13630	15241	9035	6475	4018	2879	4282	3141	5014	2962

	1993	1994
2	14095	23576
3	7024	11498
4	5614	4147
5	4497	3148
6	3982	2411

CATCH BIOMASS (MT)

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
1	1662	5061	5614	66	762	5	1	33	1	97
2	3536	13275	87624	5048	118	2446	9	202	1431	2
3	8810	5130	46352	91127	2771	750	1885	20	296	788
4	16506	6876	7306	24407	24593	2565	764	1107	70	167
5	13881	14431	7408	4758	14860	23046	1154	410	694	78
6	4773	11762	13492	5431	2504	7416	11962	514	703	352
7	3325	5050	8640	5377	2319	1566	3999	5998	841	242
8	2208	2737	2944	3679	2462	1200	679	2426	4590	228
9	3398	3956	4248	2757	2164	2408	2069	1740	3452	4524
1+	58099	68278	183627	142650	52553	41403	22521	12450	12078	6478

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
1	1543	33	119	72	1	1	1	4	0	0	0
2	2155	4620	1017	470	21094	717	26	29523	1526	1137	219
3	5	1202	3060	767	270	21762	2222	421	13788	2389	1121
4	830	5	833	1762	1483	624	14582	1696	1533	7074	1272
5	130	199	9	577	1414	1591	1325	13266	2171	933	4990
6	100	8	124	0	1156	1663	1295	1692	7054	1583	726
7	264	8	16	85	17	471	1202	1990	1242	3650	607
8	58	208	16	19	157	51	366	550	644	423	2709
9	1761	1061	381	553	554	342	224	313	417	450	325
1+	6846	7344	5576	4305	26145	27222	21244	49455	28374	17637	11968

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	0	0	3	0	2	0	1	3	4	5	0
2	86	2394	51	1664	51	1128	11	541	292	340	290
3	394	771	3854	185	3222	128	2149	120	528	610	1427
4	1342	386	410	3255	226	1579	308	3940	235	657	376
5	879	1146	376	276	1937	318	1854	224	3381	222	158
6	3998	624	493	193	368	927	252	1093	283	1755	98
7	700	1622	447	271	165	150	500	211	969	102	368
8	919	292	927	403	225	100	139	474	92	503	52
9	2020	578	227	579	420	172	183	312	401	305	181
1+	10339	7813	6788	6826	6615	4502	5396	6919	6185	4498	2951

Summaries for ages 2 9 3 9 4 9 5 9 6 9

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
2	56437	63217	178014	142584	51791	41398	22520	12417	12077	6381
3	52901	49942	90390	137537	51674	38952	22512	12215	10646	6379
4	44091	44812	44038	46409	48902	38202	20627	12196	10351	5591
5	27585	37936	36732	22002	24309	35636	19863	11089	10281	5424
6	13704	23505	29325	17244	9450	12590	18708	10679	9586	5346

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
2	5304	7310	5457	4233	26144	27222	21244	49450	28374	17637	11968
3	3148	2691	4439	3763	5050	26504	21218	19928	26848	16500	11749
4	3143	1488	1379	2996	4780	4743	18995	19507	13060	14112	10629
5	2313	1484	546	1234	3297	4118	4413	17811	11527	7038	9357
6	2184	1285	537	657	1883	2528	3087	4545	9356	6105	4367

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
2	10339	7813	6786	6826	6613	4502	5395	6916	6181	4493	2951
3	10253	5419	6735	5162	6562	3374	5384	6374	5889	4154	2660
4	9859	4648	2881	4977	3341	3247	3236	6254	5361	3543	1233
5	8517	4262	2470	1722	3114	1667	2928	2314	5126	2887	857
6	7637	3116	2094	1446	1178	1349	1074	2090	1745	2664	699

SSB AT THE START OF THE SPAWNING SEASON - males & females (MT)

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
1	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	1675	61	164	756	66
3	24230	15656	65967	91729	4933	1433	3118	185	411	1651
4	56089	23010	14887	48135	60257	4293	1636	3441	266	304
5	38627	36347	15695	8787	26342	41983	2730	1303	3213	236
6	16463	25241	20958	8947	5063	15407	26008	2066	873	2669
7	10878	10436	13801	10289	4575	2780	10823	17569	1590	354
8	6533	7058	5445	6849	5609	2397	1525	7607	12672	961
9	11435	10811	8271	5784	5324	5124	5277	6176	10447	20670
1+	164256	128559	145025	180521	112102	75092	51178	38511	30227	26912

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	0	0	0	0	0	0	0	0	0	0
2	1594	3143	2251	1510	17992	2452	1132	12803	1680	1070
3	272	4215	7623	6065	4147	45707	6784	3337	20354	4037
4	1789	359	4456	6763	7091	5669	44393	7285	3863	17336
5	189	1247	341	3692	5542	6771	5346	30457	6218	3124
6	183	116	1038	315	2925	4329	5267	3778	18149	4544
7	2306	126	113	862	351	1845	2733	3432	2256	12507
8	170	1955	105	87	724	286	1231	1491	1775	1308
9	5768	10652	2454	2769	2662	1795	798	825	1219	1438
1+	12271	21813	18381	22063	41434	68854	67683	63406	55515	45365

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
1	0	372	84	1185	110	1145	112	177	123	464
2	290	426	5559	572	5034	602	5720	484	1188	911
3	3130	1416	1856	8976	1149	6934	1086	9827	779	1520
4	3964	3191	1327	1568	7117	1111	5945	1064	9149	732
5	12886	2906	2251	1144	1281	4587	886	4533	789	5486
6	2266	8107	2136	1422	790	926	2715	613	2968	536
7	3217	1393	4814	1500	902	524	617	1863	343	1879
8	8298	2262	809	3178	1029	578	362	425	1201	163
9	1012	5093	1792	827	1669	1157	679	539	825	773
1+	35062	25166	20627	20373	19080	17563	18122	19525	17365	12463

	1993	1994
1	413	81
2	2189	4165
3	1206	6071
4	1152	998
5	542	733
6	2717	350
7	283	1379
8	926	180
9	577	691
1+	10003	14649

The above SSBs by age (a) and year (y) are calculated following the algorithm used in the NEFSC projection program, i.e.

$$SSB(a,y) = W(a,y) \times P(a,y) \times N(a,y) \times \exp[-Z(a,y)]$$

where Z(a,y) = 0.25 x M(a,y) + 0.25 x F(a,y)
N(a,y) - Jan 1 stock size estimates (males & females)
P(a,y) - proportion mature (generally females)
W(a,y) - weight at age at the beginning of the spawning season

The W(a,y) are assumed to be the same as the Jan1 weight at age estimates
(see "WT AT AGE" table in input section).
Jan1 weights at age are calculated as geometric means in ADAPT
from the mid-year weight at age estimates (from the catch)
of the cohort in successive years.

MEAN STOCK NUMBERS (thousands) - GBHADD5

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
1	171431	422775	25092	3694	11173	378	894	4201	334	7641
2	27235	131249	276144	13115	2894	7113	301	652	2696	272
3	25907	18324	77138	120854	6577	1934	3755	234	349	1443
4	35838	15780	10324	35929	51308	3221	1068	2119	165	159
5	22087	20318	8683	4903	16448	26116	1563	603	1359	102
6	7202	11774	9565	4006	2311	7705	12667	913	281	935
7	4352	3907	5331	4077	1769	1065	4123	6858	509	98
8	2164	2466	1808	2277	1962	826	501	2369	3933	274
9	3265	3167	2231	1540	1479	1519	1257	1463	2465	5098
1+	299480	629761	416316	190394	95921	49877	26129	19413	12091	16021

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	16323	9531	6844	93495	12492	5490	76026	9155	6525	2229
2	5115	10060	7271	5290	66520	9854	4482	45459	6610	4754
3	220	3037	5579	5254	4042	39146	6877	3488	19698	3856
4	798	178	2030	3375	3733	3080	22653	4439	2283	9965
5	69	468	143	1401	2146	2491	2130	12488	2756	1339
6	55	36	333	115	872	1280	1601	1218	6531	1588
7	678	32	27	244	93	502	678	850	590	3757
8	44	497	24	18	171	67	306	352	407	301
9	1293	2325	520	508	483	319	146	185	240	310
1+	24595	26163	22770	109700	90551	62230	114900	77635	45640	28099

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
1	2755	15495	1569	13110	1418	14544	1051	2255	1794	7565
2	1719	2210	11479	1258	9731	1136	11283	855	1618	1343
3	3006	1168	1487	6958	944	5915	866	7991	651	980
4	2160	1755	737	886	3744	652	3455	585	4827	428
5	5513	1289	906	450	573	1942	405	2021	358	2282
6	799	2845	779	474	273	342	1042	224	1101	193
7	980	421	1484	469	273	166	198	620	105	566
8	2213	587	214	869	269	155	100	120	356	44
9	209	1182	415	195	340	254	159	113	165	152
1+	19353	26951	19071	24669	17566	25105	18559	14784	10975	13552

	1993	1994
1	13083	6806
2	6049	10585
3	816	4405
4	514	445
5	243	277
6	934	138
7	96	452
8	254	55
9	120	154
1+	22108	23314

Time stamp at end of run 1995 6 1 18 10 9

APPENDIX 3 Presision Estimates of 1994 Fishing Mortality and Spawning Stock Biomass for Georges Bank Haddock.

BOOTSTRAP RESULTS FOR GBHADD5 Timestamp 1995 6 3 7 15 49
HADDOCK: GEORGES BANK STOCK

SEED FOR THE RANDOM NUMBER GENERATOR: 74747
MAIN LOOP LIMIT IN MARQUARDT ALGORITHM: 50
NUMBER OF BOOTSTRAP REPLICATIONS ATTEMPTED: 500
NUMBER FOR WHICH NLLS CONVERGED: 500
Results from the converged replications are used for computing the statistics that follow. Other replications are ignored.

Appendix 3: Table 1. BOOTSTRAP OUTPUT VARIABLE: N_hat
Age-specific stocksizes (on Jan 1, 1995) estimated by NLLS

AGE	ADAPT ESTIMATE	BOOTSTRAP MEAN	BOOTSTRAP STD ERROR	C.V. FOR NLLS SOLN
1	7.877E3	9.005E3	5.193E3	0.66
2	6.148E3	6.596E3	2.500E3	0.41
3	9.444E3	9.802E3	2.672E3	0.28
4	3.594E3	3.795E3	1.120E3	0.31
5	3.305E2	3.473E2	1.147E2	0.35
6	2.229E2	2.397E2	8.824E1	0.40
8	3.486E2	3.655E2	1.456E2	0.42

AGE	BIAS ESTIMATE	BIAS STD ERROR	PERCENT BIAS	NLLS EST CORRECTED FOR BIAS	C.V FOR CORRECTED ESTIMATE
1	1.127E3	2.322E2	14.31	6.750E3	0.77
2	4.475E2	1.118E2	7.28	5.701E3	0.44
3	3.586E2	1.195E2	3.80	9.085E3	0.29
4	2.015E2	5.010E1	5.61	3.392E3	0.33
5	1.674E1	5.129E0	5.06	3.138E2	0.37
6	1.677E1	3.946E0	7.52	2.061E2	0.43
8	1.690E1	6.510E0	4.85	3.317E2	0.44

Appendix 3: Table 2. BOOTSTRAP OUTPUT VARIABLE: q_unscaled
Catchability estimates (q) for each index of abundance used in the ADAPT run. Note that these q's have been re-scaled to original units.

FLEET	ADAPT ESTIMATE	BOOTSTRAP MEAN	BOOTSTRAP STD ERROR	C.V. FOR NLLS SOLN
qRV SPR 1	1.774E-4	1.800E-4	3.116E-5	0.18
qRV SPR 2	2.420E-4	2.436E-4	3.722E-5	0.15
qRV SPR 3	2.245E-4	2.264E-4	3.465E-5	0.15
qRV SPR 4	2.266E-4	2.306E-4	3.664E-5	0.16
qRV SPR 5	2.427E-4	2.484E-4	3.701E-5	0.15
qRV SPR 6	1.914E-4	1.918E-4	3.197E-5	0.17
qRV SPR 7	2.260E-4	2.291E-4	3.433E-5	0.15
qRV SPR 8	2.551E-4	2.592E-4	4.097E-5	0.16
qRV FAL 1	1.665E-4	1.669E-4	2.425E-5	0.15
qRV FAL 2	2.684E-4	2.706E-4	4.150E-5	0.15
qRV FAL 3	1.876E-4	1.890E-4	2.760E-5	0.15
qRV FAL 4	2.086E-4	2.084E-4	2.970E-5	0.14
qRV FAL 5	1.769E-4	1.777E-4	2.572E-5	0.15
qRV FAL 6	1.968E-4	1.987E-4	2.918E-5	0.15
qRV FAL 7	2.069E-4	2.090E-4	3.050E-5	0.15
qRV FAL 8	2.108E-4	2.139E-4	3.388E-5	0.16
qCANADA 1	1.709E-4	1.756E-4	4.498E-5	0.26
qCANADA 2	3.279E-4	3.388E-4	8.357E-5	0.25
qCANADA 3	6.255E-4	6.461E-4	1.709E-4	0.27
qCANADA 4	5.021E-4	5.203E-4	1.302E-4	0.26
qCANADA 5	5.985E-4	6.247E-4	1.493E-4	0.25
qCANADA 6	4.159E-4	4.263E-4	1.111E-4	0.27
qCANADA 7	5.947E-4	6.085E-4	1.613E-4	0.27
qCANADA 8	4.976E-4	5.136E-4	1.329E-4	0.27

FLEET	BIAS ESTIMATE	BIAS STD ERROR	PERCENT BIAS	NLLS EST CORRECTED FOR BIAS	C.V FOR CORRECTED ESTIMATE
qRV SPR 1	2.602E-6	1.394E-6	1.47	1.748E-4	0.18
qRV SPR 2	1.548E-6	1.665E-6	0.64	2.405E-4	0.15
qRV SPR 3	1.840E-6	1.550E-6	0.82	2.227E-4	0.16
qRV SPR 4	4.006E-6	1.639E-6	1.77	2.226E-4	0.16
qRV SPR 5	5.733E-6	1.655E-6	2.36	2.369E-4	0.16
qRV SPR 6	3.877E-7	1.430E-6	0.20	1.910E-4	0.17
qRV SPR 7	3.095E-6	1.535E-6	1.37	2.230E-4	0.15
qRV SPR 8	4.091E-6	1.832E-6	1.60	2.510E-4	0.16
qRV FAL 1	3.664E-7	1.085E-6	0.22	1.661E-4	0.15
qRV FAL 2	2.135E-6	1.856E-6	0.80	2.663E-4	0.16
qRV FAL 3	1.411E-6	1.234E-6	0.75	1.862E-4	0.15
qRV FAL 4	-1.976E-7	1.328E-6	-0.09	2.088E-4	0.14
qRV FAL 5	7.983E-7	1.150E-6	0.45	1.761E-4	0.15
qRV FAL 6	1.940E-6	1.305E-6	0.99	1.949E-4	0.15
qRV FAL 7	2.136E-6	1.364E-6	1.03	2.048E-4	0.15
qRV FAL 8	3.090E-6	1.515E-6	1.47	2.078E-4	0.16
qCANADA 1	4.666E-6	2.011E-6	2.73	1.662E-4	0.27
qCANADA 2	1.085E-5	3.737E-6	3.31	3.171E-4	0.26
qCANADA 3	2.062E-5	7.643E-6	3.30	6.049E-4	0.28
qCANADA 4	1.816E-5	5.824E-6	3.62	4.840E-4	0.27
qCANADA 5	2.619E-5	6.678E-6	4.38	5.724E-4	0.26
qCANADA 6	1.038E-5	4.967E-6	2.50	4.056E-4	0.27
qCANADA 7	1.374E-5	7.214E-6	2.31	5.810E-4	0.28
qCANADA 8	1.603E-5	5.941E-6	3.22	4.816E-4	0.28

Appendix 3: Table 3. BOOTSTRAP OUTPUT VARIABLE: F_t
Full vector of age-specific terminal F's (in 1994)

AGE	ADAPT ESTIMATE	BOOTSTRAP MEAN	BOOTSTRAP STD ERROR	C.V. FOR NLLS SOLN
1	1.472E-7	1.587E-7	6.581E-8	0.45
2	2.405E-2	2.491E-2	6.973E-3	0.29
3	1.941E-1	1.989E-1	5.663E-2	0.29
4	3.746E-1	3.894E-1	1.153E-1	0.31
5	2.147E-1	2.248E-1	8.081E-2	0.38
6	2.927E-1	3.090E-1	6.094E-2	0.21
7	2.888E-1	3.126E-1	1.134E-1	0.39
8	2.927E-1	3.090E-1	6.094E-2	0.21
9+	2.927E-1	3.090E-1	6.094E-2	0.21

AGE	BIAS ESTIMATE	BIAS STD ERROR	PERCENT BIAS	ADAPT EST CORRECTED FOR BIAS	C.V FOR CORRECTED ESTIMATE
1	1.155E-8	2.943E-9	7.85	1.356E-7	0.49
2	8.670E-4	3.119E-4	3.61	2.318E-2	0.30
3	4.745E-3	2.533E-3	2.44	1.894E-1	0.30
4	1.478E-2	5.158E-3	3.95	3.598E-1	0.32
5	1.014E-2	3.614E-3	4.72	2.046E-1	0.40
6	1.625E-2	2.725E-3	5.55	2.765E-1	0.22
7	2.382E-2	5.070E-3	8.25	2.650E-1	0.43
8	1.625E-2	2.725E-3	5.55	2.765E-1	0.22
9+	1.625E-2	2.725E-3	5.55	2.765E-1	0.22

Appendix 3: Table 4. BOOTSTRAP OUTPUT VARIABLE: F_full_t
Fully-recruited F (4-7) in the terminal year (1994)

ADAPT ESTIMATE	BOOTSTRAP MEAN	BOOTSTRAP STD ERROR	C.V. FOR NLLS SOLN
2.927E-1	3.090E-1	6.094E-2	0.21

BIAS ESTIMATE	BIAS STD ERROR	PERCENT BIAS	NLLS EST CORRECTED FOR BIAS	C.V FOR CORRECTED ESTIMATE
1.625E-2	2.725E-3	5.55	2.765E-1	0.22

Appendix 3: Table 5. BOOTSTRAP OUTPUT VARIABLE: SSB_spawn_t
SSB (males & females) at start of spawning season (1994)

ADAPT ESTIMATE	BOOTSTRAP MEAN	BOOTSTRAP STD ERROR	C.V. FOR NLLS SOLN
1.465E4	1.522E4	2.312E3	0.16

BIAS ESTIMATE	BIAS STD ERROR	PERCENT BIAS	NLLS EST CORRECTED FOR BIAS	C.V FOR CORRECTED ESTIMATE
5.715E2	1.034E2	3.90	1.408E4	0.16