Northwest Atlantic Fisheries Organization

Serial No. N4097 **NAFO SCR Doc. 99/38**

SCIENTIFIC COUNCIL MEETING – JUNE 1999

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

by

W. B. Brodie, W. R. Bowering, D. Power, M.J. Morgan, and G. Boland
Science Branch, Department of Fisheries and Oceans
P. O. Box 5667, St. John's, Newfoundland, Canada AlC 5Xl

Abstract

Assessment of the Greenland halibut stock in Subarea 2 + Divisions 3KLMNO was based primarily on the interpretation of research vessel and CPUE indices. No VPA was possible due to the lack of catch-at-age data for all years. The biomass of fish greater than 35 cm was below average in 1998, but still appears to be increasing slowly. The number of older, mature fish in the surveys remains low, and SSB estimates are still uncertain.

Surveys in 1997 confirmed the abundance of year-classes previously thought to be strong, although in 1998, the 1995 year-class did not appear to be as strong as previously thought, based on the Canadian surveys. The 1996 and 1997 year-classes do not appear to be as large as those of 1993-1995.

There was a significant reduction in catches from a range of 50 000 to 70 000 tons in the early-1990s, to between 15 000 and 20 000 tons in 1995-98. The biomass of fish greater than 35 cm continues to increase, although at a slow rate, and is still relatively low, but should continue to increase in 1999-2000 if current levels of exploitation are maintained. The success of most fisheries in 1999-2000 will depend mainly on the 1992 and 1993 year-classes, based on typical age compositions observed in the past. The 1994 and 1995 year-classes should not have a major effect on most fisheries until 2001.

The NAFO Scientific Council was unable to advise on a specific TAC for this stock for 2000. However, given the present level of fishable biomass, SC recommended that a catch in 2000 of about 30 000 tons is likely to allow the stock to continue to increase.

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 progressively northward in the other bays along the east and 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-1980s were around 18 000 to 20 000 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 tons in each year although some estimates were 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 51 000 tons in 1994, although some estimates ranged as high as 56 000 tons. As a result of management measures introduced by the NAFO Fisheries Commission in 1995 (extensive quota

restrictions and 100% observer coverage in the NRA), catches were greatly reduced (Table 1B). In 1995, the catch was estimated to be about 15 000 tons, increasing to almost 19 000 in 1996, and to about 20 000 tons in 1997-98. Catches from the stock in 1995-98 represent a reduction of about two-thirds 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. 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 (Table 2). Canadian catches have been taken mostly by gillnet, although a significant proportion has been taken by otter trawlers. With the exception of 1987, catches declined steadily inside the Canadian zone since the late-1970s 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 improved in 1996 and 1997, and catches increased to around 6 000 tons in each year, but were lower in 1998 at around 4 100 tons (Table 3). The majority of Canadian catch in the last 2 years has come from Div. 3K, and the seasonal patterns are similar in both years. The breakdown of total catches in 1998, by country and Division, is given in Table 4.

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 in recent years. The Canadian gillnet catches taken during recent years are mainly from a 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 1 600 tons annually, and were at very low levels in 1998. Almost all the Canadian otter trawl catch in 1996-98 occurred in Div. 2J and 3K.

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, and 100 000 tons in 1986-89 (Table 1B, Fig. 1). These increases in TACs were the result of research vessel survey 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 TACs, catches in the 1985 to 1989 period were lower than in the preceeding 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 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. In 1994, 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 to 1998 inclusive, and was proportioned throughout the management area in an attempt to reduce high concentrations of effort in localized areas. For 1999, Scientific Council recommended that an increase in catch to about 30 000 tons should not impede recovery, but Fisheries Commission set the TAC for 1999 at 33 000 tons.

Commercial Fishery Data

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

Sampling data were available from the 1998 catches of Russia, Spain, France, and Portugal. Canadian data were not presented, as the otolith readings were not completed. The Russian fishery in Div. 3LM caught fish mainly in

the range 34-50 cm, with a peak at 38 cm in 3L and 42 cm in 3N. The Spanish fishery consisted mainly of fish in the same length range, aged 5-7. The peak age in each of Div. 3L, 3M and 3N was 6 years. French catches in Div. 3L were comprised of similar sized fish, although the catches in Div. 3M were mainly fish between 50 and 60 cm. Length and age compositions of the Portuguese catches in Div. 3LMN were similar to the Spanish catches in that ages 6 and 7 predominated. Overall, ages 5-8 appeared to dominate otter trawl catches, with a peak usually at age 6 or 7, depending on fleet and area.

Due to the uncertainty regarding catch information on fisheries in the NRA since 1989, as well as the lack of adequate sampling data for some fleets in some years, catch-at-age data for this stock are incomplete. Brodie *et al.* (1998) presented catch-at-age for Canadian catches only from 1988-97. Prior to 1989, data are available from the entire annual fisheries which took place mainly in the Canadian zone, and have been presented in some previous assessments of this stock (see Bowering *et al*., 1996). Ages 6-8 dominated the catch in most years up to 1991. Mean weights-at-age in recent years were similar, and no trends are seen in the mean weights over the period 1988-97. For the next assessment of this stock, an attempt will be made to update the Canadian catch-at-age for 1998 and 1999, and to compile the total international catch-at-age for this stock for years after 1990.

ii) Catch and effort

Catch and effort data from the directed fishery for G. halibut during the period 1975 to 1993 were obtained from ICNAF/NAFO Statistical Bulletins and were combined with provisional 1994-1998 NAFO data. The catch/effort data were analysed with a multiplicative model (Gavaris, 1980) to derive a standardized catch rate index for hours fished, as has been done in the last few assessments of this stock. 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. It should be noted that the number of observations in 1997 and 1998 were extremely low relative to the rest of the time series. The regression was significant ($p < 0.05$), explaining 62% of the variation in catch rates (Table 5). The standardized catch rate index (Table 6, Fig. 2) 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 to the lowest levels observed in the 1990's. The substantial increase from 1996 to 1997 is not statistically significant, given the high variability around the mean CPUE, particularly in 1997 (Fig. 2). The catch rate in 1998 was similar to 1997, although there were few observations in each year. For the whole time period, catch rates were generally higher in winter and higher in Subarea 2, based on the coefficients in Table 5.

Portuguese catch rates have increased each year from 1994 to 1998 in Div. 3L, but are below the values observed in 1988-90. There are no apparent trends in Div. 3N, and CPUE in Div. 3M increased from 1995 to 1997, but declined in 1998. Overall (Div. 3LMN), Portuguese CPUE showed a similar pattern as in Div. 3L, showing an increase since 1994.

Canadian Research Vessel Surveys

From 1977-94 in Div. 2J and 1978-94 in Div. 3K, Canadian stratified random 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*. Surveys have been carried out in Div. 2GH in 1996-98, but only sporadically before then. In 1995-98, the surveys in autumn in Subareas 2 and 3 were conducted by the research vessels *Teleost*, *W. Templeman* and *A Needler* 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 onward with those prior to 1995. The 1997 assessment of this stock contained several tables and figures outlining these comparisons for G.halibut (Brodie *et al.*, 1997).

Table 7 gives an outline of the Canadian survey coverage, by division and depth, for the 1996-1998 Canadian surveys in SA 2 + 3KLMNO. Maps of the stratification schemes used in the surveys are shown in Fig. 3 to 7. The following points comparing survey coverage between years are noteworthy:

- About 850 sets were completed in each of the 3 years, with just under 60% of the sets occurring in Div. 2J3KL.
- Coverage in the deep water of Div. 3NO has not been as extensive as in other areas in the autumn surveys, particularly in 1996 and 1997. In 1998, good coverage of all depths was achieved in Div. 3N, and to 1100 m in Div. 3O.
- In 1997 and 1998, only the strata deeper than 731 m on the west and north sides of Flemish Cap (in the Flemish Pass and Sackville Spur areas of Div. 3M) were surveyed, compared to a complete survey of Div. 3M in 1996.
- Coverage was somewhat better in Div. 2G in 1997 compared to the other 2 years. Coverage in Div. 2H, 2J, 3K, 3L, and areas of Div. 3NO < 731 m were quite similar between years.
- The survey coverage was extended into new inshore strata in Div. 3K and 3L in 1996, and this was repeated in 1997 and 1998.

i) Geographic distribution of G.halibut

The spatial distribution of Greenland halibut in Div. 2J and 3KL from the autumn 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 G. halibut did not occur are depicted with a plus (+) symbol.

Data from all autumn surveys prior to 1995 (Engel trawl) were depicted 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 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, survey 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.

In 1995-98 the survey results using the Campelen trawl showed similar patterns in the distribution of catches (Fig. 8, 9). Throughout this survey period, most of the largest catches in numbers occurred in the channels between shallow banks, particularly in Div. 3K and in northern 2J. The largest catch weights of G.halibut followed a similar pattern, but some were also recorded along the deepwater slopes of Div. 3KL, particularly in 1997 and 1998. There are no obvious breaks in the north-south distribution of this species in these surveys, although catches in the shallowest survey areas were consistently low, with few fish being found in depths less than about 150 m.

To look for differences in distribution of G.halibut by size, data from the 1998 survey were split into length categories above and below 35 cm. The smaller fish tend to be distributed more in the channels between the fishing banks, and less toward the continental shelf (Fig. 10). Catches of fish less than 35 cm tended to be smaller in areas south of Div. 3K. The larger fish overlapped the distribution of smaller fish throughout the survey area, but were found mainly in deepwater areas along the slope where the younger fish were often absent, or present only in low densities (Fig. 11). In both 1997 and 1998, fish greater than 35 cm were found consistently along the slope edge in Div. 3K, and the northern part of Div. 3L.

ii) <u>Biomass indices</u> (converted from Engel to Campelen equivalents prior to 1995, and Campelen surveys in 1995-1998)

<u>1998 survey</u>. Tables 8 to 15 give detailed results of the 1998 survey, by Division, for Div. 2GHJ and 3KLMNO. The 1998 survey was incomplete in Div. 2G. In Div 2H, strata 948 and 946 accounted for about 53% of the abundance and 45% of the biomass (Table 9, Fig. 4). In Div. 2J, no single stratum contained more than 16% of the abundance or 11% of the biomasss. Strata 204 and 208 accounted for about 20% of the biomass in Div. 2J (Table 10, Fig. 5). In Div. 3K, adjacent strata 627 and 631 (401-500 m in Funk Island Deep, Fig 4) contained almost a third of the abundance and 28% of the biomass (Table 11). In Div. 3L, biomass and abundance tended to be more evenly distributed, with no single stratum containing more than 9% of the total biomass in 1998 (Table12), similar to 1997. Strata 737 and 741 (732-914 meters, Fig. 7) ranked 1 and 2 in terms of biomass in Div. 3L. In most of the depth zones greater than 367 m on the shelf edge in Div. 3L, catches declined from north to south (Table 12, Fig. 11), with the obvious break being the 200 mile

limit. In Div. 3M, catches were similar to those in the same depth in adjacent areas of Div. 3L, eg. on each side of the Flemish Pass. About 30% of the biomass in the 9 surveyed strata in Div. 3M occurred in stratum 528 on the northwest portion of Flemish Cap (Table 13, Fig. 7). In Div. 3N, coverage was completed in all but 2 strata (both deeper than 1097 m). No stratum contained more than 15% of the biomass, and the strata ranked 1 and 2 in both abundance and biomass were somewhat shallow compared to other Divisions (strata 378 and 381, depth 184 – 274 m, Table 14 and Fig. 7). In Div. 3O (Table 15), no sets were done in depths greater than 1 097 m, although all strata shallower than this were surveyed in 1998. Most of the biomass (56%) and abundance (54%) were found in the 3 strata in depths between 732 and 914 m.

1995-1998 Campelen surveys. Biomass increased from 1995 to 1996, and again to 1997 in all 3 Divisions (2J3KL), as seen in Tables 16-18, although the 1995 estimate is biased downward by the omission of several deep strata throughout the area. This increase continued in 1998 for Div. 3K and 3L, with the biomass in Div. 2J declining to the level estimated in 1996. Comparing the 4 years in each Division, only Div. 2J and 3L (1997) had confidence intervals around estimates of abundance and biomass which were very wide. In 1998, confidence intervals were widest in Div. 2G and 3N (Table 19). Overall, the trawlable biomass estimate for Div. 2J3KL was about 260 thousand tons in both 1997 and 1998, and 331 thousand tons in the surveyed areas of SA 2 + Div. 3KLMNO in both years (Tables 19 and 20).

Comparison of Campelen and Engel surveys. 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. All length frequency data on Greenland halibut collected during the autumn 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 (Bowering *et al*., 1996). The conversion for the Engel's trawl used in the surveys in Div. 3LNO has not yet been evaluated, although there was little deepwater coverage in Div. 3L in most Engel surveys, and no autumn coverage of Div. 3NO at all prior to 1990.

To allow comparison of the biomass estimates in Div. 2J and 3K from the two time periods (pre-1995 and 1995-98), the converted abundance at length was transformed to biomass at length using length-weight (L/W) relationships. The converted biomass from Div. 2J3K combined for 1978-94, and the L/W-converted Campelen values for 1995-98, are shown in Fig. 12. As was noted in the last two assessments of this stock, the L/W-converted biomass estimates in 1996 and 1997 were about 10% lower than the actual biomass derived from catch weights, suggesting a problem with the L/W equation used in the calculations. In this assessment, annual L/W relationships were used for 1990-97 (Table 3 of Gundersen and Brodie, 1999). For years prior to 1990, the 1990 L/W relationship was used, and for 1998, the 1997 values were used. The total (2J3K, all sizes) converted biomass estimates are compared against the values calculated with the old L/W relationship (Bowering and Stansbury, 1984) in Fig. 13. In every year, the biomass estimates calculated with the new L/W data are higher. One reason for this could be that the earlier L/W calculations were made with data from fish that had been frozen then thawed, and some weight may have been lost in the thawing process. In any case, the biomass estimates calculated with the new L/W values appear to be more accurate, as indicated by the comparison of the 1995-98 data (actual Campelen surveys) against the swept-area ('STRAP') biomass estimates, derived from set by set catch weights (Fig. 13). After a steady decline from the mid-1980s to 1992, the biomass has since increased, with the values in 1996 to 1998 being equal to the level seen in the late-1980s (Fig. 12).

A closer look at the trends in the biomass of fish above and below 35 cm continues to reveal some interesting patterns (Fig. 12). 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-1990s. While the biomass of the larger fish has remained fairly low throughout the 1990s, increasing somewhat from 1995-98, the biomass of G. halibut smaller than 35 cm has increased sharply, to levels in 1996-98 which are substantially higher than the values seen prior to 1993. Although these comparisons must be done with the Engels-Campelen conversion in mind, it should be noted that the 1993 and 1994 unconverted values for biomass less than 35 cm are also higher than the earlier values, ie. the increased recruitment was apparent before the switch in trawl gears occurred (Brodie *et al*., 1997).

Figure 14 shows the split, by Division, of trawlable biomass from the 1998 Canadian survey (based on the length-weight calculations). Similar to 1996 and 1997, close to two-thirds of the biomass was found in Div. 2J3K, with no more than 17% being found in any other Division (Table 20). It making this comparison, it must be noted again that coverage was not complete in all areas in all years, mainly in the deep areas of Div. 2G, 3N, and 3O. Nonetheless, the 1998 survey gives a reasonably comparable biomass estimate with those from the 1996 and 1997 surveys, in that they all cover the majority of the stock area down to 1500 meters. Figure 14 also indicates the components of the biomass above and below 35 cm, by Division. Larger fish made up more than 50% of the biomass in Div. 3L and 3NO, and about 50% in Div. 2GH, but were a much smaller percentage in Div. 2J and 3K, as was the case in 1996-97. Few small fish were found in Div. 3M, as there were no sets in this Division in depths less than 731 m.

iii) Abundance indices (converted from Engel to Campelen equivalents prior to 1995, and Campelen surveys in 1995-1998)

The age compositions from the 1996, 1997, and 1998 surveys, by Division, are shown in Table 21. In all three years, the 1995 year-class is dominant, followed by the 1994 (the 1996 year-class was slightly larger than the 1994 in the last survey). The majority of these cohorts were located in Div. 2J and 3K in all three years. Fish older than 9 comprised less than 0.4% of the total abundance in all years, with the highest numbers of older fish being found in Div. 3KL in 1997 and 1998. Overall, there was a decrease of about 13% in total abundance from 1996 to 1997, and a further decline of 28% in 1998, explained by the decline in the 1994 and 1995 year-classes during these years. Subsequent year-classes (1996 and 1997) do not appear to be as large as those of 1994 or 1995, based on the limited amount of data in the 1997 and 1998 surveys. Although there has been an overall reduction in abundance, the index of age 5+ abundance has increased by almost 80% from 1996 to 1998 as the 1992 and 1993 year-classes entered this age range. As noted previously, the number of fish aged 9+ is a relatively small portion of the abundance index, and was stable in 1996-97 before declining in 1998.

To allow comparisons over the longest possible period (1978-98), data from Div. 2J and 3K combined are used as an index of abundance. The converted data (Campelen equivalent, 2J3K only) are shown in Table 22.

The converted abundance indices for various age groupings are presented in Fig. 15. One readily apparent feature of 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-1980s, although there was a drop in 1990-91, and 1995 (Fig. 9). This figure also shows that the high points were in 1993, 1997, and 1998. On the other hand, the cohorts at ages 6-9 declined rapidly in the late-1980s and early-1990s, and ages 10+ declined since the early-1980s. Both these series have stabilized at very low levels in the mid-1990s, with a slight increase in the age 6-9 group in 1996 and 1997 before levelling off in 1998. Ages 10+ increased somewhat from very low levels in 1994-95, but remain far below levels observed in up to the mid-1980s. The increase in recruitment and decrease in older fish abundance 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. The reason for the increase in recruitment is not known , as it was generally believed that the stock had declined to lower levels in the 1990's, which is when the increase in young fish was indicated by the survey. Little can be said about SSB for this stock, as it is clear that few fish of spawning age, about 9+, are found in the surveys in many recent years. Thus it is not possible to determine a stock-recruit relationship for this stock with available data.

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

Although the converted data allow comparisons of year-class strengths throughout the time series, it should be noted that there is considerable uncertainty about the conversion factors at each end of the size range. Thus a cautious approach is warranted when comparing numbers at the youngest ages. Nonetheless, it is clear that the recent data show an increase in recruitment, and a decrease in the number of older fish in the index area (2J3K). The 1995 year-class was clearly a strong one, as it was in West Greenland also. In the 4 Campelen surveys (1995-98, Table 22), this year-class was the highest in the series of age 0, 1, and 2 (comparing across the 4 years). However, it was ranked 3 of 4 at age 4, similar in size to the 1993 year-class.

In general terms, the data indicate that estimates of recruiting year-classes at ages 2-4 exhibited an increasing trend since the early-1980s 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 (Table 22). Early indications also suggested that the 1992 and 1993 year-classes were above average, but the values for the 1992 year-class in the 1996 and 1997 surveys were average at best, and certainly below average in 1998. 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. In 1998, the 1993 year-class ranked 5th out of 21 observations at age 5, supporting previous observations on the strength of this year-class. Compared with the 1993 cohort, the 1994 year-class was somewhat more abundant at ages 2 and 3, and less abundant at age 4.

More confidence in the size of these recent year-classes should be developed over the next couple of years' surveys. Greenland halibut generally recruit to otter trawl fisheries around age 5, and usually dominate catches in this fishery at ages 6-9. If the year-classes of the early- to mid-1990s were indeed above average, then increased catch rates should be evident in the near future. However, as noted, interpretation of the survey indices for Div. 2J3K is made difficult by the suspected migration of older fish from this area. Figure 16 shows that there is no significant relationship ($r^2 = 0.04$) between abundance estimates of age 3 and 6 of the same cohort in the 2J3K data (Table 22). Year-classes in the late-1970s and early-1980s showed a much higher population size at age 6 than did year-classes of the late-1980s and early-1990s, despite having a generally lower abundance at age 3 in the same survey index. One explanation is migration of fish from the 2J3K area between ages 3 and 6 in the late-1980s, which is consistent with the escalation of the fishery at this time in Div. 3LMN. With the continued development of a time series of surveys covering Subarea 2 and Div. 3KLMNO, further analysis and evaluation of indices of abundance, biomass, and recruitment will be possible.

v) Mortality estimates

Figure 17 compares the total mortality estimates (Z-values) from 2J3K survey data at ages 7+/6+ against the trends in catch from the entire stock area (SA 2 + Div. 3KLMNO). The sharp increase in Z in Div. 2J3K in the early-1990s mirrors the increase in catch from the stock area, most of which came from the NRA in Div. 3LMN. Z-values decreased substantially after 1995, following reductions in the catch from the stock, but increased in 1998. 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, and again in 1998, which is substantially higher than the values calculated for the 1980s. Values calculated from the 1995-97 surveys are similar at around 0.3 to 0.6 to those observed in the mid-1980s, when catches were in the range of 18 000 to 28 000 tons.

Figure 18 shows the trends in Z's for ages 5 to 6, 7 to 8, and 9 to 10, from the same 2J3K survey index. These data all show increases in mortality from the mid-1980s to early-1990s, followed by a decline. The 1998 value for ages 5/6 were above average, but Z's for ages 7/8 and 9/10 were similar to those observed in 1985-87, above values of the early-1980s and below peak values of the early-1990s.

Results from Other Research Vessel Surveys

i) EU stratified-random surveys in Div. 3M.

These surveys indicated that the Greenland halibut biomass index on Flemish Cap in July in depths to 730 m, ranged from 4 300 tons to 8 600 tons in the 1988 to 1994 period. The estimated biomass has increased in each year since then, to reach a maximum value of 24 000 tons in 1998, which was slightly more than double the 1996 estimate (Vazquez, 1999). The age composition data indicated that the abundance in 1998 was dominated by ages 3-7, similar to the 1997 survey, indicating that an increase in recruitment is mainly responsible for the increase in biomass. The 1994 and 1995 year-classes had the highest values in the time series at ages 1, 2, and 3. Few fish older than age 10 were encountered in any of these surveys, probably because no depths greater than 730 m were fished.

ii) Spanish stratified-random surveys in Div. 3NO Regulatory Area.

During April-May of 1995 to 1999, stratified-random bottom trawl surveys were conducted by EU-Spain in the Regulatory Area of Div. 3NO to a depth of 730 m in 1995, 1 100 m in 1996, 1 275 m in 1997, and 1 460 m in 1998-99. The estimated biomass (comparable strata from 1996-99 only) was about 35 000 tons in 1996, 45 000 tons in 1997, 85 000 tons in 1998, and 75 000 tons in 1999 (Paz and Duran, 1999). The total biomass estimated in

1999, including the deep strata not surveyed previously, was 121 000 tons, compared to 148 000 tons in 1998. In 1999, the size composition was dominated by fish in the 32 to 41 cm range, with a peak at 34-35 cm. Few fish above 60 cm were caught, consistent with previous surveys.

STACFIS and Scientific Council Conclusions on Stock Status

The year-classes of 1990 and 1991 have recruited to fisheries in most areas, and CPUE indices have increased somewhat since 1994. The biomass of fish greater than 35 cm was below average in 1998, but still appears to be increasing slowly. The number of older, mature fish in the surveys remains low, and SSB estimates are still uncertain.

Surveys in 1997 confirmed the abundance of year-classes previously thought to be strong. In 1998, the 1995 year-class did not appear to be as strong as previously thought, based on the Canadian surveys. The 1996 and 1997 year-classes do not appear to be as strong as those of 1993-1995, based on data at ages 1 and 2 from some recent surveys. Some concerns remain about the ability to predict the strength of year-classes recruiting to the fishery from their size at younger ages in the surveys, given the short time series (1996-98) of data covering the entire stock. This also affects interpretation of mortality estimates from surveys.

There was a significant reduction in catches from a range of 50 000 to 70 000 tons in the early-1990s, to between 15 000 and 20 000 tons in 1995-98. Based on the available information STACFIS concluded that the biomass of fish greater than 35 cm continues to increase, although at a slow rate. This biomass index is still relatively low (about half of long-term average from surveys in Div. 2J3K), but should continue to increase in 1999-2000, if current levels of exploitation are maintained. The success of most fisheries in 1999-2000 will depend mainly on the 1992 and 1993 year-classes, based on typical age compositions observed in the past. The 1994 and 1995 year-classes should not have a major effect on most fisheries until 2001.

Scientific Council concluded that the biomass of fish greater than 35 cm should continue to increase in 1999-2000, if current levels of exploitation are maintained. The Council was unable to advise on a specific TAC for 2000. However, given the present level of fishable biomass, SC recommended that a catch in 2000 of about 30 000 tons is likely to allow the stock to continue to increase.

References

BLACK, G. A. 1993. ACON data visualization software : user manual - version 7.14. Unpublished manuscript. 179 p. (G. Black, Dept of Fish. and Oceans, P.O.Box 550, Halifax, Canada B3J 2S7).

BOWERING, W. R., W. B.BRODIE, M. J. MORGAN, D. POWER, and D .ORR. 1996. The status of the Greenland halibut resource in the management area of NAFO Subarea 2 and Divisions 3KLMNO. *NAFO SCR Doc*., No. 73, Serial No. N2748.

BRODIE, W. B., W. R.BOWERING, D.POWER, and D.ORRr. 1997. An assessment of the Greenland halibut in NAFO Subarea 2 and Divisions 3KLMNO. *NAFO SCR Doc*., No. 52, Serial No. N2886.

GAVARIS, S. 1980. Use of a multiplicative model to estimate catch rate and effort from commercial data. *Can. J. Fish. Aquat. Sci*., **37**: 2272-2275.

GUNDERSEN, A. C., and W. B. BRODIE. 1999. Length-weight relationships of Greenland halibut in NAFO Divisions 2GHJ and 3KLMNO, 1990-97. *NAFO SCR Doc*., No. 31, Serial No. N4087.

MCCALLUM, B. R., and S. J. WALSH. 1996. Groundfish survey trawls used at the Northwest Atlantic Fisheries Centre, 1971 to present. *NAFO SCR Doc*., No. 50, Serial No. N2726.

PAZ, X., and P. DURAN. 1999. Results from the 1999 Spanish bottom trawl survey in the NAFO Regulatory Area of Divisions 3NO. *NAFO SCR Doc*., No. 57, Serial No. N4116.

VAZQUEZ, A. 1999. Results from bottom trawl survey of of Flemish Cap in July 1998. *NAFO SCR Doc.*, No. 22, Serial No. N4073.

WARREN, W. G. 1996. Report on the comparative fishing trial between the *Gadus Atlantica* and *Teleost. NAFO SCR Doc.*, No. 28, Serial No. N2701.

Table 1A. Catches of Greenland halibut in the Northwest Atlantic by Division, 1977-97.

Year	Div. 2G	Div. 2H	Div. 2J	Div. 3K	Div. 3L	2+3KL	Footnote c	Div. 3M	Div. 3N	Div. 3O	Total reported	Total estimated [b]
1977	1778	1524	8237	13446	6956	31941		42	3	62	32048	
1978	1899	1207	3723	24107	7596	38532		528	6	4	39070	
1979	577	1623	3415	19843	8610	34068	*34069*	12	18	6	34104	
1980	36	444	1466	17923	12773	32642		141	75	9	32867	
1981	1799	2141	1358	16472	8912	30682		3	49	20	30754	
1982	370	8984	5931	6794	4135	26214		2	56	6	26278	
1983	111	5671	6028	11374	4655	27839		7	12	3	27861	
1984	214	4663	6368	8432	5132	24809		43	12	9	24873	26711
1985	193	2358	6724	5775	3560	18610		184	35	1	18830	20347
1986	455	1564	6823	4237	2799	15878		49	8	4	15939	17976
1987	2700	2631	12464	6860	6283	30938		307	173	0	31418	32442
1988	2068	2463	1971	6389	6195	19086		48	75	6	19215	19215
1989	837	1821	2952	7840	6046	19496	*20092*	491	38	9	20034	20034
1990	2809	1225	2845	4579	10779	22237		3040	1287	17	26581	47454
1991	3715	2252	3045	2229	15627	26868	*26780*	3426	4192	37	34523	65008
1992	1373	235	476	3883	29193	35160		14902	7132	425	57619	63193
1993	963	405	214	2398	25092	29072		8282	14693	644	52691	62455
1994[a]	1045	210	203	1032	18257	20747		12741	14138	3403	51029	51029
1995[a]	1109	412	375	641	5843	8380		3454	2948	490	15272	15272
1996[a]	598	621	1063	2544	4487	9313		783	934	367	11397	18840
1997[a]	365	619	1734	2658	9227	14603		1965	2958	332	19858	19858
1998[a]	362	351	1863	1400	10214	14190		3385	2112	259	19946	19946

1977-93 from NAFO Statistical Bulletins.
1994-98 are best estimates of NAFO Scientific Council.

a provisional
b In some years, estimates range above and below reported catch. Estimates from SCR 97/52.
c Slight discrepancies between totals by country in the 1960-90 summary Bulletin and the totals by Div. in the annual Bulletins.

Table 1B. Catches and TAC's of Greenland halibut in SA 2 + Div. 3KLMNO, 1960-98.
Includes estimated catches for years 1984 and later.
TAC's from 1995 onward set by NAFO Fisheries Commission.

Year	Catch(2+3KL)	2+3KLMNO	TAC
60	938	995	
61	741	786	
62	588	624	
63	1602	1621	
64	3928	4252	
65	9501	10069	
66	19244	19276	
67	25644	26525	
68	31986	32392	
69	36520	37241	
70	36402	36839	
71	24654	24834	
72	29822	30038	
73	28944	29291	
74	27123	27588	40000
75	28681	28814	40000
76	24599	24611	30000
77	31941	32048	30000
78	38532	39070	30000
79	34069	34104	30000
80	32642	32867	35000
81	30682	30754	55000
82	26214	26278	55000
83	27839	27861	55000
84	24809	26711	55000
85	18610	20347	75000
86	15878	17976	100000
87	30938	32442	100000
88	19086	19215	100000
89	19496	20034	100000
90	22237	47454	50000
91	26868	65008	50000
92	35160	63193	50000
93	29070	62455	50000
94		51029	25000
95		15272	27000
96		18840	27000
97		19858	27000
98		19946	27000
99			33000

Table 2. Greenland halibut landings (tons) by year and country for Subarea 2 and Divisions 3KL only, from 1960-93.
Does not include catches from Div. 3MNO. Data from 1960-90 from Stat Bull summary 1960-90 (1995), 1991-93 from annual Stat Bull.

	Year																	
	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Country																		
Canada	660	741	586	776	1757	8082	16209	16604	13322	11553	10706	9408	8952	6840	5745	7807	9306	17967
FRG	278	-	-	10	35	-	355	42	4	202	13	-	86	707	515	622	927	755
Poland	-	-	-	691	1834	939	1114	3296	5806	5406	8266	5234	6986	9060	7105	8447	5942	5998
Iceland	-	-	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-	-
Norway	-	-	-	-	-	1	-	-	-	36	647	-	1389	501	117	-	6	15
USSR(Russia)	-	-	-	125	302	479	242	4287	8732	9268	7384	9094	10183	8652	9650	9439	6799	4308
Romania	-	-	-	-	-	-	-	-	-	40	228	7	120	80	-	-	-	-
GDR	-	-	-	-	-	-	1324	1415	4122	10014	9158	909	402	1681	2701	2025	1512	1953
Denmark-F	-	-	-	-	-	-	-	-	-	-	-	-	970	950	4	-	1	350
Spain	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	1	-
UK	-	-	2	-	-	-	-	-	-	-	-	-	731	201	1112	62	-	476
Denmark-G	-	-	-	-	-	-	-	-	-	-	-	-	-	65	2		-	-
Portugal	-	-	-	-	-	-	-	-	-	-	-	-	-	207	161	231	73	119
France(M)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-
France(SPM)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	48	32	-
Japan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	938	741	588	1602	3928	9501	19244	25644	31986	36520	36402	24654	29822	28944	27123	28681	24599	31941

	Year															
	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Country																
Canada	24692	29940	31774	24125	19248	19031	17283	12277	8213	13450	8451	11976	9121	6418	6967	4452
FRG/ Deu	1022	15	55	-	57	2	9	482	15	1	43	5	-	8	45	-
Poland	5215	1813	203	1806	1111	5258	943	460	177	1001	904	360	-	-	-	-
Iceland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Norway	3	8	1	-	-	15	18	1	-	-	-	8	933	1531	-	-
USSR(Russia)	5632	1961	238	3325	1471	937	440	149	770	6716	1063	1058	1313	2753	22	-
Romania	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GDR	1636	178	316	1350	2487	2587	2498	1850	1868	3268	2246	1727	12	-	-	-
Denmark-F	268	-	-	-	-	-	-	193	451	2877	740	703	508	608	255	14
Spain	-	4	-	-	-	-	-	-	-	107	15	13	492	4787	23264	22682
UK	53	110	22	-	1	-	3	-	-	-	-	-	-	4	9	-
Denmark-G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Portugal	-	38	21	16	1818	-	2612	2940	3107	1390	4118	3168	8250	8768	2129	346
France(M)	-	-	-	-	-	-	-	-	-	-	-	596	-	-	-	-
France(SPM)	5	1	-	-	7	-	-	-	-	-	-	-	-	-		-
Japan	3	-	12	60	14	-	1003	258	1277	2128	1506	478	1608	1903	2469	1576
Other	-	1	-	-	-	9	-	-	-	-	-	-	-	-	-	2
Total	38532	34069	32642	30682	26214	27839	24809	18610	15878	30938	19086	20092	22237	26780	35160	29072

Table 3. Canadian catches of G.halibut in SA 2+3 in 1998.

	Gillnet+Longline								Otter Trawl				
	2G	2H	2J	3K	3L	3N	3O		2J	3K	3L	3O	**Total**
Jan							13						**13**
Feb						1	33						**34**
Mar							20						**20**
Apr							34			1	1		**36**
May	64		15	95	119				13	2		1	**309**
Jun	148		344	375	196				4	4			**1071**
Jul		48	473	577	50				2	14			**1164**
Aug	111	210	307	275	96								**999**
Sep	20	93	122	49	84								**368**
Oct	19		2	8	54								**83**
Nov					8								**8**
Dec													**0**
Total	**362**	**351**	**1263**	**1379**	**607**	**1**	**100**		**19**	**21**	**1**	**1**	**4105**
		Div. Totals							**Gear Totals**				
1998	**2G**	**2H**	**2J**	**3K**	**3L**	**3N**	**3O**		**GN**	**OT**	**LL**		
	362	**351**	**1282**	**1400**	**608**	**1**	**101**		**3956**	**42**	**107**		

Table 4. Catches of G.halibut in SA 2+3 in 1998 by country and Division.

	2G	2H	2J	3K	3L	3M	3N	3O	Total
Canada	362	351	1282	1400	608		1	101	**4105**
Japan					1927	123		3	**2053**
Portugal					1710	694	766	72	**3242**
Spain					3790	2062	1303	83	**7238**
Russia					1562	286	42		**1890**
France			581		617	220			**1418**
Total	**362**	**351**	**1863**	**1400**	**10214**	**3385**	**2112**	**259**	**19946**

Data are as reported by each contracting party.
No surveillance or observer estimates included.

Table 5 . ANOVA results and regression coefficients from a multiplicative model utilized to derive a standardized catch rate series for Greenland halibut in NAFO SA2 + Div. 3KLMNO. Effort is hours fished. (1998 based on preliminary data).

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.788

MULTIPLE R SQUARED..... 0.621

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARE	F-VALUE
INTERCEPT	1	6.56E2	6.56E2	
REGRESSION	59	1.91E2	3.24E0	17.550
Cntry|Gear|TC	18	4.10E1	2.28E0	12.342
Division	11	1.06E1	9.60E-1	5.198
Month	7	8.66E0	1.24E0	6.700
Year	23	2.71E1	1.18E0	6.375
RESIDUALS	633	1.17E2	1.85E-1	
TOTAL	693	9.64E2		

REGRESSION COEFFICIENTS

CATEGORY	CODE	VAR #	REG. COEF	STD. ERR	NO. OBS
Cntry|Gear|TC	3125	INT	-0.806	0.214	693
Division	9				
Month	22				
Year	75				
1	3123	1	-0.101	0.157	9
	3126	2	-0.017	0.167	8
	10127	3	1.064	0.186	8
	11125	4	0.258	0.134	16
	11126	5	-0.112	0.204	6
	11127	6	0.402	0.125	17
	14124	7	0.613	0.083	76
	14126	8	0.780	0.114	23
	14127	9	0.471	0.120	22
	15126	10	0.431	0.201	6
	16127	11	0.287	0.090	51
	19124	12	-0.283	0.098	102
	19125	13	0.003	0.107	75
	19126	14	0.312	0.121	28
	20125	15	0.420	0.187	7
	20126	16	-0.012	0.144	12
	20127	17	0.048	0.097	37
	27125	18	0.221	0.105	24
2	1	19	0.235	0.097	29
	2	20	0.105	0.093	33
	3	21	-0.072	0.087	42
	4	22	-0.049	0.083	48
	5	23	0.157	0.086	41
	6	24	0.142	0.082	46
	7	25	0.001	0.073	64
	8	26	0.103	0.067	81
	10	27	-0.295	0.071	72
	11	28	-0.063	0.069	81
	12	29	0.069	0.075	64
3	21	30	0.007	0.084	51
	23	31	0.013	0.065	108
	31	32	-0.248	0.079	108
	32	33	-0.067	0.090	143
	33	34	-0.428	0.109	77
	34	35	-0.137	0.115	58
	35	36	-0.168	0.145	21
4	76	37	-0.060	0.225	11
	77	38	0.115	0.216	19
	78	39	0.323	0.234	18
	79	40	0.118	0.229	10
	80	41	0.360	0.237	12
	81	42	0.171	0.225	15
	82	43	0.417	0.219	19
	83	44	0.376	0.212	24
	84	45	0.292	0.214	23
	85	46	0.094	0.215	21
	86	47	-0.205	0.214	24
	87	48	0.090	0.206	33
	88	49	-0.277	0.215	22
	89	50	-0.120	0.219	22
	90	51	-0.056	0.218	26
	91	52	-0.414	0.213	52
	92	53	-0.521	0.212	99
	93	54	-0.325	0.216	84
	94	55	-0.479	0.218	100
	95	56	-0.395	0.233	21
	96	57	-0.566	0.225	23
	97	58	-0.040	0.259	7
	98	59	-0.020	0.364	2

LEGEND FOR AVOVA RESULTS:

CGT CODES:

3123 = Can(NFLD)	TC 3				
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 6. Standardized catch rate index for Greenland halibut in NAFO SA2+ Div. 3KLMNO from a multiplicative model utilizing hours fished as a measure of effort. (1998 based on preliminary data).

PREDICTED CATCH RATE

	LN TRANSFORM		RETRANSFORMED			
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT
1975	-0.8059	0.0457	0.479	0.101	28814	60169
1976	-0.8657	0.0243	0.456	0.071	24611	53979
1977	-0.6910	0.0193	0.544	0.075	32048	58872
1978	-0.4834	0.0218	0.669	0.098	39070	58391
1979	-0.6877	0.0297	0.543	0.093	34104	62774
1980	-0.4458	0.0222	0.695	0.103	32867	47320
1981	-0.6351	0.0194	0.576	0.080	30754	53426
1982	-0.3886	0.0152	0.738	0.091	26278	35603
1983	-0.4295	0.0134	0.709	0.082	27861	39286
1984	-0.5141	0.0126	0.652	0.073	26711	40977
1985	-0.7122	0.0148	0.534	0.065	20347	38094
1986	-1.0112	0.0136	0.396	0.046	17976	45358
1987	-0.7161	0.0136	0.532	0.062	32442	60937
1988	-1.0825	0.0148	0.369	0.045	19215	52099
1989	-0.9255	0.0141	0.432	0.051	20034	46408
1990	-0.8619	0.0118	0.461	0.050	47454	103035
1991	-1.2198	0.0109	0.322	0.034	65008	201806
1992	-1.3266	0.0111	0.289	0.030	63193	218298
1993	-1.1312	0.0123	0.352	0.039	62455	177561
1994	-1.2844	0.0133	0.302	0.035	51029	169190
1995	-1.2007	0.0215	0.327	0.048	15272	46758
1996	-1.3723	0.0171	0.276	0.036	18840	68328
1997	-0.8464	0.0334	0.463	0.084	19858	42915
1998	-0.8259	0.1000	0.457	0.141	19946	43664

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.140

Table 7. Summary of sets in Canadian fall surveys in SA 2+3 in 1996 - 1998. Depth range is given in meters, numbers of sets appear in parentheses.

Year	Division	Ship			
		Teleost	*W.Templeman*	*A.Needler*	Total
1996	2G	127 - 1436 (47)			47
	2H	122 - 1415 (77)			77
	2J	126 - 1410 (117)			117
	3K	111 - 1368 (115)	126 - 472 (60)		175
	3L	805 - 1433 (31)	51 - 671 (180)		211
	3M	784 - 1400 (18)	127 - 707 (68)		86
	3N	390 - 1147 (13)		37 - 309 (69)	82
	3O	68 - 690 (26)	65 - 139 (19)	63 - 304 (16)	61
					856
1997	2G	201-1209 (69)			69
	2H	220-1382 (71)			71
	2J	123-1488 (117)			117
	3K	143-1431 (155)	117-421 (20)		175
	3L	161-1436 (71)	35-714 (134)		205
	3M	799-1379 (26)			26
	3N		41-769 (100)		100
	3O		62-611 (81)		81
					844
1998	2G	143-1488 (34)			34
	2H	98-1473 (83)			83
	2J	126-1398 (118)			118
	3K	122-1415 (154)	121-346 (17)		171
	3L	691-1437 (32)	34-675 (172)		204
	3M	768-1436 (26)			26
	3N	834-1447 (12)	37-1079 (107)		119
	3O		82-1076 (96)		96
					851

Table 8. Summary of survey results for G.halibut, fall 1998, Div. 2G.

				Number			Weight (kg)		
Depth(m)	Stratum	Units	Sets	Ave./Set	Total No.	Variance	Ave./set	Total Wgt.	Variance
<=200	909	381457	2	23.0	8,773,509	968	0.71	270,834	1.0
	910	321755	2	1.8	572,010	6	0.04	11,440	0.0
201 - 300	908	80473	2	42.0	3,379,876	2048	5.61	451,455	20
	911	95192	3	72.3	6,885,574	849	5.52	525,144	5
301 - 400	902	16507	2	12.5	206,342	13	4.05	66,855	3
	912	10042	2	24.0	241,007	162	8.68	87,114	28
401 - 500	903	11005	2	28.5	313,639	265	11.18	122,980	21
	913	8529	2	15.5	132,196	13	4.35	37,100	0.4
501 - 750	904	21047	2	27.5	578,788	113	11.83	248,879	7
	914	15544	2	36.5	567,371	613	13.55	210,627	104
751 -1000	905	22560	2	45.5	1,026,481	685	30.50	688,081	315
1001 -1250	906	31501	2	20.0	630,030	162	22.20	699,333	221
	916	20084	2	65.0	1,305,455	3200	54.35	1,091,561	2204
			27		24,612,277			4,511,402	

Table 9 . Summary of survey results for G.halibut, fall 1998, Div. 2H.

				Number			Weight (kg)		
Depth	Stratum	Units	Sets	Ave./Set	Total No.	Variance	Ave./set	Total Wgt.	Variance
<=200	930	141413	5	2.6	367,673	18	0.69	97,009	2
	954	133572	5	2.0	267,144	8	0.25	33,660	0.2
	956	144577	5	10.2	1,474,682	253	0.70	101,782	0.8
	957	188596	7	1.2	219,387	3	0.15	28,674	0.02
201 - 300	931	37967	2	27.1	1,029,324	730	4.49	170,534	21
	943	48697	2	36.5	1,777,427	61	9.08	441,922	12
	953	40030	2	74.0	2,962,240	2738	14.85	594,249	48
	955	53511	2	25.4	1,356,893	27	6.79	363,303	4
	958	40443	2	78.0	3,154,551	800	6.68	269,957	0.2
301 - 400	932	7566	2	106.3	804,083	6561	12.86	97,305	2
	944	118303	4	85.8	10,151,015	4500	19.24	2,275,845	228
	952	24348	2	613.5	14,937,690	535613	106.63	2,596,139	16390
	959	24486	2	90.0	2,203,729	1352	27.13	664,179	93
401 - 500	933	6878	2	68.9	474,204	33	15.19	104,451	4
	942	7566	2	57.0	431,254	1922	13.78	104,220	56
	945	63416	2	86.0	5,453,747	288	20.65	1,309,533	105
	948	33840	2	1678.8	56,809,886	766872	296.52	10,034,320	38352
	951	32189	2	218.5	7,033,361	24421	43.38	1,396,211	632
	960	14719	2	80.7	1,188,153	1537	25.46	374,681	236
501 - 750	934	10730	2	53.0	568,678	1458	15.52	166,484	40
	941	12243	2	38.0	465,232	512	14.55	178,135	108
	946	99182	4	324.5	32,181,656	36577	78.77	7,812,888	3276
	947	31226	2	492.5	15,378,986	78805	128.05	3,998,536	5284
	961	29025	2	26.0	754,660	98	9.30	269,936	30
751 -1000	935	13206	2	97.0	1,280,969	0	39.30	518,990	0.3
	940	13343	2	79.5	1,060,802	41	36.90	492,372	10
	962	33290	2	48.0	1,597,910	648	33.63	1,119,369	339
1001 -1250	936	10730	2	87.5	938,854	481	82.30	883,060	348
	963	36454	2	17.4	634,626	26	14.84	540,923	56
1251 -1500	937	12931	2	11.5	148,704	265	15.10	195,254	456
	938	26274	2	13.5	354,701	181	23.75	624,011	229
	964	47046	2	25.2	1,185,556	438	24.03	1,130,513	385
			82		168,647,773			38,988,448	

Table 10. Summary of survey results for G.halibut, fall 1998, Div. 2J.

				Number			Weight (kg)		
Depth	Stratum	Units	Sets	Ave./Set	Total No.	Variance	Ave./set	Total Wgt.	Variance
101 - 200	201	87076	2	8.5	740,147	41	1.05	91,430	0.8
	205	219272	6	18.7	4,105,266	197	2.29	502,256	4
	206	257239	7	16.9	4,336,318	450	1.36	349,478	2
	207	311438	9	2.3	726,689	6	0.24	74,399	0.05
	237	100832	3	2.0	201,665	7	0.19	18,822	0.1
	238	107023	3	5.6	602,497	53	0.74	78,800	0.8
201 - 300	202	85425	2	47.4	4,045,505	5	6.94	593,097	0.04
	209	93542	3	17.8	1,666,425	534	3.01	281,906	13
	210	142376	4	70.0	9,966,301	12039	7.35	1,046,462	107
	213	217759	6	74.5	16,223,060	5901	9.01	1,961,647	47
	214	184469	5	52.6	9,703,091	642	8.14	1,501,991	22
	215	179105	5	72.9	13,050,750	1681	10.55	1,888,956	6
	228	302084	8	113.6	34,324,311	5693	14.42	4,355,676	76
	234	72907	2	24.5	1,786,231	685	4.83	351,778	29
301 - 400	203	66992	2	417.5	27,969,264	125501	49.31	3,303,053	1053
	208	80886	2	396.0	32,030,824	200	80.10	6,478,962	91
	211	34528	2	113.8	3,930,418	3068	25.21	870,293	237
	216	49522	2	109.1	5,400,648	4222	32.93	1,630,649	402
	222	61902	2	29.1	1,802,050	2	6.17	381,904	0.2
	229	73733	2	189.5	13,972,355	27145	34.10	2,514,287	1021.5
401 - 500	204	39618	2	1290.0	51,106,695	860672	155.78	6,171,431	3815.0
	217	33152	2	58.4	1,935,721	552	18.74	621,420	0.9
	223	21735	2	79.1	1,719,452	6473	27.53	598,427	809
	227	82262	2	91.0	7,485,799	1352	21.80	1,793,301	41
	235	56950	2	241.5	13,753,495	19013	57.18	3,256,133	1339
	240	18296	2	36.7	671,948	254	13.73	251,191	55
501 - 750	212	76622	2	155.5	11,914,647	4705	57.10	4,375,089	198
	218	49797	3	64.9	3,231,279	3032	26.49	1,318,886	359
	224	31364	2	29.8	933,948	143	12.80	401,458	17
	230	25449	2	55.0	1,399,684	1250	21.48	546,513	193
	239	16507	2	2199.3	36,305,122	5548	294.81	4,866,499	981
751 -1000	219	38930	2	90.5	3,523,146	1985	57.78	2,249,168	1006
	231	25586	2	133.9	3,425,161	10522	63.90	1,634,969	1647
	236	26549	2	39.3	1,042,797	37	27.31	725,091	48
1001 -1250	220	41681	2	24.1	1,004,975	7	28.70	1,196,129	97
	225	26824	2	22.0	590,137	32	24.43	655,186	83
	232	31364	2	23.8	747,507	235	19.98	626,582	20
1251 -1500	221	45395	2	8.9	402,366	0.04	15.25	692,483	27
	226	27650	2	39.0	1,077,916	135	47.48	1,312,854	781
	233	32602	2	17.2	559,987	168	16.63	542,173	117
			118		329,415,600			62,110,827	

Table 11. Summary of survey results for G.halibut, fall 1998, Div. 3K.

				Number			Weight (kg)		
Depth	Stratum	Units	Sets	Ave./Set	Total No.	Variance	Ave./set	Total Wgt.	Variance
101 - 200	608	109774	3	1.0	109,774	3	0.33	36,591	0.3
	612	61215	2	0.0	-	0	0.00	-	0
	616	34390	2	3.5	120,366	5	0.66	22,526	0.8
	618	185295	4	0.8	138,971	0.9	0.08	14,824	0.0
	619	241145	6	0.0	-	0	0.00	-	0
201 - 300	609	47046	2	12.8	601,515	121	4.30	202,297	17
	611	78823	2	7.4	585,539	0.7	2.05	161,868	0
	615	34528	2	22.7	783,782	37	5.10	175,919	3
	620	350093	11	23.9	8,370,405	1662	3.35	1,171,220	29
	621	348992	11	42.3	14,777,540	3223	7.23	2,524,132	91
	624	152005	5	118.2	17,966,991	6414	11.52	1,751,706	41
	634	213907	7	56.0	11,978,819	775	6.18	1,321,337	6
	635	175253	5	66.2	11,601,737	638	7.22	1,266,026	0.9
	636	200151	6	27.5	5,504,163	224	5.27	1,053,797	12
	637	155719	5	68.8	10,713,477	2332	12.89	2,007,531	52
301 - 400	610	35216	2	208.5	7,342,461	2381	46.50	1,637,527	346
	614	36179	2	25.5	922,553	113	5.08	183,606	7
	617	81574	3	271.1	22,112,522	35460	47.38	3,864,631	2502
	623	67955	2	472.4	32,102,025	26727	90.76	6,167,272	1393
	625	122154	4	307.3	37,542,071	65544	32.28	3,943,716	502
	626	153105	5	423.2	64,794,243	51473	62.73	9,604,307	1485
	628	149254	5	86.8	12,955,228	870	20.88	3,116,087	39
	629	68093	2	543.5	37,008,403	225121	91.25	6,213,462	7589
	630	45670	2	268.0	12,239,635	18432	34.18	1,560,782	476
	633	284339	9	58.1	16,523,242	1606	14.69	4,178,200	45
	638	283238	9	137.1	38,835,115	15984	28.65	8,114,777	541
	639	201252	6	22.8	4,595,251	135	6.29	1,266,210	8
401 - 500	613	4127	2	133.0	548,869	2888	22.35	92,235	141
	622	95055	3	676.3	64,288,669	13920	109.03	10,364,132	384
	627	172639	5	916.2	158,172,001	294656	148.10	25,568,205	6639
	631	181718	6	360.0	65,418,550	15838	75.30	13,683,380	428
	640	9492	2	11.0	104,409	98	3.85	36,543	11
	645	29713	2	7.1	211,294	2	2.52	74,778	0
	650	18433	2	26.0	479,263	98	12.13	223,502	41
501 - 750	641	31639	2	28.5	901,713	685	11.68	369,386	132
	646	44707	2	7.5	335,305	0.5	3.53	157,593	2
	651	49384	2	54.5	2,691,451	221	20.58	1,016,085	0.3
751 -1000	642	57501	2	74.5	4,283,790	313	43.70	2,512,773	110
	647	49522	2	111.0	5,496,941	800	59.80	2,961,415	323
	652	70982	2	147.5	10,469,774	2965	68.23	4,842,714	530
1001 -1250	643	100832	3	84.0	8,469,911	3073	54.08	5,453,346	1054
	648	31364	2	75.5	2,367,977	685	53.78	1,686,595	59
	653	73045	2	83.0	6,062,730	722	50.10	3,659,551	99
1251 -1500	644	65204	2	41.5	2,705,964	61	43.63	2,844,523	261
	649	29163	2	7.0	204,141	0	9.68	282,152	17
	654	65892	2	92.7	6,109,107	598	72.96	4,807,745	45
			171		709,547,686			142,197,005	

Table 12. Summary of survey results for G.halibut, fall 1998, Div. 3L.

				Number			Weight (kg)		
Depth(m)	Stratum	Units	Sets	Ave./Set	Total No.	Variance	Ave./set	Total Wgt.	Variance
30 - 56	784	36866	2	0.0	-	0	0.00	-	0
57 - 92	350	284889	7	0.0	-	0	0.00	-	0
	363	244859	6	0.0	-	0	0.00	-	0
	371	154206	4	0.0	-	0	0.00	-	0
	372	338400	8	0.0	-	0	0.00	-	0
	384	154068	4	0.0	-	0	0.00	-	0
	785	63966	2	0.0	-	0	0.00	-	0
93 - 183	328	208955	5	0.2	41,791	0.2	0.00	836	0
	341	216521	5	3.0	649,563	32	0.85	183,610	2
	342	80473	2	1.0	80,473	2	0.20	16,095	0.1
	343	72220	2	1.8	132,403	1	0.62	44,696	0.2
	348	291630	6	2.1	622,143	19	0.61	176,922	1
	349	290804	7	2.4	685,928	3	0.87	251,661	0.4
	364	387510	9	3.3	1,286,915	66	1.07	413,583	6.7
	365	143201	3	2.7	381,870	8	0.98	139,860	1.5
	370	181581	4	14.4	2,622,831	460	4.79	870,578	46.5
	385	324094	8	3.3	1,057,807	11	1.03	333,772	1.2
	390	203728	5	9.3	1,892,406	93	3.07	625,264	7.8
	786	11555	2	1.0	11,555	2	0.38	4,333	0.3
	787	84325	2	0.0	-	0	0.00	-	0
	788	35903	2	2.5	89,759	13	0.85	30,518	1
	790	12243	2	1.5	18,364	5	0.53	6,428	0.6
	793	9904	2	1.0	9,904	2	0.45	4,457	0.4
	794	29713	2	0.5	14,857	0.5	0.14	4,011	0.04
	797	13481	2	2.5	33,702	4.5	1.06	14,222	1
	799	9904	2	0.9	9,354	0.01	0.39	3,830	0
184 - 274	344	217622	5	14.2	3,096,445	607	4.07	885,098	38
	347	135223	3	23.7	3,200,267	224	7.55	1,020,930	14
	366	191760	5	38.0	7,278,363	459	11.33	2,171,790	27
	369	132196	3	54.4	7,192,453	234	17.76	2,347,217	15
	386	135223	3	44.2	5,979,842	181	12.45	1,683,270	19
	389	112938	3	19.0	2,145,815	175	4.20	473,920	12
	391	38792	2	25.0	968,944	13	6.64	257,494	6
	795	22560	2	1.0	22,560	2	0.26	5,753	0.1
184 - 366	789	9904	2	2.5	24,761	13	0.98	9,657	2
	791	31226	2	12.0	374,716	242	4.85	151,448	41
	798	13756	2	34.0	467,708	2048	11.04	151,867	213
275 - 366	345	196987	5	112.9	22,231,444	5289	22.13	4,359,051	123
	346	118990	2	66.5	7,912,858	145	17.33	2,061,508	52
	368	45945	2	159.0	7,305,319	242	49.45	2,272,000	116
	387	98769	2	50.7	5,004,289	158	16.29	1,608,835	69
	388	49660	2	18.0	893,872	2	7.65	379,896	2
	392	19946	2	28.5	568,471	613	10.78	214,922	69
	796	24073	2	40.5	974,964	925	12.03	289,480	96
	800	11142	2	163.4	1,820,994	16718	46.41	517,129	1091
367 - 549	729	25586	2	18.0	460,555	338	9.48	242,431	93
	731	29713	2	17.4	516,679	141	10.26	304,725	33
	733	64379	2	93.1	5,990,785	202	39.38	2,534,907	78
	735	37417	2	128.5	4,808,035	13945	55.93	2,092,524	2596
	792	6878	2	270.5	1,860,514	18241	88.40	608,020	1458
550 - 731	730	23385	2	2.2	51,873	4	1.87	43,624	3
	732	31777	2	37.0	1,175,735	200	22.20	705,441	97
	734	31364	2	29.6	928,721	0.8	16.43	515,414	2
	736	24073	2	126.5	3,045,259	6613	53.38	1,284,907	1504
732 - 914	737	31226	2	298.0	9,305,457	123008	152.60	4,765,144	26221
	741	30676	2	333.8	10,239,251	17969	164.91	5,058,712	2205
	745	47871	2	41.5	1,986,657	613	27.13	1,298,508	461
	748	21872	2	12.1	263,855	0.5	7.59	165,951	6
915 -1097	738	30401	2	38.7	1,175,505	174	25.31	769,314	18
	742	28338	2	42.5	1,204,347	265	32.40	918,138	212
	746	53924	2	12.5	674,049	221	9.85	531,151	97
	749	17333	2	10.7	185,845	6	7.78	134,810	29
1098 -1280	739	34941	2	73.5	2,568,128	3121	51.05	1,783,713	1004
	743	29025	2	17.0	493,432	72	16.25	471,663	105
	747	99594	2	5.0	497,971	2	5.73	570,177	10
	750	76484	2	24.5	1,873,857	761	22.88	1,749,571	646
1281 -1463	740	36316	2	33.5	1,216,590	85	27.90	1,013,220	167
	744	38517	2	55.6	2,139,839	2592	45.33	1,746,109	1679
	751	31501	2	98.5	3,102,897	5305	83.58	2,632,737	2824
			204		142,871,547			55,926,849	

Table 13. Summary of survey results for G.halibut, fall 1998, Div. 3M

				Number			Weight (kg)		
Depth	Stratum	Units	Sets	Ave./Set	Total No.	Variance	Ave./set	Total Wgt.	Variance
732 - 914	528	72907	3	45.2	3,297,034	1276	31.50	2,296,690	558
	533	13481	2	8.9	119,981	0.02	5.75	77,448	2
915 -1097	529	67130	3	9.2	614,113	10	9.94	667,444	2
	532	32740	2	21.0	687,530	242	16.02	524,378	85
	534	66855	3	26.8	1,790,220	529	21.93	1,466,222	280
1098 -1280	530	155994	7	10.2	1,594,608	16	9.65	1,505,964	23
	535	12656	2	29.5	373,341	85	34.31	434,214	253
1281 -1463	531	27925	2	18.5	516,611	85	18.18	507,535	64
	536	15407	2	17.2	264,998	348	19.24	296,351	443
			26		9,258,435			7,776,247	

Table 14. Summary of survey results for G.halibut, fall 1998, Div. 3N.

				Number			Weight (kg)		
Depth	Stratum	Units	Sets	Ave./Set	Total No.	Variance	Ave./set	Total Wgt.	Variance
<=56	375	219135	10	0.0	-	0	0.00	-	0
	376	206204	10	0.0	-	0	0.00	-	0
57 - 92	360	411583	18	8.0	3,292,662	334	2.37	974,079	29
	361	254901	12	0.0	-	0	0.00	-	0
	362	346654	7	0.0	-	0	0.00	-	0
	373	346654	7	0.0	-	0	0.00	-	0
	374	128069	3	0.0	-	0	0.00	-	0
	383	92716	2	0.0	-	0	0.00	-	0
93 - 183	359	57913	2	32.0	1,853,223	722	12.50	723,915	99
	377	13756	2	5.5	75,659	5	2.20	30,263	1.0
	382	89002	2	2.5	222,505	13	1.25	111,253	3
184 - 274	358	30951	2	7.5	232,134	41	1.35	41,784	1
	378	19121	2	380.5	7,275,537	273061	114.95	2,197,958	25742
	381	25036	2	261.0	6,534,427	66248	64.80	1,622,340	5111
275 - 366	357	22560	2	2.0	45,120	8	0.30	6,768	0.2
	379	14581	2	11.6	168,497	40	2.15	31,310	3
	380	15957	2	142.8	2,278,317	20312	49.77	794,220	2188
367 - 549	723	21322	2	47.0	1,002,133	3362	15.76	335,999	313
	725	14444	2	16.0	231,103	0	4.48	64,637	0
	727	22010	2	84.9	1,868,385	5225	23.13	509,098	234
550 - 731	724	17058	2	83.3	1,420,517	0.2	21.91	373,750	7
	726	9904	2	269.1	2,665,384	61172	77.23	764,895	5591
	728	21460	2	96.0	2,060,115	10658	31.48	675,439	905
732 - 914	752	18433	2	54.0	995,392	1352	30.52	562,591	479
	756	14581	2	36.0	524,933	0	16.58	241,688	6
	760	21184	2	38.8	821,484	21	16.62	352,073	34
915 -1097	753	18983	2	18.5	351,193	13	11.78	223,530	41
	757	14031	2	81.4	1,142,766	146	45.82	642,864	33
	761	23523	2	40.7	957,907	275	29.23	687,458	26
1098 -1280	754	24761	2	96.6	2,392,187	14659	62.75	1,553,684	5767
	758	13619	2	39.3	535,663	44	32.55	443,246	60
1281 -1463	755	52961	2	16.4	870,915	67	12.42	657,894	69
	759	17470	2	10.5	183,438	25	9.45	165,094	35
			119		40,001,595			14,787,829	

Table 15. Summary of survey results for G.halibut, fall 1998, Div. 3O.

				Number			Weight (kg)		
Depth	Stratum	Units	Sets	Ave./Set	Total No.	Variance	Ave./set	Total Wgt.	Variance
57 - 92	330	287365	6	0.0	-	0	0.00	-	0
	331	62728	2	1.0	62,728	0	0.17	10,664	0
	338	261091	5	1.0	261,091	3	0.14	37,597	0.1
	340	236055	5	0.0	-	0	0.00	-	0
	351	346654	7	0.0	-	0	0.00	-	0
	352	354908	16	0.3	110,909	1	0.08	27,949	0.1
	353	176353	4	13.0	2,292,593	49	3.09	544,491	1
93 - 183	329	236743	5	0.2	47,349	0.2	0.05	11,364	0.01
	332	144026	3	4.3	624,115	8	0.52	74,414	0.1
	337	130408	3	1.3	169,047	2	0.16	21,203	0.02
	339	80473	2	1.7	137,954	6	0.10	8,277	0.02
	354	65204	2	1.0	65,204	2	0.23	14,671	0.1
184 - 274	333	20221	2	0.0	-	0	0.00	-	0
	336	16645	2	1.8	30,516	1	0.28	4,735	0.1
	355	14169	2	1.5	21,253	0.5	0.19	2,621	0.01
275 - 366	334	13206	2	2.5	33,015	13	0.45	5,943	0.4
	335	7979	2	0.0	-	0	0.00	-	0
	356	8391	2	1.0	8,391	2	1.00	8,391	2
367 - 549	717	22835	2	2.5	57,088	13	1.18	26,831	3
	719	10455	2	3.0	31,364	2	1.38	14,375	0.1
	721	10455	2	12.0	125,456	200	4.53	47,307	30
550 - 731	718	18433	2	30.0	552,996	578	8.55	157,604	33
	720	14444	2	19.0	274,434	392	6.40	92,441	38
	722	12793	2	30.1	385,217	1163	9.71	124,200	108
732 - 914	764	14444	2	121.9	1,760,094	789	42.90	619,696	183
	768	13619	2	220.1	2,996,837	1464	78.55	1,069,699	15
	772	18571	2	200.0	3,714,149	968	71.81	1,333,565	66
915 -1097	765	17058	2	12.3	210,377	6	10.25	174,840	0.6
	769	18983	2	45.0	854,254	50	21.55	409,093	21
	773	17608	2	44.2	777,679	1701	31.83	560,369	1188
			96		15,604,108			5,402,340	

Table 16. Estimated biomass (tons) per stratum of G. halibut from the autumn survey of the Teleost in fall-winter, 1995/96, fall 1996, fall 1997, and fall 1998 in Div. 2J. All surveys done with Campelen trawl. Based on the latest stratification update.

Depth Range (m)	Stratum	Area (sq. nm)	Trawlable Units (000)	1995/96	1996	1997	1998
101-200	201	633	87.1	-	82	26	91
	205	1594	219.3	-	514	35	502
	206	1870	257.2	399	1120	403	349
	207	2264	311.4	1	56	51	74
	237	733	100.8	0	1	4	19
	238	778	107.0	-	15	0	79
Total				*400*	*1788*	*519*	*1115*
201-300	202	621	85.4	95	89	157	593
	209	680	93.5	360	1059	424	282
	210	1035	142.4	2708	3904	893	1046
	213	1583	217.8	236	1338	1145	1962
	214	1341	184.5	327	4056	1258	1502
	215	1302	179.1	1370	1247	1448	1889
	228	2196	302.1	2219	5478	3666	4356
	234	530	72.9	-	163	753	352
Total				*7315*	*17334*	*9744*	*11982*
301-400	203	487	67.0	387	946	2233	3303
	208	588	80.9	4799	3707	12593	6479
	211	251	34.5	1400	1343	1875	870
	216	360	49.5	64	506	1089	1631
	222	450	61.9	122	1672	930	382
	229	536	73.7	1799	3900	1940	2514
Total				*8571*	*12074*	*20661*	*15179*
401-500	204	288	39.6	1437	3823	7941	6171
	217	241	33.2	131	932	676	621
	223	158	21.7	162	438	425	598
	227	598	82.3	909	5850	9244	1793
	235	414	57.0	3895	4373	8365	3256
	240	133	18.3	631	537	501	251
Total				*7165*	*15953*	*27152*	*12692*
501-750	212	557	76.6	5499	4940	10735	4375
	218	362	49.8	693	1783	1207	1319
	224	228	31.4	214	702	625	401
	230	185	25.4	652	1340	1589	547
	239	120	16.5	1675	2586	2725	4866
Total				*8733*	*11351*	*16881*	*11508*
751-1000	219	283	38.9	2021	405	1727	2249
	231	186	25.6	376	1013	651	1635
	236	193	26.5	1007	698	381	725
Total				*3404*	*2116*	*2758*	*4609*
1001-1250	220	303	41.7	-	1296	503	1196
	225	195	26.8	-	834	693	655
	232	228	31.4	-	717	935	627
Total				-	*2847*	*2132*	*2478*
1251-1500	221	330	45.4	-	131	1246	692
	226	201	27.6	-	277	407	1313
	233	237	32.6	-	889	596	542
Total				-	*1297*	*2249*	*2548*
Biomass (t)				**35591**	**64760**	**82095**	**62111**
95% Lower				**28260**	**48126**	**-24180**	**52887**
95% Upper				**42922**	**86821**	**188371**	**71335**

Table 17. Estimated biomass (tons) per stratum of G. halibut from the autumn survey of the W.Templeman and Teleost in fall-winter, 1995/96, fall 1996, fall 1997, and fall 1998 in Div. 3K. All surveys done with Campelen trawl. Based on the latest stratification update.

Depth Range(m)	Stratum	Area (sq. nm.)	Trawlable Units (000)	1995/96	1996	1997	1998
101-200	608	798	109.8	-	0	44	37
	612	445	61.2	-	0	135	0
	616	250	34.4	-	0	4	23
	618	1347	185.3	286	19	11	15
	619	1753	241.1	18	29	57	0
Total				*304*	*48*	*250*	*74*
201-300	609	342	47.0	-	117	386	202
	611	600	78.8	-	113	265	162
	615	251	34.5	-	39	67	176
	620	2545	350.1	790	4213	1275	1171
	621	2736	349.0	1067	3967	1320	2524
	624	1105	152.0	507	2516	1610	1752
	634	1555	213.9	727	2370	2144	1321
	635	1274	175.3	128	1344	1545	1266
	636	1455	200.2	1393	2336	1171	1054
	637	1132	155.7	179	1722	869	2008
Total				*4791*	*18737*	*10651*	*11636*
301-400	610	256	35.2	-	344	630	1638
	614	263	36.2	-	154	399	184
	617	593	81.6	3844	2464	4941	3865
	623	494	68.0	307	3588	1938	6167
	625	888	122.2	1437	4381	3075	3944
	626	1113	153.1	1962	5453	10283	9604
	628	1085	149.3	529	1799	2685	3116
	629	495	68.1	2682	6569	2179	6213
	630	332	45.7	858	4800	3261	1561
	633	2067	284.3	4649	3487	6739	4178
	638	2059	283.2	1750	3952	7031	8115
	639	1463	201.3	1520	1381	1556	1266
Total				*19538*	*38372*	*44717*	*49851*
401-500	613	30	4.1	-	51	192	92
	622	691	95.1	2638	6896	11901	10364
	627	1255	172.6	18946	15576	22176	25568
	631	1321	181.7	10094	25499	14500	13683
	640	69	9.5	179	105	59	37
	645	216	29.7	357	192	162	75
	650	134	18.4	252	147	242	224
Total				*32466*	*48466*	*49232*	*50043*
501-750	641	230	31.6	227	394	197	369
	646	325	44.7	327	564	1180	158
	651	359	49.4	1222	321	1361	1016
Total				*1776*	*1279*	*2739*	*1543*
751-1000	642	418	57.5	1741	760	2036	2513
	647	360	49.5	1087	749	2025	2961
	652	516	71.0	2365	3585	2575	4843
Total				*5193*	*5094*	*6636*	*10317*
1001-1250	643	733	100.8	1487	2121	6830	5453
	648	228	31.4	-	1641	1118	1687
	653	531	73.0	1583	2306	1643	3660
Total				*3070*	*6068*	*9590*	*10799*
1251-1500	644	474	65.2	688	870	2036	2845
	649	212	29.2	-	387	1083	282
	654	479	65.9	1375	1016	3612	4808
Total				*2063*	*2273*	*6731*	*7934*
Biomass (t)				**69206**	**120337**	**130546**	**142197**
95% Lower				**55864**	**106961**	**112147**	**120983**
95% Upper				**82547**	**150486**	**148945**	**163411**

Table 18. Estimated biomass (tons) per stratum of G. halibut from the autumn survey of the W.Templeman and Teleost in fall-winter, 1995/96, fall 1996, fall 1997, and fall 1998, in Div. 3L. All surveys done with Campelen trawl. Based on the latest stratification update.

Depth Range (m)	Stratum	Area (sq. nm.)	Trawlable Units (000)	1995/96	1996	1997	1998
30-56	784	268	36.9	-	-	0	0
Total						*0*	*0*
57-91	350	2071	284.9	1	0	0	0
	363	1780	244.9	0	0	0	0
	371	1121	154.2	0	3	0	0
	372	2460	338.4	0	0	0.4	0
	384	1120	154.1	1	0	0	0
	785	465	64.0	-	0	0	0
Total				*2*	*3*	*0.4*	*0*
93-183	328	1519	209.0	-	1	6	1
	341	1574	216.5	-	2	249	184
	342	585	80.5	-	1	84	16
	343	525	72.2	-	0	34	45
	348	2120	291.6	0	2	129	177
	349	2114	290.8	4	2	60	252
	364	2817	387.5	1	0	103	414
	365	1041	143.2	17	0	169	140
	370	1320	181.6	1	14	48	871
	385	2356	324.1	73	64	502	334
	390	1481	203.7	43	67	200	625
	786	84	11.6	-	67	2	4
	787	613	84.3	-	1	86	0
	788	252	35.9	-	0	45	31
	790	89	12.2	-	0	6	6
	793	72	9.9	-	0	4	4
	794	216	29.7	-	0	15	4
	797	98	13.5	-	0	3	14
	799	72	9.9	-	0	0	4
Total				*139*	*221*	*1745*	*3125*
184-274	344	1582	217.6	16	11	96	885
	347	983	135.2	2	0	37	1021
	366	1394	191.8	204	338	878	2172
	369	961	132.2	72	108	888	2347
	386	983	135.2	126	447	1010	1683
	389	821	112.9	71	900	875	474
	391	282	38.8	177	344	892	257
	795	164	22.6	-	5	35	6
Total				*668*	*2153*	*4711*	*8845*
184-366	789	81	9.9	-	0	14	10
	791	308	31.2	-	66	193	151
	798	100	13.8	-	76	108	152
Total					*142*	*315*	*313*
275-366	345	1432	197.0	937	3747	1775	4359
	346	865	119.0	2237	5483	2378	2062
	368	334	45.9	385	690	338	2272
	387	718	98.8	1546	1764	1613	1609
	388	361	49.7	310	711	814	380
	392	145	19.9	69	500	618	215
	796	175	24.1	-	37	355	289
	800	81	11.1	-	-	313	517
Total				*5484*	*6042*	*8203*	*11703*
367-549	729	186	25.6	215	648	496	242
	731	216	29.7	242	-	713	305
	733	468	64.4	501	706	752	2535
	735	272	37.4	526	1111	938	2093
	792	50	6.9	-	186	349	608
Total				*1484*	*2651*	*3247*	*5783*
550-731	730	170	23.4	140	37	330	44
	732	231	31.8	83	463	590	705
	734	228	31.4	280	642	604	515
	736	175	24.1	271	1116	951	1285
Total				*774*	*2258*	*2476*	*2549*
732-914	737	227	31.2	1244	2198	1981	4765
	741	223	30.7	-	867	3224	5059
	745	348	47.9	-	1075	1722	1299
	748	159	21.9	-	429	287	166
Total				*1244*	*4569*	*7214*	*11288*
915-1097	738	221	30.4	1490	1906	1439	769
	742	206	28.3	-	567	901	918
	746	392	53.9	-	783	992	531
	749	126	17.3	-	125	377	135
Total				*1490*	*3381*	*3710*	*2353*
1098-1280	739	254	34.9	-	1227	2248	1784
	743	211	29.0	-	931	2820	472
	747	724	99.6	-	438	1446	570
	750	556	76.5	-	586	3947	1750
Total				-	*3182*	*10460*	*4575*
1281-1463	740	264	36.3	-	981	2604	1013
	744	280	38.5	-	2961	1101	1746
	751	229	31.5	-	1207	2810	2633
Total				-	*5149*	*6515*	*5392*
Biomass (tons)				**11285**	**29675**	**48596**	**55927**
95% Lower				**8012**	**30961**	**-10736**	**39718**
95% Upper				**14552**	**46170**	**107928**	**72136**

Table 19. Abundance and biomass estimates of G.halibut, by Division, from fall 1998 survey.
Upper and lower indicate approximate 95% confidence limits.

	Total	Upper	Lower		Mean	Upper	Lower
2G							
Abundance	24,612,277	138,948,636	-89,724,083	No/Tow	23.76	134.16	-86.63
Biomass (kg)	4,511,402	8,364,553	658,252	Kg/Tow	4.36	8.08	0.64
2H							
Abundance	168,647,773	287,411,568	49,883,979	No/Tow	109.67	486.90	32.44
Biomass (kg)	38,988,448	66,113,986	11,862,911	Kg/Tow	25.35	42.99	7.71
2J							
Abundance	329,415,600	443,964,387	214,866,812	No/Tow	94.76	127.71	61.81
Biomass (kg)	62,110,827	71,334,647	52,887,006	Kg/Tow	17.87	20.52	15.21
3K							
Abundance	709,547,686	838,415,727	580,679,645	No/Tow	139.22	164.50	113.93
Biomass (kg)	142,197,005	163,410,968	120,983,042	Kg/Tow	27.90	32.06	23.74
3L							
Abundance	142,871,547	175,010,559	110,732,535	No/Tow	22.41	27.46	17.37
Biomass (kg)	55,926,849	72,135,874	39,717,824	Kg/Tow	8.77	11.32	6.23
3M							
Abundance	9,258,435	15,066,024	3,450,847	No/Tow	19.91	32.39	7.42
Biomass (kg)	7,776,247	11,322,832	4,229,663	Kg/Tow	16.72	24.35	9.09
3N							
Abundance	40,001,595	80,845,209	-842,019	No/Tow	15.26	30.85	-0.32
Biomass (kg)	14,787,829	24,664,228	4,911,430	Kg/Tow	5.64	9.41	1.87
3O							
Abundance	15,604,108	18,270,563	12,937,654	No/Tow	5.88	6.89	4.88
Biomass (kg)	5,402,340	11,765,376	-960,696	Kg/Tow	2.04	4.44	-0.36
2+3KLMNO							
Abundance	1,438,299,326	1,598,080,158	1,278,518,494	No/Tow	61.83	68.70	54.96
Biomass (kg)	331,245,641	359,575,082	302,916,200	Kg/Tow	14.24	15.46	13.02

Table 20. Biomass estimate (000 t), by division, from fall surveys in 1995-98.

	Division									
Year	2G	2H	2J	3K	3L	*2J3KL*	3M	3N	3O	**TOTAL**
1995			35.6	69.2	11.3	*116.1*				
1996	22.3	26.1	64.8	120.3	36.6	*221.7*	10.2	5.1	1.0	**286.4**
1997	15.5	38.6	82.1	130.5	48.6	*261.2*	7.0	6.4	2.1	**330.8**
1998	4.5	39.0	62.1	142.2	55.9	*260.2*	7.8	14.8	5.4	**331.2**

Table 21 . Abundance at age, by division, from 1996 -1998 fall surveys. Values are in millions of fish.

1996

Age	2G	2H	2J	3K	3L	3M	3N	3O	Total
0	1.732	0.582	36.508	5.488	0.720	0.039	0.607	1.887	**47.56**
1	38.280	92.106	349.250	444.197	29.710	0.396	22.262	1.362	**977.56**
2	18.467	69.304	155.915	296.627	32.406	1.624	14.040	3.176	**591.56**
3	11.254	25.096	64.009	203.474	35.042	1.746	6.129	1.581	**348.33**
4	9.240	12.639	34.589	61.979	17.723	1.427	3.071	0.749	**141.42**
5	8.623	8.840	22.836	32.775	14.735	2.683	1.949	0.383	**92.82**
6	5.087	4.712	9.883	12.422	9.848	3.913	0.750	0.119	**46.73**
7	2.079	1.872	2.966	4.456	4.825	2.515	0.096	0.012	**18.82**
8	1.107	0.853	0.782	1.138	1.451	0.826	0.007	0.002	**6.17**
9	1.093	0.635	0.733	0.408	0.671	0.402	0.007	0.007	**3.96**
10	0.210	0.156	0.138	0.239	0.221	0.050	0.000	0.004	**1.02**
11	0.251	0.048	0.072	0.106	0.071	0.031	0.000	0.000	**0.58**
12	0.119	0.049	0.066	0.049	0.050	0.046	0.000	0.000	**0.38**
13	0.000	0.027	0.085	0.033	0.028	0.085	0.000	0.000	**0.26**
14	0.000	0.003	0.024	0.018	0.006	0.038	0.000	0.000	**0.09**
15	0.000	0.000	0.000	0.010	0.015	0.011	0.000	0.000	**0.04**
Unk	0.159	0.081	0.134	0.000	0.037	0.000	0.041	0.021	**0.47**
Total	**97.70**	**217.00**	**677.99**	**1063.42**	**147.56**	**15.83**	**48.96**	**9.30**	**2277.77**
5+	**18.57**	**17.20**	**37.59**	**51.65**	**31.92**	**10.60**	**2.81**	**0.53**	**170.86**
9+	**1.67**	**0.92**	**1.12**	**0.86**	**1.06**	**0.66**	**0.01**	**0.01**	**6.32**

1997

Age	2G	2H	2J	3K	3L	3M	3N	3O	Total
0	0.821	5.799	11.897	7.649	2.152	0.000	0.111	0.067	**28.50**
1	8.348	34.687	55.308	166.704	11.176	0.000	0.801	2.139	**279.16**
2	9.751	59.277	172.556	314.015	24.000	0.001	10.261	4.081	**593.94**
3	12.125	60.661	129.939	268.426	31.299	0.018	12.099	4.068	**518.64**
4	15.335	45.591	84.511	107.534	29.139	0.070	6.596	2.835	**291.61**
5	7.424	16.822	33.570	56.239	27.814	0.867	3.529	0.939	**147.20**
6	4.468	9.271	19.248	20.864	14.972	2.423	1.459	0.224	**72.93**
7	2.684	4.709	7.411	9.910	8.215	2.733	0.491	0.036	**36.19**
8	0.927	1.449	1.616	4.042	3.484	1.190	0.103	0.059	**12.87**
9	0.263	0.448	0.598	0.949	0.914	0.292	0.013	0.017	**3.49**
10	0.217	0.132	0.242	0.251	0.245	0.051	0.003	0.000	**1.14**
11	0.130	0.088	0.208	0.072	0.165	0.067	0.004	0.009	**0.74**
12	0.012	0.035	0.100	0.051	0.148	0.038	0.003	0.001	**0.39**
13	0.012	0.040	0.074	0.026	0.103	0.065	0.006	0.000	**0.33**
14	0.000	0.058	0.028	0.026	0.117	0.020	0.000	0.000	**0.25**
15	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	**0.01**
Total	**62.52**	**239.07**	**517.31**	**956.76**	**153.94**	**7.84**	**35.48**	**14.48**	**1987.39**
5+	**16.14**	**33.06**	**63.09**	**92.43**	**56.18**	**7.75**	**5.61**	**1.28**	**275.54**
9+	**0.63**	**0.81**	**1.25**	**1.38**	**1.69**	**0.53**	**0.03**	**0.03**	**6.35**

1998

Age	2G	2H	2J	3K	3L	3M	3N	3O	Total
0	0.080	0.940	9.590	3.290	0.460	0.020	0.080	0.080	**14.54**
1	13.820	13.890	55.450	144.160	4.190	0.000	1.620	0.270	**233.40**
2	2.830	30.720	65.690	151.290	16.140	0.010	3.190	0.980	**270.85**
3	1.600	56.780	94.570	171.160	14.190	0.020	7.120	2.240	**347.68**
4	1.770	35.480	58.930	129.670	29.060	0.280	8.630	4.020	**267.84**
5	1.530	16.330	26.160	65.950	43.930	1.600	9.500	4.720	**169.72**
6	1.220	8.280	10.920	27.430	22.660	3.040	5.800	2.120	**81.47**
7	0.940	4.110	5.320	11.930	8.510	2.810	2.850	0.720	**37.19**
8	0.580	1.630	1.680	3.090	2.520	0.900	0.730	0.280	**11.41**
9	0.040	0.310	0.390	0.710	0.740	0.240	0.220	0.070	**2.72**
10	0.040	0.080	0.170	0.410	0.190	0.130	0.090	0.040	**1.15**
11	0.010	0.040	0.140	0.100	0.120	0.100	0.070	0.050	**0.63**
12	0.000	0.000	0.090	0.060	0.080	0.100	0.010	0.010	**0.35**
13	0.010	0.030	0.070	0.070	0.010	0.020	0.010	0.000	**0.22**
14	0.010	0.000	0.020	0.000	0.060	0.020	0.020	0.000	**0.13**
15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.00**
16	0.000	0.000	0.000	0.020	0.000	0.000	0.000	0.000	**0.02**
Unk	0.120	0.000	0.250	0.290	0.000	0.000	0.050	0.000	**0.71**
Total	**24.60**	**168.62**	**329.44**	**709.63**	**142.86**	**9.29**	**39.99**	**15.60**	**1440.03**
5+	**4.38**	**30.81**	**44.96**	**109.77**	**78.82**	**8.96**	**19.30**	**8.01**	**305.01**
9+	**0.11**	**0.46**	**0.88**	**1.37**	**1.20**	**0.61**	**0.42**	**0.17**	**5.22**

Table 22. Abundance (000s) of G. halibut at age from Canadian fall surveys in Div. 2J3K combined during 1978-98. Data prior to 1995 are in Campelen equivalents. Age 0 not estimated prior to 1995.

AGE	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
0																		80159	41996	19546	12880
1	67133	76275	47941	141166	33748	12131	31845	192902	125257	36234	74055	52954	9858	84583	52907	62241	359982	342056	793447	222012	199610
2	315362	128771	46187	158149	39589	34727	50917	113558	106161	81046	71555	95755	39744	59211	188121	281182	189873	397121	452542	486571	216980
3	243378	95883	43767	109462	88918	71282	70143	65428	112555	212676	109246	174201	70539	44644	148380	497522	171493	122856	267483	398365	265730
4	146864	50861	39304	41433	75651	75711	74837	54235	104606	99109	114836	174689	177413	103158	95263	182333	112859	39605	96568	192045	188600
5	90817	53099	49738	47202	57104	71101	103171	66317	72301	75271	119818	108472	115858	65701	38552	42962	51870	50370	55611	89809	92110
6	68495	50976	52627	49991	41105	51583	61334	69541	81840	53188	59218	87210	70699	40331	22088	13677	9898	15863	22305	40112	38350
7	40908	24408	32283	35482	43097	50698	42301	42805	71749	47138	41431	38560	36649	12485	10472	5905	4478	3513	7422	17321	17250
8	19170	9977	11102	15613	41244	39418	27028	17028	22142	25791	12233	9604	6200	2383	1067	1967	1347	920	1920	5658	4770
9	9940	4777	4960	7017	16566	15223	13058	7982	6546	9434	3134	2847	1500	635	140	232	172	266	1141	1547	1100
10	7366	4572	3891	4213	6765	4414	6306	5296	2380	2833	1105	747	746	310	89	32	69	104	377	493	580
11	6469	3000	4461	3349	4129	3180	2602	2257	1856	1481	781	568	640	181	12	22	13	49	178	280	240
12	4117	2638	2882	1559	2714	2291	1812	1997	1668	1454	463	151	389	104	0	94	17	0	115	151	150
13	2683	2193	1874	857	1929	1664	1480	874	879	754	361	35	223	22	0	41	9	0	118	100	140
14	992	1079	1070	446	1975	1109	1285	1002	542	583	327	81	155	8	15	24	0	0	42	54	20
15	560	699	411	268	1257	495	677	606	555	385	236	103	90	0	0	0	0	0	10	0	0
16	365	624	231	43	589	131	461	302	318	204	149	31	21	4	0	0	0	0	0	0	20
17	213	234	71	0	97	0	226	311	96	150	70	0	0	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	0	0
19	0	65	0	0	0	0	0	18	0	0	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	0	0
Unk	3706	1122	4205	35062	2831	0	0	0	4374	0	1647	4744	0	0	2484	758	0	0	134	0	540
Ages 0+																		1052882	1741409	1474064	1039070
Ages 1+	1028562	511381	347004	651312	459351	435238	489484	642558	715824	647746	610710	750752	530726	413761	559589	1088993	902080	972723	1699413	1454518	1026190
Ages 1-2	382496	205046	94128	299315	73337	46859	82762	306460	231418	117280	145609	148709	49602	143794	241027	343422	549855	739177	1245989	708583	416590
Ages 3-5	481058	199843	132809	198097	221673	218093	248151	185979	289461	387056	343900	457363	363811	213503	282195	722818	336222	212831	419662	680219	546440
Ages 6-9	138513	90137	100972	108103	142012	156921	143721	137355	182277	135551	116016	138221	115048	55833	33767	21782	15895	20562	32788	64638	61470
Ages 10+	26495	16355	19096	45797	22329	13364	14849	12763	12668	7859	5185	6459	2264	630	2600	972	108	153	974	1078	1690

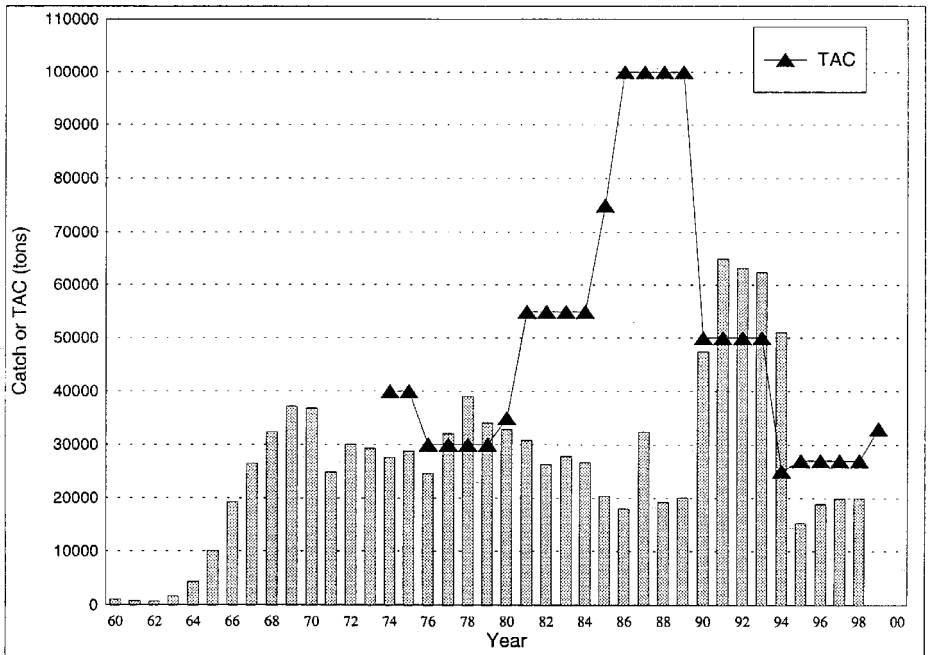

Fig.1 Catches and TAC's of Greenland halibut in Subarea 2 and Divisions 3KLMNO.

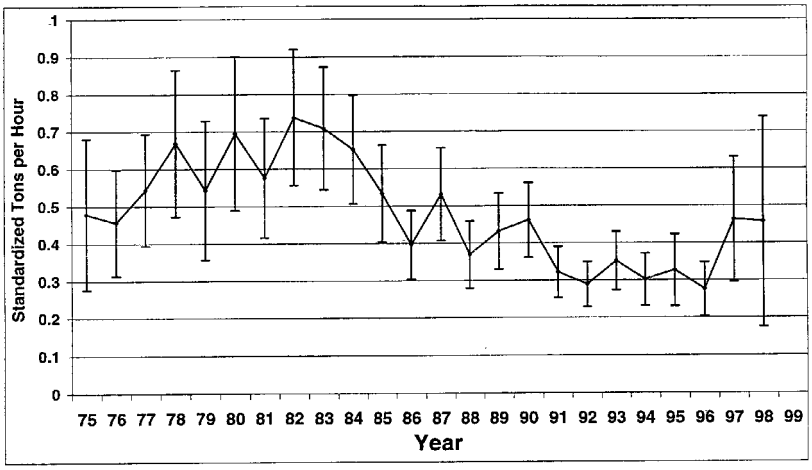

Fig. 2. Standardized CPUE (mean +/- 2 standard errors) for Greenland halibut in SA2 + Div. 3KLMNO from 1975-1998.

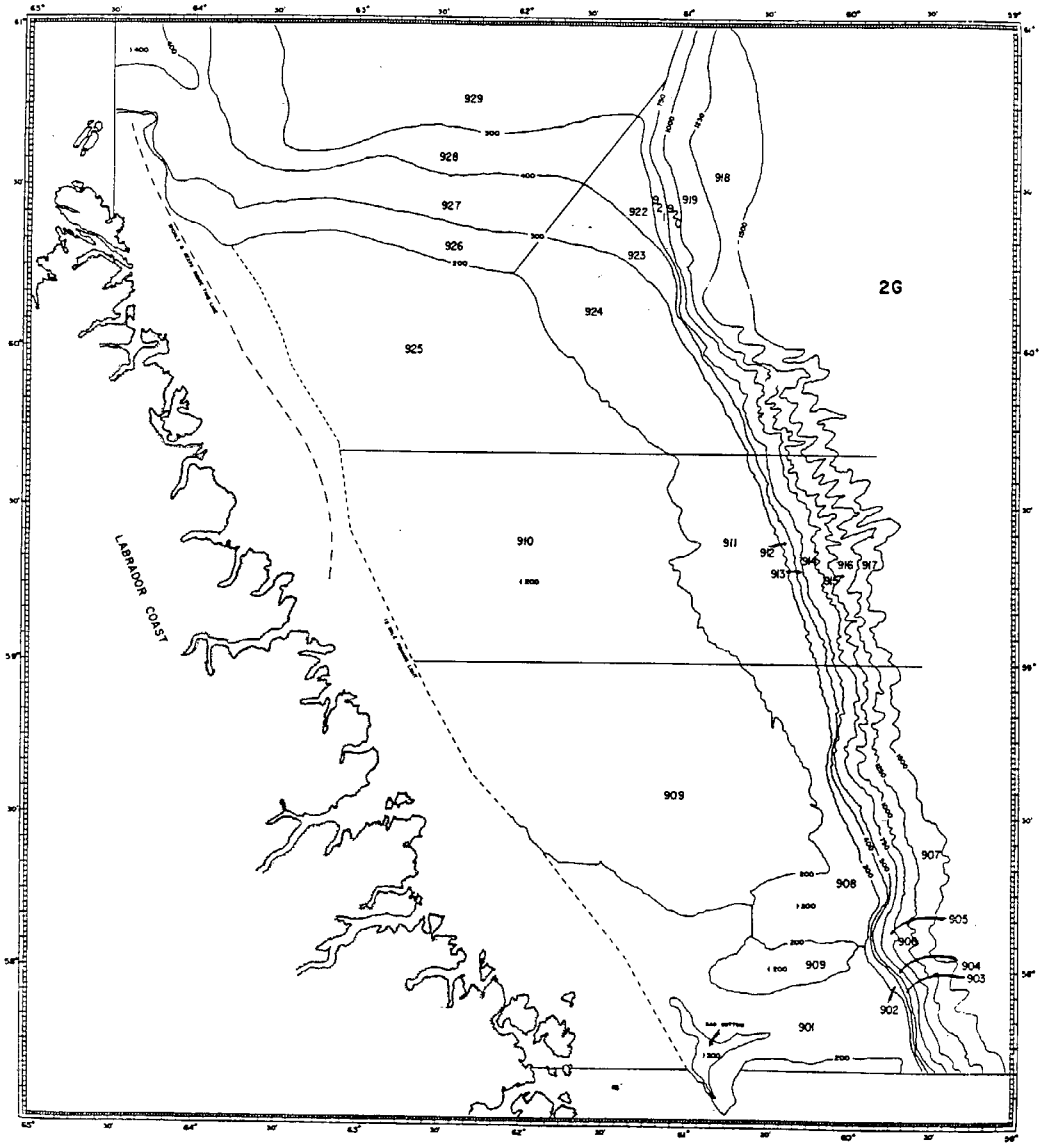

Fig.3. Stratification scheme used in Canadian surveys in Div. 2G.

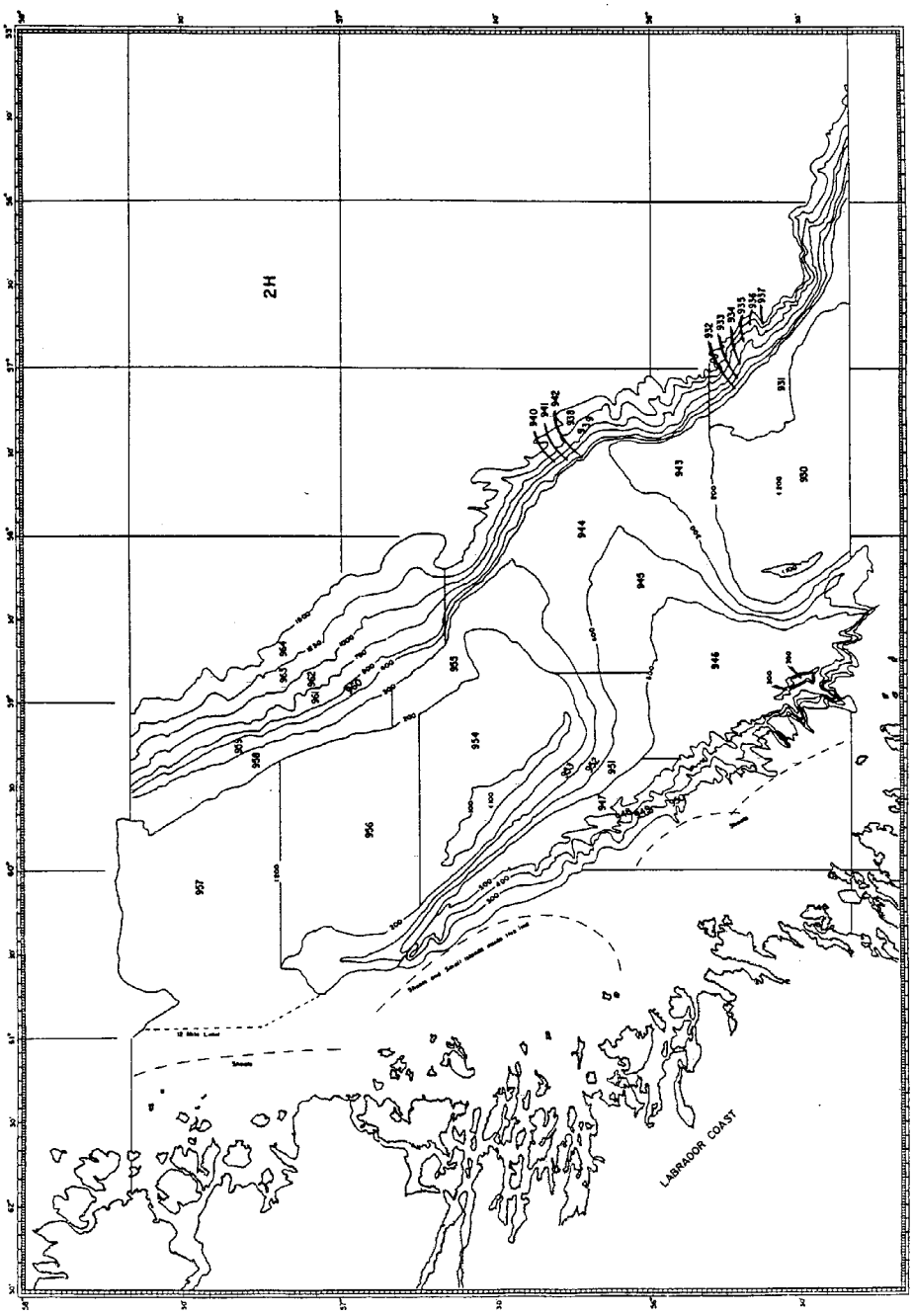

Fig.4. Stratification scheme used in Canadian surveys in Div. 2H.

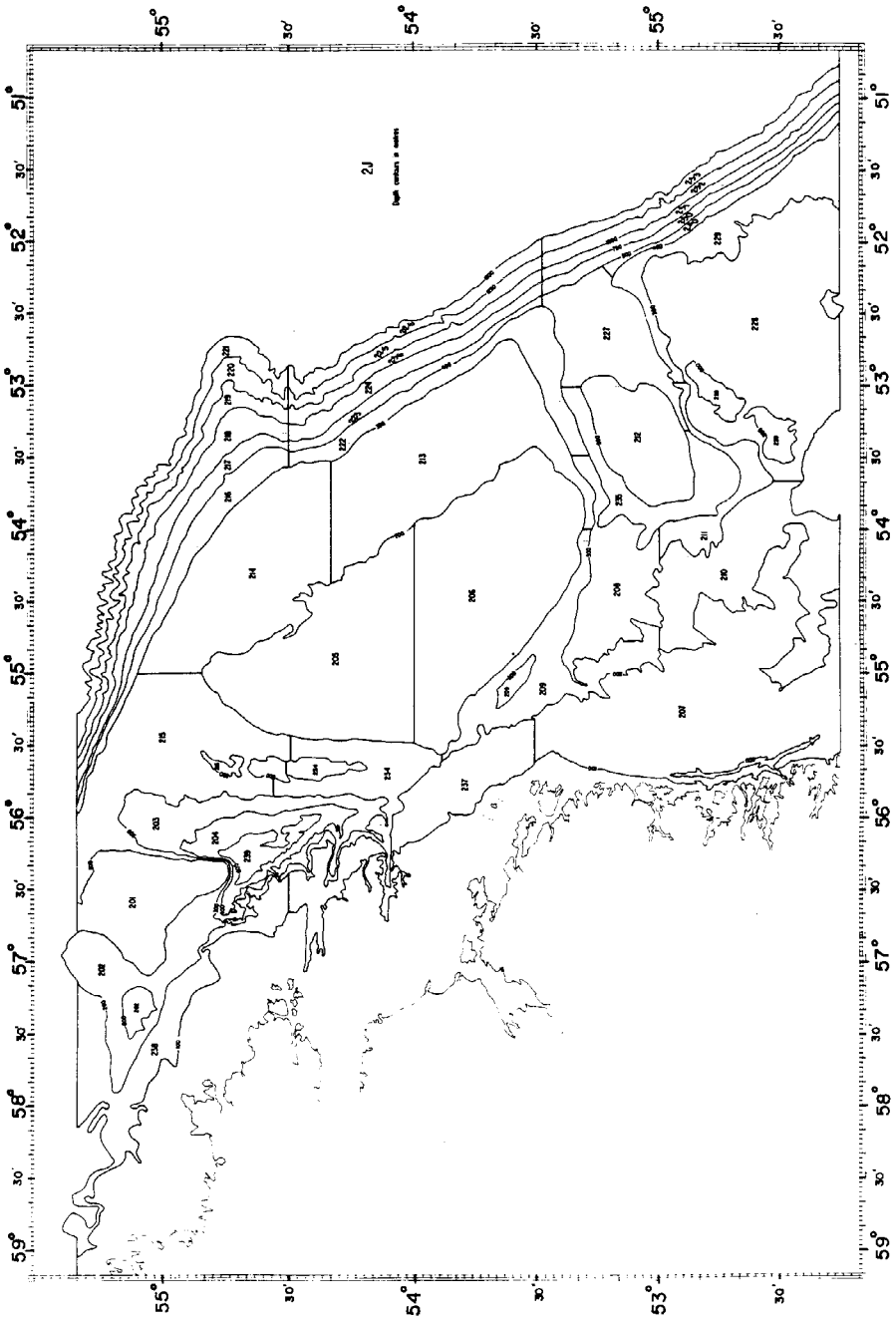

Fig.5. Stratification scheme used in Canadian surveys in Div. 2J.

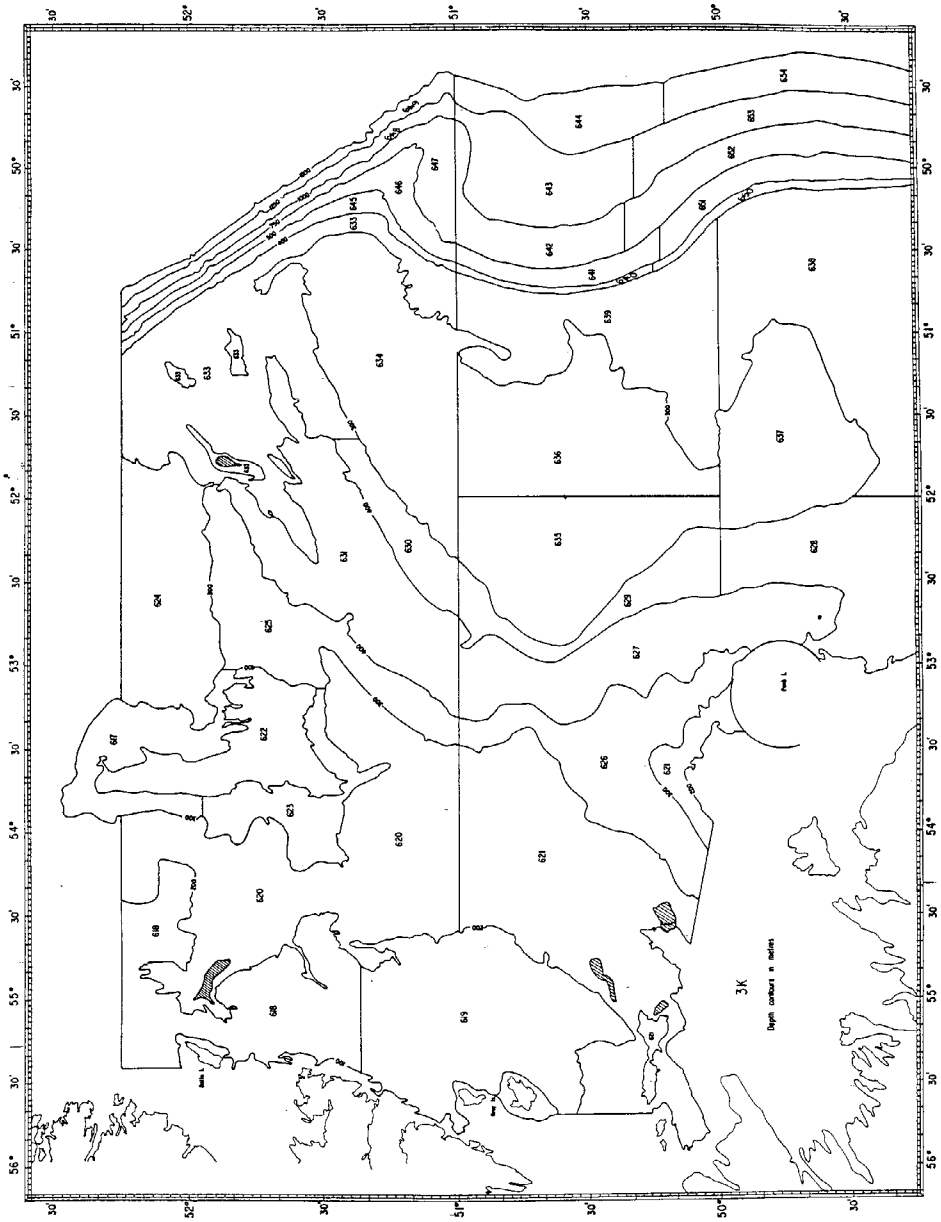

Fig.6. Stratification scheme used in Canadian surveys in Div. 3K. Inshore strata are not shown.

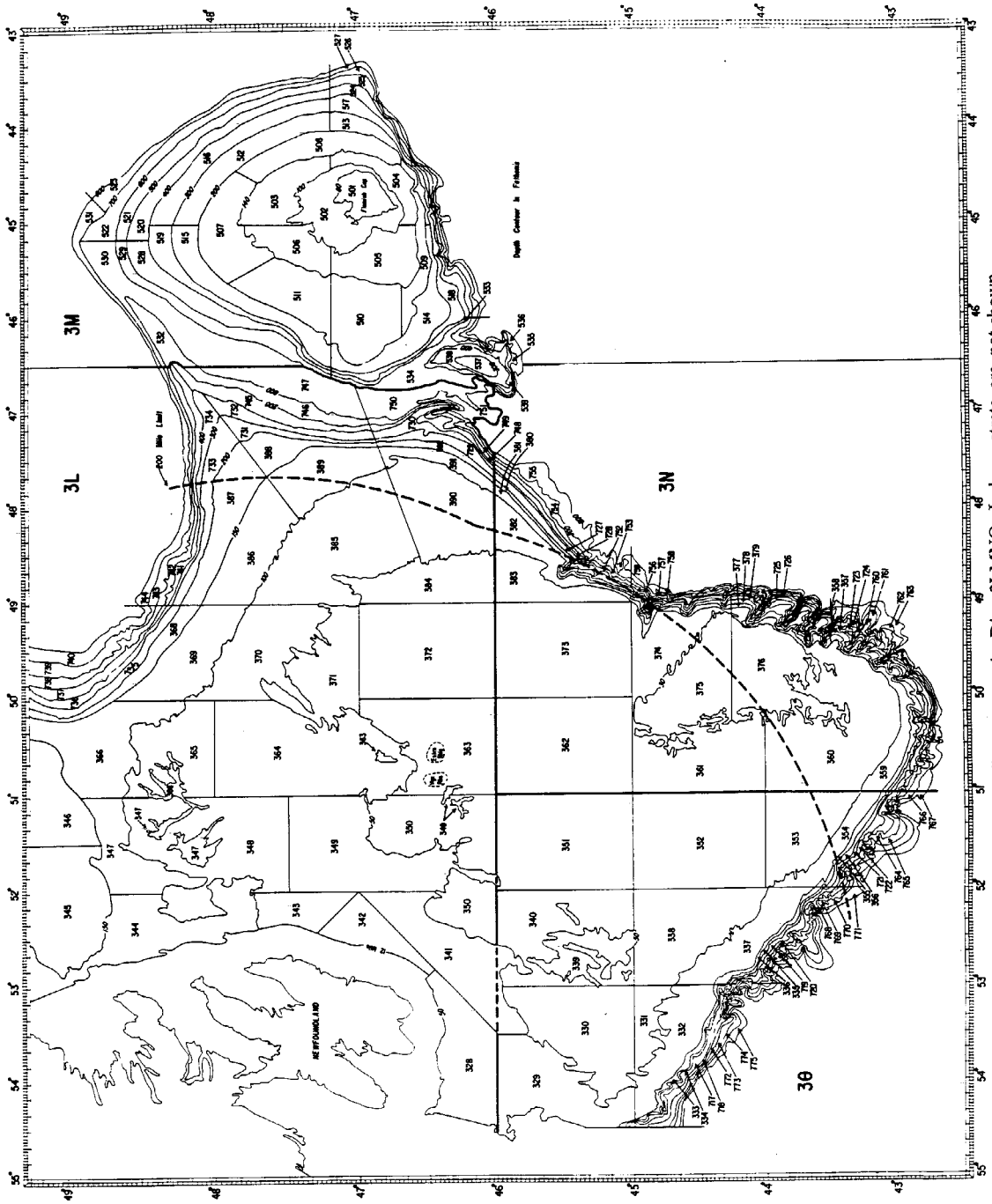

Fig.7. Stratification scheme used in Canadian surveys in Div. 3LMNO. Inshore strata are not shown.

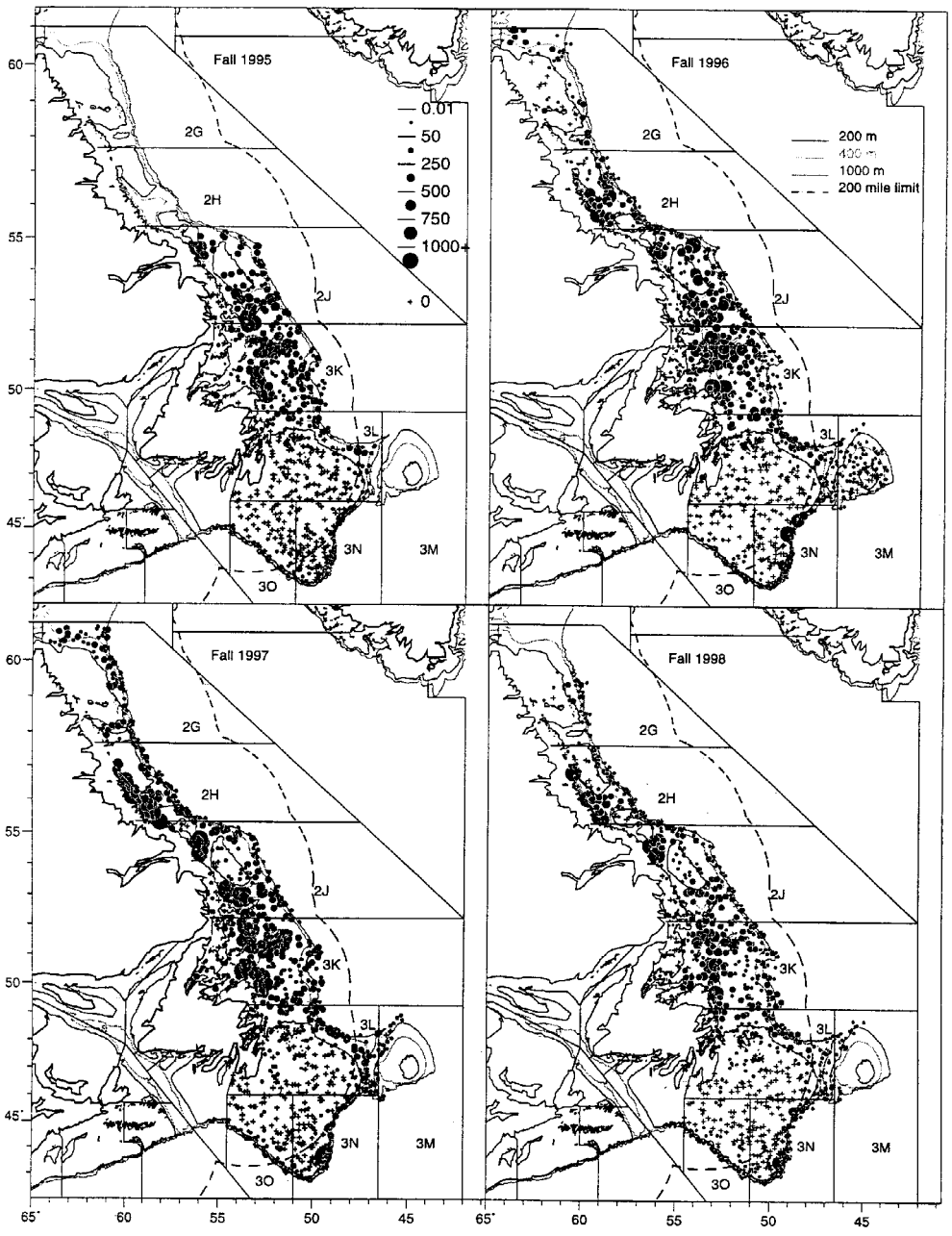

Fig 8 Distribution of Greenland Halibut catches (number) from 1995 to 1998 Canadian fall surveys to NAFO Divisions 2GHJ3KLMNO using a Campelen 1800 survey trawl. (All set standardized to 15 min. (.8 nm.) tows).

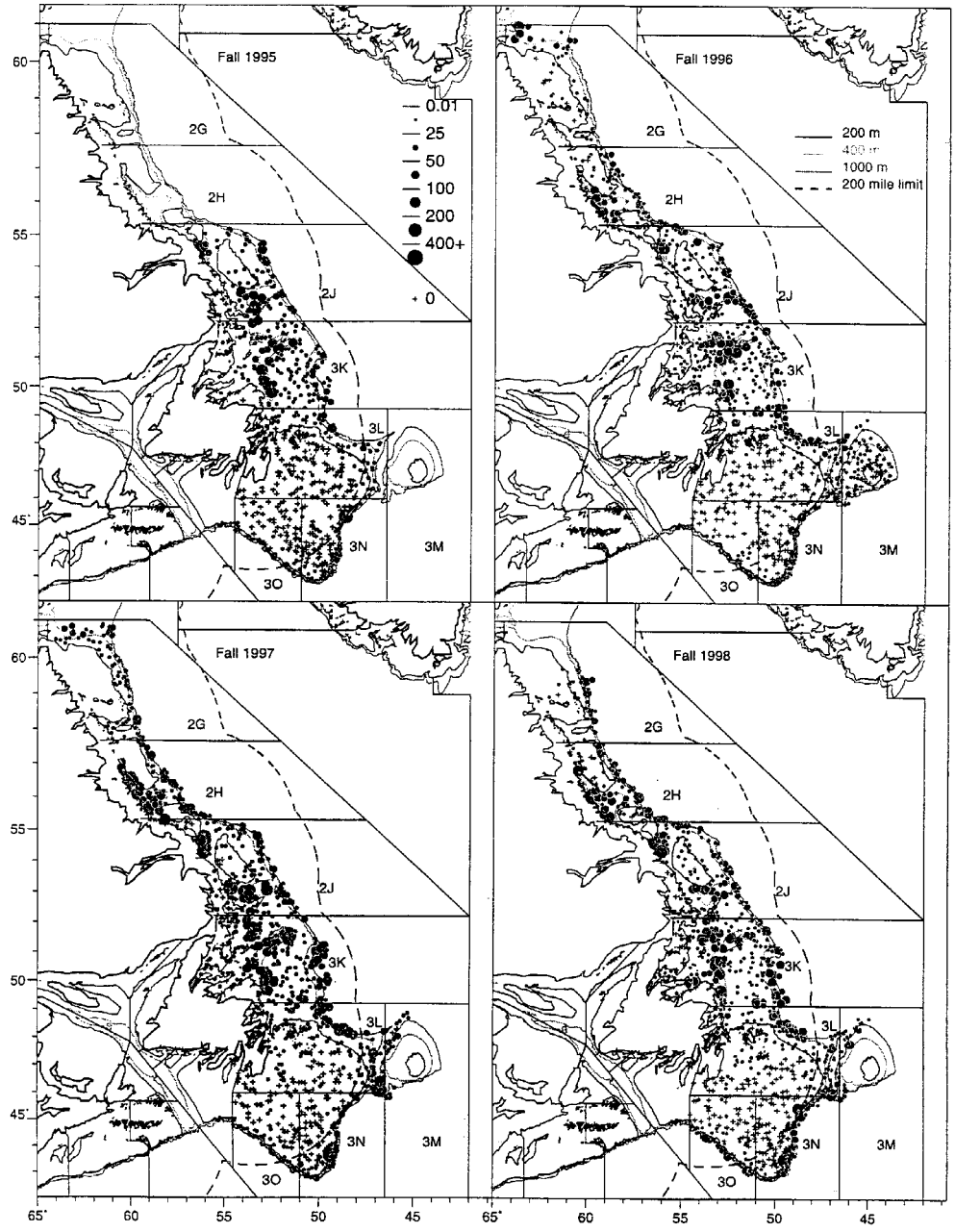

Fig. 9 Distribution of Greenland Halibut catches (kg) from 1995 to 1998 Canadian fall surveys to NAFO Divisions 2GHJ3KLMNO using a Campelen 1800 survey trawl. (All set standardized to 15 min. (.8 nm.) tows).

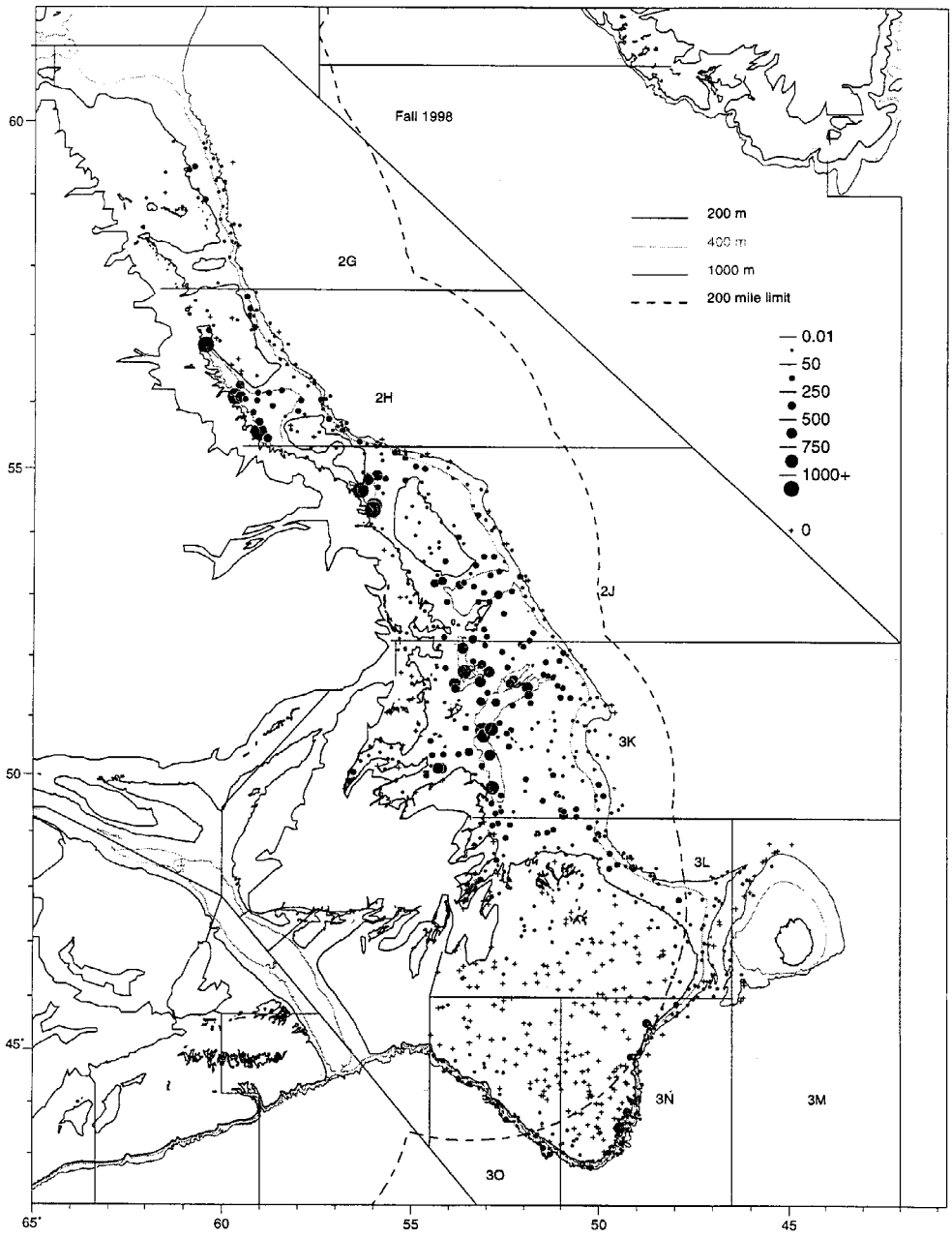

Fig 10 Distribution of Greenland Halibut catches of fish less than or equal to 35cm in length from 1998 Canadian fall surveys from NAFO Divisions 2GHJ3KLMNO using a Campelen 1800 survey trawl. All sets standardized to 15 min. (.8 nm.) tows.

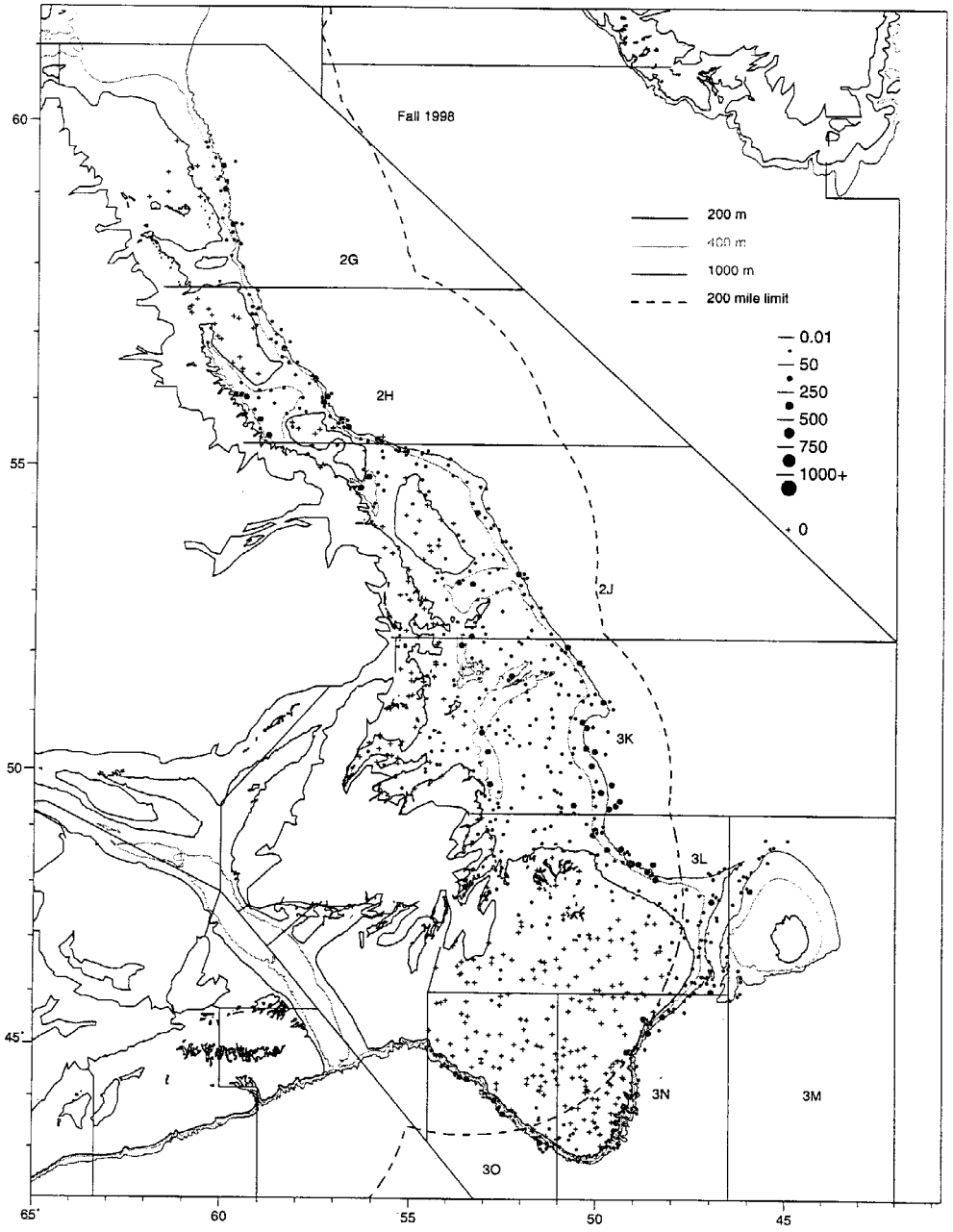

Fig. 11 Distribution of Greenland Halibut catches of fish greater than 35cm in length from 1998 Canadian fall surveys from NAFO Divisions 2GHJ3KLMNO using a Campelen 1800 survey trawl. All sets standardized to 15 min. (.8 nm.) tows.

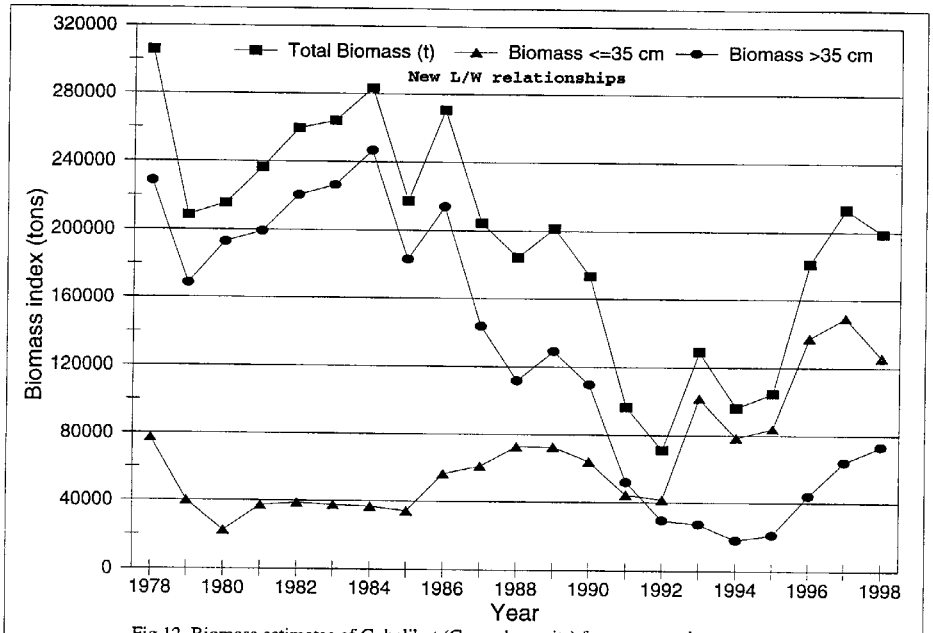

Fig 12. Biomass estimates of G. halibut (Campelen units) from surveys in Div. 2J3K, calculated from pop. nos. at length and L/W relationships.

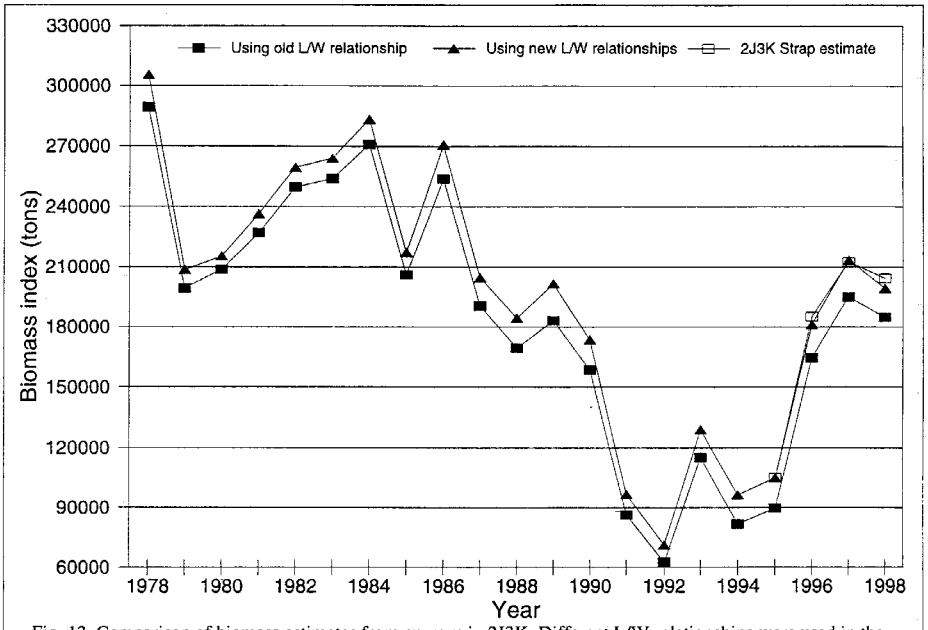

Fig. 13. Comparison of biomass estimates from surveys in 2J3K. Different L/W relationships were used in the 1998 and 1999 assessments. The "STRAP" estimate is calculated independently from set by set catch weights.

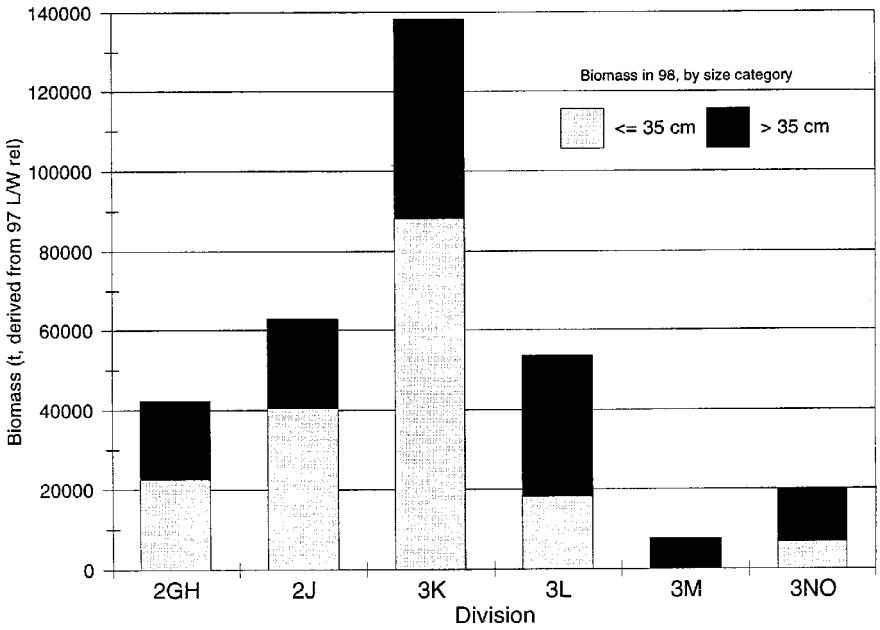

Fig. 14. Biomass estimates of G.halibut from 1998 survey, by size category and area.

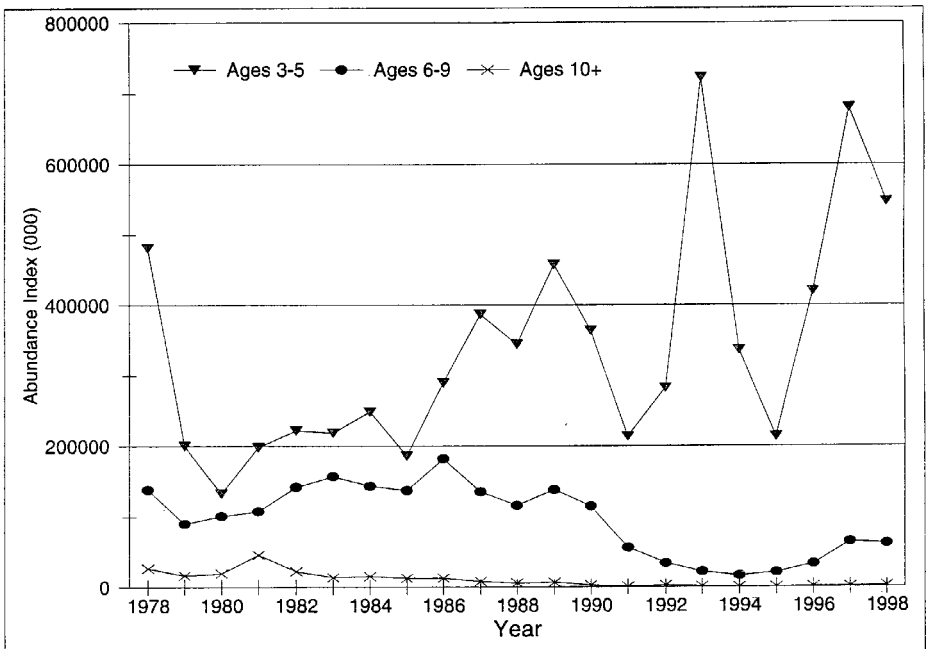

Fig. 15. Abundance estimates (Campelen data) from 1978-98 surveys, 2J3K

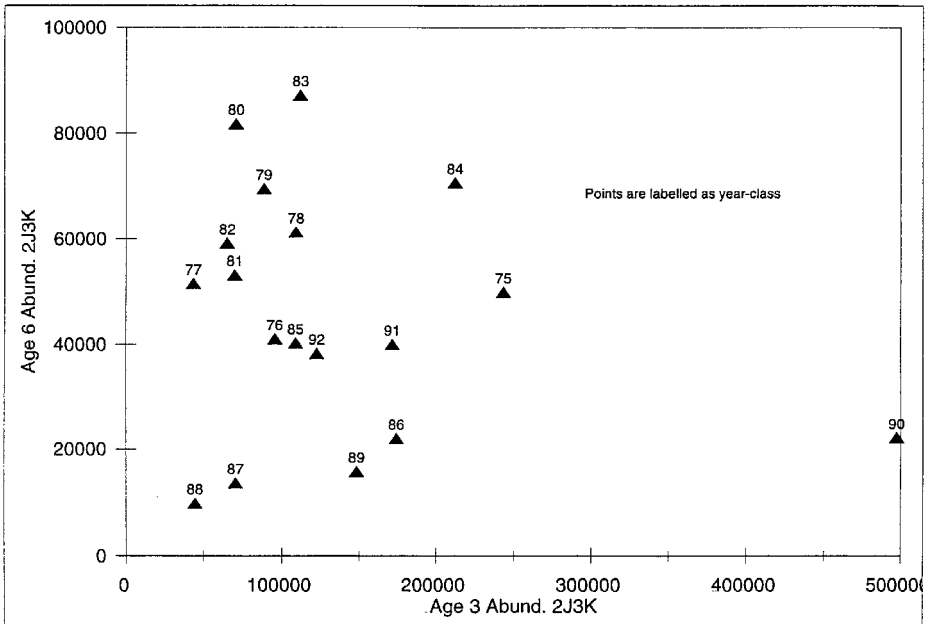

Fig. 16. Comparison of abundance (Campelen data) at ages 6 and 3, same cohort, from fall surveys in 2J3K.

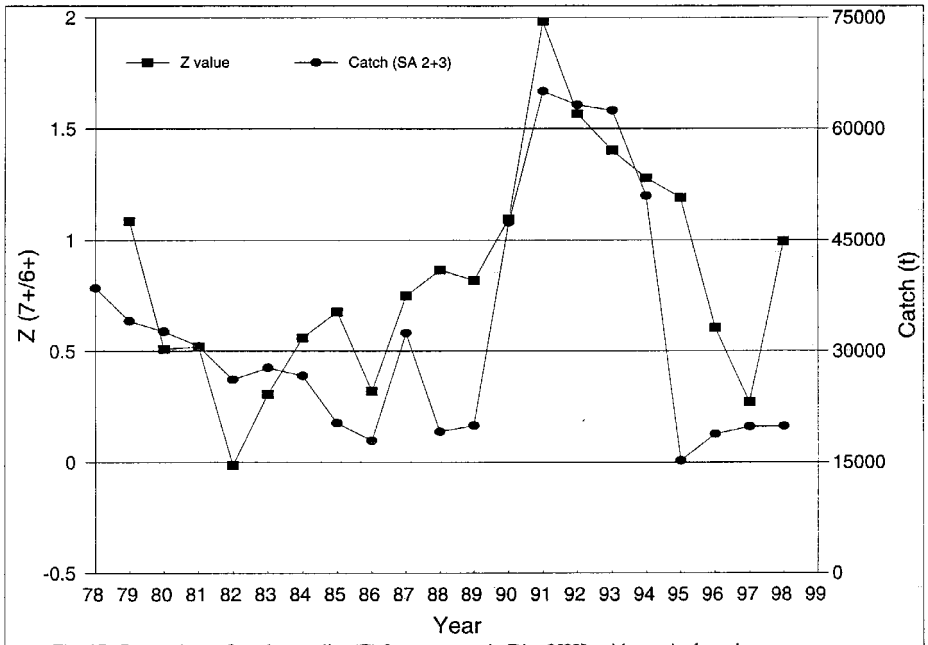

Fig. 17. Comparison of total mortality (Z) from surveys in Div. 2J3K, with nominal catches.

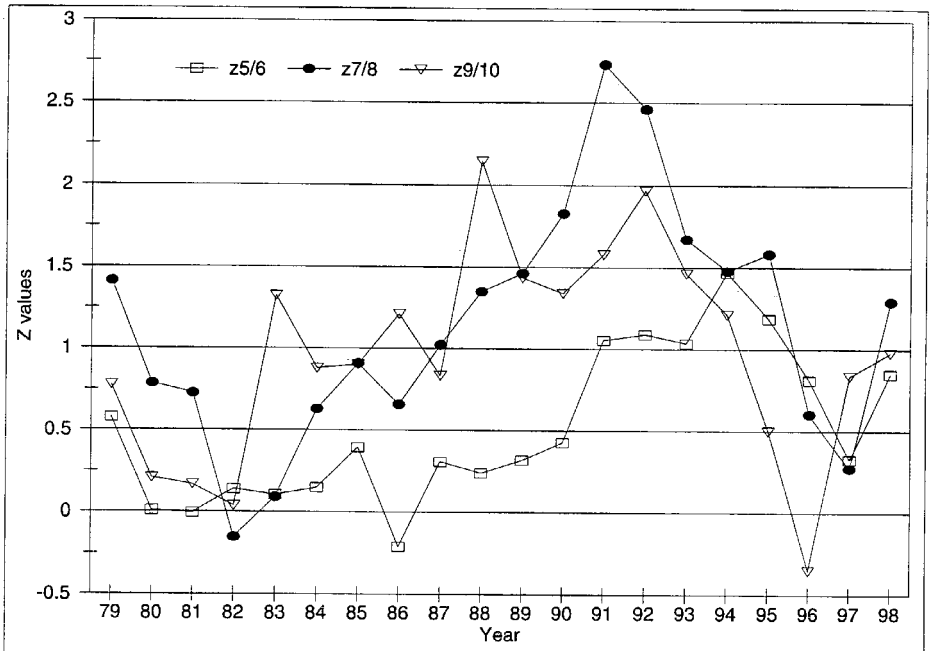

Fig. 18. Total mortality (Z) at ages 5 to 6, 7 to 8, and 9 to 10, from fall surveys, 2K3K.