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An assessment of the cod stock in NAFO Divisions 2J+3KL

by

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Abstract

A Canadian moratorium on directed fishing has been in effect for the 2J+3KL cod stock since July 1992. Catches in 1993-1997 came from various combinations of by-catch, food fisheries, and sentinel surveys. The catch in 1997 was reported as 505 tons, consisting of 159 tons from by-catch and 346 t from sentinel surveys. The quantity of cod in offshore waters, as determined from bottom-trawl surveys, continued to be only 1-2% of values in the period 1983-1989. The total mortality rate estimated from the autumn surveys in 1995-1997 was very high (Z=0.77). The quantity of cod in the inshore remains uncertain. Catch rates in the inshore sentinel surveys were poor in Division 2J and in Division 3K north of White Bay, but were considered by sentinel fishers to be good at many sites from White Bay south. Nevertheless, an acoustic survey in inshore waters from White Bay to St. Mary's Bay in southern Division 3L provided a biomass estimate of only 18,000 t. A biologically justifiable analytical assessment was not achieved, as catches could not be reconciled with the autumn research vessel index. An exploration of current stock productivity indicated that the spawner biomass may decline in the absence of a fishery if the Z of 0.77 is appropriate for all components of the stock. Recruitment to the offshore continues to be extremely low.

Introduction

Historically, many of the cod in NAFO Divisions 2J+3KL (the "northern cod") migrated between overwintering areas in deep water near the shelf break and feeding areas in shallow waters on the plateau of Grand Bank and near the coasts of Labrador and eastern Newfoundland. Some cod remained inshore throughout the winter in deep water both within the bays and off the headlands. For several centuries various nations pursued the cod while they were in the shallow areas, first with hook and line and later with nets which evolved by the late 1800s into the highly effective Newfoundland cod trap. The deep waters, both inshore and offshore, remained refugia until the 1950s, when longliners designed to exploit populations of cod in deep coastal waters were introduced to eastern Newfoundland and distant water fleets from Europe started to employ bottom-trawlers to fish the deeper water of the outer banks, first mainly in summer/autumn but later in the winter and early spring when the cod were highly aggregated. Landings increased dramatically in the 1960s as the longliner fleet switched to synthetic gillnets and, more importantly, large numbers of bottom-trawlers targetted the overwintering aggregations on the edge of the Labrador Shelf and the Northeast Newfoundland Shelf. Additional details on the history of the northern cod fishery, including changes in technology and temporal variability in the spatial distribution of fishing effort, may be found in Templeman (1966), Lear and Parsons (1993) and Hutchings and Myers (1995).

The number and individual size of the fish declined through the 1960s and 1970s and the stock reached a very low biomass by the mid-1970s (Baird et al. 1991). Following Canada's extension of jurisdiction to 200 miles in 1977, the stock began to recover as a consequence of smaller catches, entry of the strong 1973-1975 year-classes and an increase in the growth rate of individual fish. Fishing effort by an expanding Canadian trawler fleet increased

dramatically following extension of jurisdiction and this fleet took a large portion of the total allowable catch, which was almost doubled between 1978 and 1984. It became clear in retrospect that the stock size was overestimated during this period. Fishing mortality was much higher than the $F_{0.1}$ target level. In addition, the 1976-1977 year-classes were weak and individual growth rate declined. The 1978-1982 year-classes were moderate to strong but the 1983-1985 year-classes were weak. The spawner biomass did not increase after about 1982 and the 3+ population size peaked in 1984-1985.

An overestimation of stock size caused primarily by an anomalously high 1986 survey estimate was recognized in 1988-1989 (Baird et al. 1991; Lear and Parsons 1993). Quotas were reduced gradually in an attempt to avoid undue hardship to the fishing industry. By the early 1990s much hope was placed on the 1986 and 1987 year-classes, which appeared to be strong. However, in concert with older year-classes, these two year-classes appeared to decline very rapidly. Fishing mortality was very high but reported landings including documented discards were insufficient to account for the abrupt decline observed in the research vessel indices in 1990-1991. The stock was closed to Canadian fishing in July 1992. The research vessel index showed a further large decline in autumn 1992. It was thought that there might have been a substantial increase in natural mortality, especially during the first half of 1991 (Lear and Parsons 1993; Atkinson and Bennett 1994). Research vessel indices continued to decline in the absence of a Canadian fishery and reached a very low level by 1994. There was no sign of recovery in the 1995 and 1996 surveys.

Controversy continues regarding the time course and causation of the collapse. Some analyses found no support for a sudden increase in natural mortality in 1990-1991 (Myers and Cadigan 1995) and attribute the decline to fishing mortality alone (Hutchings and Myers 1994; Hutchings 1996; Myers et al. 1996a,b; Myers et al. 1997a,b). However, in the late 1980s and early 1990s the stock underwent several changes that may not have been related to fishing. For example, the distribution during the autumn was increasingly concentrated toward the outer edge of the banks (Lilly 1994; Taggart et al. 1994), the distribution during the winter was increasingly toward the south and to deeper water (Baird et al. MS 1992; Kulka et al. 1995), the inshore fishery started late (Davis MS 1992) and fish experienced a pronounced decline in growth, condition and age at maturity, especially in the north (Taggart et al. 1994). In addition, declines in abundance and changes in distribution were experienced by many other groundfish, both commercial and non-commercial (Atkinson 1994; Gomes et al. 1995). The changes in the lightly exploited American plaice in Divisions 2J and 3K parallel many of the changes in cod (Bowering et al. 1997). Capelin, the dominant pelagic species in the area and the major prey of cod, almost disappeared from Division 2J, increased in abundance in areas where they were previously uncommon (Flemish Cap and eastern Scotian Shelf), became inaccessible to acoustic surveys conducted at traditional times, arrived late in the inshore for spawning, and experienced low growth rates (Lilly 1994; Frank et al. 1996; Nakashima 1996; Carscadden et al. 1997; Carscadden and Nakashima 1997). Arctic cod, a cold water species, appeared to increase in abundance and expand its distribution (Lilly et al. MS 1994; Lilly MS 1996a). Changes were observed in salmon (Narayanan et al. 1995) and several other pelagic species, especially migrants from the south (Montevecchi and Myers 1996). These changes in cod and many other species may have been related to the prolonged period of low water temperatures in the region and a particularly cold period in the early 1990s (Narayanan et al. 1995; Drinkwater 1996; Colbourne et al. 1997), but causal links between changes in water temperature and changes in fish biology remain to be established in many cases, especially for the cod. Although much of the published literature concludes that fishing was the major cause of the collapse of the 2J+3KL cod during the late 1980s and early 1990s, the possible impacts of factors such as water temperature, the abundance and availability of prey (especially capelin) and predation by seals require additional study.

A thorough review of all analyses relating to the decline of cod in 2J+3KL from the mid-1980s to the early 1990s is beyond the scope of this paper. However, one specific aspect may be mentioned as illustrative of the degree of uncertainty. Various analyses have been presented in support of the hypothesis that the cod shifted southward in response to a decline in water temperature (deYoung and Rose 1993; Rose et al. 1994; Kulka et al. 1995; Wroblewski et al. 1995; Atkinson et al. 1997) and that this shift increased the vulnerability of the cod to both Canadian and non-Canadian fleets (Rose et al. 1994; Atkinson, et al. 1997). Other analyses find no support for this hypothesis (Hutchings and Myers 1994; Hutchings 1996; Myers et al. 1996a). There can be little progress in determining what caused the deaths of the fish until there is better understanding of where and when the deaths occurred.

Uncertainty about the time course of the decline lies at the heart of the inability to reconcile catches with the autumn research vessel index. One may class the various possibilities for the discrepancy into three groups. First, the decline may have been more gradual than indicated by the surveys. Under this scenario, the survey index had positive year effects for several years in the late 1980s and early 1990s. These effects may have been associated with the increased degree of aggregation toward the shelf edge at the time of the surveys. Hutchings (1996) suggests one mechanism for such an overestimation. Second, the survey indices may not have been severely anomalous. Instead, catches were grossly underestimated because landings were under-reported and the discarding of small fish was seriously underestimated (Hutchings 1996; Myers et al. 1997a). Third, there may have been an increase in natural mortality. If the survey index reflects accurately the change in population abundance, then the increase in natural mortality must have occurred rather suddenly. However, if the survey index had positive year effects, then an increase in natural mortality may have been less acute and severe but of longer duration. Investigation of these possibilities continues.

The inshore region has recently gained a greatly increased degree of prominence in the assessment of 2J+3KL cod (Lilly MS1996b; Rice 1997). By the autumn of 1994 there appeared to be very few cod left within the boundaries of the 2J+3KL stock complex. In spring 1995 a research vessel unexpectedly found a dense aggregation of cod in Smith Sound, Trinity Bay, and during summer/autumn of 1995 participants in the new sentinel survey program experienced good catch rates over much of the area from central 3K to southern 3L. These reports of cod in the inshore indicated that the stock was not as severely depleted as might be deduced from the offshore alone, and called into question the adequacy of the offshore survey as an index of total stock abundance.

A narrative of the assessment process for 2J+3KL cod from extension of Canadian jurisdiction in 1977 to the moratorium in 1992 has been compiled by Bishop and Shelton (1997). This paper provides details of the annual assessments, including the data and methods used to determine stock status and the results including TAC projections in terms of the standard requested reference points. The origin and evolution of the important databases such as catch at age, catch rate indices, and research survey data are discussed. Topics related to the assessments, such as the various committees and commissions that were struck to provide advice on scientific aspects of the assessments, and important issues such as the "retrospective problem", are also given attention. Documentation supporting assessments in 1993-1996 may be found in Bishop et al. (MS 1993; MS 1994; MS 1995) and Shelton et al. (MS 1996). Reports of the assessment meetings during 1993-1996 may be found in Sinclair (1993), Shelton and Atkinson (1994), Shelton (1996), Evans (MS 1996) and the NAFO Scientific Council Reports for those years.

The most recent assessment (Murphy et al. MS 1997) concluded that there was no indication that the 2J+3KL cod stock had begun to recover. The present paper updates the status based on an additional year of data from commercial by-catch, the research bottom trawl surveys, sentinel surveys, inshore acoustic surveys in specific bays in the spring, a new and intensive inshore acoustic survey in the autumn, and prerecruit surveys. Consumption of cod by seals is also discussed.

Nominal catch

The following description is based on landings only. Estimates of discards are available for trawlers directing for cod and shrimp (Kulka 1997; Kulka MS 1998), but these data have not been included in the following description of catch and have not been included in the analytical analysis to follow. The average annual discards between 1980 and 1992 is estimated to be 3,400 t, peaking at 9,000 t in 1986. There are no estimates of discards from trawl fisheries directed at species other than cod and shrimp and there are no estimates for fixed gear. There are also no estimates for other categories of mortality associated with fishing, such as those cod that fall out of gillnets before the gear is hauled onboard.

Landings from this stock increased during the late 1950s and early 1960s and peaked at just over 800,000 t in 1968 (Table 1; Fig. 1). Landings then declined rapidly to a minimum of 139,000 t in 1978, increased to a plateau of approximately 250,000 t in the mid- to late 1980s and then declined very quickly in the early 1990s. The portion of the landings coming from each of the Divisions changed over time. During the 1960s, when the fishery was primarily by non-Canadian fleets (Fig. 2), landings were taken mainly from Divisions 2J and 3L (Fig. 3). Division

3K became prominent in the mid-1970s. Landings from Division 2J were relatively small in the mid-1980s. Division 3L dominated from the mid-1980s until the moratorium in 1992.

The fixed gear landings (Table 2; Fig. 4) increased from just 41,000 t in 1975 to a peak of 113,000 t in 1982, declined to 74,000 t in 1986, and increased again to a peak of 117,000 t in 1990, just 2 years before declaration of the moratorium. There was a substantial decline to 61,000 t in 1991. The commercial fishery was closed in July 1992 and only 12,000 t were landed. Some of the increase in the late 1980s was due to a resurgence of gillnet landings in southern Division 2J and trap landings in Division 3L, but much was due to an expansion of the gillnet fishery to the Virgin Rocks and other offshore areas in Division 3L (see Table 3 of Shelton et al. MS 1996).

Landings have been small since 1992. In 1993 a recreational fishery together with by-catches accounted for 11,000 t. In 1994 a limited (10 d) food fishery during August and September, together with by-catch, accounted for about 1,300 t. In 1995 there was no recreational or food fishery but a sentinel survey was introduced to provide catch-effort information from fixed gear fished in a manner similar to a commercial fishery. Reported landings were only 330 t. In 1996 the sentinel survey continued and a food fishery was allowed on two consecutive 3-day weekends. These two fisheries together with by-catch landed approximately 1,700 t. In 1997 there was no food fishery. Sentinel surveys accounted for about 70% of the total landings of 500 t (Table 3). Gillnets accounted for 71% of the total landings. There is evidence of removals in excess of sentinel surveys and legal by-catches, but the magnitude of these removals cannot be estimated.

Catch and weight at age

A summary of the sampling used to estimate the catch at age in 1997 is given in Table 4. A total of 183,335 fish were measured and 4472 fish were aged. Sampling represented fairly well the distribution of landings by Division, gear and month. Sampling was comparatively intense compared to the level prior to the moratorium when there was a substantial commercial catch.

The quality of the age determinations is discussed in Hicks et al. (MS 1998).

The age composition and mean length-at-age of the landings, calculated as described in Gavaris and Gavaris (1983), are provided by gear in Table 5 and in total in Table 6. The following relationship was applied in deriving average weight-at-age:

$$\log(\text{weight}) = 3.0879 * \log(\text{length}) - 5.2106.$$

The proportion of the catch numbers at age varied among gears (Table 5; Fig. 5). Ages 5-8 were prominent in gillnet landings, with age 7 (the 1990 year-class) dominant. Ages 4-7 were prominent in landings from traps, longlines and handlines, with age 5 (the 1992 year-class) dominant. Age 7 was the major contributor to the total catch (Table 6) because the bulk of the landings came from gillnets.

The numbers at age, mean weight-at-age and biomass at age for fish in the reported landings from 1962 to 1997 are presented in Tables 7-9. The 1990 year-class was the most important contributor to the catch in 1995-1997. Its dominance in 1997 is attributable to its prominence in gillnet landings and the fact that the majority of the landings came from gillnets.

The mean weights-at-age calculated from mean lengths-at-age in the landings have varied over time (Table 8; Fig. 6). There was an increase in the late 1970s and early 1980s, followed by a decline through the 1980s to low levels once again in the early 1990s. There appears to have been some increase in the most recent years. Interpretation of changes in the weights-at-age is difficult because of changes in the relative contributions of the various gear components and changes in the location and timing of landings from each specific gear component, especially in the periods before and after the moratorium. There are clearly problems with the 1993 data that remain to be resolved. See Lilly (MS 1998) for additional information regarding this time-series.

Research vessel trawl surveys

Survey design

Research vessel surveys have been conducted by Canada during the autumn in Divisions 2J, 3K and 3L since 1977, 1978 and 1981 respectively. No survey was conducted in Division 3L in 1984, but the results of a summer (August-September) survey have been applied for some analyses. The 1995 autumn survey continued into late January 1996. Spring surveys have been conducted by Canada in Division 3L during the years 1971-1982 and 1985-1997. Surveys in Divisions 2J and 3K were conducted by RV Gadus Atlantica (up to 1994) while those in Division 3L were conducted by RV A.T. Cameron (1971-1982) and RV Wilfred Templeman or its sister ship RV Alfred Needler (1985-1997 for spring and 1983-1997 for autumn). The autumn surveys in Divisions 2J and 3K in 1995-1997 were conducted mainly by RV Teleost, although RV Wilfred Templeman surveyed part of Division 3K. In the autumn 1995 survey both ships used for the first time the Campelen 1800 shrimp trawl with rockhopper footgear, replacing the Engels 145 Hi-rise trawl that had been used since the start of the surveys in 2J and 3K and since the change to the RV Wilfred Templeman in Division 3L. In addition, the Campelen trawl was towed at 3.0 knots for 15 min instead of 3.5 knots for 30 min. The selectivities of the two nets were found through comparative fishing experiments in 1995 and 1996 to be markedly different, with the Campelen being far more effective at catching small cod (Warren 1997; Warren et al. MS 1997). Conversion of Engels catches to Campelen equivalent catches is reported by Stansbury (MS 1996, MS 1997).

The survey stratification scheme, illustrated in Fig. 7-9, is based on depth contours (Doubleday 1981; Bishop MS 1994). The strata used in 1996 were similar to those in previous years except that the survey was extended to 1500 m and 25 new strata were added to the inshore in Divisions 3K and 3L to obtain an estimate of the cod inshore of the standard survey area. The survey in 1997 was similar to that in 1996, except that some of the new inshore strata were modified and one stratum was added. Prior to 1988, set allocation was proportional to stratum area, with the provision that each stratum be allocated at least 2 sets. In 1989 and 1990 an "adaptive design" was introduced in an attempt to minimize variance. It was found that this method introduced a bias and the additional sets fished during the second phase of these surveys have been excluded from analyses. In 1991-1994, additional sets were allocated in advance to certain strata based on past observed stratum variance (Gagnon 1991). In 1995-1997, set allocation was based once again on stratum area alone. To account for incomplete coverage of some strata in some years, estimates of biomass and abundance for non-sampled strata were obtained using a multiplicative model. This correction was not applied after 1991 because of changes in cod distribution, a change in the stratification scheme introduced in 1993 (Bishop MS 1994) and the change in vessel and trawl gear in 1995.

Autumn surveys in Divisions 2J, 3K and 3L

Abundance and biomass have been estimated by areal expansion of the stratified arithmetic mean catch per tow (Smith and Somerton 1981). Estimates for the autumn surveys from 1978 (Divisions 2J and 3K) or 1981 (Division 3L) to 1994 may be found in Tables 12-19 of Shelton et al. (MS 1996). The data from 1983 to 1994 have been converted to Campelen equivalents and are presented along with the actual Campelen data from 1995-1997 in Tables 10-12 for Division 2J, Tables 13-15 for Division 3K and Tables 16-18 for Division 3L. Note that data for 1993-1997 are presented separately from earlier years for Divisions 2J and 3K because of the change in stratification scheme introduced in 1993 (Bishop MS 1994). Because there have been changes over time in the depths fished, annual variability in the abundance and biomass of cod has been monitored for those strata that have been fished most consistently since the start of the surveys. These "index" strata are those in the depth range 100-500 m in Divisions 2J and 3K and 55-366 m in Division 3L, but excluding the new inshore strata. Changes in abundance and biomass in these index strata are shown by Division for the years 1983-1997 in Figs. 10a and 10b. In Division 2J there was an irregular decline over time with a strong positive year effect in 1986. In Division 3K there was again a sharp positive year effect in 1986 but also a very sharp increase in 1989 followed by declines in 1990 and 1991. In Division 3L there was a gradual decline over time with a positive year effect in 1990. The abundance and biomass have remained at extremely low levels in all Divisions since 1993. The abundance and biomass estimates for the new inshore strata in 1996 and 1997 (Table 19) are less than estimated for the offshore but are relatively high given the much smaller area of the inshore strata. The total abundance and biomass of all strata fished in 1983-1997 are provided by Division and year in Table 20.

The distribution of cod at the time of the autumn surveys has been illustrated in numbers per standard tow (Shelton et al. MS 1996; Murphy et al. MS 1997) and in weight (kg) per standard tow (Lilly 1994, MS 1995). The catch from each tow in the period 1983-1994 has been recalculated to Campelen equivalents, and plots of these recalculated catches for 1983-1994 are shown together with the actual catches in 1995 and 1996 in Fig. 11. For the period 1981-1988 catches were wide-spread over the survey area. The first indication of the big changes to come occurred in 1988, when almost no fish were caught in the area of Harrison Bank in northwestern Division 2J. Commencing in 1989 the fish in Divisions 2J and 3K became increasingly concentrated toward the edge of the bank. By 1991, concentrations on Hamilton Bank and the plateau of Grand Bank disappeared, leaving fish in inner Hawke Saddle and in the saddles between Belle Isle Bank and Funk Island Bank and between Funk Island Bank and Grand Bank. In 1992, only the concentration between Funk Island Bank and Grand Bank remained. This concentration was smaller in 1993 and disappeared in 1994. Catches remained extremely small in 1995 and 1996, but the percentage of nil catches was less than in the previous few years, probably because of the ability of the Campelen trawl to catch small fish.

Since this is the first presentation of distribution maps based on Campelen equivalents, a few additional comments are in order. First, the scale used in Fig. 11 does not give sufficient emphasis to the very large catches. The largest symbol size represents catches exceeding 1000 individuals. In the 1983-1994 period, 103 catches exceeded 1000 individuals, 35 exceeded 2000 individuals, and 11 exceeded 4000 individuals (Table 21). Of those that exceeded 4000 individuals, three occurred in 1986, the year in which the survey index was anomalously high, and seven occurred in 1989-1991, when the cod were becoming increasingly aggregated toward the edge of the shelf. Five catches exceeded 6000 individuals and three of these, including the two largest at 7354 and 8048 individuals, occurred in 1991 during the latter stages of the decline. The location of the very large catches can be identified by matching the symbols in Fig. 11 with the positions provided in Table 21. The second comment regarding the new distribution plots is that the patterns look somewhat different from those seen in earlier plots based on the actual numbers of cod caught (Shelton et al. MS 1996; Murphy et al. MS 1997) or the weight (kg) of the cod caught (Lilly 1994, MS 1995). This is particularly so in 1989 and 1990 when the cod appear to be less concentrated toward the edge of the shelf than they did in the earlier plots, particularly those based on the weight of the catch. The difference is partly because the adjustment to Campelen equivalents has moved many additional sets into the largest bin (> 1000 individuals) used in the plots, and partly because the adjustment applied to each catch depends on the size distribution of the cod in that catch, so that some catches were increased very little while others were increased 10-fold and even 30-fold (Table 21). The median increase in catch (number) per standard tow in the conversion from Engels catches to Campelen equivalents for all sets (not just those greater than 1000 individuals) was about 2.3 times in 1983-1984, about 2.0 times in 1987-1988, 2.8 times in 1989, 3.1 times in 1990, and about 3.0 times in 1991-1994. The relatively large increases in 1989-1994 are probably attributable first to the recruitment of the initially strong 1986 and 1987 year-classes and then to the disappearance of the larger fish.

Because catches in recent years have been very small, the distributions in 1994-1997 have been presented in Fig. 12 with the scale reduced by an order of magnitude compared with Fig. 11. In 1994, the larger catches of cod were obtained mainly in inner Hawke Saddle, to the west and east of Funk Island Bank, and along the northeastern slope of Grand Bank. Catches tended to be extremely small on all banks. In the Hamilton Bank area, catches increased along the eastern edge of the bank in 1995 and to the northwest of the bank in 1996, but were generally smaller again in 1997. In the Belle Isle Bank area, catches increased around the edge of the bank in 1995 and 1996, but declined in 1997. In the Funk Island Bank area, catches were highest in 1995 and then declined in 1996 and again in 1997. Along the northeastern slope of Grand Bank, catches declined in 1995 and were almost nil in 1996, but increased in 1997. In general, catches at depths less than 300 m on coastal shelfs and offshore banks have remained very small. Largest catches in these areas have tended to occur off the Strait of Belle Isle in northwestern Division 3K, toward the coast in northwestern Division 3L, and just south of the Virgin Rocks in southern Division 3L. Some relatively large catches were obtained in the new inshore strata in both 1996 and 1997.

Population numbers at length, calculated by areal expansion of the stratified arithmetic mean catch at length (3 -cm groupings) per tow, are illustrated for 1995-1997 in Fig. 13. There were very few cod longer than 50 cm in any year. A strong mode at 19 cm in Divisions 2J and 3K in 1995 moved to 28-31 cm in 1996. This mode was very weak in Division 3L. In 1997, most of the catch was approximately 31-46 cm in Division 2J and 25-46 cm in

Divisions 3K and 3L. In all three years Division 3L had more large fish than Divisions 2J and 3K. Population numbers at length for the inshore strata fished in 1996 and 1997 are illustrated in Fig. 14. Division 3L had more large fish than Division 3K, but otherwise there was no consistent pattern between the 1996 frequencies and the 1997 frequencies.

The mean number caught at age per tow during autumn surveys from 1979 (1981 in Division 3L) to 1994, and the mean number per tow for Divisions 2J, 3K and 3L combined, may be found in Tables 3-6 of Bishop et al. (MS 1995). The data from 1983 to 1994 have been converted to Campelen equivalents and are presented along with the actual Campelen data from 1995-1997 in Table 22 for Divisions 2J, 3K and 3L separately and for all three Divisions combined. The 1994 year-class stands out clearly in Division 2J in 1995-1997 and in Division 3K in 1995-1996 but was not prominent at ages 1 and 2 in Division 3L. The 1994 and 1995 year-classes occurred in approximately equal strength in Divisions 3K and 3L in 1997.

The distribution of cod of ages 1-4 in 1997 (Fig. 15) may be compared with similar plots for 1996 (Fig. 13 in Murphy et al. MS 1997). In both years the age 1 cod were mainly near the coast and older cod were spread over the banks.

The sizes-at-age of cod sampled during the autumn surveys confirm the general pattern of a decline in the 1980s and early 1990s as observed in commercial weights-at-age. The research survey data (Lilly MS 1998) illustrate that the changes varied with Division; there was a strong decline in Division 2J, a lesser decline in Division 3K, and little or no decline in Division 3L (Fig. 16 and 17). These Divisional differences are more apparent in Fig. 18, which focuses on changes in mean lengths and weights of cod of ages 4 and 6. Superimposed on the long-term decline are periods of relatively quicker or slower growth associated with changes in water temperature (Shelton and Lilly MS 1995; Shelton et al. MS 1996). The trend toward very low mean lengths and weights-at-age in the early 1990s appears to have been reversed, but sample sizes at ages greater than age 4 have been very small in recent years (Lilly MS 1998), so the accuracy of these estimates is poor.

The observed proportions mature at age for female and male cod in Divisions 2J+3KL combined from 1982 to 1998 as recorded during autumn surveys in 1981 to 1997 are given in Tables 23 and 24, together with the parameters for a probit model with a logit-link function, the estimated A50 and the upper and lower 95% confidence intervals. The model estimates for A50 are illustrated in Fig. 19. The apparent reversal of the downward trend in the mid-1990s has not been continued, and the A50 for 1998 is one of the lowest in the time series. Males consistently mature at an earlier age than females. This may be seen in the 1994 year-class, in which 70% of males were maturing to spawn in 1998 but only 10% of females were maturing (Tables 23, 24). Thus, this year-class, which is stronger than adjacent year-classes, may not make an important contribution to egg production in 1998.

Spring surveys in Division 3L

Abundance and biomass of cod in Division 3L in the spring have been estimated by areal expansion of the stratified arithmetic mean catch per tow. Estimates for the surveys from 1978 to 1995 may be found in Tables 20-21 of Shelton et al. (MS 1996). The data from 1985 to 1995 have been converted to Campelen equivalents and are presented along with the actual Campelen data from 1996-1997 in Tables 25-26. The indices declined very rapidly from 1990 to 1994 and have remained very low in subsequent surveys. Fishing in waters deeper than 200 fathoms started on a regular basis in 1991 (Table 27). In some years a large portion of the total estimated abundance and biomass was caught outside the index strata in the deeper water. Trends in total estimated abundance and biomass are presented in Fig. 20.

Recruitment surveys

Information on the relative strength of incoming year-classes is available from pelagic juvenile fish surveys, which capture fish a few months old before they settle to the bottom; beach seine surveys, which capture 0-group and age 1 fish in shallow water along the coast; and the bottom-trawl survey, which captures fish of ages 1 and older.

Pelagic juvenile fish surveys have been conducted in August-September 1994-1997 in inshore and offshore waters of Divisions 2J, 3K and 3L (Anderson et al. MS 1998b). The abundance index was highest in 1994 and declined through 1995 to a low in 1996 before rising in 1997 to a value intermediate between that of 1995 and 1996. In 1994, abundance offshore was approximately equal to that inshore, whereas in all other years the abundance was much lower offshore.

A beach seine survey, referred to as the Fleming survey in honour of the scientist who conducted very similar surveys in 1959-1964, has been conducted at the same sites from St. Mary's Bay in southern Division 3L to western Notre Dame Bay in central Division 3K during September-October 1992-1997 (Schneider et al. 1997; Methven et al. MS 1998). There was a decline in year-class strength from 1994 to 1996 but the 1997 survey yielded the highest mean catch of 0-group cod since 1992. Although this high mean was associated with high confidence limits, it was predicted that this year-class would be strong at age 1 in 1998 and would contrast with the weaker 1996 year-class. It is notable that the pelagic survey and the beach seine survey were in agreement on the relative strength of the 1994-1996 year-classes, but the 1997 year-class appears relatively stronger in the beach seine survey than in the pelagic survey.

Mean catches at age per tow during the autumn research bottom-trawl surveys (Table 22; Fig. 21) have revealed very weak recruitment in the offshore in the 1990s. The 1994 year-class at age 1 was relatively large compared with actual catches of earlier year-classes, but it looks very weak compared to previous year classes following conversion to Campelen equivalent numbers. Although the bottom trawl survey is in agreement with the two juvenile surveys in indicating that the 1994 year-class was strong relative to adjacent year-classes, it also illustrates that this year-class is weak relative to many year-classes in the 1980s. All three surveys indicate that the 1996 year-class may be exceptionally weak.

Acoustic surveys

A dense aggregation of cod was first found in Smith Sound, Trinity Bay (Division 3L) in spring 1995. Acoustic surveys of this Sound have produced biomass estimates of 17 thousand tons in early May 1995, 0.2 thousand tons in April 1996 and 21 thousand tons in April 1997 (Table 28). Surveys in other areas of western Trinity Bay in April 1997 and southern Bonavista Bay in June 1997 detected relatively small quantities of fish, so that the total biomass estimated for surveyed areas in spring 1997 was 23 thousand tons.

An intensive acoustic survey covered waters landward of the research vessel bottom-trawl survey from Cape St. Mary's at the southwestern limit of Division 3L to Great Harbour Deep in White Bay (Division 3K) in October-December 1997 (Anderson et al. MS 1998a). This was after the time of the traditional offshore cod migration but at the same time as the traditional bottom-trawl survey which covered the offshore and the deeper waters of the bays. The acoustic survey gave a biomass estimate of 18 thousand t, of which 60% was in Trinity and Bonavista bays.

Sentinel survey

The inshore sentinel survey in NAFO Divisions 2J+3KL, initiated in 1995 to provide indices of cod abundance in coastal waters, has been conducted primarily with gillnets and linetrawls but also with handlines and cod traps. Catch rates have been very low north of White Bay, including southern Labrador. Catch rates from White Bay south are considered by participants to be good. Gillnet catch rates (Table 29) increased from 1995 to 1996 but remained unchanged from 1996 to 1997. Linetrawl catch rates (Table 30) were similar in 1995 and 1996 and increased in 1997. Handline catch rates (Table 31) and estimates of cod trap catches in Divisions 3KL also increased in 1997 over 1995-1996. Cod caught in linetrawls in 1997 were mainly of ages 4-7 (the 1990-1993 year-classes) whereas those caught in gillnets were mainly of ages 5-7 (Lilly et al. MS 1998).

Catch rates in the inshore sentinel survey do not provide direct measures of biomass. An attempt was made to obtain such measures by assuming that sentinel gillnet catch rates are directly proportional to cod concentration

(Winters and Brattey MS 1998). This ratio was determined from an estimate of biomass for Placentia Bay (Subdivision 3Ps) in 1997 based on a mark-recapture experiment. It was then assumed that this ratio could be applied to sentinel gillnet catch rates in Divisions 3KL. The biomass calculated by this method for coastal waters of Divisions 3KL in 1997 was 123,000 t.

Sentinel catch rates compared with commercial catch rates

Although it is not clear how to interpret sentinel catch rates in terms of information regarding current population size, a comparison can be made between sentinel catch rates and those recorded by the commercial fishery prior to the moratorium. The statistical database on catch data for 2J+3KL cod (ZIFF) contains information from logbooks for vessels greater than 35 ft to allow catch rates to be calculated by gear type from cod-directed fishing activities. The greater than 35 ft component of the fleet reflects only a small proportion of the fixed gear fleet and the usable data for this fleet sector is sparse and probably unreliable (see Murphy and Shelton (MS 1997) for more information). Only the gillnet and linetrawl catch rate data from the sentinel fishery (fixed sites, 1995-97) were available for analysis. Univariate statistics (mean, median, standard deviation, 75th percentile and 25th percentile) were computed for both the commercial data and the sentinel data for these two gear types by NAFO division (Table 32).

Mean gillnet catch rates are lower in the sentinel fishery in Divs. 2J and 3K but slightly higher in 3L. Mean catch rates for linetrawl are substantially higher in the sentinel fishery. However, for all gear type/division comparisons, the median catch rate in the sentinel fishery is lower than the median catch rate from the commercial logbook data. The higher probability of lower catch rates in the sentinel fishery is further reflected by the 75th and 25th percentiles. The explanation is that sentinel catch rates at the fixed sites are quite often low but are occasionally very high (higher than was commonly observed in the commercial fishery in 1987-92). Few low catch rates are recorded in the commercial fishery, presumably because fishermen employ their traditional knowledge to consistently obtain reasonably good catch rates. It is also possible that low catch rates are sometimes not recorded or are recorded as by-catch in a fishery directed at another species.

It is difficult, therefore, to draw comparisons between the commercial catch rates and the sentinel catch rates and therefore very difficult to infer relative status of the stock before and after the moratorium from these data. Emphasis of only the high sentinel catch rates as indicative of stock recovery would clearly be misleading. However, the low catch rates from fixed sentinel sites may reflect local movements of fish relative to the fishing gear. Given the present lack of understanding of the relationship between sentinel catch rates and the size of the 2J+3KL cod stock (either inshore component alone or the entire stock), it is not possible to infer stock status from these data. It must also be considered that inferences regarding stock status may not be able to be drawn from sentinel catch rates without detailed knowledge of temporal and spatial patterns of fish abundance relative to the sentinel sites.

Potential fishing effort

Although not relating directly to the present assessment, the number of Canadian groundfish license holders by Division and vessel size (Fig. 22) provides an indication of potential fishing effort on the 2J+3KL cod stock and how this has changed over time. Most of the groundfish license holders are in 3K and 3L. The number of licenses declined just after the moratorium but has been relatively constant (slight decline) since 1994. The current number of licenses to fish groundfish in 2J+3KL stands at close to 4,000. This is a tremendous amount of potential fishing effort given the current status of most groundfish stocks in the area. Further, what is clear from the graphs is that what little decrease in potential fishing effort that has occurred since the moratorium has taken place in the less than 25ft vessel class.

Analysis

Sequential population analysis

In contrast to previous assessments, two sequential population analysis approaches were examined in this assessment: the standard ADAPT approach (Gavaris 1988), and a new approach (Quasi-likelihood, Cadigan and Stansbury MS 1998). The two analyses gave similar outcomes. Neither approach resolves the problems associated with reconciling the information in the research vessel index and the commercial catches under the assumptions of constant catchability, constant natural mortality and no error in the catch at age. The problem of lack of model fit is viewed as a systematic departure from the assumptions and requires further research. In addition to ADAPT and QLSPA models with the standard assumptions, various alternative SPA's were considered: (i) including estimates of harp seal removals (Stansbury et al. MS 1998), (ii) including guessed-at unreported landings; (iii) including an adjustment to natural mortality or catchability to more closely fit to the observed research vessel index. These additional analyses did not lead to any acceptable modifications regarding the assessment of current stock status and are very tentative with regard to explaining past dynamics, and are not reported on further in this research document.

ADAPT

A formulation of ADAPT was applied to the autumn RV mean numbers at age index (Table 22) and catch at age (Table 7).

Parameters estimated in the ADAPT were:

Population numbers

$N_{i,t}$ where i = 2 to 14, t = 1998,

and Catchabilities

K_i where i=2 to 12.

The following assumptions were made:

(i) natural mortality assumed to be 0.20,
(ii) fishing mortality on the oldest age (10) set to be equal to the mean for ages 9 to 12,
(iii) no error in the catch numbers at age.

Input data were:

Catch numbers at age

$C_{i,t}$ where i = 3 to 10 and t = 1962 to 1997

and Research Vessel survey estimates of mean numbers at age

$RV_{i,t}$ where i = 3 to 10 and t = 1983 to 1997.

The objective function which was minimized was

$$\Sigma_{i,t} (\ln(RV_{i,t} - \ln(K_i N_{i,t})^2.$$

The parameter estimates and associated standard errors obtained from fitting the above model are given in Table 33. The estimates of numbers at age at the beginning of the year from the ADAPT are given in Table 34. The associated estimates of F are given in Table 35 and the age specific residuals from the observed and predicted RV estimates are given in Table 36 and plotted in Fig. 23. Estimated beginning of year 2+, 5+ and spawner biomass are plotted in Fig. 24.

Quasi-likelihood SPA

The quasi-likelihood SPA (QLSPA) is similar to the ADAPT framework; however, inferences are based on a semi-parametric stochastic model involving only assumptions about the first two central moments of abundance indices (Cadigan and Stansbury MS 1998). The approach taken is quite general in terms of mean and variance modeling. The quasi-likelihood SPA can accommodate Normal, Poisson-type, Gamma/Lognormal, and other types of variation in abundance indices. The quasi-likelihood method is commonly used in semi-parametric inference (see McCullagh and Nelder 1989).

Adopting the same assumptions as the ADAPT but with the different error structure and estimation approach, equivalent estimates were obtained. Note that the population estimate is for beginning of 1997 rather than beginning of 1998 as in the ADAPT formulation. The estimates of survivors on 1 January 1997 and catchabilities at age with associated estimates of uncertainty are given in Table 37. Estimates of beginning of year population size and fishing mortality are given in Tables 38 and 39. Standardized residuals from the model fit are provided in Table 40 and plotted in Fig. 25. Estimated beginning of year 2+, 5+ and spawner biomass are plotted in Fig. 26.

Despite the poor fit of the SPA model to the data, the general trends in estimated biomass are considered to be broadly reflective of the real population with biomass declining in the late 1980s to reach extremely low levels by 1992.

Risk analysis

Neither the ADAPT nor the QLSPA were considered to be adequate representations of the past dynamics and present status of the stock, and therefore do not provide a basis for carrying out risk analysis. However, recent emphasis on the "precautionary approach" in the assessment of Atlantic Canada groundfish stocks suggests that there is some value in carrying out a tentative risk analysis in order to focus on the kinds of data and analyses that are required to implement this approach. It must be borne in mind that the major source of uncertainty in the current assessment regarding appropriate model specification (i.e. unreported landings, changes in natural mortality, changes in catchability) are not considered in the analysis and therefore the calculated risks are not considered useful in evaluating TAC options at this stage.

As a first step in this process, the so-called "precautionary plots" (Sissenwine and Shepherd 1987) were constructed (Fig. 27). Assumed weights at age and maturities at age for 1998 used to calculate spawner and yield per recruit are given in Tables 41 and 42. The partial recruitment vector was derived from the average fishing mortality values in the three years preceding the moratorium. The Beverton and Holt stock-recruit model was fit to the data using a maximum likelihood procedure assuming lognormal errors. Spawner biomass was derived using model predicted maturities at age (Table 42). The following reference points were calculated based on the precautionary plots: $F_{0.1}$ = 0.251, Fmax = 0.503, Fmsy = 0.219, MSY = 301 Kt, Biomass of age 2+ fish at MSY = 2 Mt, Biomass of age 5+ fish at MSY = 1.6 Mt and Biomass of mature fish at MSY = 1.3 Mt.

The risk analysis used the estimates of population size at the beginning of 1997 from the QLSPA. A Monte Carlo analysis of the risk was carried out following the general approach given in Sinclair and Gavaris (1996) except that both the variance and the covariance of the population estimates were taken into account in generating 300 realizations of the beginning of 1997 population size for ages 2 to 14 for each TAC option. In each realization the 1997 reported catch at age was removed and the standard natural mortality rate of M=0.2 was applied following Pope's approximation to give beginning of year numbers at age for 1998. Then a range of alternative TAC options for 1998 (0, 1,000, 2,000, 3,000, and 5,000 t) were evaluated with respect to a set of reference points. The TAC was applied to the realized population using the average partial recruitment vector from the last three years of the fishery and assumed weights at age in the catch. Population biomass and mature biomass were obtained using projected maturity and weights at age based on recent estimates (Tables 41 and 42).

The following reference points were considered: P(B299/B298≤1), P(B599/B598≤1), P(Bm99/Bm98≤1) = the probability that the beginning of year 2+, 5+ and mature biomass in 1999 will be less than or equal to the corresponding beginning of year 2+, 5+ and mature biomass in 1998; P(B299/B298≤1.1), P(B599/B598≤1.1), P(Bm99/Bm98≤1.1) = the probability that the 2+, 5+ and mature biomass will grow by an amount less than or equal to 10% from 1998 to 1999 under the different TAC options; P(B299/B298≤1.2), P(B599/B598≤1.2), P(Bm99/Bm98≤1.2) = the probability that the 2+, 5+ and mature biomass will grow by an amount less than or equal to 20% from 1998 to 1999 under the different TAC options; P(B299/B292≤1), P(B599/B592≤1), (Bm99/Bm92≤1) = the probability that the beginning of year 2+, 5+ and mature biomass in 1999 will be less than or equal to the corresponding beginning of year 2+, 5+ and mature biomass in 1992 (the year in which the moratorium was declared) under different TAC options; P(B299/B2_0.5msy≤1), P(B599/B5_0.5msy≤1), P(Bm99/Bm_0.5msy≤1) = the probability that the beginning of year 2+, 5+ and mature biomass in 1999 will be less than or equal to the *estimated half the corresponding MSY biomass level (from a Beverton and Holt fit to the estimated spawner* biomass and recruit data) under different TAC options; P(B299/B2Ave80s≤1), P(B599/B5Ave80s≤1), (Bm99/BmAve80s≤1) = the probability that the beginning of year 2+, 5+ and mature biomass in 1999 will be less than or equal to the corresponding average biomass for the 1980s under different TAC options; P(F98>F0.1) = the probability that the fishing mortality in 1998 will exceed the F0.1 level under different TAC options.

Although not exhaustive, these reference points represent a range that might be considered useful to decision makers in reaching a decision regarding the appropriate TAC option in future assessments of this stock if the problem of model-misspecification can be resolved. The last reference point - the probability of exceeding F0.1, may have the most influence at present because it reflects the current view that TAC options that have a significant probability of exceeding the old F0.1 control rule (under which some Atlantic groundfish stocks declined or collapsed) are too risky to consider. In reality, the degree of risk-averseness considered appropriate by decision makers has not yet been determined in the context of groundfish stocks in Atlantic Canada. Such considerations will of course have to determine the other side of the coin as well - how much harvest are the decision makers willing to forego in order to "purchase" the amount of risk-averseness they require (i.e. there is a cost in terms of yield foregone).

The results of the risk analysis are presented in the form of a "decision table" (Table 43) in which the probability relative to each reference point is determined from the 300 Monte Carlo realizations at each TAC option. If the *present risk analysis were to be considered valid, then the decision table indicates that even a small TAC of only* 1,000 t in 1998 would have a high probability of exceeding F0.1 and that there would be a relatively large probability that the biomass would not grow. At the assumed M of 0.2, there is only a small probability that the biomass will not recover. However, as will be seen below, the current survey data, if interpreted at face value (i.e. no change in catchability) suggest that M for this stock is considerably higher than 0.2 at present.

Estimates of total mortality (Z)

In the absence of an acceptable SPA reconstruction of the stock, alternative, less data-demanding analyses need to be considered. If the autumn research vessel index at age is proportional to the population abundance at age then these data can be used to calculate total mortality (Z) for those ages that are fully recruited to the survey by means of the equation

$$Z_{a,y} = \ln\left(\frac{RV_{a+1,y+1}}{RV_{a,y}}\right).$$

For those ages that are not fully recruited to the survey, the relative Z values provide an indication of possible changes in total mortality, although not reflective of the actual mortality. The calculated Z's for ages 1 to 13 over the period 1983 to 1996 are plotted in Fig. 28. This plot demonstrates the big increase in total mortality that took place in the late 1980s and early 1990s. Although there is a marked decrease in the total mortality after the declaration of the moratorium, current values for most ages appear to be higher than the assumed value of 0.2.

Population growth

The propensity for a population to grow or decline under a range of total mortality values can be determined from age composition data alone. This was pointed out at the Zonal Cod Stock Assessment in St. John's (February 1998) by S.A. Murawski (National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole). Using the age composition from the autumn research vessel survey (Campelen equivalent values) and the projected 1998 weights and maturities at age (Tables 41 and 42) the percentage change in spawner biomass was evaluated for a range of Z from 0.2 to 1.5 (solid line, Fig. 29). The current estimate of average Z (1995 and 1996 for ages 2 to 7) is 0.77. From the graph it is clear that at this level of total mortality, the stock would be predicted to decline further, even in the absence of any commercial fishery.

For comparison, a similar exercise was carried out using the age composition determined from the length frequency composition of fish in the autumn inshore acoustic survey (Anderson et al. MS 1998), applying the age key from the autumn groundfish bottom trawl survey. The inshore age composition indicates a greater propensity for the stock decline at the estimated current levels of total mortality. An attempt was made to use the age key from trawler samples taken within the inshore acoustic survey, but the sampling was considered to be inadequate. If fish in the inshore have a different growth rate to fish in the offshore, then the inshore calculation will be inaccurate.

The apparent high levels of total mortality are of considerable concern. Even in the absence of a commercial fishery, the mortality rate is higher than the previously applied F0.1 target ($M+F=0.4$). Possible reasons include illegal fishing (unofficial estimates of current illegal removals of cod from 2J+3KL range as high as 10,000 t), increased predation (for example by seals (see Stansbury et al. (MS 1998) for estimates of seal removals)) and adverse environmental conditions. However, as discussed in the introduction, a further possible explanation is that the survey index does not provide consistent estimates of relative abundance.

Comments regarding recovery of the stock

The 2J+3KL cod stock has not experienced a detectable increase in the offshore since the declaration of a moratorium in July 1992. Indeed, indices of abundance and biomass from the spring and autumn surveys continued to decline after directed commercial fishing was closed, and total mortality calculated from recent (1995-1997) surveys is extremely high. Very few fish are surviving beyond age 5, especially in Divisions 2J and 3K. Factors that may be contributing to the apparent lack of recovery may be grouped into the following categories: egg production, egg and larval survival, and post-larval survival. Egg production may be low because of a small spawning stock biomass (Myers et al. 1996b). There has been a severe reduction in overall fish abundance, especially at older age-classes. This has been compensated for to some extent by the reduction in age at maturity. However, the younger fish have smaller individual body weights than older fish and produce gonads that are lighter per kg of body mass (Lilly MS 1998). Egg and larval survival are not being monitored. Post-larval mortality appears to be high in the offshore. The mortality imposed by harp seals is difficult to estimate, but the number of cod consumed by harp seals appears to be high (Stansbury et al. MS 1998). Predation by seals may be an important source of cod mortality.

There is no time-series of observations from research vessel surveys that would permit calculation of Z for the inshore, but Z's calculated from catch rates at age over the short 3-year period of the linetrawl sentinel survey in Divisions 3K and 3L were much lower than the offshore values (Lilly et al. MS 1998). It must be recognized, however, that the linetrawl catch rates may be influenced by many factors other than the abundance of cod and that any perception of mortality rate may change when a longer time-series is available. Additional evidence of lower mortality inshore comes from the persistence of the 1990 year-class, which was relatively strong in pelagic research traps in 1991-1994 (J. Brattey, unpubl. data), dominated most sampling during hydroacoustic/tagging surveys in the inshore in 1995-1996 (Brattey 1997; Brattey and Porter MS 1997) and contributed strongly to catches during sentinel surveys in 1995-1997 (Lilly et al. MS 1998). The actual quantity of fish inshore remains unclear. The autumn acoustic survey in the inshore provided a biomass estimate of only 18,000 t, but many fishermen felt that this was low compared with their observations and was not compatible with the catch rates in the sentinel survey.

Nevertheless, the captains of the two fishing vessels chartered to sample fish during the acoustic survey expressed concern regarding the low abundance of fish that they personally observed in the survey area.

The stock affinities of those cod currently inshore are not yet clear. The cod may belong to some components that formerly migrated between the offshore and the inshore and have remained inshore (Taggart 1997), or they may belong to inshore (coastal, bay) components. It is not known if any of these cod currently migrate seasonally between the inshore and the offshore, but the autumn bottom trawl surveys have not had one good catch of cod in the offshore for four years. Based on the uncertainities about stock affinities, any fishery on cod inshore from St. Mary's Bay in the south to White Bay in the north may hinder the ability of the cod to repopulate the offshore, especially if the cod now inshore include cod which formerly migrated between the inshore and the offshore. Cod must return in quantity to the offshore shelf from Hamilton Bank to Grand Bank before the stock can fully utilize the resources of the area and return to its former levels of productivity.

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Table 1. Historical landings (t) of cod from NAFO Divisions 2J3KL for the period 1959-97.

	2J				3K				3L				2J3KL			
	Offshore mobile gear		Fixed gear		Offshore moblie gear		Fixed gear		Offshore mobile gear		Fixed gear					
Year	Canada	Other	Canada	Total	Canada	Other	Canada	Total	Canada	Other	Canada	Total	Total Canada	Total Other	Total	TAC
1959	0	46372	17533	63905	0	97678	56264	153942	4515	51515	85695	141725	164007	195565	359572	
1960	1	164123	15418	179542	53	74999	47676	122728	7355	63985	94192	165532	164695	303107	467802	
1961	1	243144	17545	260690	0	64023	31159	95182	4675	73899	70659	149233	124039	381066	505105	
1962	0	226841	23424	250265	0	47015	42816	89831	4383	90276	72271	166930	142894	364132	507026	
1963	1	197868	23767	221636	0	79331	47486	126817	4446	83015	73295	160756	148995	360214	509209	
1964	13	197359	14787	212159	0	121423	40735	162158	10158	142370	75806	228334	141499	461152	602651	
1965	0	246650	25117	271767	21	50097	26467	76585	7353	130387	58943	196683	117901	427134	545035	
1966	39	226244	22645	248928	13	58907	32208	91128	8253	120206	55990	184449	119148	405357	524505	
1967	28	217255	27721	245004	114	78687	24905	103706	13478	200343	49233	263054	115479	496285	611764	
1968	4650	355108	12937	372695	1849	119778	40768	162395	15784	211808	47332	274924	123320	686694	810014	
1969	30	405231	4328	409589	56	80949	24923	105928	18255	151945	67973	238173	115565	638125	753690	
1970	0	212961	1963	214924	92	78274	21512	99878	14471	137840	53113	205424	91151	429075	520226	
1971	0	154700	3313	158013	31	61506	21111	82648	11976	148766	38115	198857	74546	364972	439518	
1972	0	149435	1725	151160	7	133369	14054	147430	4380	109052	46273	159705	66439	391856	458295	
1973	1123	52985	3619	57727	108	159653	13190	172951	1258	97734	24839	123831	44137	310372	354509	666000
1974	0	119463	1804	121267	19	149189	10747	159955	880	67918	22630	91428	36080	336570	372650	657000
1975	410	78578	3000	81988	189	112678	15518	128385	670	53770	22695	77135	42482	245026	287508	554000
1976	94	30691	3851	34636	771	79540	20879	101190	2187	40998	35209	78394	62991	151229	214220	300000
1977	525	39584	3523	43632	1051	26776	28818	56645	5362	26799	40282	72443	79561	93159	172720	160000
1978	4682	17546	6638	28866	7027	6373	29623	43023	9213	12263	45194	66670	102377	36182	138559	135000
1979	9194	6537	8445	24176	21572	16890	27025	65487	14184	12693	50359	77236	130779	36120	166899	180000
1980	13592	7437	17210	38239	21920	6830	37015	65765	15523	13963	42298	71784	147558	28230	175788	180000
1981	22125	4760	14251	41136	23112	3847	23002	49961	21754	15070	42827	79651	147071	23677	170748	200000
1982	58384	8923	14429	81736	8881	4074	42141	55096	27181	9271	56490	92942	207506	22268	229774	230000
1983	37276	4158	10748	52182	31621	2815	40683	75119	39123	10920	55001	105044	214452	17893	232345	260000
1984	9231	2782	13150	25163	48114	11059	35143	94316	47668	15973	49351	112992	202657	29814	232471	266000
1985	1466	78	10211	11755	68880	12945	30368	112193	36863	31176	39306	107345	187094	44199	231293	266000
1986	5734	7859	12916	26509	62086	5781	28384	96251	57805	53946	32202	143953	199127	67586	266713	266000
1987	39344	3999	16022	59365	39686	6160	27442	73288	44612	25916	36743	107271	203849	36075	239924	256000
1988	41468	9	17112	58589	40260	50	33820	74130	57805	26748	51405	135958	241870	26807	268677	266000
1989	33626	1003	23304	57933	37350	1179	20711	59240	40958	36621	59238	136817	215187	38803	253990	235000
1990	17883	183	14505	32571	26920	504	27516	54940	31187	25488	75266	131941	193277	26175	219452	199262
1991	621	82	2214	2917	30112	311	13332	43755	30264	49660 [2]	45416 [3]	125340	121959	50053	172012	190000
1992	0	0	18	18	584	273	884	1741	13627	14610 [4]	10960 [5]	39197	26073	14883	40956	0
1993 [1]	0	0	13	13	0	0	541	541	2	2425 [6]	8411 [7]	10838	8967	2425	11392	0
1994 [1]	0	0	9	9	0	0	368	368	0	50	936	986	1313	50	1363 [8]	0
1995 [1]	0	0	0	0	0	0	94	94	0	0	237	237	331	0	331 [9]	0
1996 [1]	0	0	3	3	0	0	739	739	1	0	655	656	1398	0	1501 [10]	0
1997 [1]	0	0	3	3	0	0	159	159	4		339	343	505	0	505	0

[1] Provisional catches.

[2] Includes French catch and other foreign catch as estimated by Canadian surveillance.

[3] Figure is 4000 t less than Canadian statistics as this quantity is considered 3NO catch misreported as 3L.

[4] Derived from reported catch and Canadian surveillance estimate of foreign catch.

[5] Includes 5000 t catch from the recreational fishery after the moritorium was declared.

[6] Canadian surveillance estimate of foreign catch .

[7] Includes 5053 t estimated for the recreational fishery additional to that recorded by Canadian statistic

[8] 1300 t is from the food fishery; the remainder is bycatch

[9] Includes 163 t caught in the sentinel survey and 168 t caught as bycatch.

[10] Comprised of a sentinel survey catch of 397 t, a food fishery catch of 962 t and bycatch of 142 t. However, 103 t of sentinel catch remains to be allocated by division and gear.

Table 2. Fixed gear cod landings (t) by division and gear type in NAFO Divisions 2J, 3K, and 3L in 1975 - 1997.
Landings from statistical areas other than Newfoundland are not included.

	2J					3K					3L					2J3KL
Year	Trap	GN	LL	HL	Total	TRAP	GN	LL	HL	Total	TRAP	GN	LL	HL	Total	Total
1975	642	2304	0	54	3000	4662	8645	565	1646	15518	10390	7552	1641	3112	22695	41213
1976	1022	2787	6	36	3851	7056	10666	718	2439	20879	18404	9066	2904	4835	35209	59939
1977	1285	2076	37	125	3523	11501	11611	1294	4412	28818	20988	8852	3591	6851	40282	72623
1978	2872	3376	55	335	6638	11329	11445	3647	3202	29623	23218	9023	5114	7839	45194	81455
1979	1333	5663	175	1274	8445	3532	11474	8414	3605	27025	20785	13488	7022	9064	50359	85829
1980	4679	11414	204	913	17210	12732	13549	8059	2675	37015	12871	11231	9394	8802	42298	96523
1981	3893	10105	72	181	14251	3952	10679	6360	2011	23002	10177	13579	11425	7646	42827	80080
1982	4464	9121	114	730	14429	16415	17571	6101	2054	42141	24248	20295	5704	6243	56490	113060
1983	3870	4854	842	1182	10748	10490	18305	2560	9328	40683	25690	16446	3834	9031	55001	106432
1984	5618	6116	379	1037	13150	9957	14362	2499	8325	35143	23103	14985	3824	7439	49351	97644
1985	4973	2992	252	1994	10211	13310	8082	2352	6624	30368	21594	8760	3245	5707	39306	79885
1986	4373	7804	109	630	12916	14555	7626	1555	4648	28384	15669	9865	2492	4176	32202	73502
1987	5158	9228	218	1418	16022	11278	10223	1590	4351	27442	11370	17419	3338	4616	36743	80207
1988	5907	9183	272	1750	17112	16261	11898	935	4726	33820	22148	18576	4004	6677	51405	102337
1989	6713	14846	290	1455	23304	8189	7921	700	3901	20711	23964	22231	4676	8367	59238	103253
1990	3616	9364	653	872	14505	11201	7726	3838	4751	27516	32158	28936	4545	9627	75266	117287
1991	1016	271	93	834	2214	7696	1384	1851	2401	13332	26524	11696 [2]	1247	5949	45416 [2]	60962
1992	0	0	2	16	18	27	103	9	745	884	1173	1131	16	8640 [3]	10960 [3]	11862
1993 [1]	0	0	1	12	13	3	37	9	492	541	11	93	80	8227 [3]	8411 [3]	8965
1994 [1]	0	0	0	9	9	0	8	0	359	367	6	38	22	870	936	1312
1995 [1]	<1	<1	0	0	0	13	52	28	2	95	12	176	33	16	237	332
1996 [1]	0	0	0	3	3	25	132	17	565	740	18	219	15	404	656	1500 [4]
1997 [1]	0	3	0	0	3	22	101	34	1	159	33	257	29	21	339	501

[1] Provisional catches.

[2] Catch is 4000 (t) less than Canadian statistics as this quantity is considered 3NO gillnet catch misreported in 3L.

[3] Estimate for recreational fishery has been reported as 3L Handline.

[4] Comprised of sentinel survey catch of 294 t, a food fishery catch of 1155 t and by-catch 142 t.
An amount of 103 t must still be allocated by gear type and division from the sentinel catches.

Table 3. Cod landings (t) from sentinel surveys and by-catch in Divisions 2J, 3K and 3L in 1997.

	SENTINEL 2J						SENTINEL 3K					
	TRAP	Gillnets	Gillnets (3.25)	Longline	Handline	Total	TRAP	Gillnets	Gillnets (3.25)	Longline	Handline	Total
JAN						0						0
FEB						0						0
MAR						0						0
APR						0						0
MAY						0						0
JUN						0	0.461	1.776	0.362			2.599
JUL	0	0.005	0.016		0.114	0.135	16.851	15.164	0.462			32.477
AUG	0.019	0.245	0.53		0.111	0.905	2.076	17.223	0.518	1.63	0.483	21.93
SEP		0.719	1.275	0.016	0.075	2.085	2.571	10.484	0.565	25.313		38.933
OCT		0.12	0.197			0.317	0.243	4.813	0.203	7.318	0.916	13.493
NOV						0		10.182	0.532			10.714
DEC						0						0
TOTAL	0.019	1.089	2.018	0.016	0.3	3.442	22.202	59.642	2.642	34.261	1.399	120.146

	SENTINEL 3L						By-catch Canada(N) 3K		By-catch Canada(N) 3L			
	TRAP	Gillnets	Gillnets (3.25)	Longline	Handline	Total	Gillnets	Other	OT	Gillnets	Longline	Total
JAN						0						0
FEB						0						0
MAR						0						0
APR						0						0
MAY						0	3.537		2.943	24.712	9.538	40.73
JUN	3.057	4.027	0.024			7.108	26.315	0.052		42.113		68.48
JUL	22.6	50.344	1.174		2.605	76.723	1.873		0.354	4.13		6.357
AUG	6.868	45.858	2.237	1.022	5.856	61.841	3.789	0.069	0.231	30.216		34.305
SEP		32.213	2.364	10	9.424	54.001	1.72			3.486		5.206
OCT		9.914	0.596	7.247	2.767	20.524	0.234			2.732		2.966
NOV		0.839	0.017	1.417		2.273	0.839					0.839
DEC						0						0
TOTAL	32.525	143.195	6.412	19.686	20.652	222.47	38.307	0.121	3.528	107.389	9.538	158.883

	Bycatch and sentinel combined 2J				3K									
	Trap	Gillnets	Longline	Handline	Trap	Gillnets	Longline	Handline	Otter trawl	Trap	Gillnet	Longline	Handline	Total
JAN		0.00			0.00	0					0	0		0.00
FEB		0.00			0.00	0					0	0		0.00
MAR		0.00			0.00	0					0	0		0.00
APR		0.00			0.00	0					0	0		0.00
MAY		0.00			0.00	3.537			2.943		24.712	9.538		40.73
JUN		0.00			0.51	28.453				3.057	46.164	0		78.19
JUL	0.00	0.02		0.11	16.85	17.499			0.354	22.6	55.648	0	2.605	115.69
AUG	0.02	0.78		0.11	2.15	21.53	1.63	0.483	0.231	6.868	78.311	1.022	5.856	118.98
SEP		1.99	0.02	0.08	2.57	12.769	25.313				38.063	10	9.424	100.23
OCT		0.32			0.24	5.25	7.318	0.916			13.242	7.247	2.767	37.30
NOV		0.00			0.00	11.553					0.856	1.417		13.83
DEC		0.00			0.00	0					0	0		0.00
TOTAL	0.02	3.11	0.02	0.30	22.32	100.59	34.261	1.399	3.528	32.525	256.996	29.224	20.652	504.94

Table 4. Sampling used to estimate cod catch at age for Divisions 2J3KL in 1997.

Division	Gear	Month	No. measured	Quarter	No. aged	Sample wt (t)	Catch wt (t)
2J	TRAP	7	1			0.00	0.00
		8	32	QT3	20	0.02	0.02
	GN	7	29			0.02	0.02
		8	883	QT3	96	0.78	0.78
	GN	9	7199			1.99	1.99
		10	376	QT4	195	0.32	0.32
	LL	9	21	QT4		0.02	0.02
	HL	7	161			0.11	0.11
		8	179	QT3	62	0.11	0.11
		9	133	QT4	30	0.08	0.08
	Total		9014		403	3.45	3.45
3K	Trap	6	300			0.46	0.51
		7	10429			16.85	16.85
		8	1657	QT3	506	2.15	2.15
	Trap	9	2137			2.57	2.57
		10	175	QT4	107	0.24	0.24
	GN	5		QT2			3.54
	GN	6	1192			2.14	28.45
		7	7057			15.63	17.50
		8	7665	QT3	594	17.74	21.53
	GN	9	5296			11.05	12.77
		10	2081			5.02	5.25
		11	4423	QT4	95	10.71	11.55
	LL	8	948	QT3	62	1.63	1.63
		9	16140			25.31	25.31
		10	4733		279	7.32	7.32
	HL	8	314	QT3		0.48	0.48
	HL	10	551	QT4	30	0.92	0.92
	Total		65098		1673	120.22	158.58
3L	Trap	6	1726			3.06	3.06
		7	13517			22.60	22.60
		8	4652	QT3	606	6.87	6.87
	GN	5		QT2			24.71
		6	1712			4.05	46.16
		7	23440			51.52	55.65
		8	22012	QT3	969	48.10	78.31
		9	16064			5.58	38.06
		10	4331			7.84	13.24
		11	368	QT4	436	1.43	0.09
	LL	5		QT2			9.54
		8	948	QT3	62	1.02	1.02
		9	5632			10.00	10.00
		10	4189			7.25	7.25
		11	738	QT4	166	1.42	1.42
	HL	7	1090			2.61	2.61
		8	2466	QT3	59	5.86	5.86
		9	4903			9.42	9.42
		10	1435	QT4	98	2.77	2.77
		5					2.94
		7					0.35
		8					0.23
	Total		109223		2396	191.38	342.15
	Total 2J3KL		183335		4472	315.05	504.18

Table 5. Estimated average weight (kg), length (cm), number, standard error and coefficient of variation for the 1997 catch at age by gear for cod in Divisions 2J+3KL.

Gill net

AGE	WEIGHT (kg.)	LENGTH (cm.)	NUMBER (000'S)	STD ERR.	CV
1	0.000	0.00	0.00	0.00	
2	0.240	30.58	0.02		
3	0.494	38.56	3.05	0.22	0.07
4	0.751	43.58	6.85	0.32	0.05
5	1.683	57.30	26.01	1.41	0.05
6	2.045	61.10	40.89	1.90	0.05
7	2.406	64.36	67.47	2.07	0.03
8	2.792	67.31	17.15	1.29	0.08
9	3.733	73.57	2.17	0.33	0.15
10	4.299	77.06	1.47	0.30	0.21
11	4.199	74.81	0.37	0.14	0.38
12	6.543	89.28	0.08	0.03	0.37
13	6.220	88.00	0.01	0.01	1.01
14	0.000	0.00			

Line trawl

AGE	WEIGHT (kg.)	LENGTH (cm.)	NUMBER (000'S)	STD ERR.	CV
1	0.000	0.00	0.00	0.00	
2	0.329	33.79	0.14	0.04	0.30
3	0.519	39.10	3.35	0.27	0.08
4	0.848	45.84	7.15	0.55	0.08
5	1.411	54.07	11.35	0.74	0.07
6	2.040	60.91	6.89	0.66	0.10
7	2.724	66.89	7.03	0.51	0.07
8	3.609	73.24	1.30	0.22	0.17
9	4.331	77.83	0.22	0.08	0.38
10	4.979	81.68	0.13	0.05	0.36
11	7.625	94.00	0.01		
12	0.000	0.00	0.00	0.00	
13	0.000	0.00	0.00	0.00	
14	0.000	0.00	0.00		

Trap

AGE	WEIGHT (kg.)	LENGTH (cm.)	NUMBER (000'S)	STD ERR.	CV
1	0.00	0.00	0.00	0.00	
2	0.00	0.00	0.00	0.00	
3	0.49	38.41	1.12	0.12	0.11
4	0.81	45.11	6.14	0.36	0.06
5	1.19	51.11	12.85	0.49	0.04
6	1.71	57.51	6.33	0.40	0.06
7	2.37	63.71	6.89	0.34	0.05
8	2.90	67.83	1.55	0.18	0.12
9	3.71	73.44	0.39	0.08	0.21
10	3.44	71.74	0.12	0.05	0.38
11	3.93	74.08	0.05	0.03	0.56
12	5.56	84.77	0.02	0.01	0.55
13	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00

Hand line

AGE	WEIGHT (kg.)	LENGTH (cm.)	NUMBER (000'S)	STD ERR.	CV
1	0.000	0.00	0.00	0.00	0.00
2	0.181	28.00	0.00	0.00	0.79
3	0.678	42.05	0.28	0.06	0.21
4	1.113	49.78	2.54	0.30	0.12
5	1.449	54.54	3.45	0.35	0.10
6	2.081	61.45	1.21	0.25	0.21
7	2.668	66.47	2.29	0.28	0.12
8	3.095	69.63	1.22	0.21	0.17
9	3.851	74.61	0.23	0.07	0.32
10	4.428	78.67	0.14	0.03	0.25
11	4.393	78.47	0.06	0.02	0.41
12	0.000	0.00	0.00	0.00	
13	0.000	0.00	0.00	0.00	
14	0.000	0.00	0.00	0.00	

Table 6. Estimated average weight (kg), length (cm), number, standard error and coefficient of variation for the 1997 total catch at age for cod in Divisions 2J+3KL.

AGE	WEIGHT (kg.)	LENGTH (cm.)	NUMBER (000'S)	STD ERR.	CV
1	0.00	0.00	0.0	0.00	
2	0.32	33.33	0.2	0.04	0.27
3	0.51	38.90	7.8	0.38	0.05
4	0.84	45.40	22.8	0.80	0.03
5	1.49	54.96	54.0	1.71	0.03
6	2.01	60.67	55.7	2.08	0.04
7	2.44	64.58	84.2	2.19	0.03
8	2.87	67.84	21.4	1.34	0.06
9	3.78	73.94	3.0	0.36	0.12
10	4.30	77.15	1.9	0.31	0.17
11	4.23	75.36	0.5	0.15	0.30
12	6.33	88.28	0.1	0.03	0.31
13	6.22	88.00	0.0	0.01	1.01
14	0.00	0.00	0.0	0.00	
15	0.00	0.00	0.0	0.00	
16	0.00	0.00	0.0	0.00	
17	0.00	0.00			
18	0.00	0.00			
19	0.00	0.00			

Table 7. Catch numbers at age (thousands) for cod caught in the commercial fishery in NAFO Divisions 2J+3KL for the period 1962-97.

Age	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
2	301	1446	2872	85	819	790	288	59	6819	33	236	0
3	8666	5746	19338	5177	14057	15262	6142	4330	18104	12876	6737	3963
4	26194	27577	27603	28709	65992	77873	94291	39626	60102	71557	79809	40785
5	64337	60234	57757	46800	93687	100339	205805	100858	82357	95384	116562	94844
6	58163	118112	60681	66946	62812	96759	150541	163228	101249	98111	76196	59503
7	47314	58996	100147	64360	59312	54996	83808	107509	85696	57865	55984	35464
8	27521	29349	50865	68176	30423	38691	39443	52661	29218	25055	29553	27351
9	20142	15520	20892	33819	23844	17146	23171	19651	10857	11732	11750	14153
10	18036	11612	12264	14913	8762	16084	10984	12370	3825	4470	6393	7566
11	10444	8248	8698	6945	4528	5949	5591	6389	2000	2223	2987	3815
12	9468	4204	6352	3729	2280	3367	5249	4479	1200	1287	1660	2153
13	7778	3942	4989	3948	1825	2108	1939	3004	507	1140	1388	1173
14	5785	2933	4036	3730	1186	1529	1334	1557	224	720	725	450
15	4669	2928	2703	2722	967	685	818	622	214	355	748	278
16	3888	1737	1456	1859	806	424	610	567	244	474	606	309
17	3955	1263	1918	575	416	193	127	319	124	124	452	85
18	2161	1352	1154	971	279	107	89	100	32	128	136	27
19	232	328	501	183	486	72	83	46	10	148	195	38
20	403	182	312	226	178	211	26	99	34	78	36	8
Total	319457	355709	384538	353873	372659	432585	630339	517474	402816	383760	392153	291965

Age	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
2	473	420	15	108	0	0	92	0	0	18	3	0
3	3231	3968	13767	7128	1323	1152	2554	2185	1702	2585	782	650
4	13201	14101	33727	65510	17556	12361	12025	7172	31286	13616	14871	14824
5	34927	25370	28049	40462	39206	37493	28814	13191	19003	42602	31760	36614
6	74403	34426	20898	12107	20319	29202	30016	24800	14397	19028	38624	33922
7	60539	39105	16811	5397	7711	10982	18017	22014	25435	12044	12503	28006
8	35687	36485	16022	3396	3078	3460	4830	11848	16930	14701	7246	7050
9	18854	13421	10931	2730	1530	1300	1217	3175	11936	8934	8910	3836
10	10492	7514	4637	1381	1083	757	520	779	1923	6341	4227	5162
11	5818	2315	1462	532	437	560	232	309	338	1018	2536	2905
12	2934	1179	631	296	219	183	229	195	156	248	451	1681
13	1078	808	292	149	105	116	56	125	90	90	146	254
14	652	372	251	75	62	51	65	48	153	41	48	107
15	249	165	100	42	40	43	37	14	40	29	41	39
16	338	82	50	21	21	38	13	28	12	11	30	20
17	162	5	40	20	7	7	10	20	13	9	7	17
18	113	8	64	14	8	7	14	5	4	6	7	1
19	45	22	30	2	2	4	4	5	0	2	4	3
20	20	1	20	6	7	9	10	5	0	3	3	5
Total	263216	179767	147797	139376	92714	97725	98755	85918	123418	121326	122199	135096

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
2	1	42	25	8	58	35	0	0	0	0	1	0
3	831	2329	2779	1696	7693	3111	430	940	105	7	40	8
4	15219	9217	14651	17639	40557	31654	3860	4993	379	30	237	23
5	44168	32340	20184	21150	36410	53805	14535	3343	575	71	297	54
6	45869	49061	47917	25212	22695	29553	12211	1940	177	55	341	56
7	26025	28469	45725	38708	16390	9064	4526	700	74	20	129	84
8	14722	19505	18608	28499	17940	6164	1372	147	22	11	23	21
9	3104	5818	9026	8696	9156	4745	376	21	2	3	5	3
10	2000	1346	4337	3640	2865	1696	199	0	0	0	3	2
11	1977	676	774	1695	1084	641	104	0	0	0	0	0
12	1101	873	422	572	478	250	18	0	0	0	0	0
13	574	391	366	244	103	88	9	0	0	0	0	0
14	116	200	223	180	98	39	4	0	0	0	0	0
15	29	37	100	94	36	21	0	0	0	0	0	0
16	18	22	32	43	25	9	0	0	0	0	0	0
17	11	3	5	4	8	3	0	0	0	0	0	0
18	9	1	10	9	7	2	0	0	0	0	0	0
19	2	4	5	0	1	2	0	0	0	0	0	0
20	2	0	5	1	0	0	0	0	0	0	0	
Total	155778	150334	165194	148090	155604	140882	37644	12084	1334	197	1076	252

Table 8. Catch weights-at-age (kg) for cod caught in the commercial fishery in NAFO Divisions 2J+3KL for the period 1962-97

Age	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
2	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14		0.11
3	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.44	0.32	0.35
4	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.53	0.47	0.68
5	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.64	0.71	0.91
6	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.08	0.96	1.11
7	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.52	1.30	1.27
8	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.13	1.80	1.56
9	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.86	2.20	2.05
10	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.29	2.82	2.75
11	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.95	3.19	3.13
12	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.12	3.79	3.41
13	6.06	6.06	6.06	6.06	6.06	6.06	6.06	6.06	6.06	6.06	5.00	4.53	4.92
14	5.54	5.54	5.54	5.54	5.54	5.54	5.54	5.54	5.54	5.54	9.32	6.93	4.40
15	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	9.40	7.22	6.33
16	5.83	5.83	5.83	5.83	5.83	5.83	5.83	5.83	5.83	5.83	6.89	7.05	5.50
17	6.44	6.44	6.44	6.44	6.44	6.44	6.44	6.44	6.44	6.44	14.67	9.45	7.57
18	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	12.04	11.16	11.07
19	6.61	6.61	6.61	6.61	6.61	6.61	6.61	6.61	6.61	6.61	7.62	7.62	7.62
20	7.19	7.19	7.19	7.19	7.19	7.19	7.19	7.19	7.19	7.19	17.46	17.46	17.46

Age	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
2	0.26	0.25	0.09			0.41	0.00		0.31	0.34		0.21	0.32
3	0.45	0.45	0.45	0.40	0.46	0.53	0.55	0.53	0.62	0.59	0.48	0.51	0.43
4	0.63	0.61	0.60	0.72	0.74	0.77	0.78	0.84	0.87	0.88	0.73	0.72	0.66
5	0.96	0.93	0.97	1.04	1.13	1.16	1.17	1.20	1.32	1.20	1.10	1.04	1.03
6	1.18	1.32	1.66	1.58	1.67	1.71	1.64	1.77	1.75	1.79	1.43	1.54	1.32
7	1.39	1.75	2.33	2.46	2.46	2.38	2.23	2.10	2.28	2.28	2.06	1.85	1.87
8	1.74	2.07	2.82	3.26	3.57	3.56	2.86	2.66	2.61	2.71	2.66	2.35	1.93
9	2.21	2.24	3.46	4.05	4.41	5.01	3.81	3.09	3.18	2.96	3.23	2.94	2.80
10	2.61	2.99	3.88	4.46	5.25	5.49	5.32	4.18	3.50	3.65	3.32	3.47	3.51
11	3.34	3.67	4.78	5.02	5.80	6.72	6.29	6.16	4.79	4.28	4.06	3.80	4.80
12	3.66	4.56	6.13	6.72	7.03	7.87	7.06	7.19	7.76	6.19	4.55	4.54	4.64
13	4.78	6.18	7.31	8.10	8.96	8.38	7.32	8.00	9.07	8.39	7.03	5.34	5.74
14	5.20	8.19	8.40	7.42	8.54	10.03	10.01	8.36	9.14	10.26	9.67	7.12	6.13
15	5.20	9.77	8.81	8.20	9.46	11.31	8.99	7.86	10.62	11.44	11.37	11.77	8.53
16	5.46	11.23	11.75	11.26	10.70	13.87	11.54	7.91	10.57	11.61	11.27	11.24	13.51
17	8.51	12.44	10.63	11.61	13.12	10.68	10.48	9.58	13.13	17.47	12.68	14.15	9.10
18	9.24	11.16	12.27	8.92	13.49	16.09	11.15	12.95	15.97	12.94	12.42	16.14	21.77
19	7.62	7.62	7.62	10.57	15.51	12.04	9.82	0.00	9.73	15.21	14.38	12.30	17.66
20	17.46	17.46	17.46	16.00	14.77	11.37	12.59	0.00	15.88	12.81	19.49	15.72	0.00

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
2	0.29	0.26	0.29	0.17				0.21	0.40	0.32
3	0.49	0.48	0.42	0.36	0.29	0.57	0.40	0.49	0.72	0.51
4	0.73	0.74	0.69	0.61	0.58	0.71	0.68	0.79	0.99	0.84
5	1.08	1.03	1.06	0.97	0.81	0.97	0.98	1.51	1.30	1.49
6	1.38	1.44	1.50	1.41	1.19	1.25	1.41	1.95	1.90	2.01
7	1.67	1.83	1.94	1.88	1.73	1.59	1.85	2.24	2.38	2.44
8	2.21	2.07	2.22	2.27	2.05	8.40	2.05	2.47	2.77	2.87
9	2.51	2.64	2.44	2.63	2.66	9.23	3.05	2.53	3.30	3.78
10	3.04	3.02	3.06	3.14	2.24			2.93	3.19	4.30
11	4.37	3.96	3.58	3.80	2.68			4.51	5.44	4.23
12	5.49	5.41	4.68	4.96	4.95			2.01	4.35	6.33
13	6.55	7.50	6.23	5.49	5.34				7.63	6.22
14	8.60	9.24	8.51	7.61	7.02				4.46	
15	9.76	10.05	9.78	11.58						
16	9.73	9.34	12.58	11.01						
17	12.58	15.74	15.45	12.82						
18	16.01	18.66	13.58	13.00						
19	16.60		17.26	13.10						
20	11.03	17.64								

Table 9. Catch biomass (tons) for cod caught in the commercial fishery in NAFO Divisions 2J+3KL for the period 1962-97.

Age	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
2	42	202	402	12	115	111	40	8	955	5	33	0
3	2946	1954	6575	1760	4779	5189	2088	1472	6155	4378	2964	1268
4	14407	15167	15182	15790	36296	42830	51860	21794	33056	39356	42299	19169
5	56617	53006	50826	41184	82445	88298	181108	88755	72474	83938	74600	67339
6	71540	145278	74638	82344	77259	119014	185165	200770	124536	120677	82292	57123
7	78541	97933	166244	106838	98458	91293	139121	178465	142255	96056	85096	46103
8	58345	62220	107834	144533	64497	82025	83619	111641	61942	53117	62948	49232
9	53175	40973	55155	89282	62948	45265	61171	51879	28662	30972	33605	31137
10	57354	36926	39000	47423	27863	51147	34929	39337	12164	14215	21033	21336
11	39269	31012	32704	26113	17025	22368	21022	24023	7520	8358	11799	12170
12	39292	17447	26361	15475	9462	13973	21783	18588	4980	5341	6839	8160
13	47135	23889	30233	23925	11060	12774	11750	18204	3072	6908	6940	5314
14	32049	16249	22359	20664	6570	8471	7390	8626	1241	3989	6757	3119
15	28528	17890	16515	16631	5908	4185	4998	3800	1308	2169	7031	2007
16	22667	10127	8488	10838	4699	2472	3556	3306	1423	2763	4175	2178
17	25470	8134	12352	3703	2679	1243	818	2054	799	799	6631	803
18	13117	8207	7005	5894	1694	649	540	607	194	777	1637	301
19	1534	2168	3312	1210	3212	476	549	304	66	978	1486	290
20	2898	1309	2243	1625	1280	1517	187	712	244	561	629	140
total	644926	590090	677428	655244	518248	593302	811698	774346	503047	475357	458793	327188

Age	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
2	52	109	4	10	0	0	38	0	0	6	1	0
3	1131	1786	6195	3208	529	530	1354	1202	902	1603	461	312
4	8977	8884	20573	39306	12640	9147	9259	5594	26280	11846	13086	10822
5	31784	24355	26086	39248	40774	42367	33424	15433	22804	56235	38112	40275
6	82587	40623	27585	20098	32104	48767	51327	40672	25483	33299	69137	48508
7	76885	54356	29419	12575	18969	27016	42880	49091	53414	27460	28507	57692
8	55672	63484	33166	9577	10034	12352	17195	33885	45034	38370	19637	18753
9	38651	29660	24485	9446	6197	5733	6097	12097	36882	28410	26374	12390
10	28853	19612	13865	5358	4830	3974	2855	4144	8038	22194	15429	17138
11	18210	7732	5366	2543	2194	3248	1559	1944	2082	4876	10854	11794
12	10005	4315	2877	1814	1472	1286	1802	1377	1122	1924	2792	7649
13	5304	3862	1805	1089	851	1039	469	915	720	816	1225	1786
14	2869	1934	2056	630	460	436	652	480	1279	375	492	1035
15	1576	858	977	370	328	407	418	126	314	308	469	443
16	1859	448	562	247	236	407	180	323	95	116	348	225
17	1226	43	498	213	81	92	107	210	125	118	122	216
18	1251	74	714	172	71	94	225	56	52	96	91	12
19	343	168	229	15	21	62	48	49	0	19	61	43
20	349	17	349	105	112	133	114	63	0	48	38	97
total	367583	262319	196809	146023	131904	157091	170005	167661	224625	228118	227236	229191

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
2	0	13	7	2	17	6	0	0	0	0	0	0
3	424	1001	1362	814	3231	1120	125	536	42	3	29	4
4	10958	6083	10695	13053	27984	19309	2239	3545	258	24	234	19
5	45935	33310	21799	21785	38595	52191	11773	3243	564	107	385	81
6	70638	64761	66125	36305	34043	41670	14531	2425	250	107	647	112
7	48146	53237	76361	70836	31797	17040	7830	1113	137	45	306	205
8	34597	37645	41124	58993	39827	13992	2813	1235	45	27	63	61
9	9126	16290	22655	22957	22341	12479	1000	194	6	8	18	11
10	6940	4724	13184	10993	8767	5325	446	0	0	0	11	8
11	7513	3245	3382	6712	3881	2436	279	0	0	0	1	2
12	4999	4051	2317	3095	2237	1240	89	0	0	0	0	1
13	3065	2244	2397	1830	642	483	48	0	0	0	0	0
14	826	1226	1918	1663	834	297	28	0	0	0	0	0
15	341	316	976	945	352	243	0	0	0	0	0	0
16	202	297	311	402	315	99	0	0	0	0	0	0
17	156	27	63	63	124	38	0	0	0	0	0	0
18	145	22	160	168	95	26	0	0	0	0	0	0
19	25	71	83	0	17	26	0	0	0	0	0	0
20	31	0	55	18	0	0	0	0	0	0	0	0
total	244066	228564	264975	250632	215096	168021	41200	12290	1301	321	1694	504

Table 10. Cod abundance (thousands) for NAFO Division 2J 1983-1992 in Campelen equivalent units.

Stratum depth (meters)	Stratum number	Area sq. nautical miles	Gadus 86-88 1983	Gadus 101-102 1984	Gadus 116-118 1985	Gadus 131-132 1986	Gadus 145-146 1987	Gadus 159-160 1988	Gadus 174-176 1989	Gadus 190-191 1990	Gadus 208-209 1991	Gadus 224-226 1992
	Mean survey date		05-Nov-83	05-Nov-84	30-Oct-85	11-Nov-86	06-Nov-87	14-Nov-88	10-Nov-89	12-Nov-90	14-Nov-91	05-Nov-92
101-200	201	1427	87811	52543	82806	99720	25126	319	0	0	0	0
	205	1823	122517	182501	48964	44029	34532	38745	502	1223	0	0
	206	2582	55637	142654	68017	134937	17607	83620	48332	2874	3197	3339
	207	2246	145830	101693	171902	37826	38648	45550	9825	15492	0	1545
201-300	202	440	5387	8111	4086	31746	7838	1025	0	0	0	0
	209	1608	108766	14599	39668	142610	48249	47602	140710	8590	9006	2522
	210	774	389901	16929	772	97706	479	10221	43414	34603	24230	2783
	213	1725	62645	33648	67470	102247	36569	43632	183006	89430	25390	1948
	214	1171	18102	112678	78314	157299	128223	115524	70582	18267	2942	897
	215	1270	25616	42569	26380	293011	27603	90521	1689	9434	2271	2114
	228	1428	22525	8643	2582	61157	4153	6679	14364	15813	154727	1964
	234	508	50198	16841	11926	22187	6825	2690	0	0	0	256
301-400	203	480	990	1552	638	5745	3962	5910	0	0	66	110
	208	448	5947	760	4622	9768	12572	1849	53462	8012	986	2465
	211	330	4698	908	2361	4880	4835	6945	35386	23197	67475	8058
	216	384	18	740	396	317	9720	1347	2562	872	687	106
	222	441	0	20	698	61	849	182	33214	4853	1597	364
	229	567	6357	208	3536	1872	338	1222	6214	5577	11518	1508
401-500	204	354	1704	5235	0	1802	1242	5405	268	146	0	162
	217	268	0	38	0	0	184	0	0	0	74	0
	227	686	47	0	0	157	236	252	3350	18150	6810	582
	235	420	9620	404	144	0	780	462	664	3178	12537	212
total strata fished <= 500 meters			1124316	743236	615282	1249077	410570	508714	647594	260268	323637	30960
1 STD strata fished <= 500 meters			320612	112688	88262	261581	66519	74633	112157	45978	165231	5287
501-750	212	664	0	91	23	761	365	548	206	3562	41423	274
	218	420	0	nf	0	0	0	0	0	0	0	0
	224	270	0	0	0	0	0	0	0	0	130	0
	230	237	0	0	0	0	0	98	0	978	0	0
501-750		1591	0	91 [1]	23	761	365	646	206	4540	41553	274
751-1000	219	213	0	nf	0	0	0	0	0	0	0	0
	231	182	0	0	0	0	0	0	nf [T]	0	0	325
	236	122	0	0	0	34	0	0	nf [T]	0	0	0
751-1000		517	0	0	0	34	0	0	0 [T]	0	0	325
total strata fished > 500 meters			0	91	23	795	365	646	206	4540	41553	599
total all strata fished			1,124,317	743,328	615,304	1,249,871	410,936	509,360	647,797	264,807	365,191	31,560
1 STD all strata fished			320612	112687	88263	261582	66519	74635	112159	46014	170124	5304
mean number per tow			345.328	237.344	188.987	383.891	126.217	159.411	201.556	81.334	112.166	9.693

[1] Not all strata in the depth range have been fished. Strata not fished in the <= 500 meter depth range have been filled using a multiplicative model using data to 1992. Std are for strata fished in the depth range.

Table 11 . Cod biomass (t) for NAFO Division 2J 1983 -1992 in Campelen equivalent units.

Stratum depth (meters)	Stratum number	Area sq. nautical miles	Gadus 86-88 1983	Gadus 101-102 1984	Gadus 116-118 1985	Gadus 131-132 1986	Gadus 145-146 1987	Gadus 159-160 1988	Gadus 174-176 1989	Gadus 190-191 1990	Gadus 208-209 1991	Gadus 224-226 1992
Mean survey date			05-Nov-83	05-Nov-84	30-Oct-85	11-Nov-86	06-Nov-87	14-Nov-88	10-Nov-89	12-Nov-90	14-Nov-91	05-Nov-92
101-200	201	1427	61842	41743	58556	88676	27395	208	0	0	0	0
	205	1823	53701	95026	30679	38754	31421	61555	691	182	0	0
	206	2582	33286	121643	49111	123683	16999	92563	38555	661	1333	1489
	207	2246	46134	55054	107180	25989	36773	18803	2352	6370	0	649
201-300	202	440	8365	7647	3064	32711	11398	4874	0	0	0	0
	209	1608	127333	17017	35398	119210	56901	28242	52339	1670	3966	990
	210	774	241006	21752	1521	87332	737	10667	36642	12536	13406	1116
	213	1725	50086	27703	55229	98497	41997	53146	120476	34360	11859	587
	214	1171	19316	104048	77051	189715	170212	137161	56924	13766	1018	399
	215	1270	30986	31690	30602	379256	36553	146322	315	8508	1073	760
	228	1428	8049	7695	1244	52833	4800	10296	12552	8973	65772	672
	234	508	16910	11930	9173	22705	7342	5157	0	0	0	68
301-400	203	480	2250	3445	582	7875	6300	9640	0	0	45	77
	208	448	7465	1115	4301	8575	16641	3653	22845	3699	455	1091
	211	330	6334	1570	3287	4661	7667	7283	56896	10465	35048	3629
	216	384	52	1592	429	435	13557	2201	3178	255	287	25
	222	441	0	32	784	59	1192	247	9028	2559	579	175
	229	567	2354	263	3823	2399	340	1889	6166	4265	4906	595
401-500	204	354	2458	5863	0	2174	1732	8318	36	37	0	48
	217	268	0	60		0	211	0	0	0	45	0
	223	180	0	0	0	0	0	57	23	212	107	13
	227	686	217	0	0	224	341	353	5407	17904	4643	311
	235	420	4348	332	133	0	1090	717	962	1930	5594	101
total strata fished <= 500 meters			722492	557160	472147	1285763	491599	598478	425387	128352	150136	12795
1 STD strata fished <= 500 meters			177183	83218	65293	325107	31381	97959	218324	25701	72612	2315
501-750	212	664	0	nf	0	0	0	0	0	2196	20693	159
	218	420	0	0	0	0	0	0	0	0	62	0
	224	270	0	0	0	0	0	193	0	0	0	0
	230	237	0	0	0	0	0	0	0	1395	0	0
501-750		1591	0	0 [1]	0	0	0	193	0	3591	20755	159
751-1000	219	213	0	nf	0	0	0	0	0	0	0	0
	231	182	0	0	0	0	0	0	nf	0	0	144
	236	122	0	0	0	62	0	0	nf	0	0	0
751-1000		517	0	0	0	62	0	0	0 [1]	0	0	144
total strata fished > 500 meters			0	0	0	62	0	193	0	3591	20755	303
total all strata fished			722491	557302	472214	1287042	492144	599436	425874	131943	170892	13096
1 STD all strata fished			177183	83218	65293	325108	84935	97963	85921	25746	74135	2326

[1] Not all strata in the depth range have been fished. Strata not fished in the <= 500 meter depth range have been filled using a *multiplicative model* using data to 1992. Std are for strata fished in the depth range.

Table 12. Abundance and biomass estimates for NAFO Division 2J for the revised stratification scheme in Campelen equivalent units for 1993 and 1994 and actual Campelen units for 1995-1997.

Stratum depth (meters)	Stratum number	Area sq. nautical miles	GADUS 236-238 1993	GADUS 250-252 1994	TELEOST 20-23 1995-6	TELEOST 39 1996	TELEOST 54-54 1997	GADUS 236-238 1993	GADUS 250-252 1994	TELEOST 20-23 1995-6	TELEOST 39 1996	TELOST 54-55 1997
Mean survey date			07-Nov-93	17-Nov-94	28-Dec-95	30-Oct-96	27-Oct-97	07-Nov-93	17-Nov-94	28-Dec-95	30-Oct-96	27-Oct-97
			ABUNDANCE (000'S)					BIOMASS TONS				
101-200	201	633	0	0	nf	0	0	0	0	nf	0	0
	205	1594	63	219	nf	110	110	63	151	nf	16	42
	206	1870	547	0	0	184	257	155	0	0	62	125
	207	2246	2128	2699	350	588	138	452	507	44	57	110
	237	733	151	0	273	134	0	83	0	13	8	0
	238	778	nf	0	nf	107	36	nf	0	nf	21	27
201-300	202	621	0	0	49	0	0	0	0	9	0	0
	209	680	374	514	327	249	62	100	67	52	20	44
	210	1035	5731	854	1424	320	214	1158	139	108	26	112
	213	1583	871	0	2504	835	1085	346	0	336	214	586
	214	1341	1771	338	323	959	406	700	174	39	273	186
	215	1302	1719	358	90	2373	1381	443	210	21	773	586
	228	2196	436	0	949	2068	1347	294	0	263	665	747
	234	530	0	0	nf	73	142	0	0	nf	22	83
301-400	203	487	0	301	0	335	234	0	220	0	136	157
	208	588	0	162	768	566	0	0	41	123	200	0
	211	251	414	322	708	483	0	241	110	141	81	0
	216	360	0	173	927	715	99	0	96	234	194	54
	222	450	279	846	495	543	1021	146	276	124	290	495
	229	536	590	295	627	946	205	109	124	184	305	138
401-500	204	288	0	0	16	20	0	0	0	1	8	0
	217	241	66	55	561	63	0	67	19	135	26	0
	223	158	0	0	880	91	54	0	0	135	32	35
	227	598	795	0	370	1207	41	441	0	109	748	33
	235	414	1044	1006	541	101	85	318	559	175	84	30
	240	133	9	0	123	9	18	13	0	68	2	19
total strata fished <= 500 meters			16989	8145	12305	13081	6936	5129	2693	2312	4261	3609
1STD strata fished <= 500 meter			4595	2584	1822	1968	1000	883	514	272	796	463
501-750	212	557	77	128	69	136	77	93	15	15	22	49
	218	362	0	50	1660	75	0	0	519	519	12	0
	224	228	0	0	596	0	0	0	205	205	0	0
	230	185	0	34	13	0	0	0	14	14	0	0
	239	120	17	17	0	8	7	17	0	0	2	3
751-1000	219	283	0	0	0	0	0	0	0	0	0	0
	231	186	0	0	0	0	0	0	0	0	0	0
	236	193	0	0	12	0	0	0	2	2	0	0
1001-1250[1]		753	nf	nf	nf	0	0	nf	nf	nf	0	0
1251-1500[1]		768	nf	nf	nf	0		nf	nf	nf	0	0
total strata fished > 500 meters			94	229	2350	219	84	110	755	755	36	52
total all strata fished			17082	8373	14654	13300	7020	5238	2877	3067	4298	3662
1 STD all strata fished			4596	2588	2057	1973	1003	888	524	380	797	465

[1] Not all strata in the depth range have been fished . Because of the short time series with the revised stratification scheme and a switch in 1995 to a different vessel and gear no attempt has been made to use a multiplicative model to fill strata which were not fished.

Table 13. Cod abundance (thousands) for NAFO Division 3K 1983-1992 in Campelen equivalent units.

Stratum depth (meters)	Stratum number	Area sq. nautical miles	GADUS 87-88 1983	GADUS 101-103 1984	GADUS 117-118 1985	GADUS 131-132 1986	GADUS 146-147 1987	GADUS 160-161 1988	GADUS 175-176 1989	GADUS 191-192 1990	GADUS 209-210 1991	GADUS 224-226 1992
Mean survey date			26-Nov-83	23-Nov-84	18-Nov-85	01-Dec-86	27-Nov-87	05-Dec-88	05-Dec-89	04-Dec-90	04-Dec-91	26-Nov-92
101-200	618	1455	17028	24569	26453	64689	14954	57577	14811	13210	721	1268
	619	1588	3835	9955	1155	17476	6826	19598	63705	2578	0	218
201-300	620	2709	126888	110535	4685	135397	32793	100337	253826	11304	3780	2236
	621	2859	33593	32109	8338	27811	16059	32525	44025	14230	2517	131
	624	668	10016	9786	2550	2573	1746	3982	4901	24948	7076	735
	632	447	30765	9851	4591	4735	7410	51959	4888	22044	10336	1438
	634	1618	61564	31160	29182	323578	60702	21441	269092	4610	99321	694
	635	1274	7711	29442	4682	14225	3593	9534	5934	3505	1490	701
	636	1455	8807	17788	3828	21566	6777	12743	13850	715	1134	133
	637	1132	31704	73889	15928	46132	15805	24915	13766	6634	5320	156
301-400	623	1027	29291	51057	3697	4026	11782	23649	102872	50690	3155	5557
	625	850	4677	1988	7156	3196	11400	5554	21251	11693	1676	546
	626	919	6953	3266	2705	62324	5815	5006	12566	9260	1264	632
	628	1085	7935	4670	6617	2687	1582	18448	12575	5522	9303	4179
	629	495	2357	2557	1647	5720	938	7276	3135	6521	978	1853
	630	544	1497	2170	262	262	524	524	7009	1085	499	150
	633	2179	15312	21312	38293	96780	49404	15737	220703	243039	185926	7410
	638	2059	53867	17476	37259	36467	24472	23650	137139	360185	200000	7511
	639	1463	12449	5283	8780	15127	5980	12176	19270	52757	91771	2262
401-500	622	632	304	1434	283	1652	174	3188	21561	12476	1449	1594
	627	1194	1032	1038	372	4658	2633	1173	10505	85313	4506	3692
	631	1202	1025	33	472	207	3059	6063	42471	28964	15157	992
	640	198	194	0	9	14	0	109	2982	150	1970	17459
	645	204	0	0	9	90	112	28	4686	379	0	75
total strata fished <=500 meters			447748	451517	208952	891302	284541	457191	1307523	971810	649350	61622
1 STD strata fished <=500 meters			61132	68574	27228	321032	44267	73335	270219	184614	159892	17726
501-750[1]		917	0	0	0	nf	107	nf	nf	92	122	263
51-1000[1]		1340	nf	nf	0	nf	nf	nf	nf	128	56	0
total strata fished > 500 meters			0	0	0	0	107	0	0	220	178	263
total all strata fished			447748	451517	208952	891302	284648	457191	1307523	972029	649529	61886
1 STD all strata fished			61132	68574	27228	321032	44267	73335	270219	184614	159892	17726

[1] Not all strata in the depth range have been fished. Strata not fished in the <= 500 meter depth range have been filled using a multiplicative model using data to 1992. Std are for strata fished in the depth range.

Table 14. Cod biomass (t) for NAFO Division 3K 1983 -1992 in Campelen equivalent units.

Stratum depth (meters)	Stratum number	Area sq. nautical miles	GADUS 87-88 1983	GADUS 101-103 1984	GADUS 117-118 1985	GADUS 131-132 1986	GADUS 146-147 1987	GADUS 160-161 1988	GADUS 175-176 1989	GADUS 191-192 1990	GADUS 209-210 1991	GADUS 224-226 1992
Mean survey date			26-Nov-83	23-Nov-84	18-Nov-85	01-Dec-86	27-Nov-87	05-Dec-88	05-Dec-89	04-Dec-90	04-Dec-91	26-Nov-92
101-200	618	1455	**7987**	18702	24894	53641	10200	2443	1575	1514	261	450
	619	1588	**1491**	4801	1113	3157	2538	1212	3363	154	0	119
201-300	620	2709	67557	87523	8223	131461	27088	13232	24447	1636	1158	847
	621	2859	18041	25813	6216	19356	3294	11590	7313	1021	359	194
	624	668	3920	3082	2340	2798	802	3087	1660	8649	3809	331
	632	447	33968	**10779**	4106	4540	7824	51549	2030	8677	5581	663
	634	1618	56301	24843	28663	436500	80357	19008	322401	1976	77639	450
	635	1274	4940	11970	3551	16754	3329	3843	2609	998	617	319
	636	1455	11657	13899	3977	13264	5871	9229	3577	431	334	138
	637	1132	36769	75369	15341	50718	15913	29982	13010	2665	2332	85
301-400	623	1027	23690	46679	5155	4602	17254	3662	22849	12857	1130	1960
	625	850	5410	2474	7062	3405	11136	5766	12105	4049	861	291
	626	919	5565	3377	4274	41267	4852	1188	5858	718	345	218
	628	1085	8807	4909	7807	2564	1484	7998	7102	2184	4028	1345
	629	495	2506	1739	955	5557	907	1391	1550	2003	95	535
	630	544	1452	1564	435	292	743	863	9065	644	267	85
	633	2179	15440	23201	39817	115810	66782	15297	148660	169097	132091	4366
	638	2059	56662	12773	35965	37822	31829	18946	184194	353107	150413	3564
	639	1463	17739	5242	8657	14185	6332	7526	7803	24244	74514	941
401-500	622	632	541	1487	215	1307	163	847	8794	2974	498	564
	627	1194	970	772	360	5307	1150	1208	4805	13523	1248	765
	631	1202	2700	138	493	273	3049	6448	31211	11300	8691	732
	640	198	**385**	0	16	22	0	299	2436	204	1231	16334
	645	204	0	0	50	**255**	139	122	1628	368	0	48
total strata fished <=500 meters			374634	370356	209686	964600	303038	216734	830045	624993	467505	35346
1 STD strata fished <=500 meters			51399	58138	26560	428297	61366	50225	289567	207590	128742	16146
501-750[1]		917	0	0	0	**nf**	174	**nf**	**nf**	72	133	258
51-1000[1]		1340	**nf**	**nf**	0	**nf**	**nf**	**nf**	**nf**	70	39	0
total strata fished > 500 meters			0	0	0	0	174	0	0	142	172	258
total all strata fished			374634	370356	209686	964600	303212	216734	830045	645136	649529	35604
1 STD all strata fished			51399	58138	26560	428297	61366	50225	289567	198748	159892	16146

[1] Not all strata in the depth range have been fished. Strata not fished in the <= 500 meter depth range have been filled using a multiplicative model using data to 1992. Std are for strata fished in the depth range.

Table 15. Abundance and biomass estimates for the revised stratification scheme in NAFO Division 3K in Campelen equivalent units for 1993 and 1994 and actual Campelen units for 1995-97.

Depth range meters	Stratum number	Stratum area sq. mi.	GADUS 236-238 1993	GADUS 250-252 1994	WT 176-81 TELEOST 20-23 1995-6	WT 196-199 TELEOST 40-42 1996	WT 217 TELOEST 55-57 1997	GADUS 236-238 1993	GADUS 250-252 1994	WT 176-181 TELEOST 20-23 1995-6	WT 196-199 TELEOST 40-42 1996	WT 217 TELOEST 55-57 1997
Mean survey date			23-Nov-93	07-Dec-94	26-Dec-95	14-Nov-96	18-Nov-97	23-Nov-93	07-Dec-94	26-Dec-95	14-Nov-96	18-Nov-97
			abundance (000's)					biomass (tons)				
101-200	618	1347	2409	159	1170	1887	1174	721	40	87	221	291
	619	1753	965	0	655	218	448	708	0	32	42	36
201-300	620	2545	3268	350	1465	947	764	614	118	238	230	203
	621	2736	0	251	2393	303	44	0	267	302	77	202
	624	1105	391	152	813	2432	395	177	85	251	714	207
	634	1555	468	642	214	1246	31	189	417	97	391	7
	635	1274	467	0	88	386	243	189	0	10	94	208
	636	1455	734	200	286	133	267	334	141	92	39	234
	637	1132	4983	389	242	810	125	2039	74	74	358	38
301-400	617	593	1876	184	693	109	1006	383	74	97	14	359
	623	494	1138	0	578	510	136	213	0	32	144	37
	625	888	285	0	342	131	305	229	0	99	66	139
	626	1113	714	204	2709	1415	31	468	89	289	340	6
	628	1085	1443	299	1556	826	358	736	80	353	409	274
	629	495	908	375	545	68	69	343	20	70	12	45
	630	332	0	0	41	0	69	0	0	11	0	53
	633	2067	1153	2218	851	1381	885	502	1067	420	535	516
	638	2059	8780	1187	1252	2155	472	3913	401	635	723	232
	639	1463	1489	1711	712	1025	537	622	761	290	415	260
401-500	622	691	1141	57	542	230	63	299	32	68	55	19
	627	1255	2992	604	4924	1918	514	891	226	702	466	211
	631	1321	0	182	501	273	84	0	208	99	45	90
	640	69	228	16	218	25	43	131	11	90	13	30
	645	216	79	119	134	30	15	84	87	48	14	11
	650	134	995	65	276	92	350	441	43	112	40	292
total strata fished <= 500 meters			36907	9361	23200	18550	8428	14227	4241	4578	5457	3978
1 STD strata fished <= 500 meters			5817	2408	1734	2115	1130	1925	1062	427	608	492
501-750	641	230	11	21	63	47	0	16	18	83	101	0
	646	325	75	0	0	0	22	51	0	0	0	42
	651	359	16	123	691	25	0	25	116	317	30	0
751-1000	642	418	115	0	0	0	0	72	0	0	0	0
	647	360	0	0	0	0	0	0	0	0	0	0
	652	516	142	106	0	0	0	208	62	0	0	0
1001-1250	643	733	nf	nf	0	0		nf	nf	0	0	0
1251-1500[1]		953	nf	nf	0	0		nf	nf	0	0	0
total strata fished > 500 meters			359	250	754	72	22	372	196	400	131	42
total all strata fished			37265	9612	23954	18621	11384	14598	4437	4978	5588	4496
1 STD all strata fished			5819	2412	1790	2116	1189	1927	1066	475	608	515

[1] **Not all strata in the depth range have been fished. Because of the short time series with the revised stratification scheme and a switch in 1995 to a different vessel and gear no attempt has been made to use a multiplicative model to fill strata which were not fished.**

Table 16. Cod abundance (thousands) for NAFO Division 3L from fall surveys in 1983-1997 in depths <= 200 fathoms. The 1983 -94 data are in Campelen equivalent units and 1995-97 in actual Campelen units.

Stratum depth (meters)	Stratum number	Area sq. nautical miles	WT 7-9 1983	WT 16-18 1984	WT 37-39 1985	AN 72 1986	WT 65 1987	WT 78 1988	WT 87 1989	WT 101 1990	WT 114-115 1991	WT 129-130 1992	WT 145-146 1993	WT 160-162 1994	WT 176-181 1995	Tel 41 WT 196-198 1996	Tel 55-57 WT 213-217 1997
Mean survey date			27-Oct-83	15-Aug-84	27-Oct-85	21-Nov-86	24-Oct-87	03-Nov-88	20-Oct-89	05-Nov-90	21-Nov-91	16-Nov-92	23-Nov-93	22-Nov-94	27-Nov-95	02-Nov-96	27-Nov-97
31-50	350	2071	26886	62391	66442	43614	15131	13276	10854	5911	5359	1140	1804	122	1045	285	570
	363	1780	38933	73152	143316	6156	21384	23286	43993	52247	3702	13036	408	367	365	82	1306
	371	1121	20972	36304	5199	565	3547	4472	193	7556	411	1079	103	0	31	0	0
	372	2460	157018	160636	65709	16318	57710	16269	32627	141824	3774	2919	299	0	353	414	42
	384	1120	29119	73645	1560	801	34383	1489	986	41791	1061	146	154	0	0	0	0
51-100	328	1519	[6869]	1985	1802	37264	2507	8806	1224	2090	279	1114	488	139	0	334	376
	341	1574	14723	8401	4949	6124	337	1245	298	1985	505	217	1516	0	36	289	54
	342	585	2837	4466	912	885	1073	429	80	2052	161	54	0	80	40	121	40
	343	525	915	14408	1517	1974	337	650	24	1372	481	722	72	96	36	0	68
	348	2120	8934	34810	6978	6008	3143	3995	6189	6389	1896	3208	nf	219	250	393	167
	349	2114	9306	62170	15645	8724	2472	7302	1745	4736	3722	58	1939	208	122	166	344
	364	2817	25576	97381	20064	3720	*4789*	*10048*	1656	13595	291	388	1421	323	43	116	525
	365	1041	7074	102281	4242	8821	1456	1690	573	895	1575	286	95	95	215	207	191
	370	1320	5811	52295	2865	2905	1059	623	121	1888	121	484	666	0	73	0	91
	385	2356	5445	20391	756	4497	972	25	29	1713	389	648	0	0	0	36	0
	390	1481	815	33751	553	5229	23276	3107	2183	1290	0	136	0	0	34	0	0
101-150	344	1494	5823	15722	10733	8250	5600	4874	4580	9454	3186	5446	2363	771	530	2950	914
	347	983	5995	11719	3056	3651	2502	10628	4571	30560	609	676	439	34	199	391	541
	366	1394	11314	56011	[51115]	59062	25367	66130	17888	9812	19359	44544	2972	115	230	236	652
	369	961	9628	14919	5222	53011	11336	12241	1005	2809	12559	1884	227	0	78	0	220
	386	983	[10316]	8587	4327	14705	7167	4895	6464	7099	135	766	135	0	0	45	0
	389	821	[10850]	3614	4518	4179	49636	13270	10023	2936	10842	0	0	0	38	0	38
	391	282	16778	291	6440	485	2289	427	1028	1629	233	129	116	0	0	0	19
151-200	345	1432	6821	7936	14730	12410	8963	11285	5881	11977	4432	985	1510	542	2780	433	302
	346	865	17634	9023	9567	14120	30253	27058	9073	14517	37387	33292	1417	136	754	379	1269
	368	334	[21247]	2688	6524	12497	3101	5008	1861	11555	27437	30338	15627	88	299	128	459
	387	718	[12466]	19062	3704	22519	4708	1753	1350	3325	2963	2864	2601	779	66	44	1514
	388	361	[6572]	4817	1341	[1529]	*844*	*1813*	5761	1962	1556	579	414	177	99	0	135
	392	145	150	1107	339	110	10	289	40	598	259	20	27	0	19	18	20
total strata fished <= 200 fathoms			428505	993964	464125	358606	325352	256383	172299	395569	144684	147159	36813	4292	7732	7066	9859
1 STD strata fished <= 200 fathoms			47712	106973	88489	50292	50645	26946	30742	58945	17534	33948	12486	951	1993	1939	1862

[1] Not all strata in the depth range have been fished. Strata not fished in the <= 200 fathom depth range have been filled using a multiplicative model using data to 1992. Std are for strata fished in the depth range.

Table 17. Cod biomass (t) for NAFO Division 3L from fall surveys in 1983 - 1997 in depths < = 200 fathoms. The 1983-1994 data are in Campelen equivalent units and the 1995-1997 are in actual Campelen units.

Stratum depth (meters)	Stratum number	Area sq. nautical miles	WT 7-9 1983	WT 16-18 1984	WT 37-39 1985	AN 72 1986	WT 65 1987	WT 78 1988	WT 87 1989	WT 101 1990	WT 114-115 1991	WT 129-130 1992	WT 145-146 1993	WT 160-162 1994	WT 176-181 1995	Teleost 41 WT 196-199 1996	Tel 55-57 WT 213-217 1997
Mean survey date			27-Oct-83	15-Aug-84	27-Oct-85	21-Nov-86	24-Oct-87	03-Nov-88	20-Oct-89	05-Nov-90	21-Nov-91	16-Nov-92	23-Nov-93	22-Nov-94	27-Nov-95	02-Nov-96	27-Nov-97
31-50	350	2071	18204	42081	35227	46248	14242	16885	10769	6602	6434	1877	1522	179	1276	362	1355
	363	1780	36935	50726	103274	9116	22124	30177	33959	35121	4266	7504	344	211	506	224	2895
	371	1121	13316	24055	3285	366	4935	7746	457	9110	481	893	91	0	10	0	0
	372	2460	100388	74560	62776	22328	68454	19194	29816	177108	3164	1896	287	0	54	557	29
	384	1120	15999	57404	1314	163	27226	1681	223	61815	674	127	67	0	0	0	0
51-100	328	1519	2634	832	1378	11971	603	3397	1101	415	185	1748	166	248	0	537	1014
	341	1574	4517	5043	2694	4218	473	1273	198	1237	920	253	289	0	2	248	16
	342	585	752	1733	554	588	451	583	114	1029	383	123	0	36	22	184	66
	343	525	1341	6036	518	1930	404	661	90	653	132	459	79	34	18	0	45
	348	2120	6763	24084	4851	5686	3229	3906	4158	2995	1666	1504	nf	322	181	326	144
	349	2114	5245	23149	9512	7711	2203	8207	2690	3630	5454	66	1755	54	88	117	327
	364	2817	5306	21027	4966	2813	3463	7216	1681	6851	915	526	873	302	1	95	353
	365	1041	2101	20303	2383	4292	2116	1961	797	509	2814	347	54	114	129	147	72
	370	1320	2403	21444	1579	579	1605	1128	224	1159	189	673	171	0	72	0	41
	385	2356	1719	5657	316	2583	1624	303	110	1620	300	735	0	0	0	11	0
	390	1481	1366	6250	108	561	1850	516	294	283	0	81	0	0	13	0	0
101-150	344	1494	3698	12067	9056	7635	4726	2746	2435	5079	809	3003	988	382	233	2214	221
	347	983	6183	10733	2265	3960	1906	9386	5239	18473	369	181	351	20	99	324	259
	366	1394	15941	18725	54100	70142	28721	76378	18189	8194	15225	40824	2426	116	121	87	264
	369	961	9321	8962	8086	65455	19792	12361	3266	3223	13072	937	180	0	174	0	170
	386	983	8056	5281	6595	23005	5487	6410	7472	10209	124	366	194	0	0	20	0
	389	821	5221	4726	5017	3420	9036	2951	5134	3838	3388	0	0	0	12	0	35
	391	282	1418	157	1522	711	400	76	158	577	74	18	53	0	0	0	21
151-200	345	1432	10540	7499	15729	16629	9962	14557	7883	7575	1775	736	957	245	1441	370	76
	346	865	14781	6034	10546	15984	36414	33516	14619	13512	27945	29383	702	91	459	243	466
	368	334	23841	2557	10438	21732	7227	7539	4904	13883	26629	29646	10776	80	129	48	181
	387	718	13000	14254	7063	37565	5152	2623	1146	9129	3515	2018	1984	321	25	19	851
	388	361	5572	1730	3116	3929	389	1067	3506	1564	740	390	268	119	35	0	78
	392	145	172	245	251	43	15	110	55	276	117	9	19	0	15	7	10
total strata fished <= 200 fathoms			278412	477355	368514	387438	284230	274553	160688	405668	121761	126323	24594	2873	5114	6140	8991
1 STD strata fished <= 200 fathoms			35321	40504	58214	62019	31955	30073	21690	81110	15570	33260	8723	502	1187	1587	2212

[1] Not all strata in the depth range have been fished. Strata not fished in the <= 200 fathom depth range have been filled using a multiplicative model using data to 1992. Std are for strata fished in the depth range.

Table 18. Cod abundance (thousands) and biomass (t) for NAFO Division 3L in 1983-1997 in depths > 200 fathoms. The 1983-1994 data are in Campelen equivalent units and the 1995-1997 data are in actual Campelen units.

Stratum depth (fathoms)	Stratum number	Area sq. nautical miles	WT 7-9	WT 16-18	WT 37-39	AN 72	WT 65	WT 78	WT 87	WT 101	WT 114-115	WT 129-130	WT 145-146	WT 160-162	WT 176-181	Teleost 41 WT 196-198	Tel 55-57 WT 213-217
			1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Mean survey date			27-Oct-83	15-Aug-84	27-Oct-85	21-Nov-86	24-Oct-87	03-Nov-88	20-Oct-89	05-Nov-90	21-Nov-91	16-Nov-92	23-Nov-93	22-Nov-94	27-Nov-95	02-Nov-96	27-Nov-97
ABUNDANCE																	
201-300	729	186	nf	320	0	0	nf	nf	nf	38	0	13	213	0	0	0	13
	731	216	nf	15	30	nf	nf	nf	nf	15	30	168	277	21	13	nf	178
	733	468	nf	1481	43	nf	nf	nf	nf	386	21	494	1223	107	32	0	193
	735	272	nf	25	94	0	nf	nf	nf	nf	923	886	9155	180	187	0	449
301-400	730	170	nf	0	0	nf	nf	nf	nf	nf	0	0	0	8	0	0	0
	732	231	nf	0	0	nf	nf	nf	nf	0	0	0	0	0	0	0	0
	734	228	nf	0	0	nf	nf	nf	nf	0	0	0	31	42	0	0	167
	736	175	0	nf	0	0	nf	nf	nf	0	24	0	96	28	32	0	144
401-500		957	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	16	0	0
501-600		945	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	0	0	0
601-700		1745	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	0	0
701-800		773	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	0	0
total strata fished > 200 fathioms			0	1841	167	0	0	0	0	439	998	1561	10995	386	280	0	1144
total all strata fished offshore			428505	995804	464291	358606	325352	256383	172299	396008	145682	148719	47809	4678	8013	7066	11003
1 STD all strata fished offshore			47712	106981	88490	50292	50645	26946	30742	58946	17559	33959	13351	954	2002	1939	3654
BIOMASS																	
201-300	729	186	nf	206	0	0	nf	nf	nf	107	0	45	208	0	0	0	19
	731	216	nf	92	248	nf	nf	nf	nf	19	49	131	177	23	5	nf	178
	733	468	nf	1678	461	nf	nf	nf	nf	937	28	316	837	85	14	0	161
	735	272	nf	276	466	0	nf	nf	nf	nf	1214	1233	4809	91	109	0	369
301-400	730	170	nf	0	0	nf	nf	nf	nf	nf	0	0	0	8	0	0	0
	732	231	nf	0	0	nf	nf	nf	nf	0	0	0	0	0	0	0	0
	734	228	nf	0	0	nf	nf	nf	nf	0	0	0	18	42	0	0	313
	736	175	0	nf	0	0	nf	nf	nf	0	56	0	51	28	15	0	169
401-500		957	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	17	0	0
501-600		945	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	0	0	0
601-700		1745	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	0	0
701-800		773	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	nf	0	0
total strata fished > 200 fathoms			0	2252	1175	0	0	0	0	1063	1347	1725	6100	277	160	0	1209
total all strata fished offshore			278412	479606	369689	387438	284230	274553	160688	406730	123108	128048	30694	3149	5275	6140	10200
1 STD all strata fished offshore			35321	40525	58217	62019	31955	30073	21690	81110	15618	33279	9033	506	1193	1587	3922

nf Not all strata in the depth range hav been fished. Strata not fished in the greater than 200 fathom depth range have not been filled using a multiplicative model.

Table 19. Abundance (thousands) and biomass (t) estimated for inshore strata in Divisions 3K and 3L in autumn 1996-1997. Also shown are totals for offshore strata and for all strata fished.

			3K			
Stratum depth (meters)	Stratum number	Area sq. nautical miles	WT 196-199 TELEOST 40-42 1996	WT 217 TELEOST 55-57 1997	WT 196-199 TELEOST 40-42 1996	WT 217 TELEOST 55-57 1997
Mean survey date			14-Nov-96	18-Nov-97	14-Nov-96	18-Nov-97
			abundance		biomass	
101-200	608	798	915	1061	201	142
	612	445	510	92	111	3
	616	250	103	52	4	0
201-300	609	342	436	329	108	64
	611 [3]	600	122	578	25	129
	615	251	0	17	0	0
301-400	610	256	31	405	3	117
	614	263	16	0	2	0
401-500	613	30	0	0	0	0
total inshore strata			2133	2534	454	455
total offshore			18622	8850	5588	4040
total all strata fished			20756	11384	6039	4495
STD all strata fished			2209	1189	491	515

			3L			
Stratum depth (fathoms)	Stratum number	Area sq. nautical miles	Teleost 41 WT 196-198 1996	WT 213-217 TELEOST 57-58 1997	Teleost 41 WT 196-198 1996	WT 213-217 TELEOST 57-58 1997
Mean survey date			02-Nov-96	27-Nov-97	02-Nov-96	27-Nov-97
			abundance		biomass	
16-30	784	268	1161	977	80	40
31-50	785	465	3998	1279	6627	1786
51-100	786	84	12	97	2	36
	787	613	42	84	135	61
	788 [1]	252	2409	323	177	232
	790	89	55	444	56	222
	793	72	599	119	155	56
	794	216	609	97	84	122
	797	98	20	27	11	13
	799	72	857	30	410	19
101-150	795	164	11	64	5	50
	791 [2]	227		200		154
101-200	789 [1]	81	0	0	0	0
	791 [2]	308	191		114	
	798	100	14	0	47	0
151-200	796	175	0	23	0	8
	800 [2]	81		6		2
201-300	792	50	0	0	0	0
total inshore strata			9978	3770	7903	2801
total offshore			7066	11004	6140	10200
total all strata fished			17044	14774	14044	13000
STD all strata fished			3932	2113	6198	2778

changes below were made before 1997 fall survey

[1] Area of strata 788 was increased by 9 sq. n. mi and the area of strata 789 was decreased by 9 sq.n. mi.

2 Strata 791 in the 100-200 depth range was divided into two separate strata 791 101-150 with area =227 sq. n. mi.and strata 800 151-200 area = 81 sq. n.mi.

[3] Strata 611 area was decreased by 27 sq. n. mi.

Table 20. Summary of autumn survey abundance (thousands) and biomass (t) for all strata fished; 1983-1994 in Campelen equivalent units and 1995-97 in actual Campelen units.

DIVISION	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Total abundance all strata fished															
2J	1,124,317	743,328	615,304	1,249,871	410,936	509,360	647,797	264,807	365,191	31,560	17082	8373	14654	13300	7020
3K	447748	451517	208952	891302	284648	457191	1307523	972029	649529	61886	37265	9612	23954	20756	11384
3L	428505	995804	464291	358606	325352	256383	172299	396008	145682	148719	47809	4678	8013	17044	17044
2J3KL	2,000,570	2,190,649	1,288,547	2,499,779	1,020,936	1,222,934	2,127,619	1,632,844	1,160,402	242,165	102,156	22,663	46,621	51,100	35,448
Total biomass all strata fished															
2J	722491	557302	472214	1287042	492144	599436	425874	131943	170892	13096	5238	2877	3067	4298	3662
3K	374634	370356	209686	964600	303212	216734	830045	645136	649529	35604	14598	4437	4978	6039	4496
3L	278412	479606	369689	387438	284230	274553	160688	406730	123108	128048	30694	3149	5275	14044	13000
2J3KL	1375537	1407264	1051589	2639080	1079586	1090723	1416607	1183809	943529	176748	50530	10463	13320	24381	21158
Percent abundance															
2J	56	34	48	50	40	42	30	16	31	13	17	37	31	26	20
3K	22	21	16	36	28	37	61	60	56	26	36	42	51	41	32
3L	21	45	36	14	32	21	8	24	13	61	47	21	17	33	48
Percent biomass															
2J	53	40	45	49	46	55	30	11	18	7	10	27	23	18	17
3K	27	26	20	37	28	20	59	54	69	20	29	42	37	25	21
3L	20	34	35	15	26	25	11	34	13	72	61	30	40	58	61

Table 21. Cod catches exceeding 1000 individuals (Campelen equivalents) during autumn bottom-trawl surveys in Divisions 2J+3KL in 1983-1994. The catches in each year and Division are listed from north to south. Catches exceeding 4000 individuals are highlighted. GA is "Gadus Atlantica" and WT is "Wilfred Templeman".

Year	NAFO Division	Latitude (deg. min.)	Longitude (deg. min.)	Catch		Ship	Trip	Set no.
				Actual	Campelen equivalent			
1983	2J	5458.8	5623.0	449	1468	GA	86	74
		5356.3	5533.7	254	1660	GA	87	22
		5347.3	5540.4	504	2255	GA	87	21
		5341.6	5533.5	150	1244	GA	87	20
		5318.6	5341.2	535	1331	GA	87	30
		5254.2	5456.0	159	1191	GA	86	104
		5251.5	5455.9	164	1163	GA	87	10
		5251.3	5416.7	863	1158	GA	87	4
		5223.9	5355.5	1716	**6493**	GA	88	48
	3K	5214.5	5148.7	613	1109	GA	87	42
1984	2J	5502.0	5449.8	750	1779	GA	101	70
		5445.1	5512.0	442	1132	GA	101	68
		5409.4	5446.4	393	1040	GA	102	18
		5406.6	5525.8	434	2001	GA	102	14
		5342.7	5528.4	270	1379	GA	102	10
		5332.7	5524.1	183	1071	GA	102	8
		5330.8	5439.1	602	1319	GA	102	31
	3K	5150.8	5400.0	424	1102	GA	103	79
		5150.7	5411.7	618	1684	GA	103	78
		4946.4	5149.7	676	1321	GA	102	93
1985	2J	5506.0	5700.2	488	1548	GA	116	69
		5459.7	5443.4	715	1520	GA	116	48
		5326.9	5517.8	205	1259	GA	116	104
		5301.0	5515.0	430	1350	GA	116	107
		5247.2	5507.5	678	2136	GA	117	21
	3L	4615.8	5051.2	744	1286	WT	38	20
		4603.5	5056.0	1500	3100	WT	38	16
		4601.9	5107.8	447	1296	WT	37	84
1986	2J	5510.4	5637.3	464	1219	GA	132	18
		5509.9	5527.8	3195	**5565**	GA	131	56
		5506.3	5542.3	944	2046	GA	131	58
		5457.3	5446.0	2588	**5140**	GA	131	51
		5447.0	5452.6	414	1026	GA	131	49
		5418.1	5411.5	535	1439	GA	131	33
		5354.4	5418.5	563	1288	GA	132	28
		5327.0	5451.4	397	1130	GA	131	68
		5238.5	5351.3	1042	2618	GA	132	43
		5221.4	5403.1	668	1831	GA	132	48
	3K	5210.4	5401.1	606	1399	GA	132	51
		5129.4	5436.4	524	1442	GA	132	60
		5126.0	5036.1	3970	**6935**	GA	133	75
		5054.9	5326.7	468	1375	GA	133	45
1987	2J	5440.2	5349.8	1430	2506	GA	145	46
	3K	5147.7	5106.9	1160	1770	GA	147	52
	3L	4706.9	4731.0	152	1312	WT	65	109
1988	2J	5506.7	5514.0	861	1236	GA	160	52
		5457.9	5440.0	995	1688	GA	160	51
		5452.7	5501.1	1074	1712	GA	160	9
	3K	5214.6	5150.0	707	1530	GA	161	44
		5140.7	5449.3	43	1306	GA	161	72
		5120.7	5445.8	42	1091	GA	161	73

(cont'd)

Table 21 (cont'd)

Year	NAFO Division	Latitude (deg. min.)	Longitude (deg. min.)	Catch Actual	Catch Campelen equivalent	Ship	Trip	Set no.
1989	2J	5412.1	5410.7	472	1776	GA	174	106
		5410.7	5348.5	247	1153	GA	174	104
		5406.6	5339.5	793	1500	GA	174	108
		5349.5	5252.6	171	1093	GA	175	23
		5348.7	5407.3	400	1065	GA	174	39
		5310.6	5422.5	216	1046	GA	175	11
		5259.8	5244.7	897	1313	GA	175	32
		5234.9	5401.9	513	2794	GA	175	5
		5230.2	5405.0	301	1202	GA	175	3
		5224.6	5356.6	558	1551	GA	175	4
	3K	5153.0	5152.3	1752	**5220**	GA	176	48
		5141.0	5352.7	101	1108	GA	175	123
		5138.0	5035.2	3366	**5885**	GA	176	58
		5128.7	5037.7	896	1510	GA	176	59
		5104.9	5333.9	165	3117	GA	175	114
		5103.3	5330.6	355	**4168**	GA	175	113
		4924.8	5011.2	1855	2083	GA	176	110
1990	2J	5336.0	5318.4	191	1158	GA	191	12
	3K	5210.0	5145.8	205	1105	GA	191	90
		5203.2	5057.2	367	1008	GA	191	94
		5202.4	5142.2	296	1380	GA	191	91
		5156.9	5117.5	618	1564	GA	191	92
		5152.8	5328.6	196	1121	GA	191	110
		5128.9	5022.4	1123	2513	GA	191	132
		5036.9	5309.5	132	1337	GA	192	54
		4937.9	5012.5	2870	**4780**	GA	192	15
		4921.0	5055.5	768	2307	GA	192	13
		4918.5	5101.5	1222	2874	GA	192	12
	3L	4639.9	4856.5	900	1060	WT	101	120
1991	2J	5246.8	5355.2	1856	**6500**	GA	209	11
		5234.6	5359.2	418	1437	GA	209	9
		5217.7	5149.8	567	2343	GA	209	77
	3K	5214.2	5149.9	399	1387	GA	209	81
		5207.7	5129.1	1280	3483	GA	209	86
		5155.4	5149.6	373	1241	GA	209	119
		5148.5	5049.1	1304	3638	GA	209	131
		5136.0	5042.5	463	1285	GA	209	136
		5134.4	5028.1	1620	3760	GA	209	133
		5131.6	5035.6	3266	**8048**	GA	209	134
		5130.6	5043.6	999	2390	GA	209	151
		5053.6	5043.3	541	1291	GA	210	55
		4928.3	5014.5	1182	2678	GA	210	21
		4927.3	5010.5	2850	**7354**	GA	210	24
		4921.4	5042.8	700	1891	GA	210	28
		4920.9	5015.8	837	2217	GA	210	25
	3L	4844.9	4959.1	1164	1746	WT	115	120
1992	3K	4918.4	5006.1	879	1887	GA	226	16
	3L	4912.1	5008.3	1016	1620	WT	130	84
		4903.8	5014.3	1917	2921	WT	130	83
		4903.1	5044.0	1553	2349	WT	130	93
		4856.7	5008.2	1788	2772	WT	130	81
1993	3L	4908.1	5007.6	1048	2098	WT	146	79

Table 22. Autumn research vessel mean number per tow at age in index strata adjusted for missing strata. The 2J+3KL total is the mean of the Divisional means, weighted by the Divisional survey areas.

2J

Age	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	46.58	7.57	1.71	0.65	1.46	20.52	4.86	2.75	0.37	0.00	0.00	0.18	2.46	0.52	0.00
2	147.86	41.01	14.01	18.71	3.03	17.69	108.44	13.80	11.17	0.68	3.22	1.21	1.24	2.10	0.43
3	61.64	86.28	48.03	39.16	8.12	10.83	33.77	46.34	19.04	4.45	1.03	0.83	0.80	1.21	1.47
4	61.08	38.75	74.50	97.79	12.11	12.14	16.27	12.48	60.31	1.70	1.05	0.34	0.31	0.49	0.40
5	25.59	53.27	28.44	153.27	50.67	16.35	10.85	4.79	14.89	3.29	0.32	0.15	0.08	0.13	0.12
6	10.44	14.98	27.11	68.45	43.15	41.46	12.35	2.39	1.73	0.31	0.27	0.01	0.03	0.02	0.00
7	4.87	2.87	9.75	29.99	9.98	42.71	17.99	1.44	0.70	0.01	0.02	0.02	0.00	0.02	0.00
8	12.46	1.83	1.35	10.84	6.58	6.93	11.13	2.35	0.42	0.00	0.00	0.00	0.00	0.00	0.00
9	5.05	3.46	0.83	0.70	2.64	4.27	1.45	1.08	0.28	0.00	0.00	0.00	0.00	0.00	0.00
10	2.87	1.49	1.14	0.64	0.41	2.06	0.77	0.23	0.14	0.00	0.00	0.00	0.00	0.00	0.00
11	0.58	0.54	0.39	0.55	0.04	0.28	0.35	0.06	0.02	0.00	0.00	0.00	0.00	0.00	0.00
12	0.04	0.12	0.17	0.29	0.16	0.11	0.12	0.05	0.03	0.00	0.00	0.00	0.00	0.00	0.00
13	0.03	0.02	0.03	0.07	0.06	0.08	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
14	0.02	0.00	0.00	0.02	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	379.11	252.19	207.46	421.13	138.45	175.48	218.36	87.76	109.11	10.44	5.91	2.74	4.92	4.49	2.42

3K

Age	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08
1	22.84	8.27	0.28	7.91	7.35	37.54	36.91	22.21	0.59	0.65	0.28	0.20	2.78	0.70	0.07
2	32.49	32.45	5.07	18.35	6.63	29.28	111.95	32.45	15.74	2.85	4.67	0.39	1.56	2.28	0.92
3	27.87	24.34	13.32	21.13	8.34	18.49	58.16	83.98	23.97	4.12	2.24	1.16	0.97	1.20	0.85
4	15.09	22.21	12.39	65.26	10.01	8.40	44.92	48.74	70.05	2.33	1.27	0.38	0.34	0.34	0.20
5	17.24	11.98	10.93	56.87	17.27	6.92	25.69	23.11	37.29	4.01	0.30	0.14	0.10	0.10	0.09
6	4.39	8.97	4.13	29.01	11.21	7.54	17.17	12.35	9.09	1.16	0.34	0.02	0.02	0.00	0.00
7	2.58	3.12	3.23	13.32	4.17	3.70	14.93	7.74	2.80	0.16	0.09	0.03	0.00	0.01	0.00
8	4.26	1.41	0.86	6.66	2.67	1.00	7.06	7.62	1.03	0.03	0.01	0.02	0.00	0.00	0.00
9	2.98	2.12	0.65	2.41	1.21	0.44	2.54	2.35	0.56	0.00	0.00	0.00	0.01	0.00	0.00
10	0.91	1.06	0.55	0.64	0.52	0.22	1.41	0.68	0.24	0.00	0.00	0.00	0.00	0.00	0.00
11	0.22	0.34	0.40	0.79	0.21	0.04	0.65	0.22	0.01	0.00	0.00	0.00	0.00	0.00	0.00
12	0.12	0.11	0.09	0.58	0.08	0.04	0.16	0.06	0.02	0.00	0.00	0.00	0.00	0.00	0.00
13	0.02	0.05	0.01	0.09	0.06	0.01	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.01	0.02	0.00	0.07	0.02	0.02	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	131.02	116.45	51.91	223.09	69.75	113.64	321.74	241.51	161.39	15.31	9.20	2.34	5.78	4.63	2.21

(cont'd)

Table 22 (cont'd). Autumn research vessel mean number per tow at age in index strata adjusted for missing strata. The 2J+3KL total is the mean of the Divisional means, weighted by the Divisional survey areas.

3L

Age	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	17.62	7.68	0.15	1.03	3.87	1.26	0.54	0.82	1.06	0.08	0.00	0.00	0.11	0.04	0.07
2	27.24	75.48	11.11	9.71	22.54	12.57	5.36	6.54	5.27	3.25	1.66	0.19	0.34	0.21	0.64
3	40.89	56.42	32.05	9.02	7.70	13.43	12.73	22.12	5.02	8.14	2.44	0.28	0.52	0.36	0.61
4	9.53	35.05	24.62	22.23	6.96	4.08	7.03	24.38	7.89	7.96	2.46	0.23	0.27	0.43	0.27
5	9.21	6.44	13.18	13.13	10.93	5.57	2.17	11.06	5.59	5.64	0.79	0.09	0.15	0.19	0.15
6	1.50	10.12	5.23	10.20	6.81	5.91	2.30	5.29	2.66	3.07	0.32	0.04	0.11	0.09	0.04
7	1.45	1.48	3.04	2.97	2.86	4.19	2.20	3.21	0.44	0.79	0.05	0.02	0.03	0.05	0.07
8	2.36	1.02	0.57	2.09	1.10	1.86	0.81	2.38	0.22	0.06	0.01	0.00	0.01	0.01	0.09
9	1.26	0.88	0.69	0.80	0.85	0.90	0.56	1.31	0.23	0.04	0.00	0.00	0.00	0.01	0.01
10	0.44	0.94	0.35	0.32	0.09	0.46	0.17	0.51	0.09	0.03	0.00	0.00	0.00	0.00	0.00
11	0.13	0.38	0.25	0.41	0.12	0.12	0.06	0.24	0.07	0.00	0.00	0.00	0.00	0.00	0.00
12	0.06	0.22	0.11	0.22	0.19	0.10	0.03	0.15	0.02	0.02	0.00	0.00	0.00	0.00	0.00
13	0.02	0.04	0.04	0.09	0.10	0.12	0.03	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.05	0.03	0.01	0.03	0.03	0.07	0.04	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.03	0.01	0.03	0.01	0.03	0.01	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00
16	0.01	0.03	0.00	0.01	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
17	0.02	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	111.87	196.27	91.42	72.30	64.19	50.68	34.04	78.19	28.59	29.08	7.73	0.85	1.54	1.39	1.95

2J+3KL

Age	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
1	26.49	7.85	0.58	3.23	4.44	18.12	13.75	8.44	0.73	0.25	0.09	0.11	1.58	0.38	0.05
2	58.68	52.62	9.81	14.81	12.42	19.41	66.33	16.98	10.22	2.48	3.05	0.51	0.97	1.37	0.68
3	41.65	53.05	29.73	20.48	8.02	14.48	33.08	48.74	14.80	5.89	2.03	0.71	0.74	0.85	0.90
4	24.08	31.67	32.81	55.20	9.25	7.51	21.96	29.59	41.55	4.54	1.72	0.31	0.30	0.41	0.28
5	15.93	19.82	16.18	62.23	22.83	8.67	12.16	13.54	18.47	4.52	0.51	0.12	0.12	0.15	0.12
6	4.67	10.93	10.25	30.82	17.22	15.21	9.74	6.93	4.58	1.75	0.31	0.03	0.06	0.04	0.02
7	2.67	2.37	4.76	13.08	5.05	13.51	10.34	4.29	1.29	0.39	0.06	0.02	0.01	0.03	0.03
8	5.48	1.35	0.86	5.77	2.97	2.82	5.44	4.12	0.54	0.04	0.01	0.01	0.00	0.00	0.04
9	2.77	1.93	0.71	1.31	1.41	1.58	1.44	1.60	0.35	0.02	0.00	0.00	0.00	0.00	0.00
10	1.20	1.12	0.61	0.51	0.31	0.77	0.73	0.50	0.15	0.01	0.00	0.00	0.00	0.00	0.00
11	0.27	0.41	0.33	0.57	0.13	0.13	0.33	0.19	0.04	0.00	0.00	0.00	0.00	0.00	0.00
12	0.07	0.16	0.12	0.36	0.15	0.08	0.10	0.10	0.02	0.01	0.00	0.00	0.00	0.00	0.00
13	0.02	0.04	0.03	0.09	0.08	0.07	0.04	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.03	0.02	0.00	0.04	0.03	0.04	0.04	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.02	0.00	0.01	0.00	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	184.04	183.38	106.79	208.52	84.33	102.43	175.50	135.09	92.76	19.89	7.77	1.81	3.79	3.24	2.13

Table 23. Observed proportion mature at age of female Atlantic cod (Gadus morhua) in NAFO Div. 2J3KL (1982-1998). A50=median age at maturity (years); L95% and U95%=lower and upper 95% confidence intervals. Parameter estimates of the logit model are shown: Int=intercept, SE=standard error, n=number of fish examined, dot=no fish sampled. Years are spawning years.

AGE	1982	1983	1984	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
2	0	0	0	0	0	0	0	0	0	0	0	.	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0.01	0	0	0.01	0	0	0	0.02	0.05	0.07	0.02	0.01	0.10
5	0.01	0.05	0.05	0.03	0.02	0.08	0.08	0.11	0.13	0.29	0.30	0.55	0.59	0.39	0.31	0.50
6	0.44	0.45	0.49	0.42	0.47	0.39	0.67	0.70	0.43	0.63	0.84	0.90	1	0.7	0.49	0.94
7	0.88	0.93	0.84	0.85	0.88	0.90	0.90	0.91	0.88	0.83	0.84	0.98	1	0.86	1	.
8	0.96	0.99	0.93	1	0.97	0.96	0.97	0.99	0.97	0.98	1	1	1	1	1	1
9	1	1	1	1	0.98	1	1	1	1	1	1	1	1	.	1	1
10	1	1	1	1	1	1	1	1	1	1	1	.	.	.	1	1
11	1	1	1	1	1	1	1	1	0.84	1	1	1	.	.	.	.
12	1	1	1	1	1	1	1	1	1	1	1	.	.	.	.	.
13	1	1	1	1	1	1	1	1	1	1	.	.	.	.	.	.
A50	6.27	6.07	6.13	6.20	6.18	6.16	5.91	5.81	6.19	5.72	5.44	5.01	4.86	5.44	5.66	4.95
L 95%	6.12	5.96	6.01	6.10	6.06	6.05	5.78	5.70	6.06	5.60	5.32	4.89	4.68	5.22	5.44	4.78
U 95%	6.41	6.20	6.26	6.29	6.30	6.28	6.03	5.93	6.33	5.84	5.56	5.13	5.04	5.75	5.95	5.18
Slope	2.30	2.70	2.22	2.48	2.25	2.21	2.17	2.48	1.59	1.61	2.00	2.52	3.38	2.11	2.16	2.51
SE	0.18	0.23	0.19	0.17	0.17	0.17	0.14	0.18	0.09	0.11	0.15	0.24	0.65	0.28	0.27	0.31
Int	-14.45	-16.43	-13.59	-15.37	-13.91	-13.65	-12.81	-14.39	-9.84	-9.19	-10.90	-12.64	-16.46	-11.48	-12.22	-12.43
SE	1.17	1.34	1.15	1.05	1.08	1.05	0.86	1.04	0.55	0.61	0.82	1.22	3.22	1.41	1.38	1.42
n	1028	1354	1202	1260	1037	1146	1386	1422	1361	1045	697	489	139	389	501	339

Table 24. Observed proportion mature at age of male Atlantic cod (Gadus morhua) in NAFO Div. 2J3KL (1982-1998). A50=median age at maturity (years); L95% and U95%=lower and upper 95% confidence intervals. Parameter estimates of the logit model are shown: Int=intercept, SE=standard error, n=number of fish examined, dot=no fish sampled. Years are spawning years.

AGE	1982	1983	1984	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0.02	0	0.05	0	0.06	0	0.06	0.11	0.16
4	0.14	0.24	0.15	0.05	0.21	0.05	0.08	0.25	0.25	0.48	0.48	0.40	0.70	0.37	0.50	0.71
5	0.58	0.56	0.72	0.59	0.47	0.61	0.66	0.66	0.57	0.88	0.83	0.94	0.95	0.73	0.76	0.82
6	0.96	0.85	0.95	0.86	0.86	0.86	0.95	0.95	0.72	0.93	1	1	0.96	1	1.00	1
7	0.99	1	1	0.97	0.93	0.97	0.98	0.99	0.98	0.98	1	1	1	1	1	1
8	0.99	1	1	1	0.99	1	0.99	1	1	1	1	1	1	1	1	1
9	1	0.99	1	1	1	1	1	1	1	1	1	1	1	.	.	1
10	1	1	0.98	1	1	1	1	1	1	1	1	.	.	1	.	.
11	1	1	1	0.97	1	1	1	0.99	1	1	1	.	.	.	.	.
12	1	1	1	1	1	1	1	1	1	1	1	.	.	.	.	.
13	1	1	1	1	1	1	1	1	1	1	1	.	.	.	.	.
A50	4.83	4.86	4.72	5.02	5.04	5.03	4.85	4.64	4.91	4.13	4.12	4.11	3.73	4.34	4.10	3.70
L 95%	4.70	4.75	4.61	4.91	4.89	4.90	4.74	4.52	4.79	4.00	4.01	3.99	3.38	4.18	3.97	3.56
U 95%	4.97	4.98	4.84	5.12	5.19	5.15	4.96	4.75	5.04	4.25	4.24	4.22	3.94	4.52	4.26	3.84
Slope	2.29	1.80	2.26	1.96	1.66	2.15	2.60	1.96	1.50	1.94	2.45	2.84	2.44	2.04	1.86	1.98
SE	0.19	0.12	0.16	0.13	0.12	0.16	0.20	0.13	0.10	0.14	0.24	0.31	0.53	0.22	0.17	0.23
Int	-11.05	-8.74	-10.69	-9.86	-8.37	-10.82	-12.62	-9.10	-7.40	-8.01	-10.11	-11.68	-9.10	-8.86	-7.63	-7.35
SE	0.90	0.56	0.76	0.66	0.64	0.80	0.94	0.60	0.47	0.63	1.02	1.28	2.15	0.89	0.66	0.88
n	923	1359	1119	1187	954	1095	1205	1235	1165	843	599	375	141	410	512	351

Table 25. Cod abundance (000's) for NAFO Division 3L in spring 1985 -1996 in depths <= 200 fathoms. The 1985-1995 data are in Campelen equivalent units and the 1996-97 data are in actual Campelen units.

Depth range (fath)	Stratum number	Stratum area sq mi.	WT 28-30 1985	WT 48 1986	WT 59-60 1987	WT 70-71 1988	WT 83 1989	WT 96 1990	WT 106-107 1991	WT 119-122 1992	WT 137-138 1993	WT 152-154 1994	WT 168-170 1995	WT 189-191 1996	WT 207-208 1997
Mean Date			07-May-85	16-May-86	23-May-87	15-May-88	18-May-89	26-May-90	20-May-91	24-May-92	31-May-93	01-Jun-94	06-Jun-95	14-Jun-96	15-Jun-97
31-50	350	2071	52111	14685	17275	90559	24682	8018	748	414	32	0	0	412	122
	363	1780	25710	24878	27778	46453	21738	3918	1504	789	306	0	0	111	0
	371	1121	29035	2262	3503	3115	4086	3315	32260	123	93	0	0	0	0
	372	2460	83387	37973	21684	37778	17675	2852	541	34	62	0	0	217	0
	384	1120	591	4442	5238	1078	1566	193	270	0	31	0	0	102	0
51-100	328	1519	5642	2113	2866	522	0	3194	1846	0	453	0	0	90	35
	341	1574	17899	5678	14651	20425	7984	2436	469	0	0	736	0	340	1728
	342	585	3702	1127	1328	402	5445	523	0	1314	322	188	0	0	121
	343	525	9076	4496	1300	2744	8065	891	2239	1565	614	361	361	36	0
	348	2120	38479	16258	21435	19062	12022	6575	73	227	109	365	510	151	65
	349	2114	32383	21146	12795	14649	25115	10986	1066	711	905	0	0	424	145
	364	2817	38614	10691	21365	13718	24050	4456	1902	0	97	0	0	234	49
	365	1041	22237	6272	15466	15931	8306	2076	322	36	0	0	0	58	0
	370	1320	57062	2973	16783	8861	18226	1219	34833	0	91	0	0	61	0
	385	2356	22038	997	1886	5736	25360	7808	17055	97	383	0	0	30	0
	390	1481	2513	484	320	0	891	41	122	34	102	0	0	59	0
101-150	344	1494	10481	21142	3288	4110	31503	4864	986	1165	514	0	822	565	300
	347	983	7221	14225	7077	11981	6694	913	1690	34	304	0	0	0	34
	366	1394	207996	63401	41749	8885	33414	15053	12651	415	384	0	0	245	447
	369	961	58351	33952	16392	28158	13021	6134	3701	198	0	0	0	30	33
	386	983	46544	12395	14766	26504	37547	32048	32544	68	54	0	0	0	30
	389	821	70767	10458	8150	11181	13214	5788	9524	75	0	0	56	0	33
	391	282	5916	4442	2812	1494	2819	45154	6750	0	0	0	0	0	0
151-200	345	1432	16153	41480	60278	19723	29548	14232	3217	492	525	2167	197	773	972
	346	865	10650	63279	18991	11602	9965	145882	10812	1577	833	278	476	487	579
	368	334	10154	10912	14289	414	4150	51551	4992	10866	1355	184	23	402	158
	387	718	131461	22816	691	2272	16336	241169	93995	23145	6288	0	560	142	1037
	388	361	2955	11496	25	1738	1606	36947	10809	4618	2235	0	174	84	0
	392	145	6642	1855	20	2094	645	22130	4618	40	479	0	110	111	0
total strata fished <= 200 fath			1025769	468328	374201	411190	405673	680365	263087	48038	16569	4278	3289	5166	5888
ADJUSTED			1025770	468328	374201	411189	405673	680366	291539	48037	16571	4279	3289	5166	5888
1 STD strata fished <= 200 fath			143389	39174	51595	50874	34169	176063	56184	13459	3989	1279	1043	522	1897

[1] **Not all strata in the depth range have been fished. Strata not fished in the <= 200 fathom depth range have been filled using a multiplicative model using data to 1992. Std are for strata fished in the depth range.**

Table 26. Cod biomass (t) for NAFO Division 3L in spring 1985 -1996 in depths <= 200 fathoms. The 1985-1995 data are in Campelen equivalent units and the 1996-97 data are in actual Campelen units.

Depth range (fath) Mean Date	Stratum number	Stratum area sq mi.	WT 28-30 1985 07-May	WT 48 1986 16-May	WT 59-60 1987 23-May	WT 70-71 1988 15-May	WT 83 1989 18-May	WT 96 1990 26-May	WT 106-107 1991 20-May	WT 119-122 1992 24-May	WT 137-138 1993 31-May	WT 152-154 1994 01-Jun	WT 168-170 1995 06-Jun	WT 189-191 1996 14-Jun	WT 207-208 1997 15-Jun
31-50	350	2071	61578	29203	32147	116896	41232	14057	1636	315	35	0	0	359	135
	363	1780	29020	26035	38567	49356	30897	12388	2289	526	111	0	0	61	0
	371	1121	29516	5426	7039	6714	7089	5149	44086	36	37	0	0	0	0
	372	2460	87371	39729	37570	52582	31350	12849	1553	112	96	0	0	83	0
	384	1120	557	7038	7416	1515	1308	1029	653	0	71	0	0	65	0
51-100	328	1519	568	1708	3573	879	0	5670	180	0	243	0	0	6	5
	341	1574	11711	12988	20564	32613	9121	5854	376	0	0	65	0	127	4497
	342	585	1445	2669	1041	600	1400	1035	0	66	64	33	0	0	346
	343	525	2833	3087	1981	2878	3927	255	207	70	52	46	42	9	0
	348	2120	17699	22373	52505	40777	18921	6772	273	37	43	47	87	53	13
	349	2114	31189	44296	22988	34821	50689	3835	836	125	158	0	0	303	419
	364	2817	21165	17309	34942	26822	34642	15553	1228	0	124	0	0	20	11
	365	1041	5934	6427	19818	18776	10427	2210	154	81	0	0	0	5	0
	370	1320	21097	6523	16440	12422	15405	1288	29422	0	74	0	0	6	0
	385	2356	6499	894	2131	4572	10414	2269	13797	95	256	0	0	4	0
	390	1481	874	764	891	0	520	129	604	58	83	0	0	31	0
101-150	344	1494	1926	16730	1768	2949	15613	696	103	167	83	0	95	111	115
	347	983	6837	19615	8729	17943	5283	669	199	35	83	0	0	0	8
	366	1394	111212	62264	42788	15741	32354	12386	6899	111	121	0	0	104	173
	369	961	36262	27273	23039	37815	18342	7693	3547	78	0	0	0	16	3
	386	983	13632	5635	10490	10110	19985	59202	17066	154	66	0	0	0	16
	389	821	21457	3540	2864	3284	3509	1529	1654	114	0	0	36	0	9
	391	282	1380	1944	797	316	513	6018	1220	0	0	0	0	0	0
151-200	345	1432	6738	39168	63833	24326	40145	5601	466	332	120	437	108	149	294
	346	865	1650	48302	18827	13037	10501	136822	4834	613	302	86	91	178	238
	368	334	4237	13403	16324	1286	5297	41814	3318	4684	590	120	22	148	96
	387	718	60424	16437	508	1609	8453	101468	37550	18465	2329	0	227	84	303
	388	361	1143	5814	27	695	676	35162	4031	1078	1431	0	60	12	0
	392	145	5177	1121	11	573	251	6418	1107	22	63	0	37	18	0
total strata fished <= 200 fathoms			601128	487714	489618	531905	428264	505819	164236	27374	6633	834	805	1951	6667
ADJUSTED			601131	487715	489618	531907	428264	505820	179288	27374	6635	834	805	1952	6667
1 STD strata fished <= 200 fathoms			78100	37492	58340	63543	30961	106059	50106	10276	1896	201	197	256	4264

[1] **Not all strata in the depth range have been fished. Strata not fished in the <= 200 fathom depth range have been filled using a multiplicative model using data to 1992. Std are for strata fished in the depth range.**

Table 27. Cod abundance (000's) and biomass (t) for NAFO Division 3L in spring 1985 -1996 in depths > 200 fathoms. The 1985-1995 data are in Campelen equivalent units and the 1996-97 data are in actual Campelen units.

Depth range (fath)	Stratum number	Stratum area nautical miles	WT 28-30 1985	WT 48 1986	WT 59-60 1987	WT 70-71 1988	WT 83 1989	WT 96 1990	WT 106-107 1991	WT 119-122 1992	WT 137-138 1993	WT 152-154 1994	WT 168-170 1995	WT 189-191 1996	WT 207-208 1997
Mean Date			07-May	16-May	23-May	15-May	18-May	26-May	20-May	24-May	31-May	01-Jun	06-Jun	14-Jun	15-Jun
							abundance								
201-300	729	186	102	nf	nf	nf	nf	nf	141	3876	192	77	0	13	0
	731	216	30	nf	nf	nf	nf	nf	3046	267	416	9701	0	152	0
	733	468	1674	nf	nf	nf	nf	nf	7339	2672	880	1513	483	41	89
	735	272	94	nf	nf	nf	nf	nf	nf	92905	0	6080	673	5512	524
301-400	730	170	0	nf	nf	nf	nf	nf	0	0	0	0	0	0	0
	732	231	0	nf	nf	nf	nf	nf	0	0	0	0	0	0	0
	734	228	0	nf	nf	nf	nf	nf	267	0	0	0	0	0	0
	736	175	0	nf	nf	nf	nf	nf	nf	60	0	0	0	0	0
401-500	737	227	nf	nf	nf	nf	nf	nf	nf	nf	nf	0	nf	nf	nf
	741	223	nf	nf	nf	nf	nf	nf	nf	nf	nf	0	nf	nf	nf
	745	348	nf	nf	nf	nf	nf	nf	nf	nf	nf	0	nf	nf	nf
	748	159	nf	nf	nf	nf	nf	nf	nf	nf	nf	0	nf	nf	nf
Total >200 fathoms			1900	0	0	0	0	0	10793	99780	1488	17371	1156	5718	613
Total all strata fished			1027668	468328	374201	411190	405673	680365	273879	147819	18056	21649	4445	10884	6501
1 STD all strata fished			143399	39174	51595	50874	34169	176063	56567	93188	4007	9990	1275	2473	1933
							biomass								
201-300	729	186	78	nf	nf	nf	nf	nf	320	1683	78	29	0	2	0
	731	216	78	nf	nf	nf	nf	nf	1967	389	248	5913	0	69	0
	733	468	755	nf	nf	nf	nf	nf	6351	1959	345	556	219	28	74
	735	272	894	nf	nf	nf	nf	nf	nf	50199	0	3238	386	3823	352
301-400	730	170	0	nf	nf	nf	nf	nf	0	0	0	0	0	0	0
	732	231	0	nf	nf	nf	nf	nf	0	0	0	0	0	0	0
	734	228	0	nf	nf	nf	nf	nf	437	0	0	0	0	0	0
	736	175	0	nf	nf	nf	nf	nf	nf	69	0	0	0	0	0
401-500	737	227	nf	nf	nf	nf	nf	nf	nf	nf	nf	0	nf	nf	nf
	741	223	nf	nf	nf	nf	nf	nf	nf	nf	nf	0	nf	nf	nf
	745	348	nf	nf	nf	nf	nf	nf	nf	nf	nf	0	nf	nf	nf
	748	159	nf	nf	nf	nf	nf	nf	nf	nf	nf	0	nf	nf	nf
Total >200 fathoms			1805	0	0	0	0	0	9075	54299	671	9736	605	3922	426
Total all strata fished			602932	487714	489618	531905	428264	505819	173311	81673	7304	10570	1410	5874	7093
1 STD all strata fished			78105	37492	58340	63543	30961	106059	50374	50990	1899	5960	440	6255	4271

nf Not all strata in the depth range were fished. Strata not fished in the greater than *200 fathom depth range have not* been filled using a multiplicative model.

Table 28. Summary of acoustic biomass estimates for portions of Trinity Bay and Bonavista Bay in spring 1995-1997.

Year	Area	Location	Stratum	Date Surveyed	Biomass (t)
1995[1]	Trinity Bay	Smith Sound	38	3-4 May	16,800
1996[2]	Trinity Bay	Smith Sound	38	15-24 April	154
1997[3]	Trinity Bay	Smith Sound	38	21-24 April	20,968
		Northwest Arm	40	25 April	46
		Southwest Arm	41	26 April	749
		Deer Harbour	42	27 April	1
		Bull Arm	43	28 April	20
				Subtotal	21,784
	Bonavista Bay	Newman Sound	31	24-25 June	88
		Goose Bay	32	29 June	627
		Clode Sound	33	30 June	676
		Sweet Bay	34	28 June	
		Western Head	34	29 June	
		Southern Bay	34	30 June	125
				Subtotal	1,516
				Total for 1997	23,300

[1] Rose MS 1996

[2] Brattey and Porter MS 1997

[3] Porter et al. MS 1998

Table 29 Divisions 2J3KL Sentinel Survey Gillnet Comparisons

Gillnet Means Ln(CPUE)=fish/net

	1995	1996	1997
2Jm	-4.0114	-4.6888	-3.1807
3Ka	-2.7486	-1.051	-2.0879
3Kd	-2.3987	-0.0007	-0.6348
3Kh	0.0814	1.2212	2.1158
3Ki	0.212	2.2148	1.9185
3La	1.9304	2.3731	2.4057
3Lb	0.211	1.9369	2.0556
3Lf	0.1774	2.0073	2.1979
3Lj	0.7896	1.9755	1.9447
3Lq	1.3769	2.0714	2.1395

Gillnet Means Ln(CPUE)=fish/net

	1995	1996	1997
2J	-4.0114	-4.4516	-3.2064
3K	-0.8112	1.096	1.0494
3L	0.7578	1.8842	1.9396

Gillnet between years by bay*

	1995	1996	1997
2Jm	AB	B	A
3Ka	B	A	AB
3Kd	B	A	A
3Kh	C	B	A
3Ki	B	A	A
3La	A	A	A
3Lb	B	A	A
3Lf	B	A	A
3Lj	B	A	A
3Lq	B	A	A

Gillnet between year by division*

	1995	1996	1997
2J	AB	B	A
3K	B	A	A
3L	B	A	A

Gillnet within years by bay*

	1995	1996	1997
2Jm	E	C	D
3Ka	D	B	C
3Kd	D	B	B
3Kh	C	A	A
3Ki	BC	A	A
3La	A	A	A
3Lb	BC	A	A
3Lf	BC	A	A
3Lj	ABC	A	A
3Lq	AB	A	A

Gillnet within year by division*

	1995	1996	1997
2J	C	C	C
3K	B	B	B
3L	A	A	A

***Cells with the same letter are not significantly different**

Table 30 Divisions 2J3KL Sentinel Survey Trawl Comparisons

Trawl Mean Ln(CPUE)=Fish/1000 Hooks

	1995	1996	1997
2Jm		1.6509	-0.7967
3Ka			
3Kd	-0.218	0.5421	1.72
3Kh	3.8884	4.3548	4.9904
3Ki	4.7953	4.5289	5.0934
3La	4.5598	4.924	5.6233
3Lb	3.179	3.22	
3Lf	3.4307	3.7279	5.1079
3Lj	3.6055	2.9509	4.2862
3Lq	0.6627	1.6446	3.75

Trawl Mean Ln(CPUE)=Fish/1000 Hooks

	1995	1996	1997
2J		1.651	-0.797
3K	3.7351	3.9798	4.743
3L	2.9953	2.9892	4.6302

Trawl between years by bay*

	1995	1996	1997
2Jm		A	B
3Ka			
3Kd	A	A	A
3Kh	B	AB	A
3Ki	AB	B	A
3La	A	A	A
3Lb		A	A
3Lf	B	B	A
3Lj	A	A	A
3Lq	B	AB	A

Trawl between year by division*

	1995	1996	1997
2J		A	B
3K	B	B	A
3L	B	B	A

Trawl within years by bay*

	1995	1996	1997
2Jm		BC	D
3Ka			
3Kd	C	C	C
3Kh	AB	AB	AB
3Ki	A	A	AB
3La	AB	A	A
3Lb	B	C	
3Lf	AB	AB	AB
3Lj	AB	AB	AB
3Lq	C	BC	B

Trawl within year by division*

	1995	1996	1997
2J		C	C
3K	A	A	A
3L	B	B	B

***Cells with the same letter are not significantly different**

Table 31 Divisions 2J3KL Sentinel Survey Handline Comparisons

Handline Mean Ln(CPUE)=(Fish/Hook)/Hr

	1995	1996	1997
2Jm		-3.715	-3.277
3Ka			
3Kd			0.41
3Kh	2.84	-0.477	2.163
3Ki	0.617		2.93
3La			
3Lb			
3Lf		1.584	1.94
3Lj	-1.003	-0.595	0.915
3Lq			

Handline Mean Ln(CPUE)=(Fish/Hook)/Hr

	1995	1996	1997
2J		-3.715	-3.2769
3K	1.728	-0.477	2.04
3L	-1.003	-0.301	0.9545

Handline between years by bay*

	1995	1996	1997
2Jm		A	A
3Ka			
3Kd			
3Kh	A	A	A
3Ki	A		A
3La			
3Lb			
3Lf		A	A
3Lj	B	AB	A
3Lq			

Handline between year by division*

	1995	1996	1997
2J		A	A
3K	A	A	A
3L	B	AB	A

Handline within years by bay*

	1995	1996	1997
2Jm		B	A
3Ka			
3Kd			A
3Kh	A	AB	A
3Ki	A		A
3La			
3Lb			
3Lf		AB	A
3Lj	A	AB	A
3Lq			

Handline within year by division*

	1995	1996	1997
2J		A	B
3K	A	A	A
3L	B	A	A

***Cells with the same letter are not significantly different**

Table 32. Comparison of univariate statistics for commercial catch rate data from logbooks for vessels greater than 35 ft (ZIFF data) with catch rate data from three years of the Sentinel surveys. Gillnet catch rates are in kg/net/day and linetrawl catch rates are in kg/1000 hooks.

Gear	Division	ZIFF	Sentinel
Gillnets	**2J**		
N		790	301
Mean		40.04	7.97
Median		19.71	0.00
Standard deviation		223.91	43.85
75th percentile		38.25	0.03
25th percentile		10.21	0.00
Gillnets	**3K**		
N		1622	851
Mean		23.20	12.30
Median		9.53	0.15
Standard deviation		150.17	51.63
75th percentile		19.67	1.29
25th percentile		4.57	0.01
Gillnets	**3L**		
N		1258	943
Mean		30.10	31.03
Median		13.41	0.67
Standard deviation		80.27	92.84
75th percentile		1873.50	14.21
25th percentile		5.74	0.10
Linetrawls	**3K**		
N		50	851
Mean		233.44	512.60
Median		165.00	6.33
Standard deviation		202.38	2151.29
75th percentile		314.33	53.80
25th percentile		79.71	0.47
Linetrawls	**3L**		
N		186	943
Mean		210.74	1292.84
Median		207.71	27.85
Standard deviation		145.87	3868.17
75th percentile		279.67	592.06
25th percentile		77.37	4.18

Table 33 . Parameter estimates from an ADAPT fit to the Campelen-equivalent fall survey mean numbers per tow for ages 2 to 12 for the period 1983 to 1997. Catch data are for the period 1959 to 1997and ages 2 to 14, and are not corrected for estimates of discards. Missing catch data for oldests age replaced with 1 and missing RV data are replaced with 0.00001. Catchability estimates (Ki) are logged values. The estimate of survivors (N2-N14) is for January 1, 1998

Parameter	Estimate	STD Error	Rel. Error	Bias	Rel. Bias
Catchability					
K2	-8.050	0.3805	0.04727	-0.01540	0.00191
K3	-8.031	0.3671	0.04571	-0.01529	0.00190
K4	-8.128	0.3614	0.04447	-0.01540	0.00190
K5	-8.150	0.3602	0.04420	-0.01171	0.00144
K6	-8.142	0.3600	0.04422	-0.01019	0.00125
K7	-7.967	0.3642	0.04572	0.04987	-0.00062
K8	-7.780	0.3575	0.04595	0.03260	-0.00042
K9	-8.791	0.3706	0.04216	-0.03276	0.00037
K10	-8.479	0.3806	0.04489	-0.02936	0.00035
K11	-8.900	0.3824	0.04297	-0.03428	0.00039
K12	-8.941	0.3599	0.04025	-0.04750	0.00053
Survivors					
N2	2219	0	0.00	0	0.00
N3	2086	2943	1.41	2108	1.01
N4	3030	3032	1.00	1562	0.52
N5	1533	1273	0.83	544	0.35
N6	728	596	0.82	227	0.31
N7	250	238	0.95	93	0.37
N8	77	100	1.29	54	0.70
N9	72	76	1.06	33	0.46
N10	0	0	1.60	0	1.27
N11	0	0	1.60	0	1.28
N12	0	0	1.08	0	0.58
N13	0	0	0.72	0	0.26
N14	0	0	0.73	0	0.27

Mean square residuals = 1.844994

Table 34. ADAPT estimates of numbers at age from a fit to the Campelen-equivalent fall survey mean numbers per tow for ages 2 to 12 over the period 1983 to 1997. Catch data are for the period 1959 to 1997 and ages 2 to 14, and are not corrected for estimates of discards. Missing catch data for oldest age is replaced with 1 and missing RV data are replaced with 0.00001. Population estimates are bias-adjusted.

Year/age	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1962	766385	714308	561393	692804	368885	196218	107737	76222	59079	44022	34314	24006	21337	0
1963	1064585	627191	576999	435988	509207	249643	118127	63482	44313	32187	26655	19592	12679	12274
1964	1258298	870302	508311	447518	302695	310729	151363	70342	38028	25850	18943	18037	12494	7744
1965	1445527	1027613	695082	391261	314356	193237	164588	78325	38842	20136	13367	9814	10288	6610
1966	1046804	1183421	836662	543171	278160	197166	100506	73777	33897	18450	10261	7596	4503	5082
1967	881895	856311	956208	625479	360376	171266	108201	54988	39020	19881	11037	6351	4578	2621
1968	808926	721321	687306	712641	421751	208150	90897	53923	29639	17560	10939	6015	3310	2378
1969	892668	662033	585020	477774	398721	210423	95434	39165	23435	14429	9362	4272	3186	1516
1970	729270	730801	538116	443225	300459	180433	76449	31271	14543	8168	6105	3668	845	1219
1971	307315	590917	581983	386398	288768	155228	71237	36433	15873	8471	4890	3918	2546	490
1972	170010	251579	472175	412004	230644	148477	75269	35873	19307	8982	4939	2848	2185	1438
1973	166299	138980	199892	314736	232673	120515	71433	35175	18834	10075	4676	2555	1093	1139
1974	282078	136154	110209	126971	172576	137039	66840	33998	16136	8650	4833	1906	1045	492
1975	502151	230518	108556	78335	72592	74785	58101	22942	11059	3918	1935	1352	602	277
1976	413606	410747	185149	76173	41383	28705	26388	15215	6857	2410	1151	538	390	162
1977	363974	338619	323863	121234	37243	15250	8564	7382	2814	1513	675	381	180	97
1978	184665	297899	270801	206226	62981	19635	7649	3972	3599	1072	762	288	178	81
1979	194687	151191	242704	205874	133565	33342	9174	3509	1883	1975	487	427	142	90
1980	435560	159396	122744	187554	134812	83095	17451	4413	1709	864	1114	235	246	70
1981	387741	356523	128196	89652	127608	83386	51830	9951	2520	932	499	706	142	143
1982	422852	317455	289923	98486	61520	82163	48498	31784	5299	1365	486	234	465	73
1983	521552	346202	258373	209167	63536	37427	44450	24535	15334	2616	814	258	111	244
1984	407619	426994	281111	199251	132929	34943	19841	23212	12084	6883	1231	444	131	54
1985	189519	333727	348887	216735	134535	74164	17407	9754	11027	6106	3364	604	232	64
1986	155499	155165	272646	272264	144486	79669	35644	7944	4553	4420	2406	1255	267	95
1987	189195	127311	126288	209490	183143	77152	41890	16015	3726	1940	1853	987	515	115
1988	205206	154862	102130	95081	142392	105882	37669	16882	7900	1845	983	737	458	243
1989	94888	167986	124280	70420	59694	73624	45816	14244	5784	2608	818	427	277	176
1990	17578	77681	136003	85863	38676	26329	25795	12231	3943	1508	634	165	133	68
1991	10510	14339	56664	74953	37744	11500	7018	5271	1954	703	278	98	43	22
1992	3163	8573	8942	18231	13901	4960	1462	394	211	125	22	11	4	2
1993	1344	2590	6631	3871	2184	779	156	22	3	3	11	2	1	0
1994	1621	1100	1278	1036	260	106	32	2	0	2	2	9	2	0
1995	1895	1327	806	707	336	57	22	7	0	0	2	2	8	1
1996	2203	1551	1080	633	514	226	28	8	3	0	0	1	1	5
1997	2548	1803	1234	672	253	119	70	3	2	0	0	0	1	0
1998	2219	2086	1469	990	501	157	24	39	0	0	0	0	0	0

Table 35. ADAPT estimates of fishing mortality from a fit to the Campelen-equivalent fall survey mean numbers per tow for ages 2 to 12 over the period 1983 to 1997. Catch data are for the period 1959 to 1997 and ages 2 to 14, and are not corrected for estimates of discards. Missing catch data for oldests age is replaced with1 and missing RV data are replaced with 0.00001. F estimates are bias-adjusted.

Year/Age	2	3	4	5	6	7	8	9	10	11	12	13	14
1962	0.000	0.013	0.053	0.108	0.190	0.307	0.329	0.342	0.407	0.302	0.360	0.438	0.353
1963	0.001	0.010	0.054	0.165	0.294	0.300	0.318	0.312	0.339	0.330	0.191	0.250	0.293
1964	0.003	0.025	0.062	0.153	0.249	0.435	0.459	0.394	0.436	0.460	0.458	0.361	0.437
1965	0.000	0.006	0.047	0.141	0.266	0.454	0.602	0.638	0.544	0.474	0.365	0.579	0.505
1966	0.001	0.013	0.091	0.210	0.285	0.400	0.403	0.437	0.334	0.314	0.280	0.306	0.341
1967	0.001	0.020	0.094	0.194	0.349	0.433	0.496	0.418	0.598	0.397	0.407	0.452	0.455
1968	0.000	0.009	0.164	0.381	0.495	0.580	0.642	0.633	0.520	0.429	0.740	0.436	0.581
1969	0.000	0.007	0.078	0.264	0.593	0.812	0.916	0.791	0.854	0.660	0.737	1.421	0.760
1970	0.010	0.028	0.131	0.228	0.460	0.729	0.541	0.478	0.340	0.313	0.243	0.165	0.344
1971	0.000	0.024	0.145	0.316	0.465	0.524	0.486	0.435	0.369	0.340	0.341	0.384	0.371
1972	0.002	0.030	0.206	0.371	0.449	0.532	0.561	0.444	0.450	0.453	0.459	0.757	0.452
1973	0.000	0.032	0.254	0.401	0.329	0.389	0.542	0.579	0.578	0.535	0.698	0.695	0.597
1974	0.002	0.027	0.141	0.359	0.636	0.658	0.869	0.923	1.216	1.297	1.074	0.953	1.127
1975	0.001	0.019	0.154	0.438	0.728	0.842	1.140	1.008	1.324	1.025	1.080	1.044	1.109
1976	0.000	0.038	0.223	0.516	0.798	1.010	1.074	1.488	1.311	1.073	0.906	0.892	1.194
1977	0.000	0.023	0.251	0.455	0.440	0.490	0.568	0.518	0.765	0.486	0.651	0.558	0.605
1978	0.000	0.005	0.074	0.234	0.436	0.561	0.579	0.547	0.400	0.589	0.378	0.509	0.479
1979	0.000	0.008	0.058	0.223	0.275	0.447	0.532	0.520	0.579	0.373	0.530	0.353	0.500
1980	0.000	0.018	0.114	0.185	0.280	0.272	0.362	0.360	0.406	0.349	0.256	0.304	0.343
1981	0.000	0.007	0.064	0.177	0.240	0.342	0.289	0.430	0.414	0.451	0.557	0.216	0.463
1982	0.000	0.006	0.126	0.238	0.297	0.414	0.481	0.529	0.506	0.317	0.433	0.546	0.446
1983	0.000	0.008	0.060	0.253	0.398	0.435	0.450	0.508	0.601	0.554	0.407	0.481	0.517
1984	0.000	0.002	0.060	0.193	0.384	0.497	0.510	0.544	0.483	0.516	0.512	0.447	0.514
1985	0.000	0.002	0.048	0.205	0.324	0.533	0.584	0.562	0.714	0.731	0.786	0.615	0.698
1986	0.000	0.006	0.063	0.197	0.427	0.443	0.600	0.557	0.653	0.670	0.691	0.691	0.643
1987	0.000	0.020	0.084	0.186	0.348	0.517	0.709	0.507	0.503	0.480	0.721	0.568	0.553
1988	0.000	0.020	0.172	0.266	0.460	0.638	0.773	0.871	0.908	0.613	0.633	0.778	0.756
1989	0.000	0.011	0.170	0.399	0.619	0.849	1.121	1.084	1.145	1.214	1.403	0.968	1.212
1990	0.004	0.115	0.396	0.622	1.013	1.122	1.388	1.634	1.525	1.490	1.663	1.131	1.578
1991	0.004	0.272	0.934	1.485	1.829	1.862	2.679	3.018	2.549	3.251	2.995	2.913	2.953
1992	0.000	0.057	0.637	1.922	2.681	3.257	4.007	4.825	4.197	2.186	1.998	1.872	3.297
1993	0.000	0.506	1.657	2.499	2.822	2.979	4.066	5.770	0.000	0.000	0.000	0.000	1.394
1994	0.000	0.111	0.393	0.925	1.325	1.388	1.319	3.214	0.000	0.000	0.000	0.000	0.772
1995	0.000	0.006	0.042	0.117	0.198	0.488	0.801	0.619	0.000	0.000	0.000	0.000	0.154
1996	0.001	0.029	0.276	0.717	1.261	0.969	1.997	1.132	5.115	0.000	0.000	0.000	1.411
1997	0.000	0.005	0.021	0.093	0.278	1.423	0.398	4.485	4.477	0.000	0.000	0.000	2.450

Table 36. Residuals from the ADAPT fit to the to the Campelen-equivalent fall survey mean numbers per tow for ages 2 to 12 over the period 1983 to 1997 and catch data for the period 1959 to 1997 for ages 2 to 14.

Year/Age	2	3	4	5	6	7	8	9	10	11	12
1983	-0.870	-0.816	-0.929	-0.943	-0.863	-1.037	-0.662	0.310	-0.292	0.368	0.138
1984	-0.751	-0.807	-0.763	-0.763	-0.815	-1.095	-1.269	-0.032	-0.285	-0.289	0.538
1985	-1.651	-1.125	-0.935	-1.012	-0.901	-1.072	-1.478	-0.096	-0.553	-0.130	-0.488
1986	-1.031	-0.719	-0.142	0.119	0.247	-0.176	-0.236	0.756	0.135	0.723	0.922
1987	-1.409	-1.453	-1.150	-0.642	-0.659	-1.051	-0.991	0.061	-0.303	-0.123	0.284
1988	-1.040	-1.053	-1.063	-0.742	-0.423	-0.263	-0.863	0.454	0.224	0.076	0.288
1989	0.956	-0.320	-0.195	0.001	0.125	-0.002	-0.123	0.696	0.660	1.136	1.264
1990	1.287	0.935	0.219	0.118	0.583	0.408	0.436	1.463	1.019	1.403	1.778
1991	1.284	1.580	1.931	1.358	0.951	0.729	0.899	2.074	1.494	2.167	2.391
1992	1.019	0.959	1.279	1.714	1.698	1.551	0.845	3.127	2.602	-3.413	2.959
1993	1.965	1.417	1.456	1.619	1.985	1.253	1.621	-0.769	-3.833	-3.208	-4.843
1994	-0.108	0.776	0.204	-0.037	0.315	0.987	0.667	-0.682	-0.276	0.347	-3.168
1995	0.235	0.454	0.265	-0.421	-0.318	0.189	0.149	-3.943	-0.528	0.079	-2.965
1996	0.114	0.287	0.332	0.202	-0.413	-0.410	0.827	-3.668	-0.402	0.864	0.574
1997	0.000	-0.113	-0.510	-0.572	-1.514	-0.013	0.177	0.249	0.336		0.326

Table 37. Parameter estimates for the QLSPA fit to the Campelen-equivalent fall survey mean numbers per tow for ages 2 to 12 over the period 1983 to 1997. Catch data are for the period 1959 to 1997 and ages 2 to 14, and are not corrected for estimates of discards.

Estimates of survivors (thousands) on January 1, 1997

Age	Survivors	CV	L95%	U95%
2	1410.2	1.24	123.04	16162.89
3	2103.2	0.88	375.01	11795.62
4	1150.71	0.72	279.92	4730.35
5	576.95	0.7	147.64	2254.61
6	427.73	0.67	114.81	1593.53
7	149.34	0.47	59.62	374.11
8	84.27	0.72	20.39	348.29
9	10.08	0.72	2.47	41.1
10	2.21	0	2.21	2.21
11	0.9	0.86	0.17	4.85
12	0.91	0.59	0.28	2.92
13	0.78	0.62	0.23	2.62
14	1.95	0.59	0.61	6.23

Estimates of catchability at age (x1000)

Age	Estimate	SE
2	0.189321	0.058583
3	0.305699	0.094595
4	0.309645	0.095816
5	0.439073	0.135866
6	0.467087	0.144535
7	0.481908	0.149121
8	0.487496	0.15085
9	0.490995	0.151933
10	0.543465	0.168169
11	0.560902	0.173565
12	0.599567	0.185529

Extended deviance = 748.8 df = 141

Table 38. QLSPA estimates of numbers at age from a fit to the Campelen-equivalent fall survey mean numbers per tow for ages 2 to 12 over the period 1983 to 1997. Catch data are for the period 1959 to 1997 and ages 2 to 14, and is not corrected for estimates of discards.

Year/Age	2	3	4	5	6	7	8	9	10	11	12	13	14
1962	773000	720000	566000	699000	372000	198000	109000	76859	59616	44382	34604	24218	21518
1963	1070000	633000	582000	439000	514000	252000	119000	64051	44701	32490	26887	19765	12790
1964	1270000	879000	513000	451000	305000	314000	153000	71003	38397	26091	19138	18209	12615
1965	1460000	1040000	702000	395000	317000	195000	166000	79291	39229	20340	13492	9921	10394
1966	1060000	1200000	845000	549000	281000	199000	101000	74551	34317	18624	10369	7672	4550
1967	891000	864000	966000	632000	364000	173000	109000	55550	39463	20168	11151	6426	4630
1968	817000	728000	694000	720000	427000	211000	92043	54627	29966	17756	11129	6083	3354
1969	902000	669000	591000	483000	404000	213000	96808	39669	23759	14595	9478	4363	3226
1970	737000	739000	544000	448000	304000	183000	77311	31610	14698	8260	6169	3707	854
1971	311000	597000	588000	391000	292000	157000	72124	36859	16056	8572	4953	3965	2577
1972	172000	254000	477000	417000	234000	150000	76323	36379	19562	9101	5007	2890	2214
1973	168000	140000	202000	319000	236000	122000	72529	35748	19153	10232	4749	2597	1111
1974	284000	137000	111000	129000	175000	139000	67984	34634	16462	8835	4925	1940	1065
1975	506000	232000	110000	79230	73653	75958	59328	23369	11296	3984	1969	1377	613
1976	417000	414000	187000	76931	41912	29152	26806	15561	6989	2449	1167	545	397
1977	367000	341000	326000	122000	37606	15405	8657	7450	2849	1527	682	385	182
1978	186000	300000	273000	208000	63560	19834	7729	4015	3629	1083	769	291	180
1979	196000	152000	245000	208000	135000	33653	9262	3543	1902	1991	492	431	143
1980	440000	161000	124000	189000	136000	83867	17616	4452	1725	873	1124	237	248
1981	392000	360000	129000	90441	129000	84204	52362	10052	2544	942	505	713	143
1982	428000	321000	293000	99419	62111	83020	49021	32150	5357	1378	491	237	470
1983	528000	350000	261000	211000	64203	37825	44956	24816	15522	2646	822	261	112
1984	413000	432000	284000	201000	134000	35348	20071	23505	12234	6971	1245	449	132
1985	193000	338000	353000	219000	136000	75097	17627	9876	11182	6192	3413	611	235
1986	158000	158000	277000	276000	146000	80762	36143	8053	4615	4484	2441	1273	271
1987	193000	129000	128000	213000	186000	78342	42574	16271	3784	1969	1883	1002	523
1988	210000	158000	104000	96711	145000	108000	38381	17208	8057	1881	1000	751	467
1989	96919	172000	127000	71772	60917	75229	46894	14587	5921	2672	839	437	284
1990	17980	79344	139000	87898	39624	27062	26568	12606	4074	1554	654	170	137
1991	10812	14669	58000	77165	39020	11906	7326	5519	2037	743	292	103	46
1992	3281	8820	9195	18845	14492	5206	1547	421	225	133	29	13	5
1993	1741	2687	6832	4035	2277	816	167	25	4	4	15	7	2
1994	1451	1426	1349	1076	279	109	35	4	1	4	4	12	6
1995	1771	1188	1072	762	361	68	22	9	1	1	3	3	10
1996	2570	1450	967	851	559	245	38	8	4	1	1	2	2
1997	1410	2103	1151	577	428	149	84	10	2	1	1	1	2

Table 39. QLSPA estimates of fishing mortality from a fit to the Campelen-equivalent fall survey mean numbers per tow for ages 2 to 12 over the period 1983 to 1997. Catch data are for the period 1959 to 1997 and ages 2 to 14, and are not corrected for estimates of discards.

Year/Age	2	3	4	5	6	7	8	9	10	11	12	13	14
1962	0.000	0.013	0.053	0.107	0.190	0.307	0.328	0.342	0.407	0.301	0.360	0.438	0.353
1963	0.001	0.010	0.054	0.164	0.293	0.299	0.318	0.312	0.338	0.329	0.190	0.249	0.292
1964	0.003	0.025	0.061	0.152	0.248	0.435	0.458	0.393	0.435	0.460	0.457	0.361	0.436
1965	0.000	0.006	0.046	0.140	0.265	0.454	0.603	0.637	0.545	0.474	0.365	0.579	0.505
1966	0.001	0.013	0.090	0.209	0.284	0.399	0.402	0.436	0.332	0.313	0.278	0.305	0.340
1967	0.001	0.020	0.093	0.193	0.347	0.432	0.495	0.417	0.599	0.395	0.406	0.450	0.454
1968	0.000	0.009	0.163	0.379	0.494	0.578	0.642	0.633	0.519	0.428	0.737	0.434	0.579
1969	0.000	0.007	0.077	0.263	0.592	0.815	0.919	0.793	0.857	0.661	0.739	1.431	0.762
1970	0.010	0.027	0.130	0.227	0.459	0.730	0.541	0.477	0.339	0.311	0.242	0.164	0.343
1971	0.000	0.024	0.144	0.315	0.464	0.522	0.484	0.434	0.368	0.338	0.339	0.382	0.369
1972	0.002	0.030	0.204	0.369	0.447	0.530	0.558	0.442	0.448	0.451	0.456	0.757	0.449
1973	0.000	0.032	0.252	0.399	0.327	0.387	0.539	0.575	0.574	0.531	0.695	0.691	0.594
1974	0.002	0.026	0.140	0.357	0.635	0.654	0.868	0.920	1.219	1.301	1.074	0.952	1.129
1975	0.001	0.019	0.153	0.437	0.727	0.842	1.138	1.007	1.329	1.028	1.084	1.045	1.112
1976	0.000	0.037	0.223	0.516	0.801	1.014	1.080	1.498	1.321	1.078	0.910	0.896	1.202
1977	0.000	0.023	0.251	0.455	0.440	0.490	0.568	0.519	0.767	0.486	0.653	0.559	0.606
1978	0.000	0.005	0.074	0.234	0.436	0.562	0.580	0.547	0.400	0.590	0.378	0.509	0.479
1979	0.000	0.008	0.057	0.223	0.274	0.447	0.533	0.520	0.579	0.372	0.530	0.353	0.500
1980	0.000	0.018	0.114	0.184	0.280	0.271	0.361	0.360	0.405	0.348	0.255	0.303	0.342
1981	0.000	0.007	0.063	0.176	0.239	0.341	0.288	0.429	0.413	0.451	0.557	0.215	0.463
1982	0.000	0.006	0.126	0.237	0.296	0.413	0.481	0.528	0.505	0.316	0.432	0.545	0.445
1983	0.000	0.008	0.059	0.252	0.397	0.434	0.448	0.507	0.601	0.554	0.405	0.480	0.517
1984	0.000	0.002	0.060	0.192	0.382	0.496	0.509	0.543	0.481	0.514	0.511	0.445	0.512
1985	0.000	0.002	0.047	0.204	0.322	0.531	0.583	0.561	0.714	0.731	0.786	0.614	0.698
1986	0.000	0.006	0.063	0.195	0.425	0.440	0.598	0.555	0.652	0.668	0.690	0.690	0.641
1987	0.000	0.020	0.083	0.184	0.345	0.514	0.706	0.503	0.499	0.477	0.718	0.564	0.549
1988	0.000	0.020	0.169	0.262	0.455	0.632	0.767	0.867	0.904	0.607	0.628	0.773	0.751
1989	0.000	0.011	0.167	0.394	0.611	0.841	1.114	1.075	1.137	1.207	1.399	0.960	1.205
1990	0.004	0.113	0.389	0.612	1.002	1.107	1.371	1.623	1.501	1.473	1.649	1.112	1.561
1991	0.004	0.267	0.924	1.472	1.814	1.841	2.657	2.999	2.530	3.060	2.933	2.888	2.881
1992	0.000	0.055	0.624	1.913	2.677	3.239	3.927	4.375	3.752	2.007	1.195	1.523	2.832
1993	0.000	0.489	1.648	2.472	2.840	2.951	3.566	2.666	0.000	0.000	0.000	0.000	0.667
1994	0.000	0.085	0.372	0.893	1.209	1.390	1.190	0.847	0.000	0.000	0.000	0.000	0.212
1995	0.000	0.007	0.031	0.109	0.185	0.392	0.793	0.479	0.000	0.000	0.000	0.000	0.120
1996	0.000	0.031	0.316	0.488	1.120	0.869	1.120	1.114	1.389	0.000	0.000	0.000	0.626
1997	0.000	0.004	0.022	0.109	0.156	0.972	0.322	0.399	17.840	0.000	0.000	0.000	0.837

Table 40. Standardised residuals from the QLSPA fit to the to the Campelen-equivalent fall survey mean numbers per tow for ages 2 to 12 over the period 1983 to 1997 and catch data for ages 2 to 14 over the period 1959 to 1997. Standardised residuals are (observed-expected)/(variance)$^{-2}$.

Year/Age	2	3	4	5	6	7	8	9	10	11	12
1983	-0.650	-0.620	-0.640	-0.620	-0.620	-0.620	-0.470	-0.530	-0.420	0.020	-0.430
1984	-0.630	-0.610	-0.600	-0.580	-0.610	-0.640	-0.640	-0.620	-0.420	-0.390	-0.230
1985	-0.750	-0.670	-0.640	-0.640	-0.630	-0.630	-0.670	-0.630	-0.520	-0.310	-0.620
1986	-0.680	-0.590	-0.410	-0.220	-0.180	-0.340	-0.280	-0.360	-0.200	0.390	0.050
1987	-0.730	-0.720	-0.680	-0.550	-0.570	-0.630	-0.570	-0.600	-0.430	-0.310	-0.370
1988	-0.680	-0.660	-0.660	-0.580	-0.500	-0.380	-0.540	-0.490	-0.150	-0.200	-0.370
1989	0.300	-0.480	-0.430	-0.300	-0.260	-0.250	-0.220	-0.390	0.220	0.990	0.400
1990	0.740	0.410	-0.230	-0.240	0.070	0.030	0.230	0.110	0.640	1.500	1.190
1991	0.740	1.520	2.500	1.200	0.440	0.340	0.800	0.840	1.500	3.320	2.650
1992	0.420	0.450	0.890	2.060	1.840	1.780	0.610	2.420	3.950	-0.830	1.890
1993	2.080	1.300	1.360	1.730	2.810	1.100	1.340	-0.830	-0.830	-0.830	-0.830
1994	-0.250	0.150	-0.180	-0.260	-0.240	0.730	0.320	-0.830	-0.830	-0.830	-0.830
1995	0.080	0.320	-0.240	-0.450	-0.410	-0.280	-0.030	0.230	-0.830	-0.830	-0.830
1996	0.040	0.260	0.290	-0.250	-0.420	-0.320	-0.250	1.480	-0.830	-0.830	-0.830
1997	-0.030	-0.050	-0.330	-0.300	-0.740	0.120	0.380	0.210	-0.830	-0.830	-0.830

Table 41a. Catch weights at age (kg) for cod caught in the commercial fishery in NAFO Divisions 2J+3KL for the period 1962-1997 and predicted for 1998. Other highlighted entries indicate missing values which were assumed as described in Lilly (MS 1998).

Age	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
2	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.26	0.11	0.26	0.25	0.09	0.26	0.26	0.41
3	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.44	0.32	0.35	0.45	0.45	0.45	0.40	0.46	0.53
4	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.53	0.47	0.68	0.63	0.61	0.60	0.72	0.74	0.77
5	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.64	0.71	0.91	0.96	0.93	0.97	1.04	1.13	1.16
6	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.23	1.08	0.96	1.11	1.18	1.32	1.66	1.58	1.67	1.71
7	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.52	1.30	1.27	1.39	1.75	2.33	2.46	2.46	2.38
8	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.13	1.80	1.56	1.74	2.07	2.82	3.26	3.57	3.56
9	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.86	2.20	2.05	2.21	2.24	3.46	4.05	4.41	5.01
10	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.29	2.82	2.75	2.61	2.99	3.88	4.46	5.25	5.49
11	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.76	3.95	3.19	3.13	3.34	3.67	4.78	5.02	5.80	6.72
12	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.12	3.79	3.41	3.66	4.56	6.13	6.72	7.03	7.87
13	6.06	6.06	6.06	6.06	6.06	6.06	6.06	6.06	6.06	6.06	5.00	4.53	4.92	4.78	6.18	7.31	8.10	8.96	8.38
14	5.54	5.54	5.54	5.54	5.54	5.54	5.54	5.54	5.54	5.54	9.32	6.93	4.40	5.20	8.19	8.40	7.42	8.54	10.03
15	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	9.40	7.22	6.33	5.20	9.77	8.81	8.20	9.46	11.31
16	5.83	5.83	5.83	5.83	5.83	5.83	5.83	5.83	5.83	5.83	6.89	7.05	5.50	5.46	11.23	11.75	11.26	10.70	13.87
17	6.44	6.44	6.44	6.44	6.44	6.44	6.44	6.44	6.44	6.44	14.67	9.45	7.57	8.51	12.44	10.63	11.61	13.12	10.68
18	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	12.04	11.16	11.07	9.24	11.16	12.27	8.92	13.49	16.09
19	6.61	6.61	6.61	6.61	6.61	6.61	6.61	6.61	6.61	6.61	7.62	7.62	7.62	7.62	7.62	7.62	10.57	15.51	12.04
20	7.19	7.19	7.19	7.19	7.19	7.19	7.19	7.19	7.19	7.19	17.46	17.46	17.46	17.46	17.46	17.46	16.00	14.77	11.37

Age	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
2	0.26	0.26	0.31	0.34	0.26	0.21	0.32	0.29	0.26	0.29	0.17	0.26	0.26	0.26	0.21	0.40	0.32	0.32
3	0.55	0.53	0.62	0.59	0.48	0.51	0.43	0.49	0.48	0.42	0.36	0.29	0.57	0.40	0.49	0.72	0.51	0.51
4	0.78	0.84	0.87	0.88	0.73	0.72	0.66	0.73	0.74	0.69	0.61	0.58	0.71	0.68	0.79	0.99	0.84	0.84
5	1.17	1.20	1.32	1.20	1.10	1.04	1.03	1.08	1.03	1.06	0.97	0.81	0.97	0.98	1.51	1.30	1.49	1.49
6	1.64	1.77	1.75	1.79	1.43	1.54	1.32	1.38	1.44	1.50	1.41	1.19	1.25	1.41	1.95	1.90	2.01	2.01
7	2.23	2.10	2.28	2.28	2.06	1.85	1.87	1.67	1.83	1.94	1.88	1.73	1.59	1.85	2.24	2.38	2.44	2.44
8	2.86	2.66	2.61	2.71	2.66	2.35	1.93	2.21	2.07	2.22	2.27	2.05	8.40	2.05	2.47	2.77	2.87	2.87
9	3.81	3.09	3.18	2.96	3.23	2.94	2.80	2.51	2.64	2.44	2.63	2.66	9.23	3.05	2.53	3.30	3.78	3.78
10	5.32	4.18	3.50	3.65	3.32	3.47	3.51	3.04	3.02	3.06	3.14	2.24	2.87	2.87	2.93	3.19	4.30	4.30
11	6.29	6.16	4.79	4.28	4.06	3.80	4.80	4.37	3.96	3.58	3.80	2.68	4.11	4.11	4.51	5.44	4.23	4.23
12	7.06	7.19	7.76	6.19	4.55	4.54	4.64	5.49	5.41	4.68	4.96	4.95	5.15	5.15	2.01	4.35	6.33	6.33
13	7.32	8.00	9.07	8.39	7.03	5.34	5.74	6.55	7.50	6.23	5.49	5.34	6.17	6.17	6.17	7.63	6.22	6.22
14	10.01	8.36	9.14	10.26	9.67	7.12	6.13	8.60	9.24	8.51	7.61	7.02	7.71	7.71	7.71	4.46	7.71	7.71
15	8.99	7.86	10.62	11.44	11.37	11.77	8.53	9.76	10.05	9.78	11.58	10.47	10.47	10.47	10.47	10.47	10.47	10.47
16	11.54	7.91	10.57	11.61	11.27	11.24	13.51	9.73	9.34	12.58	11.01	10.98	10.98	10.98	10.98	10.98	10.98	10.98
17	10.48	9.58	13.13	17.47	12.68	14.15	9.10	12.58	15.74	15.45	12.82	14.67	14.67	14.67	14.67	14.67	14.67	14.67
18	11.15	12.95	15.97	12.94	12.42	16.14	21.77	16.01	18.66	13.58	13.00	15.08	15.08	15.08	15.08	15.08	15.08	15.08
19	9.82	11.70	9.73	15.21	14.38	12.30	17.66	16.60	16.16	17.26	13.10	15.65	15.65	15.65	15.65	15.65	15.65	15.65
20	12.59	13.16	15.88	12.81	19.49	15.72	15.97	11.03	17.64	15.97	15.97	15.97	15.97	15.97	15.97	15.97	15.97	15.97

Table 41b. Jan 1 weights-at-age calculated from actual and assumed commercial mean weights-at-age (Lilly MS 1998). Highlighted entries indicate values copied from adjacent cells.

Age	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
2	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.09	0.23	0.05	0.20	0.19	0.04	0.20	0.19	0.35
3	**0.22**	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.25	0.21	0.30	0.22	0.34	0.34	0.19	0.35	0.37
4	**0.43**	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.42	0.45	0.47	0.47	0.52	0.52	0.57	0.54	0.60
5	**0.70**	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.59	0.61	0.65	0.81	0.77	0.77	0.79	0.90	0.93
6	**1.04**	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	0.97	0.78	0.89	1.04	1.13	1.24	1.24	1.32	1.39
7	**1.43**	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.37	1.18	1.10	1.24	1.44	1.75	2.02	1.97	1.99
8	**1.88**	1.88	1.88	1.88	1.88	1.88	1.88	1.88	1.88	1.88	1.88	1.65	1.42	1.49	1.70	2.22	2.76	2.96	2.96
9	**2.37**	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.46	2.16	1.92	1.86	1.97	2.68	3.38	3.79	4.23
10	**2.90**	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.95	2.84	2.46	2.31	2.57	2.95	3.93	4.61	4.92
11	**3.46**	3.46	3.46	3.46	3.46	3.46	3.46	3.46	3.46	3.46	3.54	3.24	2.97	3.03	3.09	3.78	4.41	5.09	5.94
12	**3.95**	3.95	3.95	3.95	3.95	3.95	3.95	3.95	3.95	3.95	3.94	3.87	3.30	3.38	3.90	4.74	5.67	5.94	6.76
13	**5.01**	5.01	5.01	5.01	5.01	5.01	5.01	5.01	5.01	5.01	4.56	4.32	4.32	4.04	4.76	5.77	7.05	7.76	7.68
14	**5.79**	5.79	5.79	5.79	5.79	5.79	5.79	5.79	5.79	5.79	7.52	5.89	4.46	5.06	6.26	7.20	7.36	8.32	9.48
15	**5.82**	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	7.22	8.20	6.62	4.78	7.13	8.49	8.30	8.38	9.83
16	**5.97**	5.97	5.97	5.97	5.97	5.97	5.97	5.97	5.97	5.97	6.49	8.14	6.30	5.88	7.64	10.71	9.96	9.37	11.45
17	**6.13**	6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13	9.25	8.07	7.31	6.84	8.24	10.93	11.68	12.15	10.69
18	**6.25**	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	8.81	12.80	10.23	8.36	9.75	12.35	9.74	12.51	14.53
19	**6.33**	6.33	6.33	6.33	6.33	6.33	6.33	6.33	6.33	6.33	6.80	9.58	9.22	9.18	8.39	9.22	11.39	11.76	12.74
20	**6.89**	6.89	6.89	6.89	6.89	6.89	6.89	6.89	6.89	6.89	10.74	11.53	11.53	11.53	11.53	11.53	11.04	12.49	13.28
21																			

Age	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
2	0.19	0.17	0.22	0.29	0.19	0.15	0.26	0.23	0.20	0.26	0.13	0.17	0.21	0.19	0.11	0.35	0.25	**0.25**	**0.25**
3	0.47	0.37	0.40	0.43	0.40	0.37	0.30	0.40	0.37	0.33	0.32	0.22	0.38	0.32	0.36	0.39	0.45	0.40	**0.40**
4	0.64	0.68	0.68	0.74	0.66	0.59	0.58	0.56	0.60	0.58	0.51	0.46	0.45	0.62	0.56	0.70	0.78	0.65	**0.65**
5	0.95	0.97	1.05	1.02	0.98	0.87	0.86	0.84	0.87	0.89	0.82	0.70	0.75	0.83	1.01	1.01	1.21	1.12	**1.12**
6	1.38	1.44	1.45	1.54	1.31	1.30	1.17	1.19	1.25	1.24	1.22	1.07	1.01	1.17	1.38	1.69	1.61	1.73	**1.73**
7	1.95	1.86	2.01	2.00	1.92	1.63	1.70	1.48	1.59	1.67	1.68	1.56	1.38	1.52	1.78	2.16	2.15	2.21	**2.21**
8	2.61	2.44	2.34	2.49	2.46	2.20	1.89	2.03	1.86	2.02	2.10	1.96	3.81	1.81	2.14	2.49	2.61	2.64	**2.64**
9	3.68	2.97	2.91	2.78	2.96	2.80	2.57	2.20	2.42	2.25	2.42	2.46	4.35	5.06	2.28	2.85	3.23	3.29	**3.29**
10	5.16	3.99	3.29	3.41	3.13	3.35	3.21	2.92	2.75	2.84	2.77	2.43	2.76	5.15	2.99	2.84	3.77	4.03	**4.03**
11	5.88	5.72	4.47	3.87	3.85	3.55	4.08	3.92	3.47	3.29	3.41	2.90	3.03	3.44	3.60	3.99	3.67	4.26	**4.26**
12	6.89	6.72	6.91	5.45	4.41	4.29	4.20	5.13	4.86	4.30	4.21	4.34	3.71	4.60	2.87	4.43	5.87	5.17	**5.17**
13	7.59	7.52	8.08	8.07	6.60	4.93	5.10	5.51	6.42	5.81	5.07	5.15	5.53	5.63	5.63	3.91	5.20	6.27	**6.27**
14	9.16	7.82	8.55	9.65	9.01	7.07	5.72	7.03	7.78	7.99	6.89	6.21	6.42	6.90	6.90	5.24	7.67	6.93	**6.93**
15	9.50	8.87	9.42	10.23	10.80	10.67	7.79	7.73	9.30	9.51	9.93	8.93	8.57	8.99	8.99	8.99	6.83	8.99	**8.99**
16	11.42	8.43	9.11	11.10	11.35	11.30	12.61	9.11	9.55	11.24	10.38	11.27	10.72	10.72	10.72	10.72	10.72	10.72	**10.72**
17	12.06	10.51	10.19	13.59	12.13	12.63	10.11	13.04	12.38	12.01	12.70	12.71	12.69	12.69	12.69	12.69	12.69	12.69	**12.69**
18	10.91	11.65	12.37	13.03	14.73	14.31	17.55	12.07	15.32	14.62	14.17	13.90	14.87	14.87	14.87	14.87	14.87	14.87	**14.87**
19	12.57	11.42	11.23	15.59	13.64	12.36	16.88	19.01	16.08	17.95	13.34	14.27	15.36	15.36	15.36	15.36	15.36	15.36	**15.36**
20	12.31	11.37	13.63	11.16	17.22	15.04	14.02	13.96	17.11	16.06	16.60	14.46	15.81	15.81	15.81	15.81	15.81	15.81	**15.81**
21																		16.13	16.13

Table 42. Estimated and projected (to 1999) proportions mature at age for female 2J+3KL cod used in the preparation of precautionary plots and risk analysis.

Year/age	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1982	0.0000	0.0000	0.0001	0.0005	0.0053	0.0509	0.3498	0.8437	0.9819	0.9982	0.9998	1.0000	1.0000	1.0000	1.0000
1983	0.0000	0.0000	0.0000	0.0002	0.0036	0.0518	0.4499	0.9244	0.9946	0.9996	1.0000	1.0000	1.0000	1.0000	1.0000
1984	0.0000	0.0000	0.0001	0.0010	0.0088	0.0754	0.4279	0.8728	0.9844	0.9983	0.9998	1.0000	1.0000	1.0000	1.0000
1985	0.0000	0.0000	0.0000	0.0004	0.0062	0.0989	0.6603	0.9718	0.9984	0.9999	1.0000	1.0000	1.0000	1.0000	1.0000
1986	0.0000	0.0000	0.0000	0.0004	0.0043	0.0490	0.3813	0.8805	0.9888	0.9991	0.9999	1.0000	1.0000	1.0000	1.0000
1987	0.0000	0.0000	0.0001	0.0008	0.0074	0.0658	0.4007	0.8640	0.9837	0.9983	0.9998	1.0000	1.0000	1.0000	1.0000
1988	0.0000	0.0000	0.0001	0.0009	0.0082	0.0704	0.4094	0.8638	0.9831	0.9981	0.9998	1.0000	1.0000	1.0000	1.0000
1989	0.0000	0.0000	0.0002	0.0018	0.0158	0.1229	0.5506	0.9146	0.9894	0.9988	0.9999	1.0000	1.0000	1.0000	1.0000
1990	0.0000	0.0000	0.0001	0.0010	0.0112	0.1183	0.6147	0.9499	0.9956	0.9996	1.0000	1.0000	1.0000	1.0000	1.0000
1991	0.0000	0.0000	0.0013	0.0062	0.0297	0.1304	0.4234	0.7825	0.9463	0.9885	0.9976	0.9995	0.9999	1.0000	1.0000
1992	0.0000	0.0000	0.0025	0.0125	0.0594	0.2396	0.6112	0.8869	0.9751	0.9949	0.9990	0.9998	1.0000	1.0000	1.0000
1993	0.0000	0.0000	0.0008	0.0061	0.0468	0.2822	0.7589	0.9618	0.9951	0.9994	0.9999	1.0000	1.0000	1.0000	1.0000
1994	0.0000	0.0000	0.0000	0.0062	0.0727	0.4942	0.9242	0.9935	0.9995	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1995	0.0000	0.0000	0.0001	0.0018	0.0508	0.6122	0.9790	0.9993	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1996	0.0000	0.0001	0.0007	0.0058	0.0455	0.2824	0.7644	0.9640	0.9955	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1997	0.0000	0.0000	0.0004	0.0032	0.0270	0.1939	0.6762	0.9477	0.9937	0.9993	0.9999	1.0000	1.0000	1.0000	1.0000
1998	0.0000	0.0001	0.0006	0.0074	0.0835	0.5283	0.9323	0.9995	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1999	0.0000	0.0001	0.0007	0.0062	0.0516	0.3222	0.8060	0.9732	0.9969	0.9996	1.0000	1.0000	1.0000	1.0000	1.0000

Table 43. Decision table for a range of TAC options from 0 to 5,000t based on estimates of population size and uncertainty from the QLSPA fit to the Canadian fall research vessel index in Campelen equivalent units for the period 1983 to 1997 and catch data for the period 1959 to 1997 for ages 2 to 14.

Decision Table - 2J3KL cod - QLSPA - Fishery removals

	TAC options for 1998				
TAC Option	0t	1,000t	2,000t	3,000t	5,000t
Reference Point					
P(B299/B298<=1)	0.000	0.063	0.637	0.877	0.990
P(B599/B598<=1)	0.000	0.183	0.503	0.720	0.870
P(Bm99/Bm98<=1)	0.000	0.273	0.680	0.857	0.957
P(B299/B298<=1.1)	0.000	0.413	0.887	0.973	1.000
P(B599/B598<=1.1)	0.003	0.307	0.587	0.760	0.883
P(Bm99/Bm98<=1.1)	0.007	0.457	0.753	0.897	0.970
P(B299/B298<=1.2)	0.050	0.863	0.987	0.997	1.000
P(B599/B598<=1.2)	0.063	0.450	0.657	0.807	0.893
P(Bm99/Bm98<=1.2)	0.103	0.617	0.853	0.933	0.977
P(B299/B292<=1)	1.000	1.000	1.000	1.000	1.000
P(B599/B592<=1)	1.000	1.000	1.000	1.000	1.000
P(Bm99/Bm92<=1)	1.000	1.000	1.000	1.000	1.000
P(B299/B2_0.5msy<=1)	1.000	1.000	1.000	1.000	1.000
P(B599/B5_0.5msy<=1)	1.000	1.000	1.000	1.000	1.000
P(Bm99/Bm_0.5msy<=1)	1.000	1.000	1.000	1.000	1.000
P(B299/B2Ave80s<=1)	1.000	1.000	1.000	1.000	1.000
P(B599/B5Ave80s<=1)	1.000	1.000	1.000	1.000	1.000
P(Bm99/BmAve80s<=1)	1.000	1.000	1.000	1.000	1.000
P(F98>F0.1)	0.000	0.830	0.993	1.000	1.000

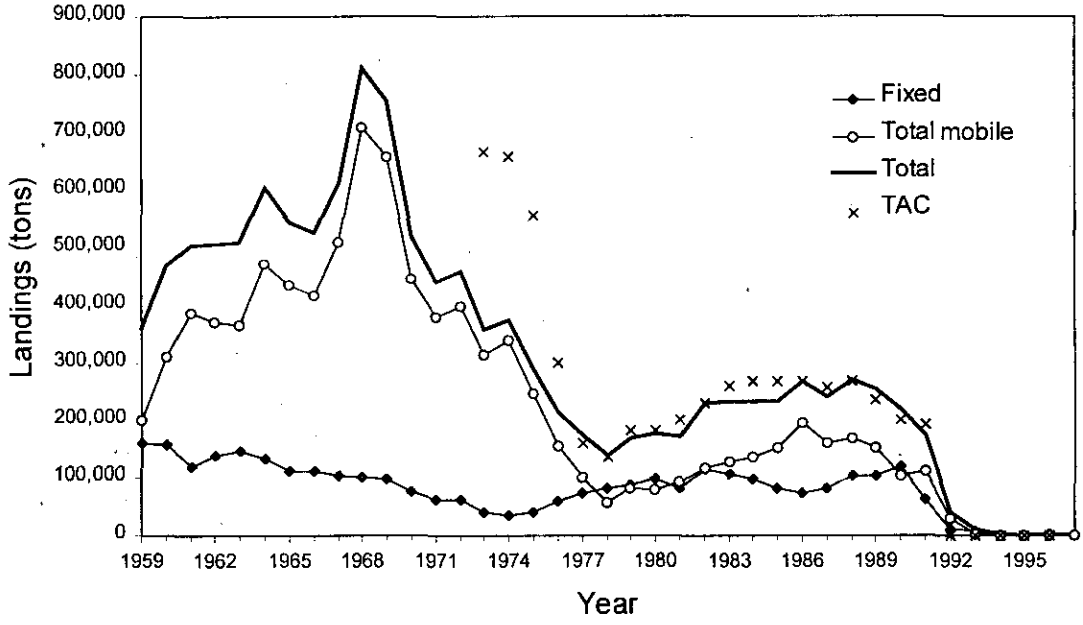

Fig. 1. *Division 2J+3KL cod landings from fixed gear and mobile gear and the TAC.*

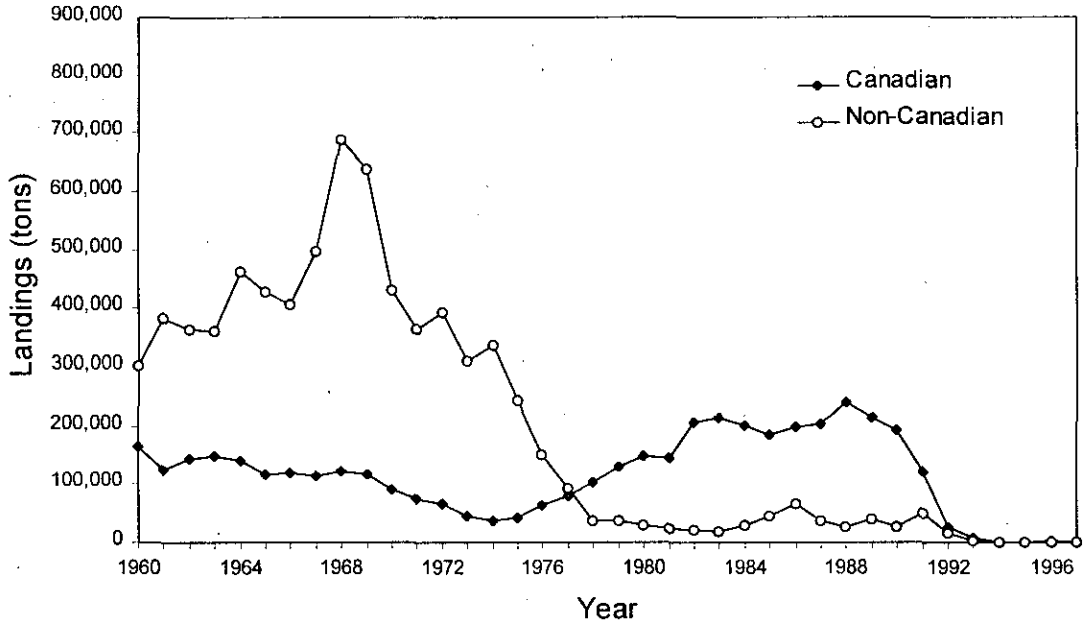

Fig. 2. Division 2J+3KL cod landings by Canadian and non-Canadian vessels.

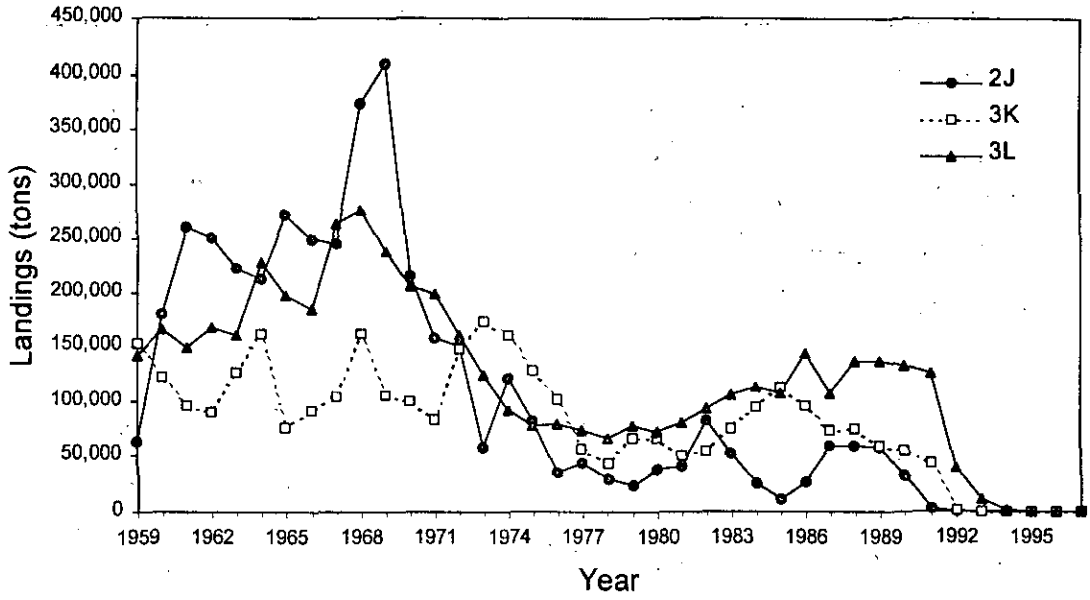

Fig. 3. Division 2J+3KL cod landings by Division.

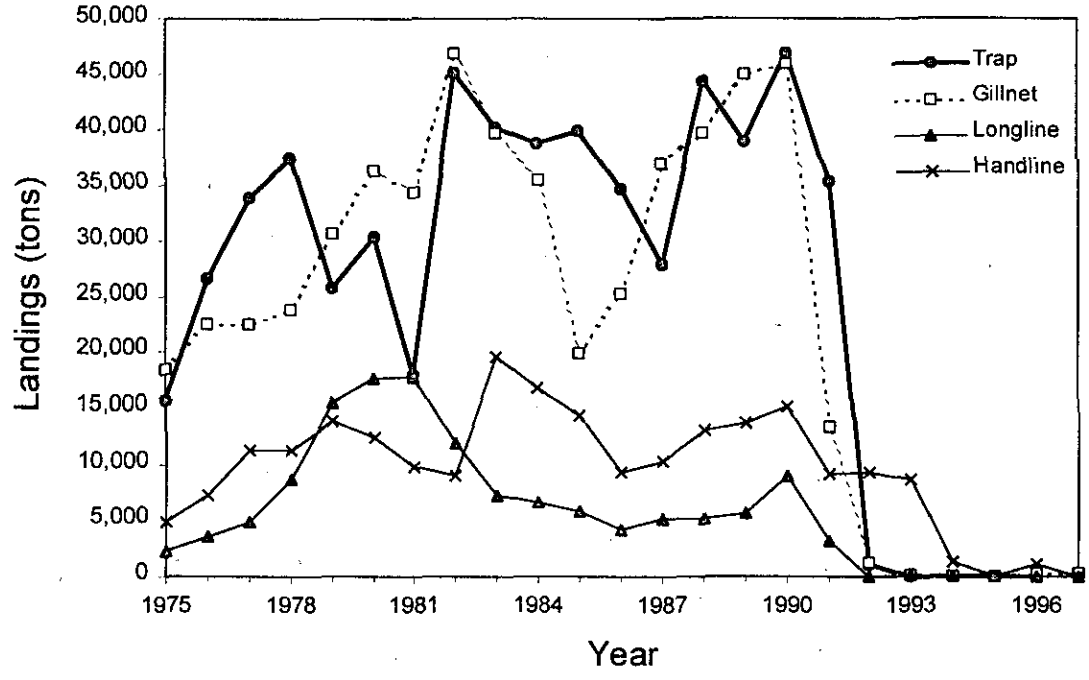

Fig. 4. Division 2J+3KL cod fixed gear landings by gear type.

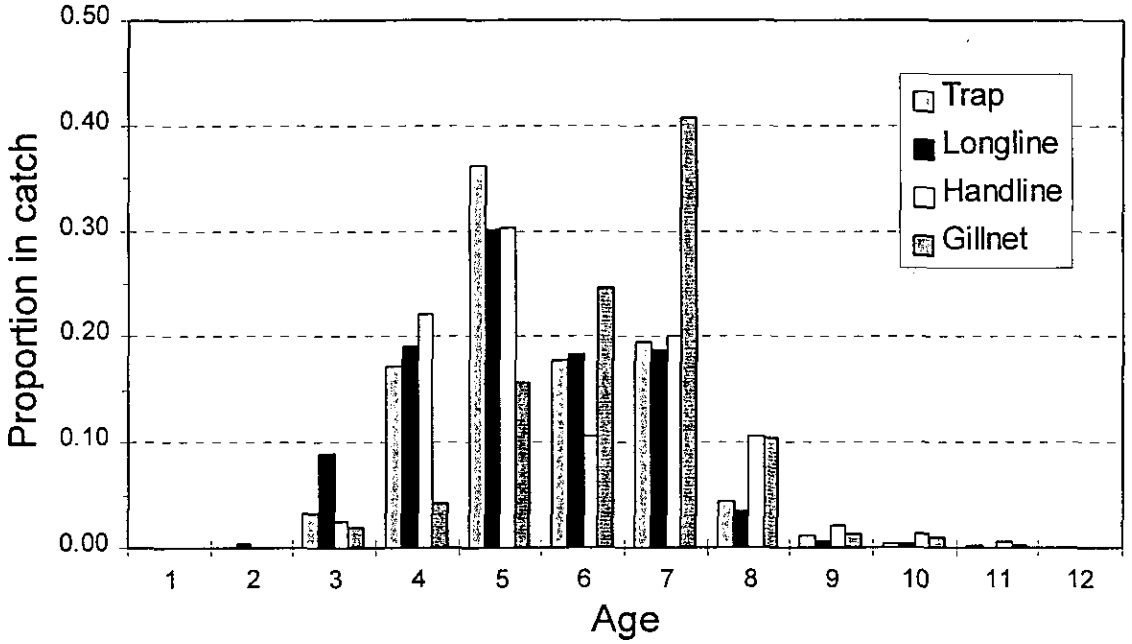

Fig. 5. Age composition of the landings of cod in Divisions 2J+3KL in 1997.

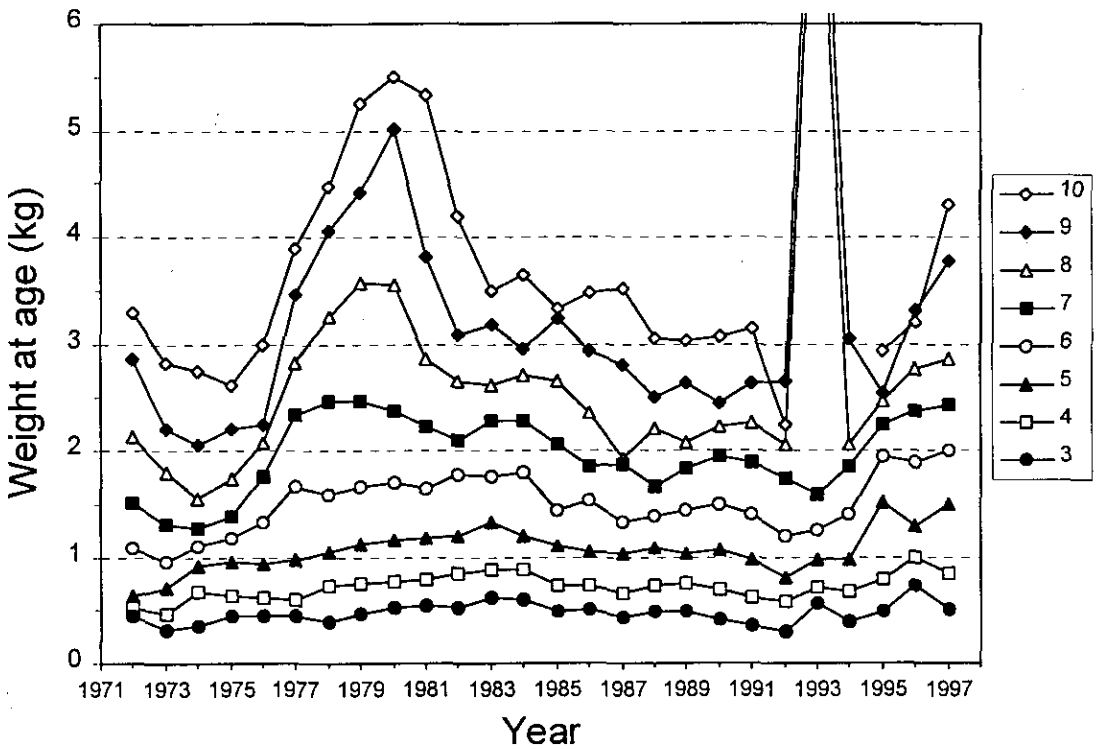

Fig. 6. Mean weights-at-age for cod of ages 3-10 landed in NAFO Divisions 2J+3KL in the period 1972-1997.

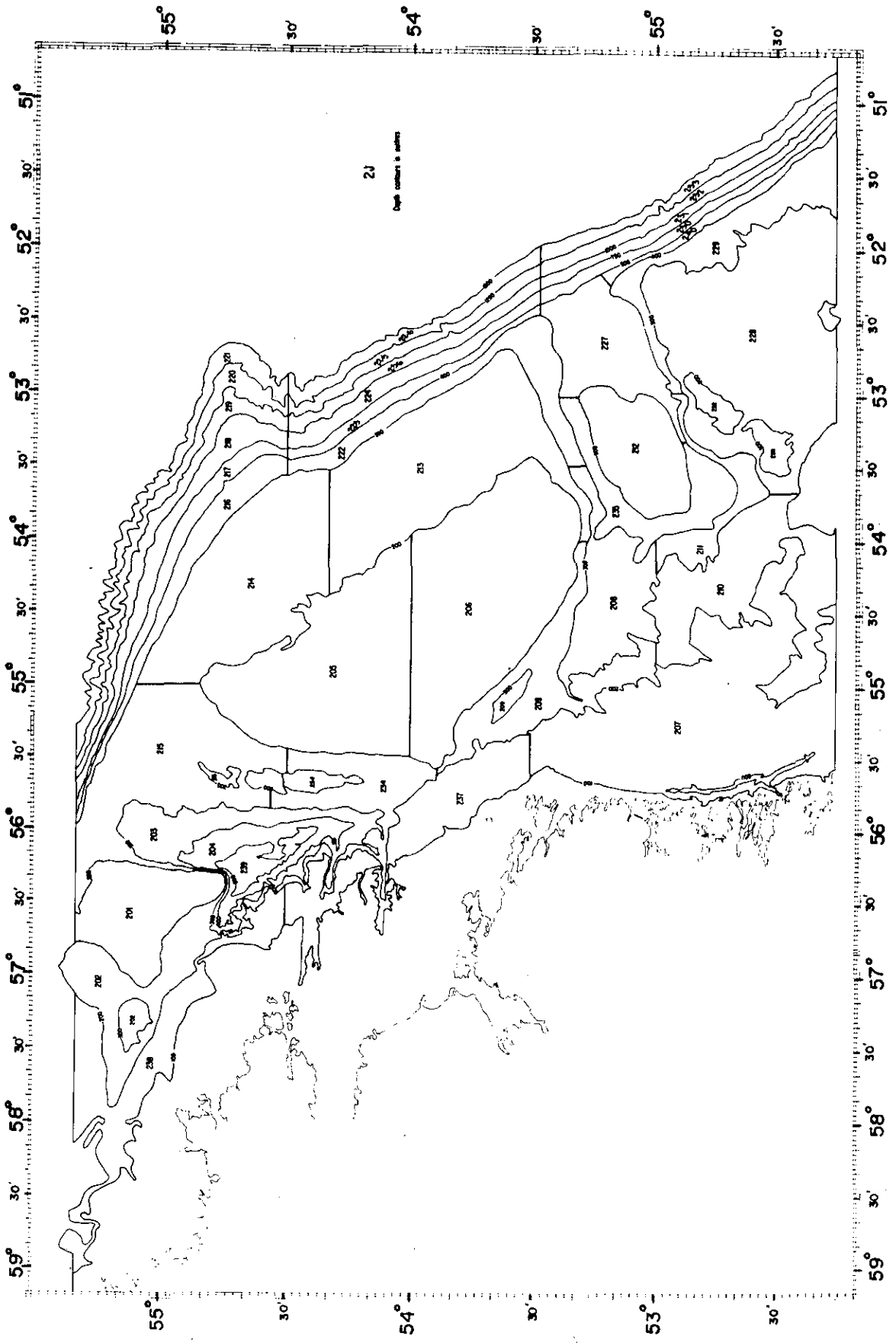

Fig. 7. Strata used for research vessel bottom trawl surveys in NAFO Division 2J.

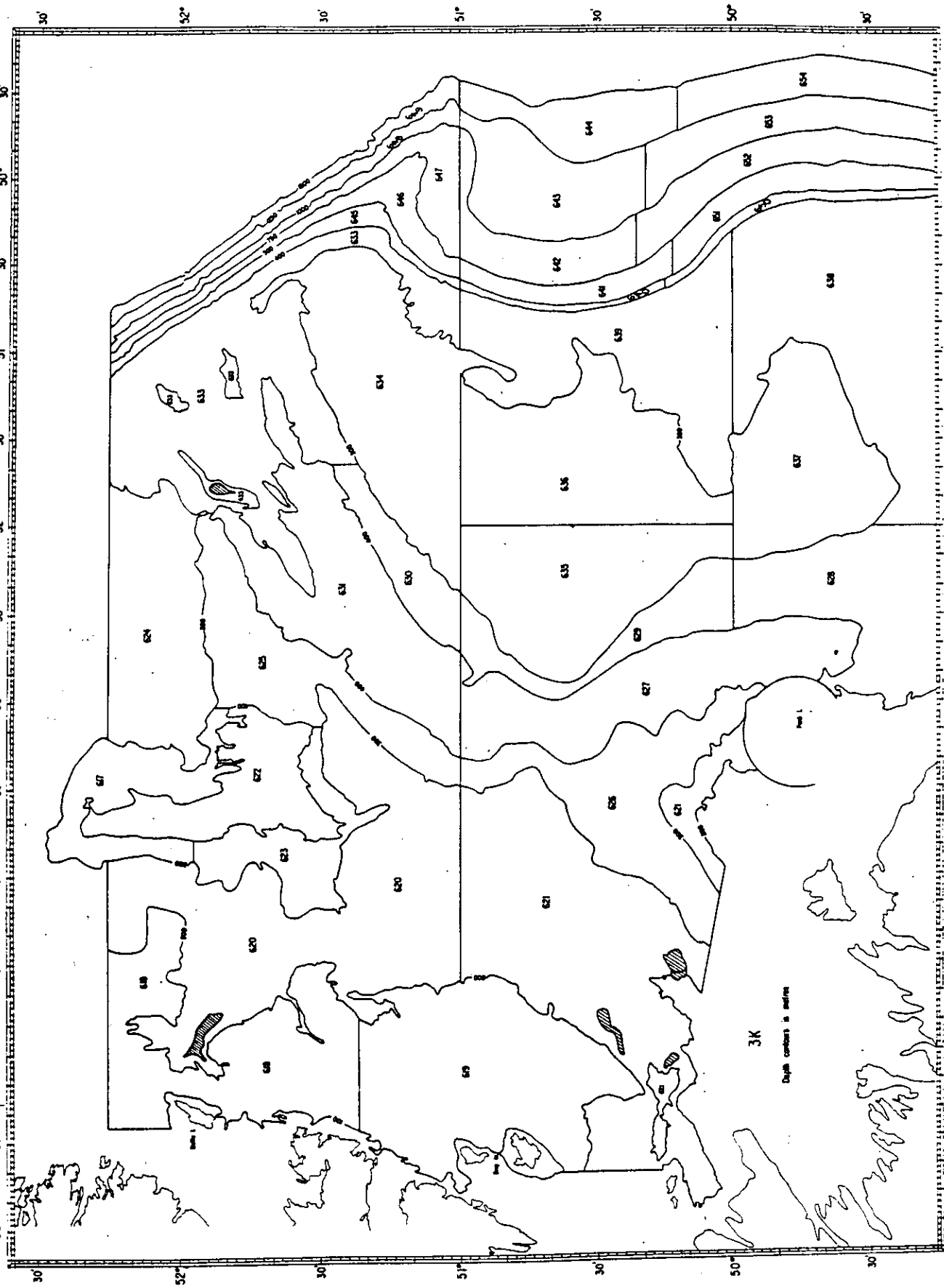

Fig. 8. Strata used for research vessel bottom trawl surveys in NAFO Division 3K.

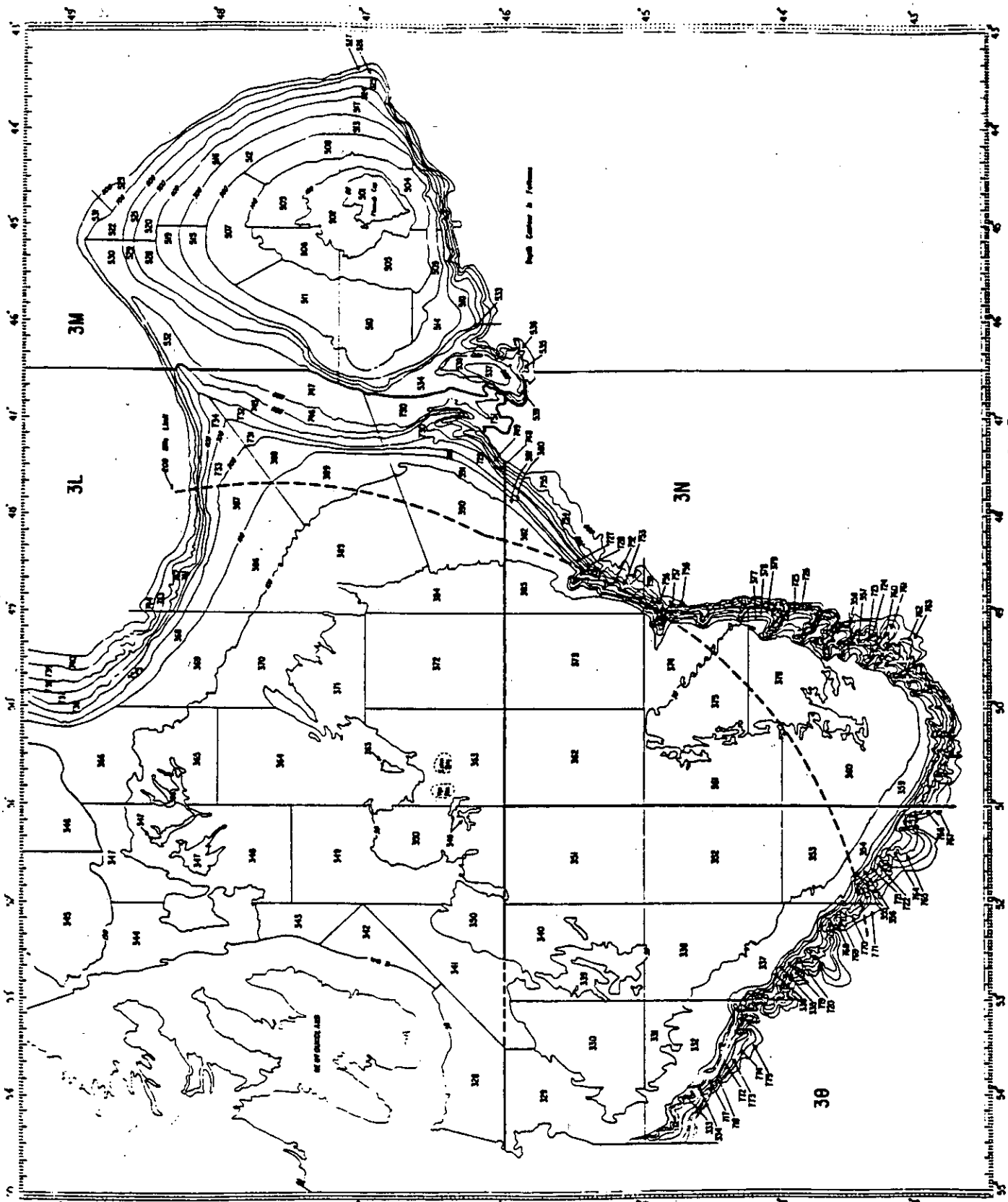

Fig. 9. Strata used for research vessel bottom trawl surveys in NAFO Division 3L.

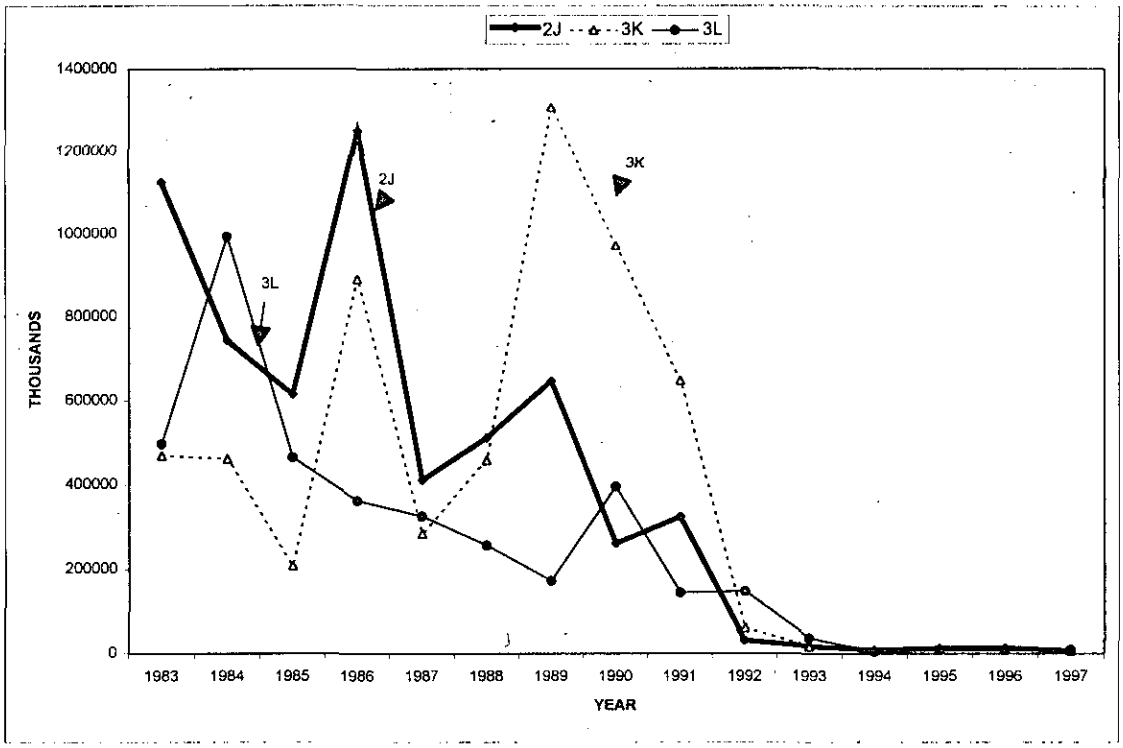

Fig 10a. Abundance by Division for index strata (<500 meters in Divisions 2J and 3K and <200 fathoms in Division 3L). Strata not fished have been filled using a multiplicative model.

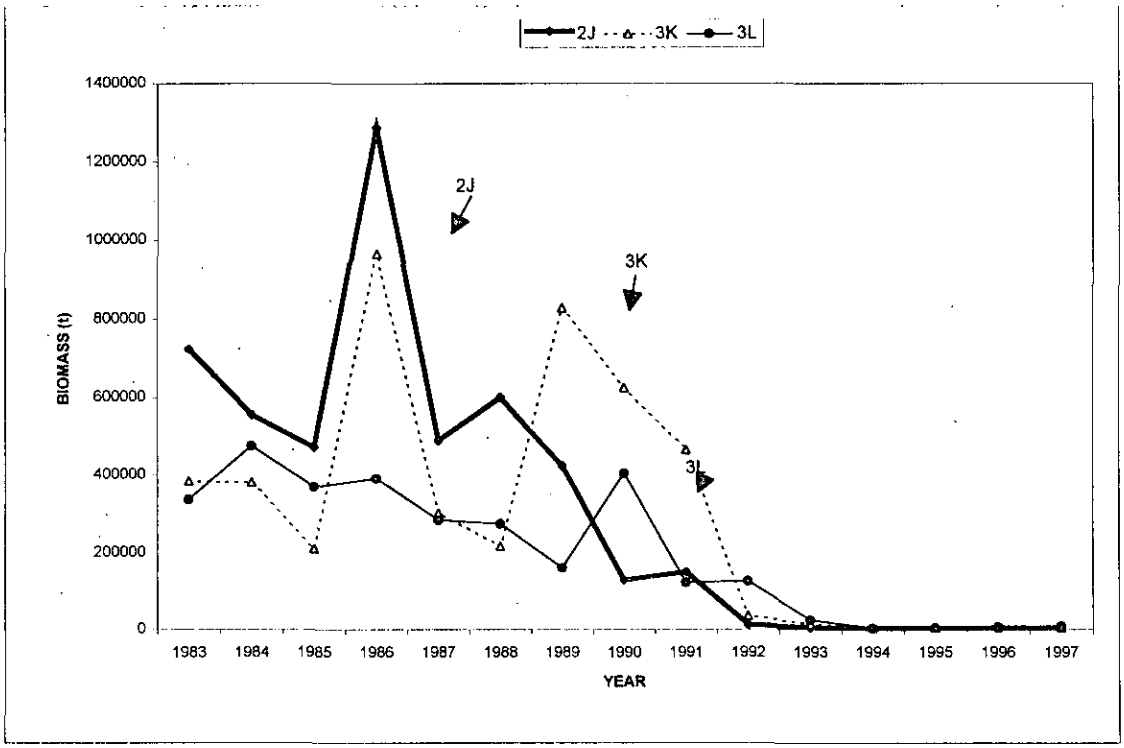

Fig 10b. Biomass by Division for index strata (<500 meters in Divisions 2J and 3K and <200 fathoms in Division 3L). Strata not fished have been filled using a multiplicative model.

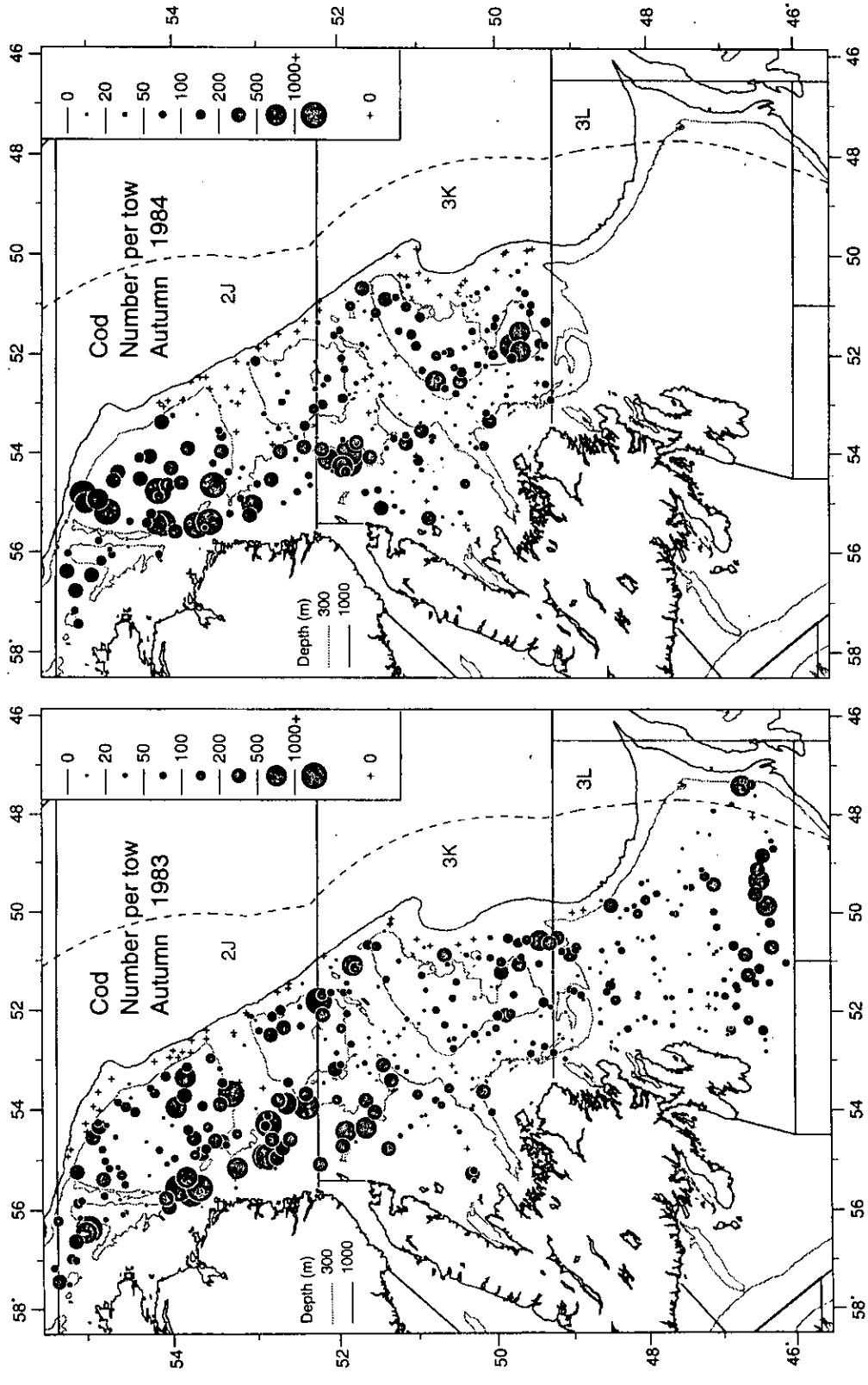

Fig. 11a. Cod distribution (numbers per standard tow) during the autumn survey in Divisions 2J, 3K and 3L in 1983-1984.

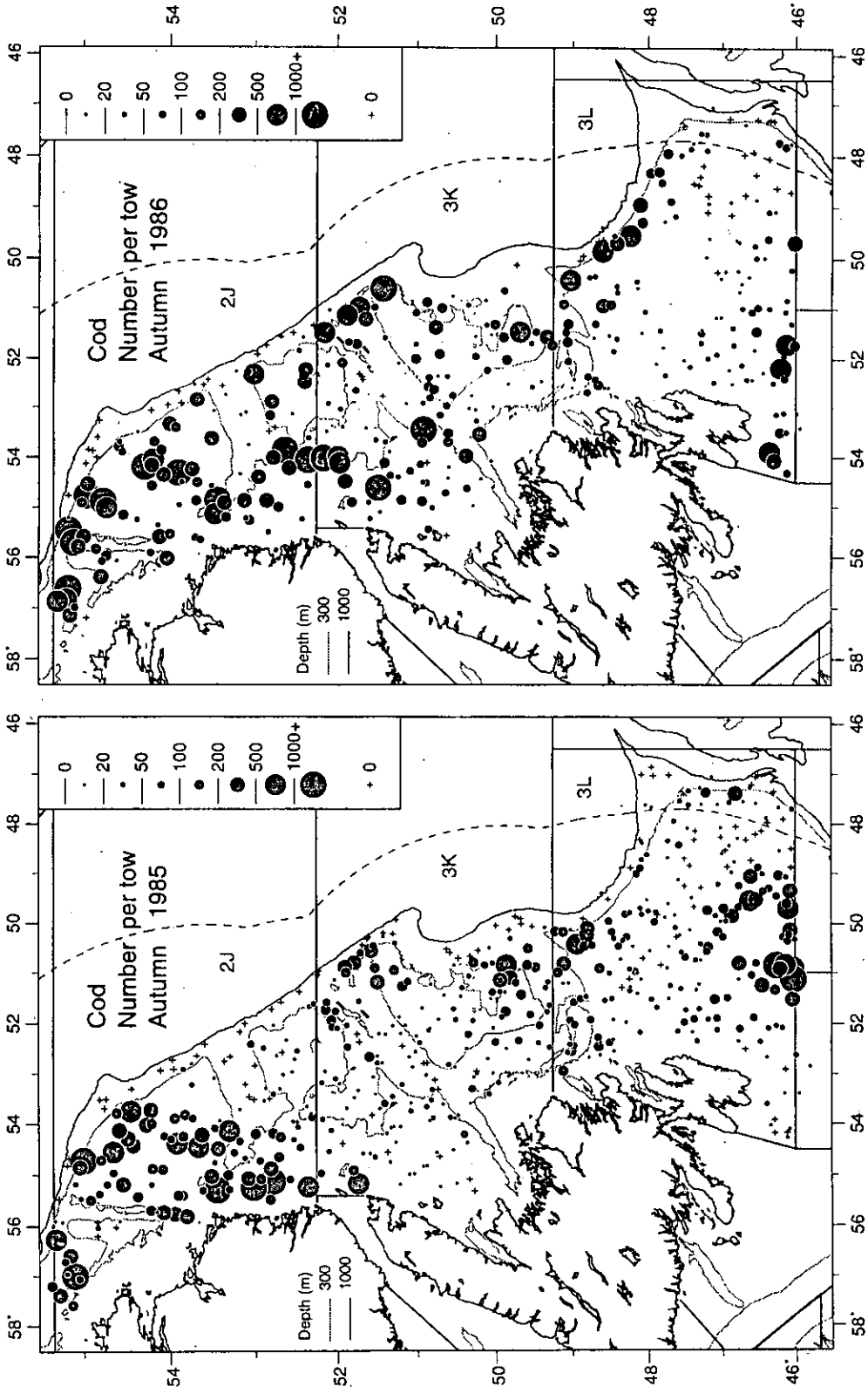

Fig. 11b. Cod distribution (numbers per standard tow) during the autumn survey in Divisions 2J, 3K and 3L in 1985-1986.

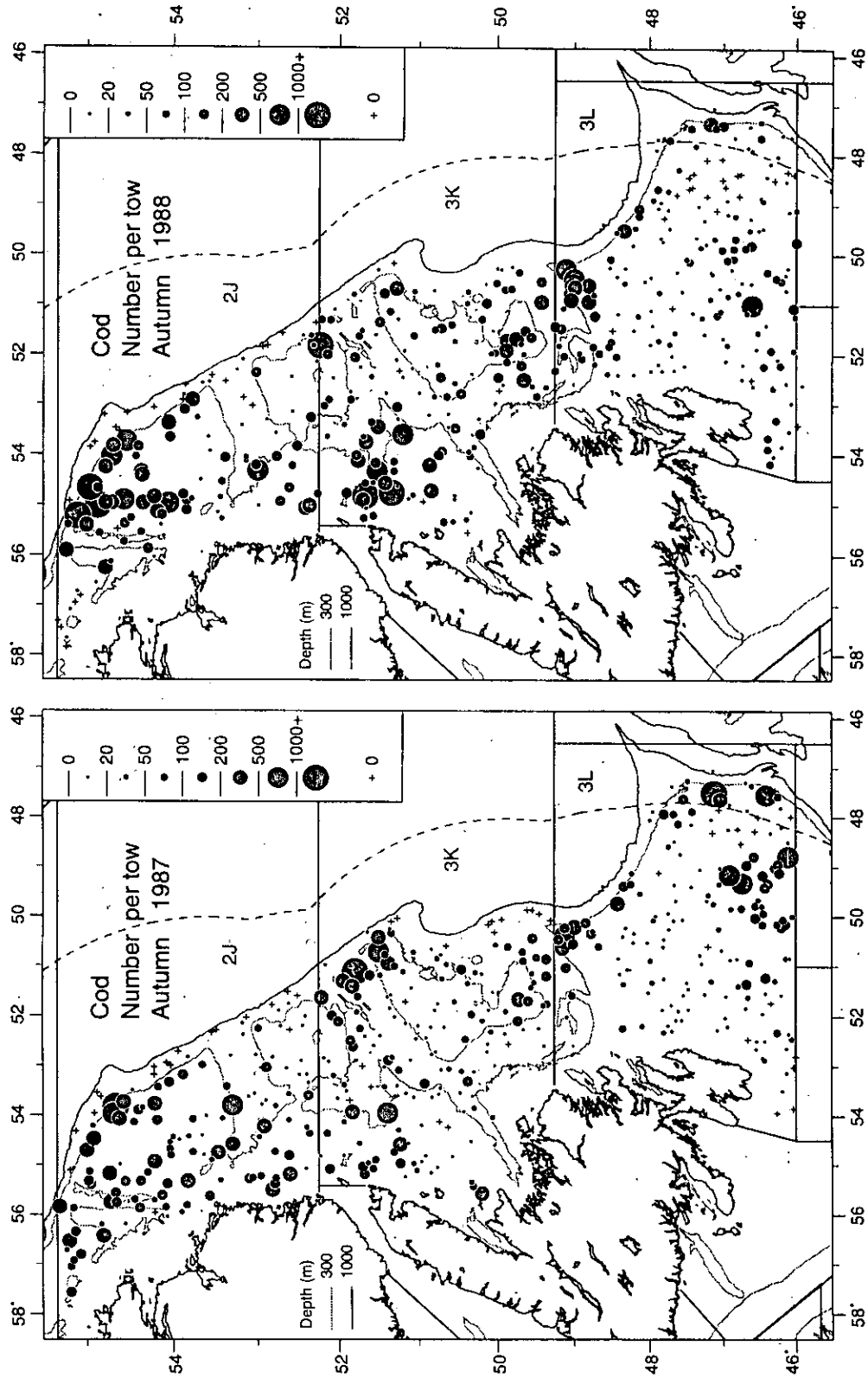

Fig. 11c. Cod distribution (numbers per standard tow) during the autumn survey in Divisions 2J, 3K and 3L in 1987-1988.

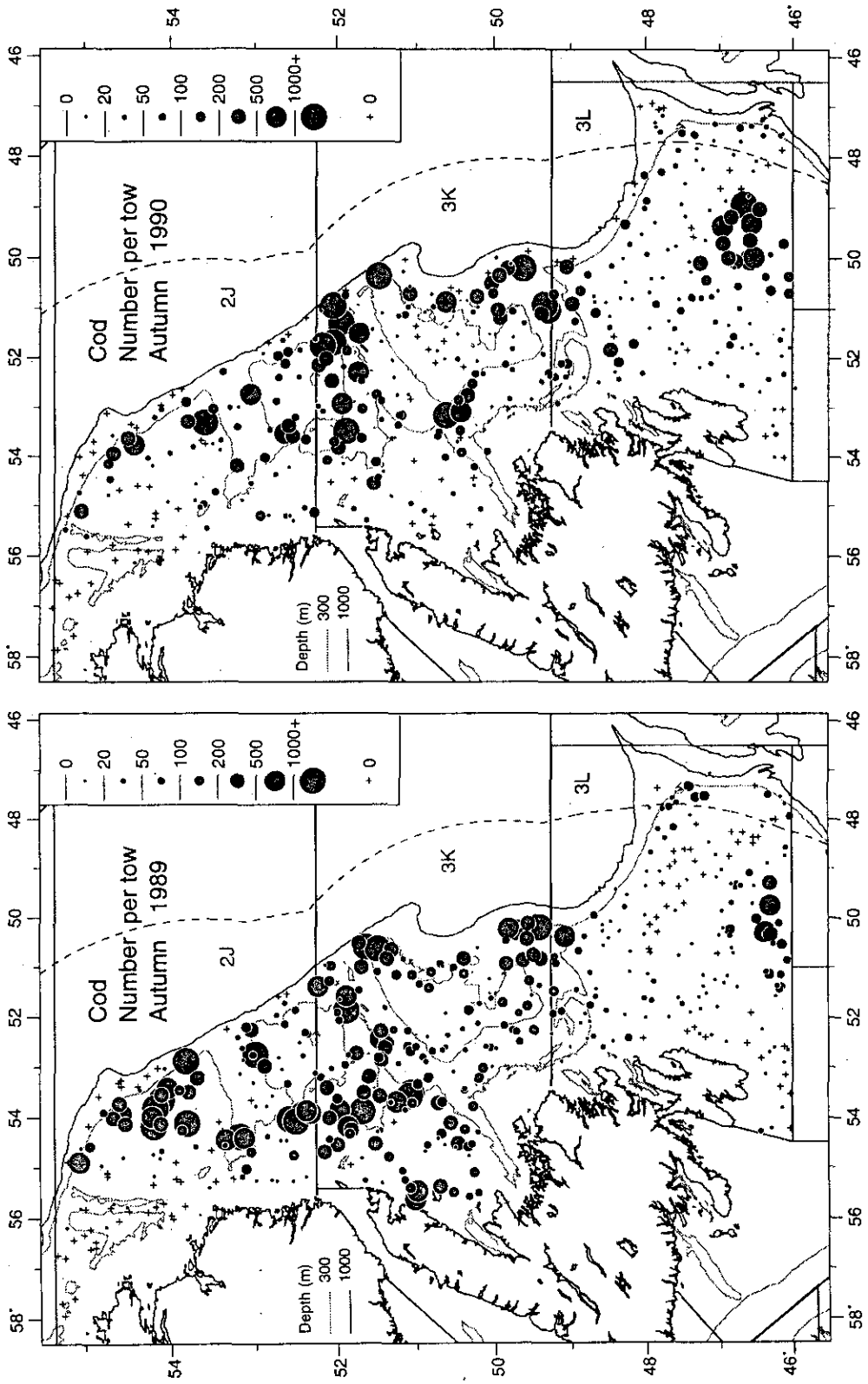

Fig. 11d. Cod distribution (numbers per standard tow) during the autumn survey in Divisions 2J, 3K and 3L in 1989-1990.

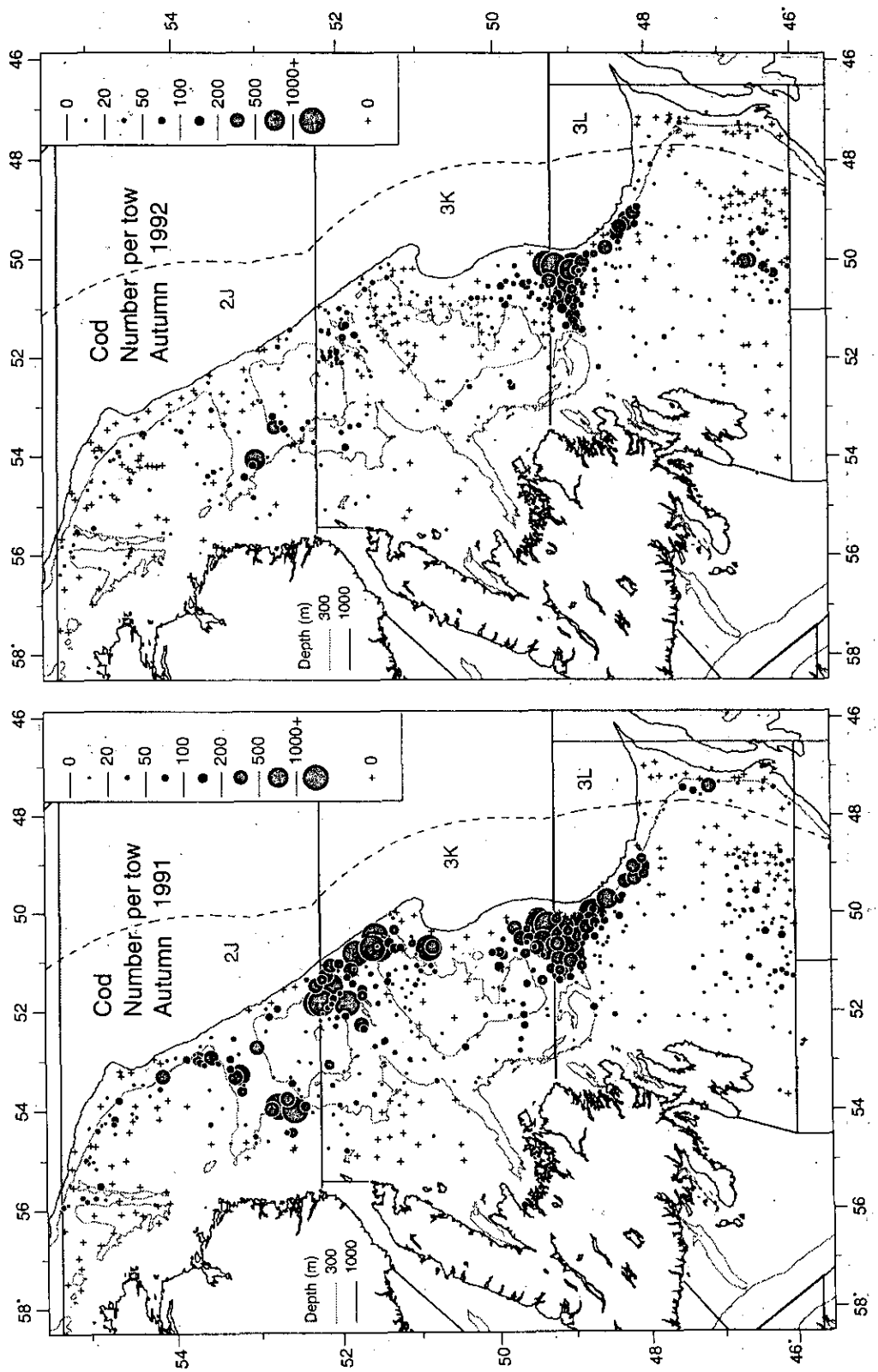

Fig. 11e. Cod distribution (numbers per standard tow) during the autumn survey in Divisions 2J, 3K and 3L in 1991-1992.

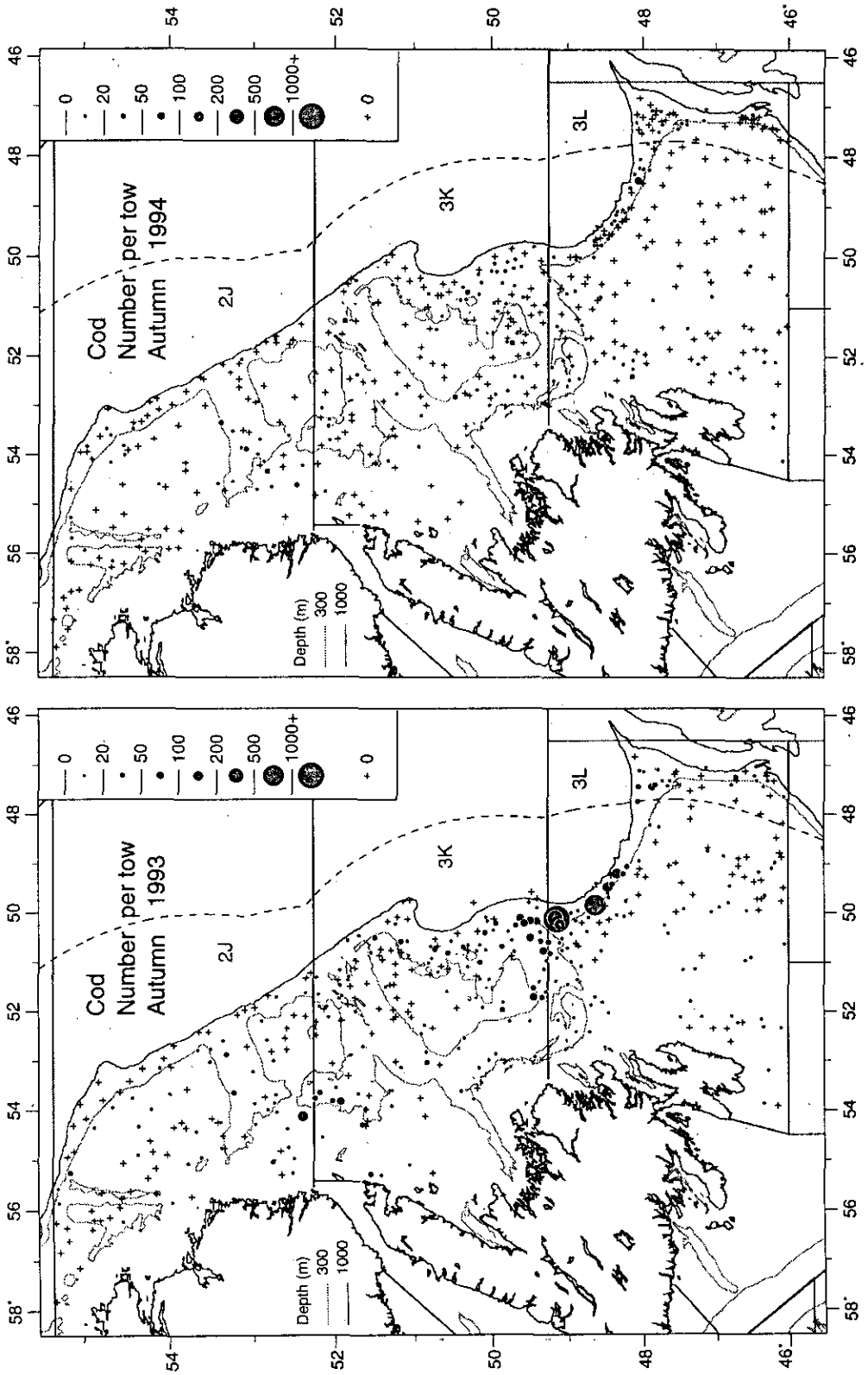

Fig. 11f. Cod distribution (numbers per standard tow) during the autumn survey in Divisions 2J, 3K and 3L in 1993-1994.

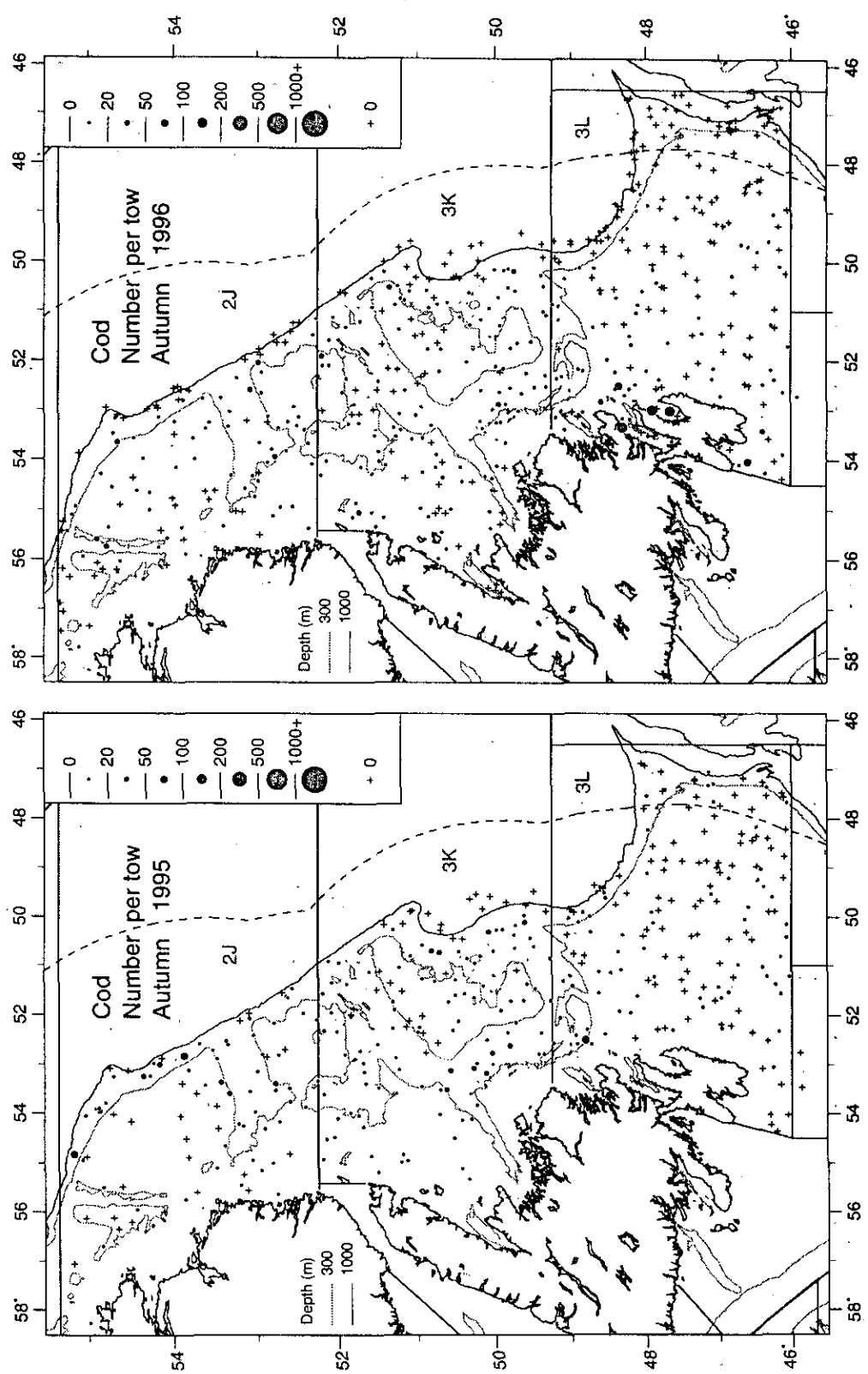

Fig. 11g. Cod distribution (numbers per standard tow) during the autumn survey in Divisions 2J, 3K and 3L in 1995-1996.

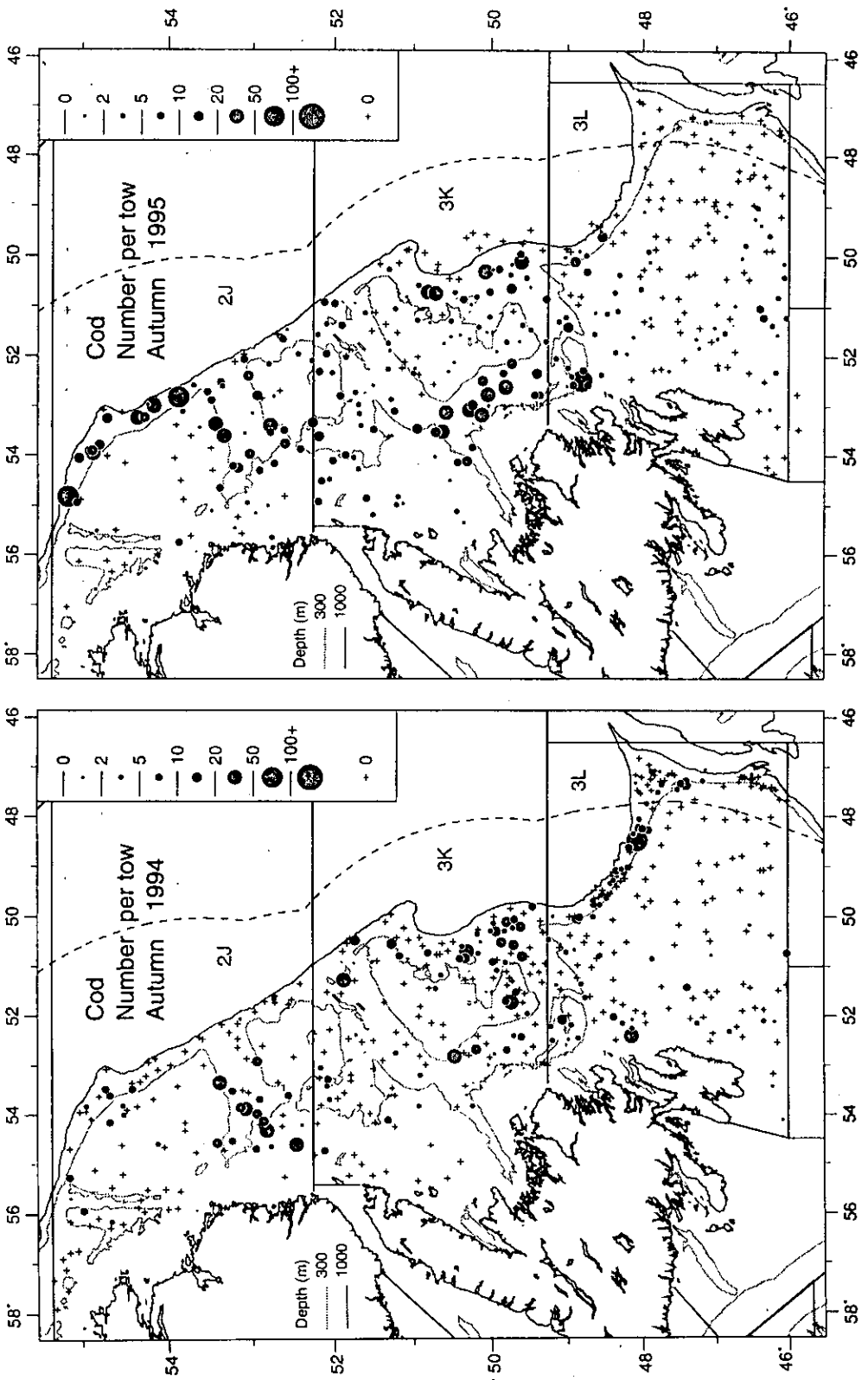

Fig. 12a. Cod distribution (numbers per standard tow) during the autumn survey in Divisions 2J, 3K and 3L in 1994-1995.

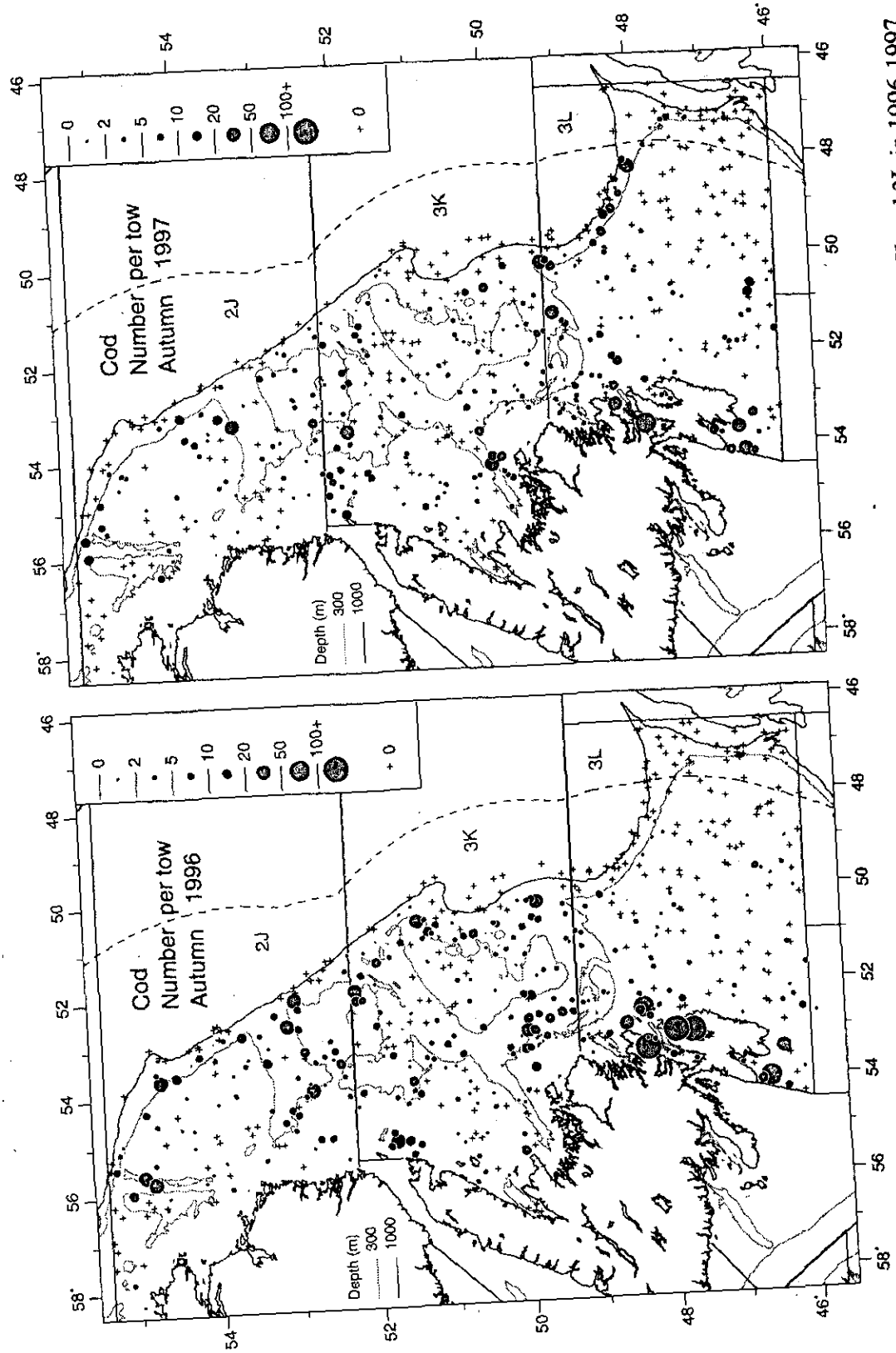

Fig. 12b. Cod distribution (numbers per standard tow) during the autumn survey in Divisions 2J, 3K and 3L in 1996-1997.

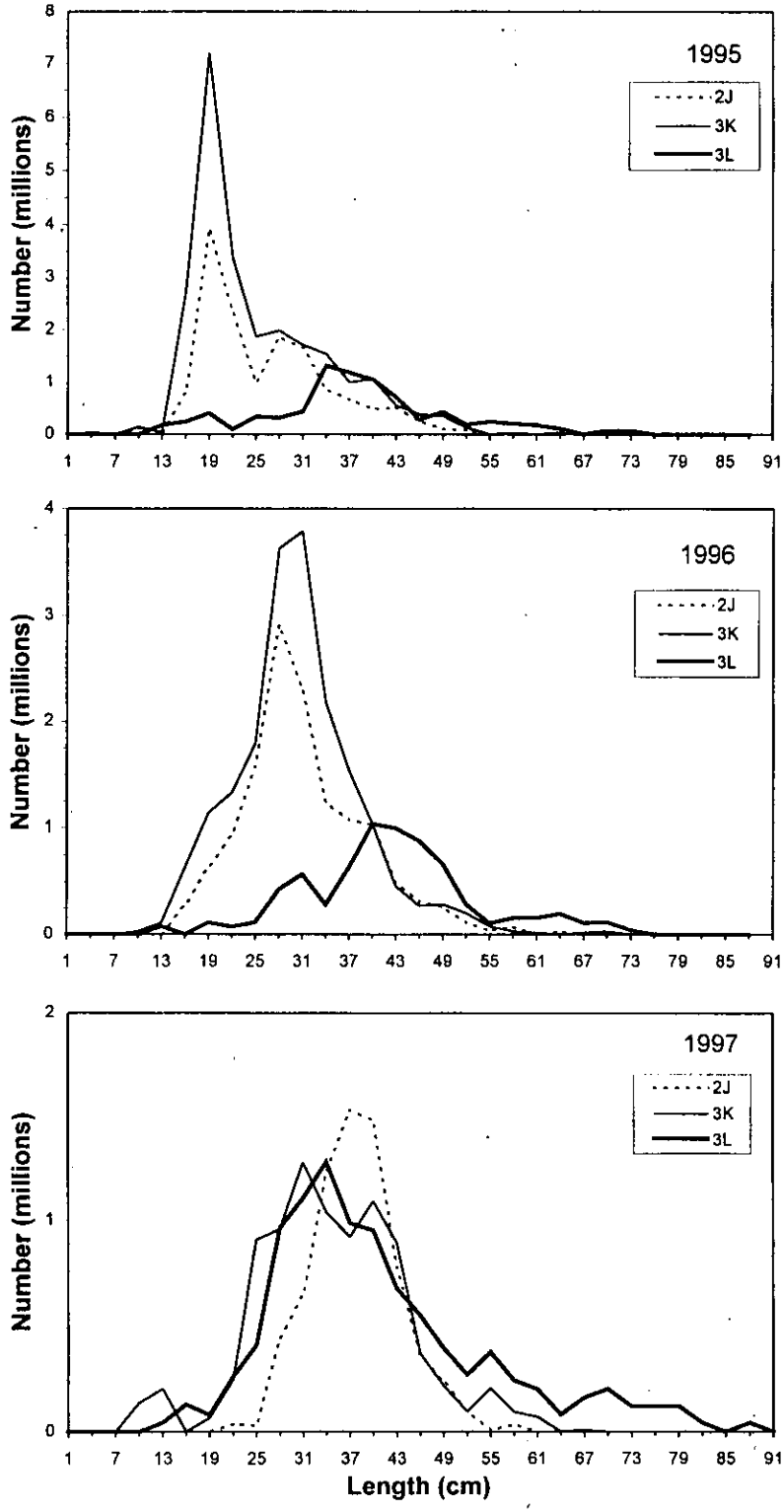

Fig. 13. Population numbers, by 3-cm length-groups, in Divisions 2J, 3K and 3L in 1995-1997, as calculated from catches during autumn bottom-trawl surveys. Only offshore strata are included in the 1996 and 1997 calculations.

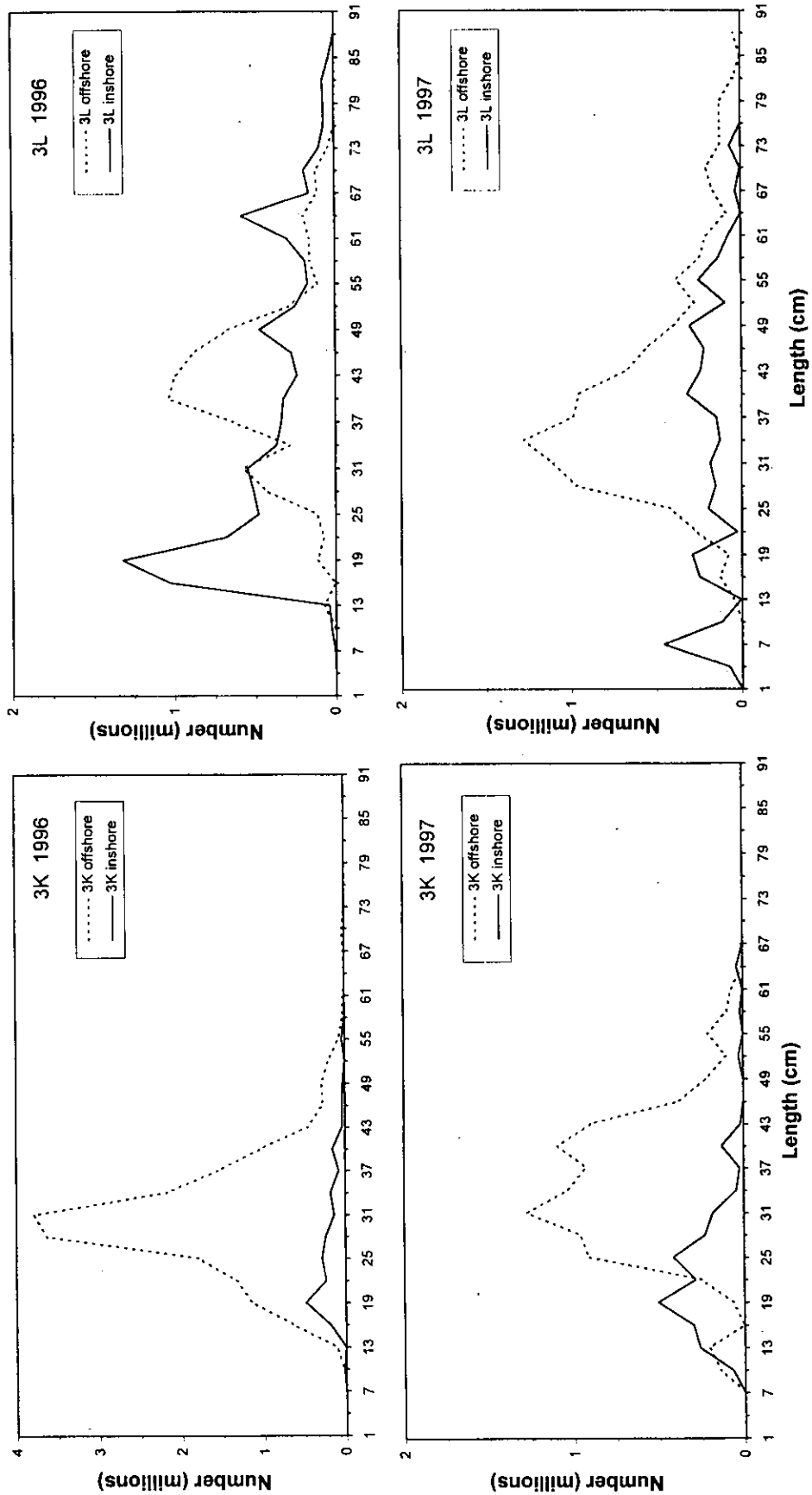

Fig. 14. Population numbers, by 3-cm length-groups, in offshore and inshore strata of Divisions 3K and 3L in 1996 and 1997, as calculated from catches during the autumn bottom-trawl survey.

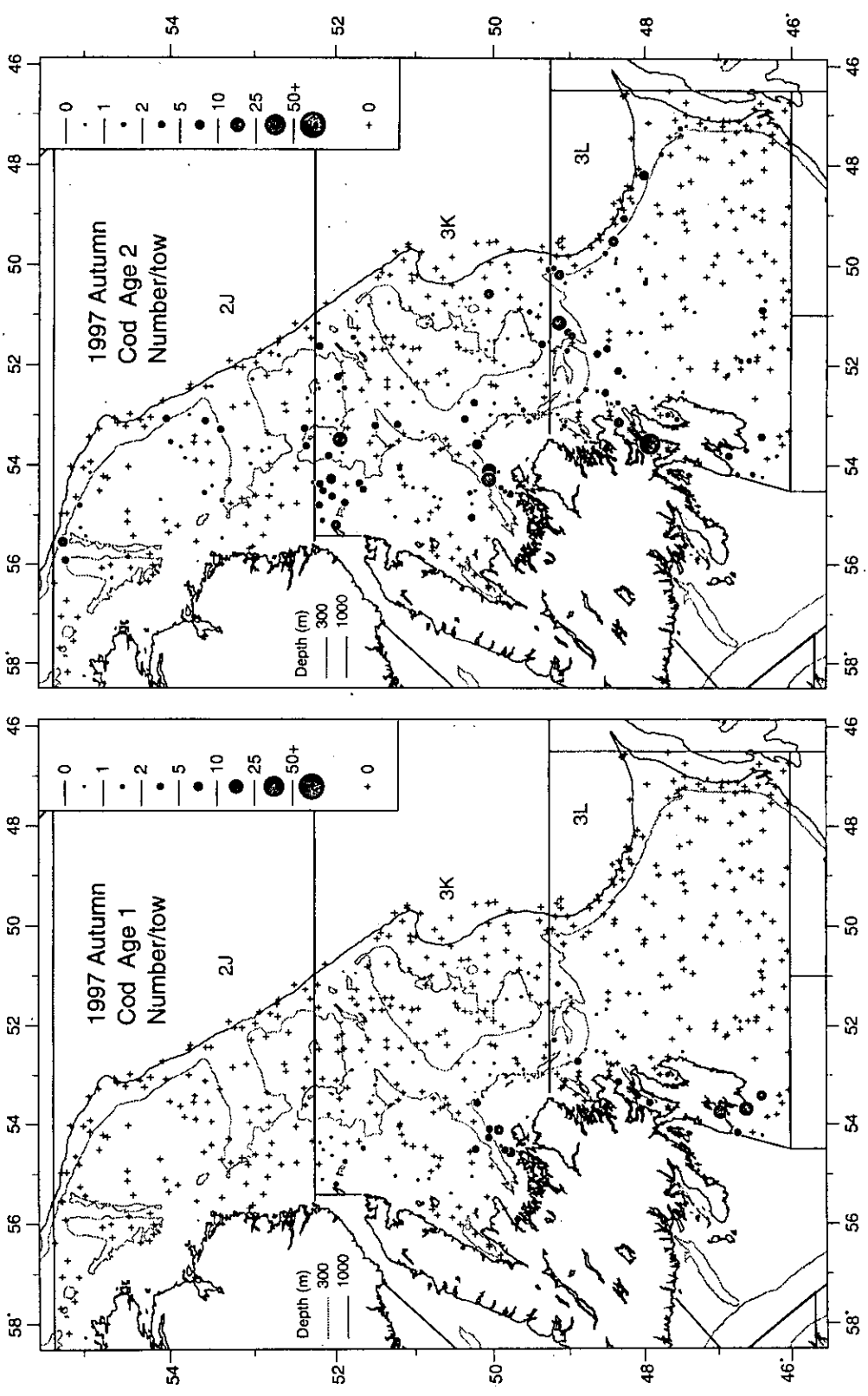

Fig. 15a. Distribution (numbers per standard tow) of cod of ages 1 and 2 during the autumn survey in Divisions 2J, 3K and 3L in 1997.

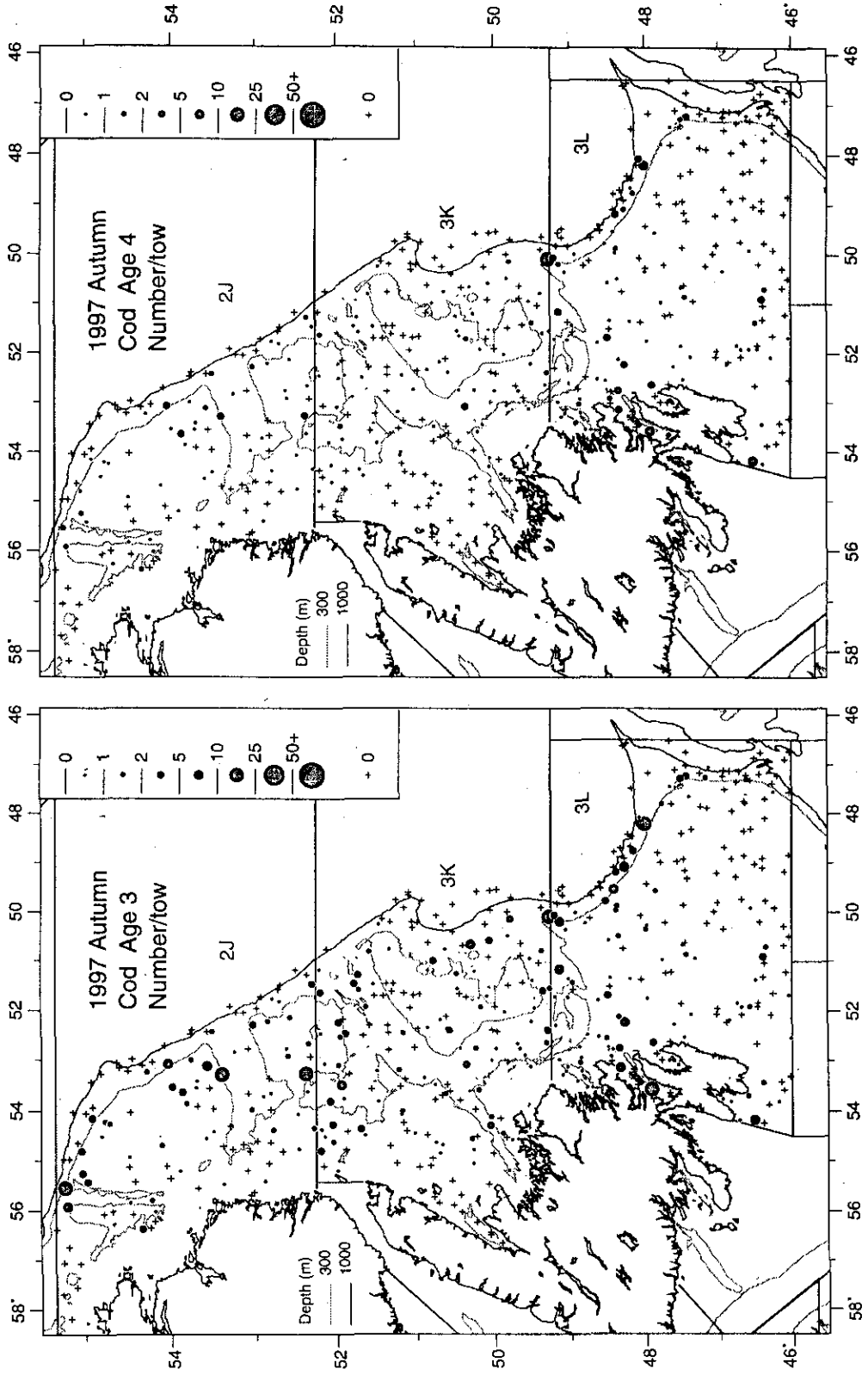

Fig. 15b. Distribution (numbers per standard tow) of cod of ages 3 and 4 during the autumn survey in Divisions 2J, 3K and 3L in 1997.

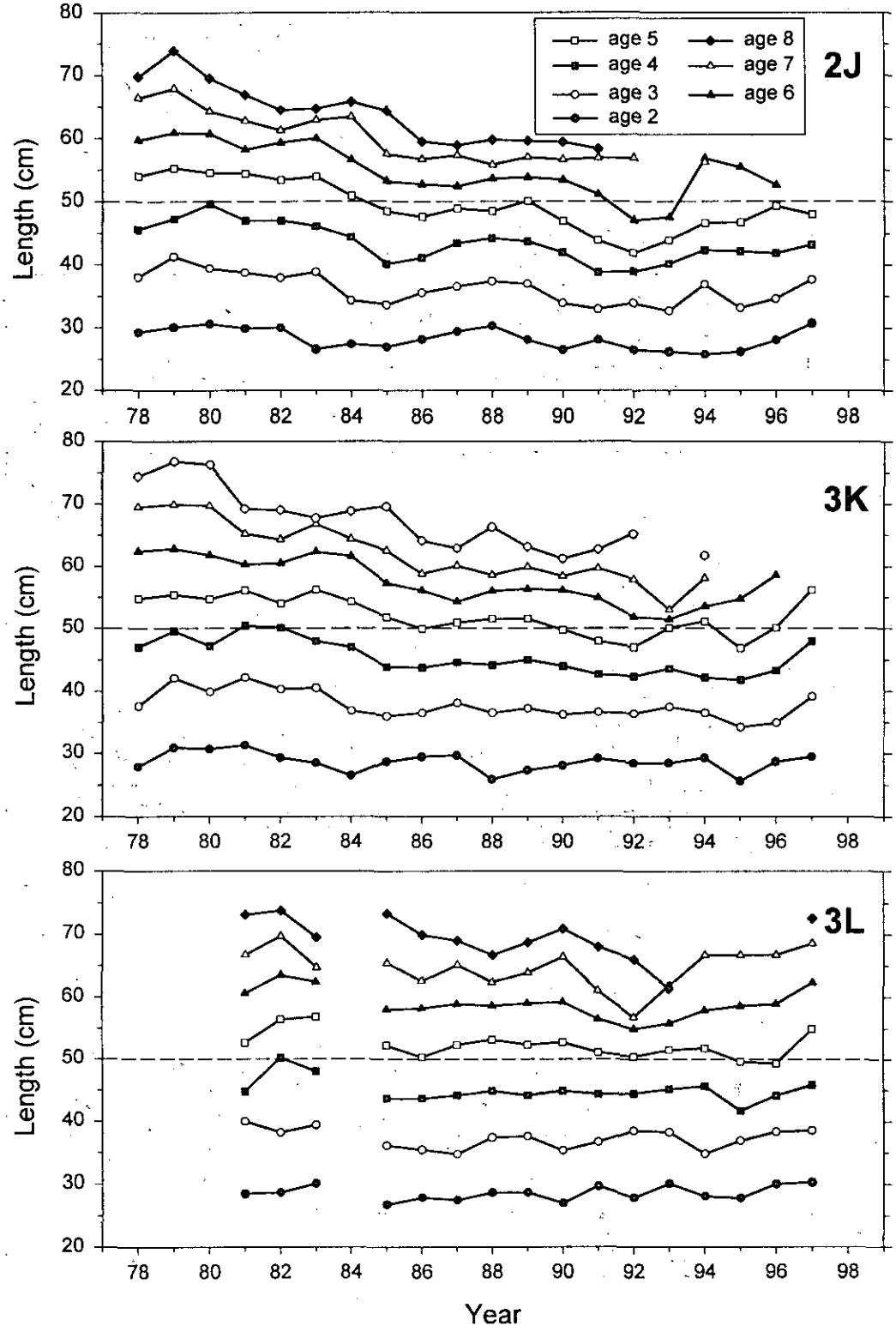

Fig. 16. Mean lengths-at-age for cod caught during the autumn bottom-trawl surveys. See Lilly (MS 1998) for details.

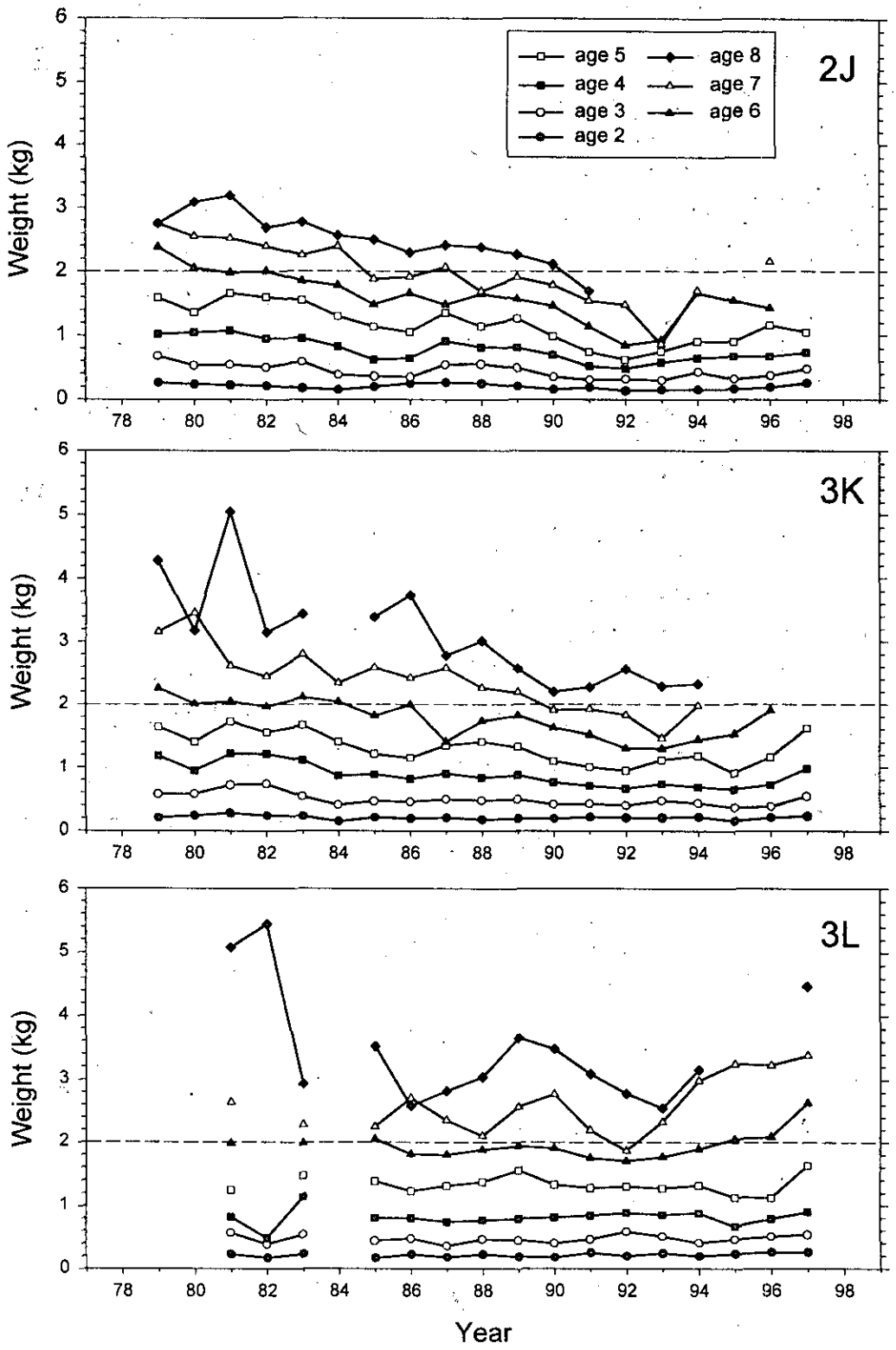

Fig. 17. Mean weights-at-age for cod caught during the autumn bottom-trawl surveys. See Lilly (MS 1998) for details.

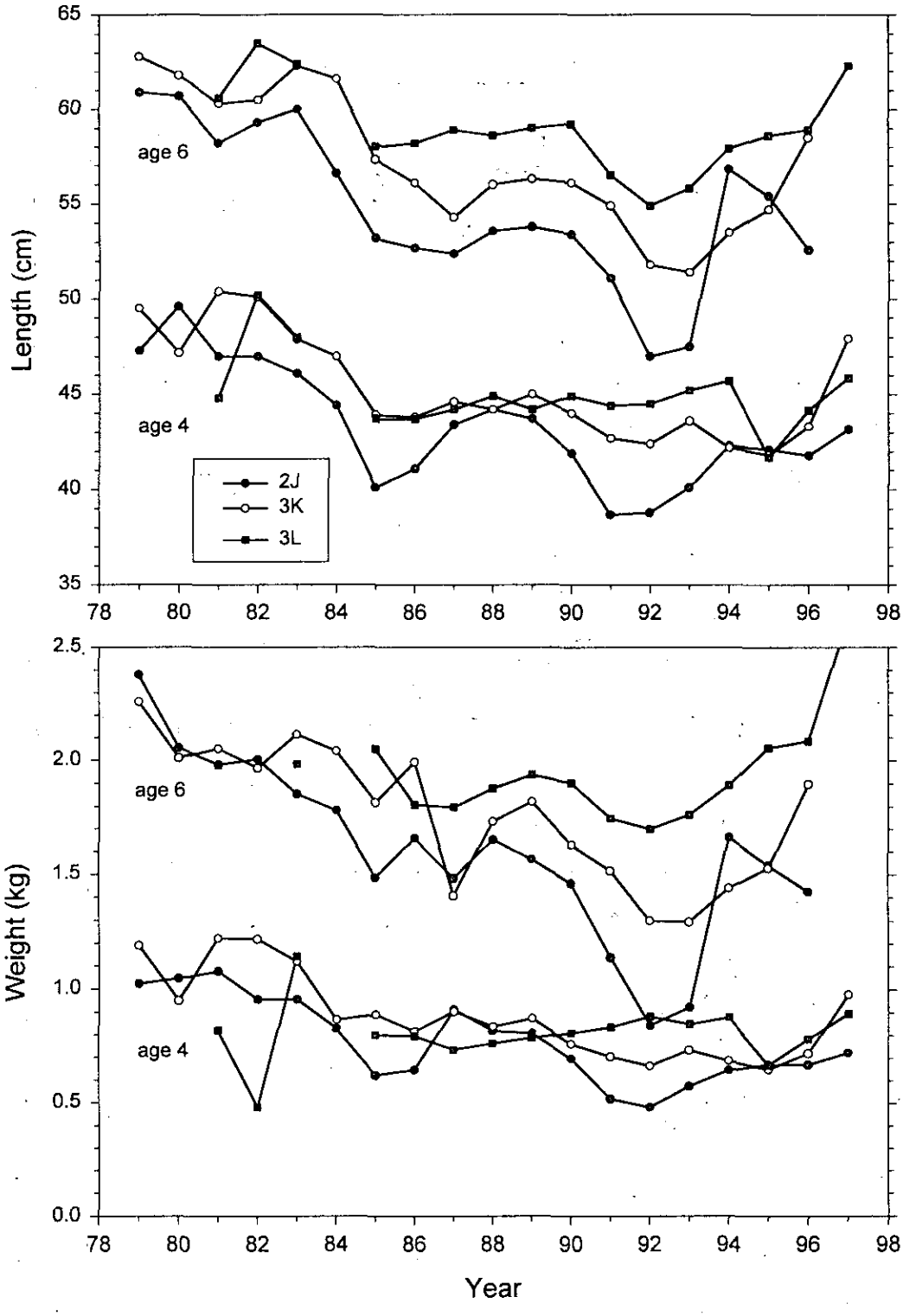

Fig. 18. Mean lengths and weights by Division for cod of ages 4 and 6 caught during the autumn bottom-trawl surveys in Divisions 2J, 3K and 3L.

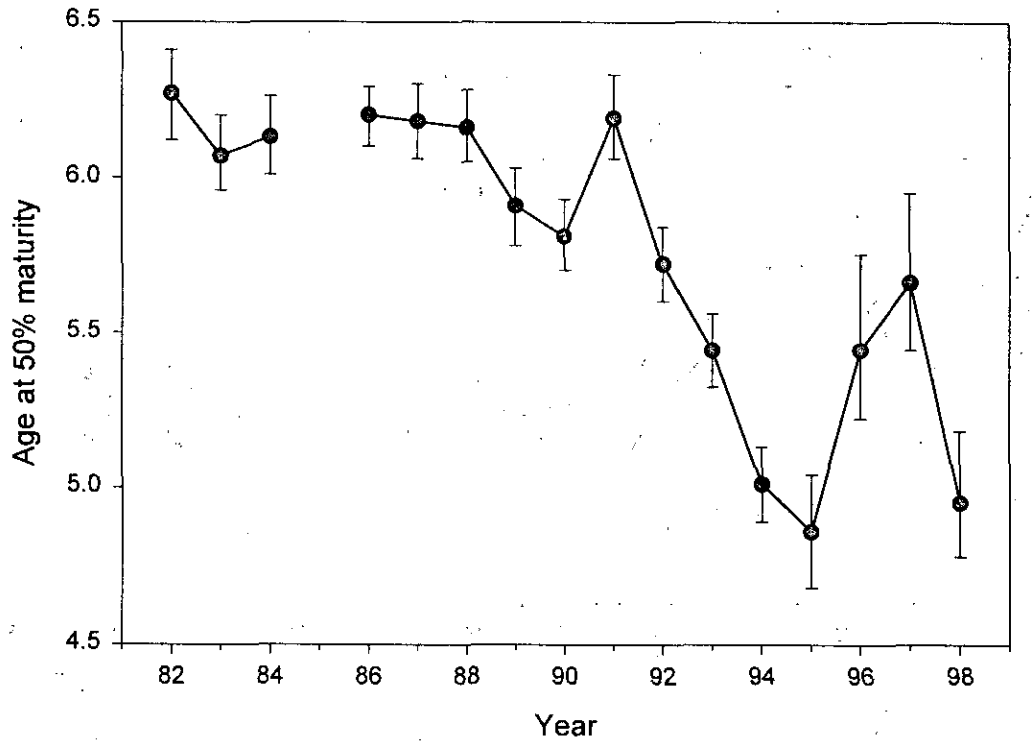

Fig. 19. Age at 50% maturity (± 95% CI) for female cod in NAFO Div 2J-3KL.

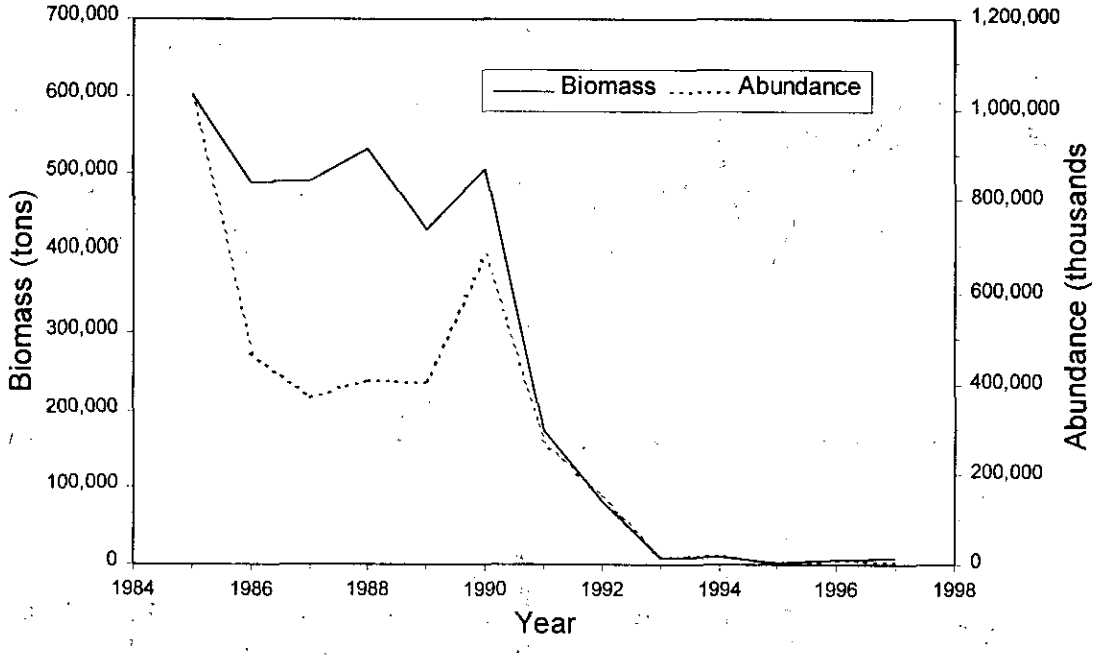

Fig. 20. Abundance and biomass for all strata fished in Division 3L in the springs of 1985-1997.

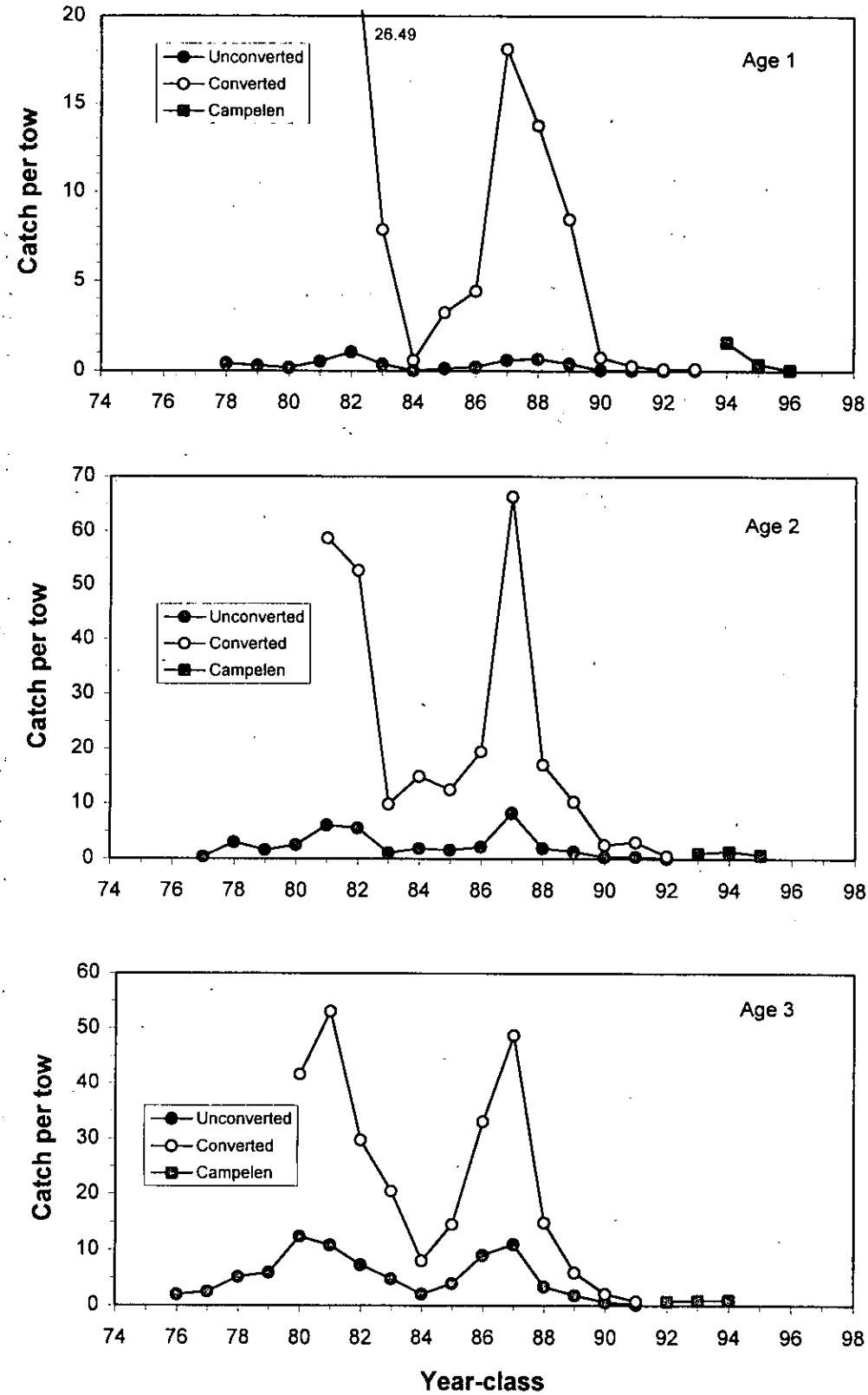

Fig. 21. Mean catch per tow of the 1976-1996 yearclasses at ages 1-3 during autumn research bottom-trawl surveys in Divisions 2J, 3K and 3L combined. Data obtained prior to the introduction of the Campelen trawl in 1996 are shown as actual (unconverted) numbers (from Shelton et al. (MS 1996)) and in numbers converted to Campelen equivalents.

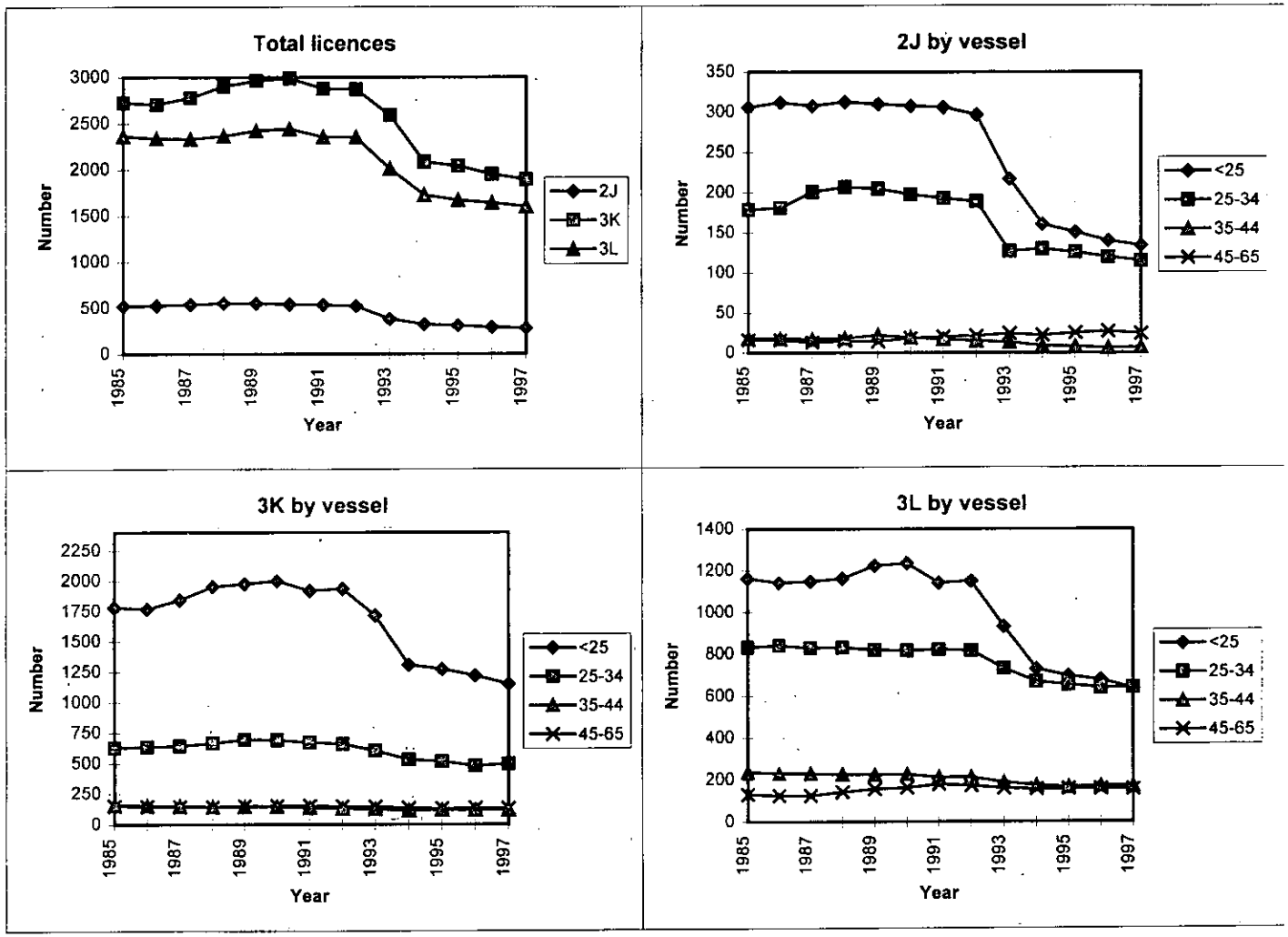

Fig. 22. Number of licenses issued to fish groundfish in each year for 1985 to 1997 in NAFO Divisions 2J, 3K, 3L and 2J3KL combined for four vessel length classes (ft).

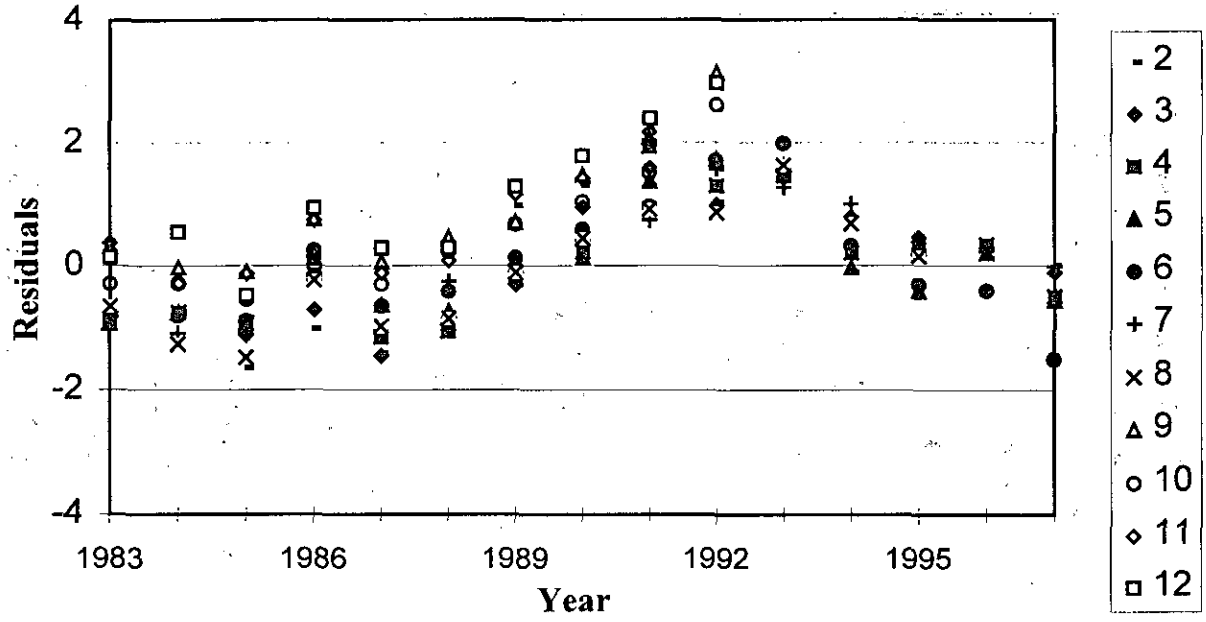

Fig. 23. Age-specific residuals from the ADAPT fit to the Canadian fall research vessel index in Campelen-equivalent units for the period 1983 to 1997 and ages 2 to 12.

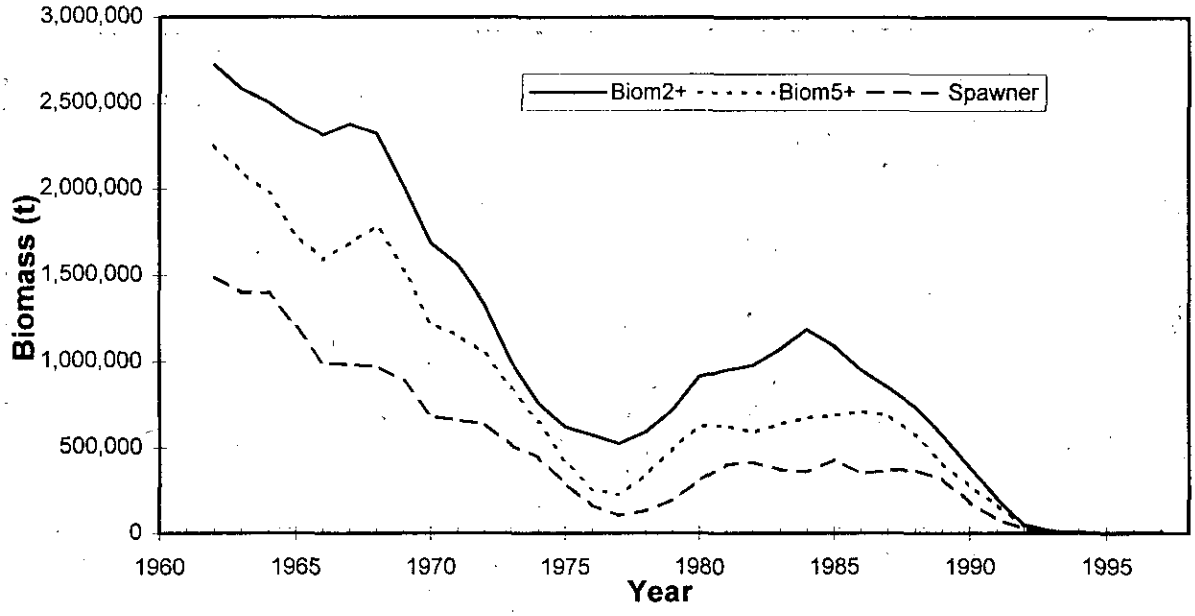

Fig. 24. ADAPT estimates of 3+, 5+ and spawner biomass from a fit to the Campelen-equivalent fall survey mean numbers per tow for ages 2 to 12 for the period 1983 to 1997. Catch data are for the period 1959 to 1997 and ages 2 to 14, and is not corrected for estimates of discards. Weights at age are January 1 values estimated from commercial catch weights. Maturities at age are the observed mean values from fall RV samples.

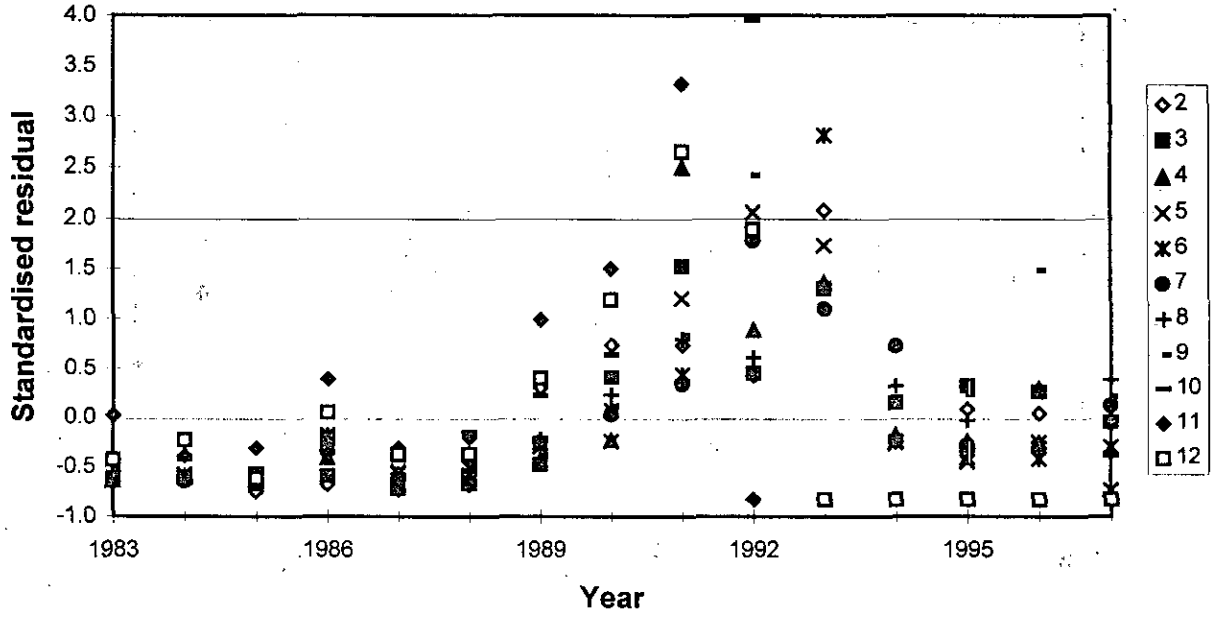

Fig. 25. Age-specific residuals from the QLSPA fit to the Canadian fall research vessel index in Campelen-equivalent units for the period 1983 to 1997 and ages 2 to 12.

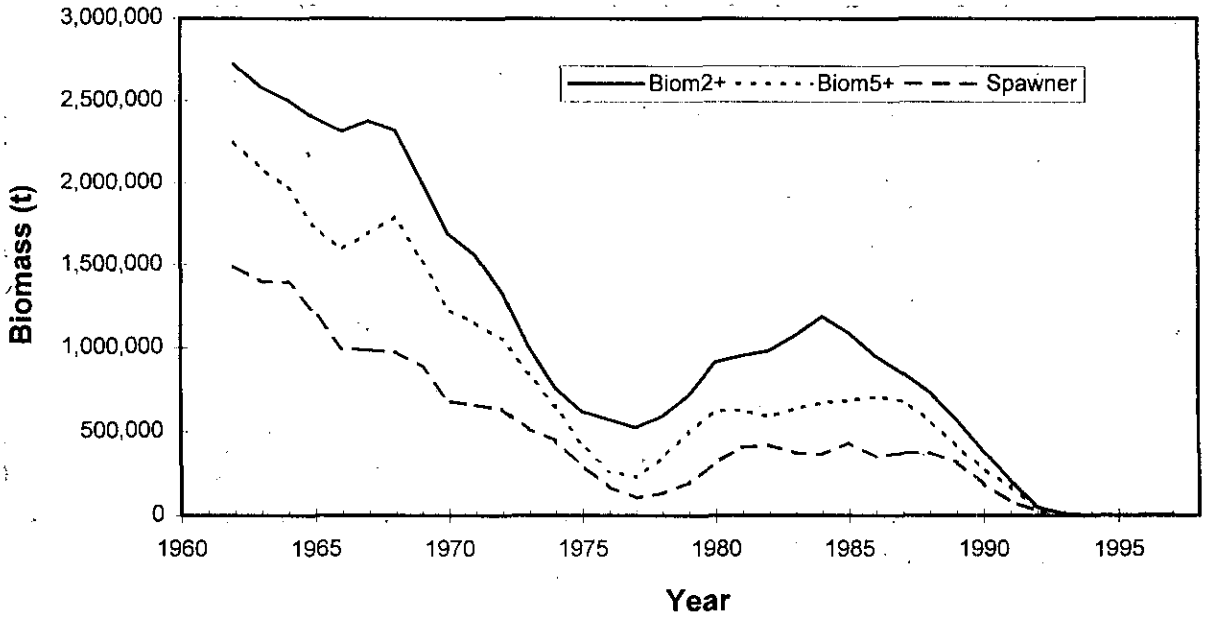

Fig. 26. QLSPA estimates of 3+, 5+ and spawner biomass from a fit to the Campelen-equivalent fall survey mean numbers per tow for ages 2 to 12 for the period 1983 to 1997. Catch data are for the period 1959 to 1997 and ages 2 to 14, and is not corrected for estimates of discards. Weights at age are January 1 values estimated from commercial catch weights. Maturities at age are the observed mean values from fall RV samples.

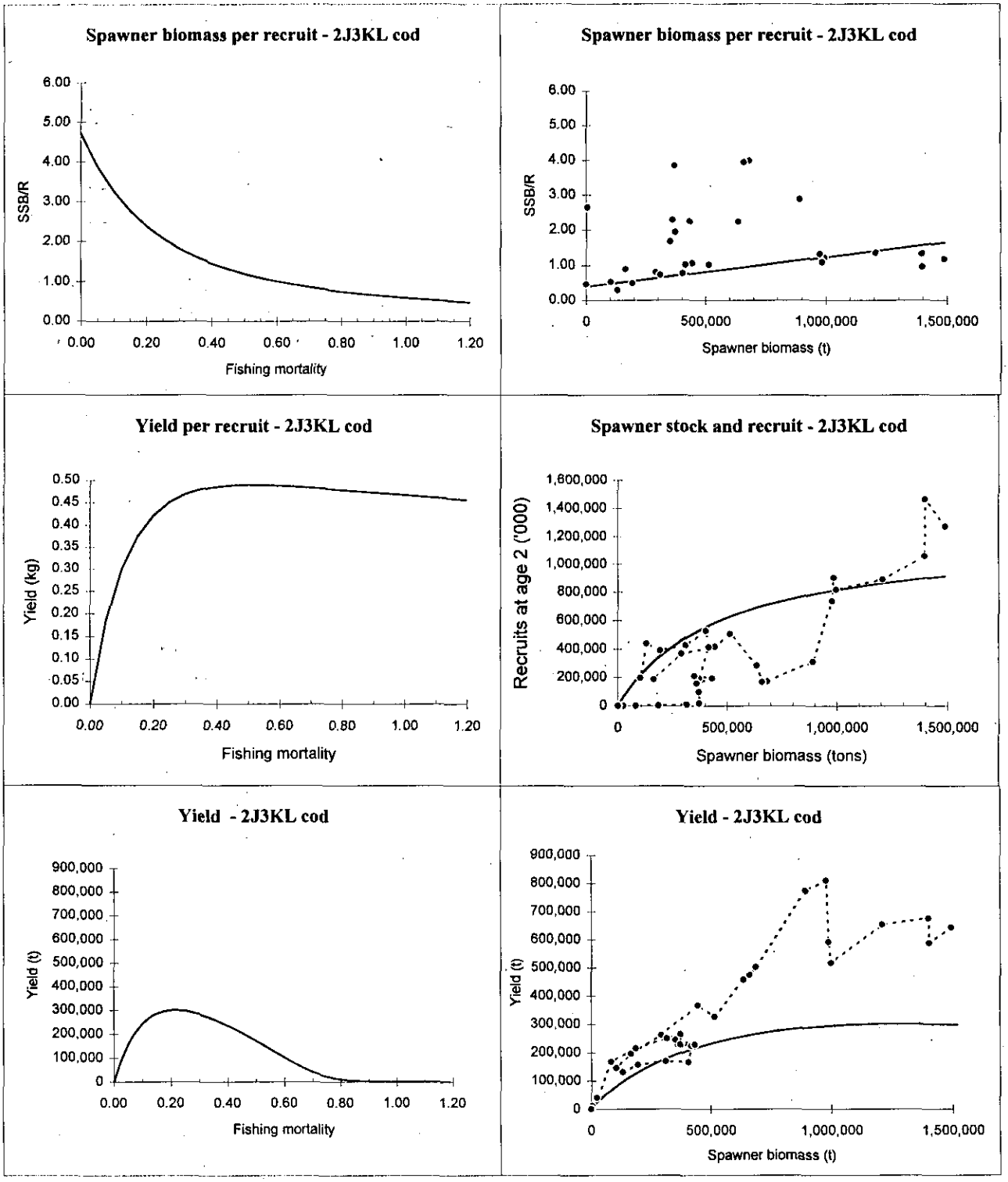

Fig. 27. Precautionary plots based on estimates of population size from the QLSPA fit to the Canadian fall research vessel index in Campelen equivalent units for the period 1983 to 1997 and catch data for the period 1959 to 1997 for ages 2 to 14.

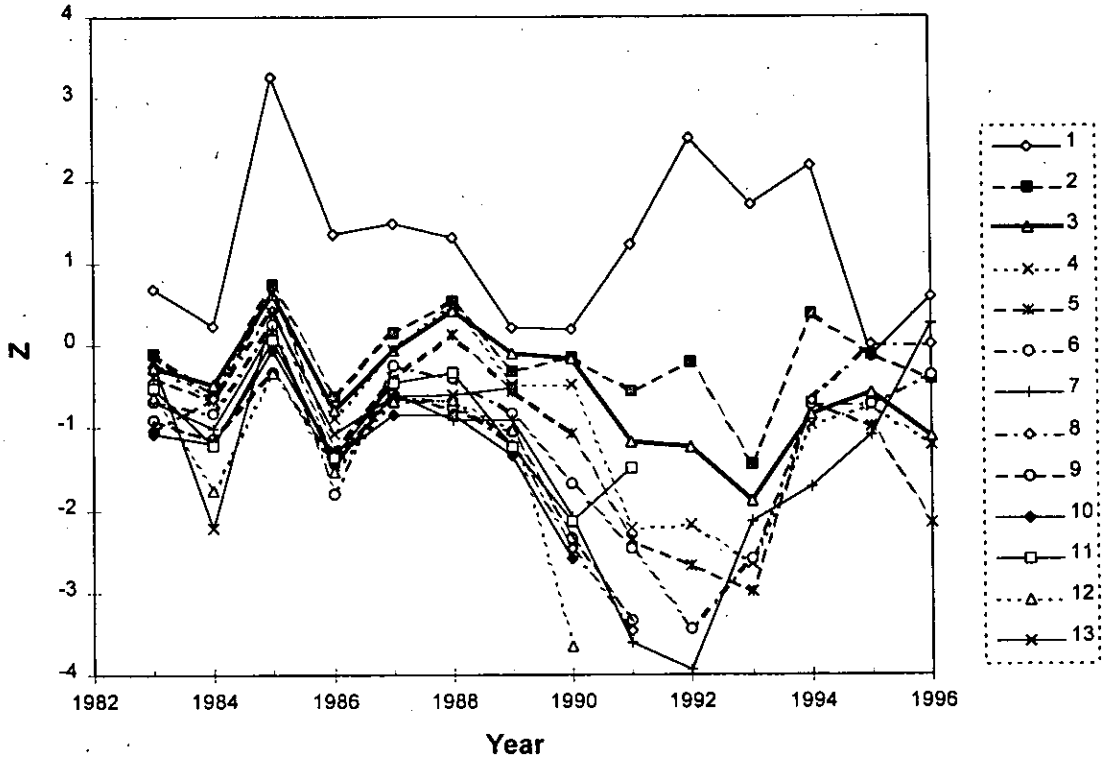

Fig. 28. Estimates of instantaneous total mortality rate (Z) from the logarithm of the ratio of fish in a cohort from one age to the next. The estimate is plotted alongside the start year for start age. The data are Campelen-equivalent autumn research vessel indices from 1982 to 1997 for ages 1 to 14.

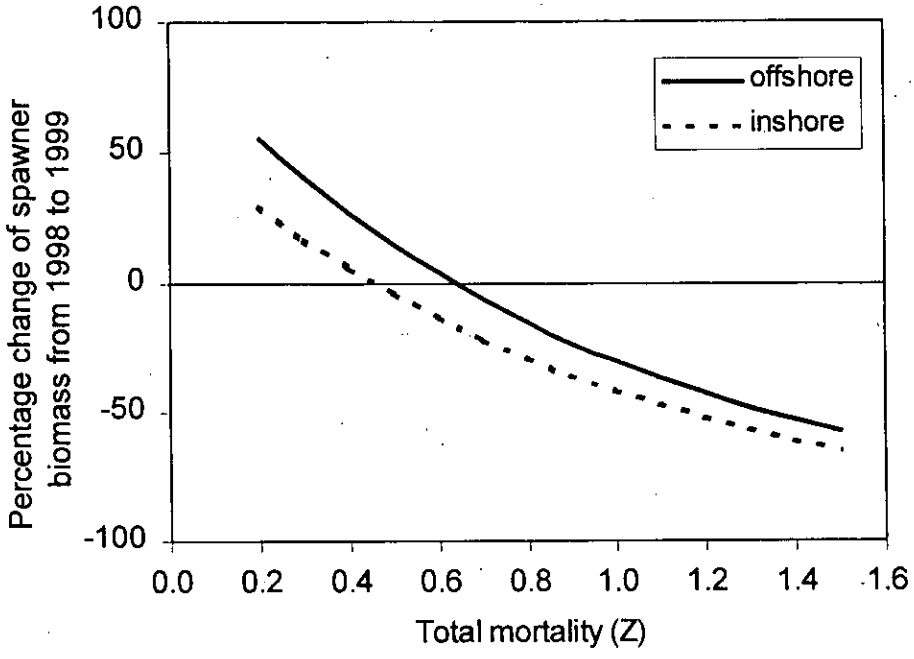

Fig. 29. Percentage change of spawner biomass from 1998 to 1999 as a function of total mortality (Z).