Northwest Atlantic Fisheries Organization

SCIENTIFIC COUNCIL MEETING - JUNE 1997

An assessment of Greenland Halibut in NAFO Subarea 2 and Divisions 3KLMNO

by

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Catch History and TACs

The fishery for Greenland halibut in this management area began in the early 1960s, using synthetic gillnets in the deepwater bays of eastern Newfoundland, particularly Trinity Bay. As catches declined here, the effort moved northward to Bonavista Bay, then Notre Dame Bay and finally White Bay on the northeast coast of Newfoundland. Subsequently, vessels moved further offshore to the deep channels running between the shallow fishing banks. Catches increased from fairly low levels in the early 1960s to over 36,000 tons by 1969 and ranged from 24,000 tons to 39,000 tons over the next 15 years. With the exception of 1987, catches in the late 1980's were around 18,000 tons (Table 1a; Fig. 1). In 1990, an intense fishery for Greenland halibut developed in the NAFO Regulatory Area (NRA) of Div. 3L and 3M, in the deepwater areas known as Sackville Spur and Flemish Pass. The development of this fishery resulted in a rapid escalation of catches to about 47,000 tons in 1990. Catches in the NRA in 1991 to 1993 were estimated to be around 55,000 t tons in each year (Table 1a; Fig. 1 and 2), although some estimates put the catch in this fishery at nearer 75,000 tons in at least one of these years. Overall, catches from the stock during 1991 to 1993 were estimated to be between 62,000 and 65,000 tons annually. Best estimates of catch suggested a decline to about 48,000 tons in 1994, although some estimates ranged as high as 56,000 tons. As a result of new management measures introduced by the NAFO Fisheries Commission in 1995 i.e. extensive quota restrictions and 100% observer coverage in the NRA, catches were greatly reduced. In 1995, the catch was estimated to be about 15,000 tons, increasing to almost 19,000 in 1996. The catch in the NRA was estimated to be around 12,400 tons in 1995 and 13,000 tons in 1996 (Table 1b), although estimates made by Canadian surveillance authorities placed the catch in the NRA in 1996 as high as 19,000 tons. Nonetheless, catches from the stock in 1995-96 represent a reduction of about 70% compared to the average annual catch of the previous 5 years.

The major participants in this fishery in the NRA have been EU/Spain and EU/Portugal, as well as a variety of non NAFO-member countries such as Panama, although by 1994, more than 80% of the catch was estimated to have been caught by EU (Spain) alone. The breakdown of catches in 1996, by country and Division, is given in Table 1b. Catches listed as "Subarea 3 Outside" in Table 1a include all non-Canadian catches during recent years and are illustrated in Fig. 2 for comparison with traditional fishing areas of Subarea 2 and 3 inside the Canadian zone. Catches in the NRA have also been taken in Div. 3N and 3O in recent years, and are included in the totals.

Prior to 1990, Canada, USSR, GDR, and Poland were usually the main participants in the fishery, although Portugal and Japan became increasingly involved in the fishery after 1984. Canadian catches have been taken mostly by gillnet, although a significant proportion is taken by otter trawlers. With the exception of 1987, catches declined steadily inside the Canadian zone since the late 1970's from a high of over 30,000 tons to less than 3,000 tons in 1994 and 1995. This declining trend was mainly a result of low catch rates and reduced effort, as multi-licensed vessels fished other species such as snow crab that offered a better return on costs. This fishery picked up in 1996, and catches increased to around 6,000 tons (Tables 2 and 3). Both gillnet and otter trawl catches were higher in 1996, with the main increase occurring in Div. 3K.

The traditional gillnet fishery has been conducted by relatively small vessels (<20 m) fishing in the deepwater channels near the Newfoundland and Labrador coast as well as the Newfoundland east coast deepwater bays using an average mesh size of 150 mm. However, this component of the fishery has declined rapidly in recent years. The Canadian gillnet catches taken during recent years are mainly from a newly developed fishery along the deep edge of the continental slope in Subarea 2 and Div. 3KL, although some fishing still occurs nearshore, mainly with 140 mm gillnets. Some fishing by Canadian gillnetters is now taking place along the southwest slope of the Grand Bank in Div. 3O although catches have been relatively low. In an attempt to reduce the catch of young Greenland halibut in the new

deepwater gillnet fishery, it is illegal to use a gillnet mesh size of less than 190 mm while fishing Greenland halibut in the Canadian zone in depths > 400 fath. (732 m).

Canadian otter trawl catches peaked at about 8,000 tons in 1982, declined to less than 1,000 tons in 1988, then increased to about 7,400 tons in 1991 which is the highest level since 1982. In 1992 , otter trawl catches were less than half that of 1991 due to low catch rates. Since then, catches by this fleet have been less than 1600 tons annually.

The TAC for this resource (Subarea 2 and Div. 3KL only), increased from 35,000 tons in 1980 to 55,000 tons in 1981-84, 75,000 tons in 1985, and 100,000 tons in 1986-89 (Fig. 1). These increases in TACs were the result of research vessel surveys estimates of stock biomass which indicated high levels of fishable biomass (in excess of 400,000 tons) as well as prospects of several better than average recruiting year-classes. Despite the large TAC's, catches in the 1985 to 1989 period were lower than in the preceding years. After observing an estimated reduction in stock biomass from the late 1970s to the late 1980s in Subarea 2 and Div. 3KL of about 50%, the TAC was reduced to 50,000 tons in 1990 and this level was maintained to 1993 despite the substantive declines in stock size throughout the normal range of observed historical stock distribution. Although the Scientific Council, in its deliberations during June 1993, could not advise an appropriate catch level for 1994, the TAC was reduced to 25,000 tons by Canada in Subarea 2 and Div. 3KL in consideration of low levels of stock size estimated for the area. It was intended that this catch should include all catches in Subarea 2 and 3 for conservation purposes. Nevertheless, catches in the NRA continued unregulated. In 1994 the, management of G. halibut in Subarea 2 and Div. 3KLMNO became the responsibility of the NAFO Fisheries Commission, which imposed a TAC of 27,000 tons for 1995. This level was maintained for 1996 and 1997, and was proportioned throughout the management area in an attempt to reduce high concentrations of effort in localized areas.

Commercial fishery data

A) Catch-at-age and mean weights-at age

Sampling data from the catches of Canada in 1995 (2315 t) and 1996 (5385 t only) were used to calculate catch at age and mean weights at age from this component of the fishery. Table 4 shows the difference in age compositions in the gillnet and otter trawl catches in 1995. The gillnet catch was comprised mainly of fish aged 9 to 13 years, compared to mainly 7 to 9 in the otter trawl catch. Overall, ages 7 to 11 comprised the bulk of the catch, with a peak at age 8. In 1996, the gillnet catch at age was bimodal (Table 5), with peaks at ages 7 and 11, reflecting catches by the different mesh sizes used. Otter trawl catches in 1996 consisted mainly of age 6-9 fish, with a peak at age 7. Overall, the catch at age had the same bimodal pattern observed in the gillnet catches, with peaks at age 7, and ages 10-11. Mean weights at age were similar in both years. A sum-of-products discrepancy of -12% relative to the 1996 catch could not be resolved at this time.

Due to uncertainty regarding catch information on fisheries in the NRA since 1989, catch-at-age for Canadian catches only were available from 1988-96. Catch numbers-at-age and mean weights-at-age for this period are presented in Tables 6 and 7. Prior to 1989, data are available from the entire annual fisheries which took place mainly in the Canadian zone, and have been presented in the last few assessments of this stock (see Bowering et al. 1996). Ages 6-8 dominated the catch in most years up to 1991. Although the Canadian catch was lower in 1992 to 1996 than in previous years, there were relatively higher proportions of older fish (ages 9+) in the catch (Table 6). This is due to the change in the fishing pattern noted above, with recent exploitation of Greenland halibut occurring mainly in depths greater than 1000 m along the continental slope by gillnetters using a 200 mm mesh size, compared to a 130-190 mm mesh size at depths of less than 500 m in the traditional gillnet fishery. Mean weights at age in 1995 and 1996 were similar to recent values (Table 7), and no trends are seen in the mean weights over the period 1988-96.

B) Catch and effort

Catch and effort data from the directed fishery for G.halibut during the period 1975 to 1992 were obtained from ICNAF/NAFO Statistical Bulletins and were combined with provisional 1993-1996 NAFO data. The catch/effort data were analyzed with a multiplicative model (Gavaris 1980) to derive a standardized catch rate index for hours fished. Factors included in the model were a combination country-gear-tonnage class category type (CGT), month, NAFO division and year. Except for the year category type, individual observations of catch or effort data less than 10 units were eliminated prior to analysis as were categories where there were less than five occurrences in the database. The regression was significant ($p < 0.05$), explaining 63% of the variation in catch rates (Table 8). The standardized catch rate index (Table 9, Fig. 3) shows high between-year variability, especially in the late 1970s to mid 1980s. There was an increasing trend from the mid 1970s that peaked in 1982 and CPUE subsequently declined fairly steadily to the lowest level observed over the period in 1992. CPUE has remained at about this level in 1993-96. The slight increase from 1994 to 1996 is not statistically significant, given the high variability around the mean CPUE in these years (Fig. 3). In this updated analysis the data suggest, relative to the

whole time period, catch rates were generally higher in winter and higher in Subarea 2, based on the coefficients in Table 8. A more detailed analysis of these data were conducted in 1995 (Myers et al., 1995) which suggested that the overall decline in CPUE was seen in the data from several countries.

Research vessel surveys

From 1977-94 in Div. 2J and 1978-94 in Div. 3K, Canadian surveys were conducted during autumn by the research vessel *Gadus Atlantica* using an Engel 145' bottom trawl. In Div. 3L from 1981-83, surveys were conducted by the *A.T. Cameron* using a Yankee 41.5 bottom trawl and in 1984-94 by either the *A. Needler* or the *W. Templeman* (sister ships) using an Engel 145 bottom trawl, which differed somewhat from the trawl used on the *Gadus Atlantica*. In 1995 and 1996, the surveys in Div. 2J, 3K and 3L were conducted by the research vessels *Teleost* and *W. Templeman* using a Campelen 1800 shrimp trawl with rockhopper footgear (for details on the trawls used in these surveys, see McCallum and Walsh, 1996). Warren (1996) outlined the conversion factors for G.halibut catches, required for comparison of results from 1995 and 1996 with those prior to 1995.

Table 10 gives an outline of the Canadian survey coverage, by division and depth, for the 1996 Canadian survey in SA 2 + 3KLMNO. Results of the survey in Div. 2GH are reported in Brodie et al (1997).

i)   Geographic distribution

The spatial distribution of Greenland halibut in Div. 2J and 3KL from standard fall surveys was examined by depicting standardized survey catches as circles and subsequently plotting these circles on a map of the survey area according to the position of each catch (Black 1993). Circle diameters were chosen to represent proportionally increasing size groups of catch weight (kg) established from a cursory examination of the entire database. All catches within the bounds of a particular size grouping are represented by the same circle diameter. Tows where Greenland halibut did not occur are depicted with a plus (+) symbol.

Fig. 4 shows the results from 6 of the earlier surveys (1982, 87, 90 and 92-94), selected from the full range of years shown in Bowering et al. (1996). During the earlier surveys, Greenland halibut were relatively abundant in the deep channels running between the shallow fishing banks, especially in Div. 2J and 3K. They were also plentiful along the slope of the continental shelf. This distribution pattern remained fairly consistent through to about 1987, but after 1987, a decreasing trend in abundance was *clearly apparent, detected first in Div. 2J. This was followed by a similar trend in Div. 3K by 1990. By* 1993, catches in Div. 2J and 3K were extremely low and the highest catches in the area were taken in the central part of Div. 3K (Fig. 4). In 1995, the survey results using the Campelen trawl showed a distribution similar to that of 1993, with the 1996 survey suggesting a slightly wider distribution in Div. 2J3KL (Fig. 5).

Throughout the survey period , there were very few large catches experienced in Div. 3L (Figs. 4 and 5) and any relatively high catches were taken near the continental slope in the area known as the "nose" of the Grand Bank or the Sackville Spur. Some catches of G.halibut were also recorded along the deepwater slopes of the Grand Bank in Div. 3NO (Fig. 5), although survey coverage in these areas was not as extensive.

ii)   Biomass and abundance indices (prior to 1995, unconverted from Engel to Campelen equivalents)

Biomass estimates from Canadian stratified random groundfish surveys in autumn in Div. 2J for 1977-92, and Div. 3K for 1978-92, are presented in Tables 11 and 12 respectively. Due to a revision of the stratification scheme in 1993, some strata are not directly comparable, therefore, the results for Div. 2J and 3K in 1993 and 1994 are presented separately in Tables 13 and 14 respectively. Biomass indices *from autumn surveys in Div. 3L during 1981-1994 are detailed in Table 12. In all cases the total annual* biomass estimates are accompanied by 95% confidence limits. Annual biomass estimates are also illustrated, separately by division, in Fig. 6. It should be noted that in Div. 2J and 3K, the strata from 1001-1500 m were rarely surveyed. In Div. 3L, the deepest strata surveyed prior to 1996 have a maximum depth of only 731 m, and these areas were not surveyed in all years.

The biomass index of Greenland halibut in Div. 2J declined from just over 100,000 tons in 1982 to less than 12,000 tons annually in 1991-94 (Tables 11 and 13, Fig. 6). The biomass index in Div. 3K peaked at 112,000 tons in 1984 but after 1989, biomass in this division also began a steep decline similar to Div. 2J, reaching lows of about 21,000 tons in 1992 and 1994 (Tables 12 and 14, Fig. 6). Estimates for Div. 3L, for depths to 366 meters only, fluctuated around a mean value of about 13,000 tons from 1981 to 1990 (Table 15, Fig. 6). From 1991 to 1994, the biomass was lower, ranging from 3800 to 7300 tons.

The cumulative biomass index for all three divisions (Fig. 6) declined steadily from a level around 200,000 tons in the mid-1980's to between 37,000 tons and 55,000 t in the 1991 to 1994 period.

Before estimates of abundance at age are examined, it is necessary to point out a change in the 1994 data. Based on an examination of mean lengths at age, and definition of ageing criteria established at the joint NAFO-ICES workshop on ageing of G.halibut held in Iceland in Nov. 1996, it was determined that ageing of G.halibut less than 30 cm. in the 1994 and 1995 Canadian surveys was mostly incorrect. Reaging of the 1994 otoliths was done in time for inclusion in this paper, but the process was not completed for the 1995 otoliths. The results for the 1994 samples indicated that most otoliths previously aged 1-3 years were re-aged as 0-2 years old. Some otoliths aged 4 and 5 were also revised downward. Almost all revisions were downward by one year. About 96% of age 1 otoliths were revised; 80% at age 2; 58% at age 3; 30% at age 4, and 1.5% at age 5.

Declines in total abundance are less apparent than the decreases in biomass due to the fact that the declines are not consistent across all age classes (Table 17; Fig. 7). An examination of the age structure shows that the abundance at ages 6-9 declined by almost 90 % from 1989 to 1993-94. Age 10+ abundance also declined since the early 1980's, and in 1992-94 had virtually disappeared from the survey catches. On the other hand, abundance at ages 3-5 slowly increased from the early 1980's to about 1989. From 1989 to 1992, however, these age groups also declined to a relatively low level, less than half the 1988 estimate. The index for these ages increased sharply in 1993 to the third highest in the 17-year time series and the 1994 value was equal to the mean of the series.

iii)   Biomass and abundance indices (converted from Engel to Campelen equivalents prior to 1995, and Campelen surveys in 1995 and 1996)

Results of the data analysis (Warren 1996) from the comparative fishing exercises carried out between the *Gadus Atlantica* using the traditional Engel 145' bottom trawl and the *Teleost* using a Campelen 1800 shrimp trawl with rockhopper footgear (McCallum and Walsh 1996) were evaluated in 1996. The length-based conversion equation presented for Greenland halibut was agreed to best represent the relationship between catches from the two gears, with catch conversions for fish below 10 cm being set equal to that of 10 cm. Similarly, for fish greater than 53 cm in length, the catch conversion was set equal to the conversion at 53 cm. All length frequency data on Greenland halibut collected during the fall surveys of the Gadus Atlantica using the Engel 145' bottom trawl from 1977-94 in Div. 2J and 3K were converted to Campelen trawl catch equivalents to allow for direct comparison of the old data series with the results of surveys from 1995 onwards. The conversion for the Engels trawl used in the 3L surveys has not yet been evaluated. The conversions presented in Bowering et al. (1996) for abundance were not adjusted for the difference in area swept between the 2 gears. Correction of this error resulted in increasing the swept-area abundance estimates from 1978 to 1994 by a factor of about 1.83, but did not affect values of mean catch per tow examined in the 1996 assessment.

To allow comparison of the biomass estimates in Div. 2J and 3K from the two time periods, the converted abundance at length was transformed to biomass at length using a length-weight relationship. The converted biomass from 1978-94, and the length-weight converted Campelen values for 1995 and 1996, are shown in Fig. 8. As expected, the converted biomass estimates are higher than the unconverted ones in Fig. 6, but both show the same trends. The major differences in the trends are related to the more recent years where the converted estimates do not express the dramatic declines during the 1990's quite as strongly as before. The reason for this is that the cohorts of the 1990's appear more abundant than those previous and these young age groups have the highest conversion factors. After a steady decline from the mid-1980's to 1992, the biomass has since increased, with the value in 1996 being equal to the level seen in 1988-90 (Fig. 8). A closer look at the trends in the biomass of fish above and below 35 cm. reveals some interesting patterns (Fig. 9). In the years prior to 1988, the trawlable biomass estimates in Div. 2J and 3K were comprised mainly of fish larger than 35 cm. As the stock size declined in these areas, the biomass became dominated by smaller fish (the actual change-over occurred from 1991 to 1992). It is thought that much of the biomass of older fish in these areas probably migrated to the deepwater areas of the NRA in Div. 3LMN, resulting in the sharp increases in catch in the early 1990's. While the biomass of the larger fish has remained fairly low throughout the 1990's, the biomass of G. halibut smaller than 35 cm. has increased sharply, to a level in 1996 which was substantially higher than the values seen prior to 1993. Although these comparisons must be done with the Engels to Campelen conversion in mind, it should be noted that the 1993 and 1994 converted values for biomass less than 35 cm. are also higher than the earlier values.

Fig. 10 shows the split, by Division, of trawlable biomass from the 1996 Canadian survey. About 65% of the biomass was found in Div. 2J3K, with no more than 13% being found in any other Division. It making this comparison, it must be noted that deepwater coverage was not complete in all areas, namely Div. 2G, 3N, and 3O. Nonetheless, it is the first biomass estimate available for the majority of the stock area. Fig. 11 indicates the components of the biomass above and below 35 cm, by Division. The 10% difference in the total biomass estimates in Figs. 10 and 11 probably stems from the application of the weight length relationship to the abundance at length. Larger fish made up more than 50% of the biomass in Div. 2G, 3L, and 3M, but were a much smaller percentage in Div. 2J and 3K.

The correct converted abundance at length, for Div. 2J3K combined, by year from 1978-94, is shown in Fig. 12. The data from the Campelen surveys in 1995 and 1996 are also included in this figure. The comparable age compositions are shown in Fig. 13 and Table 18, although it must be noted again that

the data for ages 1-5 will be modified when the otoliths have been re-aged. The unconverted age compositions described in the previous section are given in Fig. 7 for comparison. The age compositions show clearly the dominance of younger ages in the abundance indices in the 1990's, as described earlier. Fig. 14 shows a comparison of abundance at length and age for G.halibut size categories less than 29 cm.

The converted abundance indices for various age groupings are presented in Fig. 15 separately and in Fig. 16 together. What is especially interesting in these data plots is the general increase in the abundance index from cohorts at ages 3-5. The overall trend has been increasing from the early 1980's with a low point in the 1990-92 period (Fig. 16). On the other hand, the cohorts at ages 6-9 declined rapidly in the late 1980's and early 1990's, and ages 10+ declined since the early 1980's. Both these series have stabilized at very low levels in the mid 1990's. These observations are consistent with previous conclusions that Greenland halibut migrate from the survey area in Div. 2J3K when they reach about age 5, particularly since about 1990.

iv)   Recruitment indices and year-class strengths (based on converted estimates)

In order to better examine strengths of recruiting year-classes, the trends in the abundance indices for individual ages 1-5 from fall surveys in Div. 2J and 3K combined are presented in Fig. 17, as mean numbers per tow with 95% confidence limits. In addition, trends in abundance of individual year-classes at for ages 2-4 individually, as well as combined, are shown in Fig. 18. In both these figures, the 1995 data are omitted for the reasons discussed earlier.

Age 1 values in 1994 and 1996 were substantially higher than other points in the series (Fig. 17). Base on the length composition data, the age 1 value in the 1995 survey will likely be intermediate between these 2 high points (Fig. 14). Age 2 shows a very sharp increasing trend since 1990, with the 1996 estimate being the highest in the series (Fig. 17). This represents the 1994 year-class (Fig. 18). At age 3, the estimates for most years are much more stable although the recent estimates also show an increasing trend, with the 1990 year-class being the highest in the series (Fig. 17 and 18). At age 4, there is little in the way of trends although the estimates of the 1985, 1986, and 1989 year-classes are slightly higher than other values (Fig. 18). At age 5 the trend is similar to age 4 up to the 1990 survey, beyond which all estimates at this age declined considerably. The most recent estimates are below anything that has been observed in previous years (Fig. 17).

In general terms, the data indicate that estimates of recruiting year-classes at ages 2-4 exhibited an increasing trend since the early 1980's except for the 1987 and 1988 year-classes. The 1990 and particularly the 1991 year-classes appeared to be at least better than average in Div. 2J3K, but only at younger ages (Fig. 17). Early indications also suggested that the 1992 and 1993 year-classes were above average, but the value for the 1992 year-class at age 4 in the 1996 survey was average at best. The observations on the declining strength of the 1990-92 year-classes over time support the hypothesis that G. halibut migrate out of the area as they grow older. Fig. 19 indicates the change in the age of full recruitment to the survey in Div. 2J3K over time. From 1979 to 1986, the mean age at full recruitment was 6.5 years, compared to 4.8 years in 1987-94. Fig. 20 shows that no relationship exists between year-class size at age 3 and year-class size at age 6 in the 2J3K area. Among the possible explanations for the results shown in Figs. 19 and 20 is one where G.halibut leave the survey zone as they age, with Fig. 19 suggesting an increase in recent years.

Both the 1994 and 1995 year classes were the highest in their respective series in the 1996 survey (Fig. 17). It is interesting that the 1995 year class was also the largest in the time series in the surveys at west Greenland. It must be stated again that the comparison of year-class estimates at such young ages can be very much influenced by the sensitivity of the conversion factors between the survey gear types for the fish of small sizes. More confidence in the size of these year-classes should be developed over the next couple of years' surveys. Also, when the re-aging of the 1995 otoliths is complete, additional data will be available to determine year-class strengths. At that time, a model to determine cohort strength and recent mortalities from the survey data should be considered.

v)   Some observations on mortality and reference points

Fig. 21 compares the total mortality estimates (Z-values) from 2J3K survey data at ages 7+/6+ against the trends in catch from Div. 2J3K (Fig. 21a) and the catch from the entire stock area (Fig. 21b). In the first comparison, the trends in catch and Z are sharply divergent from 1988-91 (increasing Z, decreasing catch). However, the sharp increase in Z in Div. 2J3K in these years mirrors the increase in catch from the stock area, most of which came from the NRA in Div. 3LMN. Z-values decreased somewhat in 1995 and 1996, as did the catch from the stock. Again, how much of the Z-value is actually migration out of the 2J3K area (and likely into the NRA) is impossible to say. Nonetheless, Z-values for this part of the population were above 1.0 in each year from 1990 to 1995, which is substantially higher than the values calculated for the 1980's.

Fig. 22 is an attempt at a stock-recruitment plot, based on the same 2J3K survey data. The index of spawning stock biomass (SSB) was taken from the biomass at length data discussed earlier in Fig. 11, with 60 cm being used as a knife-edge value for mature fish. Data for recruitment is taken as the sum of

abundance at ages 2-4 for a cohort (last panel in Fig. 18). The difficulty with this figure is that it is most unlikely that the true SSB for this resource is being measured in Div. 2J3K during the fall surveys. Recent high estimates of recruitment (1990's year-classes) will all be at the upper end of this scale, but at the very low end of the SSB scale (the SSB index is less than 5000 t each year from 1991-96, and less than 1000 t in 3 of these years). Unfortunately, synoptic surveys of the entire area, including 2GH and deep water in the NRA, exist only for 1996. Based on these concerns, little emphasis can be placed on Fig. 22.

Finally, Fig. 23 shows a yield per recruit curve taken from the 1987 assessment of this stock, based on mean weights at age and PR values averaged over the early 1980's. The PR vector is dome-shaped, with full recruitment at ages 8 and 9. F0.1 is 0.29, indicating an exploitation rate of about 23%, assuming m=0.2. Applying this to the the trawlable biomass >35 cm (Fig. 11) in SA 2+3 suggests a catch at F0.1 of around 23,000 t, which is mid-way between the 1996 catch and the 1996/97 TAC's. Again, the 1996 survey is the only one available on which this calculation can be done, warranting very cautious evaluation of this approach, for a number of reasons.

vi) Conclusions on stock status

The fishable biomass in this stock is still at a relatively low level. Most indices of abundance showed some improvement in 1996, due mainly to the recruitment of above-average year-classes. Given the reduction in catches in 1995-96 (and anticipated in 1997), combined with improved recruitment estimates, this stock should show signs of recovery over the next few years.

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Table 1A. Catches of Greenland halibut in the Northwest Atlantic by division and selected areas from 1977-96.

Year	Div. 2G	Div. 2H	Div. 2J	Div. 3K	Div. 3L Inside	Div. 3N Inside	Div. 3O Inside	Total Inside	Subarea 3 Outside	Overall Total
1977	1778	1524	8237	13446	6956	2	3	31946	-	31946
1978	1899	1207	3723	24107	7596	5	4	38541	-	38541
1979	577	1623	3415	19843	8610	17	4	34089	-	34089
1980	36	444	1466	17923	12773	43	3	32688	-	32688
1981	1799	2141	1358	16472	8912	49	6	30737	-	30737
1982	369	8985	5931	6794	4135	55	6	26275	-	26275
1983	111	5671	6028	11374	4655	12	2	27853	-	27853
1984	214	4663	6368	8432	5120	12	2	24811	1900	26711
1985	193	2358	6724	5775	3061	35	1	18147	2200	20347
1986	455	1564	6823	4237	2794	2	1	15876	2100	17976
1987	2700	2631	12464	6860	4786	1	-	29442	3000	32442
1988	2068	2463	1971	6389	2019	12	2	14924	3500	18424
1989	837	1821	2952	7840	2860	7	3	16320	2600	18920
1990	905	1158	2911	4952	2020	4	4	11954	35500	47454
1991	1556	2591	3034	2019	1590	11	7	10808	54200	65008
1992	1264	107	382	3489	1694	10	22	6968	56225	63193
1993	557	403	213	2398	880	19	435	4905	57550	62455
1994	1045	210	203	1032	258	1	204	2953	44570	47523
1995	320	303	777	556	296	6	57	2315	12384	14699
1996	590	611	776	2544	879	0	339	5739	13101	18840

Note: Catches in Subarea 2 and Div. 3KLNO inside are Canadian only.
Catches in Subarea 3 outside include estimates of non-reported catches.

Table 1b). Catches of G.halibut in SA 2+3 in 1996 by country and Division.

	2G	2H	2J	3K	3L	3M	3N	3O	Total
Canada	590	611	776	2544	879			339	5739
Japan					1899	113			2012
Russia						311			311
Portugal					1709	645	934	28	3316
Spain					4087	2013	1201	5	7306
Others					100	56			156
Total	590	611	776	2544	8674	3138	2135	372	18840

Table 2 . Canadian catches of G.halibut in SA 2+3 in 1995.

	Gillnet							Otter Trawl					Other			Total
	2G	2H	2J	3K	3L	3N	3O	2G	2H	2J	3K	3L	2G	2J		
Jan																0
Feb																0
Mar							2				3	6				11
Apr																0
May				1	1		21									23
Jun			2	31	19											52
Jul	100	13	124	2	119		15			30				3		406
Aug	159	73	279	94	143		19	3		99	309					1178
Sep	34	213	203	41	8	6			3	7	66					581
Oct	21	1	28							2	9		1			62
Nov								2								2
Dec																0
Total	314	300	636	169	290	6	57	5	3	138	387	6	1	3		2315

1995	Div. Totals							Gear Totals		
	2G	2H	2J	3K	3L	3N	3O	GN	OT	Oth
	320	303	777	556	296	6	57	1772	539	4

Table 3. Canadian catches of G.halibut in 1996 used in calculating catch at age. Totals differ from the values in Table 1b).

	Gillnet							Otter Trawl						Other			Total
	2G	2H	2J	3K	3L	3O		2G	2J	3K	3L	3O		2J	3L		
Jan																	0
Feb																	0
Mar						49											49
Apr				3		73				3	4						83
May				355	200	93									1		649
Jun		30	30	588	215	37			8	38	1						947
Jul	183	30	121	56	32	5			185	171							783
Aug	186	166	236	236	143				227	184	1			1			1380
Sep	57	214	124	509	120				57	153		2					1236
Oct	4	49	9	92	85												239
Nov					1							1					2
Dec						14		2				1					17
Total	430	489	520	1839	796	271		2	477	549	6	4		1	1		5385

		Div. Totals							Gear Totals		
1996	2G	2H	2J	3K	3L	3N	3O		GN	OT	Oth
	432	489	998	2388	803	0	275		4345	1038	2

Table 4. Catch at age and mean weights at age from the Canadian commercial fishery for G.halibut in SA 2+3 in 1995. Data are shown for gillnet, otter trawl, and total catches.

Gillnet

AGE	AVERAGE WEIGHT	AVERAGE LENGTH	CATCH MEAN	CATCH STD. ERR.	CATCH C.V.
6	0.611	42.500	1	0.47	0.60
*7	0.914	47.774	28	2.67	0.10
8	1.247	52.414	45	3.58	0.08
9	1.913	59.539	95	6.47	0.07
10	2.522	64.693	113	9.17	0.08
11	3.160	69.167	100	10.97	0.11
*12	3.830	73.181	83	9.94	0.12
13	4.809	78.224	64	7.22	0.11
14	5.890	83.171	16	3.25	0.21
15	6.955	81.425	8	1.81	0.21
16	7.490	89.300	5	1.36	0.27
*17	9.533	96.045	2	0.40	0.20

Otter trawl

AGE	AVERAGE WEIGHT	AVERAGE LENGTH	CATCH MEAN	CATCH STD. ERR.	CATCH C.V.
*4	0.417	37.484	1	0.56	0.63
5	0.399	37.336	7	1.20	0.16
6	0.571	41.554	29	2.64	0.09
7	0.909	47.665	106	7.05	0.07
8	1.281	52.796	140	7.78	0.06
9	1.839	58.870	56	4.68	0.08
10	2.429	63.958	25	2.87	0.12
*11	3.134	68.974	17	1.84	0.11
12	3.776	72.929	2	0.98	0.39
*13	5.104	79.792	3	0.32	0.13
*14	7.226	88.212	1	0.01	0.01
*15	6.683	86.500	1	0.01	0.01

Total

AGE	AVERAGE WEIGHT	AVERAGE LENGTH	CATCH MEAN	CATCH STD. ERR.	CATCH C.V.
*4	0.417	37.484	1	0.58	0.63
5	0.399	37.336	8	1.23	0.16
6	0.572	41.578	31	2.76	0.09
*7	0.910	47.688	137	7.76	0.06
8	1.273	52.704	191	8.82	0.05
9	1.886	59.289	156	8.23	0.05
10	2.505	64.562	142	9.89	0.07
*11	3.156	69.139	120	11.45	0.10
*12	3.828	73.173	88	10.29	0.12
*13	4.820	78.284	69	7.44	0.11
*14	5.961	83.438	17	3.35	0.20
*15	6.953	87.417	9	1.86	0.21
16	7.490	89.300	5	1.41	0.27
*17	9.533	96.045	2	0.42	0.20

Table 5. Catch at age and mean weights at age from the Canadian commercial fishery for G.halibut in SA 2+3 in 1996. Data are shown for gillnet, otter trawl, and total catches.

Gillnet

AGE	AVERAGE WEIGHT	AVERAGE LENGTH	CATCH MEAN	CATCH STD. ERR.	CATCH C.V.
*5	0.395	37.300	2	1.02	0.47
6	0.633	42.823	45	9.25	0.21
*7	0.900	47.510	200	16.79	0.08
*8	1.308	53.092	152	15.31	0.10
9	1.926	59.696	171	13.00	0.08
10	2.535	64.789	283	18.07	0.06
*11	3.188	69.326	307	27.13	0.09
*12	3.866	73.373	161	24.76	0.15
13	5.010	79.183	83	12.02	0.15
14	5.870	83.066	30	5.65	0.19
15	6.837	86.998	12	3.92	0.32
16	7.973	91.137	4	2.52	0.60
17	8.376	92.500	2	1.33	0.87

Otter trawl

AGE	AVERAGE WEIGHT	AVERAGE LENGTH	CATCH MEAN	CATCH STD. ERR.	CATCH C.V.
*4	0.253	32.545		0.15	0.33
*5	0.393	37.170	31	4.27	0.14
6	0.548	41.054	170	10.10	0.06
7	0.871	47.080	432	13.20	0.03
8	1.300	53.124	178	10.94	0.06
9	1.759	58.081	124	6.96	0.06
*10	2.348	63.342	18	2.54	0.14
11	3.106	68.844	2	0.56	0.24
*12	3.890	73.638	1	0.28	0.46
*13	4.948	79.087	1	0.01	0.01
*14	6.177	84.500			
*15	7.218	88.500			

Total

AGE	AVERAGE WEIGHT	AVERAGE LENGTH	CATCH MEAN	CATCH STD. ERR.	CATCH C.V.
*4	0.253	32.545		0.15	0.33
*5	0.393	37.179	33	4.39	0.13
6	0.566	41.424	215	13.70	0.06
*7	0.880	47.216	632	21.37	0.03
*8	1.304	53.110	330	18.82	0.06
9	1.856	59.018	294	14.75	0.05
*10	2.523	64.702	301	18.26	0.06
*11	3.188	69.323	310	27.14	0.09
*12	3.866	73.374	161	24.78	0.15
*13	5.009	79.181	84	12.03	0.14
*14	5.871	83.067	30	5.65	0.19
*15	6.838	87.000	12	3.92	0.32
16	7.973	91.137	4	2.52	0.60
17	8.376	92.500	2	1.33	0.87

Table 6. Catch at age (000) of Greenland halibut from the Canadian fishery only
in SA 2+3 from 1988 - 1996.

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996
5	41	166	148	159	18	33	8	8	33
6	2124	1878	2979	1684	255	281	45	31	215
7	5429	7076	6706	4348	1319	847	154	137	632
8	1659	3568	1813	2121	840	411	196	191	330
9	404	597	300	900	359	190	153	156	294
10	130	90	78	295	316	169	139	142	301
11	25	19	34	89	268	173	185	120	310
12	10	4	21	80	234	192	107	88	161
13	2	2	11	21	119	107	101	69	84
14	2	1	13	21	70	54	57	17	30
15	1	1	9	4	36	31	15	9	12
16	1	1	2	1	8	12	4	5	4
17	0	1	1	1	4	2	0	2	2
Ages 5+	9828	13404	12115	9724	3846	2502	1164	975	2408
Ages 6-9	9616	13119	11798	9053	2773	1729	548	515	1471

Table 7. Weight at age (kg) of Greenland halibut from the Canadian fishery
in SA 2+3 from 1988 - 1996.

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996
5	0.397	0.403	0.416	0.410	0.386	0.398	0.372	0.399	0.393
6	0.583	0.561	0.587	0.596	0.560	0.580	0.572	0.572	0.566
7	0.801	0.765	0.754	0.808	0.797	0.814	0.866	0.91	0.88
8	1.157	1.065	1.052	1.179	1.252	1.196	1.227	1.273	1.304
9	1.640	1.619	1.542	1.736	1.937	1.815	1.835	1.886	1.856
10	2.240	2.201	2.116	2.404	2.544	2.445	2.368	2.505	2.523
11	2.837	2.980	2.850	3.078	3.169	3.064	3.023	3.156	3.188
12	3.593	3.981	3.632	3.821	3.942	3.984	3.765	3.828	3.866
13	4.456	4.455	4.524	5.294	5.111	5.120	4.928	4.82	5.009
14	5.512	5.623	5.567	5.940	6.220	6.091	6.005	5.961	5.871
15	6.821	6.962	6.906	6.674	7.194	7.125	7.649	6.953	6.838
16	7.782	7.547	8.546	9.001	8.290	8.462	7.830	7.49	7.973
17	-	9.659	9.601	9.659	10.623	9.763	-	9.533	8.376

TABLE 8 . ANOVA results and regression coefficients from a multiplicative model utilized to derive a standardized catch rate index for Greenland halibut in SA2 + Div. 3KLMNO. Effort is measured in hours fished (1993~1996 data preliminary)

REGRESSION OF MULTIPLICATIVE MODEL
MULTIPLE R............. 0.796
MULTIPLE R SQUARED..... 0.634

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	6.181E2	6.181E2	
REGRESSION	56	1.922E2	3.433E0	18.671
Country¦Gear¦TC	17	4.185E1	2.462E0	13.388
Month	11	1.040E1	9.452E⁻1	5.141
Division	7	9.492E0	1.356E0	7.375
Year	21	2.800E1	1.333E0	7.253
RESIDUALS	603	1.109E2	1.839E⁻1	
TOTAL	660	9.212E2		

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
Country¦Gear¦TC	3125	INTERCEPT	⁻0.825	0.214	660
Month	9				
Division	22				
Year	75				
(1)	3126	1	0.034	0.167	8
	10127	2	1.077	0.186	8
	11125	3	0.246	0.134	16
	11126	4	⁻0.125	0.204	6
	11127	5	0.397	0.125	17
	14124	6	0.682	0.085	67
	14126	7	0.789	0.114	23
	14127	8	0.452	0.136	16
	15126	9	0.457	0.202	6
	16127	10	0.283	0.090	51
	19124	11	⁻0.258	0.098	102
	19125	12	0.028	0.107	75
	19126	13	0.343	0.122	28
	20125	14	0.435	0.188	7
	20126	15	0.000	0.145	12
	20127	16	0.048	0.097	37
	27125	17	0.224	0.105	24
(2)	1	18	0.251	0.099	28
	2	19	0.139	0.095	31
	3	20	⁻0.054	0.088	41
	4	21	⁻0.011	0.084	47
	5	22	0.187	0.088	39
	6	23	0.203	0.086	40
	7	24	⁻0.003	0.075	60
	8	25	0.118	0.068	77
	10	26	⁻0.274	0.072	68
	11	27	⁻0.040	0.070	78
	12	28	0.094	0.076	62
(3)	21	29	⁻0.007	0.084	51
(3)	23	30	0.013	0.065	101
	31	31	⁻0.284	0.081	97
	32	32	⁻0.050	0.094	129
	33	33	⁻0.418	0.111	77
	34	34	⁻0.122	0.117	58
	35	35	⁻0.152	0.147	21
(4)	76	36	⁻0.052	0.224	11
	77	37	0.129	0.216	19
	78	38	0.332	0.233	18
	79	39	0.138	0.229	10
	80	40	0.365	0.237	12
	81	41	0.173	0.225	15
	82	42	0.427	0.218	19
	83	43	0.393	0.212	24
	84	44	0.305	0.214	23
	85	45	0.112	0.215	21
	86	46	⁻0.206	0.214	24
	87	47	0.096	0.206	33
	88	48	⁻0.275	0.215	22
	89	49	⁻0.112	0.219	22
	90	50	⁻0.062	0.218	26
	91	51	⁻0.428	0.213	49
	92	52	⁻0.568	0.214	95
	93	53	⁻0.367	0.216	84
	94	54	⁻0.524	0.218	100
	95	55	⁻0.458	0.236	21
	96	56	⁻0.338	0.265	6

LEGEND FOR AVOVA RESULTS:

CGT CODES:
3125 = Can(NFLD) TC 5 ¦ 15126 = Norway TC 6
3126 = " TC 6 ¦ 16127 = Poland TC 7
10127 = Former FRG TC 7 ¦ 19124 = Spain TC 4
11125 = Former DDR TC 5 ¦ 19125 = " TC 5
11126 = " TC 6 ¦ 19126 = " TC 6
11127 = " TC 7 ¦ 20125 = Former USSR TC 5
14124 = Japan TC 4 ¦ 20126 = " TC 6
14126 = " TC 6 ¦ 20127 = " TC 7
14127 = " TC 7 ¦ 27125 = Can(M) TC 5

All of the above CGT are Stern Trawlers

DIVISION CODES: 21 = 2G, 22 = 2H, 23 = 2J, 31 = 3K, 32 = 3L
33 = 3M, 34 = 3N, 35 = 3O

TABLE 9 . Standardized catch rate index for Greenland halibut in SA2 + Div. 3KLMNO from a multiplicative model utilizing hours fished as a measure of. effort (1993-1996 based on preliminary data)

PREDICTED CATCH RATE

YEAR	LN TRANSFORM		RETRANSFORMED		CATCH	EFFORT
	MEAN	S.E.	MEAN	S.E.		
1975	⁻0.8247	0.0456	0.470	0.099	28681	61050
1976	⁻0.8764	0.0243	0.451	0.070	24598	54554
1977	⁻0.6955	0.0194	0.542	0.075	31946	58978
1978	⁻0.4929	0.0220	0.662	0.098	38541	58178
1979	⁻0.6867	0.0299	0.544	0.093	34089	62711
1980	⁻0.4595	0.0224	0.685	0.102	32688	47734
1981	⁻0.6519	0.0196	0.566	0.079	30737	54332
1982	⁻0.3980	0.0152	0.731	0.090	26275	35949
1983	⁻0.4317	0.0134	0.707	0.082	27853	39380
1984	⁻0.5194	0.0126	0.648	0.073	26711	41212
1985	⁻0.7126	0.0148	0.534	0.065	20347	38126
1986	⁻1.0310	0.0136	0.388	0.045	17976	46285
1987	⁻0.7283	0.0137	0.526	0.061	32442	61713
1988	⁻1.0998	0.0149	0.362	0.044	18424	50847
1989	⁻0.9368	0.0143	0.427	0.051	18920	44346
1990	⁻0.8869	0.0119	0.449	0.049	47454	105690
1991	⁻1.2531	0.0114	0.311	0.033	65008	208779
1992	⁻1.3928	0.0118	0.271	0.029	63193	233401
1993	⁻1.1913	0.0129	0.331	0.037	62455	188692
1994	⁻1.3483	0.0140	0.283	0.033	48000	169769
1995	⁻1.2824	0.0232	0.301	0.046	15000	49899
1996	⁻1.1624	0.0365	0.337	0.064	20000	59399

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.134

Table 10. Summary of sets in fall survey in SA 2+3 in 1996. Depth range is in m., # sets in ( ).

Division	Ship		
	Teleost	W.Templeman	A.Needler
2G	127 - 1436 (47)		
2H	122 - 1415 (77)		
2J	126 - 1410 (117)		
3K	111 - 1368 (115)	126 - 472 (60)	
3L	805 - 1433 (31)	51 - 671 (180)	
3M	784 - 1400 (18)	127 - 707 (68)	
3N	390 - 1147 (13)		37 - 309 (69)
3O	68 - 690 (26)	65 - 139 (19)	63 - 304 (16)

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Table . Unconverted biomass (tons) of Greenland halibut per stratum from fall surveys in Division 2J from 1977-92.

Stratum	Depth (m)	Area	Units	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
206	101-200	2582	194	4031	1508	1572	1959	7206	3628	1686	2105	861	781	79	345	126	182	23	37
207		2246	169	13112	4306	1752	1163	3072	1742	1290	1055	368	204	44	8	7	0	0	0
201		1427	107	778	146	48	303	289	1036	398	517	44	105	20	9	86	57	6	0
205		1823	137	2870	900	1397	513	2044	3297	1950	954	197	152	48	144	53	41	48	8
Total				20790	6860	4769	3939	12612	9702	5324	4631	1469	1242	192	506	272	280	78	45
215	201-300	1270	95	3592	2100	678	1764	1173	3649	1378	4004	1545	1415	1132	859	514	671	324	251
234		508	38	1870	3757	2487	3012	1983	3737	1781	3459	699	486	197	772	388	187	111	70
228		1428	107	700	235	899	1972	858	992	1107	1769	682	1116	566	279	565	914	228	159
214		1171	88	3425	4235	1935	1354	5283	7411	3923	5252	5874	779	1208	1941	525	447	68	105
202		440	33	705	541	727	958	1139	1503	1016	3063	332	281	587	-	16	111	70	43
210		774	58	1128	512	554	627	290	1213	2411	1562	302	213	232	458	393	687	138	137
213		1725	129	2131	1704	1242	2970	3798	4427	3011	2654	4639	2546	1142	757	304	293	32	79
209		1608	121	7876	2657	10675	12644	6720	15648	6370	4517	4161	1650	1032	1354	1241	990	304	223
Total				21427	15741	19196	25302	21243	38580	20997	26280	16234	8485	6095	6420	3945	4301	1276	1067
208	301-400	448	34	6260	4909	3051	5032	8096	11725	3699	16686	13658	6377	3462	2825	6785	5749	1240	697
229		567	43	1661	613	1014	1091	1298	915	1553	468	553	624	252	137	131	96	301	389
203		480	36	1137	1444	2354	761	1874	2318	8173	6459	901	3889	1003	1225	3242	877	1109	201
222		441	33	3817	2136	2539	2992	1846	6223	4353	916	1126	74	1092	1374	265	471	32	71
211		330	25	866	2113	1164	1804	886	1381	3338	1381	4062	2550	1102	2019	578	3749	440	145
216		384	29	2964	4202	5228	5369	1823	6205	2959	4987	2356	998	1474	101	362	228	89	90
Total				16705	15417	15348	17048	15822	28767	24076	30896	22657	14514	8384	7681	11362	11169	3211	1593
227	401-500	686	51	5938	4473	1415	3798	2240	2827	1983	1888	1912	1064	1891	1648	2697	2103	658	1014
217		268	20	2856	3385	1753	3138	825	1172	1298	-	2917	2187	834	880	121	645	87	69
223		180	14	3398	1146	864	1838	1280	1189	834	1537	1084	1715	284	858	213	317	41	45
204		354	27	4669	12879	6918	-	4531	7547	6665	6909	438	7104	3893	4411	15073	3326	1490	988
235		420	32	3707	3375	2648	4035	1230	2827	7961	2585	2680	5762	3742	2215	4579	5862	404	285
Total				20568	25258	13599	12920	10105	15562	18740	12919	9032	17832	10644	10012	22683	12252	2681	2402
230	501-750	237	18	4328	1436	-	3014	1072	548	1654	382	467	1819	1209	787	770	827	551	1032
212		664	50	9451	7517	11575	5159	7364	7182	2230	3530	5470	19079	18665	3751	2131	3988	1062	1336
218		420	32	6870	7508	-	4083	4934	1261	1230	-	954	2592	1544	1844	567	1329	668	94
224		270	20	3519	1595	2482	664	2331	740	1024	760	567	4949	1286	1277	53	250	134	107
Total				24168	18057	14058	12920	15701	9731	6138	4673	7458	28439	22704	7659	3520	6394	2414	2569
236	751-1000	122	9	898	1893	-	-	410	611	925	485	781	2050	860	119	-	1014	1014	360
231		182	14	878	-	-	2548	-	1281	700	1349	1636	386	526	2329	-	1704	374	465
219		213	16	-	-	-	-	767	-	1647	-	1339	4574	1342	723	560	1502	200	130
Total				1776	1893	0	2548	1177	1892	3272	1834	3756	7011	2728	3172	560	4220	1588	954
-225	1001-1250	177	13	531	482	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-232		236	18	869	1384	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-220		324	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total				1399	1866	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-233	1251-1500	180	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-221		268	20	-	43	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-226		180	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total				0	43	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Biomass (t)				106834	85135	66969	74565	76660	104234	78547	81234	62605	77522	50747	35450	42342	38617	11248	8630
95% Lower				90708	62722	53867	54260	49579	82993	63918	55160	47364	47571	25957	26531	-74245	29215	8574	5267
95% Upper				122960	107550	80071	94867	103742	125473	93175	107308	77842	107539	75586	44364	158923	48018	13925	11993

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Table   Unconverted biomass (tons) per stratum of Greenland halibut from fall surveys in Division 3K from1978-92.

Stratum	Depth (m)	Area	Units	Year														
				1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
618	101-200	1455	109	-	-	-	-	-	-	164	484	22	8	3	36	0	0	0
619		1588	119	-	-	-	-	-	-	226	68	26	7	1	32	0	0	0
Total				0	0	0	0	0	0	390	552	48	15	4	68	0	0	0
637	201-300	1132	85	334	353	510	701	825	1258	422	1147	930	772	336	286	461	169	86
632		447	34	107	95	392	210	252	115	0	288	75	67	27	53	242	55	104
635		1274	96	640	585	1841	1148	1635	749	974	403	1054	1060	434	668	164	25	44
636		1455	109	609	510	1288	1393	2386	442	808	474	371	186	434	384	222	135	100
621		2859	215	27144	24549	10387	7033	3150	6840	3932	6552	1075	1751	1453	1792	210	524	685
624		668	50	469	532	257	188	263	119	251	249	181	291	115	165	181	159	135
634		1618	121	766	1147	642	657	1711	802	720	568	452	1099	419	327	386	288	109
620		2709	203	13570	5976	5757	5230	4541	3914	2660	2985	2591	1212	1936	323	230	415	51
Total				43640	33747	21074	16559	14764	14239	9767	12666	6729	6437	5154	4000	2094	1770	1314
639	301-400	1463	110	563	860	723	810	2092	1286	265	515	805	395	355	303	502	460	517
638		2059	155	2342	2046	1717	3294	3151	2790	1940	5335	3933	2887	1700	1776	4261	1312	1266
625		850	64	1120	909	925	2010	558	4232	2740	3548	2488	3358	1951	449	2210	997	185
628		1085	81	3517	2912	5555	1330	1052	2939	2216	6675	4918	3458	3282	2435	1422	516	263
623		1027	77	12297	2585	6412	6424	11271	16742	20815	5204	13847	10546	10461	6326	2758	2433	844
626		919	69	4190	2910	9651	4015	8306	7019	15021	8602	10693	4574	6560	6824	1620	1749	1595
633		2179	164	1325	1480	2633	1632	1297	2025	1971	2365	3222	3208	2166	3654	1961	1966	1495
630		544	41	1112	440	873	4788	-	2767	316	1354	1256	2307	2300	1607	1145	1166	434
629		495	37	764	497	970	1164	2545	2440	1157	817	2006	2960	3734	2462	578	230	505
Total				27230	14639	29459	25467	30273	42239	46440	34415	43169	33693	32510	25837	16457	10829	7104
645	401-500	204	15	285	-	184	333	271	50	831	641	-	390	175	49	312	59	123
627		1194	90	6424	3740	6139	17007	11152	19792	26938	12580	23626	12265	13009	21830	10390	5664	1371
631		1202	90	4098	2102	3113	6190	3429	6018	9501	6394	6098	9812	6904	10089	3153	10139	1787
622		632	47	6789	5666	2076	6286	5732	10627	6820	2864	26745	9826	10500	7034	18287	2916	1397
640		198	15	489	-	881	535	320	-	204	275	152	301	93	134	245	178	74
Total				18085	11509	12392	30350	20903	36487	44294	22754	56621	32595	30681	39136	32387	18957	4751
646	501-750	333	25	1481	2224	1287	1581	387	2281	2512	1662	-	750	-	-	260	692	232
641		584	44	239	1174	1392	956	1074	2689	2740	995	-	1135	-	-	1750	364	286
Total				1720	3397	2679	2537	1461	4969	5252	2657	0	1885	0	0	2010	1056	518
642	751-1000	931	70	1302	-	2324	652	2329	-	5685	2341	-	1936	-	-	3159	2659	6580
647		409	31	4919	1478	2740	2533	1213	-	-	3522	-	-	-	-	2938	763	432
Total				6221	1478	5064	3185	3542	0	5685	5863	0	1936	0	0	6097	3422	7013
-643	1001-125	1266	95	712	1230	-	-	-	-	-	-	-	-	-	-	-	-	-
-648		232	17	269	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total				981	1230	0	0	0	0	0	0	0	0	0	0	0	0	0
-644	1251-150	954	72	1090	357	-	-	-	-	-	-	-	-	-	-	-	-	-
-649		263	20	215	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total				1305	357	0	0	0	0	0	0	0	0	0	0	0	0	0
Biomass (t)				99182	66356	70668	78098	70944	97934	111829	78907	106567	76561	68350	69041	59045	36034	20700
95% Lower				68648	49413	55888	64299	55559	76916	86170	63917	76206	57939	51398	53665	40175	28656	16511
95% Upper				129622	83247	85358	91633	86182	118664	137055	93691	136567	95025	85143	84090	80368	43318	24917

Table. 13 Estimated biomass (tons) per stratum of G. halibut from the autumn survey of the GADUS
ATLANTICA in Div. 2J during 1993-94 and TELOST in fall-winter, 1995/96 and fall 1996.
Based on the latest stratification update. No conversions have been applied.

Depth Range (m)	Stratum	Area (sq. nm)	Trawlable Units (000)	1993	1994	1995/96	1996
101-200	201	833	48	1	10		82
	205	1594	120	1	5		514
	206	1870	140	11	32	399	1120
	207	2264	170	0	10	1	56
	237	733	55	0	0	0	1
	238	778	58	-	-		15
Total				14	58	400	1788
201-300	202	621	47	1	107	95	89
	209	680	51	166	33	360	1059
	210	1035	78	253	50	2708	3904
	213	1583	119	62	156	236	1338
	214	1341	101	241	171	327	4056
	215	1302	98	502	321	1370	1247
	228	2196	165	345	943	2219	5478
	234	530	40	407	59	-	163
Total				1977	1840	7315	17334
301-400	203	487	37	863	547	387	946
	208	588	44	433	1908	4799	3707
	211	251	19	573	336	1400	1343
	216	360	27	166	171	64	506
	222	450	34	78	199	122	1672
	229	536	40	119	410	1799	3900
Total				2231	3570	8571	12074
401-500	204	288	22	975	1366	1437	3823
	217	241	18	143	123	131	932
	223	158	12	77	76	162	438
	227	598	45	843	913	909	5850
	235	414	31	340	439	3895	4373
	240	133	10	43	58	631	537
Total				2421	2975	7165	15953
501-750	212	557	42	2732	814	5499	4940
	218	362	27	137	76	693	1783
	224	228	17	54	165	214	702
	230	185	14	79	191	652	1340
	239	120	9	556	615	1675	2586
Total				3559	1862	8733	11351
751-1000	219	283	21	429	1105	2021	405
	231	186	14	406	393	376	1013
	236	193	14	558	136	1007	698
Total				1394	1634	3404	2116
1001-1250	220	303	23	-	-		1296
	225	195	15	-	-		834
	232	228	17	-	-		717
Total				-	-		2847
1251-1500	221	330	25	-	-		131
	226	201	15	-	-		277
	233	237	18	-	-		889
Total				-	-		1297
Biomass (t)				11595	11939	35591	64760
95% Lower				9598	16064	28260	48126
95% Upper				13589	7816	42922	86821

Table. 14   Biomass (tons) per stratum of G. halibut from the autumn survey of the
GADUS ATLANTICA in Div. 3K during 1993-94; TELEOST 1996 and TELEOST with
W. TEMPLEMAN during fall-winter 1995/96. Based on the latest stratification update.
No conversions have been applied.

Depth Range(m)	Stratum	Area (sq. nm.)	1993	1994	1995/96	1996
101-200	608	798	-	-		0
	612	445	-	-		0
	616	250	-	-		0
	618	1347	0	3	286	18
	619	1753	0	0	18	29
Total			0	3	304	48
201-300	609	342	-	-	-	117
	611	600	-	-	-	113
	615	251	-	-	-	39
	620	2545	34	470	790	4213
	621	2736	407	483	1087	3967
	624	1105	286	212	607	2516
	634	1555	391	505	727	2370
	635	1274	51	29	128	1344
	636	1455	395	181	1393	2336
	637	1132	201	30	179	1722
Total			1765	1909	4781	16737
301-400	610	256	-	-	-	344
	614	263	-	-	-	154
	617	593	1957	871	3844	2464
	623	494	496	668	307	3588
	625	888	1005	677	1437	4381
	626	1113	1178	1564	1982	5453
	628	1085	544	642	529	1799
	629	495	582	612	2662	6569
	630	332	430	559	858	4800
	633	2067	1516	1145	4649	3487
	638	2059	1253	748	1750	3952
	639	1463	700	310	1520	1381
Total			9660	7796	19538	38372
401-500	613	30	-	-	-	51
	622	691	2788	1205	2638	6896
	627	1255	10455	2425	18946	15576
	631	1321	3580	3188	10094	25499
	640	69	40	52	179	105
	645	216	56	72	357	192
	650	134	95	148	252	147
Total			17014	7090	32466	48466
501-750	641	230	228	58	227	394
	646	325	58	257	327	564
	651	359	387	468	1222	321
Total			673	783	1776	1279
751-1000	642	418	1014	1423	1741	760
	647	360	1618	1148	1087	749
	652	516	1521	906	2365	3585
Total			4154	3476	5193	5094
1001-1250	643	733	-	-	1487	2121
	648	228	-	-	-	1641
	653	531	1180	0	1583	2306
Total			1180	0	3070	6068
1251-1500	644	474	-	-	888	870
	649	212	-	-	-	387
	654	479	-	-	1375	1016
Total			-	-	2063	2273
Biomass (t)			34445	21057	69206	120337
95% Lower			29067	17763	55864	106961
95% Upper			39821	24352	82547	150486

Table 15. Unconverted biomass (tons) per stratum of Greenland halibut from fall surveys in Division 3L during 1981-94.

Stratum	Depth (f)	Area	Units	1981	1982	1983	1984	1985	Year 1986	1987	1988	1989	1990	1991	1992	1993	1994
371	31-50	1121	84	1	0	0	0	0	3	0	0	0	0	1	0	0	0
363		1780	134	0	0	0	0	0	0	0	0	0	0	0	0	0	0
372		2460	185	0	0	0	0	0	2	0	0	0	0	0	0	0	0
350		2071	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0
384		1120	84	-	0	0	0	0	7	0	0	0	0	0	0	0	0
Total				1	0	0	0	0	12	0	0	0	0	1	0	0	0
348	51-100	2120	159	67	331	48	18	97	140	68	70	46	41	0	0	0	8
343		525	39	35	-	21	0	3	1	0	0	11	4	0	0	0	0
328		1519	114	-	-	-	23	10	59	29	7	11	1	0	0	0	0
341		1574	118	59	22	95	59	31	5	73	37	31	21	0	35	0	0
342		585	44	58	124	38	0	32	9	0	10	7	25	0	0	0	0
349		2114	159	14	5	68	16	11	14	38	0	6	10	0	0	0	0
370		1320	99	0	50	44	39	151	228	25	1	4	72	0	0	0	0
385		2356	177	46	387	566	88	219	826	432	0	30	127	0	108	0	48
390		1481	111	0	389	8	0	302	402	118	0	63	58	241	36	13	23
364		2817	211	104	53	184	0	11	30	112	57	74	44	2	6	0	0
365		1041	78	225	215	102	23	9	84	248	23	70	24	1	5	0	0
Total				608	1576	1172	266	877	1798	1143	205	354	428	245	191	13	79
391	101-150	282	21	0	58	455	397	630	175	87	51	275	128	365	87	163	119
344		1494	112	778	112	487	20	276	519	323	359	773	127	38	0	25	0
389		821	62	-	486	-	1186	1652	604	693	547	632	387	283	525	128	221
347		983	74	135	223	190	13	56	217	10	1498	1114	291	1	0	5	6
369		961	72	956	938	1010	374	962	459	667	263	294	894	343	83	10	54
386		983	74	2730	1605	-	936	2767	615	452	359	804	854	421	710	27	86
366		1394	105	523	1002	628	652	1893	1141	849	2160	1203	713	29	129	9	16
Total				5123	4424	2770	3579	8235	3730	3081	5236	5096	3393	1481	1533	368	500
368	151-200	334	25	539	721	-	445	727	167	226	545	683	4629	246	185	82	227
392		145	11	0	152	166	288	272	196	90	144	131	117	241	73	56	32
346		865	65	584	755	1136	1775	2325	1692	1461	1039	1672	2119	827	378	243	104
345		1432	107	2230	932	994	4257	3935	673	1935	2480	1336	2646	223	274	828	45
387		718	54	3638	2354	-	2641	2277	431	1419	687	826	647	1322	748	635	520
388		361	27	-	63	-	650	671	-	467	515	420	113	345	814	274	88
Total				6992	4977	2297	10056	10207	3159	5598	5410	5068	10271	3203	2471	2119	1017
731	201-300	216	16	-	-	-	677	243	-	-	-	-	295	116	232	84	134
735		272	20	-	674	-	858	597	970	-	-	-	-	294	380	220	538
729		186	14	-	-	-	988	426	250	-	-	-	316	357	269	149	389
733		468	35	-	-	-	448	1259	-	-	-	-	503	928	969	416	646
Total				0	674	0	2970	2525	1220	0	0	0	1114	1695	1851	868	1707
734	301-400	228	17	-	-	-	302	633	-	-	-	-	315	226	133	147	186
736		175	13	-	394	-	-	920	690	-	-	-	252	208	147	231	449
730		170	13	-	-	-	156	86	-	-	-	-	-	195	141	109	208
732		231	17	-	-	-	219	364	-	-	-	-	282	71	269	21	133
Total				0	394	0	678	2003	690	0	0	0	849	699	691	507	977
737	401-500	227	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-
741		223	70			-	-	-	-	-	-	-		-	-	-	-
745		348	110											-		-	-
748		159	50														
Total									-				-				
738	501-600	221	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-
742		206	60			-	-	-	-	-	-	-		-	-	-	-
746		392	120											-		-	-
749		126	40						-				-				
Total						-								-			-
Biomass (tons)				12723	12045	6239	17548	23846	10609	9822	10851	10518	16054	7323	6737	3875	4280
95% Lower				5692	9130	5010	12286	19726	6743	6996	8443	8133	-44558	4584	4875	3106	3345
95% Upper				19752	14168	8258	22810	27970	14477	12646	13259	12903	76667	10067	8596	4646	5219

Table 16 . Biomass (tons) per stratum of Greenland halibut from the autumn surveys in Div. 3L during 1995-96 with the Campelen trawl. Based on the latest stratification update. No conversions have been applied.

Depth Range (m)	Stratum	Area (sq. nm.)	1995/96	1996
57-91	350	2071	1	0
	363	1780	0	0
	371	1121	0	3
	372	2460	0	0
	384	1120	1	0
	785	465	.	0
Total			2	3
93-183	328	1519	.	1
	341	1574	.	2
	342	585	.	1
	343	525	.	0
	348	2120	0	2
	349	2114	4	2
	364	2817	1	0
	365	1041	17	0
	370	1320	1	14
	385	2356	73	84
	390	1481	43	67
	786	84	.	67
	787	613	.	1
	788	252	.	0
	790	89	.	0
	793	72	.	0
	794	216	.	0
	797	98	.	0
	799	72	.	0
Total			139	221
184-274	344	1582	16	11
	347	983	2	0
	366	1394	204	338
	369	961	72	108
	386	983	128	447
	389	821	71	900
	391	282	177	344
	795	164	.	5
Total			668	2153
275-366	345	1432	937	3747
	346	865	2237	5483
	368	334	385	690
	387	718	1846	1764
	388	361	310	711
	392	145	89	500
	789	81	.	0
	791	308	.	66
	796	175	.	37
	798	100	.	76
Total			5484	13074
367-549	729	186	215	648
	731	216	242	.
	733	468	501	706
	735	272	526	1111
	792	50	.	186
Total			1484	2651
550-731	730	170	140	37
	732	231	83	463
	734	228	280	642
	736	175	271	1116
Total			774	2258
732-914	737	227	1244	2198
	741	223	.	867
	745	348	.	1075
	748	159	.	429
Total			1244	4569
915-1097	738	221	1490	1906
	742	206	.	567
	746	392	.	783
	749	126	.	125
Total			1490	3381
1098-1280	739	254	.	1227
	743	211	.	931
	747	724	.	438
	750	556	.	586
Total			0	3182
1281-1463	740	264	.	981
	744	280	.	2961
	751	229	.	1207
Total			0	5149
Biomass (tons)			11282	36641
95% Lower			8012	30961
95% Upper			14552	45170

Table 17 Abundance (000s) of Greenland halibut at age from Canadian research vessel surveys in Div. 2J3KL combined during fall 1978-94. Estimates have NOT been converted to Campelen equivalents.

Age (yrs)	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	2538	2805	2994	7563	2137	1004	1452	7460	13005	1491	4025	3407	547	5814	1684	7510	14541
2	25686	22523	8911	22486	5991	5905	7148	18147	22185	8685	12436	10414	5347	6726	14858	62818	30412
3	54708	28846	15315	30875	23971	19036	21435	20024	32997	47694	28404	35816	14506	11369	26664	97955	42221
4	55914	25799	22680	21226	31204	31465	36094	36224	55685	35752	50345	69334	68019	37832	34313	46098	43669
5	57650	35886	35995	34277	31061	40182	72180	44886	45213	35854	58938	77935	65410	38273	23316	18385	31165
6	45141	38805	42154	38654	29062	34742	38931	37715	57886	33486	39603	56524	48199	27416	17109	6912	7237
7	28923	18843	27942	26647	32070	38908	30683	22359	45327	33956	29733	32108	28837	9020	8406	2520	3136
8	13379	7378	9511	11458	32617	31538	21712	12761	12676	20722	9257	9627	6828	2155	962	739	947
9	6983	3316	4207	5281	13535	11559	10222	6293	3306	7621	2525	2884	1839	475	95	63	114
10	5112	3179	3229	2824	5375	3040	4132	3498	1430	2156	809	675	718	231	48	0	38
11	4237	2102	3601	2255	2801	2049	1869	1592	960	1065	542	558	488	104	13	0	7
12	2541	1843	2393	1030	1790	1497	1216	1218	961	642	309	161	267	61	0	13	0
13	1611	1520	1551	579	1276	1089	964	517	441	504	267	56	160	14	0	0	4
14	476	762	858	276	1306	713	804	636	411	200	210	73	115	5	0	0	0
15	335	493	326	155	835	306	427	330	213	151	151	77	49	0	0	0	0
16	243	426	182	19	325	81	294	210	62	100	81	77	27	2	0	0	0
17	130	153	53	0	51	0	140	161	0	10	38	0	0	0	0	0	0
Ages 1+	305607	194679	181902	205605	215407	223114	249703	214031	292758	230089	237673	299672	241356	139497	127468	243013	173491
Ages 3-5	168272	90531	73990	86378	86236	90683	129709	101134	133895	119300	137687	183085	147935	87474	84293	162438	117055
Ages 6-9	94426	68342	83814	82040	107284	116747	101548	79128	119195	95785	81118	101143	85703	39066	26572	10234	11434
Ages 10+	14685	10478	12193	7138	13759	8775	9846	8162	4478	4828	2407	1623	1824	417	61	13	49

Table 18 Abundance at age (000s) of male, female and unsexed Greenland halibut combined estimated from research vessel surveys in Divisions 2J, 3K combined. Estimates are converted into Campelen equivalents. Shaded area in 1995 to be revised when otoliths have been re-aged.

| AGE	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	67133	76275	47941	141166	33748	12131	31845	192902	125257	36234	74055	52954	9858	84583	52907	62241	359982	124344	818781
2	315362	128771	46187	158149	39589	34727	50917	113558	106161	81046	71555	95755	39744	59211	188121	281182	189873	460178	438849
3	243378	95883	43767	109462	88918	71282	70143	65428	112555	212676	109246	174201	70539	44644	148380	497522	171493	279812	263196
4	146864	50861	39304	41433	75651	75711	74837	104606	72301	99109	114836	174689	177413	103158	95263	182333	112859	115567	95700
5	90817	53099	49738	47202	57104	71101	103171	66317	104606	75271	119818	108472	115858	65701	38552	42962	51870	53519	55266
6	68495	50976	52627	49991	41105	51583	61334	69541	81840	53188	59218	87210	70699	40331	22088	13677	9898	15873	17682
7	40908	24408	32283	35482	43097	50698	42301	42805	71749	47138	41431	38560	36649	12485	10472	5905	4478	3514	6191
8	19170	9977	11102	15613	41244	39418	27028	17028	22142	25791	12233	9604	6200	2383	1067	1967	1347	920	1865
9	9940	4777	4960	7017	16566	15223	13058	7982	6546	9434	3134	2847	1500	635	140	232	172	267	866
10	7366	4572	3891	4213	6765	4414	6306	5296	2380	2833	1105	747	746	310	89	32	69	104	394
11	6469	3000	4461	3349	4129	3180	2602	2257	1856	1481	781	568	640	181	12	22	13	50	214
12	4117	2638	2882	1559	2714	2291	1812	1997	1668	1454	463	151	389	104	0	94	17	28	93
13	2683	2193	1874	857	1929	1664	1480	874	879	754	361	35	223	22	0	41	9	0	130
14	992	1079	1070	446	1975	1109	1285	1002	542	583	327	81	155	8	15	24	0	0	51
15	560	699	411	268	1257	495	677	606	555	385	236	103	90	0	0	0	0	0	15
16	365	624	231	43	589	131	461	302	318	204	149	31	21	4	0	0	0	0	0
17	213	234	71	0	97	0	226	311	96	150	70	0	0	0	0	0	0	0	0
18	0	128	0	0	43	81	0	100	0	14	16	0	0	0	0	0	0	0	0
19	0	65	0	0	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0
20	25	0	0	0	0	0	0	0	0	0	29	0	0	0	0	0	0	0	0
Unk	3706	1122	4205	35062	2831	0	0	0	4374	0	1647	4744	0	0	2484	758	0	0	134
Ages 1+	1028562	511381	347004	651312	459351	435238	489484	642558	715824	647746	610710	750752	530726	413761	559589	1088993	902080	1054176	1699427
Ages 1-2	382496	205046	94128	299315	73337	46859	82762	306460	231418	117286	145609	148709	49602	143794	241027	343422	549855	584522	1257630
Ages 3-5	481058	199843	132809	198097	221673	218093	248151	185979	289461	387056	343900	457363	363811	213503	282195	722218	336222	448898	414162
Ages 6-9	138513	90137	100972	108103	142012	156921	143721	137355	182277	135551	116016	138221	115048	55833	33767	21782	15895	20574	26604
Ages 10+	26495	16355	19096	45797	22329	13364	14849	12763	12668	7859	5185	6459	2264	630	2600	972	108	182	1031
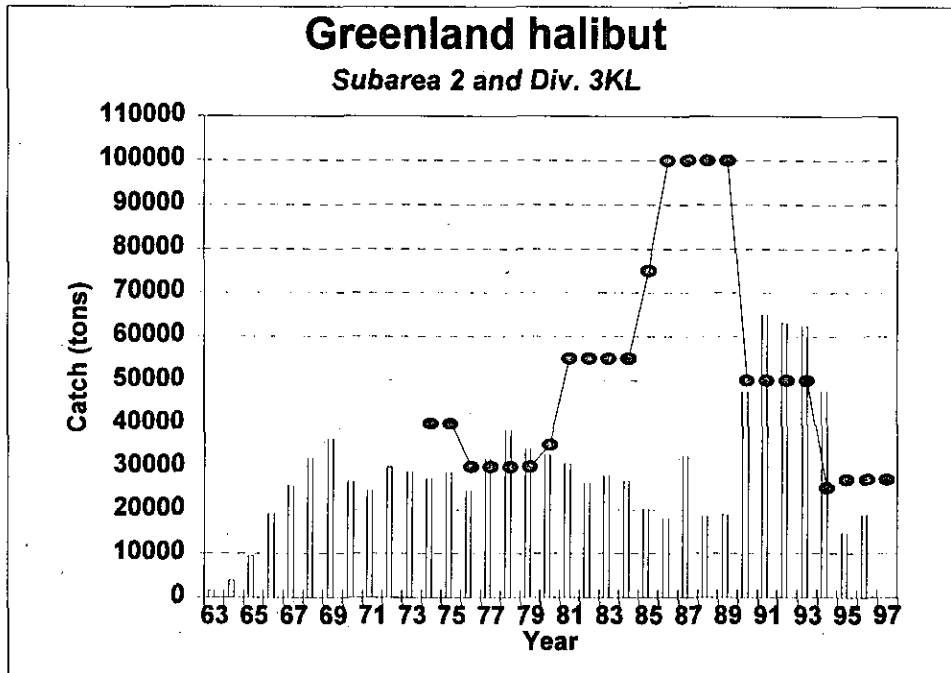
Fig. 1 Nominal catches of G. halibut in Subarea 2 and Div. 3KL from 1963-96.
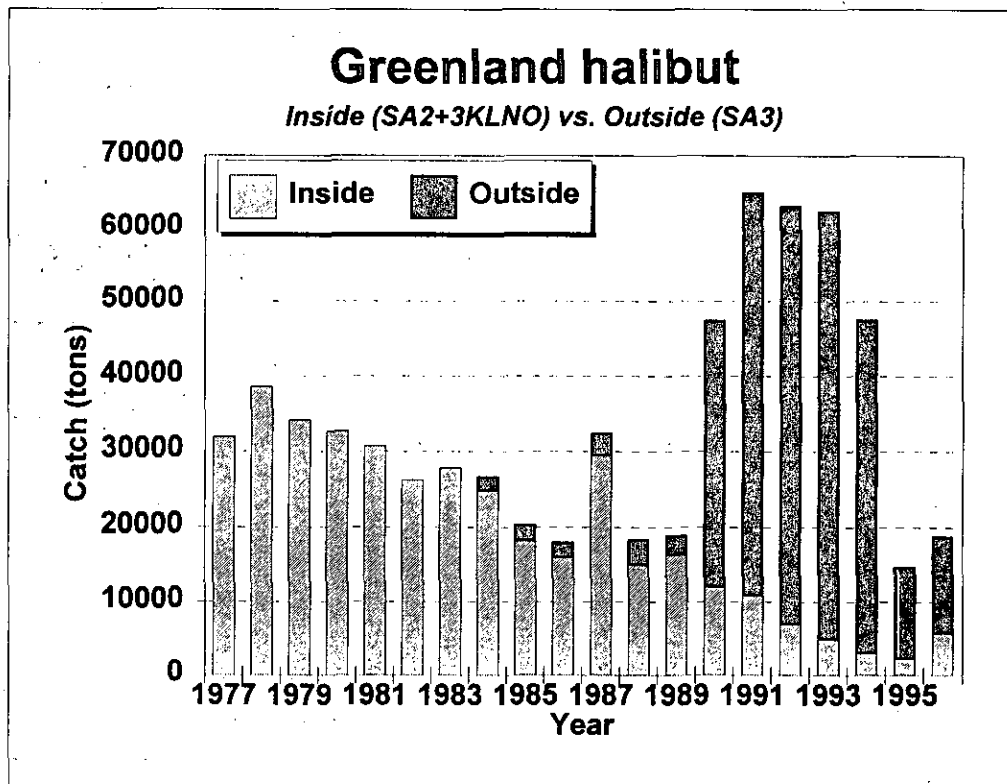   Recent years include Div. 3MNO.

Fig. 2 Catch of G. halibut inside 200 miles for Subarea 2+ Div. 3KLNO compared to the
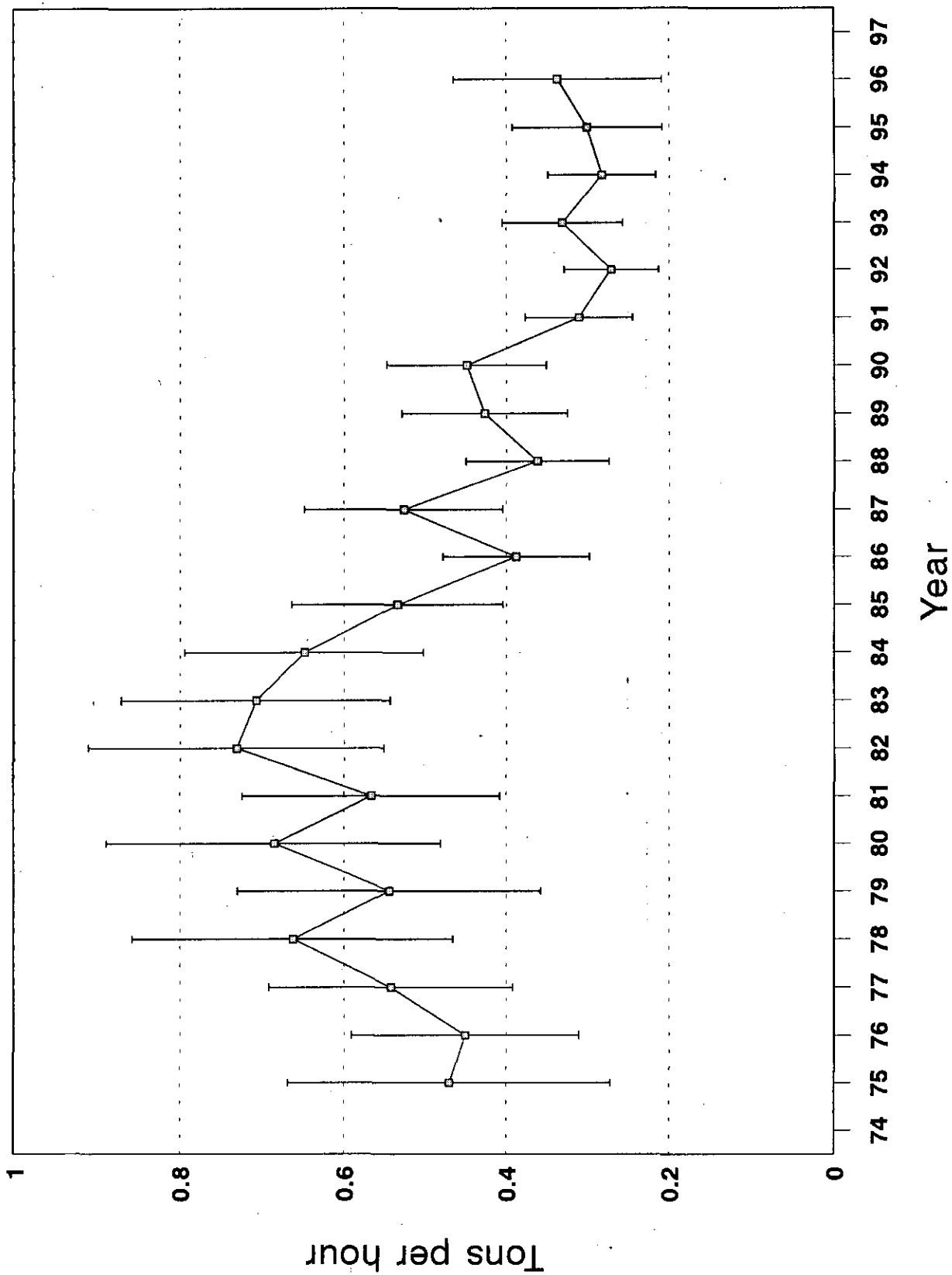   catch outside 200 miles (Subarea 3) from 1977-96.

Fig. 3   Standardized CPUE (mean plus/minus 2 standard errors)
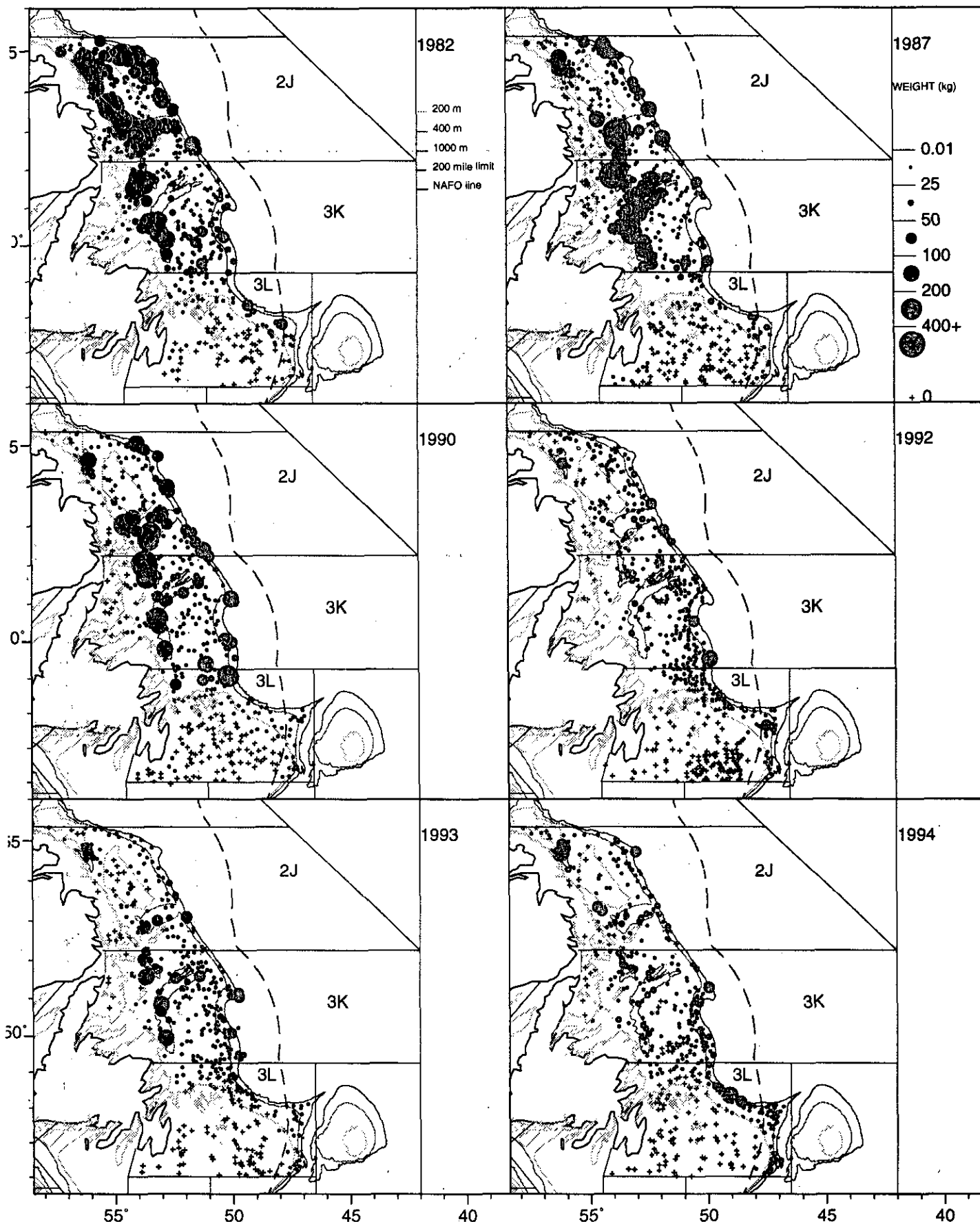for Greenland Halibut in SA2 + Div. 3KLMNO from 1975-1996.

Fig. 4 Distribution of Greenland Halibut catches from 1982-1994 Canadian autumn Surveys
to NAFO Divisions 2J3KL by the Canadian research vessels.
(weights standardized to 30 min. (1.8 nm.) tows)
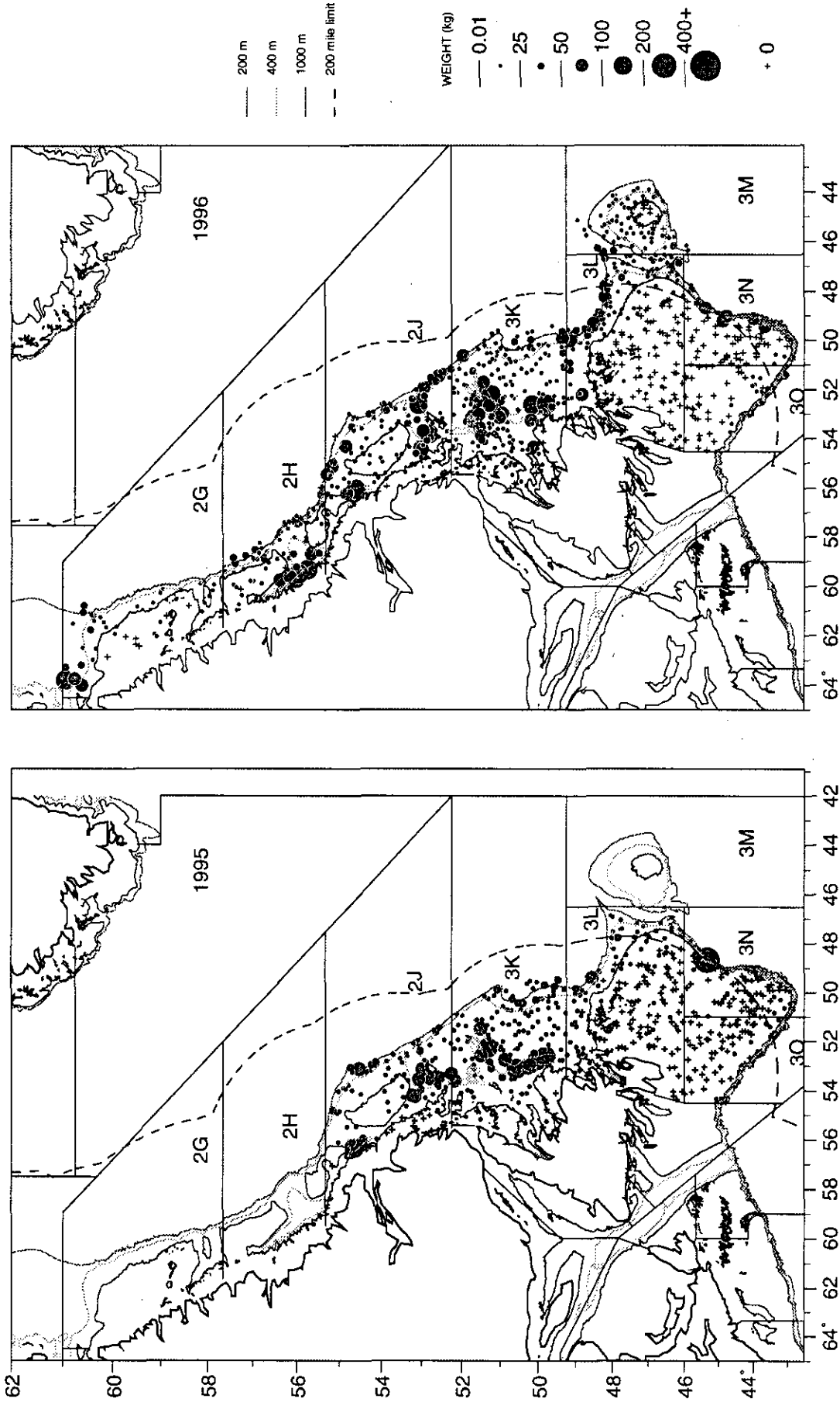
Fig. 5 Distribution of Greenland Halibut catches from 1995 and 1996 Canadian fall surveys to NAFO Divisions 2GHJ3KLMNO using a Campelen 1800 survey trawl. (All set standardized to 15 min. (.8 nm.) tows).
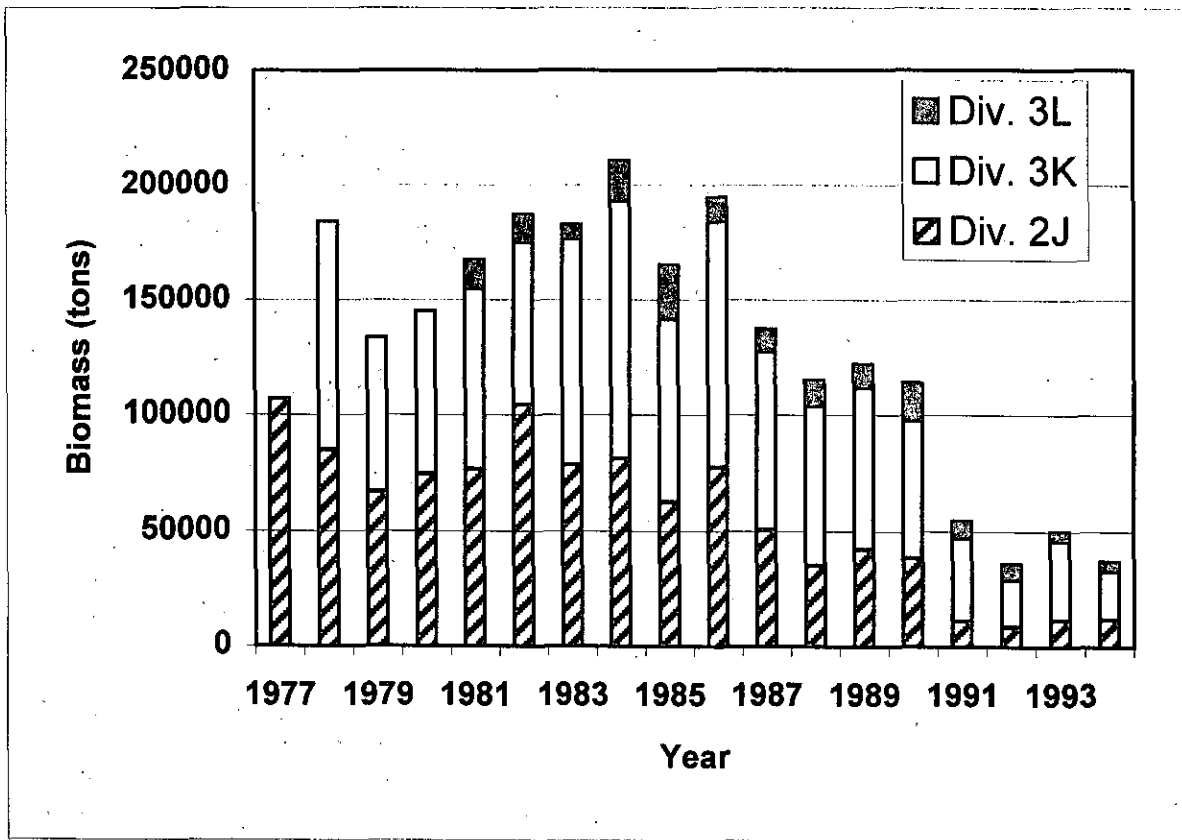
Fig. 6 Cumulative biomass estimates of Greenland halibut since 1977, 1978 and 1981 in Div. 2J, 3K and 3L respectively from Canadian fall surveys using an Engel survey trawl. Data have not been converted.
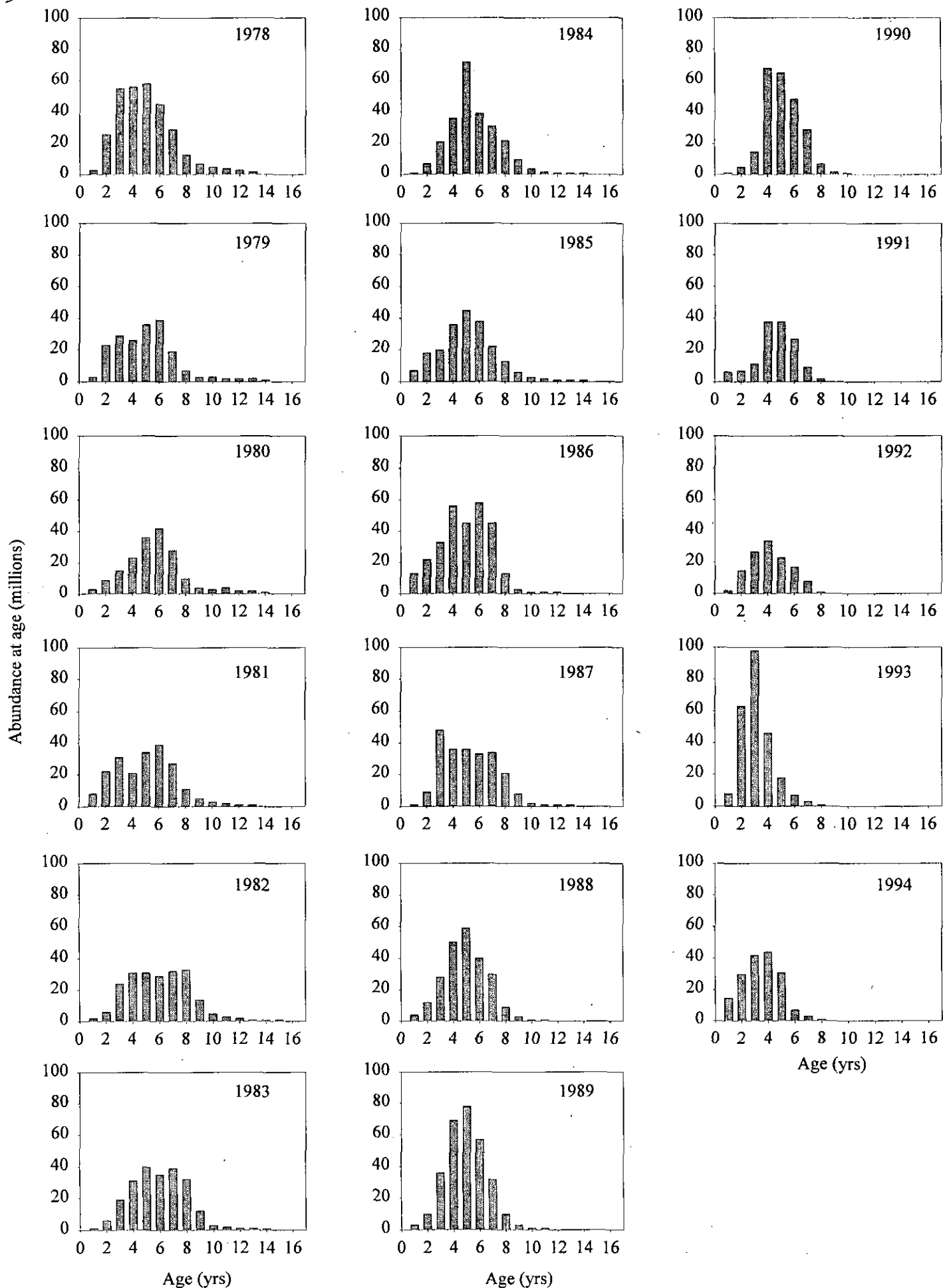
Fig. 7 Abundance estimates of Greenland halibut in Div. 2J and 3KL combined from surveys in 1978-94. Estimates **have not been** converted and are shown in Engel trawl catch units.
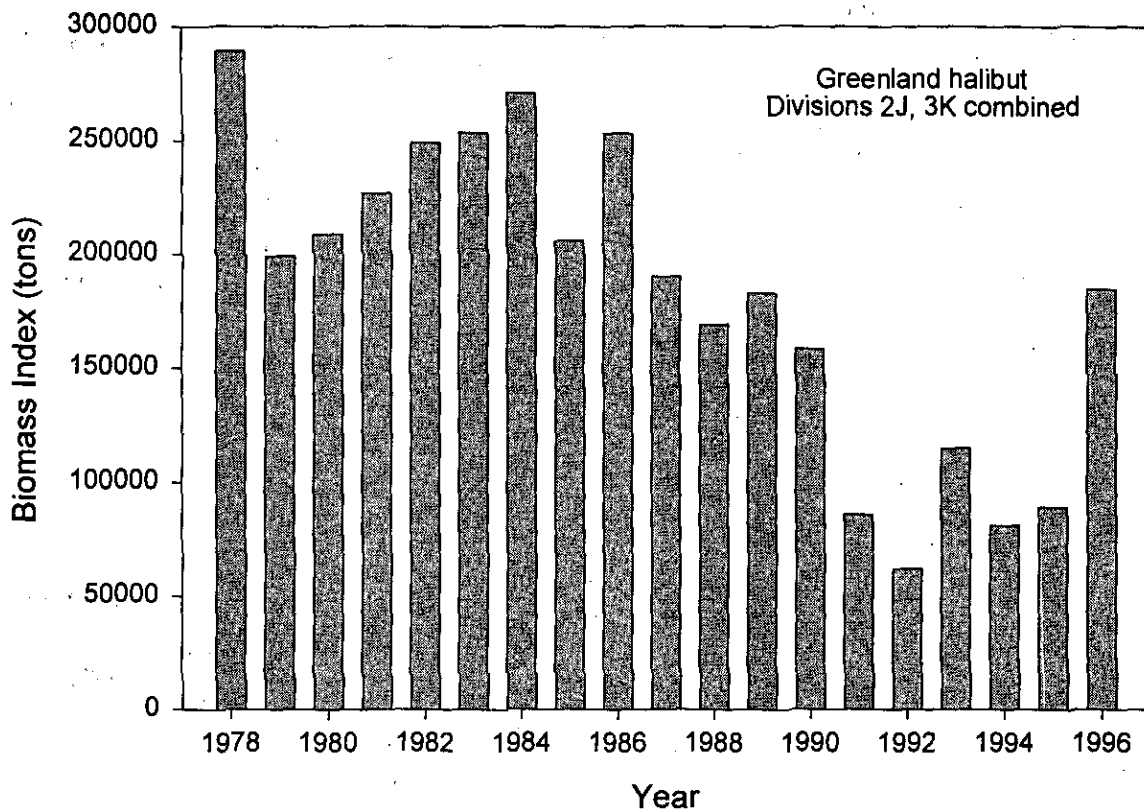
Fig. 8 Biomass indices of Greenland halibut from fall surveys in Div. 2J and 3K combined. Estimates expressed as Campelen trawl catch equivalents. The 1995 and 1996 values are actual stratified analysis estimates not L/W conversions.
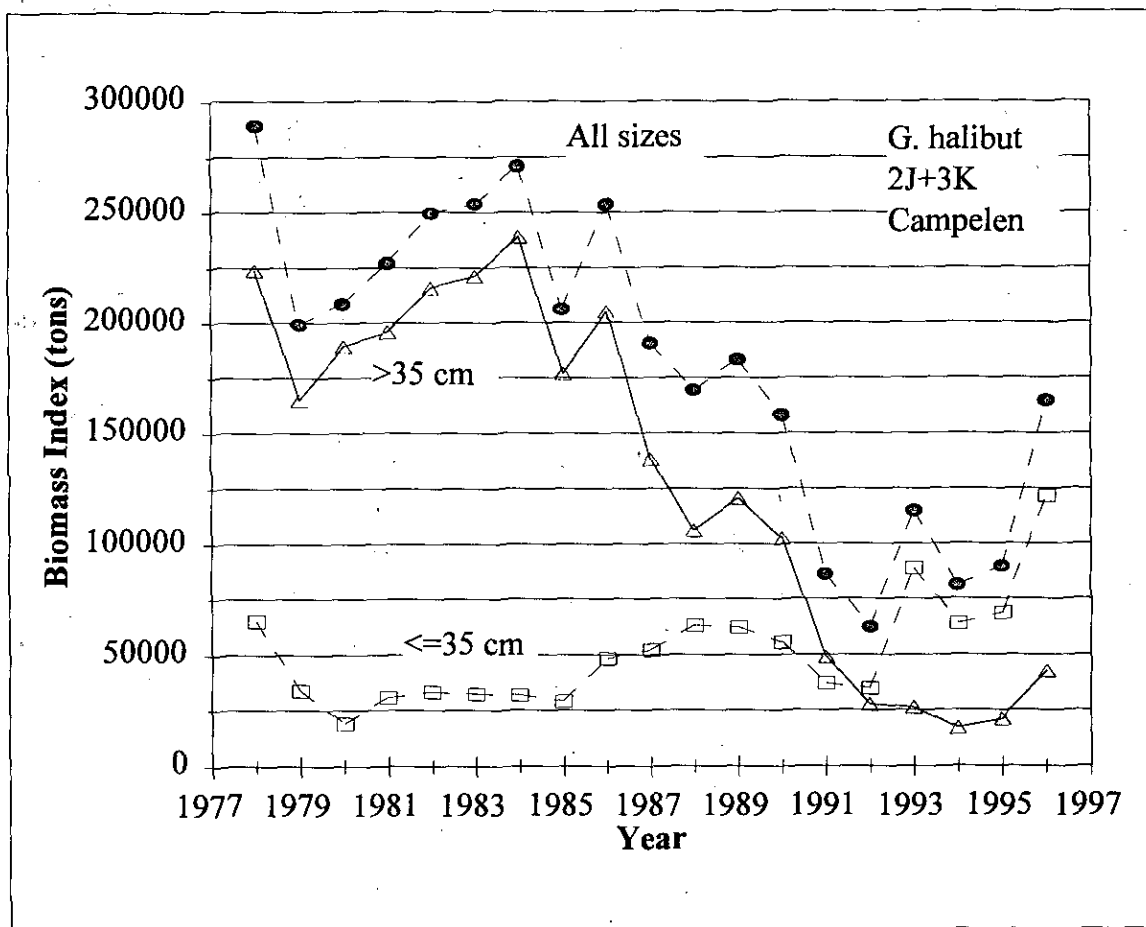
Fig. 9 Biomass indices for different size ranges of Greenland halibut from surveys in Div. 2J3K combined from 1978-96. Estimates for all years are derived by applying a L/W relationship to abundance at length expressed in Campelen catch equivalents.

Fig. 10 Proportional allocation of Greenland halibut biomass by division from the
1996 Canadian research survey in Divisions 2GHJ and 3KLMNO.

Division	Biomass (t)
2G	22275
2H	26062
2J	64771
3K	120335
3L	36642
3M	10175
3N	5079
3O	1026
Total	286365
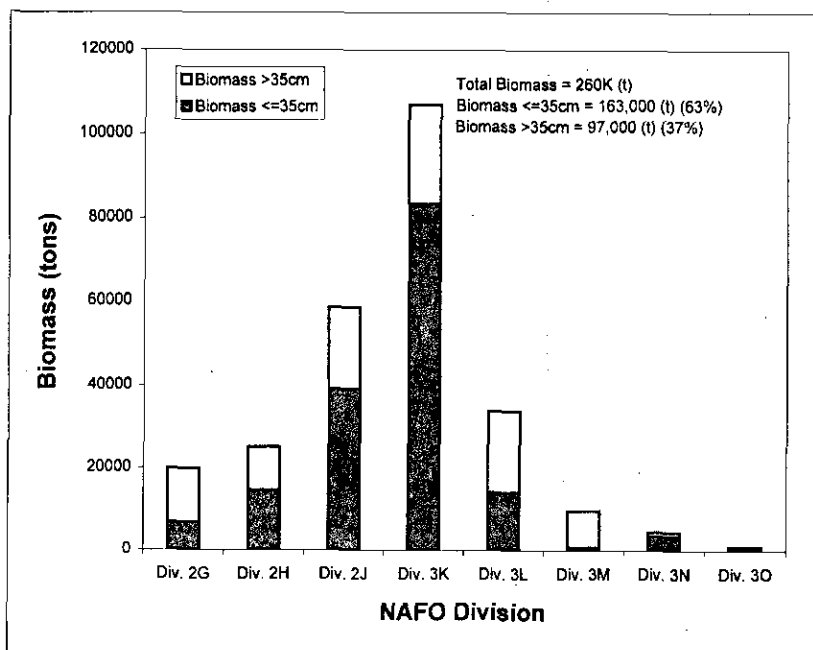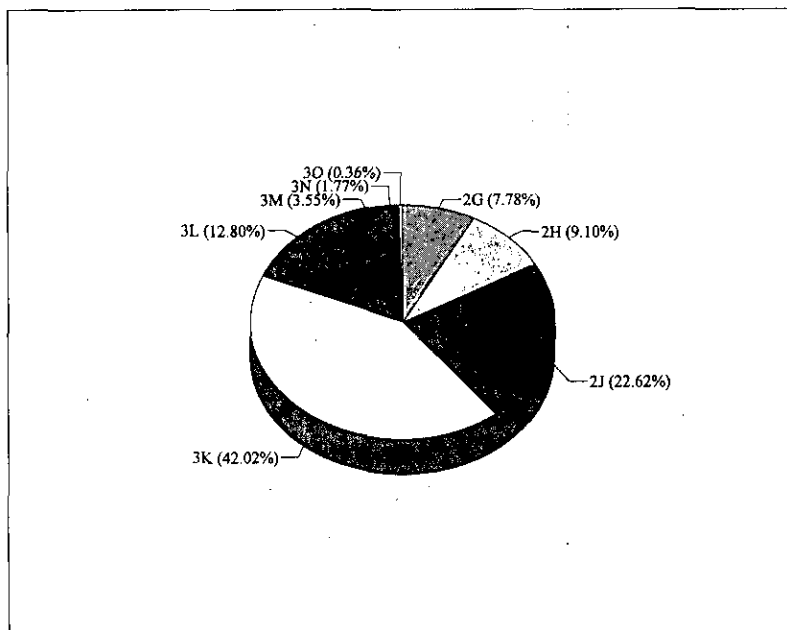
Fig. 11 Distribution of biomass by size grouping of Greenland halibut from the 1996 Canadian
fall survey using a Campelen 1800 survey trawl.
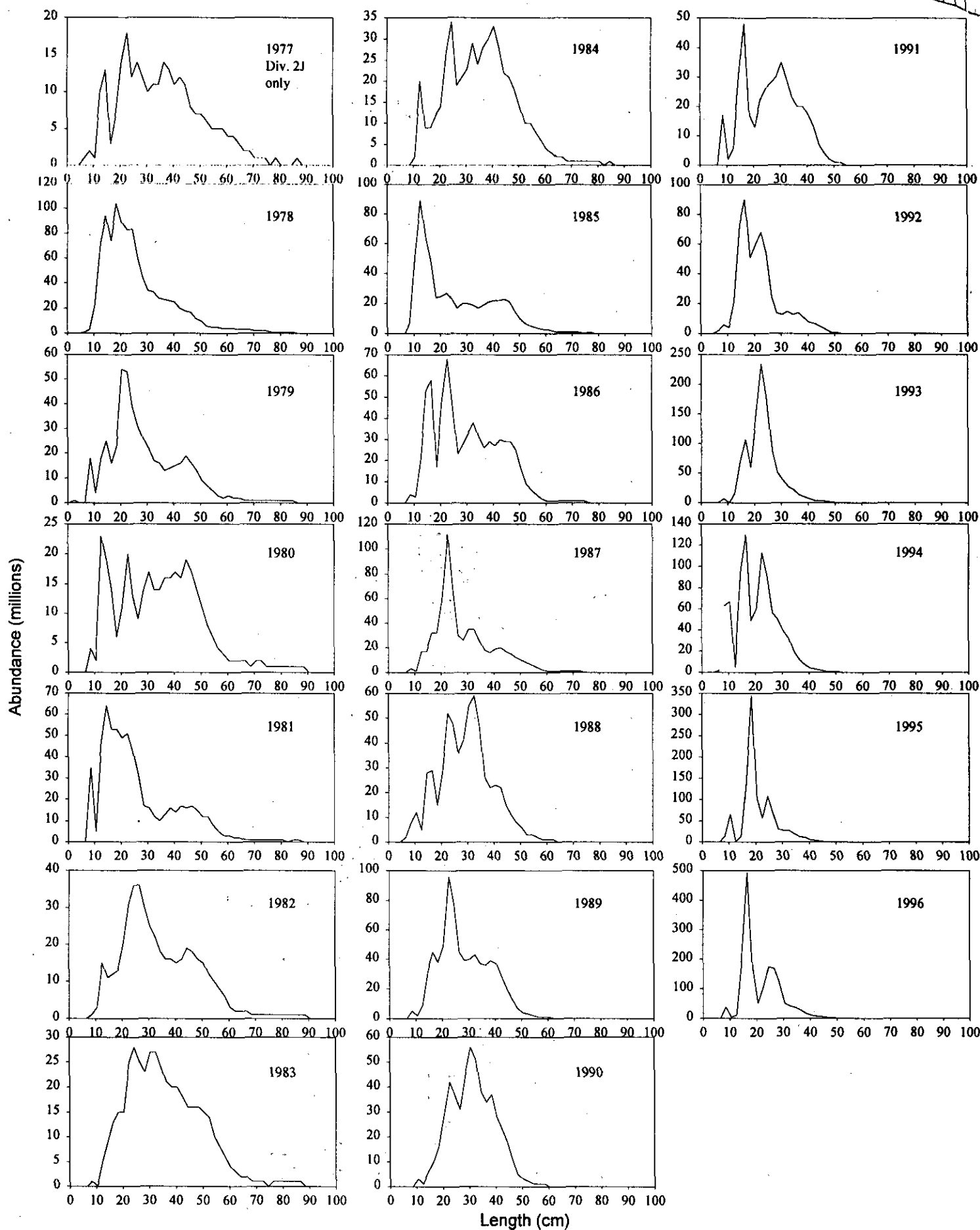
Fig. 12 Abundance (millions) at length (cm) for Greenland halibut from fall surveys in Div. 2J3K combined during 1977-96. All data are Campelen trawl catch equivalents.
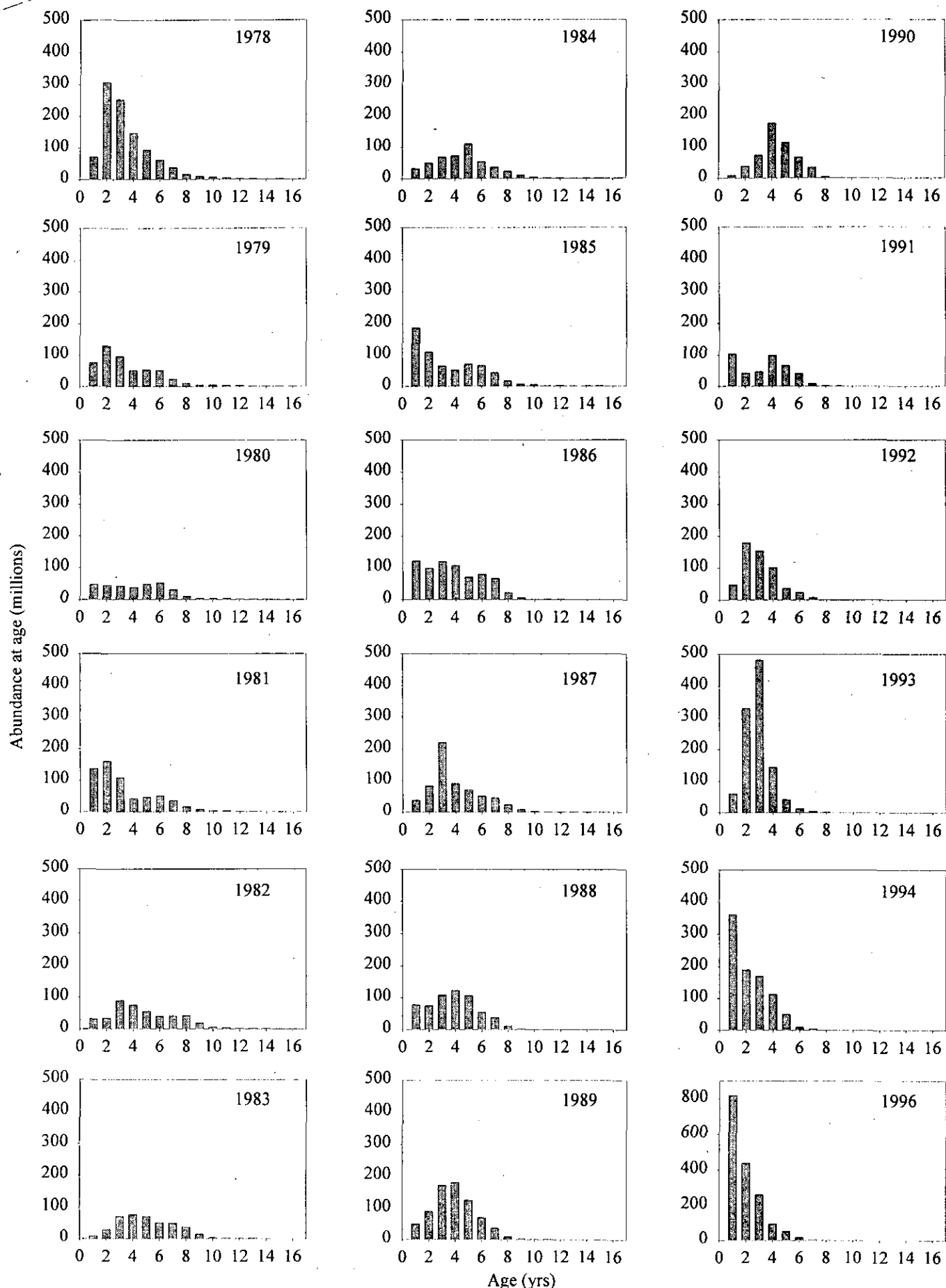
Fig.13 Abundance estimates at age of Greenland halibut in Div. 2J and 3K combined from surveys in 1978-96
Estimates are shown in Campelen trawl catch equivalents (Data for 1995 to be revised and added at a
later date). ** Note difference in Y-axis scale for 1996.
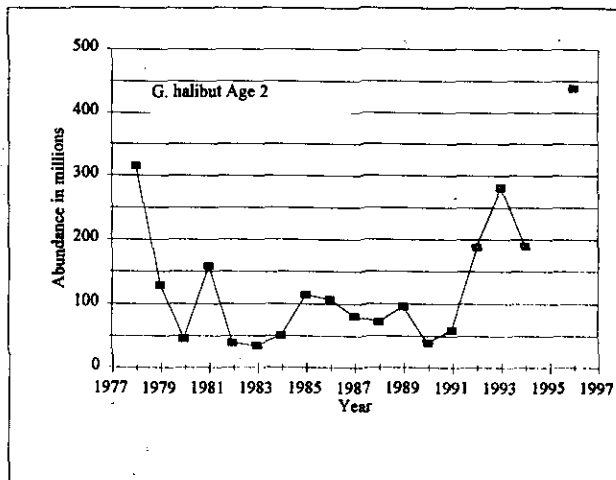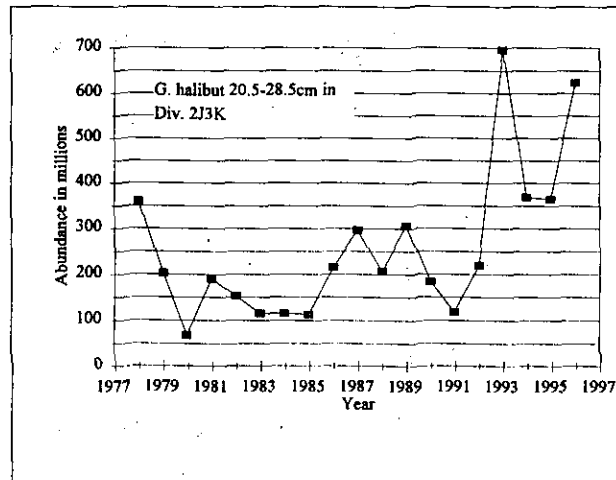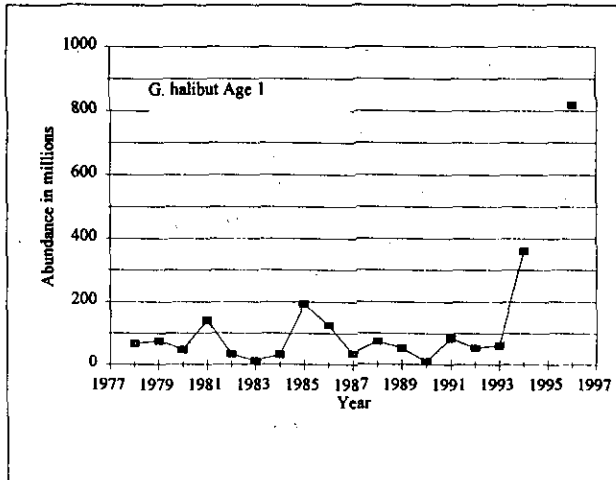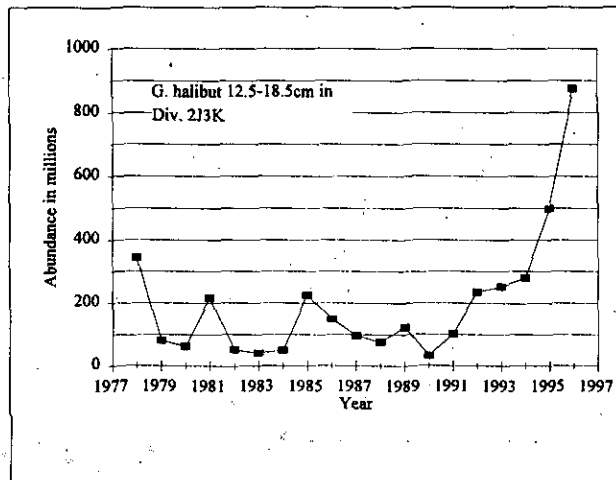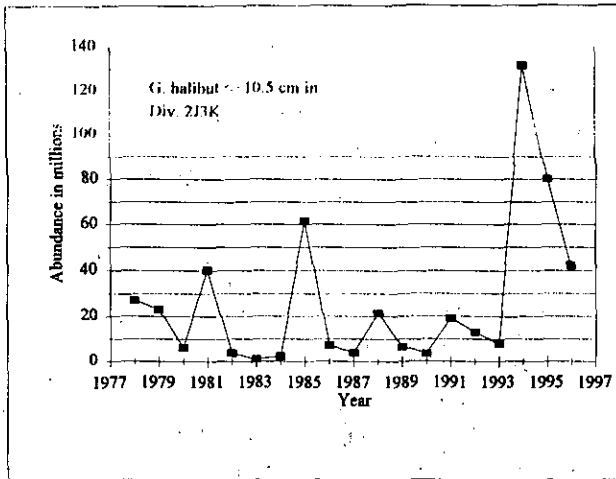
Fig. 14 Abundance of Greenland halibut in Div. 2J3K by length category from surveys during 1978-96. Presented in Campelen units.

Abundance of Greenland halibut in Div. 2J3K at ages 1 and 2 as read from otoliths from surveys during 1978-96. Presented in Campelen units. Note: Revised data for 1995 not available at the time of the meeting.
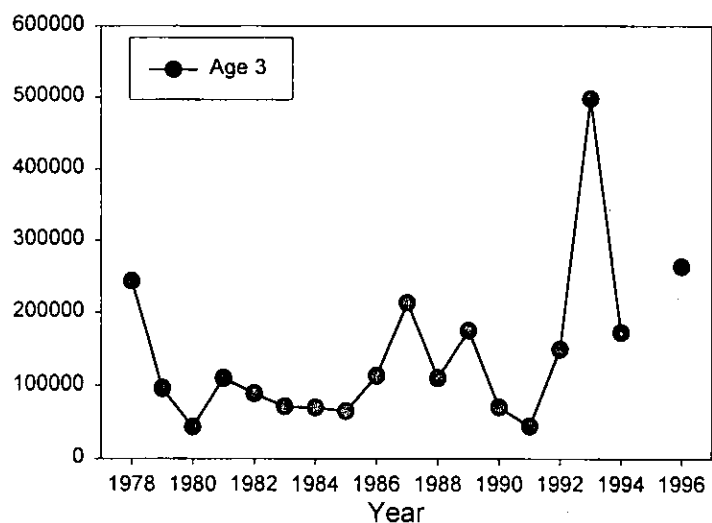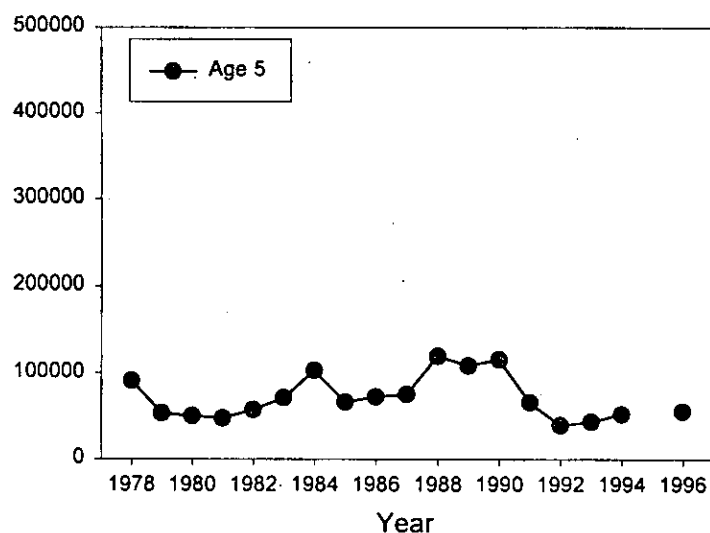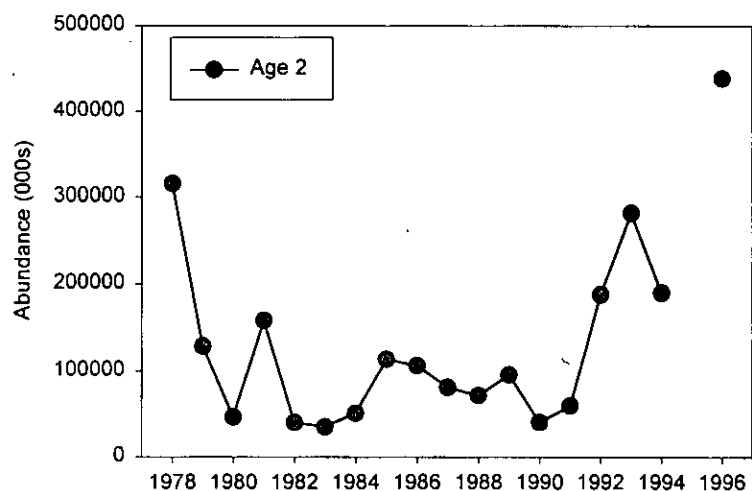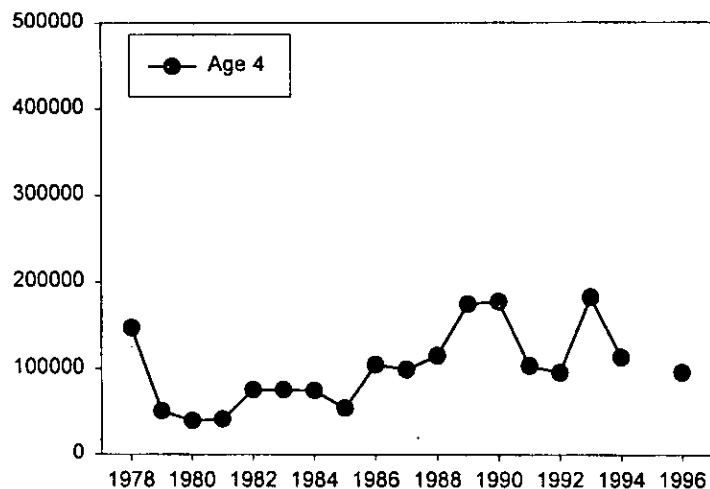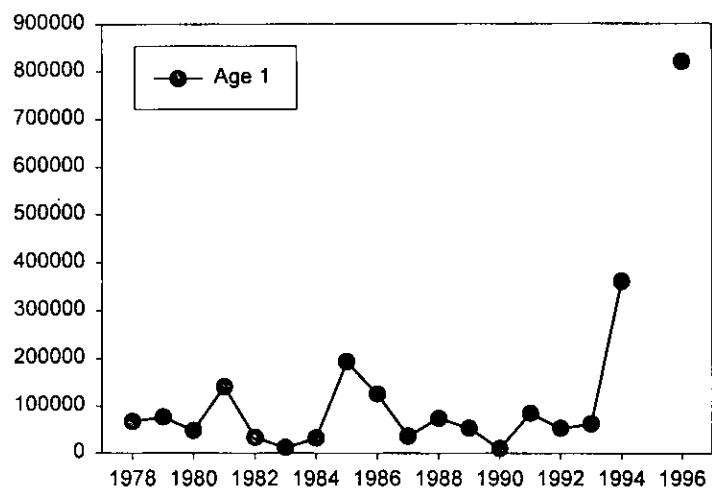
Fig. 15 Abundance estimates of Greenland halibut in Divisions 2J and 3K (combined) at ages 1-5 individually. Estimates are presented as Campellen trawl catch equivalents. Data for 1995 under revision and will be added at a later date.
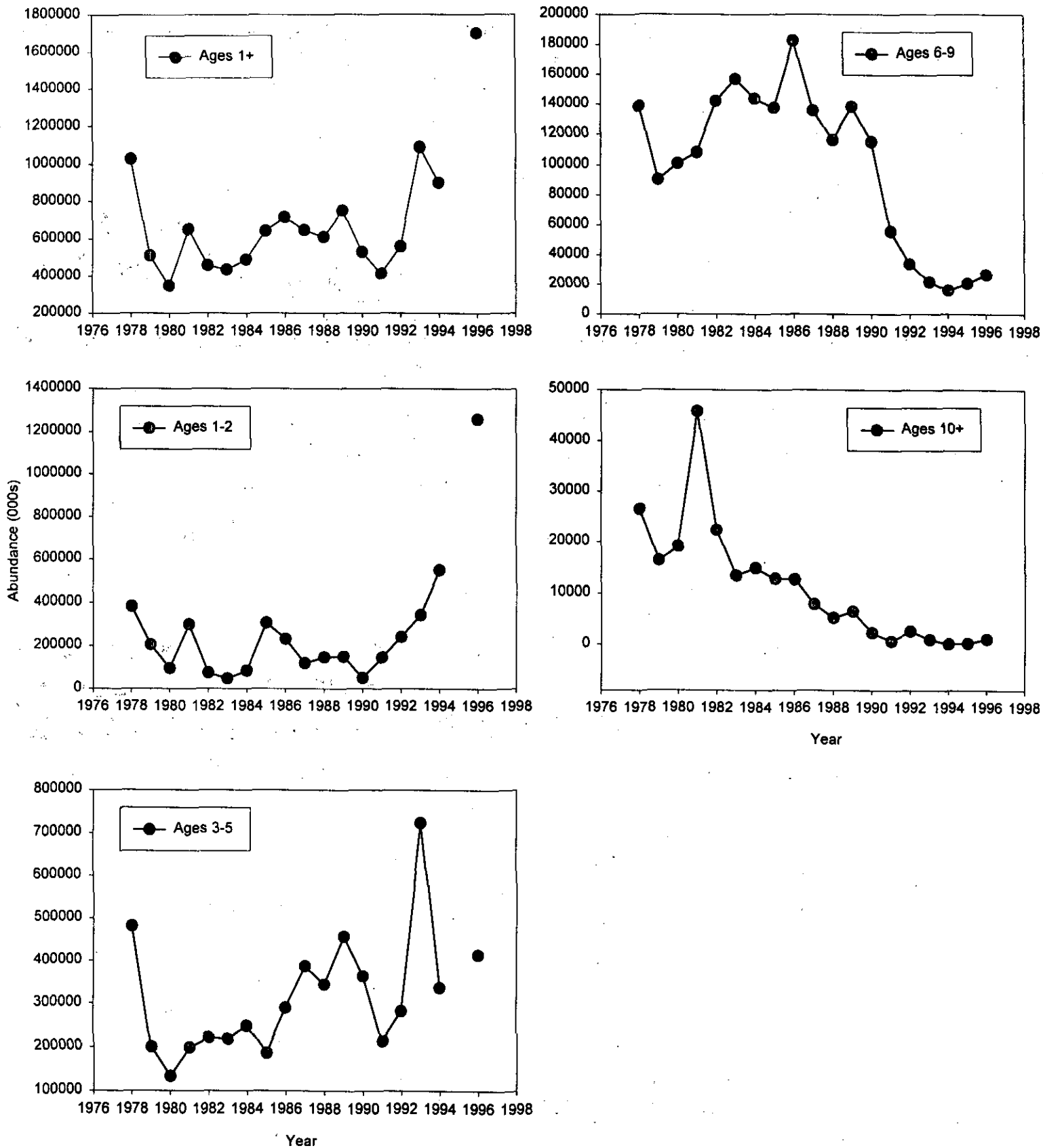
Fig. 16 Abundance estimates for various age groupings of Greenland halibut from surveys in Div. 2J and 3K combined. Estimates are in Campelen trawl catch equivalents. Data for ages 1-5 in 1995 to be added at a later date after being revised.
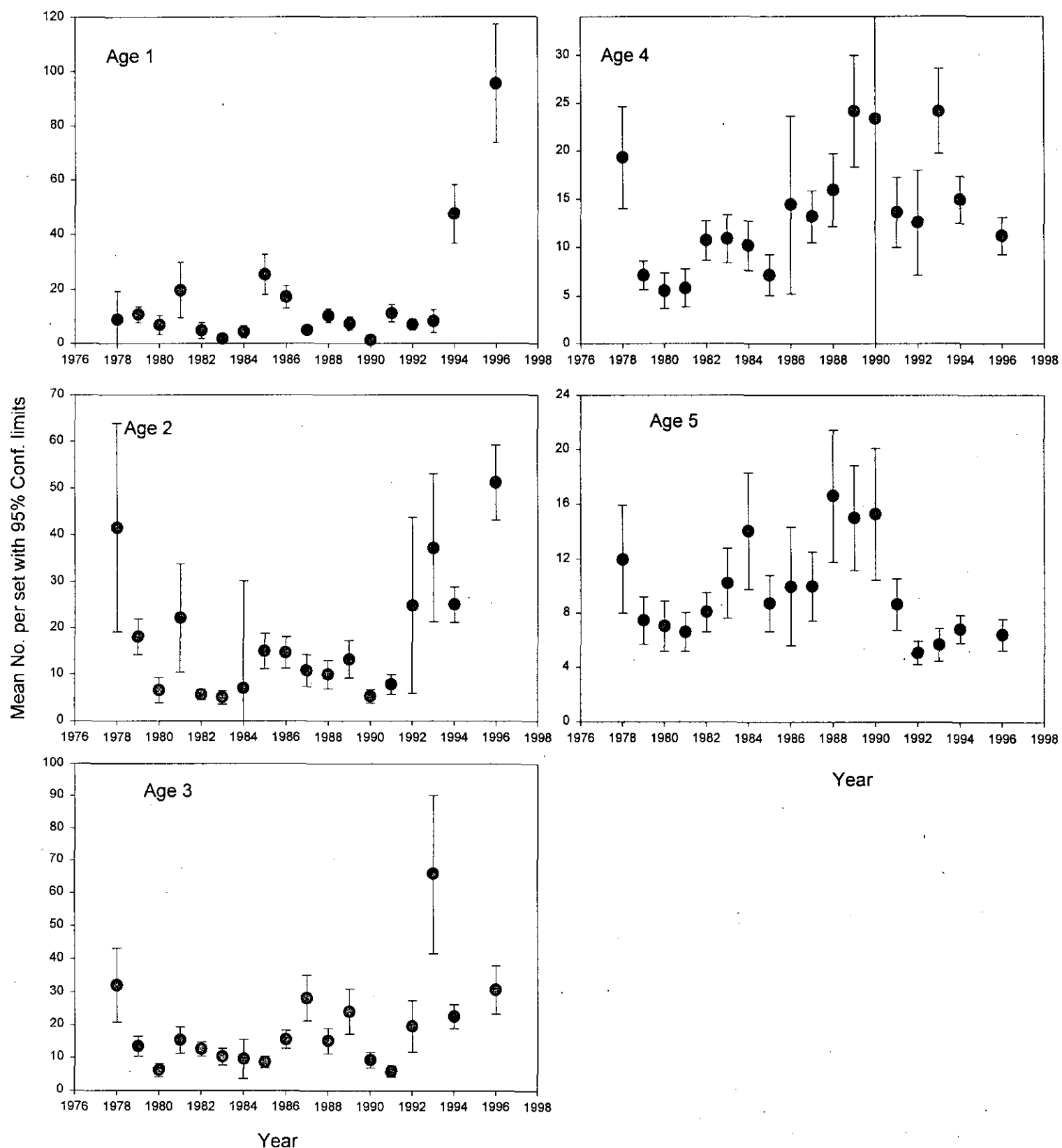
Fig. 17 Mean no. per set of Greenland halibut at age with 95% confidence limits from Canadian surveys
in Div. 2J and 3K combined. Estimates are in Campellen trawl catch equivalents. Data for 1995
to be added after revision at a later date.
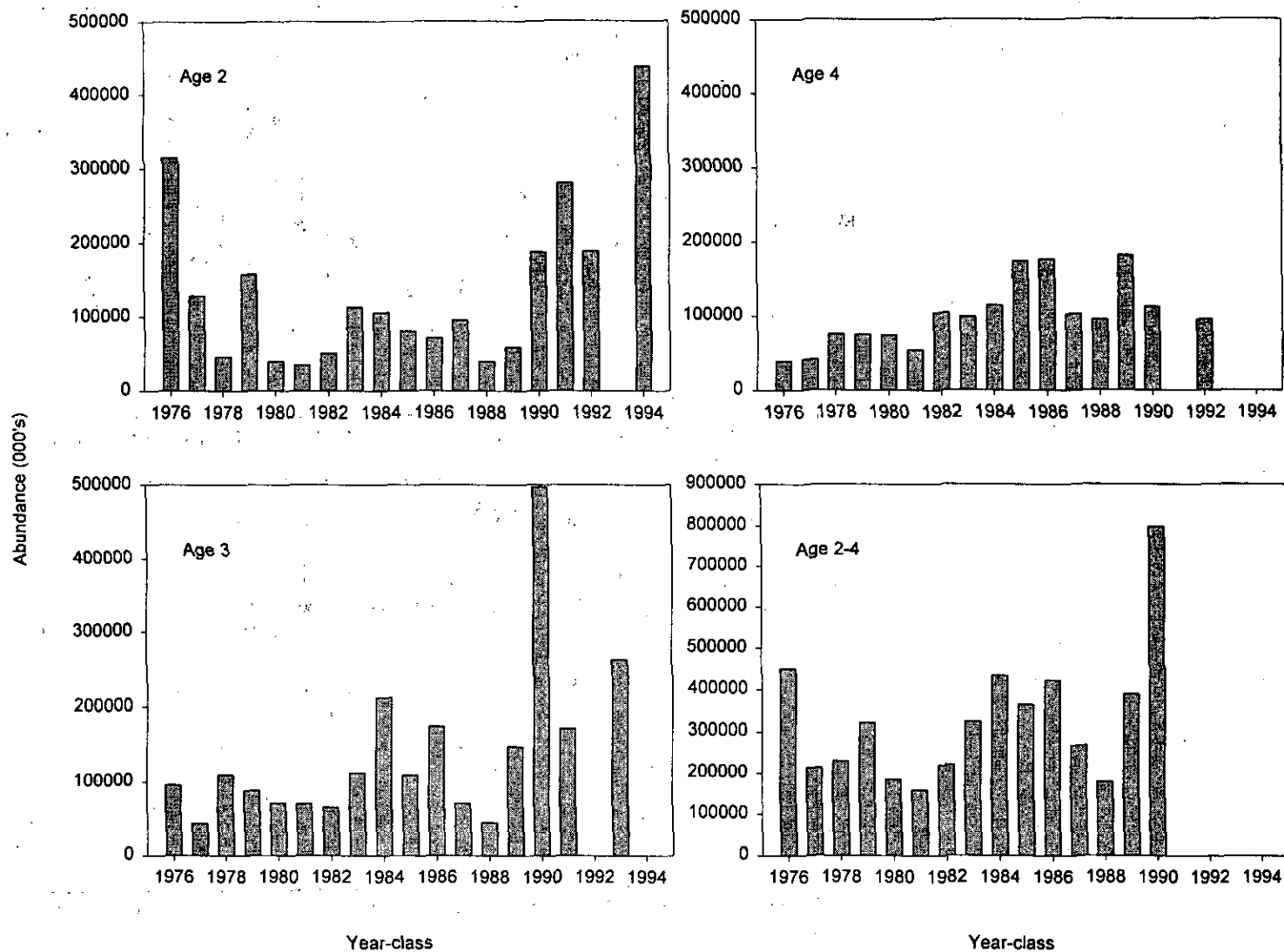
Fig. 18 Abundance estimates of pre-recruit year-classes at ages 2, 3, 4 and 2-4 combined from surveys in Div. 2J and 3K during fall 1978-96. Estimates are presented in Campelen trawl catch equivalents. Data from the 1995 survey to be added after revision.
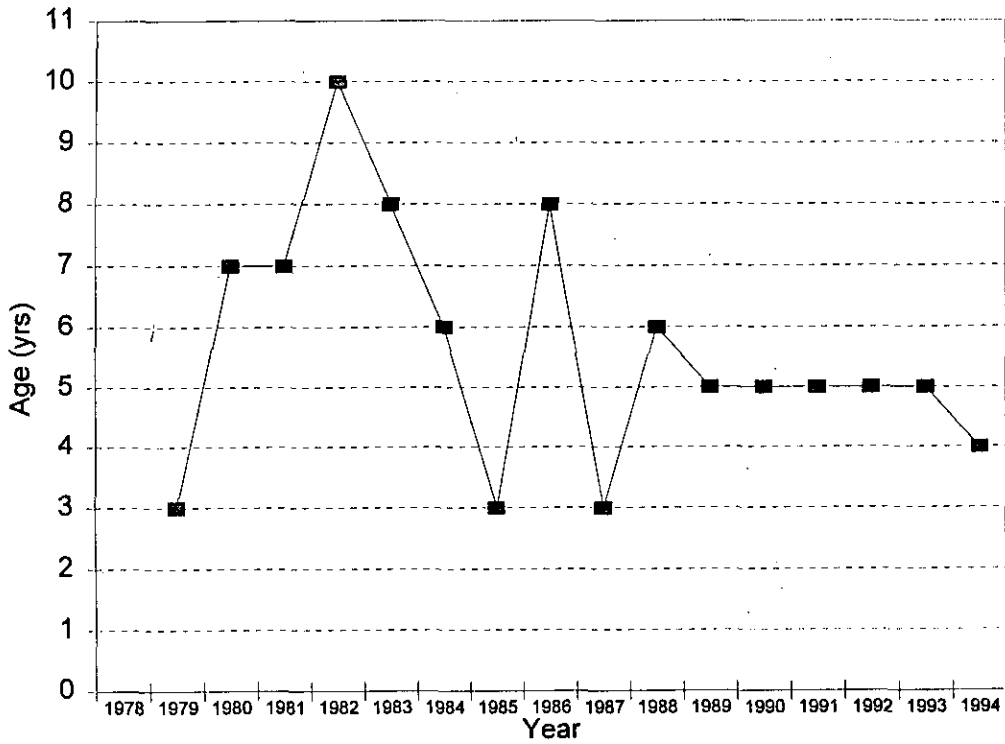
Fig. 19. Age of full recruitment to the survey in Divs.
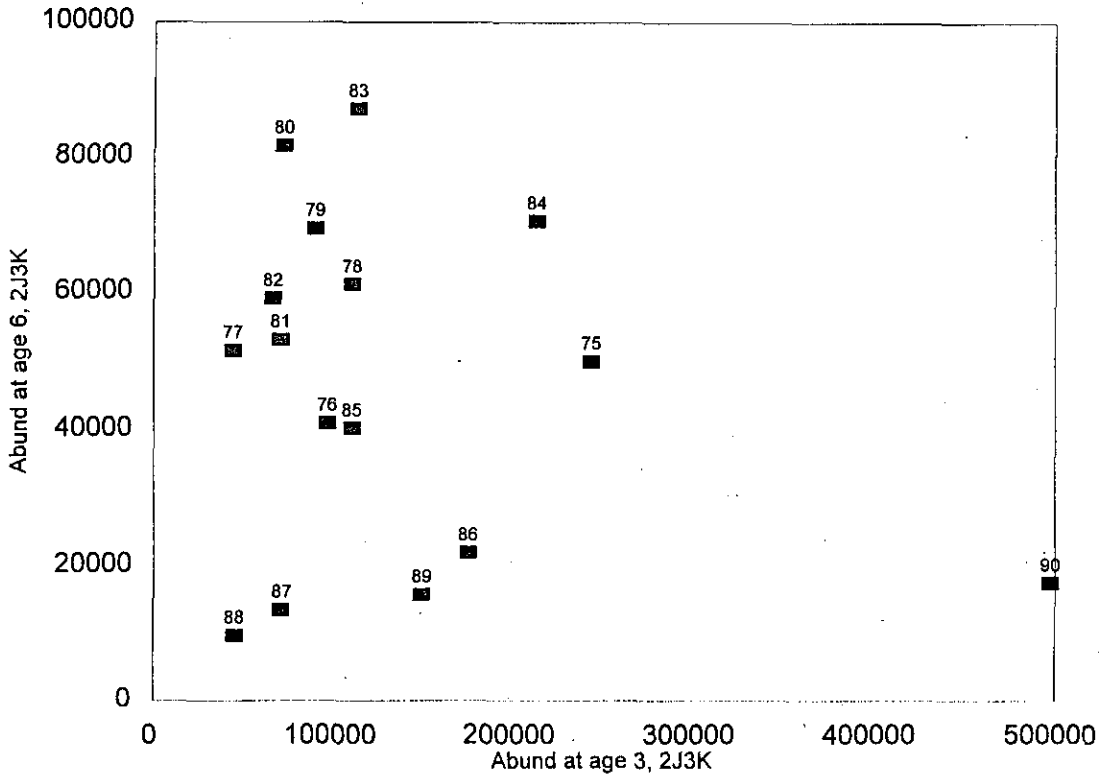
Fig. 20. Relationship between abundance at age 6 and abundance at age 3, for the same cohort, from surveys in Div. 2J3K.
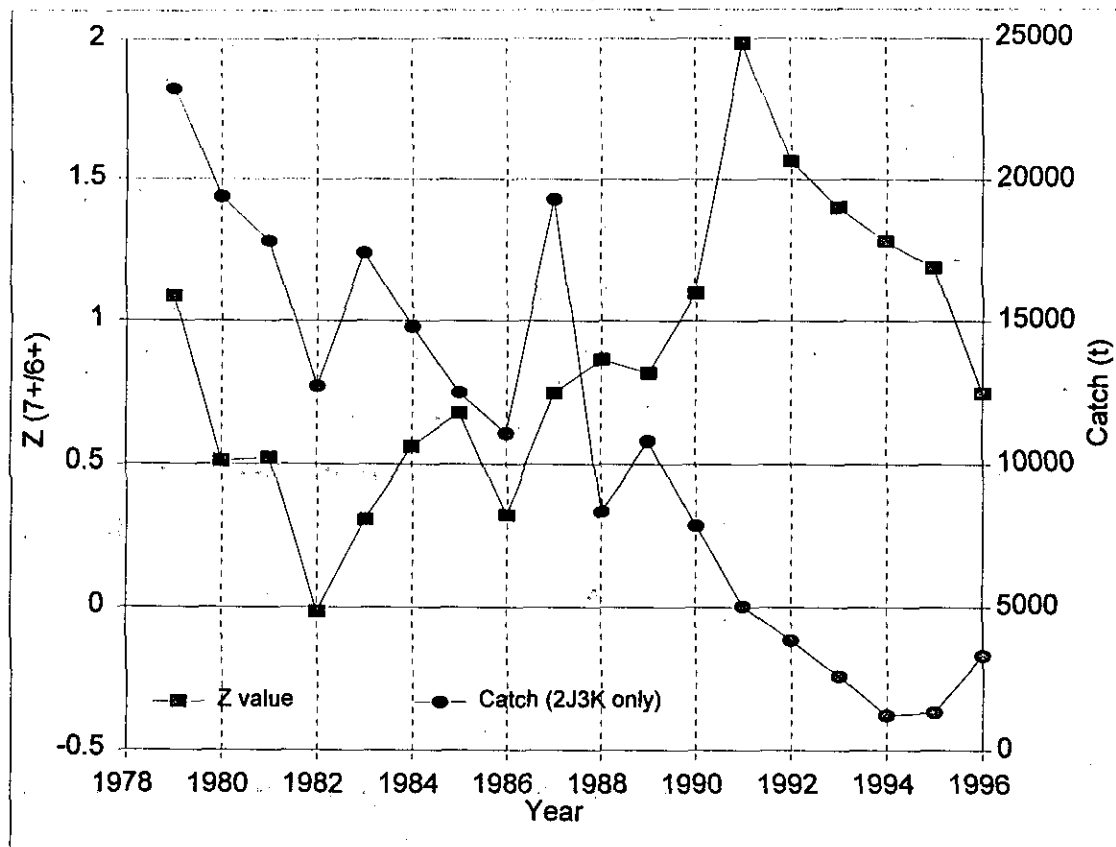
Fig. 21a. Trends in total mortality (Z) from surveys in Divs. 2J3K, and catches in the same area.
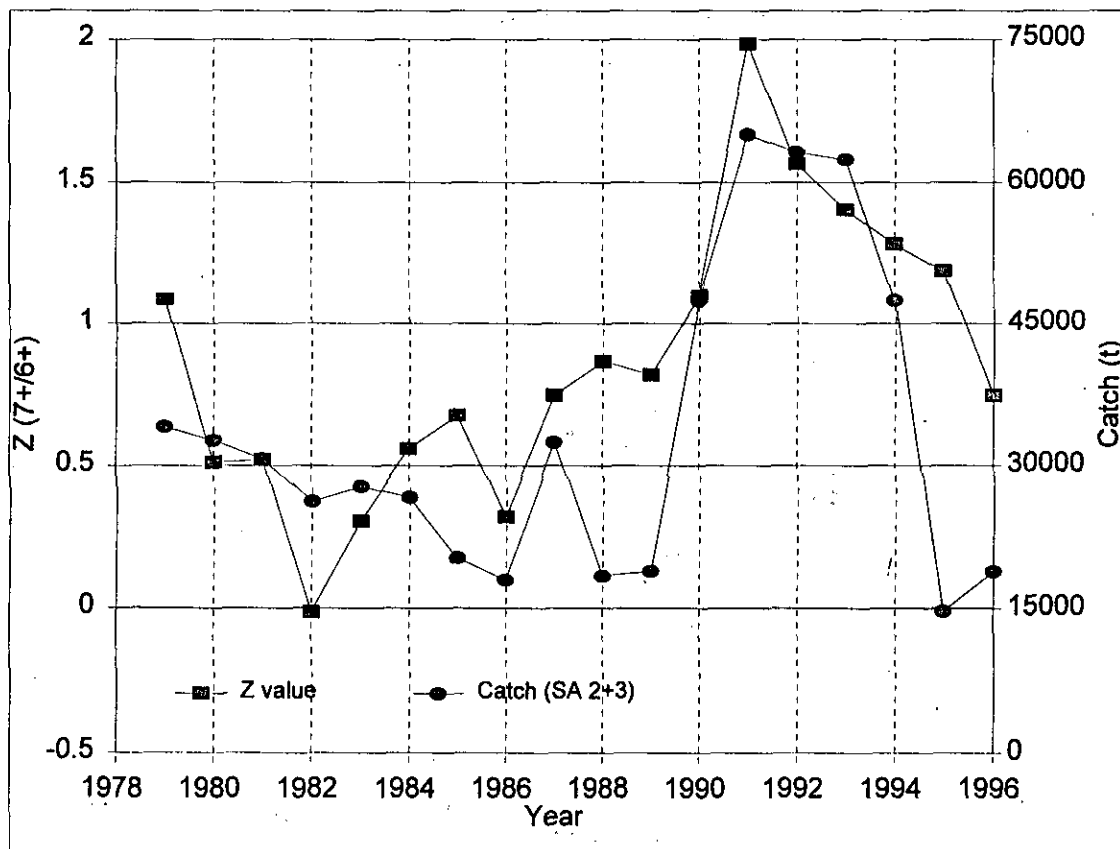
Fig. 21b. Trends in total mortality (Z) from surveys in Divs. 2J3K, and catches in the whole stock area (SA 2+3).
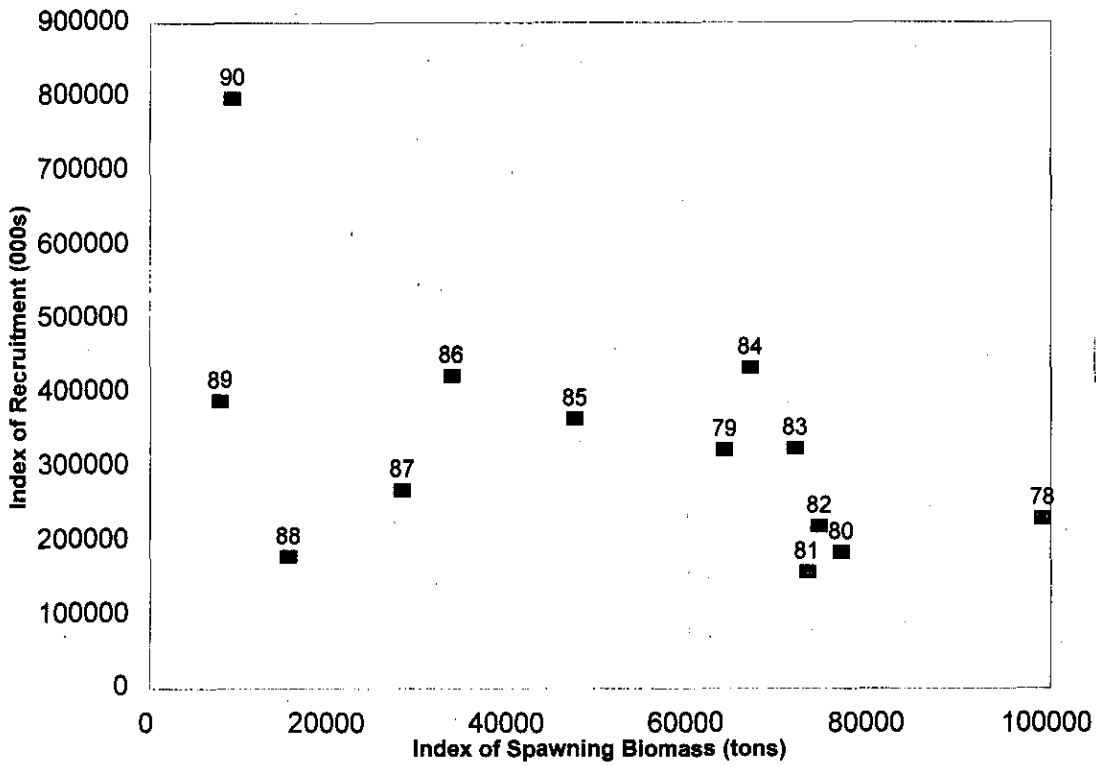
Fig. 22. Plot of recruitment against "SSB Index" from RV surveys in Div. 2J3K.
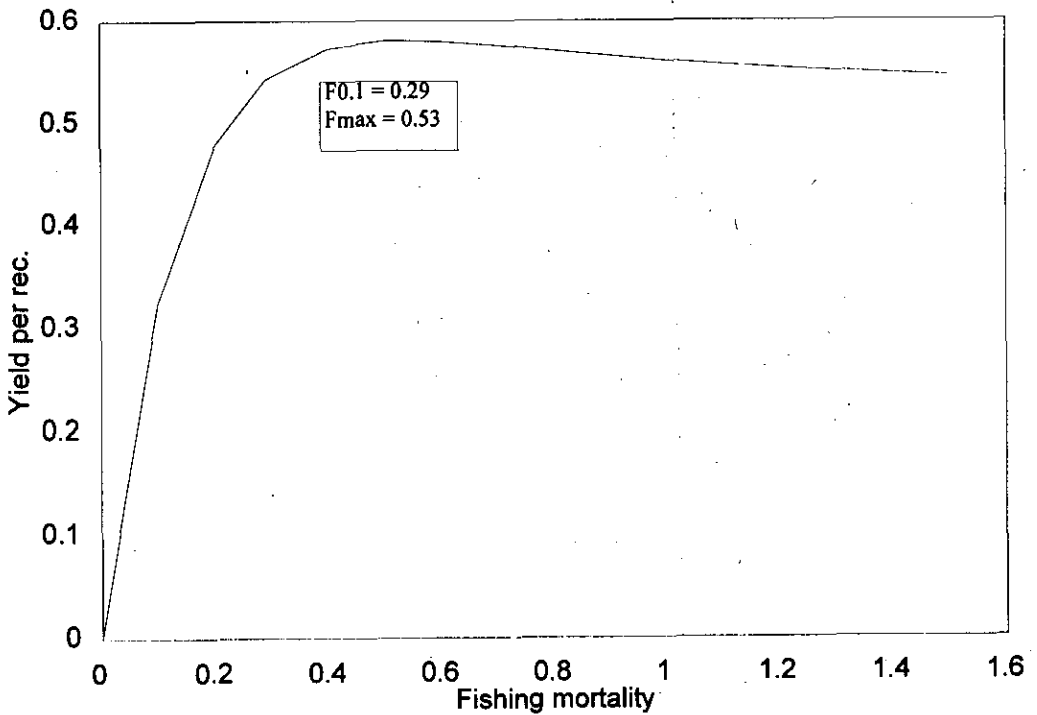

Fig. 23. Yield per recruit curve for G.halibut in SA 2+3 (Taken from Bowering and Brodie, 1987).