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An Assessment of the Cod Stock in NAFO Divisions 2J+3KL.

by

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Abstract

Landings from this stock ranged between 200,000 tons and 300,000 tons prior to the early-1960s but peaked at just over 800,000 tons in 1968. In recent years severe reductions in stock size has lead to reduced TACs and subsequently to a moratorium on commercial fishing since 1992. Research survey data suggest that the stock has declined sharply in recent years to very low levels and that there have been distributional changes toward deeper water and toward the nose of the Grand Bank. Stock size and fishing mortality could not be determined through analysis of commercial catch and survey data. Total mortality appears to have been high in recent years but declined from 1992 to 1993. However, mortality was still higher than could be explained by the estimated non-commercial catch. The source of this discrepancy could not be determined. There is little doubt that the stock decline observed in recent years continued in 1993 and that the stock is at a dangerously low level. Survey data indicate that the low recruitment levels estimated for recent years will persist. Stock recovery will depend on production and survival of significant numbers of new recruits.

Nominal catch

Nominal catches for this stock increased during the late-1950s and early-1960s and peaked at just over 800,000 tons in 1968 (Table 1, Fig. 1). Catches rapidly declined thereafter and were at a low of 139,000 tons in 1978. From 1980 to 1992 catches ranged from 219,000 to 270,000 tons, but declined to 150,000 tons in 1991 and further to 44,000 tons in 1992. In the same period Canadian catches peaked at 242,000 tons in 1988 but subsequently declined to 29,000 tons in 1992. The commercial fishery on this stock was closed in mid-1992. At the end of 1993 the recreational fishery was closed. During 1993 the latter fishery was estimated to have caught about 9,000 tons of cod. Most of this catch was taken by handline in Division 3L, and mainly during the Sept.-Oct. period (Table 2). Canadian Surveillance has also estimated that about 2,500 tons of cod were obtained by foreign fleets on or outside the nose of the Bank in Div. 3L.

During the 1960s, when the fishery was dominated by non-Canadian fleets (Fig. 2), most of the catch occurred in Div. 2J and 3L with Div. 2J generally predominating. Since that time catches have been mainly from Div. 3K and 3L (Fig. 3). Fixed gear catches have been predominantly by trap and gillnet (Fig. 4).

The total cod catch for 2J3KL in 1993 was approximately 11,400 tons (Table 3). This estimate included; the reported Canadian catch of 3,947 tons, a foreign catch (outside the 200-mile limit on the Nose of the Grand Bank) estimated by Canadian Surveillance at 2,425 tons and an additional estimate of approximately 5,000 tons from the inshore "recreational fishery". The latter estimate was based on a combination of information supplied by Dept. of Fisheries and Oceans and Union (FFAW) officials.

Catch- and weight-at-age

The total catch and consequently total removals at age were only roughly estimated. A summary of the sampling used to derive the catch- and weight-at-age of the Canadian recreational fishery in 1993 is given in Table 4. The following relationship was applied in deriving average weight-at-age: $\log \text{weight} = 3.0879 \log \text{length} - 5.2106$. A limited amount of data (length frequency only) was available for the foreign by-catch fishery in the Regulatory area. Catch-at-age for the latter (Table 6) was obtained using the Canadian spring 3L RV age-length key. Canadian catches were mainly of ages 4 and 5 (Table 5).

The catch numbers, average weights and biomass at age for the years 1962-1993 are presented in Tables 7 to 9. Average weights increased from the early-1970s to the early-1980s and subsequently declined. The catch biomass at age for 1993 using available sampling data was approximately 96% of that reported.

Research vessel survey data

Stratified random trawl surveys

Research vessel surveys have been conducted by Canada during autumn in Div. 2J, 3K, and 3L since 1977, 1978, and 1981, respectively. The 1984 autumn survey in Div. 3L was conducted earlier in the year than the other surveys (August-September as opposed to October-November). Spring surveys have been conducted by Canada in Div. 3L for the years 1971-82 and 1985-93. Surveys in Div. 2J3K have been conducted by the RV *Gadus Atlantica* while those in Div. 3L have been conducted by the RV *A. T. Cameron* (1971-82) and RV *Wilfred Templeman* (1983-93). To account for incomplete coverage of strata in certain years, estimates of biomass and abundance for non-sampled strata were obtained using a multiplicative model. Because of apparent distributional changes in recent years, this analysis did not include 1992 or 1993 survey data. Estimated values presented are those provided previously.

The stratification developed for this stock area and others have been based on depth contours as shown on nautical charts. Since their first use in 1977 in Div. 2J there have been problems with the accuracy of these charts, particularly in Div. 2J and 3K. The availability of accurate charts from the Canadian Hydrographic Service enabled a revision of these stratification charts. A more detailed description of the revision is described by Bishop (1994). The revised stratification schemes for Div. 2J and 3K were first used during the 1993 autumn surveys. The original and revised stratification used for the surveys in Div. 2J and 3K are described in Fig. 5-8 and Tables 10 and 11. Stratification for Div. 3L was unchanged and is shown in Fig. 9. This revision will make between year comparisons of strata difficult although the total area covered by the old and revised schemes were only slightly different.

Autumn survey estimates of biomass and abundance have declined sharply in recent years with the 1993 values being extremely low, the lowest in the time series (Tables 12-18; Fig. 10-12). Biomass and abundance from the Div. 3L spring surveys declined substantially since 1990 and in 1993 were the lowest in the time series since 1977 (Tables 19-20, Fig. 13).

Abundance in Div. 2J and 3K generally increased at depths greater than 400 m. since 1987 (Fig. 14) although total abundance was constant or declining.

Percent biomass by Division (Table 21) was fairly stable for a period in the early-1980s and averaged about one third in each of the three Divisions. The percentages became quite variable after 1987. Since 1991 most of the biomass has occurred in Div. 3L.

Tables 22-26 give the mean numbers per tow at age for the surveys conducted in all Divisions. The survey catches at age were mainly from ages 3 and 4 although, as already indicated, absolute abundance was very low. No cod were caught older than age 9.

There were no autumn surveys in Div. 3L for the years 1978-80. As in the past, an index for these years was estimated using spring survey data from Div. 3L. This 2J3KL index (Table 26) indicated that the total abundance had declined substantially.

Average weights at age from the surveys (Tables 27-30), although represented by small samples, were not substantially different from those observed in the 1992 survey. Recent average weights for all Divisions were substantially lower than those observed in the early to mid-1980s.

Distribution plots (Fig. 15-17) of the numbers of cod caught per tow during the autumn surveys from 1981 to 1993 indicate a fairly typical pattern from 1981 to 1988. Catches were spread over the entire survey area and most large catches were in shallower water. Commencing in 1989 changes started to occur in that fewer cod were found near the coast, mainly in Div. 2J. During 1990 and 1991 most cod were found on the seaward slopes of the offshore Banks and in 1992 there were virtually none in 2J3K and low abundance in Div. 3L, particularly in 1993. The only cod located during 1992 and 1993 were in the northern part of Div. 3L bordering with Div. 3K.

Autumn research vessel survey total catch at age (ages 1 to 23) data without weighting by survey stratum area data were used to examine the age distribution of 2J and 2J3KL cod. The age structure of the 2J cod survey population has collapsed from a relatively wide age distribution (20+) in 1982 to a relatively narrow (7+) age distribution in 1992 (Fig.18). This represents a loss of the majority of the spawning-aged fish in 2J. The average, modal and median ages of the 2J3KL cod stock have cycled between ~ages-5 and ~ages-6 over the last decade or so but has recently (1988 to 1993) decreased to ~age-4 (Fig.19) with a corresponding decrease in the width of the age distribution (maximum age-8 in 1992). Variations in the age distribution over the 1981 to 1993 period are revealed through patterns in the skewness and kurtosis of the distribution, which in most recent years (1992 and 1993) are more "normal" with a low mean - a distribution that reflects the dominance of few and younger year-classes and the absence of older age classes.

Winter Hydroacoustic surveys

Winter hydroacoustic surveys conducted since 1987 found large concentrations in southern 2J and northern 3K at depths ranging from 300 to 500 m from 1987 to 1989. In the 1990 survey, commercial concentrations of cod were found still further south in Div. 3K and mainly 550 m, about 150 m deeper than in previous years. Survey data from 1991-93 indicated substantial declines in cod densities, particularly in 1993. Significant concentrations were encountered outside the survey area at depths approximating 930 m on the nose of the Bank. There was no comparable survey in 1994.

Spring hydroacoustic studies.

An acoustic survey using 2 vessels (*Gadus Atlantica* 231 and *Petrel V* 93-2) was conducted from the Nose of the Grand Bank (47°06'N, 47°18'W) to the outer reaches of the Funk Island Bank (50°45'N, 50°30'W), from June 8-30, 1993 (NAFO Divisions 3L and 3K) (Fig. 20a). The survey grid consisted of parallel transects spaced 10 nmiles apart and covered waters within the depth range 200-900 m. (a total of approximately 3480 km of transects). There were three

deviations from this general design: 1) In areas characterized by temperatures and salinities previously identified as holding the bulk of the cod in this region at this time of year (from 1990-1992 data), transect spacing was reduced to 5 nautical miles; 2) storm conditions reduced the precision of the spacing on several occasions, and 3) secondary adaptive grids were conducted on 3 occasions when aggregations of cod were located on the large grid (several hundred kms of additional transects). Adaptive grid results were not included in present estimates. Thirty-four fishing sets were made as directed by acoustic indications of target density, size, and species.

Dual beam echosounders were used on both vessels. On the Gadus an EK400 sounder (49 KHz) with the deep tow system enabled integration measurements (20 Log R amplification) to be made to 750-800 m (300 m tow depth + 450-500 m acoustic range). Depths from 800-900 m could be surveyed only qualitatively (no cod were identified there). Single target mensuration is limited with this system to 525 m at 300 m tow depth because of the restricted TVG properties of the EK400. On the Petrel V a Biosonics 102 sounder (38 KHz) was used with a 40 m tow depth (this combination and the quieter conditions of this vessel relative to the Gadus allowed integration and single target mensuration (20 and 40 Log R amplification) of small cod to a maximum of 550 m). Signal processing on both vessels was done using Biosonics ESP technology with data channelled directly to optical storage drives. Both vessels and their respective hardware and software were calibrated in two ways:

- 1) Sounder outputs and receiving sensitivities were calibrated against standard spheres (copper 49 KHz; tungsten carbide 38 KHz).
- 2) An intervesSEL calibration comparing *in situ* target strength measures was conducted over an aggregation of capelin on the north Cape of the Grand Bank. In this exercise, vessels ran similar transects at a distance of approximately 0.5 miles apart with the following vessel just off the leading vessel's stern. Each vessel took a turn at leading and following. The results of the target strength comparison of the two vessel indicated that differences in frequency, vessel, and hardware brand had no significant effect on results.

Data analysis included simultaneous integration and target strength estimation. Integration was done simultaneously from the transducer down in 20 m strata and from the bottom up in 1 m strata (to 10 m off bottom). Report length was 1 km (except for adaptive grids). The bottom up strata were used in a back stepping algorithm to find the first inflection point in the echo signal (nearest bottom) and any signal below this was subtracted from the top down strata (used for the integration). This procedure has been found to reduce the noise in integrator signals near bottom and to give less variable results than commercial integrators. Signal "bins" were classified as to taxa by combining information from three sources: 1) set results, 2) echogram interpretations, and 3) signal patterns (Rose and Leggett, 1988). Integration then was done by taxa (cod, capelin, deep-water species, pelagic scatterers [euphausiids, myctophiid fishes]). Total abundance estimates were derived by expanding mean transect densities over the area half way to adjacent transects.

The largest sources of uncertainty in the acoustic abundance estimates are thought to be the target strength applied to the acoustic integration and the proportions of the stock area covered by the surveys in each year. Standard procedures have been based on average trawl samples and average length-TS relationships. This procedure assumes no trawl selectivity or fish size segregation. Recent data suggest both assumptions are violated. Hence, *in situ* target strengths have been analyzed from the adaptive surveys conducted. Preliminary results suggest strong interaction between target strength and likely trawl selectivity (e.g. smaller TS fish are undersampled in trawl). A preliminary estimate of 1993 mean TS (*in situ*) is -36 dB. Research to better estimate and apply TS values continues.

A total of 59 transects ranging in length from 9 to 198 km were used to estimate fish numbers. Cod were located in 3 regions: 1) 4-8 yr-olds on the Nose and North Cape of the Grand Bank; 2) 3-4 year olds in the Bonavista Basin; and 3) 2-3 year olds (some 4's) in the Notre Dame Channel (Fig. 20b). The estimate of cod numbers is 8.0×10^7 (based on -36 dB mean TS). Thirty bottom and 4 mid-water sets were completed (Fig. 20c). The single large set was made on the aggregation located on the Nose of the Grand Bank (12622 fish). Set data were used to aid acoustic interpretations.

Several findings are noteworthy: 1) acoustic densities in the post-spawning migratory aggregation in 1993 did not differ from those in 1990-1992 (Bishop et al., 1993) assuming equal TS values (aggregation size declined); 2) total minimal numbers were <0.5 those estimated in 1992 (again assuming equal TS); and 3) distributions changed remarkably between June 1992 and June 1993 (Fig. 20b,d). Distributions reported here suggest that fish moved along the North Cape further to the southeast in the winter of 1992/3 (the location of the aggregation in the spring was 20-25 nautical miles shoreward from where cod were located in Feb. 1993 by the Gadus acoustic survey after surveillance reported foreign vessels fishing cod).

Distributions and abundances of Pre-recruits of the Northern cod

Introduction

A program of research was implemented in 1991, as part of the Northern Cod Science Program, to develop a scientific basis for pre-recruit indices for the Northern cod population (2J3KL). At the outset, very little was known regarding the distributions of juvenile cod during their first three years of life. It had been described that cod eggs spawned offshore drifted to the inshore bays along the NE coast of Newfoundland where the fish settled to the bottom, or the nearshore, as juveniles in the fall. Based on this description, the original working hypothesis was that the inshore bays along the NE coast of Newfoundland served as the primary nursery areas for young cod.

Research programs have been directed primarily at sampling the nearshore environment (beach seines, traps) and the inshore-to-offshore environment during the pelagic 0-group stage (pelagic survey) and during the demersal juvenile stage (demersal survey). This approach enabled a comparison of results among the different field programs. Additional work has involved analyses of historical data, much of which was collected for other purposes, and modelling of egg and larval drift. The following summary focuses on current attempts to measure pre-recruit abundance. Data on cod by-catch in the capelin fishery are also included because of a positive statistical relationship with recruitment.

Summary

The predominantly inshore distributions sampled for pelagic (0-group) juvenile cod during 1991-93 differed significantly from the offshore distribution observed in 1981. The different distributions are consistent with that expected based on historic and recent spawning distributions, and modelled drift of cod eggs and larvae. Compared to the numbers sampled and the broad offshore distribution in 1981, it would appear that significantly fewer pelagic cod occurred in recent years, 1991-93.

The distribution of 0-group cod at beaches along the coast in the nearshore environment in 1992-93 was remarkably similar to the historic distribution sampled in the early-1960s. Similarly, abundances of cod aged 0-2 years were not different, although values in 1992-93 tended to rank towards the lower range. The persistence of 0-group cod within the nearshore environment indicates this is a preferred habitat. However, this persistence contrasts with observations that there has been a significant southward shift in spawning and significantly lower recruitment during the 1990s.

The discrepancy between the distributions of pelagic 0-group cod and that of 0-group cod in the beach environment could be explained by a persistence of inshore spawning in the bays along the NE coast of Newfoundland. If there has not been a southward contraction of inshore spawning, as has occurred offshore, then a contraction would not be observed in the distribution of 0-group cod in the beach environment, whereas a significant shift would be observed in the distribution of pelagic juveniles offshore. Alternatively, it has been hypothesized that the nearshore beach environment is a highly preferred habitat of juvenile cod, albeit a limited habitat. In this case, it can be argued that the beach environment is always saturated by 0-group and 1-group juvenile cod regardless of cohort abundance or spawning distributions. In either case, the nearshore beach environment would not be sensitive to year-class strength variations of the Northern cod population, as observed.

The distributions of cod aged 1-3 years observed during the demersal surveys in 1992-93 is consistent with the historical description: age 1 cod predominate inshore while age 3 cod are more predominant offshore. Because directed sampling previously has not been carried out inshore a direct comparison to historical distributions is not possible. The recent observations emphasize that cod <3 years of age occur predominantly shoreward of the fall RV survey boundary. As such, we might expect the RV survey to systematically underestimate the abundance of young cod, but particularly at small cohort sizes where most juvenile cod (<3 years) are found shoreward of the survey boundary.

The cod by-catch data from capelin traps has demonstrated a statistical relationship to year-class size during the period 1981-91. Based on this relationship, the prediction from the 1992 by-catch data is the lowest mean year-class size yet observed (1989-90 year-classes) while in 1993 the by-catch data predicts moderately good mean year-class size (1990-91 year-classes). The 1992 by-catch data, however, may be biased downwards because of the absence of a capelin trap fishery in NAFO 3L where much of the by-catch occurs. There is also a statistical relationship between the by-catch data and the mean catch rate of 2 and 3 year old cod in the fall RV survey during the period 1981-92. However, this relationship appears to break down in 1993 when the by-catch data indicate a stronger combined year-class for the 1990-91 cohorts than that estimated from the RV survey. This comparison indicates a possible shift in distribution of juvenile cod, ages 2 and 3, to the inshore area in 1993. However, the demersal juvenile cod surveys carried out in 1992 and 1993 indicated no significant change in distribution between years. In fact, an overall decrease in catch rates of 2 and 3 year old cod in the demersal survey in 1993 resulted from reduced catch rates in the inshore relative to the offshore. The difference between these two indices, by-catch and RV, in 1993 remains unresolved.

Catch rates of 0-group cod were higher in 1993 than 1992, as measured in both the beach seine surveys and the demersal juvenile cod surveys. This contrasts with results of the pelagic juvenile cod surveys which indicated that catch rates in 1992 were higher. Catch rates were slightly higher for age 1-group fish in 1993 in both the beach seine and demersal surveys, indicating that the 1992 year-class maybe greater than in 1991. This result agrees with estimates from the pelagic juvenile survey, which indicated the 1991 year-class to be less than either 1992 or 1993. Overall catch rates from Japanese Pelagic traps were 20% higher in 1993 than 1992 but data is not yet available to evaluate the relative catch rates of age groups in the traps in 1993.

Preliminary predictions of year-class size from the different data sources has been qualitatively summarized in Table 31. There is agreement between the by-catch and RV age 2+3 estimates that the combined 1989-90 year-classes will be at historically low levels. However, there is disagreement between the by-catch and RV 2+3 indices for the combined 1990-91 year-classes, which are ranked as "medium" and "lowest" for the available time series, respectively. Year-class size in 1991 appears to be very low, based on the beach seine, the pelagic 0-group, demersal juvenile and RV2+3 indices. Presently, the data for 1992 and 1993 year-classes are too limited to draw general conclusions about year-class size, although it is suspected that they will be low.

Food and Feeding

Capelin was the major prey of cod in the offshore area of Div. 2J and 3K during the autumn of most years in the period 1978-1989. (Lilly, 1991; 1994). During the recent decline in cod abundance and reduction in cod distribution, there was also a severe decline in capelin biomass as estimated from offshore Canadian and Russian acoustic surveys, with the Canadian series showing a very abrupt drop between 1989 and 1990. Nevertheless, many cod had a relatively high content of capelin in their stomachs in 1990-1992, in part because capelin changed their distribution and overlapped the general area where the remaining cod were concentrated. A preliminary analysis of the average quantity of food in cod stomachs by Division (2J, 3K, 3L) revealed a decline only in Div. 2J (on Hamilton Bank in 1990 and in the whole Division in 1991 and 1992), (Lilly, 1994; Taggart *et al.*, 1994).

Condition Factors

Information was available relative to condition factors (gutted weight/length³) for cod in Div. 2J+3KL. In both 2J and 3K a declining trend was observed from 1990 to 1992 for all ages although it was less pronounced in Div. 3K

(Fig. 21 and 22). No trend was observed in 3L although there was a decline at most ages from 1992 to 1993 (Fig. 23). The impact of factors such as changes in growth rate over time, migrations between Divisions and aliasing of the indices with respect to normal seasonal cycles in cod physiology on the interpretation of the results has been described previously (Taggart et al., 1994).

Estimation of stock parameters

A formulation of the adaptive framework (ADAPT) using Canadian research vessel data was used to estimate stock size. The formulation of ADAPT used was that accepted at the most recent assessment of this stock and is described as follows:

Parameters estimated by ADAPT:

- Year-class estimates
 $N_{i,1993}$ *i = 3 to 12*
- Catchabilities for RV numbers
 K_i *i = 3 to 12*

Additional structure imposed:

- Natural mortality assumed to be 0.20.
- Error in the catch at age was assumed negligible.
- F on oldest age group (13) set to the unweighted F for age groups 7-9.
- Intercepts not fitted.

Input data:

- C_{it} *i = 3 to 13 t = 1978-93*
- RV_{it} *i = 3 to 12 t = 1978-93*
- Fall RV related to population at end of November.

Objective function:

- Minimize

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

Summary:

- Number of observations = 165
- Number of parameters estimated = 20

In previous assessments it had been established that intercepts were not significant and hence were not included in this analysis. The CVs on the estimated age 3-12 abundance (Table 32) ranged from 54% to 92% while those on estimated slopes were approximately 24%. The patterns of residuals that were produced showed strong year effects reflecting the large interannual variation in the RV index. Residuals for 1993 were all strongly negative while those for 1989 to 1992 were all positive. It was considered that the results from ADAPT were too imprecise and did not adequately represent stock abundance. Consequently, it was not possible to provide an estimate of the size of the current stock biomass.

Assessment Results

Fishing mortality and stock abundance

Research vessel survey results imply that stock abundance has declined to less than 1/10 of that in the mid-1980s and that the decline persisted from 1992 to 1993 in spite of a moratorium on commercial fishing. It also suggests that the size of the 1986 and 1987 year-classes, which were originally considered to be above average size, may have been well below average, particularly that for 1987. As well, the size of year-classes since that time (1988-90) are also well below average.

Although stock size and fishing mortality could not be estimated, analyses incorporating the extremely low RV abundance estimate for 1993 suggest that total mortalities in recent years have been very high and most likely in excess of 1.0 for the fully recruited age groups. Although total mortality appears to have declined between 1992 and 1993 because of the fishery closure, the total estimated catch for 1993 of 11,000 tons seems to have been too low to account for the continuing decline in RV estimates. Possible reasons for this inconsistency include the following: 1) the survey results are real implying that factors other than fishing might be responsible for the observed declines; 2) year effects in recent years are hampering calibration of SPA; or 3) the 1993 catch has been underestimated. It is not possible to determine which of these is correct. It is possible that the recreational fishery in 1993 took fish predominantly originating from supposed inshore stocks. The areas where these fish would occur are not covered during the autumn surveys, and no information exists concerning possible trends in inshore 'stock' abundance.

Recruitment

The 1986 and 1987 year-classes were previously considered to be well above average. The current analyses suggest that these year-classes may have been well below average, particularly that for 1987. All other indices have indicated that subsequent year-classes are weak, particularly those for 1988 to 1990. More recent year-class sizes are not well estimated although it is suspected that they will be low.

Prognosis

Although it was not possible to provide an adequate determination of absolute stock size, it is possible to describe general trends from the data.

The Div. 2J3KL cod stock abundance increased from the mid-1970s to the mid-1980s but has since declined. There is little doubt that the stock decline observed in recent years has continued in 1993 and that the stock is at a dangerously low level. The continuing decline in RV estimates is not consistent with the reduced fishing in 1992 and 1993, although there are indications that total mortality declined somewhat.

Survey data indicate that the low recruitment levels estimated for recent years will persist because of the current low spawning stock biomass and consequently stock recovery will not occur in the near future. Stock recovery cannot begin until there is production and survival of significant numbers of new recruits.

References:

- Bishop, C., A. E., F., Murphy, M., B., Davis, J., W., Baird, and G., A., Rose. 1993. An assessment of the cod stock in NAFO Divisions 2J+3KL. NAFO SCR Doc. 93/86. Ser. No. N2271.
- Bishop, C. A. 1994. Review of stratification schemes used in NAFO Subareas 3 and 3. NAFO SCR Doc. 94/43.
- Lilly, G. R. 1991. Interannual variability in predation by cod (*Gadus morhua*) on capelin (*Mallotus villosus*) and other prey off southern Labrador and northeastern Newfoundland. ICES mar. Sci.Symp. 133-146.
- Lilly, G. R. 1994. Predation by Atlantic cod on capelin on the southern Labrador and Northeast Newfoundland shelves during a period of changing spatial distributions. ICES mar. Sci. Symp. (in press).
- Rose, G. A., and W. C. Leggett. 1988. Hydroacoustic signal classification of fish schools by species. Can. J. Fish. Aquat. Sci. 45: 597-604.
- Taggart, C. T, J. Anderson, C. Bishop, E. Colbourne, J. Hutchings, G. Lilly, J. Morgan, E. Murphy, R. Myers, G. Rose, and P. Shelton. 1994. Overview of cod stocks, biology, and environment in the northeast Atlantic region of Newfoundland with emphasis on northern cod. ICES mar. Sci. Symp. (in press)

Table 1. Historical catches of cod from NAFO Divisions 2J3KL for the period 1959-93.

Year	Offshore mobile gear			Fixed gear			Offshore mobile gear			Fixed gear			Offshore mobile gear			Fixed gear			Total		
	Can.	Other	Total	Total	Can.	Other	Total	Total	Can.	Other	Total	Total	Canada	fixed	mobile	offshore	gear	Total	TAC		
2J	3K	3L	2J3KL																		
1959	-	46372	17533	63905	-	97678	56264	153942	4515	51515	56030	85695	141725	164007	159492	267080	359572	-	-		
1960	1	164036	164037	15418	179455	53	69835	69908	47676	7355	60213	67568	94192	161760	164695	157286	301513	458799	-		
1961	1	243147	243148	17545	260693	-	60574	31159	91733	4675	70318	74993	70659	145652	124039	119363	378715	498078	-		
1962	-	226841	23424	250265	-	45554	45554	42916	88370	4383	87463	91846	72271	164117	142894	138511	36241	502752	-		
1963	1	197868	197869	23767	221636	-	79331	79331	47486	126817	4446	83015	87461	73295	160756	148995	144548	364661	509209	-	
1964	13	197359	197372	14787	212159	-	121423	40735	162158	10158	142370	152528	75806	228334	141499	131328	471323	602651	-		
1965	-	246650	246650	25117	271767	21	50097	50118	26467	76585	7353	130387	137740	58943	196683	117901	110527	434508	545035	-	
1966	39	226244	226283	22645	248928	13	58907	58920	32208	91128	8253	120206	128459	55990	184449	119148	110843	413662	524505	-	
1967	28	217255	217283	27721	245004	114	78687	78801	24905	103706	13478	200343	213821	49233	263054	115479	101859	508905	611764	-	
1968	4650	355108	359758	12937	372695	1849	119778	121627	40768	162395	15784	211808	227592	473332	274924	123320	101037	703977	810014	-	
1969	30	405231	405261	4328	409589	56	80949	81005	24923	103928	18255	151945	170200	67973	238173	115565	97224	655466	753690	-	
1970	-	212961	212961	1963	214924	92	78274	78366	21512	99878	14471	137840	152311	531113	205424	911151	76388	445638	520226	-	
1971	-	154700	154700	3313	158013	31	61506	61537	21111	82648	11976	148766	160742	381115	198857	74546	62539	437918	-		
1972	-	149435	149435	1725	151160	7	133369	133376	14054	147430	4380	109052	113432	46273	159705	66439	62052	396243	458295	-	
1973	1123	52985	54108	3619	57727	108	159653	159761	13190	172951	1258	97734	98992	24839	123831	44137	41648	312861	354509	666000	
1974	-	119463	119463	1804	121267	19	149189	149208	10747	159955	880	67918	67978	22630	91428	36080	35181	331469	372650	657000	
1975	410	78578	78988	3000	81988	189	112678	112867	128385	670	53770	54440	22695	77135	42482	41213	24295	287508	554000	-	
1976	94	30691	30785	3851	34636	771	79340	80311	20879	101190	2187	40998	43185	35209	78394	62991	59939	154281	214220	309000	
1977	525	39584	40109	3523	43632	1051	26776	27827	28818	56645	5362	26799	32161	40282	72443	79561	72623	100097	172720	169000	
1978	4682	222228	6638	28866	7027	673	13400	29623	43023	9213	12263	21476	45194	66670	102377	81455	57104	133559	133000	-	
1979	9194	6537	15731	8445	24176	21579	161890	38469	27018	64487	14184	12693	26877	503359	77236	130779	85822	81077	166899	180000	
1980	13592	7437	21029	17210	38239	21920	68330	28750	37015	65765	15523	13963	29486	42298	71784	147558	96523	79265	1175788	180000	
1981	22125	4760	26885	14215	41100	23112	3847	26959	23002	49961	21760	15070	36830	42821	79651	147035	80038	90674	170712	200000	
1982	58384	6923	67307	14429	81736	8881	4074	12955	42141	55096	27192	9271	36463	56479	92942	207506	113049	116725	229774	230000	
1983	37281	4158	41439	10743	52182	31623	2815	34438	40681	75119	39125	10920	50044	54999	214452	106423	125922	233345	260000		
1984	10754	1259	12013	13150	25163	48114	11059	59173	35143	94316	49620	13944	63564	49428	112992	206209	97721	134750	232471	266000	
1985	1541	5	1546	10289	11755	72111	9714	81825	30368	112193	39112	28927	68039	39306	107345	192647	79883	151410	231293	266000	
1986	4627	7373	12011	12567	24578	58239	2226	60465	28539	89004	55117	106672	31263	137935	190352	723369	179137	251506	266000	-	
1987	38216	3620	41836	16139	57975	39240	6119	45359	27141	72500	59107	33820	74130	26748	85855	50103	135938	241870	101035	167642	266677
1988	41468	9	41477	17112	58539	40260	50	40310	38820	38474	59185	40943	36540	7483	136721	214676	102869	156555	253424	233000	
1989	33584	1014	34598	22930	57518	37720	1194	38474	20711	59185	40943	36540	7483	59827	70624	130451	190660	112333	199262	218688	
1990	17863	689	18493	14332	32884	26593	883	25577	55353	33371	42148	30146	49660	79806	44317	124123	120116	59830	111039	170869	190000
1991	635	84	719	2195	2914	29505	1009	30514	13318	43832	16418	31028	10876	36904	28796	11794	31885	43679	2425	11425	-
1992	-	-	-	19	584	273	857	899	1756	16418	14610	31028	10876	547	547	2	2425*	3384	5810	9000*	-
1993	-	-	-	14	14	-	-	-	-	-	-	-	-	-	-	-	-	2426	-	-	

*Surveillance catch estimate.
This includes a further 5053 t catch estimated from the recreational fishery additional to that recorded in DFO statistical records.

Table 2. Fixed gear cod catches (000's t) by division and gear in NAFO Divisions 2J, 3K, and 3L from 1975 to 1993.

Year	2J				3K			
	Trap	GN	LL	HL	Trap	GN	LL	HL
1975	0.7	2.3	0	<0.1	4.7	8.5	0.6	1.6
1976	0.4	2.4	<0.1	<0.1	7.1	10.6	0.7	2.4
1977	1.5	1.9	<0.1	0.1	11.5	11.6	1.3	4.4
1978	3.0	3.2	0.1	0.3	11.3	11.4	3.6	3.2
1979	1.3	5.7	0.2	1.3	3.5	11.5	8.4	3.6
1980	4.7	11.4	0.2	0.9	12.7	13.5	8.1	2.7
1981	3.9	10.1	0.1	0.2	4.0	10.7	6.4	2.0
1982	4.5	9.1	0.1	0.7	16.4	17.6	6.1	2.1
1983	3.9	4.9	0.8	1.2	10.5	18.3	2.6	9.3
1984	5.3	6.0	0.4	1.0	9.9	14.3	2.4	8.4
1985	4.6	2.7	0.2	1.8	13.4	8.0	2.3	6.6
1986	4.3	7.6	0.1	0.6	14.8	7.6	1.4	4.7
1987	5.0	9.5	0.2	1.4	11.3	10.1	1.5	4.3
1988	5.9	9.1	0.3	1.8	16.2	11.7	0.9	4.7
1989	6.7	14.6	0.2	1.4	8.2	7.9	0.7	3.9
1990	3.6	9.2	0.6	0.9	11.2	7.8	3.8	4.7
1991	1.0	0.3	0.1	0.8	7.7	1.4	1.8	2.4
1992	-	-	-	-	-	0.1	-	0.7
1993	-	-	-	-	-	-	-	0.5
	3L				Total			
1975	10.4	7.5	1.6	3.1	15.8	18.3	2.2	4.7
1976	18.4	9.1	2.9	4.8	25.9	22.1	3.6	7.2
1977	21.0	8.9	3.6	6.9	34.0	22.4	4.9	11.4
1978	23.2	9.0	5.1	7.8	37.5	23.6	8.8	11.3
1979	20.8	13.5	7.0	9.1	25.6	30.7	15.6	14.0
1980	12.9	11.2	9.4	8.8	30.3	36.1	17.7	12.4
1981	10.2	13.6	11.4	7.6	18.1	34.4	17.9	9.8
1982	24.2	20.3	5.7	6.2	45.1	47.0	11.9	9.0
1983	25.7	16.4	3.8	9.0	40.1	39.6	7.2	19.5
1984	23.0	14.9	3.8	7.4	38.2	35.2	6.6	16.8
1985	21.8	8.8	2.6	5.7	39.8	19.5	5.1	14.1
1986	15.8	8.9	2.4	4.1	34.9	24.2	3.9	9.4
1987	11.4	17.4	2.1	4.6	27.7	37.0	3.8	10.3
1988	22.2	18.1	2.7	6.7	44.3	38.9	4.1	13.2
1989	24.0	22.2	4.7	8.4	38.8	44.7	5.6	13.7
1990	32.1	26.7	2.2	9.7	46.9	43.7	6.7	15.3
1991	26.4	10.9	1.2	5.8	35.1	12.6	3.1	9.0
1992	1.2	1.0	-	3.6	1.2	1.1	-	4.4
1993	-	0.1	0.1	3.2	-	0.1	0.1	3.7

Table 3. Cod landings (t) in 1993 for Divisions 2J, 3K, and 3L by gear and month for Canada with a total estimate for all countries.

Mo.	2J			3K				3L				2J3KL			
	LL	HL	Tot. 2J	GN	LL	HL	Trap	Tot. 3K	OT	GN	LL	HL	Trap	Tot. 3L	
J				6		6				76		76		82	
F										3		3		3	
M										4		4		4	
A									1	9		1		12	
M				2				2		2		14	13	29	
J				9		5		14		2		34	1	37	
A	1	5	6	6	3	67	1	77	31	1	103	5	140	183	
S	1	6	7	1	177		1	179	7	1	358		366	449	
O	1	1		12	3	144		159	27	6	1438		1471	1657	
N				5	3	57		65	19	9	827	10	865	1025	
D						2		2	1	5	230		285	350	
	2	12	14	41	10	493	3	547	2	102	79	3173	30	3386	3947

Total Canada = 9000 t (Includes catch of 5053 additional to that in DFO statistical records.)

Other countries = 2425 t (Includes 2200 by EU - Spain)

Total 2J3KL 11425 t

Table 4. Commercial sampling by Canada used to estimate catch at age for Divisions 2J3KL in 1993.

Gear	Month	Number Measured	Number Aged	Weight Total (t)	Cumulative Total (t)
3K HL	Aug	64	44	67	
	Sep	62		177	
	Oct	613	47	144	493
3L HL	Aug	19	98	358	
	Sep	2524		1438	
	Oct	159			3173
Total		3282	189		9000*

* Includes estimate of 5000 tons from the recreational fishery additional to that obtained from official statistics..

Table 5. Estimated catch, average weight, and average length-at-age from the 'recreational' and by-catch fisheries in NAFO Divisions 2J3KL during 1993.

AGE	AVERAGE		CATCH		
	WEIGHT	LENGTH	MEAN	STD. ERR.	C. V.
3	0.569	40.332	816	167.19	0.20
4	0.710	43.277	4390	300.61	0.07
5	0.972	47.916	2699	282.62	0.10
6	1.252	51.785	1339	201.22	0.15
7	1.592	56.121	454	98.85	0.22
8	8.401	97.000	2	0.01	0.01
9	9.230	100.000	2	0.01	0.01

Table 6. Estimated catch and average weight-at-age from fisheries for cod in NAFO Divisions 2J3KL during 1993.

Age	Canada		Other		Total	
	Nº (t)	Ave. wt.	Nº	Nº	Ave. wt.	
3	816	0.57	124	940	0.57	
4	4390	0.71	603	4993	0.71	
5	2699	0.97	644	3343	0.97	
6	1339	1.25	601	1940	1.25	
7	454	1.59	246	700	1.59	
8	2	8.40	145	147	8.40	
9	2	9.23	19	21	9.23	
10						
Catch	9000		2425	11425		

TABLE 7. CATCH NUMBERS AT AGE (THOUSANDS) FROM THE COMMERCIAL COD FISHERY IN NARO
DIVISIONS 2J3KL FOR THE YEARS 1962-93

	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
2	301	1446	2872	85	819	790	288	59	6819	33	236	0	473	420	15	108	0
3	8666	5746	19338	5177	14057	15262	6142	4330	18104	12876	6737	3963	3231	3968	13767	7128	1323
4	26194	27577	27603	28709	63992	77873	94291	39626	60102	71557	79809	40785	13201	14101	33727	65510	17556
5	64337	60234	57757	46800	93687	100339	205805	100858	82357	95384	116562	94844	34927	25370	28049	40462	39206
6	58163	118112	60681	66946	62812	96759	150541	163228	101249	98111	76196	59503	74403	34426	20898	12107	20319
7	47314	58996	108147	64360	59312	54996	83808	107509	85696	57865	55984	35464	60539	39105	16811	5397	7711
8	27521	29349	50865	68176	30423	38691	39443	52661	29218	25055	29553	27351	35687	36485	16022	3396	3078
9	20142	15520	20892	33819	23844	17146	23171	19651	10857	11732	11750	14153	18854	13421	10931	2730	1530
10	18036	11612	12264	14913	8762	16084	10984	12370	3825	4470	6393	7566	10492	7514	4637	1381	1083
11	10444	8248	8698	6945	4528	5949	5591	6389	2000	2223	2987	3815	5818	2315	1462	532	437
12	9468	4204	6352	3729	2280	3367	5249	4479	1200	1287	1660	2153	2934	1179	631	296	219
13	7778	3942	4989	3948	1825	2108	1939	3004	507	1140	1388	1173	1078	808	292	149	105
14	5785	2933	4036	3730	1186	1529	1334	1557	224	720	725	450	652	372	251	75	62
15	4669	2928	2703	2722	967	685	818	622	214	355	748	278	249	165	100	42	40
16	3888	1737	1456	1859	806	424	610	567	244	474	606	309	338	82	50	21	21
17	3955	1263	1918	575	416	193	127	319	124	124	452	85	162	5	40	20	7
18	2161	1352	1154	971	279	107	89	100	32	128	136	27	113	8	64	14	8
19	232	328	501	183	486	72	83	46	10	148	195	38	45	22	30	2	2
20	403	182	312	226	178	211	26	99	34	78	36	8	20	1	20	6	7
2+1	319457	355709	384538	353873	372659	432585	630339	517474	402816	383760	392153	291965	263216	179767	147797	139376	92714
	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993		
2	0	92	0	0	18	3	0	1	42	25	8	58	35	0	0		
3	1152	2554	2185	1702	2585	782	650	831	2329	2779	1696	7693	3111	430	940		
4	12361	12025	7172	31286	13616	14871	14824	15219	9217	14651	17639	40557	31654	3860	4993		
5	37493	28814	13191	19003	42602	31760	36614	44168	32340	20184	21150	36410	53805	14535	3343		
6	29202	30016	24800	14397	19028	38624	33922	45869	49061	47917	25212	22695	29553	12211	1940		
7	10982	18017	22014	25435	12044	12503	28006	26025	28469	45725	38708	16390	9064	4526	700		
8	3460	4830	11848	16930	14701	7246	7050	14722	19505	18608	28499	17940	6164	1372	147		
9	1300	1217	3175	11936	8934	8910	3836	3104	5818	9026	8696	9156	4745	376	21		
10	757	520	779	1923	6341	4227	5162	2000	1346	4337	3640	2865	1696	199	0		
11	560	232	309	338	1018	2536	2905	1977	676	774	1695	1084	641	104	0		
12	183	229	195	156	248	451	1681	1101	873	422	572	478	250	18	0		
13	116	56	125	90	90	146	254	574	391	366	244	103	88	9	0		
14	51	65	48	153	41	48	107	116	200	223	180	98	39	4	0		
15	43	37	14	40	29	41	39	29	37	100	94	36	21	0	0		
16	38	13	28	12	11	30	20	18	22	32	43	25	9	0	0		
17	7	10	20	13	9	7	17	11	3	5	4	8	3	0	0		
18	7	14	5	4	6	7	1	9	1	10	9	7	2	0	0		
19	4	4	5	0	2	4	3	2	4	5	0	1	2	0	0		
20	9	10	5	0	3	3	5	2	0	5	1	0	0	0	0		
2+1	97725	98755	85918	123418	121326	122199	135096	155778	150334	165194	148090	155604	140882	37644	12084		

TABLE 8. AVERAGE WEIGHTS AT AGE (KILOGRAMS) FROM THE COMMERCIAL COD FISHERY IN NAFO DIVISIONS 2J3KL FOR THE YEARS 1962-93

	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
2	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.00	0.11	0.26	0.25	0.09	0.00	0.00	0.41	0.00
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	0.55
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	0.78
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	1.17
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	1.64
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	2.23
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	2.86
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	3.81
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	5.32
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	6.29
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	7.06
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	7.32
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	10.01
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	8.99
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	11.54
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	10.48
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	11.15
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	9.82
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	12.59

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
2	0.00	0.31	0.34	0.00	0.21	0.32	0.29	0.26	0.29	0.17	0.00	0.00
3	0.53	0.62	0.59	0.48	0.51	0.43	0.49	0.48	0.42	0.36	0.29	0.57
4	0.84	0.87	0.88	0.73	0.72	0.66	0.73	0.74	0.69	0.61	0.58	0.71
5	1.20	1.32	1.20	1.10	1.04	1.03	1.08	1.03	1.06	0.97	0.81	0.97
6	1.77	1.75	1.79	1.43	1.54	1.32	1.38	1.44	1.50	1.41	1.19	1.25
7	2.10	2.28	2.28	2.06	1.85	1.87	1.67	1.83	1.94	1.88	1.73	1.59
8	2.66	2.61	2.71	2.66	2.35	1.93	2.21	2.07	2.22	2.27	2.05	8.40
9	3.09	3.18	2.96	3.23	2.94	2.80	2.51	2.64	2.44	2.63	2.66	9.23
10	4.18	3.50	3.65	3.32	3.47	3.51	3.04	3.02	3.06	3.14	2.24	0.00
11	6.16	4.79	4.28	4.06	3.80	4.80	4.37	3.96	3.58	3.80	2.68	0.00
12	7.19	7.76	6.19	4.55	4.54	4.64	5.49	5.41	4.68	4.96	4.95	0.00
13	8.00	9.07	8.39	7.03	5.34	5.74	6.55	7.50	6.23	5.49	5.34	0.00
14	8.36	9.14	10.26	9.67	7.12	6.13	8.60	9.24	8.51	7.61	7.02	0.00
15	7.86	10.62	11.44	11.37	11.77	8.53	9.76	10.05	9.78	11.58	0.00	0.00
16	7.91	10.57	11.61	11.27	11.24	13.51	9.73	9.34	12.58	11.01	0.00	0.00
17	9.58	13.13	17.47	12.68	14.15	9.10	12.58	15.74	15.45	12.82	0.00	0.00
18	12.95	15.97	12.94	12.42	16.14	21.77	16.01	18.66	13.58	13.00	0.00	0.00
19	0.00	9.73	15.21	14.38	12.30	17.66	16.60	0.00	17.26	13.10	0.00	0.00
20	0.00	15.88	12.81	19.49	15.72	0.00	11.03	17.64	0.00	0.00	0.00	0.00

TABLE 9. CATCH BIOMASS AT AGE (TONS) FROM THE COMMERCIAL COD FISHERY IN NAFO DIVISIONS 2J3KL FOR THE YEARS 1962-93

	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	
2	42	202	402	12	115	111	40	8	955	5	33	0	52	109	4	10	0	
3	1	2946	1954	6575	1760	4779	5189	2088	1472	6155	4378	2964	1268	1131	1786	6195	3208	529
4	1	14407	15167	15182	15790	36296	42830	51860	21794	33056	39356	42299	19169	8977	8884	20573	39306	12640
5	1	56617	53006	50826	41184	82445	88298	181108	88755	72474	83938	74600	67339	31784	24355	26086	39248	40774
6	1	71540	145278	74638	82344	77259	119014	185165	200770	124536	120677	82292	57123	82587	40623	27585	20098	32104
7	1	78541	97933	166244	106838	98458	91293	139121	178465	142255	96056	85096	46103	76885	54356	29419	12575	18969
8	1	58345	62220	107834	144533	64497	82025	83619	111641	61942	53117	62948	49232	55672	63484	33166	9577	10034
9	1	53175	40973	55155	89282	62948	45265	61171	51879	28662	30972	33605	31137	38651	29660	24485	9446	6197
10	1	57354	36926	39000	47423	27863	51147	34929	39337	12164	14215	21033	21336	28853	19612	13865	5358	4830
11	1	39269	31012	32704	26113	17025	22368	21022	24023	7520	8358	11799	12170	18210	7732	5366	2543	2194
12	1	39292	17447	26361	15475	9462	13973	21783	18388	4980	5341	6839	8160	10005	4315	2877	1814	1472
13	1	47135	23889	30233	23925	11060	12774	11750	18204	3072	6908	6940	5314	5304	3862	1805	1089	851
14	1	32049	18249	22359	20664	6570	8471	7390	8626	1241	3989	6757	3119	2869	1934	2056	630	460
15	1	28528	17890	16515	16631	5908	4185	4998	3800	1308	2169	7031	2007	1576	858	977	370	328
16	1	22667	10127	8488	10838	4699	2472	3556	3306	1423	2763	4175	2178	1859	448	562	247	236
17	1	25470	8134	12352	3703	2679	1243	818	2054	799	799	6631	803	1226	43	498	213	81
18	1	13117	8207	7005	5894	1694	649	540	607	194	777	1637	301	1251	74	714	172	71
19	1	1534	2168	3312	1210	3212	476	549	304	66	978	1486	290	343	168	229	15	21
20	1	2898	1309	2243	1625	1280	1517	187	712	244	561	629	140	349	17	349	105	112
2+1		644926	590090	677428	655244	518248	593302	811698	774346	503047	475357	458793	327188	367583	262319	196809	146023	131904
	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993			
2	1	0	38	0	0	6	1	0	0	13	7	2	17	6	0	0	0	
3	1	530	1354	1202	902	1603	461	312	424	1001	1362	814	3231	1120	125	536		
4	1	9147	9259	5594	26280	11846	13086	10822	10958	6083	10695	13053	27984	19309	2239	3545		
5	1	42367	33424	15433	22804	56235	38112	40275	45935	33310	21799	21785	38595	52191	11773	3243		
6	1	48767	51327	40672	25483	33299	69137	48508	70638	64761	66125	36305	34043	41670	14531	2425		
7	1	27016	42880	49091	53414	27460	28507	57692	48146	53237	76361	70836	31797	17040	7830	1113		
8	1	12352	17195	33885	45034	38370	19637	18753	34597	37645	41124	58993	39827	13992	2813	1235		
9	1	5733	6097	12097	36882	28410	26374	12390	9126	16290	22655	22957	22341	12479	1000	194		
10	1	3974	2855	4144	8038	22194	15429	17138	6940	4724	13184	10993	8767	5325	446	0		
11	1	3248	1559	1944	2082	4876	10854	11794	7513	3245	3382	6712	3881	2436	279	0		
12	1	1286	1802	1377	1122	1924	2792	7649	4999	4051	2317	3095	2237	1240	89	0		
13	1	1039	469	915	720	816	1225	1786	3065	2244	2397	1830	642	483	48	0		
14	1	436	652	480	1279	375	492	1035	826	1226	1918	1663	834	297	28	0		
15	1	407	418	126	314	308	469	143	341	316	976	945	352	243	0	0		
16	1	407	180	323	95	116	348	225	202	297	311	402	315	99	0	0		
17	1	92	107	210	125	118	122	216	156	27	63	63	124	38	0	0		
18	1	94	225	56	52	96	91	12	145	22	160	168	95	26	0	0		
19	1	62	48	49	0	19	61	43	25	71	83	0	17	26	0	0		
20	1	133	114	63	0	48	38	97	31	0	55	18	0	0	0	0		
2+1		157091	170005	167661	224625	228118	227236	229191	244066	228564	264975	250632	215096	168021	41200	12290		

Table 10. List of strata, depth zones, and stratum areas for NAFO Division 2J.

Strata	Depth Range (m)	New		Old	
		Area (mi ²)	Units	Area (mi ²)	Units
201	101-200	633	200	1427	480
202	201-300	621	190	440	150
203	301-400	487	150	480	160
204	401-500	288	90	354	120
205	101-200	1594	510	1823	580
206	101-200	1870	600	2582	860
207	101-200	2264	700	2246	750
208	301-400	588	190	448	150
209	201-300	680	200	1608	540
210	201-300	1035	320	774	260
211	301-400	251	80	330	110
212	501-750	557	190	664	220
213	201-300	1583	510	1725	570
214	201-300	1341	440	1171	390
215	201-300	1302	400	1270	420
216	301-400	360	100	384	130
217	401-500	241	70	268	90
218	501-750	362	110	420	140
219	751-1000	283	90	213	70
220	1001-1250	303	90	324	110
221	1251-1500	330	100	268	90
222	301-400	450	140	441	150
223	201-300	158	50	180	60
224	501-750	228	70	270	90
225	1001-1250	195	60	177	60
226	1251-1500	201	60	180	60
227	401-500	598	190	686	230
228	201-300	2196	740	1428	480
229	301-400	536	160	567	190
230	501-750	185	50	237	80
231	751-1000	186	50	182	60
232	1001-1250	228	70	236	80
233	1251-1500	237	70	180	60
234	201-300	530	160	508	170
235	401-500	414	130	420	140
236	751-1000	193	60	122	40
237	101-200	733	220	-	-
238	101-200	778	240	-	-
239	501-750	120	40	-	-
240	401-500	133	40	-	-
Total		25272		25033	

Table 11. List of strata, depth zones, and stratum areas for NAFO Division 3K.

Strata	Depth	New		Old		
		Range (m)	Area (mi^2)	Units	Area (mi^2)	Units
617	301-400	593	190	-	-	-
618	101-200	1347	420	1455	420	
619	101-200	1753	550	1588	480	
620	201-300	2545	780	2709	860	
621	201-300	2736	830	2859	900	
622	401-500	691	220	632	200	
623	301-400	494	150	1027	320	
624	201-300	1105	350	668	210	
625	301-400	888	270	850	270	
626	301-400	1113	340	919	290	
627	401-500	1255	390	1194	380	
628	301-400	1085	340	1085	340	
629	301-400	495	160	495	160	
630	301-400	332	100	544	170	
631	401-500	1321	420	1202	380	
633	301-400	2067	660	2179	690	
634	201-300	1555	500	1618	510	
635	201-300	1274	400	1274	400	
636	201-300	1455	460	1455	460	
637	201-300	1132	360	1132	360	
638	301-400	2059	650	2059	650	
639	301-400	1463	460	1463	460	
640	401-500	69	20	198	60	
641	501-750	230	70	584	180	
642	751-1000	418	130	931	290	
643	1001-1250	733	230	1266	400	
644	1251-1500	474	150	954	300	
645	401-500	216	70	204	60	
646	501-750	325	100	333	110	
647	751-1000	360	110	409	130	
648	1001-1250	228	70	232	70	
649	1251-1500	212	60	263	80	
650	401-500	134	40			
651	501-750	359	110			
652	751-1000	516	160			
653	1001-1250	531	170			
654	1251-1500	479	150			
Total		34042		34228		

Table 12. Cod abundance estimates (in thousands of fish) from research vessel surveys in NAFO Division 2U (fall).

Depth range (m)	Stratum number	area	Gadus	Gadus	Gadus	Gadus	Gadus	Gadus	Gadus											
101-200	201	1427	3071	1500	5749	8377	16692	16246	10633	15246	21638	6784	54	0	0	0	0	0	0	
	205	1823	8039	1574	787	4550	21765	13547	25230	8159	9481	7841	13707	164	68	0	0	0	0	
	206	2582	1634	2136	2104	6220	5858	30077	12764	29985	4222	21638	9363	211	420	420	485			
	207	2246	5100	2664	3406	5479	9994	13294	14210	27850	6310	9027	4504	711	1740	0	225			
	Total	4078	17844	6974	12046	24626	53419	51511	80050	64019	67414	27874	39903	10238	2019	420	710			
201-300	202	440	462	396	5681	2378	1833	1866	760	7663	2626	746	0	0	0	0	0	0	0	
	209	1608	3531	21485	3410	10099	7581	29567	3843	8599	28567	13594	6711	14318	583	1224	338			
	210	774	4169	2760	2982	445	4703	59785	4953	299	21187	145	2401	8886	3776	3976	363			
	213	1725	19714	18516	19811	2158	5807	12806	6915	14028	23624	10316	12334	10278	3663	3663	206			
	214	1171	10860	6527	10958	3956	5900	4659	28667	19030	43496	40024	31085	13844	3621	334	132			
	215	1270	34281	9986	26562	35768	27583	7233	8040	7424	85617	8593	32304	111	2069	337	255			
	228	1428	359	6780	6254	10701	2187	2269	1853	352	12702	1164	2272	3001	2358	20652	236			
	Total	8924	508	553	267	1506	534	2250	4698	3005	2339	5415	1760	1125	0	0	0	25		
	Total	8924	78699	66717	78294	66039	58489	122850	56162	52831	228271	78222	88978	70231	22685	30186	1555			
301-400	203	480	256	236	3081	81	1117	462	703	156	1784	1405	2090	0	0	12	24			
	208	448	247	1480	202	303	1368	1749	224	1043	2051	3918	757	6356	1073	146	359			
	211	330	5450	2737	4659	1746	2415	1325	297	776	1090	1709	1647	12299	3109	10582	1181			
	216	384	152	202	3663	86	14	10	331	115	94	3127	476	149	86	96	10			
	222	441	1479	149	1258	132	0	11	11	182	17	281	66	2847	712	188	55			
	229	567	234	2873	1319	447	298	670	71	936	539	85	440	1475	1085	1518	199			
	Total	2659	7861	7677	14122	2795	5212	4227	1637	5208	5575	10525	5476	23726	6085	12542	1828			
401-500	204	354	151	116	133	1342	142	540	1422	0	518	425	1860	13	13	0	18			
	217	288	1	0	1	0	0	0	5	0	0	50	0	0	0	0	0	0		
	223	180	6	2	0	0	0	0	0	0	0	0	0	14	7	66	32	5		
	227	686	98	73	106	0	21	26	0	0	51	77	86	1146	4446	1337	94			
	235	420	144	114	156	158	126	1135	63	32	0	268	173	236	567	1734	32			
	Total	1908	397	305	432	1500	289	1701	1490	32	569	820	2133	1402	5094	3116	149			
501-750 751-1000	Total	1591	nf	nf	nf	50	50	0	33*	12	249	125	216	100	936	6350	50	48		
	Total	517	nf	nf	nf	0*	0*	0*	0*	0	14	0	0	0*	0	0	0	0		
	Total	10301	8163	104894	94950	117499	180289	139339	120090	301829	117441	134900	105597	36833	44264	4242				
	mean no. per tow	63.64	50.47	50.47	50.47	58.68	72.55	111.4	86.1	74.21	186.5	72.57	84.78	65.25	22.16	28.59	2.62			
	Unadjusted total for all sampled strata	98643	81130	104461	95010	117459	180290	139366	120103	302093	117569	136682	105669	36801	52613	4336				
	Upper limit	135651	129789	139530	162757	151075	744885	184179	154187	468311	163856	183268	149747	51757	126298	6077				
	Lower limit	61634	32470	59382	27253	83843	34105	94553	86020	135374	71282	90096	61651	21845	21071	2995				

Note shaded numbers are estimates for non sampled strata and only 0-500 m strata are used in deriving these estimates.

nf = not fished

* not all strata fished

** total and mean no. per tow include sampled and estimated values for depths to 500 meters. Estimates were derived from a multilevel model using survey data to 1991.

Table 13. Cod biomass estimates (t) from research vessel surveys in NAFO Division 2J (Fall).

Depth range (m)	Stratum number	Area (sq mi.)	GADUS	GADUS	GADUS	GADUS	GADUS	GADUS	GADUS	GADUS	GADUS	GADUS	GADUS	GADUS	GADUS
			15	29	44	58	71	86-88	101-102	116-118	131-132	145-146	159-160	174-176	190-191
			1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
101-200	201	1427	4847	3256	11319	15998	18086	16764	12033	14952	24712	9158	84	0	0
	205	1823	16200	2669	1676	10126	39216	17742	25093	7526	11016	9456	27403	240	11
	206	2832	2014	2671	3849	13153	8533	11442	39133	13133	34327	5313	36617	13183	107
	207	2246	8209	4192	7738	12284	12612	12608	18136	27954	7864	11883	7613	4656	1770
Total	8078	31330	12788	24582	51561	78446	58556	94395	63618	77919	35810	71717	13888	1888	221
201-300	202	440	525	749	12964	6292	5681	3798	2948	850	10363	4533	1436	0	0
	209	1608	5384	43569	12810	22275	18351	53925	7678	12245	37475	19297	11006	13957	228
	210	774	5572	5771	5810	823	10428	97578	9448	782	25147	360	4532	13125	746
	213	1725	31627	31100	34058	5622	8073	14748	9401	16121	27904	13819	20289	36371	154
	214	1171	20791	13231	25096	9669	10993	6944	33853	24715	61918	62937	52313	19424	293
	215	1270	55780	19546	64301	96161	60996	12584	10471	10732	131984	14279	65032	40	123
	228	1428	5671	12374	16972	23904	4357	2215	30112	299	15820	1749	4845	4582	3096
	234	508	1030	553	3699	1192	4614	5370	3657	2402	7178	2790	2521	0	10
Total	8924	126390	126893	175720	165936	123493	197162	80468	68146	317789	119764	161974	81499	18980	731
301-400	203	480	649	64	7467	230	3141	1369	2054	192	2982	2798	4396	0	10
	208	448	438	3341	631	908	3750	3153	454	1454	2589	6120	1816	5189	82
	211	330	10285	5685	9384	4747	6490	3016	954	1400	1462	3573	3412	26274	185
	216	384	311	484	10204	454	86	24	908	180	142	5462	937	1356	615
	222	441	2029	653	2780	281	0	105	22	281	15	463	91	1199	3
	229	567	319	7394	3150	1144	467	516	106	1397	816	96	786	656	28
Total	2650	14031	18198	33616	7764	13934	8183	4498	4904	8006	18512	14438	4004	2899	116
401-500	204	354	261	258	397	3149	316	1506	2192	0	829	683	3514	2	9
	217	268	3	9	0	0	0	0	0	0	80	0	0	0	0
	223	180	2	7	0	0	0	0	0	0	0	19	4	39	3
	227	227	486	183	291	0	36	129	0	0	101	117	137	2483	1063
	235	420	252	249	355	347	315	1584	121	24	497	334	410	465	925
Total	1908	704	695	1039	3496	667	3219	2320	24	930	1377	4004	2899	6798	16
501-750	Total	1591	nf	nf	137	140	0	0	58*	31	515	202	388	269	1097
751-1000	Total	517	nf	nf	0*	0*	0	0	0*	0	27	0	0*	0	0
Mean wt. per tow		106.55	97.98	145.21	141.35	133.8	165.06	112.26	84.46	260.03	108.42	153.94	87.02	20.3	17.62
Unadjusted total for all sampled strata		165109	157237	233916	228894	216680	267121	181731	136723	405185	175653	249133	140829	32855	28511
Upper limit		228326	255091	314420	424722	288881	1174856	241662	174398	667127	248495	336941	234034	33950	32327
Lower limit		101392	59384	153412	33067	144479	-640615	12800	9048	143243	102841	159229	48162	51160	2140
Note shaded numbers are estimates for non sampled strata and only 0-500 m strata are used in deriving these estimates.															
nf = not fished															
* Total and mean no. per tow include sampled and estimated values for depths to 500 meters. Estimates were derived from a multiplicative model using survey data to 1991.															

Note shaded numbers are estimates for non sampled strata and only 0-500 m strata are used in deriving these estimates.

nf = not fished

* Total and mean no. per tow include sampled and estimated values for depths to 500 meters. Estimates were derived from a multiplicative model using survey data to 1991.

Table 14. Cod abundance estimates (thousands of fish) from research vessel surveys in NAFO Division 3K (Fall).

Depth range (m)	Stratum area sq mi	Stratum GADUS	GADUS	GADUS	GADUS	GADUS	GADUS	GADUS	GADUS	GADUS	GADUS	GADUS	GADUS	GADUS
	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
101-200	618	1455	2031	2855	580	1899	1407	206	4806	6458	1243	221	930	671
	total	619	1588	2521	751	396	429	538	6049	6679	2593	13905	3323	1534
201-300	620	2709	17749	26203	15206	12689	4248	17610	22825	1728	31158	6449	4236	9368
	total	621	2859	14665	25646	2739	7453	6472	4603	6070	1531	4654	2854	2512
301-400	622	668	13121	23166	627	3686	2470	1128	978	552	602	234	769	520
	total	623	447	727	2255	5078	3171	2494	8321	2336	1029	1158	1879	12516
401-500	624	1618	4057	18157	13651	19455	11384	14186	62229	7112	99787	18660	4676	77314
	total	625	1274	3921	1492	3706	4743	3175	1227	3275	874	3727	829	1033
501-750	626	1456	1820	2446	6051	3695	7001	2603	3413	928	3440	1482	2312	1136
	total	627	1132	2634	5778	3909	4744	6409	8718	19062	3824	11939	3781	6936
751-1000	628	58684	105153	59697	59436	43653	58396	17578	156465	34244	35332	95376	8333	25575
	total	629	1027	6142	298	7593	876	1557	5769	11764	1015	1060	3855	1172
1001-2000	630	625	850	1340	2488	1515	1021	2169	1276	574	1723	808	2760	1340
	total	631	919	3191	759	1012	2235	911	1276	770	826	10451	1173	3238
2001-3000	632	1085	1433	2891	1008	1371	570	1955	1140	1826	624	375	2101	1853
	total	633	495	724	449	144	50	412	459	212	1348	237	431	425
3001-4000	634	544	255	388	315	225	72	306	414	82	65	177	191	2151
	total	635	2179	4283	3044	2944	3106	3552	3748	5954	10059	26717	15375	3660
4001-5000	636	638	2059	2720	8081	3246	9158	5699	13643	3323	9189	9080	7388	4637
	total	637	1463	1603	3075	741	1303	2921	4095	1304	2128	3423	1459	1977
5001-7500	638	10621	21691	24156	18518	19345	17963	32630	25702	27120	53576	32799	15826	99436
	total	639	3430	1398	1986	1060	622	347	891	526	276	1701	1178	2180
7501-10000	640	645	204	19	26	13	0	5	8	15	15	31	15	505
	total	641	1194	476	337	14	0	0	5	8	15	32	31	103
10001-20000	642	1202	571	631	430	37	14	0	0	0	0	0	0	0
	total	643	198	24	37	14	0	0	0	0	0	0	0	0
20001-30000	644	204	19	26	13	0	0	5	8	15	15	31	15	505
	total	645	3430	1398	1986	1060	622	347	891	526	276	1701	1178	2180
30001-40000	646	646	204	19	26	13	0	5	8	15	15	31	15	505
	total	647	1194	476	337	14	0	0	0	0	0	0	0	0
40001-50000	648	648	204	19	26	13	0	5	8	15	15	31	15	505
	total	649	1194	476	337	14	0	0	0	0	0	0	0	0
50001-75000	650	650	204	19	26	13	0	5	8	15	15	31	15	505
	total	651	1194	476	337	14	0	0	0	0	0	0	0	0
75001-100000	652	652	204	19	26	13	0	5	8	15	15	31	15	505
	total	653	1194	476	337	14	0	0	0	0	0	0	0	0
100001-200000	654	654	204	19	26	13	0	5	8	15	15	31	15	505
	total	655	1194	476	337	14	0	0	0	0	0	0	0	0
200001-300000	656	656	204	19	26	13	0	5	8	15	15	31	15	505
	total	657	1194	476	337	14	0	0	0	0	0	0	0	0
300001-400000	658	658	204	19	26	13	0	5	8	15	15	31	15	505
	total	659	1194	476	337	14	0	0	0	0	0	0	0	0
400001-500000	660	660	204	19	26	13	0	5	8	15	15	31	15	505
	total	661	1194	476	337	14	0	0	0	0	0	0	0	0
500001-750000	662	662	204	19	26	13	0	5	8	15	15	31	15	505
	total	663	1194	476	337	14	0	0	0	0	0	0	0	0
750001-1000000	664	664	204	19	26	13	0	5	8	15	15	31	15	505
	total	665	1194	476	337	14	0	0	0	0	0	0	0	0
1000001-2000000	666	666	204	19	26	13	0	5	8	15	15	31	15	505
	total	667	1194	476	337	14	0	0	0	0	0	0	0	0
2000001-3000000	668	668	204	19	26	13	0	5	8	15	15	31	15	505
	total	669	1194	476	337	14	0	0	0	0	0	0	0	0
3000001-4000000	670	670	204	19	26	13	0	5	8	15	15	31	15	505
	total	671	1194	476	337	14	0	0	0	0	0	0	0	0
4000001-5000000	672	672	204	19	26	13	0	5	8	15	15	31	15	505
	total	673	1194	476	337	14	0	0	0	0	0	0	0	0
5000001-7500000	674	674	204	19	26	13	0	5	8	15	15	31	15	505
	total	675	1194	476	337	14	0	0	0	0	0	0	0	0
7500001-10000000	676	676	204	19	26	13	0	5	8	15	15	31	15	505
	total	677	1194	476	337	14	0	0	0	0	0	0	0	0
10000001-20000000	678	678	204	19	26	13	0	5	8	15	15	31	15	505
	total	679	1194	476	337	14	0	0	0	0	0	0	0	0
20000001-30000000	680	680	204	19	26	13	0	5	8	15	15	31	15	505
	total	681	1194	476	337	14	0	0	0	0	0	0	0	0
30000001-40000000	682	682	204	19	26	13	0	5	8	15	15	31	15	505
	total	683	1194	476	337	14	0	0	0	0	0	0	0	0
40000001-50000000	684	684	204	19	26	13	0	5	8	15	15	31	15	505
	total	685	1194	476	337	14	0	0	0	0	0	0	0	0
50000001-75000000	686	686	204	19	26	13	0	5	8	15	15	31	15	505
	total	687	1194	476	337	14	0	0	0	0	0	0	0	0
75000001-100000000	688	688	204	19	26	13	0	5	8	15	15	31	15	505
	total	689	1194	476	337	14	0	0	0	0	0	0	0	0
10000001-200000000	690	690	204	19	26	13	0	5	8	15	15	31	15	505
	total	691	1194	476	337	14	0	0	0	0	0	0	0	0
20000001-300000000	692	692	204	19	26	13	0	5	8	15	15	31	15	505
	total	693	1194	476	337	14	0	0	0	0	0	0	0	0
30000001-400000000	694	694	204	19	26	13	0	5	8	15	15	31	15	505
	total	695	1194	476	337	14	0	0	0	0	0	0	0	0
40000001-500000000	696	696	204	19	26	13	0	5	8	15	15	31	15	505
	total	697	1194	476	337	14	0	0	0	0	0	0	0	0
50000001-750000000	698	698	204	19	26	13	0	5	8	15	15	31	15	505
	total	699	1194	476	337	14	0	0	0	0	0	0	0	0
75000001-1000000000	700	700	204	19	26	13	0	5	8	15	15	31	15	505
	total	701	1194	476	337	14	0	0	0	0	0	0	0	0
10000001-2000000000	702	702	204	19	26	13	0	5	8	15	15	31	15	505
	total	703	1194	476	337	14	0	0	0	0	0	0	0	0
20000001-3000000000	704	704	204	19	26	13	0	5	8	15	15	31	15	505
	total	705	1194	476	337	14	0	0	0	0	0	0	0	0
30000001-4000000000	706	706	204	19	26	13	0	5	8	15	15	31	15	505
	total	7												

Table 15. Cod biomass estimates (t) from research vessel surveys in NAFO Division 3K (Fall).

Depth range (m)	Stratum area	GADUS	GADUS	GADUS	GADUS	GADUS	GADUS	GADUS	GADUS									
(m)	Sq. mi.	15	29	44	58-59	71-72	87-88	101-103	117-118	132-133	146-147	160-161	175-176	191-192	209-210			
	Stratum number	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991			
101-200	618	1455	2015	3623	2319	2383	1891	2469	9363	10318	18917	3979	97	202	39	450		
	619	1588	691	1256	790	813	637	890	3004	652	811	1164	469	254	4	15	20	
	Total	3043	2696	4879	3109	3106	2528	3490	12367	10970	19228	5143	566	463	206	54	470	
201-300	620	2709	32708	55286	33699	33603	9851	33248	41781	4190	46251	11244	2721	2293	263	174	126	
	621	2859	25889	63106	5939	10935	11764	6750	14149	2229	7283	887	4361	1401	59	42	95	
	624	668	29936	40531	1742	7973	5365	1586	959	1153	232	1112	284	1597	712	44	44	
	632	447	873	3894	10165	7566	5721	13992	14163	1667	2072	2726	16458	514	1726	1217	112	
	634	1618	6907	29309	29404	40573	23579	22967	11703	11161	163994	32997	7054	11699	432	20673	108	
	635	1274	3702	2551	7902	10221	7249	3236	5457	1619	7900	1404	1423	745	195	96	62	
	636	1456	2248	5040	11959	8428	14144	6335	7065	1884	4489	3011	4087	649	142	39	45	
	637	1132	3540	10613	7871	9829	13256	17317	34548	6209	17860	7109	11429	4815	579	475	16	
	Total	12162	105803	210332	108681	129178	9029	105351	119835	29912	251002	59610	48645	127400	4993	23428	608	
301-400	623	1027	11293	7522	15746	2175	4849	12071	20190	2303	2182	7108	1041	3353	1665	178	284	
	625	850	1825	5538	4626	2640	4817	3499	1397	2935	1446	4490	2549	3446	657	152	48	
	626	919	6976	1940	3242	4781	2076	3322	1653	1735	12331	1914	327	1696	31	36	26	
	628	1085	2729	6206	2739	3848	1480	3841	2112	3000	842	658	2329	1739	397	798	279	
	629	495	1145	1070	337	150	1255	1167	832	346	2066	322	270	443	273	5	76	
	630	544	531	1019	1174	939	448	847	708	230	84	327	415	3726	191	49	18	
	633	2179	6947	6379	8073	8406	8482	6558	10361	16779	45140	68625	6307	40630	50281	33839	929	
	638	2059	4210	13362	7161	17706	10143	23310	5511	13654	13234	12674	6547	92164	125506	41930	750	
	639	1463	2204	5734	1949	3225	8335	9295	2884	3349	5372	2526	3185	1589	5031	22727	185	
	Total	10621	37850	48770	45047	43870	41935	64520	45948	44531	82697	56844	22970	148786	184032	99714	2595	
401-500	622	632	457	830	527	1257	561	287	646	79	451	47	353	2249	416	90	83	
	627	1194	688	1257	796	267	330	601	318	127	2121	350	446	1580	1319	218	114	
	631	1202	674	1589	1000	451	0	1489	72	220	113	1200	2165	9010	1930	1767	203	
	640	194	61	115	71	0	0	81	119	59	11	45	216	841	97	302	4889	
	645	204	52	99	51	0	54	42	176	130	77	47	77	197	123	0	12	
	Total	3430	2132	3890	2464	1975	945	2500	1331	615	2775	1689	3257	13877	3885	2377	5301	
501-750	Total	917	nf	nf	nf	0	0	88	0	0	nf	73	nf	nf	28	44	66	
	Total	1340	nf	nf	nf	0	0	nf	0*	0	nf	0*	nf	nf	16	7	0	
	Total**	148491	267871	159301	178219	136337	175941	179471	8011	8172	3917	1622	5614	3435	1323	87.94	57.18	4.09
	Mean wt per tow	67.61	121.97	72.54	81.15	62.08	133310	172458	175308	86030	356120	123286	75437	290526	193116	125573	8974	
	Unadjusted total for all sampled strata	143132	259102	153728	175023	133310	172458	175308	86030	356120	123286	75437	290526	193164	125625	9040		
	Upper limit	216442	426246	201839	237799	159091	216591	228070	107721	798817	180376	285967	542668	382515	24831	29925		
	Lower limit	69822	91937	105616	112247	107529	128325	122545	64338	-84576	66340	-135093	38385	3812	46418	-1184		

Note: shaded numbers are estimates for non sampled strata and only 0-500 m strata are used in deriving these estimates.

nf = not fished

* not all strata fished

** total and mean wgt. per tow includes sampled and estimated values for depths to 500 meters. Estimates were derived from a multiplicative model using survey data to 1991.

Table 16. Cod abundance estimates (thousands of fish) from research vessel surveys in NAFO Division 3I (Cell).

Depth range (fath)	Stratum number	Stratum (sq mi.)	ATC 1981	ATC 1982	WT 1981	WT 1982	AN	WT 1983	WT 1984	WT 1985	WT 1986	WT 1987	WT 1988	WT 1989	WT 1990	WT 1991	WT 1992	WT 1993
31-50	350	2021	4923	2332	6335	15485	13498	15197	4785	3902	3327	1498	1826	505	622			
	363	1780	802	1960	13050	19314	40059	2439	6770	9193	12169	12259	1377	2517	134			
	371	1121	105	1010	4679	8018	1058	151	1330	1963	105	2844	168	280	28			
	372	2460	14254	8679	37532	27415	21453	6039	21406	5128	8956	54511	781	585	87			
	384	1120	168	273	6025	20303	452	52	8589	336	67	19295	103	40	32			
	Total	8552	20254	14254	67621	90565	77320	23878	42880	20522	24614	90407	4254	3927	903			
51-100	328	1519	373	469	684	285	385	4598	257	928	309	114	76	274	76			
	341	1574	1930	975	1359	1512	945	1287	144	266	74	217	236	79	118			
	342	585	381	1039	274	439	205	219	176	132	44	417	66	29	0			
	343	525	897	263	328	2089	236	617	131	210	13	236	53	158	26			
	348	2120	1724	3310	1953	7002	1284	1999	1008	1194	1432	984	557	517	147			
	349	2114	2154	1492	1622	8059	3047	2739	681	2257	730	1111	1587	32	635			
	364	2817	963	1113	1629	8162	1774	964	1012	2145	442	2397	159	169	352			
	365	1041	8693	2090	578	8400	684	1583	521	375	234	195	547	104	26			
	370	1320	173	413	727	7799	561	248	380	255	66	357	66	165	66			
	385	2356	44	309	318	1827	118	702	197	27	16	354	106	212	0			
	390	1481	37	111	111	2483	48	241	764	125	79	111	0	37	0			
	Total	17452	17369	11574	9583	48057	9287	15197	5271	7914	3439	6493	3453	1776	1448			
101-150	344	1494	2075	5047	1103	3701	2978	2464	1654	977	881	2093	336	1009	393			
	347	983	2706	2915	2041	2976	576	1290	553	2966	1476	7600	148	74	129			
	366	1394	5197	8022	4447	6221	18207	23099	9433	23992	6278	2703	5454	14704	942			
	369	961	2669	1371	2525	2803	1960	21671	5194	3203	418	866	4408	334	62			
	386	983	861	553	1324	1513	1269	5737	1107	1004	1550	2287	49	123	49			
	389	821	640	1756	1127	811	961	985	3374	1017	1263	801	1335	0	0			
	391	282	74	95	635	32	635	95	169	32	64	191	28	7	21			
	Total	6918	14222	19759	13202	18057	26586	55341	21484	33191	11930	16541	11758	16251	1596			
151-200	345	1432	2015	3637	2929	2300	4658	5105	3386	4208	2319	2826	618	242	358			
	346	865	5822	2337	4389	1731	3441	5089	11834	10259	4091	4523	10631	10783	242			
	368	334	1316	1429	4313	602	2871	6168	1617	1580	928	4162	9540	10568	4240			
	387	718	808	3000	2182	3072	1253	10618	880	377	305	1590	1046	683	790			
	388	361	305	253	534	528	461	516	149	339	935	420	271	135	108			
	392	145	22	147	33	103	60	16	5	38	16	65	47	4	7			
	Total	3855	10288	10803	14382	8336	12744	27512	17871	16801	8594	13586	22153	22415	5745			
201-300	Total	1142	nf	20*	nf	410	90	0*	nf	nf	nf	180*	404	541	2390			
301-400	Total	804	nf	nf	0*	0*	0	0*	nf	nf	nf	0*	13	0	31			
Total **		62133	56390	104788	165015	125937	121928	87506	78428	48577	127027	41618	44369	9692				
Mean no. per tow		22.51	20.43	37.96	59.78	45.62	44.17	31.70	28.41	17.60	46.02	15.08	16.07	3.51				
Unadjusted total for all sampled strata		60719	55689	94623	165427	126027	121411	87505	78427	48578	127207	42036	44909	11966				
Upper limit		83412	67092	123050	197373	175608	169896	109122	98525	65582	185198	53941	68984	20008				
Lower limit		38025	44285	66195	133482	76446	72925	65889	58329	31575	69216	30131	20834	3923				

Note: shaded numbers are estimates for non sampled strata and only 0-200 fathom strata are used in deriving these estimates.

nf = not fished

* not all strata fished

** total and mean no. per tow include sampled and estimated values for depths to 200 fathom.

Estimates were derived from a multiplicative model using survey data to 1993.

Table 17. Cod biomass (t) from research vessel cruises in NAFO Division 3L (Fall).

Depth range (fath)	Stratum number	Stratum area sq mi.	AIC 323-325 1981	AIC 333-334 1982	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
31-50	350	2071	6244	3848	8463	16498	11219	21047	6486	8216	4815	3270	3165	984	645
	363	1780	852	2009	17993	20017	40414	4605	11261	15379	13532	14606	2065	2815	128
	371	1121	137	1363	6126	11210	1304	89	2710	4404	231	4906	230	398	26
	372	2460	20737	6882	44364	27045	29915	11255	40873	9964	13626	99632	1636	778	146
	384	1120	112	1090	5941	27463	583	53	13690	911	76	33264	293	47	24
Total		8552	26082	15192	82887	102233	63435	37049	75020	38874	32280	155578	7389	5022	969
51-100	328	1519	474	530	921	299	656	3128	131	1215	437	130	84	930	33
	341	1574	2146	901	1949	1760	957	1793	309	561	69	582	463	87	56
	342	585	834	951	263	736	205	233	167	237	60	257	186	65	0
	343	525	1419	279	661	2261	99	690	194	269	39	234	30	138	35
	348	2120	2651	4249	3125	11537	1995	2384	1512	1973	1312	1026	645	500	124
	349	2114	3604	3174	2266	8257	3856	3211	1069	3835	1238	1681	2444	37	608
	364	2817	1932	1800	1946	4536	1419	1298	1521	3309	773	2536	482	256	278
	365	1041	17904	3702	961	3624	977	1512	1087	1035	316	205	1288	1589	55
	370	1320	300	446	1184	7891	597	69	842	562	116	520	160	332	64
	385	2356	38	43	1019	1886	94	1095	951	326	64	711	124	278	0
Total		17452	31311	16133	15197	43917	10864	15448	8060	13526	4532	7947	5906	4237	1253
101-150	344	1494	3869	7701	1682	6121	4010	3623	2019	897	854	1485	140	760	207
	347	983	4550	4805	3167	5731	996	1833	701	3852	2332	5735	122	20	132
	366	1394	9313	11920	8999	7101	27549	34160	15868	39741	8412	3593	6226	15681	936
	369	961	7755	2290	5849	3962	4557	33585	12236	6341	2034	1683	6328	351	78
	386	983	1414	1430	3410	2546	4162	13630	2869	4044	4007	5653	49	143	93
	389	821	371	3426	1999	2737	2521	1723	1733	704	2009	1875	907	0	0
	391	282	66	487	159	79	325	370	70	6	23	165	15	1	10
Total		6918	27937	32061	25175	28277	44120	88924	35496	55585	19671	20189	13787	16956	1456
151-200	345	1432	4703	7686	6443	3673	8104	9106	5375	7693	4028	3034	520	222	263
	346	865	12012	4212	7746	3003	5805	7670	19771	18031	7978	6309	10822	11524	226
	368	334	5948	3604	11086	1222	6011	12300	5353	4319	3165	7317	11827	12239	3991
	387	718	1334	9216	5885	7465	4056	20225	2740	1289	476	8644	1733	820	722
	388	361	459	461	901	616	1951	652	115	366	1362	1066	258	125	91
	392	145	29	220	109	68	106	11	8	41	22	120	30	1	6
Total		3855	24485	25399	32172	16047	26033	49964	33362	31739	17031	26490	24990	24931	5299
201-300	Total	1142	nf	20*	nf	1224	721	0*	nf	nf	nf	522*	647	787	1932
301-400	Total	804	nf	nf	0*	0*	0	0*	nf	nf	nf	0*	32	0	21
Total **		111815	88785	155431	190474	164452	191385	151938	139724	73514	210204	52072	51146	8977	
Mean wt. per tow		40.50	32.16	56.30	70.00	59.57	69.33	55.04	50.61	26.63	76.14	18.86	18.01	3.25	
Unadjusted total		109819	87997	131268	191702	165169	190732	151936	139726	73514	210725	52750	50506	10808	
Upper limit		153245	105967	175408	226109	213267	264592	191200	172522	92871	319223	67681	77415	18480	
Lower limit		66392	70027	87127	157294	117071	116872	112672	106929	54156	102228	37820	23596	3136	

Note shaded numbers are estimates for non sampled strata and only 0-200 fathom strata are used in deriving these estimates.

nf = not fished

* not all strata fished

** total and mean wt. per tow include sampled and estimated values for depths to 200 fathom.

Estimates were derived from a multiplicative model using survey data to 1993.

Table 18. Abundance and biomass for Divisions 2J and 3K.

Strata in this table are those in the new stratification scheme shown in figures 6 and 8.

2J					3K				
Depth range (m)	Stratum number	Stratum area sq mi.	GADUS 236-239 1993	GADUS 236-238 1993	Depth range (m)	Stratum number	Stratum area sq. mi.	GADUS 236-237 1993	GADUS 236-238 1993
ABUNDANCE BIOMASS					ABUNDANCE BIOMASS				
101-200	201	633	0	0	101-200	618	1347	236	110
	205	1594	17	16		619	1753	197	148
	206	1870	53	24		Total	3100	433	258
	207	2246	156	49	201-300	620	2545	191	103
	236	733	0	0		621	2736	0	0
	237	778	28	15		624	1105	47	34
	Total	7854	254	104		634	1555	58	29
201-300	202	621	0	0		635	1274	64	34
	209	680	34	10		636	1455	109	121
	210	1035	408	125		637	1132	623	434
	213	1583	119	82		Total	11802	1092	755
	214	1341	221	111	301-400	617	593	134	47
	215	1302	156	71		623	494	76	18
	223	158	0	0		625	888	67	78
	228	2196	92	63		626	1113	139	131
	234	530	0	0		628	1085	217	118
	Total	9446	1030	462		629	495	99	60
301-400	203	487	0	0		630	332	0	0
	208	588	0	0		633	2067	155	107
	211	251	72	58		638	2059	1182	791
	216	360	0	0		639	1463	198	114
	222	450	51	41		Total	10589	2267	1464
	229	536	40	8	401-500	622	691	91	48
	Total	2672	163	107		627	1255	283	120
401-500	204	288	0	0		631	1321	0	0
	217	241	18	17		640	69	38	27
	227	598	135	93		645	216	22	24
	235	414	104	48		650	134	134	82
	240	133	5	7		TOTAL	3686	568	301
	Total	1674	262	165	501-750	641	230	6	8
501-750	212	557	21	25		646	325	16	12
	218	362	0	0		651	359	9	14
	224	228	0	0		Total	914	31	34
	230	185	0	0	751-1000	642	418	21	21
	239	120	5	5		647	360	0	0
	Total	1452	26	30		652	516	52	85
751-1000	219	283	0	0		Total	1294	73	106
	231	186	0	0	TOTAL*				
	236	193	0	0	MEAN*				
	Total	662	0	0					
	TOTAL*		1709	838				4360	2778
	MEAN*		1.09	0.53				1.99	1.27
TOTAL**	23760	1735	868		Total			4464	2918
UPPER		2431	1145		UPPER			5764	3830
LOWER		1034	589		LOWER			3163	2007

* Totals and means are for strata <= 500 meters.

** Totals and limits are for all strata fished.

Table 19. Cod abundance estimates (thousands of fish) from research vessel surveys in NAFO Division 3L (Spring).

Depth range (fath)	Stratum number	Stratum area sq. mi.	ATC 1978	ATC 1979	ATC 304-305	ATC 1980	ATC 1981	ATC 1982	WT 1985	WT 1986	WT 1987	WT 1988	WT 1989	WT 1990	WT 1991	WT 1992	WT 1993
31-50	360	2071	1373	7756	2798	829	1221	15883	5893	6685	32355	9836	2199	369	71	17	
	363	1780	2378	7649	1817	3296	1924	7182	7429	11194	14621	3982	2119	363	59	50	
	371	1121	477	1599	2917	0	189	8061	926	1647	1178	1501	996	15483	17	17	
	372	2460	9022	6135	3293	5032	1477	27099	12451	9290	13346	4281	1794	203	18	34	
	384	1120	56	2711	1555	28	42	98	1906	2174	387	280	84	147	0	17	
	Total	8552	13306	25850	12380	9185	4853	58323	28605	30990	61887	19880	7192	16565	165	135	
51-100	328	1519	104	296	243	0	342	257	443	794	285	0	1124	76	0	76	
	341	1574	325	827	1024	1004	2150	3505	1661	2599	8330	1669	591	59	0	0	
	342	585	922	132	417	132	278	586	454	307	176	454	176	0	29	29	
	343	525	867	768	1399	887	2374	1103	719	381	801	1340	105	99	39	20	
	348	2120	2361	3687	3456	887	2467	4986	5450	10702	8391	4367	1345	60	18	20	
	349	2114	4628	4035	2997	595	3729	7016	6767	4616	5951	11148	1092	175	53	71	
	364	2817	599	4705	2996	1128	1304	5821	3483	8064	5286	7250	2115	308	0	35	
	365	1041	391	2481	1035	977	4689	1797	1516	5798	5236	2683	430	59	20	0	
	370	1320	363	817	1486	0	248	7394	805	4742	2715	4013	212	11593	0	33	
	385	2356	59	783	3139	59	0	2087	258	514	849	3493	611	4863	35	96	
	390	1481	1056	2223	1223	389	139	358	97	79	0	125	22	67	19	37	
	Total	17452	11675	20754	19415	6058	17720	34910	21653	38596	38020	36542	7823	17359	213	417	
101-150	344	1494	11607	15981	7947	29001	9168	695	4864	449	841	5239	299	45	79	37	
	347	983	6272	5737	10212	3247	10773	1668	5519	2410	5003	1439	221	92	18	37	
	366	1394	9200	11118	5232	56749	18521	41420	20339	13214	4133	10215	3645	4238	52	60	
	369	961	577	2813	6757	7286	1876	10950	9534	6810	10929	5134	1890	1205	36	0	
	386	983	615	2749	2066	2693	812	5372	1783	3011	3320	6924	14920	6911	37	30	
	389	821	1130	1464	5259	1140	2712	8677	1380	1150	1335	1430	447	760	41	0	
	391	282	201	1117	1757	688	191	476	603	286	127	191	2593	445	0	0	
	Total	6918	29602	40979	39230	100804	44053	69258	44022	27330	25688	30572	40105	13696	263	164	
151-200	345	1432	5321	1800	6385	15264	2714	2107	13160	21498	7820	12860	2069	1496	125	54	
	346	865	1876	1380	1125	2727	801	714	16999	6324	4058	3360	52513	760	276	130	
	368	334	574	56	113	1880	639	1492	4250	5382	238	1270	14491	167	2269	263	
	387	718	198	256	108	296	1419	24226	5686	189	552	2878	43939	17660	8192	1078	
	388	361	257	190	41	393	989	488	2520	14	244	289	13603	1805	501	650	
	392	145	44	178	5	196	218	1618	403	5	234	98	2961	528	11	27	
	Total	3855	7870	3860	7777	20756	6780	30845	43018	33412	13146	20755	129576	22416	11374	2202	
201-300	Total	1142	nf	nf	nf	204*	nf	329	nf	nf	nf	nf	nf	3498*	26821	320	
301-400	Total	804	nf	nf	nf	nf	nf	0	nf	nf	nf	nf	nf	144*	26	0	
Total **		62453	91443	78802	136803	73406	193336	137298	130328	138741	107749	168606	70036	12015	2918		
Mean no. per tow		22.62	33.12	28.54	49.55	26.59	70.03	49.74	47.21	50.26	39.03	61.07	25.37	4.35	1.06		
Unadjusted total for all sampled strata		51099	91444	78561	136875	73406	193665	137300	130329	138741	107747	168604	65810	38863	3238		
Upper Limit		72936	113863	93294	267984	94173	255913	161283	179958	177548	126081	263989	110424	360368	7083		
Lower Limit		29262	69024	63828	5766	52638	131418	113317	80699	99933	89414	73220	21196	283142	-606		

Note shaded numbers are estimates for non sampled strata and only 0-200 fathom strata are used in deriving these estimates.

nf = not fished

* not all strata fished

** total and mean no. per tow. Include sampled and estimated values for depths to 200 fathom.

Estimates were derived from a multiplicative model using survey data to 1991.

Table 20. Cod biomass estimates (t) from research vessel surveys in NAFO Division 3J (Spring)

Depth range (fath)	Stratum area sq mi.	Stratum number	ATC 1978	ATC 1979	ATC 304-305	ATC 1980	ATC 1981	ATC 1982	WT 1985	WT 1986	WT 1987	WT 1988	WT 1989	WT 1990	WT 1991	WT 1992	WT 1993
31-50	350	2071	2108	13637	7124	2539	4775	31785	16344	19008	56567	22760	8359	1059	170	24	
	363	1780	3923	11237	4182	7082	6721	14881	12152	19419	23096	8070	8270	1433	343	19	
	371	1121	1492	2439	8148	0	789	15647	3184	4122	4005	4080	3282	25696	6	6	
	372	2460	7015	8342	7448	7155	3978	44792	19171	22017	27917	12397	8981	883	69	56	
	384	1120	19	3521	2480	308	231	284	3667	3681	844	549	578	381	0	41	
	Total	8552	14557	39176	29382	17084	16494	107389	54518	68247	112429	47856	29470	29452	588	146	
51-100	328	1519	105	518	328	0	893	74	838	1897	456	0	3577	59	0	97	
	341	1574	1007	2468	3291	2038	8495	4735	8022	12076	16947	4772	3291	167	0	0	
	342	585	3014	409	961	277	871	429	1639	604	307	483	509	0	2	6	
	343	525	1791	1190	2936	946	4768	795	1502	1064	1346	1511	92	31	2	2	
	348	2120	3551	7129	7855	1966	5709	7904	11590	33966	23118	9796	3958	229	3	8	
	349	2114	8890	8800	7282	1321	10182	16005	27730	14008	17951	28008	1622	573	34	12	
	364	2817	929	7884	7154	2361	3938	9837	9223	20328	13755	18200	10495	709	0	59	
	365	1041	533	2953	2442	2090	6056	2160	3329	9791	8361	5262	1373	68	51	0	
	370	1320	368	1046	2807	0	99	7054	3511	7679	5896	6663	980	12956	0	29	
	385	2356	80	1118	6278	413	0	2084	424	1066	2133	3088	792	6510	41	91	
	390	1481	796	2125	2798	500	217	261	406	503	0	197	63	367	37	29	
	Total	17452	21064	35640	44202	11912	41228	51338	68214	102982	90270	77980	26752	21669	170	333	
101-150	344	1494	20390	19398	10172	50712	19583	648	8032	1023	1121	5808	183	6	15	6	
	347	983	8502	7705	16019	8043	21435	3416	10419	4919	8818	2386	312	15	22	15	
	366	1394	7733	11509	5912	81497	21817	45178	30705	19201	7551	13832	5895	4074	35	65	
	369	961	1000	2448	7406	9378	4959	19297	11488	11564	16889	9252	3960	1318	31	0	
	386	983	252	2881	2361	4593	1279	3877	1906	4368	3274	6748	38420	6640	92	37	
	389	821	1065	1098	6923	478	1664	6169	900	647	692	616	513	226	64	0	
	391	282	356	1048	2064	1212	95	429	826	201	41	95	621	283	0	0	
	Total	6918	39298	46087	50857	155913	70832	79014	64276	41923	38386	38737	49904	12562	259	123	
151-200	345	1432	10700	4844	11674	29493	6060	2939	17444	28741	11340	18456	2048	2324	167	17	
	346	865	1660	2137	2154	4307	1223	341	20427	8298	5203	4496	57484	666	213	82	
	368	334	542	239	796	1761	809	1536	6412	7166	652	2503	18601	281	1407	195	
	387	718	184	459	256	243	2353	21491	6555	195	520	2506	28531	9249	8121	650	
	388	361	182	349	108	190	1321	346	1572	10	179	122	14910	1005	241	486	
	392	145	66	189	0	128	256	2237	435	3	98	57	1162	179	10	5	
	Total	3855	13334	8217	14988	36122	12022	26890	52845	44413	17992	28140	122736	13902	10159	1435	
201-300	Total	1142	nf	nf	nf	225*	nf	887	nf	nf	nf	nf	nf	nf	3434*	16712	208
301-400	Total	804	nf	nf	nf	nf	nf	0	nf	nf	nf	nf	nf	nf	258*	30	0
Total **			88253	129120	139429	221031	140576	266631	239853	257565	259077	192713	228862	77585	11176	2037	
Mean wt. per tow			31.97	46.77	50.51	80.07	50.92	96.58	86.89	93.3	93.85	69.81	82.9	28.1	4.05	0.74	
Unadjusted total for all sampled strata			78212	129117	139030	220979	140578	267516	239857	257566	259080	192713	228865	72416	27919	2248	
Upper limit			102912	155685	166966	407989	171827	338672	278798	321060	325467	226139	335403	141984	227097	4773	
Lower limit			53513	102549	111095	33969	109329	196360	200917	194071	192693	159288	122327	2847	-171259	-277	

Note shaded numbers are estimates for non sampled strata and only 0-200 fathom strata are used in deriving these estimates.

nf =not fished

- * not all strata fished

** total and mean wgt. per tow include sampled and estimated values for depths to 200 fathom.

Estimates were derived from a multiplicative model using survey data to 1991.

Table 21. Biomass estimates ('000 t) of cod from the autumn research vessel surveys in NAFO Division 2J, 3K, and 3L. (Depths to 500 m - 2J and 3K - and 400 fms - 3L.)

Table 22. MEAN NUMBERS PER TOW OF COD AT
AGE FROM AUTUMN RV SURVEYS IN DIVISION 2J.

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	0.00	0.00	0.36	0.00	1.06	1.99	0.52	0.06	0.03	0.08	0.75	0.24	0.12	0.01	0.00	0.00
2	0.50	0.31	1.54	4.16	3.09	14.10	5.30	1.51	2.28	0.41	2.55	12.85	1.39	1.29	0.06	0.33
3	7.45	1.37	1.32	3.06	18.26	16.83	16.75	9.06	8.49	1.93	2.63	8.09	8.64	3.35	0.85	0.18
4	13.75	11.46	4.48	2.29	6.42	25.91	16.55	22.07	31.24	4.43	4.62	5.87	4.06	16.09	0.47	0.33
5	27.80	16.81	20.37	4.22	4.47	16.46	26.70	13.65	70.31	24.93	7.74	5.69	2.14	5.48	1.07	0.11
6	9.52	16.19	20.80	17.01	4.28	8.85	10.19	16.54	41.29	25.16	25.28	7.85	1.50	0.99	0.14	0.13
7	2.11	2.31	12.34	15.23	13.24	4.54	2.46	7.32	21.61	7.37	29.34	13.26	1.07	0.56	0.01	0.01
8	0.77	0.73	1.79	9.63	11.65	12.34	1.55	1.26	8.71	5.29	5.49	9.01	1.96	0.35	0.00	0.00
9	0.61	0.50	0.52	2.00	7.91	5.61	3.50	0.86	0.72	2.21	3.91	1.28	0.97	0.26	0.00	0.00
10	0.44	0.28	0.38	0.51	1.33	3.56	1.50	1.18	0.66	0.38	1.92	0.67	0.21	0.14	0.00	0.00
11	0.24	0.28	0.24	0.08	0.36	0.74	0.66	0.43	0.60	0.05	0.31	0.33	0.06	0.02	0.00	0.00
12	0.11	0.11	0.29	0.14	0.17	0.24	0.32	0.22	0.35	0.18	0.14	0.11	0.04	0.03	0.00	0.00
13	0.13	0.04	0.09	0.15	0.10	0.11	0.05	0.03	0.11	0.08	0.08	0.00	0.00	0.01	0.00	0.00
14	0.21	0.08	0.31	0.21	0.22	0.13	0.02	0.02	0.11	0.09	0.02	0.00	0.00	0.01	0.00	0.00
1+	63.64	50.47	64.82	58.68	72.55	111.40	86.10	74.21	186.50	72.57	84.78	65.25	22.16	28.59	2.60	1.09
2+	63.64	50.47	64.46	58.68	71.49	109.41	85.58	74.15	186.47	72.49	84.03	65.01	22.04	28.58	2.60	1.09
3+	63.14	50.16	62.92	54.52	68.40	95.31	80.27	72.65	184.19	72.08	81.49	52.16	20.65	27.29	2.54	0.76
4+	55.68	48.79	61.61	51.46	50.14	78.49	63.52	63.59	175.70	70.16	78.85	44.07	12.02	23.94	1.69	0.58
5+	41.93	37.33	57.12	49.17	43.72	52.57	46.97	41.52	144.46	65.72	74.23	38.20	7.96	7.84	1.22	0.25
6+	14.13	20.52	36.76	44.95	39.25	36.12	20.26	27.87	74.15	40.80	66.49	32.51	5.82	2.36	0.15	0.14

Table 23. MEAN NUMBERS PER TOW (ADJUSTED FOR MISSING STRATA) OF COD AT
AGE FROM AUTUMN RV SURVEYS IN DIVISION 3K.

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	0.00	0.00	0.18	0.01	0.22	0.83	0.26	0.01	0.35	0.38	1.14	1.79	1.08	0.02	0.03	0.01
2	0.25	0.13	1.01	1.25	1.71	3.36	3.23	0.65	2.41	0.90	2.43	14.36	3.82	2.05	0.34	0.56
3	2.59	2.13	1.37	5.14	1.66	7.29	5.58	2.96	4.84	2.15	4.12	15.80	18.77	5.59	0.95	0.55
4	11.29	14.46	1.98	3.22	4.72	6.17	9.64	4.56	24.10	3.88	3.18	15.91	18.07	24.42	0.78	0.48
5	13.76	23.80	11.16	3.51	4.65	10.88	7.77	6.21	29.07	9.38	3.91	11.98	12.00	17.25	1.78	0.15
6	6.31	14.15	12.19	11.72	2.61	3.33	7.98	3.09	20.18	7.26	5.36	10.53	8.75	5.92	0.66	0.18
7	2.02	3.63	2.64	8.48	5.50	2.25	2.96	2.98	10.33	3.48	2.89	11.60	6.01	2.32	0.13	0.05
8	0.94	1.82	1.27	2.63	5.36	3.96	1.48	0.92	6.22	2.44	0.97	6.62	6.65	0.93	0.03	0.01
9	0.59	0.44	0.47	0.48	1.56	3.07	2.37	0.69	2.37	1.25	0.46	3.00	2.17	0.55	0.00	0.00
0	0.46	0.38	0.32	0.23	0.60	1.07	1.43	0.64	0.79	0.62	0.27	2.18	0.66	0.25	0.00	0.00
1	0.03	0.26	0.03	0.19	0.16	0.38	0.59	0.54	0.98	0.32	0.07	0.94	0.24	0.01	0.00	0.00
2	0.09	0.06	0.19	0.19	0.07	0.16	0.28	0.16	0.68	0.17	0.09	0.35	0.06	0.02	0.00	0.00
3	0.03	0.04	0.07	0.06	0.06	0.07	0.10	0.06	0.25	0.11	0.03	0.26	0.00	0.01	0.00	0.00
4	0.03	0.12	0.13	0.11	0.12	0.23	0.21	0.05	0.18	0.23	0.07	0.17	0.00	0.01	0.00	0.00
1+	38.39	61.43	33.02	37.22	29.01	43.04	43.88	23.52	102.75	32.58	24.99	95.49	78.29	59.34	4.70	1.99
2+	38.39	61.43	32.84	37.21	28.79	42.21	43.62	23.51	102.40	32.20	23.85	93.70	77.21	59.32	4.67	1.98
3+	38.14	61.30	31.83	35.96	27.08	38.85	40.39	22.87	99.99	31.30	21.41	79.35	73.39	57.27	4.33	1.42
4+	35.56	59.18	30.46	30.83	25.42	31.56	34.82	19.90	95.15	29.15	17.30	63.54	54.62	51.68	3.38	0.87
5+	24.27	44.71	28.48	27.60	20.70	25.38	25.17	15.34	71.05	25.27	14.12	47.63	36.55	27.26	2.60	0.39
6+	10.51	20.91	17.32	24.09	16.05	14.51	17.40	9.13	41.98	15.89	10.22	35.65	24.54	10.01	0.82	0.24

Table 24. MEAN NUMBERS PER TOW (ADJUSTED FOR MISSING STRATA) OF COD AT AGE FROM AUTUMN RV SURVEYS IN DIVISION 3L.

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	0.37	0.41	0.65	0.36	0.01	0.04	0.16	0.05	0.02	0.03	0.05	0.01	0.00
2	0.36	2.74	3.58	7.58	1.22	1.15	2.77	1.68	0.70	0.69	0.80	0.39	0.25
3	6.29	1.97	13.64	11.43	9.65	2.53	2.02	4.54	4.08	6.03	1.58	2.99	0.89
4	2.62	6.60	5.27	18.89	12.84	11.82	3.91	2.38	3.68	14.08	4.41	4.58	1.39
5	2.49	2.80	7.61	5.18	10.91	10.19	9.43	4.96	1.89	9.71	4.49	4.43	0.62
6	3.72	2.07	1.41	10.52	5.17	10.44	7.13	6.09	2.56	5.60	2.59	2.78	0.30
7	5.24	1.72	1.36	1.69	3.43	3.27	3.33	4.62	2.60	3.88	0.46	0.73	0.06
8	0.97	1.56	2.36	1.18	0.71	2.47	1.31	2.16	0.99	3.05	0.25	0.06	0.01
9	0.20	0.29	1.27	1.03	0.81	0.96	1.00	1.03	0.71	1.69	0.25	0.04	0.00
10	0.07	0.09	0.45	1.08	0.40	0.38	0.10	0.54	0.21	0.67	0.09	0.03	0.00
11	0.04	0.05	0.13	0.43	0.29	0.48	0.13	0.13	0.08	0.31	0.07	0.01	0.00
12	0.03	0.06	0.06	0.25	0.11	0.26	0.22	0.10	0.04	0.20	0.02	0.02	0.00
13	0.12	0.06	0.19	0.18	0.07	0.18	0.18	0.13	0.03	0.10	0.01	0.00	0.00
1+	22.51	20.42	37.97	59.78	45.62	44.17	31.70	28.41	17.60	46.04	15.08	16.07	3.52
2+	22.14	20.01	37.31	59.42	45.61	44.12	31.54	28.36	17.58	46.01	15.03	16.06	3.52
3+	21.78	17.27	33.73	51.85	44.39	42.97	28.77	26.68	16.89	45.32	14.22	15.67	3.27
4+	15.50	15.29	20.09	40.42	34.74	40.44	26.75	22.15	12.80	39.29	12.65	12.68	2.38
5+	12.88	8.70	14.82	21.53	21.90	28.62	22.83	19.77	9.12	25.21	8.24	8.10	0.99
6+	10.39	5.89	7.22	16.35	10.99	18.44	13.41	14.81	7.23	15.50	3.75	3.67	0.37

Table 25. MEAN NUMBERS PER TOW (ADJUSTED FOR MISSING STRATA) OF COD AT AGE FROM SPRING RV SURVEYS IN DIVISION 3L.

	1977	1978	1979	1980	1981	1982	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	0.00	0.00	0.06	0.09	0.17	0.03	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00
2	0.91	0.08	0.08	1.90	0.50	1.73	1.39	0.25	0.42	0.28	0.30	0.46	0.22	0.08	0.00
3	4.15	3.65	0.84	0.88	8.98	1.57	12.17	3.44	2.39	5.15	4.17	7.74	2.47	0.97	0.25
4	5.96	6.82	9.19	3.42	7.19	9.28	18.23	12.62	5.24	4.50	8.25	18.52	7.26	3.93	0.30
5	4.63	5.43	13.94	10.46	6.40	2.35	16.44	12.73	13.43	7.48	3.51	13.17	7.27	5.94	0.20
6	2.16	3.51	6.50	8.44	10.96	2.97	8.25	9.27	12.62	16.68	3.31	4.79	4.12	1.79	0.18
7	0.65	1.58	1.54	2.13	11.17	4.17	8.16	4.39	6.68	8.03	8.88	4.61	1.22	0.47	0.07
8	0.67	0.51	0.46	0.77	2.97	3.09	1.72	3.49	2.34	4.10	6.64	5.76	1.00	0.10	0.04
9	0.44	0.43	0.12	0.15	0.77	0.93	0.76	0.77	1.83	1.47	1.85	3.30	0.97	0.02	0.00
10	0.15	0.25	0.19	0.07	0.25	0.20	1.08	0.65	0.67	1.21	0.76	1.35	0.36	0.05	0.00
11	0.10	0.19	0.08	0.12	0.08	0.07	1.20	1.11	0.48	0.34	0.64	0.59	0.34	0.00	0.00
12	0.06	0.13	0.04	0.07	0.08	0.05	0.40	0.70	0.61	0.40	0.15	0.34	0.10	0.00	0.00
13	0.05	0.03	0.03	0.02	0.04	0.12	0.16	0.23	0.38	0.35	0.21	0.26	0.04	0.00	0.00
14	0.02	0.02	0.04	0.04	0.00	0.03	0.06	0.08	0.10	0.27	0.35	0.17	0.01	0.00	0.00
1+	19.96	22.62	33.12	28.55	49.55	26.59	70.03	49.74	47.21	50.26	39.03	61.07	25.37	13.35	1.04
2+	19.96	22.62	33.06	28.46	49.38	26.56	70.03	49.74	47.20	50.26	39.03	61.06	25.37	13.35	1.04
3+	19.05	22.54	32.98	26.56	48.88	24.83	68.64	49.49	46.78	49.98	38.73	60.60	25.15	13.27	1.04
4+	14.90	18.89	32.14	25.68	39.90	23.27	56.47	46.05	44.39	44.83	34.56	52.86	22.68	12.30	0.79
5+	8.93	12.07	22.94	22.27	32.72	13.98	38.23	33.43	39.15	40.33	26.31	34.34	15.42	8.37	0.49
6+	4.30	6.65	9.00	11.81	26.32	11.63	21.79	20.70	25.72	32.85	22.79	21.17	8.15	2.43	0.29

Table 26.. MEAN NUMBERS PER TOW OF COD FROM AUTUMN RV SURVEYS IN DIV. 2J3KL.

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	0.02	0.41	0.27	0.16	0.51	1.04	0.36	0.02	0.14	0.21	0.59	0.66	0.40	0.03	0.01	0.00
2	0.40	0.32	3.00	1.59	2.49	6.09	5.57	1.10	1.85	1.56	2.14	8.25	1.91	1.34	0.29	0.37
3	5.39	1.94	2.48	5.11	5.88	12.31	10.79	7.27	4.77	2.04	3.93	8.98	10.93	3.35	1.78	0.60
4	11.51	11.78	3.83	2.74	5.93	10.65	15.23	12.35	20.70	4.03	3.20	8.30	12.95	13.97	2.30	0.83
5	13.95	16.79	13.23	3.26	3.83	10.88	11.34	10.01	31.29	13.23	5.29	6.20	8.61	9.00	2.72	0.34
6	5.51	10.53	13.31	9.67	2.79	3.88	9.59	7.28	21.29	11.61	10.57	6.52	5.64	3.31	1.42	0.22
7	1.62	2.27	4.99	8.78	5.82	2.44	2.30	4.24	10.14	4.38	10.13	8.23	3.90	1.10	0.35	0.04
8	0.63	0.92	1.19	3.66	5.31	5.35	1.37	0.92	5.26	2.67	2.58	4.84	3.98	0.50	0.04	0.01
9	0.47	0.31	0.37	0.74	2.59	2.94	2.09	0.78	1.37	1.38	1.55	1.62	1.68	0.35	0.02	0.00
10	0.33	0.26	0.23	0.23	0.57	1.42	1.30	0.67	0.58	0.34	0.79	0.98	0.55	0.16	0.01	0.00
11	0.12	0.19	0.11	0.10	0.16	0.36	0.54	0.41	0.68	0.17	0.15	0.43	0.23	0.04	0.00	0.00
12	0.09	0.06	0.16	0.11	0.09	0.14	0.28	0.15	0.42	0.19	0.11	0.16	0.12	0.02	0.01	0.00
13	0.06	0.04	0.05	0.10	0.07	0.13	0.12	0.06	0.19	0.13	0.08	0.10	0.04	0.01	0.00	0.00
1+	40.11	45.80	43.21	36.23	36.03	57.63	60.87	45.25	98.68	41.96	41.11	55.29	50.93	33.18	8.96	2.41
2+	40.09	45.39	42.94	36.08	35.52	56.58	60.51	45.23	98.54	41.74	40.53	54.62	50.53	33.15	8.94	2.41
3+	39.69	45.07	39.94	34.49	33.03	50.49	54.94	44.13	96.69	40.18	38.38	46.37	48.62	31.81	8.65	2.03
4+	34.30	43.13	37.47	29.38	27.16	38.18	44.15	36.86	91.92	38.14	34.46	37.39	37.70	28.46	6.87	1.43
5+	22.79	31.35	33.64	26.64	21.23	27.53	28.93	24.52	71.22	34.11	31.26	29.09	24.75	14.49	4.57	0.61
6+	8.84	14.57	20.41	23.38	17.40	16.66	17.59	14.50	39.93	20.88	25.97	22.89	16.14	5.49	1.85	0.27

COEFFICIENTS OF VARIATION - PERCENT

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1	25	18	33	34	23	46	26	64	28	38	33	22	25	56	53	100
2	27	22	39	22	23	28	17	16	18	24	12	15	16	24	19	29
3	21	17	53	22	18	19	16	20	16	15	17	23	17	28	18	29
4	21	22	38	20	14	23	16	18	24	13	21	36	21	29	29	30
5	24	26	27	24	17	26	20	16	31	16	19	44	31	27	34	38
6	26	32	28	29	19	28	15	14	35	18	18	37	38	25	32	35
7	24	33	24	29	20	24	15	12	36	18	17	32	40	28	31	26
8	22	32	21	32	18	25	14	9	33	18	14	31	41	27	31	44
9	21	25	22	28	16	22	13	9	32	16	14	36	37	26	50	100
10	20	26	24	26	11	25	12	9	29	17	14	47	35	29	33	100
11	27	23	33	23	15	26	12	10	25	16	13	46	30	26	0	100
12	32	28	26	23	26	24	13	11	30	15	14	54	32	43	100	100
13	43	27	32	20	15	7	13	13	23	13	13	71	29	97	100	100

Table 27. Average Weight at Age (Kg) for Cod in Division 2J.
Autumn Research Vessel Survey.

Age	Year	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
2		0.21	0.23	0.24	0.22	0.22	0.15	0.17	0.16	0.19	0.21	0.24	0.19	0.17	0.19	0.15	0.15
3		0.48	0.6	0.52	0.5	0.47	0.5	0.34	0.32	0.38	0.41	0.44	0.46	0.35	0.32	0.32	0.28
4		0.83	0.93	1.06	0.9	0.92	0.84	0.75	0.55	0.59	0.7	0.75	0.72	0.62	0.5	0.51	0.57
5		1.38	1.5	1.4	1.42	1.32	1.36	1.14	0.99	0.93	1.02	0.98	1.07	0.87	0.71	0.63	0.75
6		1.88	2.02	1.99	1.75	1.83	1.92	1.6	1.31	1.28	1.25	1.33	1.37	1.29	1.19	0.86	0.98
7		2.61	2.79	2.35	2.19	2.02	2.22	2.26	1.69	1.6	1.65	1.53	1.6	1.55	1.65	1.86	0.84
8		2.95	3.61	3.03	2.67	2.37	2.42	2.52	2.35	1.87	1.83	1.88	1.81	1.78	1.78	0	0
9		4.51	2.99	4.94	3.54	2.93	2.9	2.68	2.74	2.81	2.05	2.27	2.05	1.99	2.19	0	0
10		4.6	4.18	5.17	5.45	4.13	3.61	3.3	3.1	2.82	2.78	2.51	2.05	2.03	2.42	0	0
11		6.11	6.07	5.84	6.69	5.71	3.75	4.3	3.46	3.33	4.2	3.63	2.95	3.23	3.69	0	0
12		6.78	5.75	5.96	6.46	7.8	7.93	5.27	3.94	4.04	3.84	4.56	2.72	3.07	2.42	0	0

Table 28. Average Weight at Age (Kg) for Cod in Division 3K.
Autumn Research Vessel Survey

Age	Year	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
2		0.18	0.24	0.24	0.25	0.21	0.19	0.15	0.2	0.22	0.22	0.17	0.18	0.2	0.23	0.21	0.2
3		0.45	0.64	0.55	0.64	0.56	0.57	0.44	0.39	0.41	0.47	0.41	0.44	0.41	0.43	0.42	0.45
4		0.89	1.05	0.9	1.11	1.09	0.96	0.82	0.72	0.73	0.79	0.74	0.77	0.74	0.69	0.67	0.71
5		1.47	1.48	1.42	1.55	1.38	1.57	1.42	1.19	1.07	1.16	1.19	1.2	1.09	0.96	0.92	1.06
6		2.14	2.18	2.09	1.95	1.92	2.16	1.92	1.64	1.54	1.4	1.53	1.56	1.56	1.43	1.22	1.18
7		3	3.04	3.04	2.45	2.35	2.67	2.29	2.16	1.78	1.9	1.76	1.91	1.79	1.91	1.74	1.3
8		3.66	4.07	4	2.97	2.93	2.74	2.9	2.99	2.34	2.21	2.57	2.25	2.11	2.17	2.24	2.33
9		4	5.15	5.75	5.04	3.77	3.38	3.35	3.04	2.69	2.96	3.49	2.77	2.44	2.49	2.33	0
10		5.04	4.17	6.15	6.78	4.51	4	3.7	3.45	4.1	3.67	4.35	3.63	2.77	2.9	0	0
11		6.29	5.67	10.57	7.02	6.6	5.49	6.18	4.46	3.91	4.76	4.94	3.78	3.4	4.37	0	0
12		7.02	4.1	7.67	7.09	8.29	5.53	6.69	6.05	3.61	5.86	6.35	5	3.43	2.96	0	0

Table 29. Average Weight at Age (Kg) for Cod in Division 3L.
Autumn Research Vessel Survey

Age	Year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
2		0.2	0.2	0.21	0.14	0.16	0.18	0.17	0.18	0.2	0.17	0.23	0.18	0.23
3		0.54	0.47	0.52	0.31	0.39	0.37	0.35	0.44	0.45	0.36	0.44	0.5	0.48
4		0.78	1.1	1.01	0.72	0.72	0.72	0.75	0.78	0.75	0.79	0.75	0.77	0.8
5		1.28	1.59	1.63	1.17	1.25	1.11	1.25	1.31	1.27	1.25	1.14	1.11	1.19
6		1.97	2.26	2.16	1.85	1.72	1.74	1.81	1.74	1.8	1.82	1.57	1.4	1.5
7		2.63	3.04	2.49	2.5	2.49	2.17	2.46	2.13	2.32	2.59	1.93	1.55	2.11
8		3.49	3.64	2.99	2.83	3.48	3.05	2.91	2.66	2.9	3.21	2.74	2.55	2.17
9		5.17	5.27	3.51	4.04	3.43	3.54	3.81	2.99	3.64	3.91	3.16	3.4	0
10		7.62	7.33	3.92	4.25	5.1	4.22	4.87	3.64	5.27	4.05	3.39	2.95	6.22
11		9.9	7.78	6.83	5.67	5.88	4.98	6.18	6.31	6.15	5.15	3.51	4.23	0
12		15.39	12.99	6.33	4.47	8.43	6.09	5.65	8.24	7.38	5.96	4.91	7.67	0

Table 30. Average Weights at Age (Kg) for Cod in Division 3L.
Spring Research Vessel Survey

Age	Year	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
2		0.07	0.11	0.12	0.1	0.09	0	0	0.08	0.08	0.1	0.09	0.06	0.08	0.07	0.08	0.09
3		0.22	0.3	0.36	0.32	0.33	0	0	0.22	0.27	0.28	0.29	0.25	0.23	0.26	0.3	0.21
4		0.52	0.66	0.76	0.63	0.74	0	0	0.5	0.52	0.6	0.59	0.54	0.57	0.46	0.54	0.5
5		0.97	1.15	1.33	1.17	1.25	0	0	0.98	0.94	0.97	1.04	0.91	0.98	0.94	0.76	0.78
6		1.74	1.79	1.99	1.74	1.92	0	0	1.67	1.54	1.56	1.55	1.35	1.45	1.42	1.21	1.09
7		2.57	2.99	3	2.42	2.7	0	0	2.33	2.34	2.04	2.13	1.94	1.83	2.03	1.68	2.02
8		3.33	4.25	4.6	2.95	3.38	0	0	3.32	3.01	3.32	2.48	2.19	2.46	2.61	2.3	1.57
9		4.23	4.98	6.83	3.91	5.13	0	0	4.55	3.89	3.88	3.75	3.19	3.11	3.21	2.87	3.07
10		5.57	5.98	8.56	6.4	7.11	0	0	5.1	5.08	4.35	3.81	4.2	3.64	3.99	4.34	0
11		7.04	7.7	10.17	7.48	10.23	0	0	6.09	5.86	6.42	6.55	4.6	4.67	3.77	4.46	0
12		6.99	8.59	11.11	8.29	8.86	0	0	8.64	8.4	7.98	6.8	7.96	7.33	8.43	11.05	0

Table 31. Preliminary classification of relative year-class strength based on different data sources and compared for different time series, as available. The time series are referenced in parentheses for each data source. By-Catch - refers to juvenile cod ages 2 & 3 years caught in capelin trap nets; RV2+3 - refers to the mean catch rate of cod ages 2 & 3 years from the fall RV surveys; VPA Age 3 - refers to estimates available from the 1994 assessment document; Beach Seine - refers to the Fleming Beach Seine Surveys; Pelagic 0-Group - refers to the pelagic 0-group surveys carried out in 1981 and 1991-93; Demersal - refers to juvenile cod surveys carried out in 1992 and 1993.

Year-Class	By-Catch (1981-93)	RV2+3 (1981-93)	Beach Seine (1959-64, 1992-93) Age 0 Age 1		Pelagic 0-Group (1981 & 1991-93) 1991-93)		Demersal (1992-93) (1992-93) Age 0 Age 1	
1989-90	lowest	very low	N/A	N/A	N/A	N/A	N/A	N/A
1990-91	medium	lowest	N/A	N/A	N/A	N/A	N/A	N/A
1991	N/A	N/A	N/A	lowest	lowest	lowest	N/A	lower
1992	N/A	N/A	low	med.	low	highest	lower	higher
1993	N/A	N/A	med.	N/A	low	medium	higher	N/A

Table 32. Results from ADAPT using Autumn Research Vessel Index

	POPULATION NUMBERS (000s)														10/ 5/94	
	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
3	300363	152275	160671	359797	320664	349967	432460	338626	157808	129970	160619	182303	95684	37065	36739	22023
4	272786	244719	123630	129236	292600	260997	284190	353361	276655	128450	104303	128990	147723	71378	27531	29690
5	209089	207453	189174	90339	99320	211251	201366	219219	275894	212735	96826	72139	89647	84248	29798	19048
6	63704	135712	135923	128811	62028	64121	134410	136127	146352	185918	144911	61011	39925	40452	20291	11245
7	19658	33771	84689	84125	83021	37757	35281	75097	80757	78319	107825	75286	27139	12153	6379	5564
8	7741	9117	17713	53035	48956	44958	20015	17572	36144	42570	38362	46906	26614	7389	1748	1127
9	4072	3553	4334	10131	32701	24763	23506	9830	8008	16271	17205	14571	12616	5557	472	190
10	3176	1950	1733	2447	5422	15973	12191	11183	4577	3748	8057	5919	4061	2044	256	47
11	1054	1621	911	948	1299	2699	7340	6156	4485	1938	1850	2672	1552	733	139	30
12	635	467	820	536	497	757	1289	3715	2412	1883	975	815	654	290	20	20
13	267	321	217	464	263	265	396	647	1520	978	752	416	149	103	11	0
3+1	882545	790960	719815	859869	946769	1013510	1152443	1171534	994612	802781	681685	591028	445766	261412	123386	88983

ADAPT (6 INDEX) TUNING JUNE 1991

ZJ3KL COD

5/09/94 10:11

	FISHING MORTALITY														10/ 5/94	
	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
3	0.005	0.008	0.018	0.007	0.006	0.008	0.002	0.006	0.020	0.019	0.010	0.093	0.097	0.013	0.048	
4	0.074	0.057	0.114	0.063	0.126	0.059	0.060	0.047	0.063	0.083	0.169	0.164	0.362	0.674	0.168	0.204
5	0.232	0.223	0.184	0.176	0.238	0.252	0.192	0.204	0.195	0.184	0.262	0.392	0.596	1.224	0.775	0.214
6	0.435	0.272	0.280	0.239	0.296	0.397	0.382	0.322	0.425	0.345	0.455	0.610	0.989	1.647	1.094	0.210
7	0.568	0.445	0.268	0.341	0.413	0.435	0.497	0.531	0.440	0.514	0.632	0.840	1.101	1.739	1.533	0.149
8	0.579	0.544	0.359	0.284	0.482	0.448	0.511	0.586	0.598	0.706	0.768	1.113	1.366	2.550	2.019	0.155
9	0.537	0.518	0.372	0.425	0.517	0.509	0.543	0.564	0.559	0.503	0.867	1.078	1.620	2.876	2.116	0.130
10	0.473	0.561	0.403	0.434	0.498	0.578	0.483	0.714	0.659	0.506	0.904	1.138	1.512	2.487	1.952	0.000
11	0.613	0.481	0.330	0.447	0.339	0.539	0.481	0.737	0.668	0.487	0.620	1.207	1.477	3.405	1.745	0.000
12	0.480	0.567	0.369	0.514	0.426	0.449	0.489	0.693	0.702	0.718	0.651	1.496	1.648	3.041	6.939	0.000
13	0.561	0.502	0.333	0.350	0.470	0.464	0.517	0.561	0.533	0.574	0.756	1.010	1.362	2.388	1.890	0.072

ADAPT (6 INDEX) TUNING JUNE 1991

ZJ3KL COD

5/09/94 10:11

MEAN SQUARE RESIDUALS : 0.8724966885
 MEAN RESIDUAL : 0.000001458740949
 SUM OF ALL RESIDUALS : 0.0002333985518

Table 32 (cont'd)

	LOG RESIDUALS FROM BV													10/ 5/94		
	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
3	-0.456	-0.796	-0.598	-0.688	-0.436	-0.211	-0.131	-0.280	0.064	-0.577	-0.134	0.558	1.474	1.245	0.543	0.000
4	-0.158	-0.041	-0.431	-0.855	-0.845	-0.208	-0.068	-0.371	0.405	-0.446	-0.391	0.347	0.837	1.926	0.612	-0.450
5	-0.018	0.167	-0.014	-0.683	-0.561	-0.263	-0.224	-0.422	0.479	-0.132	-0.190	0.381	0.680	1.361	0.793	-1.352
6	0.095	-0.164	0.077	-0.226	-0.685	-0.299	-0.146	-0.490	0.606	-0.313	-0.057	0.468	1.094	1.151	0.487	-1.597
7	0.115	-0.204	-0.496	0.144	-0.190	-0.256	-0.185	-0.299	0.418	-0.324	-0.304	0.646	1.158	1.285	0.592	-2.709
8	-0.037	-0.136	-0.439	-0.480	0.134	0.214	-0.277	-0.484	0.554	-0.190	-0.060	0.684	1.287	1.578	0.007	-2.649
9	-0.038	-0.269	-0.424	-0.539	-0.368	0.027	-0.229	-0.318	0.443	-0.311	0.082	0.485	1.161	1.574	0.472	-1.825
10	-0.278	0.055	-0.100	-0.415	-0.255	-0.342	-0.243	-0.607	0.095	-0.374	-0.058	0.797	0.941	1.253	0.095	-0.682
11	-0.165	-0.235	-0.342	-0.390	-0.295	-0.041	-0.699	-0.584	0.201	-0.489	-0.444	0.759	0.905	1.666	0.442	-0.309
12	-0.733	-0.828	-0.552	-0.363	-0.575	-0.546	-0.345	-1.794	-0.349	-0.866	-0.870	0.503	0.524	1.006	6.422	-0.632

2J3EL COD

5/09/94 10:11

APPROXIMATE STATISTICS ASSUMING LINEARITY NEAR SOLUTION

ORTHOGONALITY OFFSET..... 0.006754
 MEAN SQUARE RESIDUALS 0.872497

PARAMETER	AGE	ESTIMATE	STD. ERR.	T-STAT	C.V.
<hr/>					
NUMBERS					
3		22077	20391	1.083	0.924
4		29841	18348	1.626	0.615
5		19148	10376	1.845	0.542
6		11303	6704	1.686	0.593
7		5587	3456	1.617	0.618
8		1132	708	1.597	0.626
9		191	123	1.548	0.646
10		47	33	1.417	0.706
11		30	21	1.419	0.705
12		20	14	1.425	0.702
<hr/>					
INDEX 1: BV					
3		3.42E-5	8.45E-6	4.047	0.247
4		6.35E-5	1.53E-5	4.139	0.242
5		1.01E-4	2.43E-5	4.158	0.241
6		1.41E-4	3.39E-5	4.148	0.241
7		1.49E-4	3.57E-5	4.158	0.240
8		1.74E-4	4.18E-5	4.152	0.241
9		2.21E-4	5.33E-5	4.135	0.242
10		2.55E-4	6.16E-5	4.139	0.242
11		2.74E-4	6.62E-5	4.142	0.241
12		5.68E-4	1.36E-4	4.186	0.239

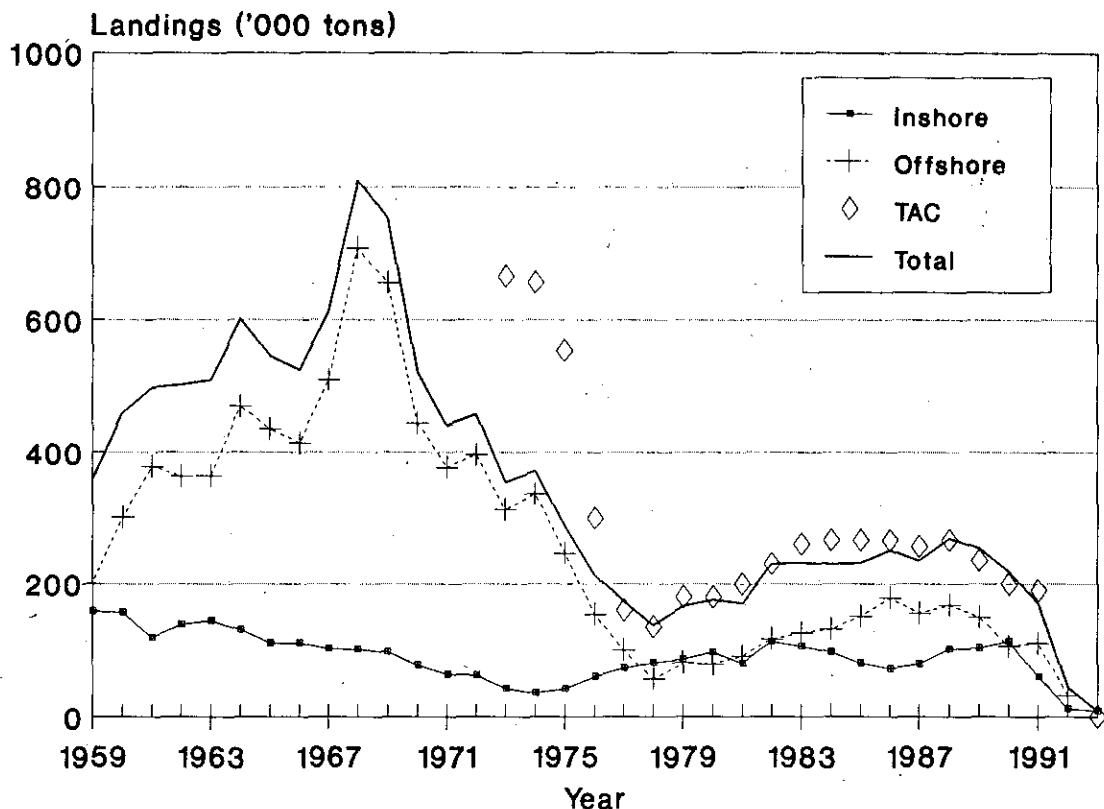


Figure 1. Cod in Divisions 2J3KL:
Inshore and offshore landings and TAC's.

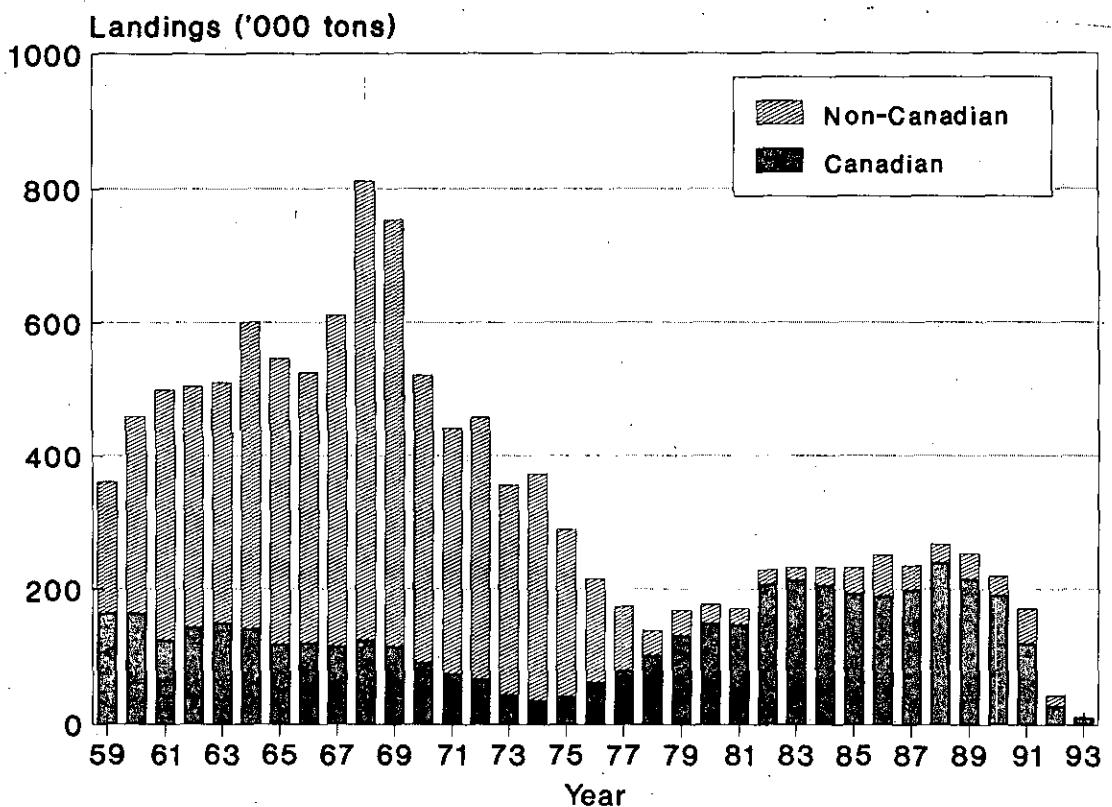


Figure 2. Landings of cod in Divisions
2J3KL by Canadian and other vessels.

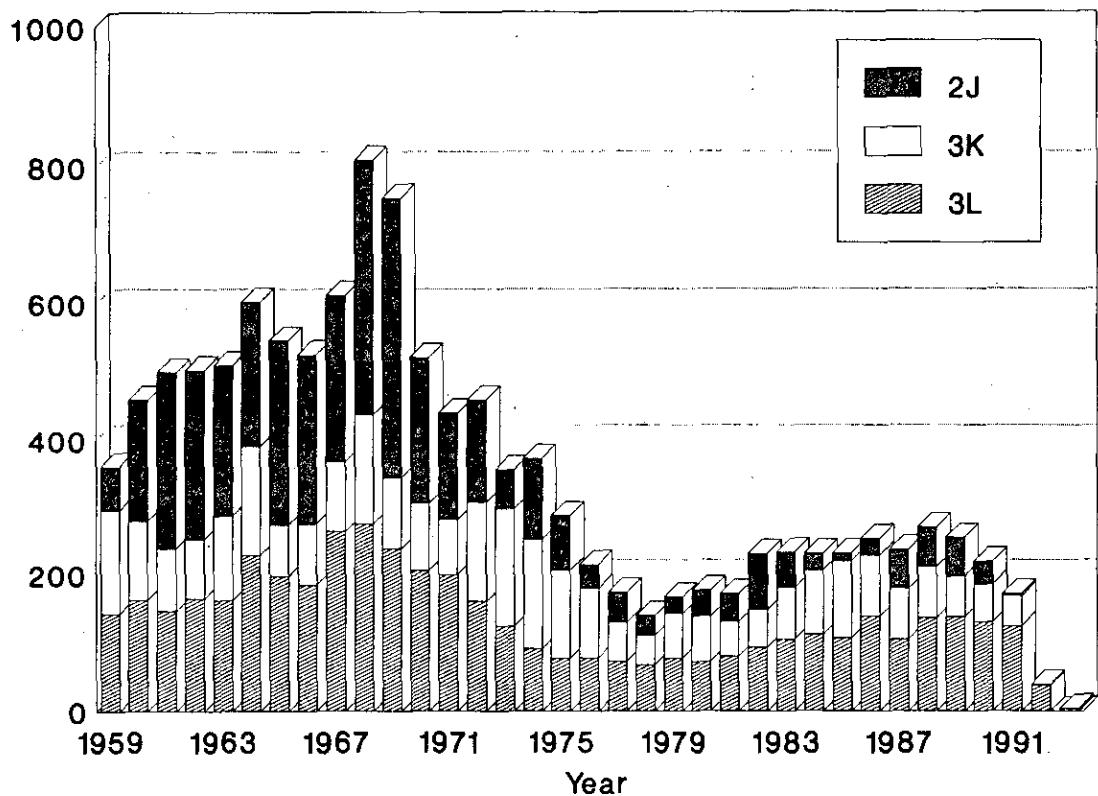


Figure 3. Cod in Divisions 2J3KL:
Landings by Division.

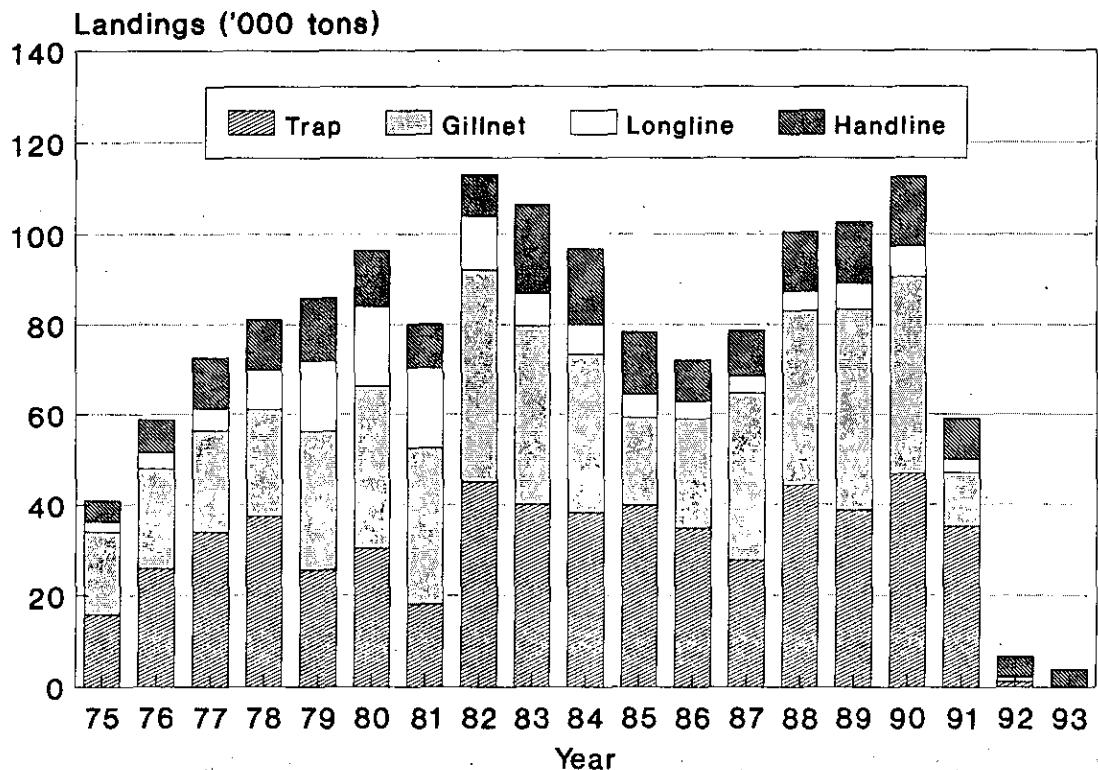


Figure 4. Cod in 2J3KL: Inshore
landings by gear. An additional 5000t
from Recreational Fishery is not shown

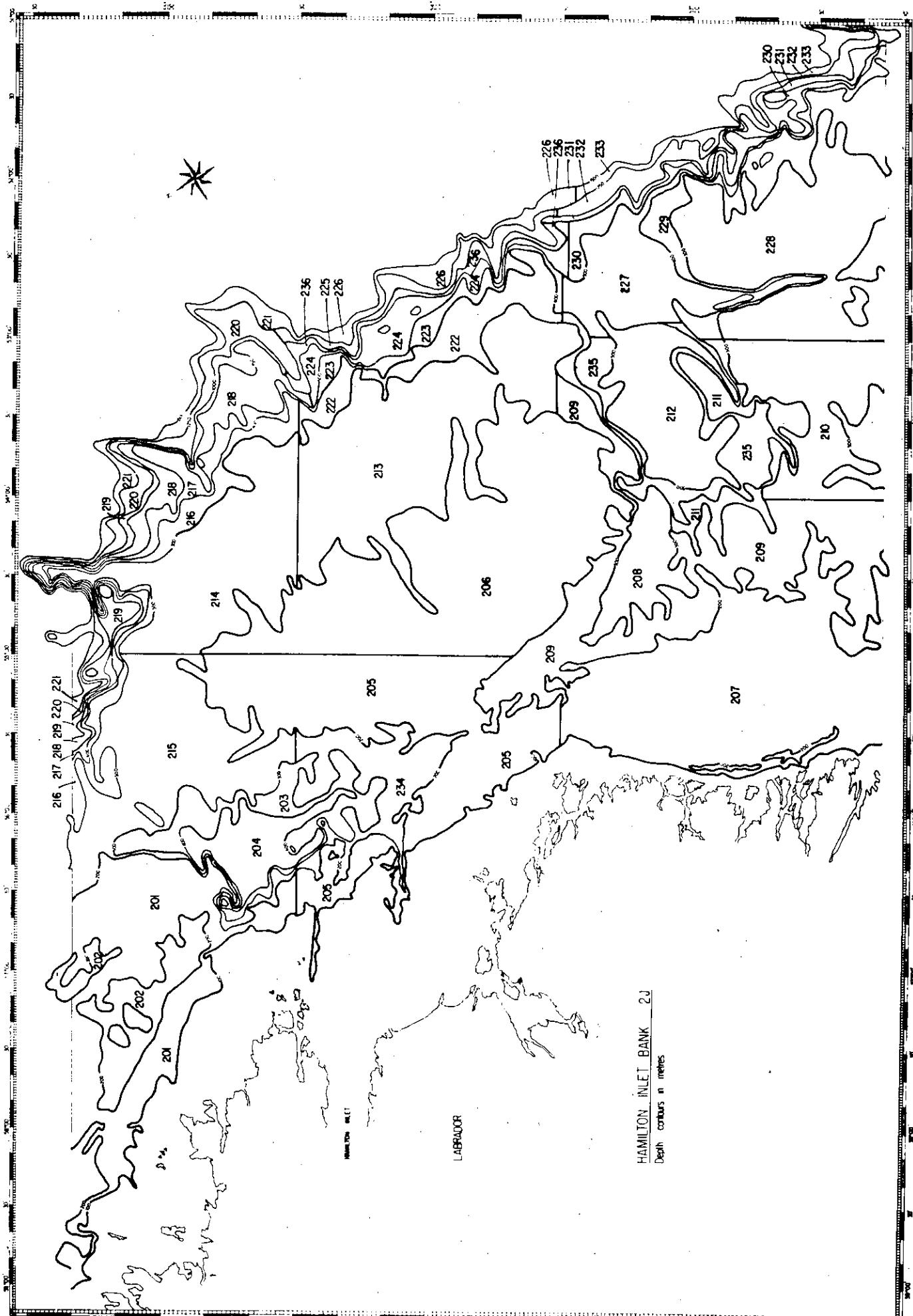


Fig. 5. Area of stratification for Research Vessel surveys in NAFO division 2J.

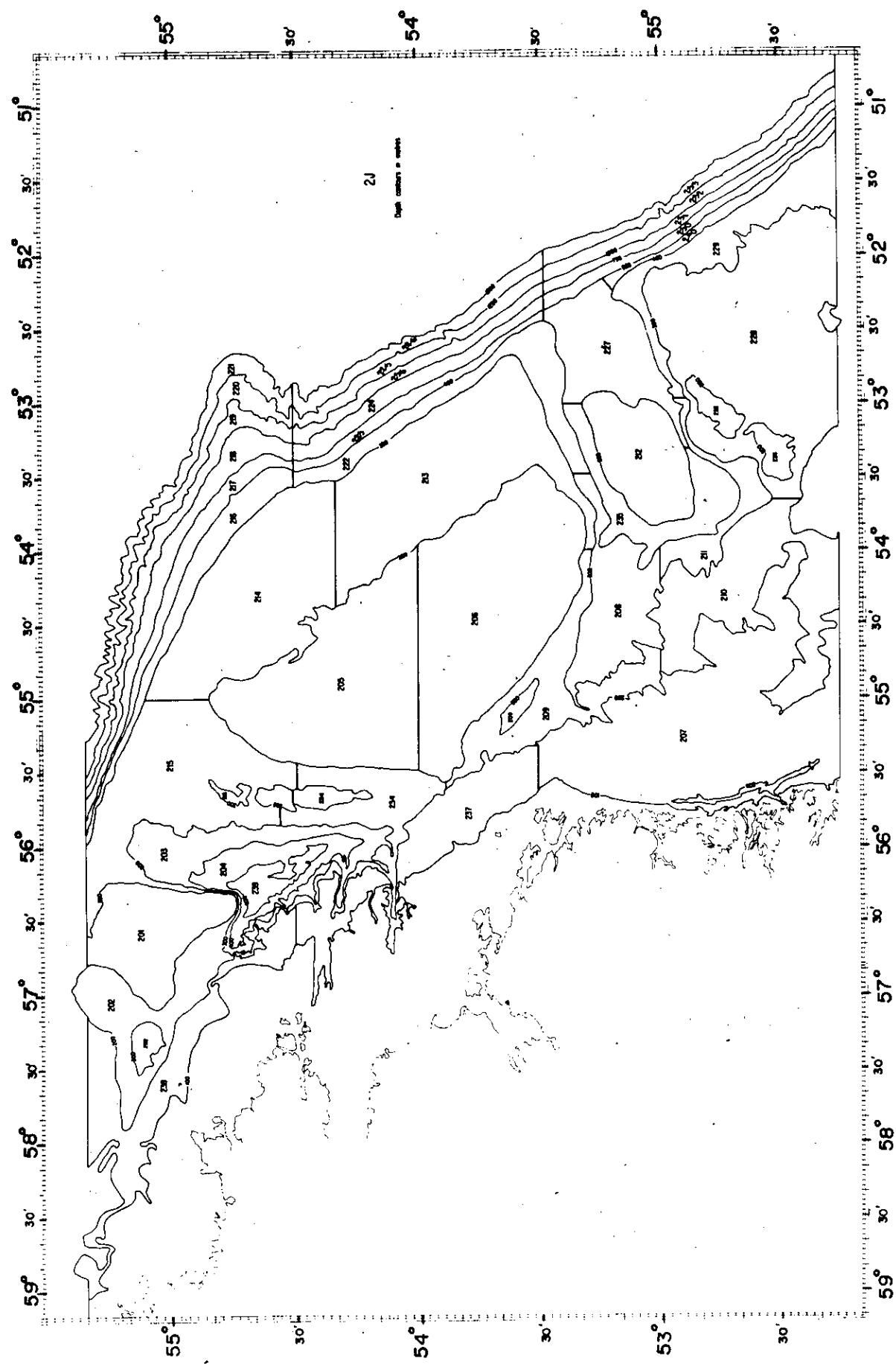


Fig. 6. Revised area of stratification for research vessel surveys in NAFO Division 2J.

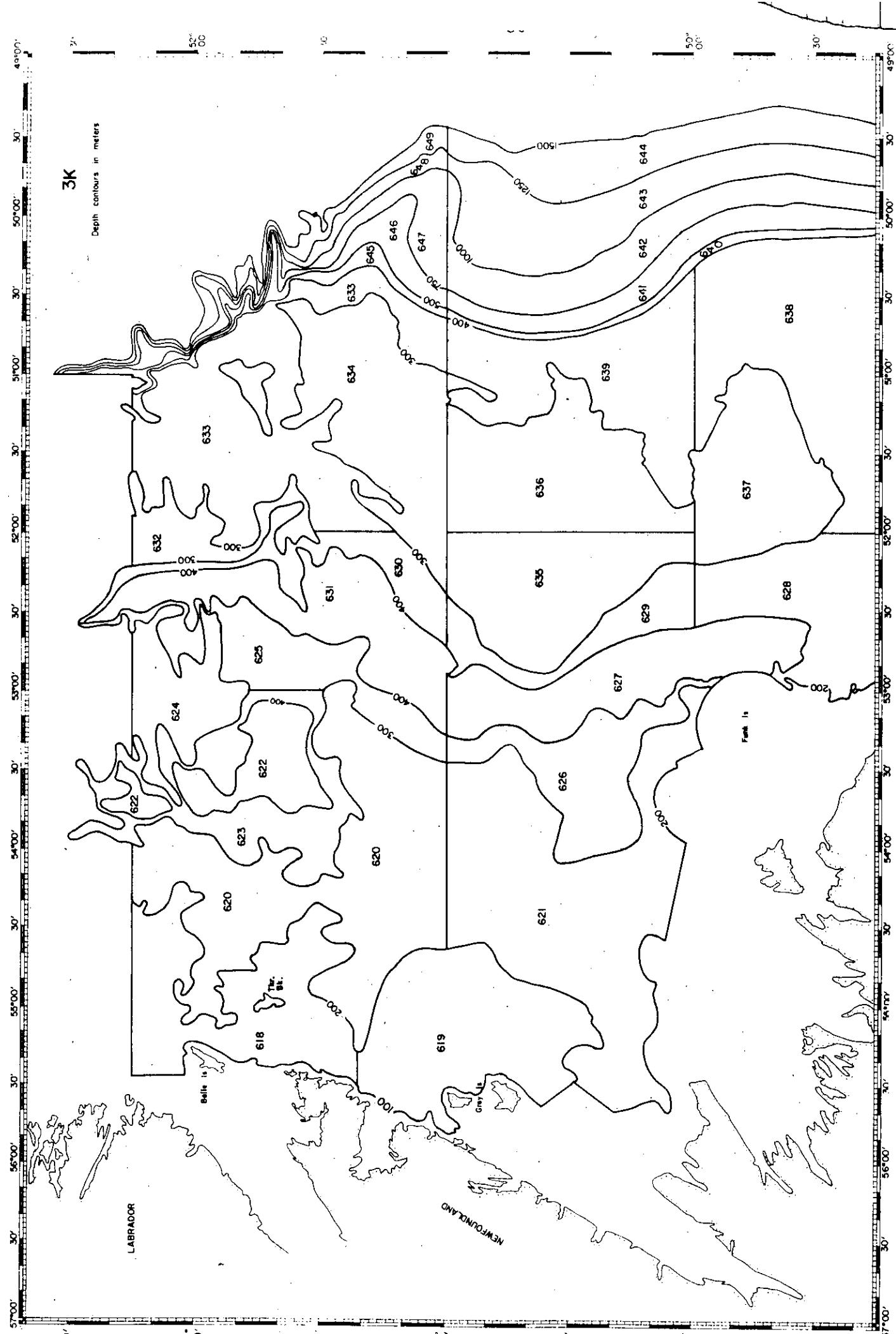


Figure 7. Area of stratification for Research Vessel surveys in NAFO division 3K.

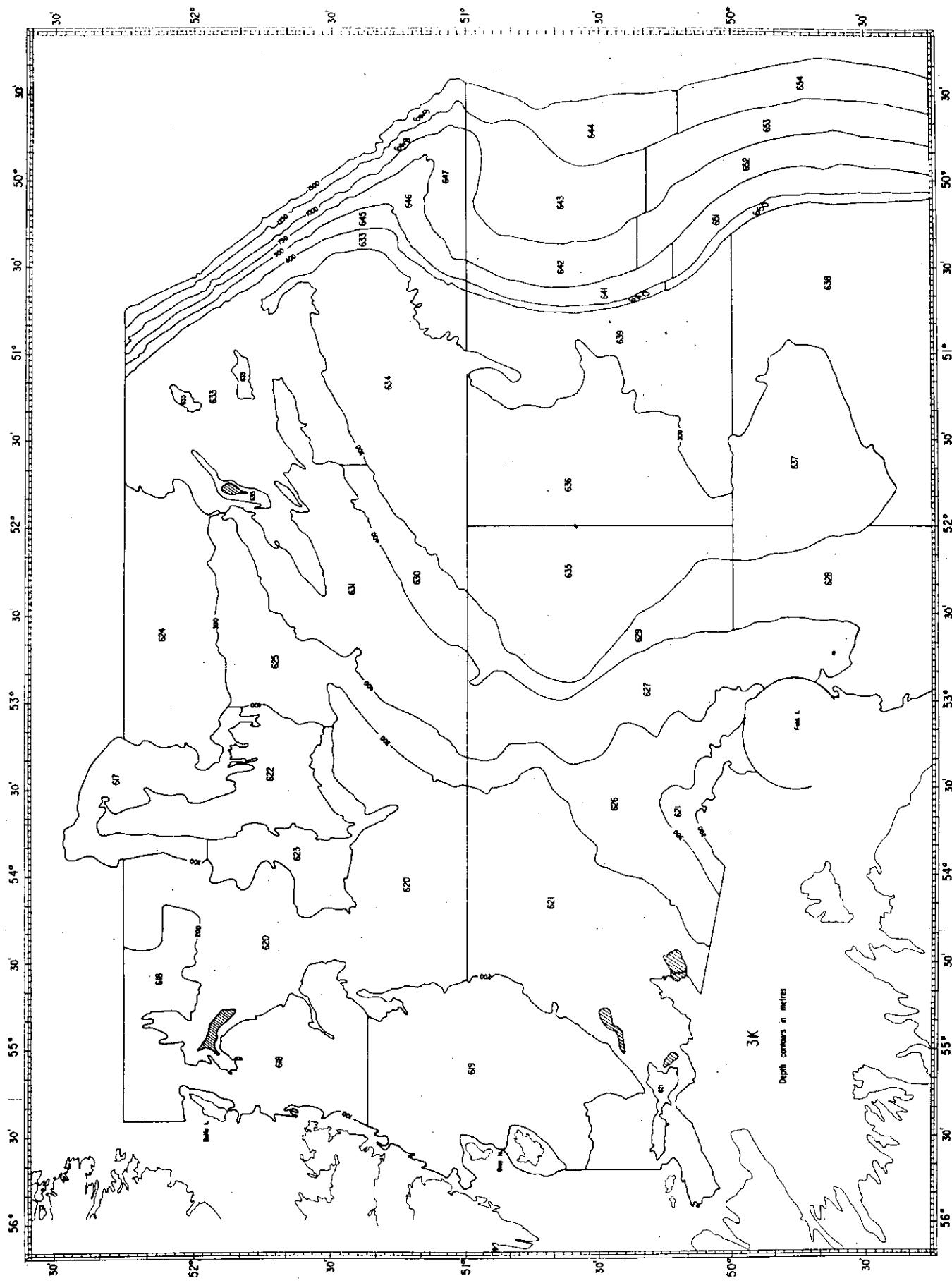


Fig. 8. Revised area of stratification for research vessel surveys in NAFQ Division 3K.

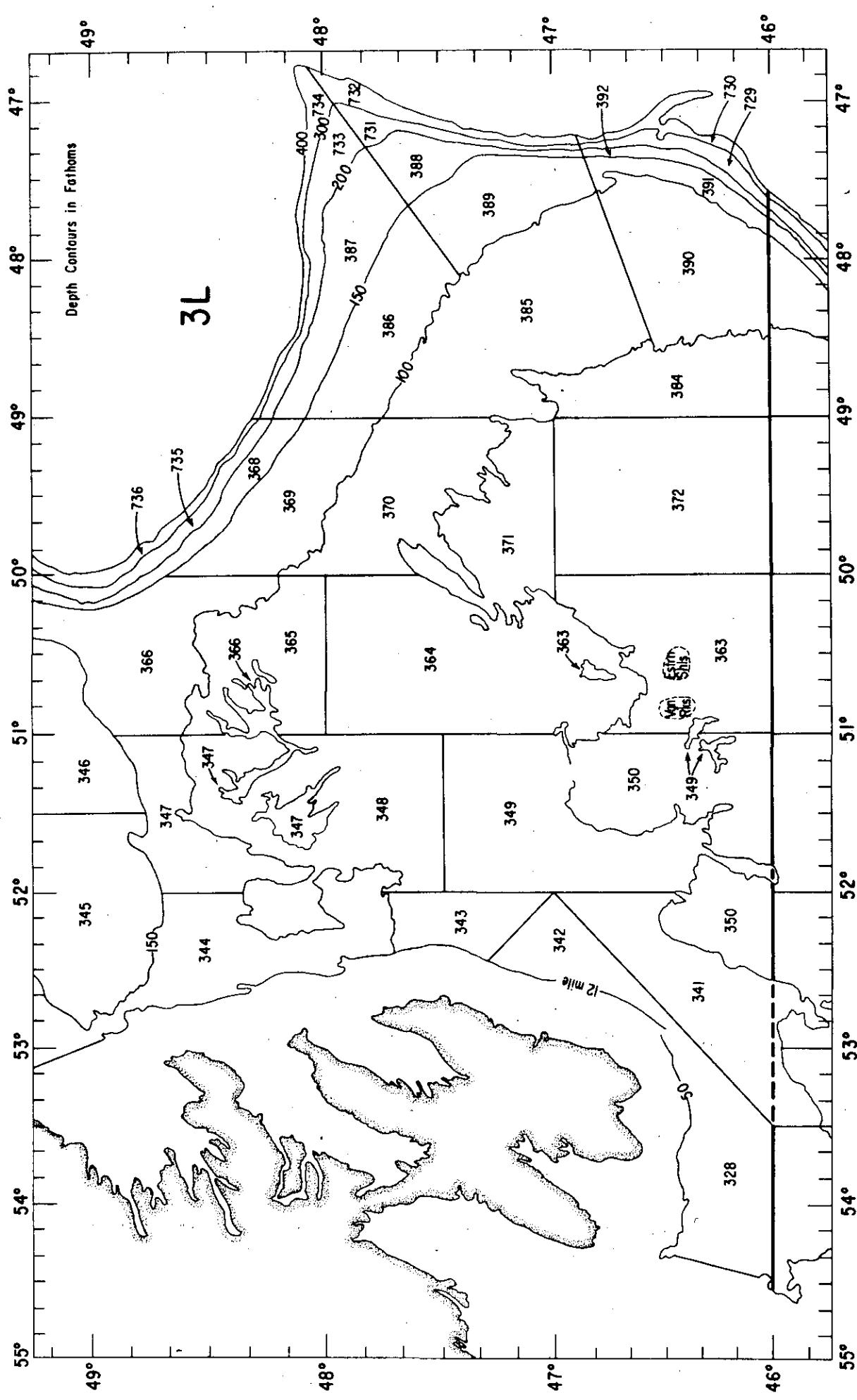


Fig. 9. Area of stratification for Research Vessel surveys in NAFO Division 3L.

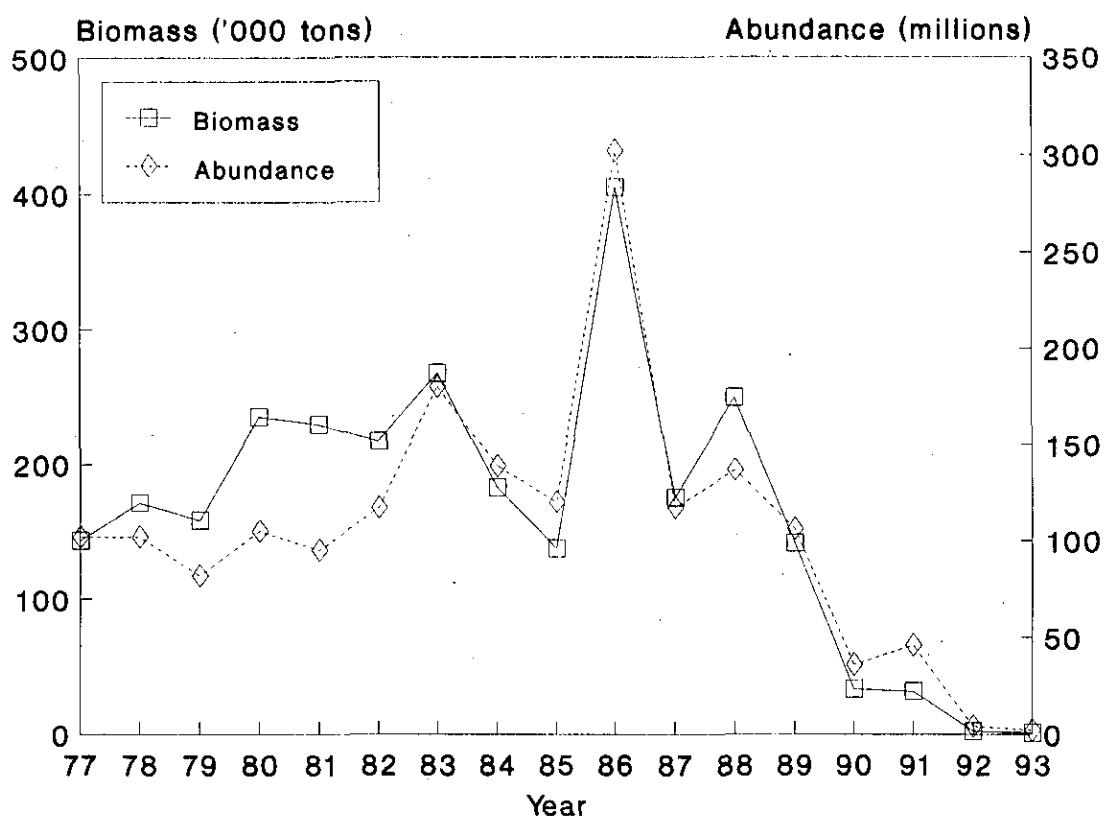


Figure 10. Biomass and abundance of cod from autumn RV surveys in Division 2J.

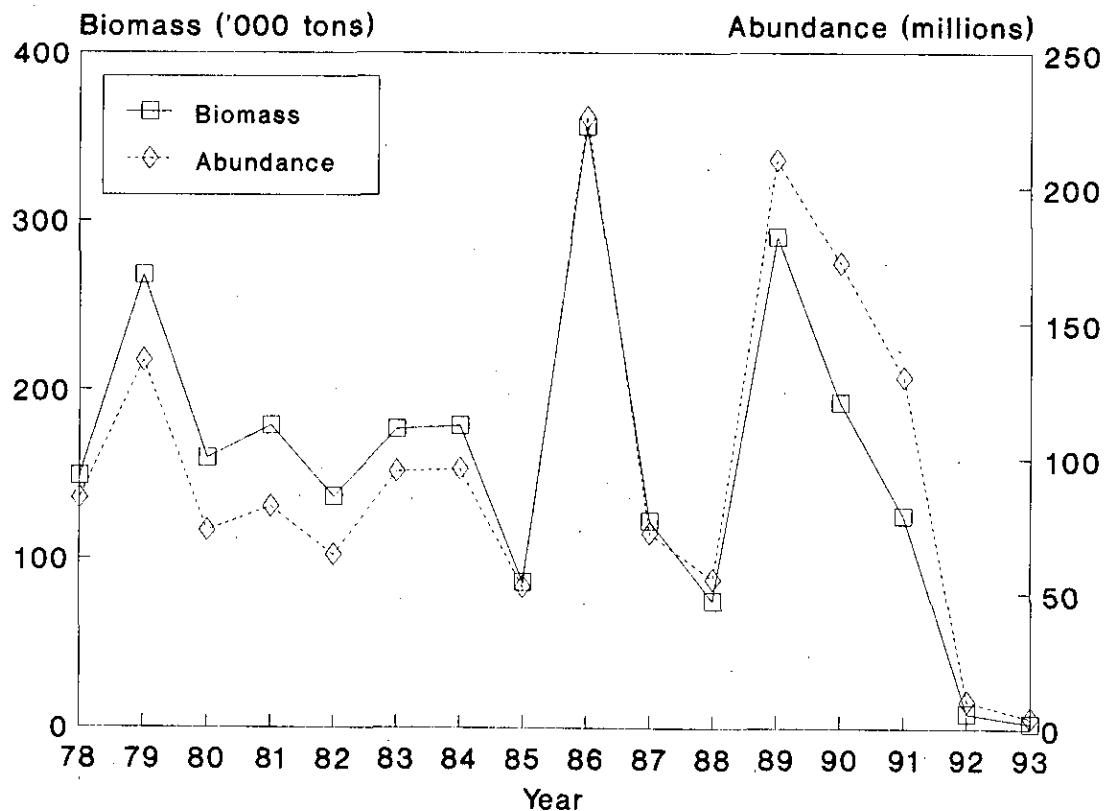


Figure 11. Biomass and abundance of cod from autumn RV surveys in Division 3K.

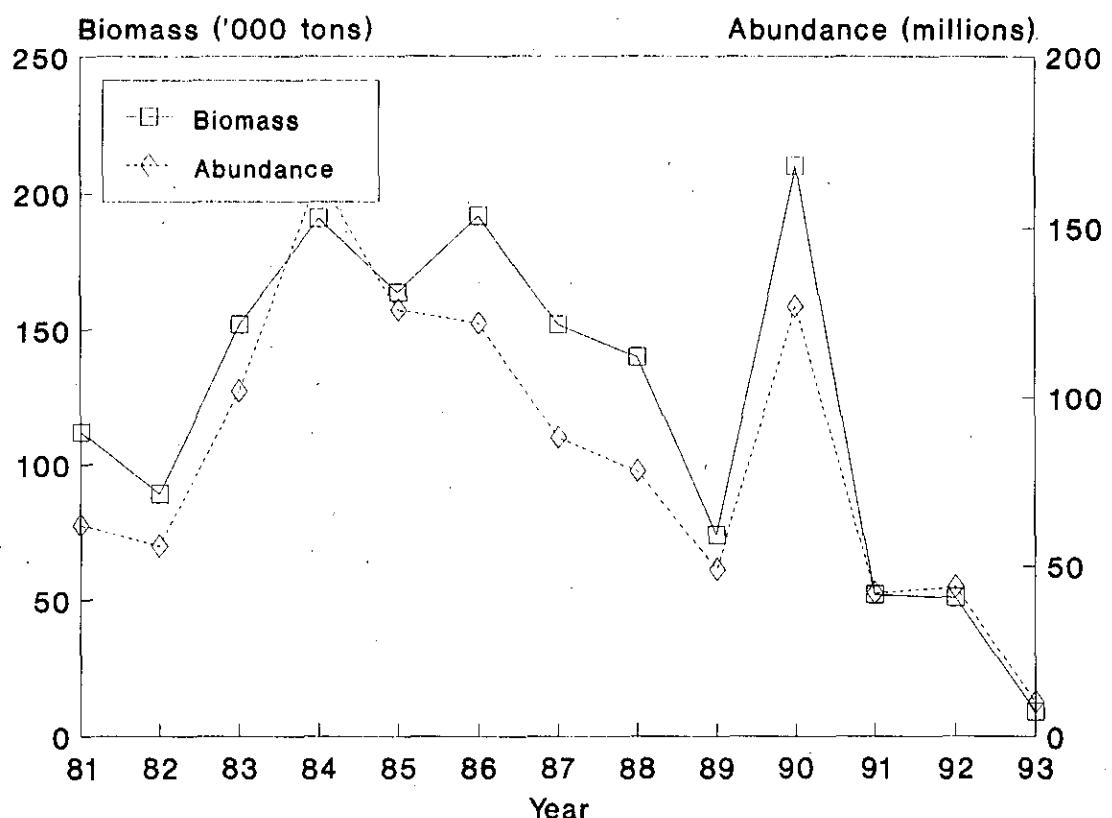


Figure 12. Biomass and abundance of cod from autumn RV surveys in Division 3L.

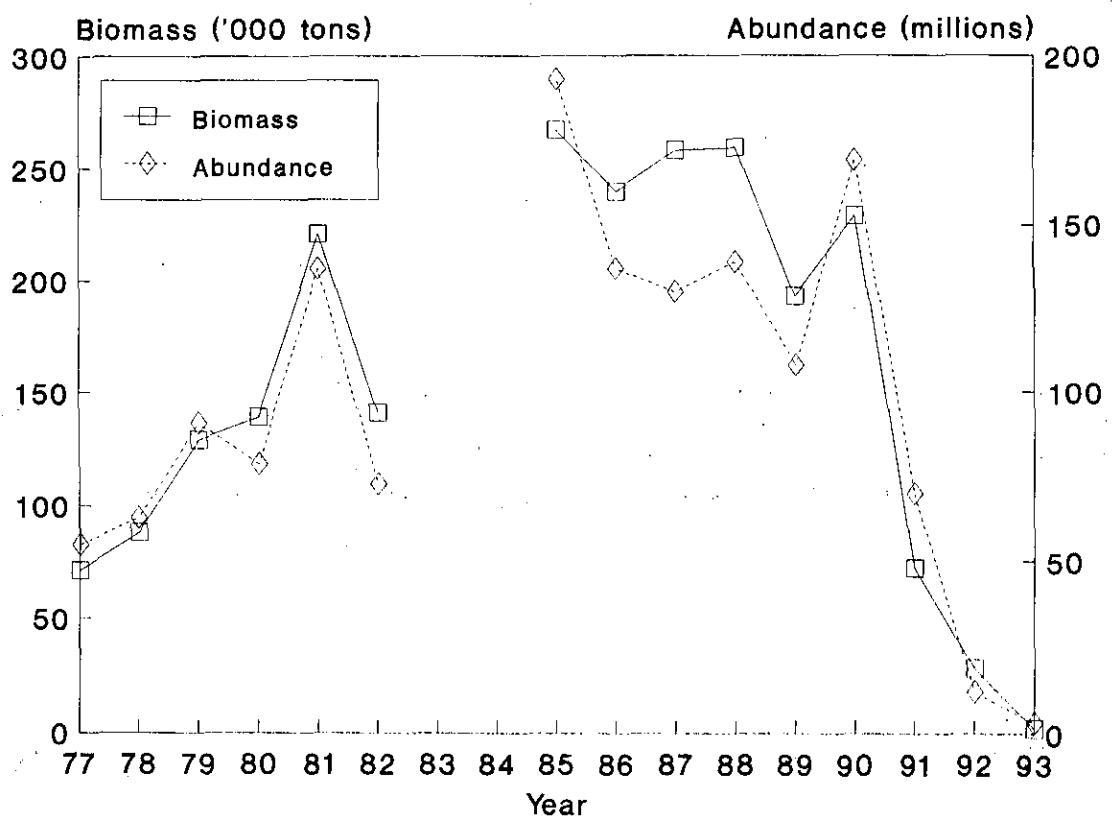


Figure 13. Biomass and abundance of cod from spring RV surveys in Division 3L.

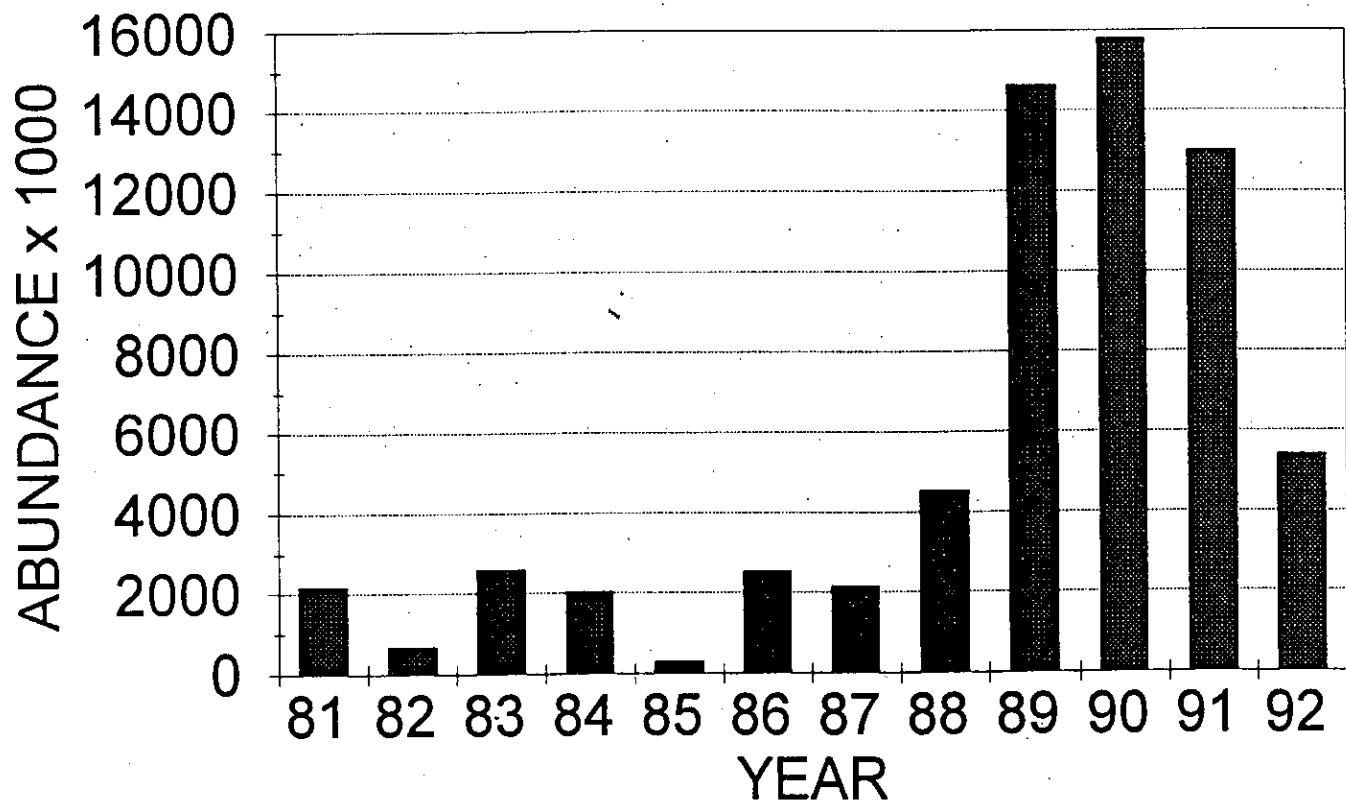


Figure 14. Abundance of cod at depths >400m from autumn RV surveys in Divs. 2J+3K from the period 1981-1992.

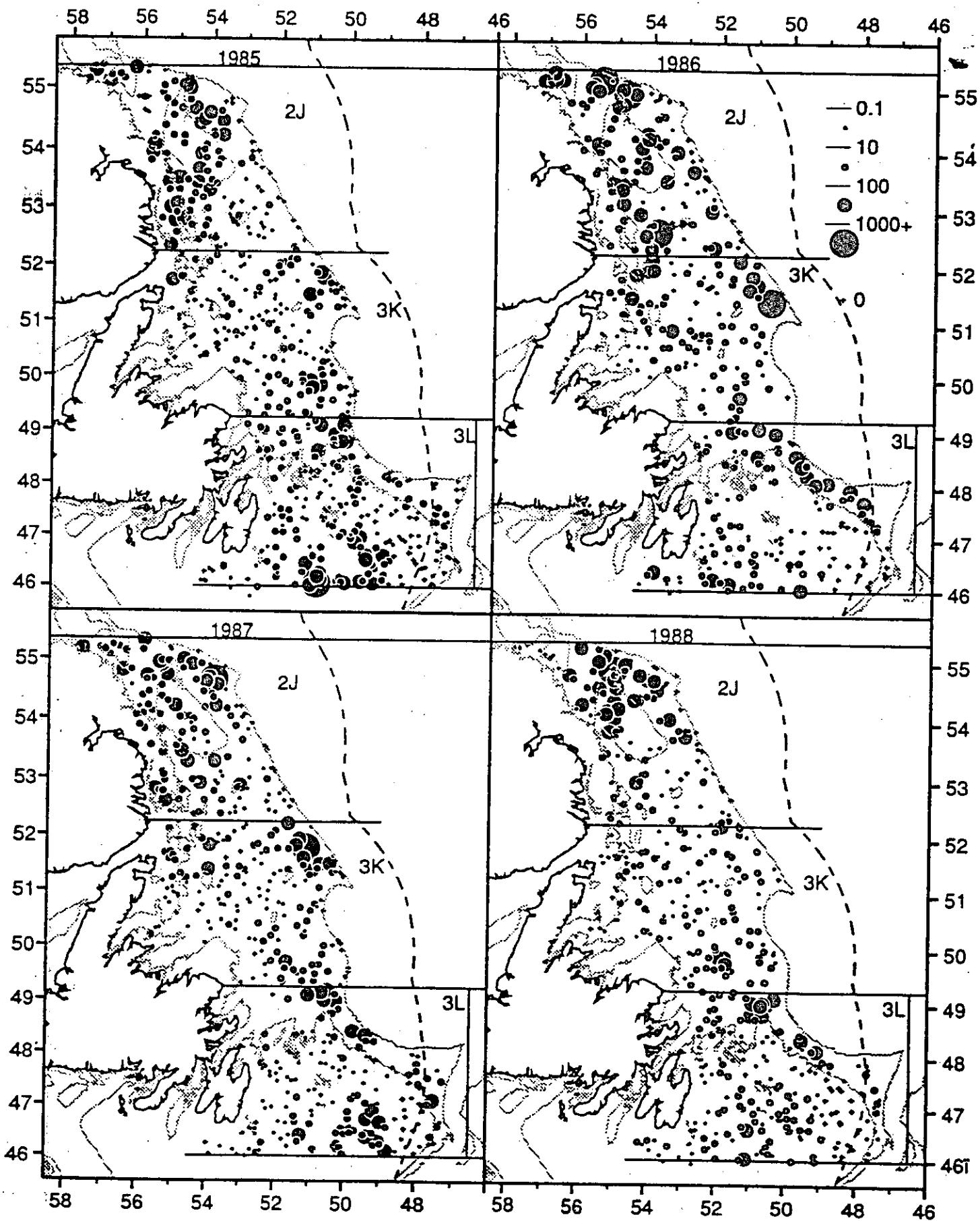


Figure 15. Cod Distribution 1985-88 from Autumn RV Surveys, Numbers per Tow.

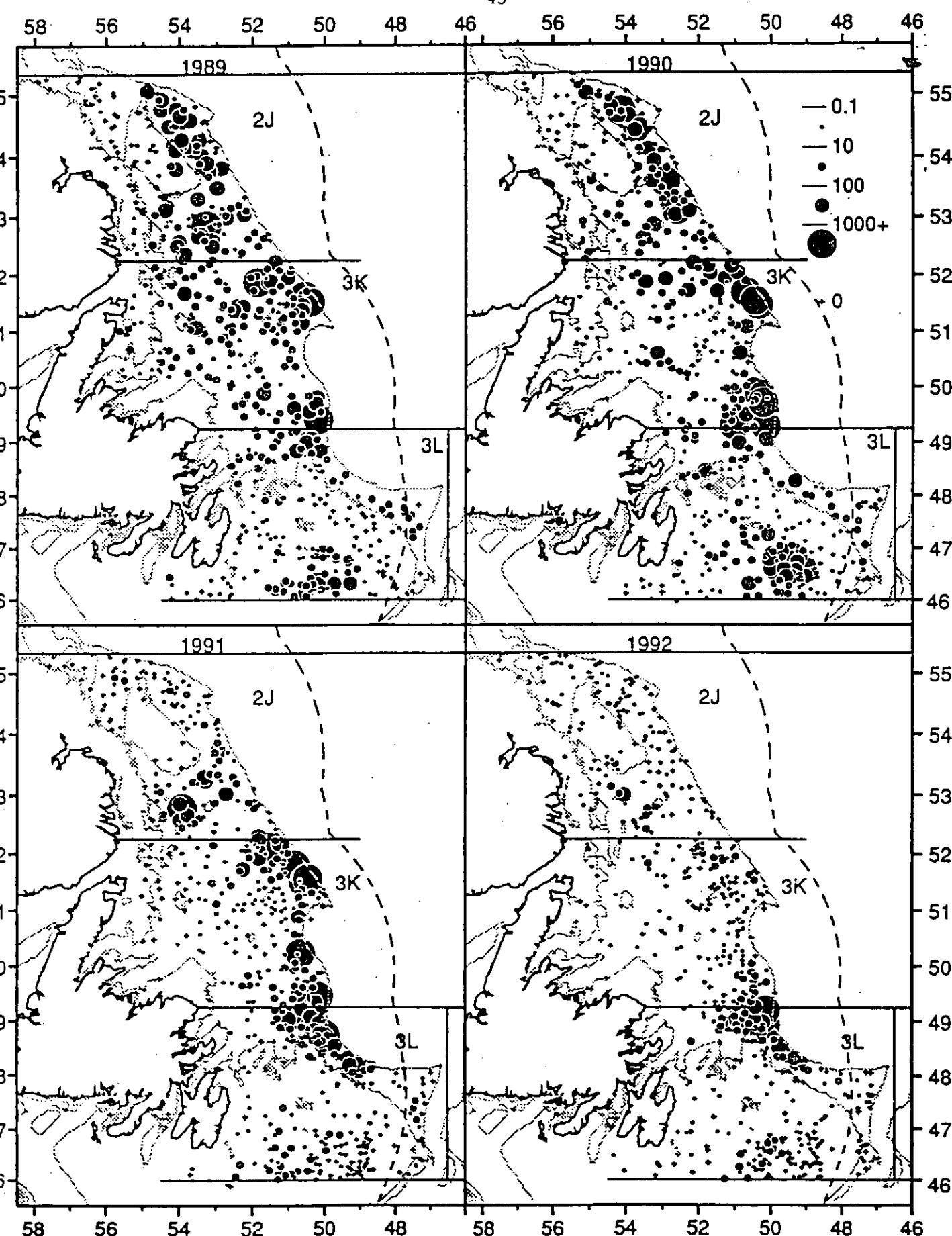


Figure 16. Cod Distribution 1989-1992 from Autumn 2J3KL RV Surveys, Numbers per Tow.

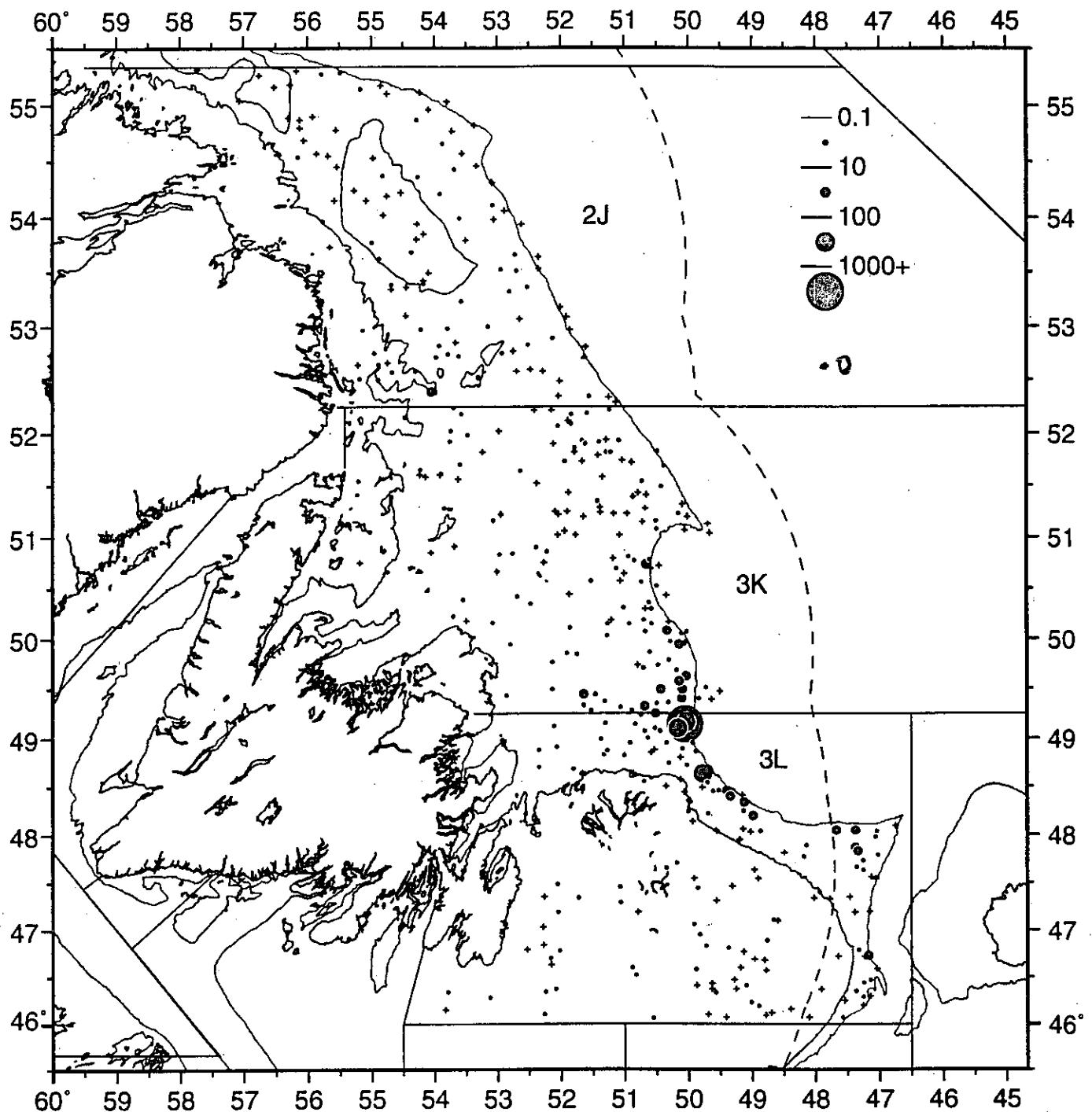


Figure 17. Cod distribution, mean numbers per tow, from the autumn 1993 R.V. survey in 2J3KL.

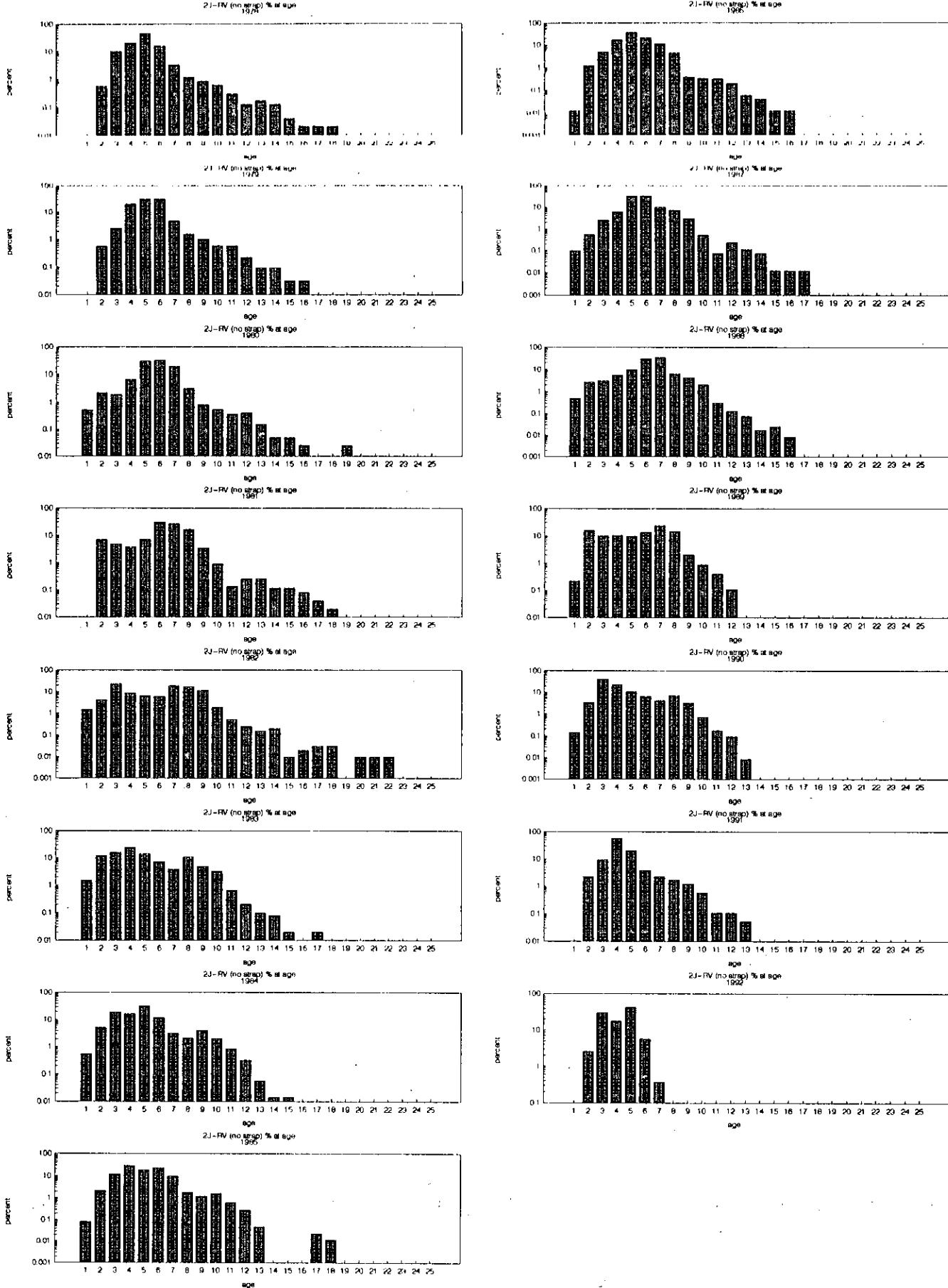


Figure 18. Percent age distribution of cod from RV surveys in Div. 2J over the 1978-1992 period.

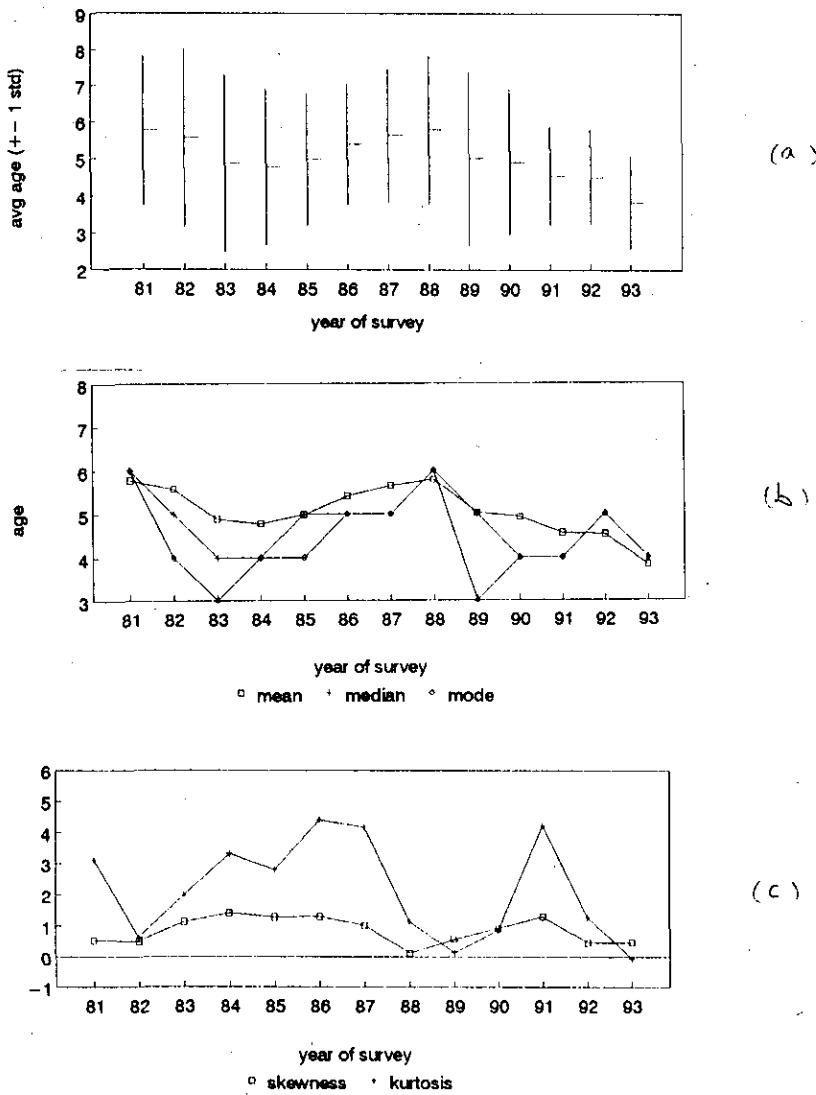


Figure 19. The age structure of cod from autumn RV surveys in Divs. 2J3KL for the period 1981-93. (a) The average age (years +/- 1 std); b) mean, median and modal age; c) extent of skewness and kurtosis.

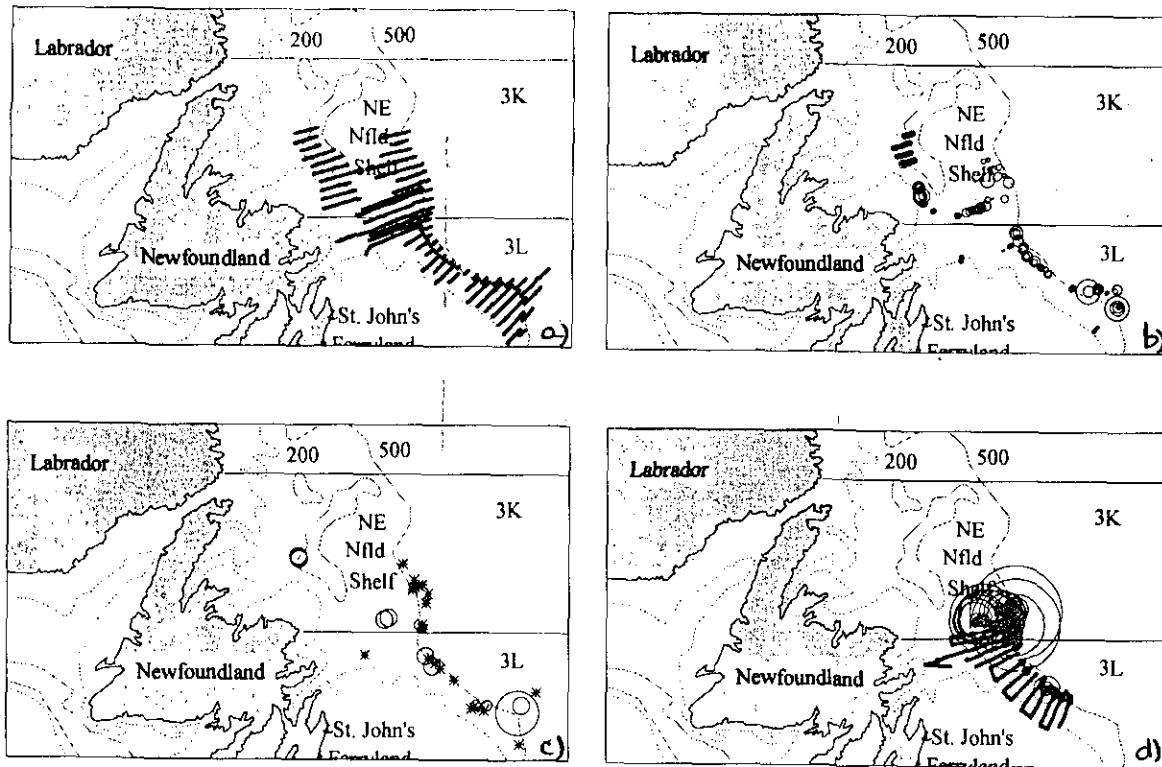
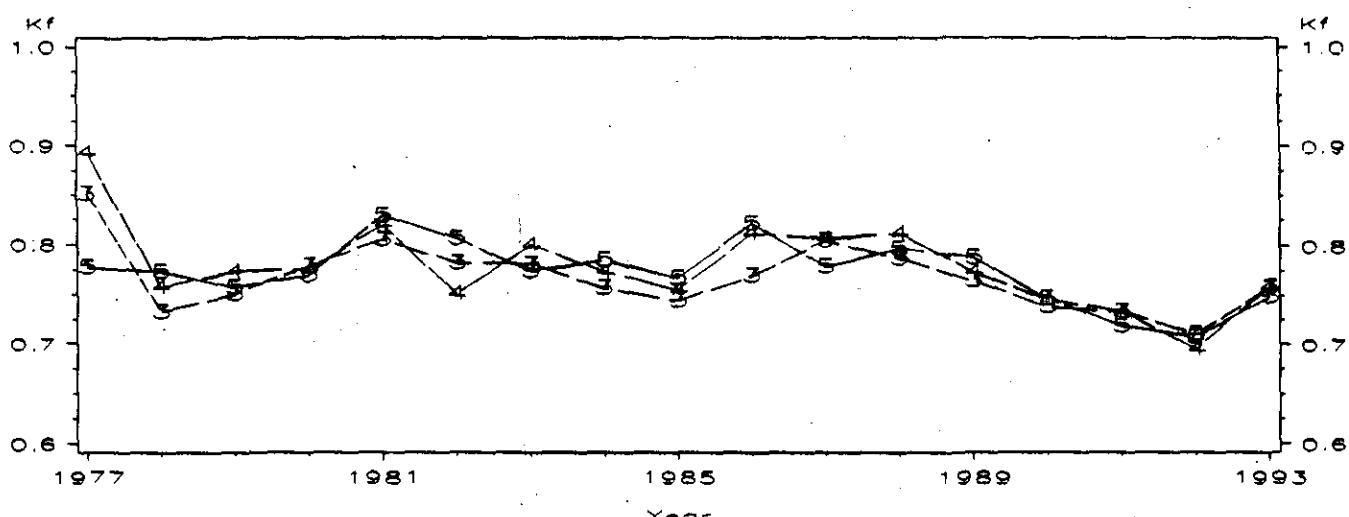
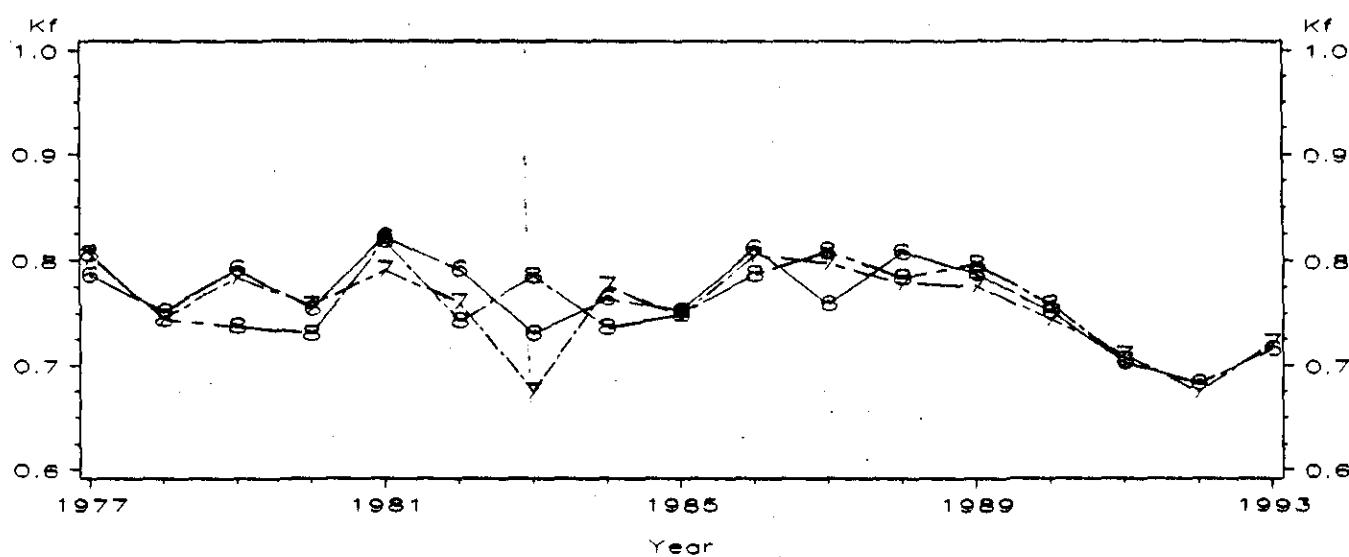


Figure 20. a) Survey transects data points from 2 vessel grid run in June 1993 and used in minimal numbers estimation; b) distribution of cod from acoustic records collected in transects identified in a), densities range from 0.00001 to 0.3 fish/square metre; c) numbers of cod caught in bottom trawls directed by acoustic data interpretations, stars are 0 up to 12500 fish at largest symbol; d) distribution of cod from similar survey in June 1992 (note that area covered is only part of area covered in 1993, values range from 0.00001 to 6 fish/square metre).



DIV=2J AGES=6 to 8



DIV=2J AGES=9,10(A),11(B)

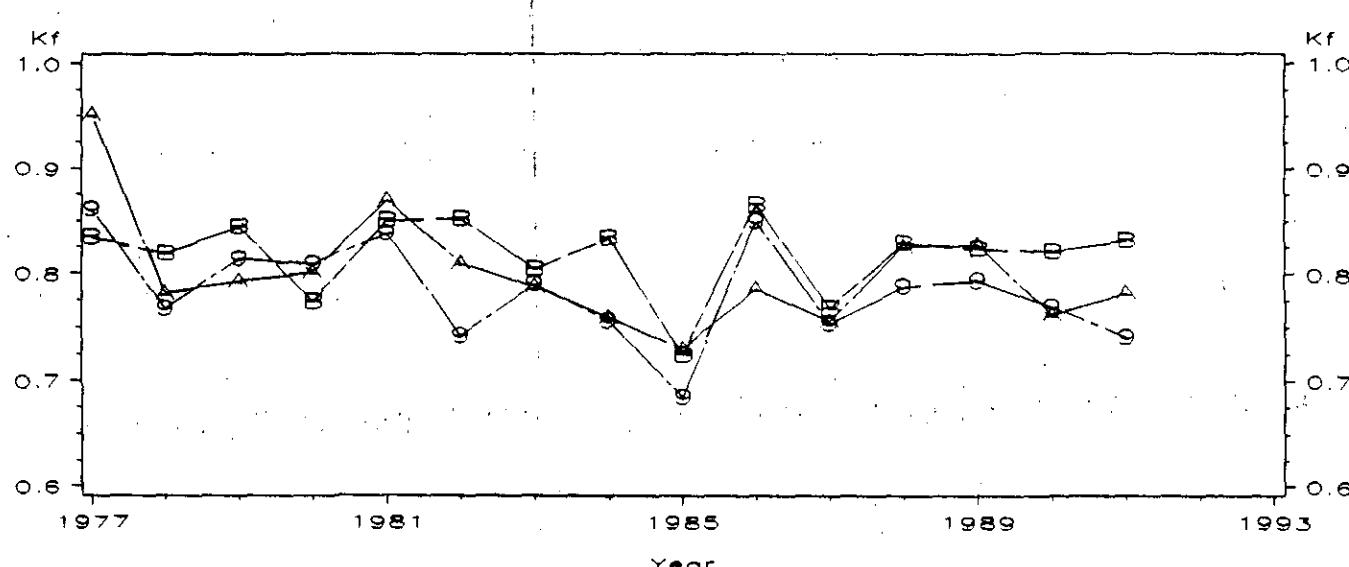
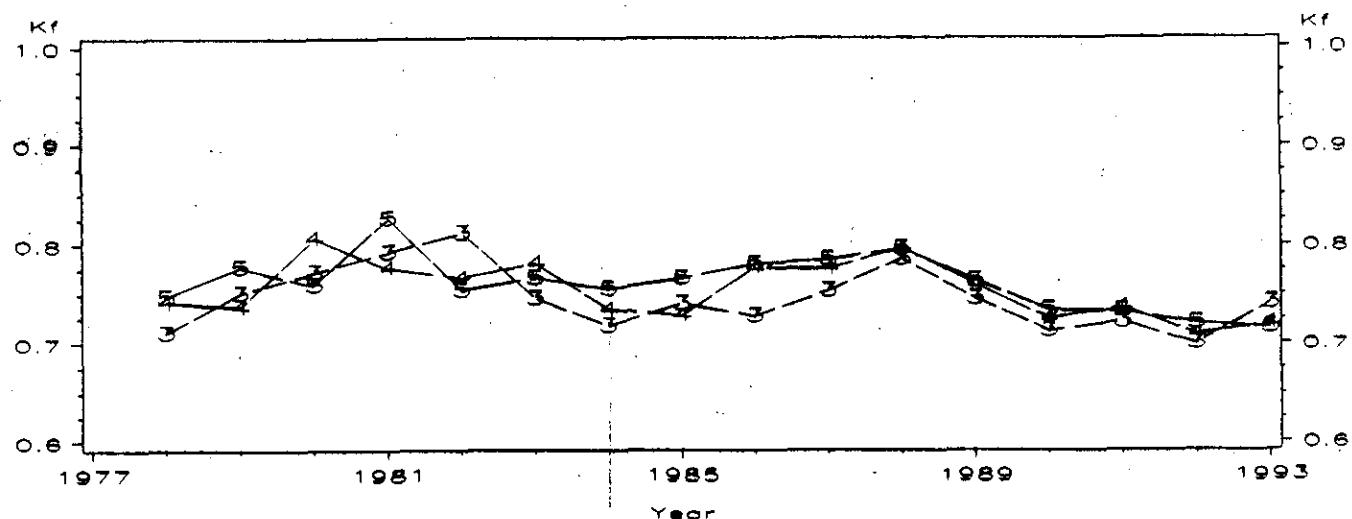
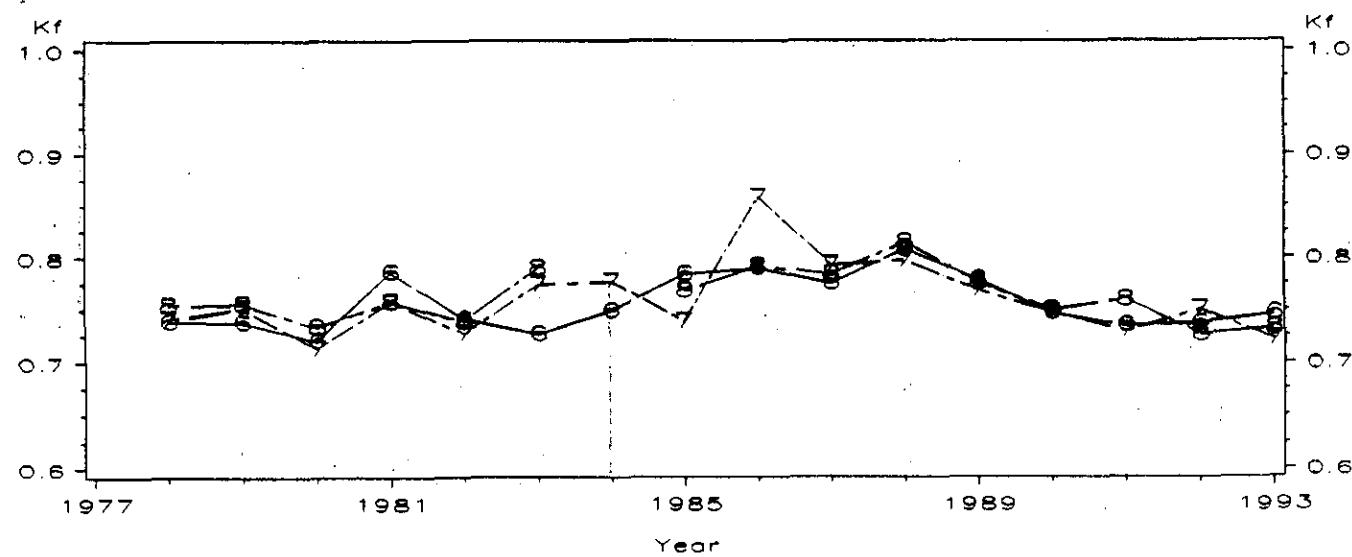


Figure 21. Annual mean condition factors (Kf) by age and year for cod in Division 2J.

DIV=3K AGES=3 to 5



DIV=3K AGES=6 to 8



DIV=3K AGES=9,10(A),11(B)

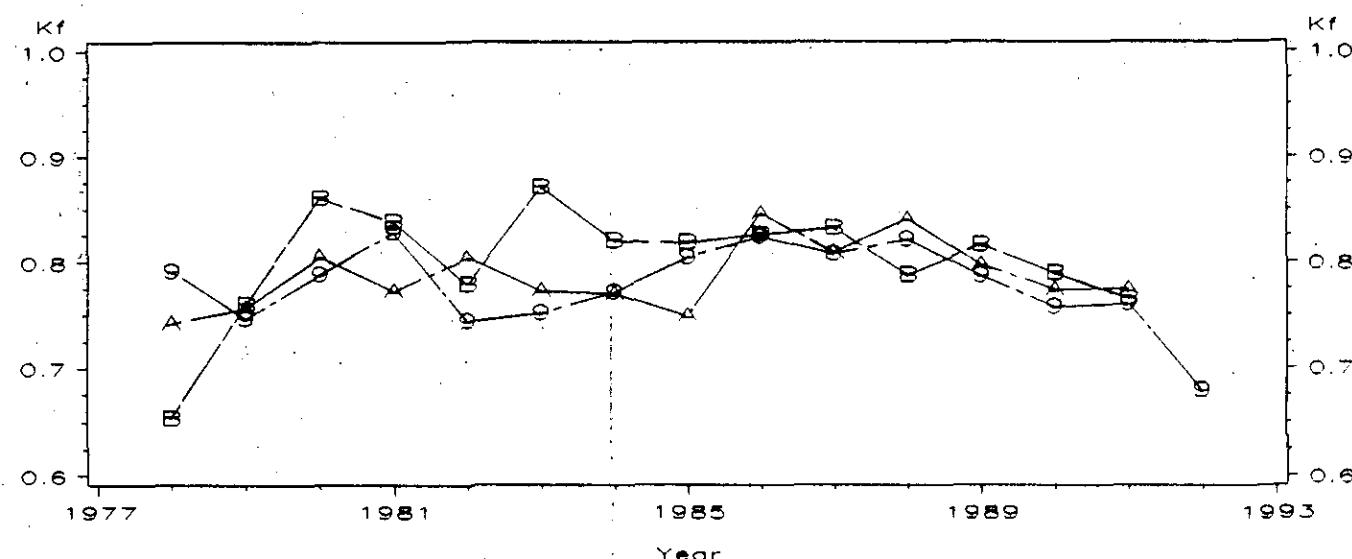
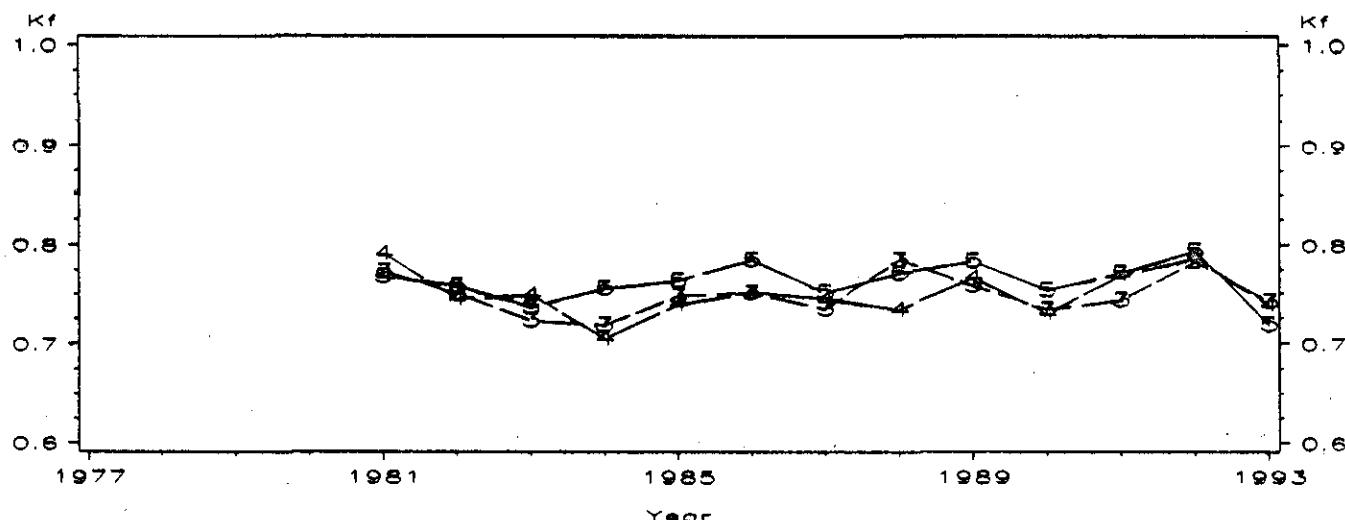
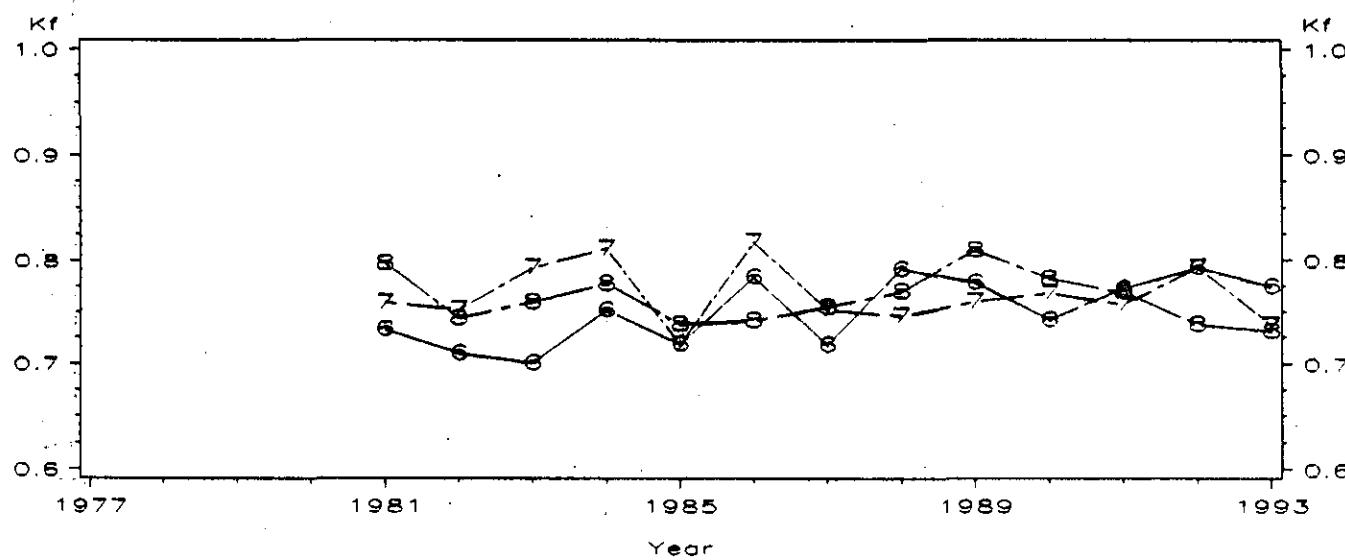


Figure 22. Annual mean condition factors (Kf) by age and year for cod in

DIV=3L AGES=3 to 5



DIV=3L AGES=6 to 8



DIV=3L AGES=9,10(A),11(B)

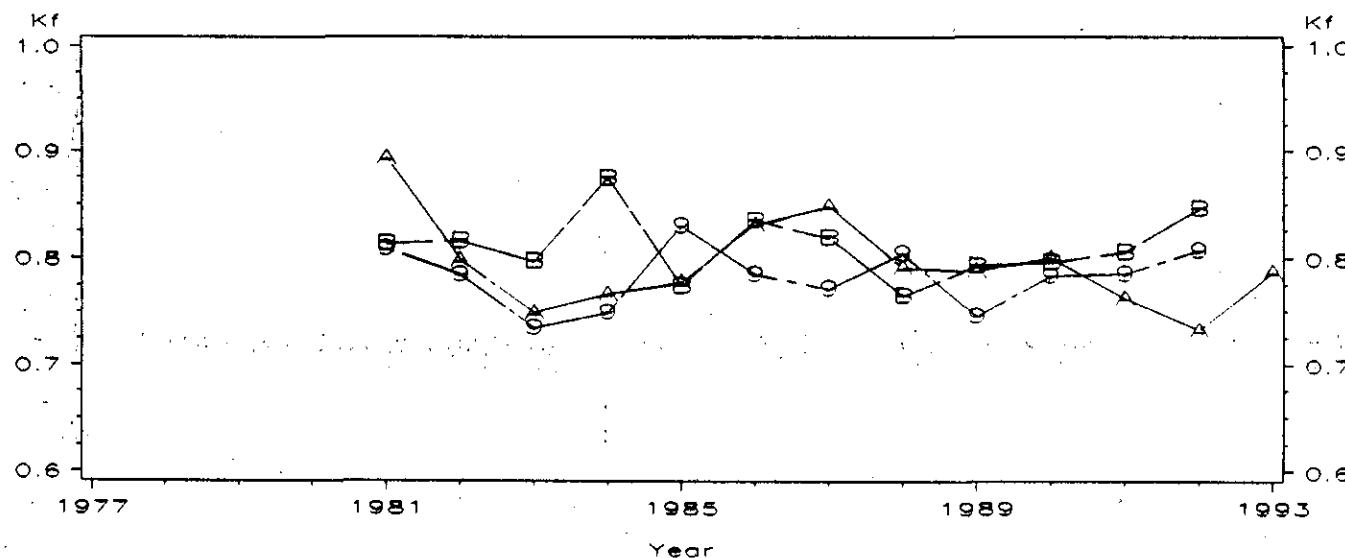


Figure 23. Annual mean condition factors (Kf) by age and year for cod in Division 3L.