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The assessment of the cod stock in NAFO Divisions 2J, 3K, and 3L

by

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Abstract

Catches of cod from NAFO Div. 2J3KL have declined from a high of about 800,000 t in 1968 to low of about 140,000 t in 1978. Catches from the 1982-89 period have been between 230,000 and 266,000 t. Two indices of abundance, research vessel surveys and commercial catch rates, were used on an age-disaggregated basis in a single ADAPT calibration analysis to estimate fishing mortality and stock size for 1989. This assessment indicates that the fully recruited (ages 7-9) fishing mortality in 1989 is about 0.56. The age 3+ biomass at the beginning of 1989 is estimated to be about 850,000 t with the population numbering just over one billion fish.

Résumé

Les prises de morue des divisions 2J3KL de l'OPANO ont diminué pour passer d'un maximum de 800 000 t environ en 1968 à un minimum de 140 000 t environ en 1978. Les prises de la période 1982-89 ont fluctué entre 230 000 t et 266 000 t. L'estimation de la mortalité par pêche et de la taille du stock en 1989 a été réalisée par analyse à étalonnage simple ADAPT et sans regroupement par âges des paramètres tirés de deux indices d'abondance, des relevés par navires de recherche et des taux de prises de la pêche commerciale. Selon cette évaluation, la mortalité par pêche de plein recrutement (âges 7-9) a été de 0,56 environ en 1989. La biomasse des poissons d'âges 3+ au début de 1989 est estimée à 850 000 t environ pour un effectif de population tout juste supérieur à un milliard d'individus.

Nominal catch

Nominal catches for this stock for the 1959-89 period are given in Table 1 and are also shown in Figure 1. The peak catch of about 800,000 t occurred during 1968. This was followed by a steady decline to a low of 139,000 t during 1978. Catches gradually increased in the late 1970s and early 1980s and have been in the range of 230,000-266,000 tons since 1982. During the 1960s, landings were mainly from Div. 2J and 3L with the largest catches being taken in Div. 2J. In recent years, landings have been mainly from Divisions 3L and 3K (Fig. 2).

The offshore catch in 1989 of 141,000 t (Table 1) was the lowest since 1984. The reduction in the 1989 offshore catch from recent highs was due to reduced allocations in the that sector. The catch of inshore gears (traps, gillnet, longline, and handline) was about 100,000 t in 1988 and 1989, up from the 1985-87 average of about 75,000 t (Table 2). The predominant inshore gears for the 1975-89 period were traps and gillnets (Table 2, Fig. 3). The 1989 trap catch (38,000 t) declined marginally from 1988 but is still above the 1975-88 average of about 33,000 t. The gillnet catch in 1989 (42,000 t) increased rapidly from 19,000 t in 1985 and is the second largest since 1975.

Nominal catches in 1989 by country, month, and division are shown in Table 3. These were obtained from the Department of Fisheries and Oceans for vessels licenced to fish within Canada's 200-mile fishing zone and from NAFO circular letters for foreign fleets fishing outside the zone. Monthly breakdown of catch was not available for France (3217 t), production estimates for Canadian vessels (15,662 t), or for countries fishing outside Canada's 200-mile zone (25,000 t).

Catch and average weights at age

A summary of the sampling used to derive the catch at age in 1989 is given in Table 4. Sampling was spread over time, area, and gears with a total of about 8000 fish aged and 170,000 fish measured. The following relationship was applied in deriving average weight at age: log weight = 3.0879 log length - 5.2106. The discrepancy between reported catch and catch calculated from these average weights for 1989 was about 2%. Catch numbers, average weight, and average length at age for 1989 are presented in Table 5. The 1981, 1982, and 1983 year-classes (ages 6, 7, and 8 in 1989) were most abundant in the commercial catch, as they had been in the 1988 commercial catch. These year-classes also dominated the offshore catch during 1989 (Fig. 4) while the 1982-85 year-classes were dominate in the inshore catch. While the relatively

strong 1981 and 1982 year-classes along with the 1983 year-class dominated most divisions and fleet sectors, the 1984 and 1985 year-classes (ages 4 and 5) dominated the inshore catch in Div. 3L (Table 6).

Catch at age for the 1962-89 period is shown in Table 7 with respective average weight at age given in Table 8. During the mid- to late-1980s, fish of ages 5 and 6 years dominated the commercial catch. This pattern shifted to ages 6 and 7 in 1988 and ages 7 and 8 in 1989. This indicates that the 1983 and 1984 year-classes (ages 5 and 6 in 1989) may be weak.

Weights at age for the 1962-72 period were estimates obtained using weight-at-age data for 1964-68 (Div. 2J) and 1965-70 (Div. 3KL) weighted by divisional catch. Average weights increased from the early 1970s to the early 1980s and subsequently declined. Average weights in recent years (1987-89) have been relatively stable.

Research vessel surveys

Research vessel cruises have been conducted during autumn by the GADUS ATLANTICA in Divisions 2J and 3K since 1977 and 1978 respectively. Autumn surveys in Div. 3L were conducted by the A. T. CAMERON during 1981-82 and by the WILFRED TEMPLEMAN in 1983-89. The 1984 autumn survey in Division 3L was conducted earlier in the year than were the other surveys (August-September as opposed to October-November). Spring surveys in Division 3L were conducted by the A. T. CAMERON for the 1971-82 period and by the WILFRED TEMPLEMAN during 1985-89. 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. Stratification charts used for the surveys in the three NAFO Divisions are shown in Figures 5-7.

The results from the autumn surveys indicate that biomass and abundance have shown large fluctuations in Div. 2J and 3K, especially in recent years (Tables 9-12, Figs. 8-9). In these survey series, population estimates have occasionally been half or double the estimates of previous years. Biomass and abundance from autumn surveys in Div. 3L were highest during 1984 and have subsequently declined (Tables 13-14, Fig. 10), with the decline in abundance greater than that of biomass. In Division 3L during spring, estimates have also displayed a decreasing trend in recent years (Tables 15-16, Fig. 11).

Percent biomass by division (Table 17) was fairly stable for a period in the early 1980s, but, in recent years, has become quite variable. The average percentages for the 1981-89 period are 41% in 2J, 31% in 3K, and 28% in 3L.

In an attempt to minimize the variance in survey estimates, a two-phase survey design (Francis, 1984) was used for Div. 2J3KL and for the first time during 1989. This method consists of completing the first phase of the survey as had been done in the past while allocating the sets in the second phase based on catches obtained in the first phase. During 1989, 450 tows were selected to cover the survey area. An additional 69 tows were allocated based on the catches obtained in phase 1 of the survey. Table 18 shows the biomass and abundance estimates for the 3 divisions along with their associated variances for phase 1 of the survey as well as with the inclusion of phase 2 sets. Results indicate that while there was about an 11% reduction in both

abundance and biomass, the variance was reduced by about 43% and 26% respectively with the allocation of additional sets.

Tables 19-22 give mean numbers per tow at age for surveys conducted in all divisions. The values include adjustments to account for strata omitted during the surveys. The dominant year-classes for these surveys are as follows:

Survey	Dominant Year-classes	Age in 1989
2J autumn	1982, 1987, 1981, 1986	7, 2, 8, 3
3K autumn	1985, 1986, 1987	4, 3, 2
3L autumn	1986, 1985	3, 4
3L spring	1982, 1985	7, 4

The 1983 and 1984 year-classes, ages 5 and 6 in 1989, appear to be relatively weak in all three divisions. There were no autumn surveys in Division 3L for the years 1978-80, so an index for these years was estimated by averaging year-class estimates in successive spring surveys in Div. 3L in 1977-81 (Table 22). A total stock area survey index at age for autumn was then calculated by averaging (weighted by the surveyed area) the results from all three divisions. The surveyed area (square nautical miles) used as weights for this average are as follows:

2J	-	21,560
3K	-	29,256
3L	-	36,777

The 1982, 1985-87 year-classes dominate this 2J3KL survey index (Table 23), while the index indicates that the 1983-84 year-classes are relatively weak at all ages. Coefficients of variation for the mean numbers per tow of cod in Div. 2J3KL are also presented in Table 23.

Commercial catch effort

Offshore catch and effort data are available by Division, month, country, and gear, and a multiplicative model (Gavaris, 1980) was used to account for the country/gear, seasonal, and divisional differences.

Data are available for two time-periods: 1962-79 and 1978-89. There is not sufficient overlap in country/gear categories to include data from both periods in a single analysis. Catch and effort data for the earlier period were obtained from NAFO Statistical Bulletins and included data for Canadian (tonnage classes 4 and 5), Portuguese (T.C. 6 and 7), and Spanish (T.C. 6) otter trawlers. For the latter period, data were obtained from DFO and included Canadian (T.C. 4, 5, and 6) and Portuguese (T.C. 6 and 7) otter trawlers. The Portuguese data for the latter period were obtained from the observer program.

As in previous assessments (Baird and Bishop, 1989; 1987; 1986), the analysis was done separately for both these series. Plots of residuals showed

that data with greater catch and effort were less variable; therefore, estimated weights calculated according to Judge et al. (1980, p. 132) were applied in a weighted regression of the multiplicative model. To reduce the possible effects of truncation and rounding errors, data with less than 10 t catch or 10 hours effort were excluded from the analysis.

The regression of ln catch rate of cod in the 1962-79 period explained about 60% of the variation in the data and all category types were significant (Table 24). Regression coefficients for this period (Table 25) indicate that Portuguese otter trawlers were most effective and the highest catch rates overall occurred during the first quarter of the year. The time series of catch rates indicate a declining trend throughout the period (Table 26, Fig. 12).

The regression of ln catch rates for the 1978-89 period explained about 70% of the variation in the data; and, again, all category types were significant (Table 27). Canadian tonnage class 6 trawlers were most effective; as was the case with the earlier period, the best catch rates occurred during the first quarter (Table 28). Catch rates increased steadily from 1978 to 1985 and have been variable since that time. (Table 29, Figure 13).

The series from the two periods were combined to provide a catch rate index for the entire period by scaling each series to its respective mean of the 1978-79 indices. In only these two years was there sufficient overlap in country/gear components to adequately link the two periods. The resulting catch rate index is presented in Figure 14 and indicates that catch rates in the latter period (1984-89) are about the same as those of the early 1960s. This index is only presented for illustrative purposes and is not used in calibration because of the uncertainty of linking the two periods with only two years of overlap.

Catch and effort data were also analyzed by division for the 1978-89 period. The results of the divisional regressions are given in Tables 30-35. All regressions were significant as were the category types in each analysis. Catch rates in Division 2J increased from 1978 to 1983 and subsequently declined (Table 36, Fig. 15), in Division 3K generally increased over the time period (Table 37, Fig. 16), and in Division 3L increased from 1978 to 1986 with a small decline in the most recent years (Table 37, Fig. 17).

A catch rate index at age was estimated for the entire stock for the 1978-89 period and is presented in Table 39. This index was derived using the catch at age of the offshore fleet along with the calculated fishing effort from the standardization of commercial catch rates. This index, like the RV index, indicates that the 1983 and 1984 year-classes are relatively weak. The dominant year-classes during 1989 are those of 1981 and 1982.

Data from observers on Canadian trawlers, collected on a set-by-set basis, was available for the cod fishery in Div. 2J3KL for the period 1980-89. A total of 29,864 sets was observed, about 71% of which were from 1987-89. Data were available for Canada (M) and (N) in all years, with the Canada (N) values comprising about 88% of the total. Data for 1989 were not complete.

To facilitate analysis in the multiplicative model, the data were summed to give one value for each available year - Division - country/gear/T.C. - month cell. Only data from stern trawlers of T.C. 4-6 were used in the analysis, resulting in the exclusion of a very small amount of data from side trawlers, and from stern trawlers of T.C. 3 and 7.

Results from the multiplicative analysis are shown in Tables 40 and 41. This analysis was conducted in a manner similar to previous analyses of commercial catch rates. The resulting CPUE series is shown in Table 42 and Figure 18. Both this CPUE index and the total CPUE index for the stock show the same trends, with 1985 being the peak year in each series (Fig. 19). There is virtually no change in CPUE from 1988 to 1989 in both series.

Estimation of stock size

Research vessel survey and commercial catch rate indices were analyzed in a number of formulations of the adaptive framework (Gavaris 1988). The accepted formulation is as follows:

Parameters:

- Year-class estimates

  $N_{i,1989}$ $\quad i = 3$ to 12

- Calibration coefficients for RV and C/E numbers

  $K_{i_2}^{1}$ $\quad i = 3$ to 12 $\quad$ (RV)

  K_i $\quad i = 5$ to 8 $\quad$ (C/E)

Additional structure:

- Natural mortality assumed to be 0.20.
- Error in the catch at age was assumed negligible.
- F on oldest age group (13) was calculated as 50% of the weighted (by population numbers) F for age groups 7-9.
- Intercepts were not fitted.

Input:

- $C_{i,t}$ $\quad i = 3$ to 13, $\quad t = 1978$-89
- $RV_{i,t}$ $\quad i = 3$ to 12, $\quad t = 1978$-89
- $C/E_{i,t}$ $\quad i = 5$ to 8, $\quad t = 1983$-89
- Fall RV survey related to the population at the same age fished to the time of the survey.
- Commercial C/E related to population at the beginning of the year.

Objective function:

- Minimize

$$\sum_{i}\sum_{t}\{obs(lnRV_{i,t})-pred(lnRV_{i,t})\}^2 + \sum_{i}\sum_{t}\{obs(lnC/E_{i,t})-pred(lnC/E_{i,t})\}^2$$

Summary:

- Number of observations = 148
- Number of parameters = 24

In previous assessments, it had been established that intercepts were not significant and hence were not included in this analysis. Parameter estimates for age 3-12 abundance as well as RV and C/E slopes are given in Table 43. All estimated parameters were significant with CV's on abundance ranging from 12% to 33% while those on the estimated slopes were in the range of 9% to 12%. Correlations between estimated parameters were low (Table 44). Residuals for RV data exhibited some patterns, with the predicted values at each age for 1986 lower than the observed while, for 1985 and 1987, the opposite was true. There were no distinct patterns in the C/E residuals; however, the time series was short (1983-89). Residuals are shown in Table 45. Plots of the calibration indices aggregated over the ages used for adapt versus the estimated population for those same ages are shown for the RV ages 3-12 in Fig. 20 and for the C/E age 5-8 in Fig. 21.

During last years assessment, commercial C/E were included in adapt aggregated for all ages (Baird and Bishop, 1989). Age-disaggregated C/E were not used because of possible correlated error structure between the catch-at-age data and the age-disaggregated C/E, potentially introducing bias in the analysis. Recently reviewed simulations indicated that age-disaggregated C/E analysis did not bias either the parameter estimates or their estimates of precision. Commercial C/E disaggregated by age also provide more information on the age compositions of the population and were, therefore, included in the accepted formulation of the adaptive framework.

Initial formulations of adapt using RV data and flat-topped partial recruitments gave catchability estimates which increased with age through the oldest ages (Table 46). Catchabilities for research vessel gear should at least be stable, and possibly declining, through the older ages. It was shown that a fishing mortality on the oldest age (13), set at about half that of ages 7-9, would produce stable catchabilities for RV ages 8+ (Table 44). A comparison of the catchabilities using the flat-topped and dome shaped partial recruitments is shown in Fig. 22. The presence of a dome-shape PR has also been observed in other otter trawl fisheries and is not surprising given the nature of the fishery in Div. 2J3KL.

Only ages 5 to 8 were used from the commercial C/E index because these ages comprised about 80%, on average, of the total offshore catch and residuals for older age groups (9+) indicated a lack of fit to the model. Data for the years 1978-82 were also excluded from the commercial catch rate indices. Analyses of these indices, on their own or when included with RV indices, indicated unacceptable patterns in the residuals for these years. Two factors were thought to possibly cause those changes: learning by the

Canadian fleet in the late 1970s and early 1980s and enterprise allocation and dockside grading, both introduced in the 1981-83 period. Because the combined effects of these events in the fishery on the commercial C/E could not be quantified, the early years were deleted from the formulation; however, their inclusion does not alter the results from the adapt formulation. Residuals for commercial catch rates including all years (1978-89) and ages (5-12) from a preliminary analysis are shown in Table 47.

The RV indices have been the focus of much discussion at this and previous assessments, for their high variance but theoretical lack of bias. The variance in the RV indices is acknowledged to have two components: process error (the widely recognized "good year" and "bad year" effect in the surveys) and random error (the sampling error at age, within each year). There are some theoretical grounds for weighting the catch at age indices by the inverse of their variances, but such a weighting treats all the variance as random error, not process error. A formulation was attempted using this weighting (each residual index at age weighted by the inverse of the standard error of its RV index) for the RV indices and excluding the catch rate indices. The results of this formulation were not used for a number of reasons: (1) The CV's on the parameter estimates for the older ages (Table 48) were larger than for the log model in accepted formulation. (2) The residuals showed a preponderance of positive values, with systematic trends for the early years and younger ages (Table 49). (3) The unavailability, presently, of comparable weightings for the C/E index. Before inverse variance weightings can be used, the above points need to be addressed, but more importantly, techniques need to be developed for partitioning process error from random error in calibration indices so that both types of error can be accommodated in the adapt framework.

Assessment results

The results of the accepted adapt formulation indicates that fully recruited fishing mortality (ages 7-9) in the terminal year is about 0.56 (Table 50). In general, the mean age 7-9 fishing mortality has been fairly stable at about 0.50 in the late 1970's and throughout the 1980's (Fig. 23). Notable exceptions are lower values (about 0.30) during 1980 and 1981 and the slight increase in the recent few years. Fully-recruited fishing mortalities for this stock were at their highest during the 1974-76 period in the range of 0.7 to 1.0.

The population biomass at the beginning of the year and that on average throughout the year are given in Tables 51 and 52 respectively. The age 3+ biomass at the beginning of each year increased from just over 500,000 t in 1976 to about 1.2 million tons in 1984 and is currently about 850,000 t (Fig. 24). The population numbers at the beginning of the year exhibit about the same trends as the biomass and are given in Table 53.

The decline in population biomass from the mid to late 1980's is due mainly to the size of the weak 1983 and 1984 year-classes. These year-classes are now estimated to be about 180 and 150 million fish at age 3 in 1986 and 1987 respectively (Table 53, Fig. 25). Only during two other periods (the 1970-71 year-classes and the 1976-77 year-classes) were the number of recruits observed to be as low as the 1983 and 1984 year-classes.

The numbers at age 3 in 1989 were estimated by the accepted adapt formulation to be 475 million fish (Table 53). This value was based completely on the research survey results, as the commercial catch rate index for age 3 was not used in the formulation. During the last assessment of this stock (Baird and Bishop, 1989), the Adapt run using only RV data estimated the 1985 year-class to be 227 million fish at age 3. The current assessment estimates it at 257 million fish, indicating that Adapt does a reasonable job of converting the RV survey estimate at age 3 into a population estimate.

Yield per recruit

The $F_{0.1}$ reference level of 0.20 used in the past for projections of catch for this stock was estimated using a partial recruitment pattern that was flat-top from approximately age 8 onwards (Baird and Bishop, 1989b). With the use of a dome-shaped PR for this assessment, it was necessary to recalculate the reference fishing mortality levels.

The age range used for this analysis was 1 to 16 years, while the weights at age were the average for the 1987-89 period. Partial recruitment was that calculated for the terminal year in the current assessment.

The data described above are presented in Table 54. The resultant reference points are $F_{0.1}$ = 0.25 and F_{max} = 0.52 (Fig. 26) with corresponding yields per recruit of 0.42 kg and 0.46 kg respectively.

References

Baird, J. W., and C. A. Bishop. 1986. Assessment of the Cod Stock in NAFO Divisions 2J+3KL. NAFO SCR Doc. 86/47. Ser. No. N1163: 51 p.

1987. Assessment of the Cod Stock in NAFO Divisions 2J+3KL. CAFSAC Res. Doc. 87/42: 96 p.

1989. Assessment of the Cod Stock in NAFO Divisions 2J and 3KL. CAFSAC Res. Doc. 89/6: 102 p.

1989b. Yield-per-recruit analysis for cod in Divisions 2J3KL. CAFSAC Res Doc. 89/34: 11 p.

Francis, R.I.C.C., 1984. An adaptive strategy for stratified random travel surveys. New Zealand Jour. of Mar. and Fresh. Res. Vol. 18: 59-71.

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

1988. An adaptive framwork for the estimation of population size. CAFSAC Res. Doc. 88/29: 12p.

Judge, C.C., W.E. Griffiths, R. C. Hills, and T. C. Lee. 1980. The theory and practice of econometrics. John Wiley and Sons, New York 793 p.

Table 1. Historical catches of cod from NAFO Divisions 2J3KL for the period 1959-89.

	2J					3K				
	Offshore mobile gear			Inshore fixed		Offshore mobile gear			Inshore fixed	
Year	Can.	Other	Total	gear	Total	Can.	Other	Total	gear	Total
1959	-	46372	46372	17533	63905	-	97678	97678	56264	153942
1960	1	164036	164037	15418	179455	53	69855	69908	47676	117584
1961	1	243147	243148	17545	260693	-	60574	60574	31159	91733
1962	-	226841	226841	23424	250265	-	45554	45554	42816	88370
1963	1	197868	197869	23767	221636	-	79331	79331	47486	126817
1964	13	197359	197372	14787	212159	-	121423	121423	40735	162158
1965	-	246650	246650	25117	271767	21	50097	50118	26467	76585
1966	39	226244	226283	22645	248928	13	58907	58920	32208	91128
1967	28	217255	217283	27721	245004	114	78687	78801	24905	103706
1968	4650	355108	359758	12937	372695	1849	119778	121627	40768	162395
1969	30	405231	405261	4328	409589	56	80949	81005	24923	105928
1970	-	212961	212961	1963	214924	92	78274	78366	21512	99878
1971	-	154700	154700	3313	158013	31	61506	61537	21111	82648
1972	-	149435	149435	1725	151160	7	133369	133376	14054	147430
1973	1123	52985	54108	3619	57727	108	159653	159761	13190	172951
1974	-	119463	119463	1804	121267	19	149189	149208	10747	159955
1975	410	78578	78988	3000	81988	189	112678	112867	15518	128385
1976	94	30691	30785	3851	34636	771	79540	80311	20879	101190
1977	525	39584	40109	3523	43632	1051	26776	27827	28818	56645
1978	4682	17546	22228	6638	28866	7027	6373	13400	29623	43023
1979	9194	6537	15731	8445	24176	21579	16890	38469	27018	65487
1980	13592	7437	21029	17210	38239	21920	6830	28750	37015	65765
1981	22125	4760	26885	14215	41100	23112	3847	26959	23002	49961
1982	58384	8923	67307	14429	81736	8881	4074	12955	42141	55096
1983	37281	4158	41439	10743	52182	31623	2815	34438	40681	75119
1984	10754	1259	12013	13150	25163	48114	11059	59173	35143	94316
1985	1541	5	1546	10209	11755	72111	9714	81825	30368	112193
1986	4627	7373	12011	12567	24578	58239	2226	60465	28539	89004
1987	38216	3620	41836	16139	57975	39240	6119	45359	27141	72500
1988	41465	9	41474	17082	58556	39933	50	39983	33509	73492
1989	22709	-	22709	21684	44393	35082	-	35082	20320	55402

(Cont'd.)

Table 1. (Cont'd.)

	3L					2J3KL			
		Offshore mobile gear		Inshore fixed		Total inshore fixed	Total offshore mobile		
Year	Can.	Other	Total	gear	Total	gear	gear	Total	TAC
1959	4515	51515	56030	85695	141725	159492	200080	359572	-
1960	7355	60213	67568	94192	161760	157286	301513	458799	-
1961	4675	70318	74993	70659	145652	119363	378715	498078	-
1962	4383	87463	91846	72271	164117	138511	364241	502752	-
1963	4446	83015	87461	73295	160756	144548	364661	509209	-
1964	10158	142370	152528	75806	228334	131328	471323	602651	-
1965	7353	130387	137740	58943	196683	110527	434508	545035	-
1966	8253	120206	128459	55990	184449	110843	413662	524505	-
1967	13478	200343	213821	49233	263054	101859	509905	611764	-
1968	15784	211808	227592	47332	274924	101037	708977	810014	-
1969	18255	151945	170200	67973	238173	97224	656466	753690	-
1970	14471	137840	152311	53113	205424	76588	443638	520226	-
1971	11976	148766	160742	38115	198857	62539	376979	439518	-
1972	4380	109052	113432	46273	159705	62052	396243	458295	-
1973	1258	97734	98992	24839	123831	41648	312861	354509	666000
1974	880	67918	68798	22630	91428	35181	337469	372650	657000
1975	670	53770	54440	22695	77135	41213	246295	287508	554000
1976	2187	40998	43185	35209	78394	59939	154281	214220	300000
1977	5362	26799	32161	40282	72443	72623	100097	172720	160000
1978	9213	12263	21476	45194	66670	81455	57104	138559	135000
1979	14184	12693	26877	50359	77236	85822	81077	166899	180000
1980	15523	13963	29486	42298	71784	96523	79265	175788	180000
1981	21760	15070	36830	42821	79651	80038	90674	170712	200000
1982	27192	9271	36463	56479	92942	113049	116725	229774	230000
1983	39125	10920	50044	54999	105043	106423	125922	232345	260000
1984	49620	13944	63564	49428	112992	97721	134750	232471	266000
1985	39112	28927	68039	39306	107345	79883	151410	231293	266000
1986	55117	51555	106672	31263	137935	72369	179137	251506	266000
1987	43185	25883	69068	35467	104535	78747	156263	235010	256000
1988	56679	26634	83313	51058	134371	101649	164770	266419	266000
1989	39254	25000	71234	57237	128471	99241	140924[a]	240165	235000

[a]Includes catch by France (3217t) and additional 15,662t from production estimates.

Table 2. Inshore cod catches (000't) by division and gear in NAFO Divisions 2J, 3K, and 3L from 1975 to 1989.

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	6.3	13.9	0.2	1.2	8.1	7.7	0.7	3.8
	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	23.6	20.6	2.9	10.1	38.0	42.2	3.8	15.1

Table 3. Cod landings (t) by Canada in 1989 from Divisions 2J, 3K and 3L by month and year.

Month	OT Can N	OT Can M	GN	TRAP	LT	HL	TOT
			2J				
J	4561	435	0	0	0	0	4996
F	730	2800	0	0	0	0	3530
M	2	0	0	0	0	0	2
A	3639	286	0	0	0	0	3925
M	624	305	0	0	0	0	929
J	363	0	102	146	0	18	629
J	0	0	2192	1295	1	69	3557
A	107	0	7511	4786	28	680	13112
S	4	0	3465	86	158	428	4141
O	925	22	649	17	23	28	1664
N	6610	994	2	0	0	0	7606
D	143	159	0	0	0	0	302
Total	17708	5001	13921	6330	210	1223	44393
			3K				
J	1206	1050	165	0	0	6	2427
F	1137	3513	59	0	0	0	4709
M	4708	3697	0	0	0	6	8411
A	7686	1347	4	0	0	0	9037
M	8487	803	170	199	0	0	9659
J	778	0	465	797	4	185	2229
J	48	43	4743	3490	3	178	8505
A	321	23	1653	2947	313	1875	7132
S	52	2	297	636	258	1218	2463
O	173	0	167	16	80	366	802
N	8	0	6	0	6	8	28
D	0	0	0	0	0	0	0
Total	24604	10478	7729	8085	664	3842	55402

Table 3. (Cont'd)

3L

Month	CAN N OT	CAN N GN	CAN N TRAP	CAN N LT	CAN N HL	CAN M OT	CAN M GN	CAN M LT	CANADA TOTAL
J	1927	37	8	0	1	508	0	15	2496
F	1055	168	0	0	0	3954	0	151	5328
M	398	204	0	15	0	1053	0	459	2129
A	4212	584	144	115	1	1777	0	118	6951
M	4398	2763	998	119	35	1386	0	116	9815
J	4191	4036	9234	280	1560	136	0	290	19727
J	3405	7891	12081	310	1500	141	9	368	25705
A	2379	2600	1110	882	3337	0	0	74	10382
S	2784	415	59	818	1382	230	0	86	5774
O	3169	870	2	321	462	95		35	4954
N	2005	916	4	36	48	51	0	20	3080
D	0	150	0	0	0	0	0	0	150
Total	29923	20634	23640	2896	8326	9331	9	1732	96491

Total this table	196,286
Other countries outside 200 miles	25,000
Production	15,662
France	3,217
Total catch	240,165

Table 4. Commercial sampling for Divisions 2J+3KL in 1989.

Div.	Gear	Qtr.	No. aged	Month	No. meas.	Landings (t) Country/month	Total
2J	OT	1	255	Jan	3682	4561	8528
		2	238	Apr	1158	3639	5217
		4	319	Oct	2171	925	947
				Nov	7998	6610	7604
				Dec	1069	143	302
		1-4	812		16078		22709
	Trap	3	409	Jul	861	1295	6330
				Aug	8235	4786	
	GN			Jul	2994	2192	13921
				Aug	10048	7511	
	HL			Aug	1987	680	1223
	LT						210
	TOT		409		24125		21684
	(OT+Fixed)		1221		40203		44393
3K	OT	1	441	Mar	3853	4708	15311
		2	391	Apr	7513	7686	19101
				May	6356	8487	
		1-4	835		17722		35082
	Trap	3	987	Jun	2040	797	7433
				Jul	1887	3490	
				Aug	8048	2947	
	GN			Jun	1619	465	465
				Jul	6655	4743	4743
				Aug	1018	1653	1653
	HL			Jun	2822	185	2238
				Aug	2156	1875	
	LT			Aug	1432	313	320
			987		27677		16852
	Trap	4	360	Sep	3312	636	652
	GN			Sep	316	297	470
	LT			Sep	403	258	344
	HL			Sep	2655	1218	1592
			360		6686		3058
	Fixed gear TOT	1-4	1347		34363		20320
	OT+Fixed	1-4	2182		52085		55402

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Table 4. (Cont'd.)

Div.	Gear	Qtr.	No. aged	Month	No. meas.	Landings (t) Country/month	Landings (t) Total
3L	OT	1	334	Jan	2238	2435	8895
				Mar	626	1451	
					2864		8895
3L	OT	2	519	Apr	735	4212	5989
				May	2531	4398	5784
				Jun	1049	4191	4327
					4315		16100
		3	583	Jul	1492	3405	3546
				Aug	1790	2379	2379
				Sep	2640	2784	3014
					5922		8939
		4	433	Oct	3200	3169	12300
				Nov	2396	2005	
				Dec	845	2000[a]	
					6441		
		1-4	1869		19542		46234
	Other[b]						25000
	OT Total						71234
	Trap	2	760	May	2781	998	1150
	GN			May	2914	2763	3756
	HL			May	1799	35	37
					7494		4943
	Trap	3	1218	Jun	11985	9234	22490
				Jul	6554	12081	
	GN			Jun	2042	4036	4036
				Jul	1666	7891	7891
				Aug	3772	2600	2600
	HL			Jun	4120	1560	1560
				Jul	1064	1500	1500
				Aug	8507	3337	3337
	LT			Aug	1731	882	2204
					41441		45618
	GN	4	692	Sep	959	415	2351
	LT			Sep	4849	904	1316
				Oct	224	356	

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Table 4. (Cont'd.)

Div.	Gear	Qtr.	No. aged	Month	No. meas.	Landings (t) Country/month	Landings (t) Total
	HL	4		Sep	3200	1382	1892
				Oct	336	462	
					9568		5559
	Fixed gear	1-4	2670		58503		57237
	Fixed+OT	1-4	4539		78045		128471
2J3KL		1-4	7942		170333		240165[c]

[a]Estimated.
[b]Estimate for other countries based on NAFO circular letters.
[c]An estimated catch of 11899 t by otter trawlers could be assigned only to stock area. The otter trawl age composition for 2J3KL was adjusted to account for the discrepancy and subsequently combined with the total inshore age composition.

TABLE 5. ESTIMATED CATCH, AVERAGE WEIGHT, AND AVERAGE LENGTH AT AGE, ALONG WITH ASSOCIATED VARIANCES FOR THE COMMERCIAL FISHERY FOR COD IN NAFO DIVISIONS 2J3KL DURING 1989.

	AVERAGE		CATCH		
AGE	WEIGHT	LENGTH	MEAN	STD. ERR.	C. V.
2	0.259	30.252	7	2.25	0.32
3	0.480	38.168	1688	117.83	0.07
4	0.744	43.904	17964	470.54	0.03
5	1.027	48.749	20578	630.90	0.03
6	1.435	54.278	23735	802.26	0.03
7	1.833	58.721	35678	946.66	0.03
8	2.067	60.930	26145	850.40	0.03
9	2.636	65.617	8428	482.72	0.06
10	3.022	68.216	3489	282.44	0.08
11	3.960	74.410	1668	146.28	0.09
12	5.409	82.370	559	58.46	0.10
13	7.502	91.932	234	25.32	0.11
14	9.243	97.997	178	22.10	0.12
15	10.078	101.189	93	12.50	0.13
16	9.341	98.481	42	8.82	0.21
17	15.752	117.767	4	2.36	0.57
18	18.658	125.318	9	2.57	0.29
19					
20	17.637	121.433	1	0.64	0.50
21	15.387	118.000		0.30	1.35
22	15.387	118.000	1	1.91	1.30

Table 6. Offshore (mobile gear) and inshore (fixed gear) catch-at-age (nos. X 10^{-3}) and mean weights at age (kg), by NAFO Division, for the commercial cod fishery in Divisions 2J3KL during 1989.

	Offshore (mobile gear)				Adj.	Inshore (fixed gear)			Total
Age	2J	3K	3L	Total	Tot.	2J	3K	3L	2J3KL
					Catch Numbers				
2	1			1	1		2	4	7
3	39		75	114	124	55	337	1172	1688
4	378	276	3386	4039	4412	634	2177	10740	17964
5	1486	1896	3106	6488	7086	1494	2816	9181	20578
6	2696	3439	5910	12046	13157	2140	2192	6248	23735
7	4582	5170	10802	20555	22451	3963	3109	6155	35678
8	4285	5252	6897	16434	17949	2816	2170	3209	26145
9	720	2403	2249	5373	5868	661	530	1369	8428
10	372	1170	587	2129	2325	535	169	459	3489
11	254	478	345	1077	1176	155	93	244	1668
12	5	186	172	363	396	35	15	112	559
13		40	107	147	160	3	8	62	234
14	3	35	81	120	131	8	6	34	178
15	3	20	48	71	77	4	3	8	93
16		13	16	30	32		1	9	42
17			3	3	4				4
18		1	7	8	9				9
19									
20			1	1	1				1
>20		1		1	1				1
Catch (t)	22709	35082	71234		140924	21684	20320	57237	240165
					Mean Weights				
2	0.13						0.42	0.19	0.26
3	0.64		0.60			0.45	0.59	0.44	0.48
4	0.77	0.95	0.90			0.70	0.75	0.68	0.74
5	0.93	0.92	1.18			1.08	0.96	1.02	1.03
6	1.19	1.14	1.64			1.45	1.39	1.52	1.44
7	1.53	1.57	2.07			1.75	1.70	2.00	1.83
8	1.64	1.86	2.42			1.89	1.98	2.44	2.07
9	1.89	2.34	3.14			2.38	2.39	2.96	2.64
10	2.14	2.55	4.12			2.42	3.19	4.22	3.02
11	2.30	3.51	5.01			3.01	3.60	5.93	3.96
12	3.84	4.30	6.13			4.10	5.82	6.62	5.41
13		5.78	8.21			5.48	5.57	7.75	7.50
14	4.21	5.30	11.30			7.20	5.71	9.96	9.24
15	3.49	9.08	11.44			5.14	9.10	9.74	10.0
16		7.19	11.13				5.51	9.65	9.34
17			15.94				13.10	15.39	15.75
18		15.39	19.30						18.66
19									
20			17.64						17.64
>20		15.39					15.39		15.39

TABLE 7 . CATCH NUMBERS AT AGE (X 1000) FROM THE COMMERCIAL COD FISHERY IN NAFO DIVISIONS 2J3KL FOR THE YEARS 1962-89.

	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
2	301	1446	2872	85	819	790	288	59	6819	33	236	0	473	420
3	8666	5746	19338	5177	14057	15262	6142	4330	18104	12876	6737	3963	3231	3968
4	26194	27577	27603	28709	65992	77873	94291	39626	60102	71557	79809	40785	13201	14101
5	64337	60234	57757	46800	93687	100339	205805	100858	82357	95384	116562	94844	34927	25370
6	58163	118112	60681	66946	62812	96759	150541	163228	101249	98111	76196	59503	74403	34426
7	47314	58996	100147	64360	59312	54996	83808	107509	85696	57865	55984	35464	60539	39105
8	27521	29349	50865	68176	30423	38691	39443	52661	29218	25055	29553	27351	35687	36485
9	20142	15520	20892	33819	23844	17146	23171	19651	10857	11732	11750	14153	18854	13421
10	18036	11612	12264	14913	8762	16084	10984	12370	3825	4470	6393	7566	10492	7514
11	10444	8248	8698	6945	4528	5949	5591	6389	2000	2223	2987	3815	5818	2315
12	9468	4204	6352	3729	2280	3367	5249	4479	1200	1287	1660	2153	2934	1179
13	7778	3942	4989	3948	1825	2108	1939	3004	507	1140	1388	1173	1078	808
14	5785	2933	4036	3730	1186	1529	1334	1557	224	720	725	450	652	372
15	4669	2928	2703	2722	967	685	818	622	214	355	748	278	249	165
16	3888	1737	1456	1859	806	424	610	567	244	474	606	309	338	82
17	3955	1263	1918	575	416	193	127	319	124	124	452	85	162	5
18	2161	1352	1154	971	279	107	89	100	32	128	136	27	113	8
19	232	328	501	183	486	72	83	46	10	148	195	38	45	22
20	403	182	312	226	178	211	26	99	34	78	36	8	20	1
2+	319457	355709	384538	353873	372659	432585	630339	517474	402816	383760	392153	291965	263216	179767
3+	319156	354263	381666	353788	371840	431795	630051	517415	395997	383727	391917	291965	262743	179347
4+	310490	348517	362328	348611	357783	416533	623909	513085	377893	370851	385180	288002	259512	175379
5+	284296	320940	334725	319902	291791	338660	529618	473459	317791	299294	305371	247217	246311	161278
6+	219959	260706	276968	273102	198104	238321	323813	372601	235434	203910	188809	152373	211384	135908
7+	161796	142594	216287	206156	135292	141562	173272	209373	134185	105799	112613	92870	136981	101482

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
2	15	108	0	0	92	0	0	18	3	0	1	42	26	7
3	13767	7128	1323	1152	2554	2185	1702	2585	782	650	831	2329	2790	1688
4	33727	65510	17556	12361	12025	7172	31286	13616	14871	14824	15219	9217	14794	17964
5	28049	40462	39206	37493	28814	13191	19003	42602	31760	36614	44168	32340	20289	20578
6	20898	12107	20319	29202	30016	24800	14397	19028	38624	33922	45869	49061	47611	23735
7	16811	5397	7711	10982	18017	22014	25435	12044	12503	28006	26025	28469	45361	35678
8	16022	3396	3078	3460	4830	11848	16930	14701	7246	7050	14722	19505	18398	26145
9	10931	2730	1530	1300	1217	3175	11936	8934	8910	3836	3104	5818	8939	8429
10	4637	1381	1083	757	520	779	1923	6341	4227	5162	2000	1346	4285	3489
11	1462	532	437	560	232	309	338	1018	2536	2905	1977	676	756	1668
12	631	296	219	183	229	195	156	248	451	1681	1101	873	410	559
13	292	149	105	116	56	125	90	90	146	254	574	391	352	234
14	251	75	62	51	65	48	153	41	48	107	116	200	216	178
15	100	42	40	43	37	14	40	29	41	39	29	37	96	93
16	50	21	21	38	13	28	12	11	30	20	18	22	31	42
17	40	20	7	7	10	20	13	9	7	17	11	3	6	4
18	64	14	8	7	14	5	4	6	7	1	9	1	10	9
19	30	2	2	4	4	5	0	2	4	3	2	4	5	0
20	20	6	7	9	10	5	0	3	3	5	2	0	5	1
2+	147797	139376	92714	97725	98755	85918	123418	121326	122199	135096	155778	150334	164380	140500
3+	147782	139268	92714	97725	98663	85918	123418	121308	122196	135096	155777	150292	164354	140493
4+	134015	132140	91391	96573	96109	83733	121716	118723	121414	134446	154946	147963	161564	138805
5+	100288	66630	73835	84212	84084	76561	90430	105107	106543	119622	139727	138746	146770	120841
6+	72239	26168	34629	46719	55270	63370	71427	62505	74783	83008	95559	106406	126481	100263
7+	51341	14061	14310	17517	25254	38570	57030	43477	36159	49086	49690	57345	78870	76528

TABLE 8 , AVERAGE WEIGHT AT AGE FROM THE COMMERCIAL COD FISHERY IN NAFO DIVISIONS 2J3KL FOR THE PERIOD 1962-89.

	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
2	0.09	0.00	0.00	0.41	0.00	0.00	0.31	0.34	0.00	0.21	0.32	0.29	0.26
3	0.45	0.40	0.46	0.53	0.55	0.53	0.62	0.59	0.48	0.51	0.43	0.49	0.48
4	0.60	0.72	0.74	0.77	0.78	0.84	0.87	0.88	0.73	0.72	0.66	0.73	0.74
5	0.97	1.04	1.13	1.16	1.17	1.20	1.32	1.20	1.10	1.04	1.03	1.08	1.03
6	1.66	1.58	1.67	1.71	1.64	1.77	1.75	1.79	1.43	1.54	1.32	1.38	1.44
7	2.33	2.46	2.46	2.38	2.23	2.10	2.28	2.28	2.06	1.85	1.87	1.67	1.83
8	2.82	3.26	3.57	3.56	2.86	2.66	2.61	2.71	2.66	2.35	1.93	2.21	2.07
9	3.46	4.05	4.41	5.01	3.81	3.09	3.18	2.96	3.23	2.94	2.80	2.51	2.64
10	3.88	4.46	5.25	5.49	5.32	4.18	3.50	3.65	3.32	3.47	3.51	3.04	3.02
11	4.78	5.02	5.80	6.72	6.29	6.16	4.79	4.28	4.06	3.80	4.80	4.37	3.96
12	6.13	6.72	7.03	7.87	7.06	7.19	7.76	6.19	4.55	4.54	4.64	5.49	5.41
13	7.31	8.10	8.96	8.38	7.32	8.00	9.07	8.39	7.03	5.34	5.74	6.55	7.50
14	8.40	7.42	8.54	10.03	10.01	8.36	9.14	10.26	9.67	7.12	6.13	8.60	9.24
15	8.81	8.20	9.46	11.31	8.99	7.86	10.62	11.44	11.37	11.77	8.53	9.76	10.05
16	11.75	11.26	10.70	13.87	11.54	7.91	10.57	11.61	11.27	11.24	13.51	9.73	9.34
17	10.63	11.61	13.12	10.68	10.48	9.58	13.13	17.47	12.68	14.15	9.10	12.58	15.74
18	12.27	8.92	13.49	16.09	11.15	12.95	15.97	12.94	12.42	16.14	21.77	16.01	18.66
19	7.62	10.57	15.51	12.04	9.82	0.00	9.73	15.21	14.38	12.30	17.66	16.60	0.00
20	17.46	16.00	14.77	11.37	12.59	0.00	15.88	12.81	19.49	15.72	0.00	11.03	17.64

Table 9. Cod abundance estimates (No. x 10^3) from research vessel surveys in NAFO Division 2J (Fall). Numbers in brackets are estimates for non-sampled strata.

Depth range (m)	Stratum number	Stratum area (mi^2)	Gadus 3 1977	Gadus 15 1978	Gadus 29 1979	Gadus 44 1980	Gadus 58 1981	Gadus 71 1982	Gadus 86-88 1983	Gadus 101-102 1984	Gadus 116-115 1985	Gadus 131-132 1986	Gadus 145-147 1987	Gadus 159-160 1988	Gadus 174-176 1989
101-200	201	1427	13336	3071	1500	5749	8355	16692	16246	10533	15246	21638	6784	54	0
	205	1823	2894	8039	1574	787	4550	21765	13547	25230	8159	9481	7841	13707	164
	206	2582	6889	1634	1236	2104	6220	5868	8694	30077	12764	29985	4222	21638	9363
	207	2246	9745	5100	2664	3406	5479	9094	13024	14210	27849	6310	9027	4504	711
Total		**8078**	**32864**	**17844**	**6974**	**12046**	**24604**	**53419**	**51511**	**80050**	**64018**	**67414**	**27874**	**39903**	**10238**
201-300	202	440	2097	462	396	5681	2378	2378	1833	1866	760	7663	2626	(2264)	0
	209	1608	10174	3531	21485	3410	10099	7681	29567	3862	8599	28567	13594	6711	1418
	210	774	6166	4154	2760	2982	445	4713	59785	4953	299	21187	145	2401	12218
	213	1725	6944	19617	18516	19811	2158	5807	12806	6915	14028	23624	10316	12334	29614
	214	1171	16716	10658	6527	10958	3956	5900	4659	25667	19030	43496	40024	31805	14574
	215	1270	19281	34205	9986	25692	35768	27583	7233	8040	7424	85617	8593	32304	111
	228	1428	2948	(4502)	6780	8254	10701	2187	2269	1853	352	12702	1164	2272	3001
	234	508	1258	553	267	1506	534	2250	4698	3005	2339	5415	1760	1125	0
Total		**8924**	**65584**	**77682**	**66717**	**78294**	**66039**	**58499**	**122850**	**56161**	**52831**	**228271**	**78222**	**95316**	**60936**
301-400	203	480	883	(710)	(589)	3081	81	1117	462	703	156	1784	1405	2090	0
	208	448	1017	247	1480	202	303	1368	1749	224	1043	2051	3918	757	6008
	211	330	632	5450	2737	4659	1746	2415	1325	297	776	1090	1709	1647	12910
	216	384	0	(251)	202	3603	86	14	10	331	115	94	3127	476	749
	222	441	50	1479	149	1258	132	0	11	11	182	17	281	66	2847
	229	567	415	234	2873	1319	447	298	670	71	936	539	85	440	1475
Total		**2650**	**2997**	**8371**	**8030**	**14122**	**2795**	**5212**	**4227**	**1637**	**3208**	**5575**	**10525**	**5476**	**23989**
401-500	204	354	199	(342)	(283)	(384)	1342	142	540	1422	0	518	425	1860	13
	217	268	0	(4)	(1)	(5)	0	0	0	(11)	0	0	50	0	0
	223	180	0	(1)	(0)	(2)	0	0	0	0	0	0	0	14	7
	227	686	51	(67)	(52)	(78)	0	21	26	0	0	51	77	86	1146
	235	420	32	(140)	(114)	(158)	158	126	1135	63	32	0	268	173	236
Total		**1908**	**282**	**554**	**450**	**627**	**1500**	**289**	**1701**	**1496**	**32**	**569**	**1101**	**2133**	**1402**
TOTAL			101727	104450	82170	105090	94940	117420	180292	139344	120091	301831	117446	138727	109470
Mean no. per tow			62.86	64.54	50.77	64.93	58.66	72.55	111.40	86.10	74.20	186.50	72.57	85.72	67.64
Unadjusted total			101786	98432	81130	104461	94988	117469	180290	139366	120103	302092	117569	136682	109567
Upper limit			149969	131104	128646	139530	162744	151085	744785	184179	154186	468810	163856	183268	139687
Lower limit			53602	65761	33613	69392	27234	83853	-384206	94552	86020	135374	71282	90096	79446

Table 10. Cod biomass estimates (t) from research vessel surveys in NAFO Division 2J (Fall). Numbers in brackets are estimates for non-sampled strata.

Depth range (m)	Stratum number	Stratum area (mi^2)	Gadus 3 1977	Gadus 15 1978	Gadus 29 1979	Gadus 44 1980	Gadus 58 1981	Gadus 71 1982	Gadus 86-88 1983	Gadus 101-102 1984	Gadus 116-115 1985	Gadus 131-132 1986	Gadus 145-147 1987	Gadus 159-160 1988	Gadus 174-176 1989
101-200	201	1427	12377	4847	3256	11319	15998	18085	16764	12033	14952	24712	9158	84	0
	205	1823	2761	16200	2669	1676	10126	39216	17742	25093	7526	11016	9456	27403	240
	206	2582	5328	2074	2671	3849	13153	8533	11442	39133	13186	34327	5313	36617	13183
	207	2246	16809	8209	4192	7738	12284	12612	12608	18136	27954	7864	11883	7613	465
Total		**8078**	**37275**	**31330**	**12788**	**24582**	**51561**	**78446**	**58556**	**94395**	**63618**	**77919**	**35810**	**71717**	**13888**
201-300	202	440	3074	525	749	12964	6292	5681	3798	2948	850	10363	4533	(4448)	0
	209	1608	15336	5384	43569	12810	22275	18351	53925	7678	12245	37475	19297	11006	13957
	210	774	10481	5572	5771	5810	823	10428	97578	9448	782	25147	360	4532	16774
	213	1725	6525	31627	31100	34068	5622	8073	14748	9401	16121	27904	13172	20289	41026
	214	1171	24370	20791	13231	25095	9669	10993	6944	33853	24715	61918	62937	52313	20548
	215	1270	31757	55780	19546	64301	96161	60996	12584	10471	10732	131984	14279	65032	40
	228	1428	3930	(7568)	12374	16972	23904	4357	2215	3012	299	15820	1749	4845	4582
	234	508	2857	1030	553	3699	1192	4614	5370	3657	2402	7178	2790	2521	0
Total		**8924**	**98330**	**126071**	**126893**	**175719**	**165938**	**123493**	**197162**	**80468**	**68146**	**317789**	**119117**	**164986**	**96927**
301-400	203	480	1930	(1621)	(1663)	7467	230	3141	1369	2054	192	2982	2798	4396	0
	208	448	1962	438	3341	631	908	3750	3153	454	1454	2589	6120	1816	5755
	211	330	1738	10285	5685	9384	4747	6490	3016	954	1400	1462	3573	3412	20686
	216	384	0	(576)	484	10204	454	86	24	908	180	142	5462	937	1356
	222	441	43	2029	653	2780	281	0	105	22	281	15	463	91	1199
	229	567	1009	319	7394	3150	1144	467	516	106	1397	816	96	786	2525
Total		**2650**	**6682**	**15268**	**19220**	**33616**	**7764**	**13934**	**8183**	**4498**	**4904**	**8006**	**18512**	**11438**	**31521**
401-500	204	354	308	(618)	(634)	(962)	3149	316	1506	2192	0	829	683	3514	2
	217	268	0	(6)	(6)	(15)	0	0	0	(13)	0	0	80	0	0
	223	180	0	(2)	(2)	(7)	0	0	0	0	0	0	0	19	4
	227	686	131	(135)	(139)	(222)	0	36	129	0	0	101	117	137	2483
	235	420	75	(268)	(276)	(423)	347	315	1584	121	24	0	497	334	410
Total		**1908**	**514**	**1029**	**1057**	**1629**	**3496**	**667**	**3219**	**2325**	**24**	**930**	**1377**	**4004**	**2899**
TOTAL			142799	175901	159957	235547	228757	216539	267120	181684	136693	404642	174819	252147	145235
Mean wt. per tow			88.24	108.69	98.84	145.54	141.35	133.80	165.05	112.26	84.46	250.03	108.02	155.80	89.74
Unadjusted total			142961	165109	157237	233916	228894	216679	267120	181731	136723	405184	175021	248085	145504
Upper limit			199808	222301	253553	314419	424737	288880	1175017	241662	174398	667126	247909	336941	191590
Lower limit			86113	107917	60921	153412	33051	144478	-640777	121800	99048	143243	102132	159229	99419

Table 11. Cod abundance estimates (No. x 10^{-3}) from research vessel surveys in NAFO Division 3K. (Fall). Numbers in brackets are estimates for non-sampled strata.

Depth range (m)	Stratum number	Stratum area (mi^2)	Gadus 15 1978	Gadus 29 1979	Gadus 44 1980	Gadus 58,59 1981	Gadus 71,72 1982	Gadus 86-88 1983	Gadus 101-102 1984	Gadus 116-115 1985	Gadus 131-132 1986	Gadus 145-147 1987	Gadus 160-161 1988	Gadus 174-176 1989
101-200	618	1455	(4438)	(6238)	(3481)	(3942)	(3280)	(4754)	4806	6458	12975	2652	1074	560
	619	1588	(1084)	(1541)	(840)	(957)	(789)	(1164)	1243	221	930	671	460	1430
Total		3043	5522	7779	4321	4899	4069	5918	6049	6679	13905	3323	1534	1990
201-300	620	2709	17720	26203	15206	12689	4248	17610	22825	1728	31158	6449	4236	9368
	621	2859	14563	25646	2739	7453	6471	4603	6070	1531	4654	930	2854	2512
	624	668	13121	23166	627	3686	2470	1128	965	552	602	234	769	520
	632	447	727	2265	5078	3171	2494	8321	(2979)	1029	1158	1879	12516	604
	634	1618	4105	18157	13651	19455	11384	14186	6229	7112	99786	18660	4676	29523
	635	1274	3825	1492	3706	4743	3175	1227	3275	874	3727	829	1033	710
	636	455	1820	2446	6051	3695	7001	2603	3413	928	3440	1482	2318	1136
	637	1132	2528	5778	3909	4744	6409	8718	19062	3824	11939	3781	6936	3212
Total		12162	58409	105153	50967	59636	43652	58396	64818	17578	156464	34244	35338	47585
301-400	623	1027	6167	2981	7593	876	1557	5769	11764	1015	1060	3855	1172	7414
	625	850	1340	2488	1515	1021	2169	1276	574	1723	808	2760	1340	3238
	626	919	3191	759	1012	2235	911	1276	770	826	10451	1173	317	1628
	628	1085	1433	2891	1008	1371	570	1955	1140	1826	672	375	2108	1853
	629	495	718	446	144	50	412	562	459	272	1348	237	431	425
	630	544	(371)	388	315	225	(270)	306	414	82	65	177	191	2151
	633	2179	4283	3044	2944	3106	3552	3748	5954	10059	26717	15375	3660	37565
	638	2059	2720	8081	3246	9158	5699	13643	3323	9189	9080	7388	4637	41590
	639	1463	1603	3075	741	1303	2921	4095	1304	2128	3423	1459	1977	2320
Total		10621	21826	24153	18518	19345	18061	32630	25702	27120	53624	32799	15833	98184
401-500	622	632	(357)	(509)	(276)	356	190	142	308	59	332	47	237	2499
	627	1194	(451)	(650)	(345)	104	152	193	178	89	1262	341	284	1304
	631	1202	(462)	(665)	(354)	162	0	523	18	103	68	752	1585	8185
	640	198	(23)	(35)	(16)	0	0	(25)	7	10	7	7	59	632
	645	204	(28)	(42)	(20)	0	5	8	15	15	(46)	31	15	505
Total		3430	1321	1901	1011	622	347	891	526	276	1715	1178	2180	13125
TOTAL			87077	138987	74816	84503	66128	97833	97098	51651	225709	71544	54871	160884
Mean no. per tow			39.65	63.29	34.07	38.48	30.11	44.55	44.21	23.52	102.78	32.58	24.99	73.26
Unadjusted total			79865	129306	69484	79602	61791	91907	94118	51653	225663	71587	54871	160883
Upper limit			113311	218233	93324	104928	75262	119955	125225	65201	498301	101570	207965	232582
Lower limit			46420	40380	45645	54276	48320	63859	63010	38104	-46976	41603	-98223	89183

Table 12. Cod biomass estimates (t) from research vessel surveys in NAFO Division 3K (Fall). Numbers in brackets are estimates for non-sampled strata.

Depth range (m)	Stratum number	Stratum area (mi²)	Gadus 15 1978	Gadus 29 1979	Gadus 44 1980	Gadus 58,59 1981	Gadus 71,72 1982	Gadus 86-88 1983	Gadus 101-102 1984	Gadus 116-115 1985	Gadus 131-132 1986	Gadus 145-147 1987	Gadus 160-161 1988	Gadus 174-176 1989
101-200	618	1455	(4604)	(8222)	(5287)	(5698)	(4541)	(6185)	9363	10318	18917	3979	97	209
	619	1588	(1484)	(2683)	(1710)	(1846)	(1463)	(2008)	3004	652	811	1164	469	254
Total		3043	6088	10905	6997	7544	(6004)	8193	12367	10970	19728	5143	566	463
201-300	620	2709	32708	55286	33699	33603	9851	33248	41781	4190	46251	11244	2721	2293
	621	2859	25889	63106	5939	10935	11764	6750	14149	2229	7283	887	4361	1401
	624	668	29936	40531	1742	7973	5365	1586	959	953	1153	232	1112	284
	632	447	873	3896	10165	7566	5721	13992	(6117)	1667	2072	2726	16458	514
	634	1618	6907	29309	29404	40573	23579	22967	11703	11161	163994	32997	7054	40703
	635	1274	3702	2551	7902	10271	7249	3236	5457	1619	7900	1404	1423	745
	636	1455	2248	5040	11959	8428	14144	6335	7065	1884	4489	3011	4087	649
	637	1132	3540	10613	7871	9829	13256	17317	34548	6209	17860	7109	11429	4815
Total		12162	105803	210332	108681	129178	90929	105431	121777	29912	251002	59610	48645	51404
301-400	623	1027	11293	7522	15746	2175	4849	12071	20190	2303	2182	7108	1041	3891
	625	850	1825	5538	4626	2640	4817	3499	1397	2935	1446	4490	2549	3446
	626	919	6976	1940	3242	4781	2076	3932	1653	1735	12331	1914	327	1696
	628	1085	2729	6206	2739	3848	1480	3841	2112	3000	1038	659	2329	1739
	629	495	1136	1062	337	150	1255	1167	832	346	2066	322	270	443
	630	544	(873)	1019	1174	939	(860)	847	708	230	84	327	415	3726
	633	2179	6947	6379	8073	8406	8482	6558	10861	16779	45140	26825	6307	44756
	638	2059	4210	13362	7161	17706	10143	23310	5511	13854	13234	12674	6547	92164
	639	1463	2204	5734	1949	3225	8335	9295	2684	3349	5372	2526	3185	1589
Total		10621	38823	48762	45047	43870	42297	64520	45948	44351	82893	56845	19970	153450
401-500	622	632	(628)	(1133)	(723)	1297	561	289	646	79	451	47	353	2249
	627	1194	(807)	(1468)	(932)	267	330	601	318	127	2121	350	446	1580
	631	1202	(827)	(1504)	(954)	451	0	1489	72	220	113	1200	2165	9010
	640	198	(61)	(114)	(71)	0	0	(84)	119	59	11	45	216	841
	645	204	(81)	(150)	(94)	0	54	42	176	130	(122)	47	77	197
Total		3430	2404	4369	2774	2015	945	2505	1331	615	2818	1689	3257	13877
TOTAL			152486	274365	163496	182567	140165	180642	181421	86029	356443	123283	75437	219203
Mean wt. per tow			69.44	124.93	74.45	83.13	63.82	82.56	82.61	39.17	162.31	56.14	34.35	99.82
Unadjusted total			143123	259093	153728	175023	133310	172458	175307	86029	356316	123358	75437	219193
Upper limit			215048	421005	201839	237798	159091	216590	228070	107721	797048	180376	285967	394022
Lower limit			71198	97181	105619	112247	107529	128325	122544	64338	-84415	66340	-135093	44363

Table 13. Cod abundance (No. x 10^{-3}) from stratified random cruises in Division 3L (Fall). Numbers in brackets are estimates for non-sampled strata.

Depth range	Stratum No.	Stratum area	ATC 323-325 1981	ATC 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
31-50	350	2071	4923	2332	6335	15455	13698	15197	4785	3902	3327
	363	1780	802	1960	13050	19374	40659	2439	6770	9193	11351
	371	1121	105	1010	4679	8018	1058	151	1330	1963	105
	372	2460	14256	8679	37532	27415	21453	6039	21406	5128	8580
	384	1120	(867)	273	6025	20303	452	52	8589	336	76
Total		8552	20953	14254	67621	90565	77320	23878	42880	20522	23430
51-100	328	1519	(576)	(685)	(985)	285	385	4598	257	928	309
	341	1574	1930	975	1359	1512	945	1287	144	966	74
	342	585	381	1039	274	439	205	219	176	132	44
	343	525	897	(333)	328	2089	263	617	131	210	13
	348	2120	1724	3310	1953	7002	1284	1999	1008	1194	1432
	349	2114	2154	1492	1622	8059	3047	2739	681	2257	730
	364	2817	963	1113	1629	8162	1774	964	1012	2145	442
	365	1041	8693	2090	578	8400	684	1583	521	375	234
	370	1320	173	413	727	7799	561	248	380	255	66
	385	2356	44	309	318	1827	118	702	197	27	10
	390	1481	37	111	111	2483	48	241	764	125	79
Total		17452	17572	11870	9884	48057	9364	15197	5271	8614	3439
101-150	344	1494	2075	5047	1103	3701	2978	2464	1654	977	881
	347	983	2706	2915	2041	2976	719	1290	553	2966	1476
	366	1394	5197	8022	4473	6221	18207	23099	9433	23992	8671
	369	961	2669	1371	2525	2803	1960	21671	5194	3203	418
	386	983	861	553	(2234)	1513	1269	5737	1107	1004	1550
	389	821	(1235)	1756	(2053)	811	961	985	3374	1017	1263
	391	282	(102)	95	635	32	635	95	169	32	64
Total		6918	14845	19759	15064	18057	26729	55341	21484	33191	14323
151-200	345	1432	2015	3637	2929	2300	4658	5105	3386	4208	2319
	346	865	5822	2337	4389	1731	3441	5089	11834	10259	6948
	368	334	1316	1429	(2439)	602	2871	6168	1617	1580	928
	387	718	808	3000	(2228)	3072	1253	10618	880	377	305
	388	361	(329)	253	(550)	528	461	(531)	149	339	935
	392	145	(23)	147	33	103	60	16	5	38	16
Total		3855	10313	10803	12568	8336	12744	27527	17871	16801	11451
TOTAL			63683	56687	105138	165018	126083	121943	87506	78425	52644
Mean no. per tow			23.07	20.53	38.08	59.78	45.67	44.17	31.70	28.41	19.07
Unadjusted total			60550	55688	94649	165427	125937	121410	87505	78427	52644
Upper limit			83240	67092	123077	197373	175516	169896	109122	98525	64954
Lower limit			37860	44285	66220	133481	76355	72925	65889	58329	40334

Table 14. Cod biomass (t) from stratified random cruises in Division 3L (Fall). Numbers in brackets are estimates for non-sampled strata.

Depth range	Stratum No.	Stratum area	ATC 323-325 1981	ATC 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
31-50	350	2071	6244	3849	8463	16498	11218	21047	6486	8216	4815
	363	1780	852	2009	17993	20017	40414	4605	11261	15379	16040
	371	1121	137	1363	6126	11210	1304	89	2710	4404	231
	372	2460	20737	6882	44364	27045	29915	11255	40873	9964	12957
	384	1120	(1443)	1090	5941	27463	583	53	13690	911	76
Total		8552	29413	15193	82887	102233	83434	37049	75020	38874	34119
51-100	328	1519	(662)	(683)	(1246)	299	656	3128	131	1215	437
	341	1574	2146	901	1949	1760	957	1793	309	561	69
	342	585	834	951	263	736	205	233	167	237	60
	343	525	1419	(388)	661	2261	99	690	194	269	39
	348	2120	2651	4249	3125	11537	1995	2384	1512	1973	1312
	349	2114	3604	3174	2266	8257	3856	3211	1067	3835	1238
	364	2817	1932	1800	1946	4536	1419	1298	1521	3309	773
	365	1041	17904	3702	961	3624	977	1512	1087	1035	316
	370	1320	300	446	1184	7891	597	69	842	562	116
	385	2356	38	43	1019	1886	94	1095	951	326	64
	390	1481	9	58	852	1130	9	35	277	204	108
Total		17452	31499	16395	15482	43917	10864	15448	8058	13526	4532
101-150	344	1494	3869	7701	1682	6121	4010	3623	2019	897	854
	347	983	4550	4805	3167	5731	1245	1833	701	3852	2332
	366	1394	9313	11920	8999	7101	27549	34160	15868	39741	11921
	369	961	7755	2290	5849	3962	4557	33585	12236	6341	2034
	386	983	1414	1430	(6687)	2546	4162	13630	2869	4044	4007
	389	821	(2057)	3428	(3753)	2737	2521	1723	1733	704	2009
	391	282	(97)	487	159	79	325	370	70	6	23
Total		6918	29055	32061	30296	28277	44369	88924	35496	55585	23180
151-200	345	1432	4703	7686	6443	3673	8104	9106	5375	7693	4028
	346	865	12012	4212	7746	3003	5805	7670	19771	18031	13436
	368	334	5948	3604	(7933)	1222	6011	12300	5353	4319	3165
	387	718	1334	9216	(6503)	7465	4056	20225	2740	1289	476
	388	361	(534)	461	(979)	616	1951	(708)	115	366	1362
	392	145	(33)	220	109	68	106	11	8	41	22
Total		3855	24564	25399	29713	16047	26033	50020	33362	31739	22489
TOTAL			114533	89048	158370	190480	164700	191440	151936	139727	84319
Mean wt. per tow			41.49	32.26	57.37	69.00	59.66	69.35	55.04	50.61	30.54
Unadjusted total			109706	87997	131267	191701	164448	190731	151936	139726	84320
Upper limit			153131	105967	175407	226108	212703	264591	191200	172522	102409
Lower limit			66281	70027	87127	157294	116193	116872	112672	106929	66231

Table 15. Cod abundance estimates (No. x 10^{-3}) from research vessel surveys in NAFO Division 3L (Spring). Numbers in brackets are estimates for non-sampled strata.

Depth range (fath)	Stratum number	Stratum area (mi^2)	ATC 262 1977	ATC 276 1978	ATC 290 1979	ATC 304-305 1980	ATC 317-318 1981	ATC 329 1982	WT 28-30 1985	WT 48 1986	WT 59-60 1987	WT 70-71 1988	WT 83 1989
31-50	350	2,071	2,993	1,373	7,756	2,798	829	1,221	15,883	5,893	6,685	32,355	9836
	363	1,780	4,783	2,352	7,616	1,817	3,296	1,924	7,182	7 429	11,194	14,621	3482
	371	1,121	112	477	1,599	2,917	0	189	8,061	926	1,647	1,178	1501
	372	2,460	2,247	8,969	6,135	3,293	5,032	1,477	27,099	12,451	9,290	13,346	4281
	384	1,120	42	56	2,711	1,555	42	42	98	1,906	2,174	387	280
Total		8,552	10,177	13,227	25,817	12,380	9,199	4,853	58,323	28,605	30,990	61,887	19880
51-100	328	1,519	72	(139)	296	(315)	0	342	257	443	794	285	0
	341	1,574	3,161	325	827	1,024	1,004	2,150	3,505	1,661	2,599	8,330	1669
	342	585	768	747	132	417	(263)	278	586	454	307	176	454
	343	525	335	867	768	1,399	867	2,374	1,103	719	381	801	1340
	348	2,120	875	2,361	3,687	3,456	887	2,467	4,986	5,450	10,702	8,391	4367
	349	2,114	3,385	4,337	4,035	2,997	595	3,729	7,016	6,767	4,616	5,951	11148
	364	2,817	967	599	4,705	2,996	952	1,304	5,821	3,483	8,064	5,286	7250
	365	1,041	781	391	2,481	1,035	(1,675)	4,689	1,797	1,516	5,798	5,236	2683
	370	1,320	66	330	817	1,486	0	248	7,394	805	4,742	2,715	4013
	385	2,356	383	59	783	3,139	59	0	2,087	258	514	849	3493
	390	1,481	1,223	1,056	2,223	1,223	389	139	358	97	79	0	125
Total		17,452	12,016	11,211	20,754	19,487	6,691	17,720	34,910	21,653	38,596	38,020	36542
101-150	344	1,494	7,327	11,635	15,981	7,947	29,001	9,196	695	4,864	449	841	5239
	347	983	861	6,254	5,737	10,212	3,247	10,773	1,668	5,519	2,410	5,003	1439
	366	1,394	10,461	(15,832)	11,118	5,232	56,749	18,521	41,420	20,339	13,214	4,133	10215
	369	961	761	577	2,813	6,757	7,286	1,876	10,950	9,534	6,810	10,929	5134
	386	983	1,599	639	2,749	2,066	2,693	812	5,371	1,783	3,011	3,320	6924
	389	821	2,178	1,130	1,464	5,259	1,140	2,712	8,677	1,380	1,150	1,335	1430
	391	282	921	201	1,117	1,757	688	191	476	603	286	127	191
Total		6,918	24,108	(36,268)	40,979	39,230	100,804	44,081	69,257	44,022	27,330	25,688	30572
151-200	345	1,432	5,505	5,321	1,800	6,385	15,264	2,714	2,107	13,160	21,498	7,820	12860
	346	865	782	(2,046)	1,380	1,125	2,727	801	714	16,999	6,324	4,058	3360
	368	334	319	(478)	56	113	1,880	639	1,492	4,250	5,382	238	1270
	387	718	108	198	256	108	296	1,419	24,226	5,686	189	552	2878
	388	361	881	257	190	41	393	989	488	2,520	14	244	289
	392	145	44	44	178	5	196	218	1,818	403	5	234	98
Total		3,855	7,639	8,344	3,860	7,777	20,756	6,780	30,845	43,018	33,412	13,146	20755
TOTAL			53,938	69,046	91,411	78,676	137,449	73,434	193,336	137,302	130,329	138,742	107747
Mean no. per tow			19.54	25.01	33.11	28.57	49.79	26.60	70.03	49.74	47.21	50.26	39.03
Unadjusted total			53,938	50,554	91,410	78,560	135,716	73,433	193,335	137,299	130,328	138,741	107747
Upper Limit			67,857	70,457	112,937	93,294	266,824	94,202	255,581	161,282	179,957	177,548	126081
Lower Limit			40,018	30,651	69,883	63,827	4,608	52,665	131,090	113,317	80,699	99,933	89404

Table 16. Cod biomass estimates (t) from research vessel surveys in NAFO Division 3L (Spring). Numbers in brackets are estimates for non-sampled strata.

Depth range (fath)	Stratum number	Stratum area (mi^2)	ATC 262 1977	ATC 276 1978	ATC 290 1979	ATC 304-305 1980	ATC 317-318 1981	ATC 329 1982	WT 28-30 1985	WT 48 1986	WT 59-60 1987	WT 70-71 1988	WT 83 1989
31-50	350	2,071	5,187	2,106	13,637	7,124	2,539	4,775	31,785	16,344	19,008	56,567	22,760
	363	1,780	5,399	3,919	11,237	4,182	7,082	6,721	14,881	12,152	19,419	23,096	8,070
	371	1,121	535	1,490	2,439	8,148	0	789	15,647	3,184	4,122	4,005	4,080
	372	2,460	1,865	7,006	8,342	7,448	7,155	3,978	44,792	19,171	22,017	27,917	12,397
	384	1,120	10	19	3,521	2,480	462	231	284	3,667	3,681	844	549
Total		8,552	12,996	14,540	39,176	29,382	17,238	16,494	107,389	54,518	68,247	112,429	47,856
51-100	328	1,519	38	(136)	518	(489)	0	893	74	838	1,897	456	0
	341	1,574	3,916	1,006	2,468	3,291	2,038	8,495	4,735	8,022	12,076	16,947	4,772
	342	585	1,196	3,010	409	961	(557)	871	429	1,639	604	307	483
	343	525	438	1,789	1,190	2,936	946	4,768	795	1,502	1,064	1,346	1,511
	348	2,120	1,701	3,546	7,128	7,855	1,966	5,709	7,904	11,590	33,966	23,118	9,796
	349	2,114	10,746	8,879	8,800	7,282	1,321	10,182	16,005	27,730	14,008	17,951	28,008
	364	2,817	1,101	928	7,884	7,154	1,533	3,938	9,837	9,223	20,328	13,755	18,200
	365	1,041	1,112	532	2,953	2,442	(2,412)	6,056	2,160	3,324	9,791	8,361	5,262
	370	1,320	330	367	1,046	2,807	0	99	7,054	3,511	7,679	5,896	6,603
	385	2,356	422	80	1,118	6,278	413	0	2,084	424	1,066	2,133	3,088
	390	1,481	505	795	2,125	2,798	500	217	261	406	503	0	197
Total		17,452	21,505	21,068	35,639	44,293	11,686	41,228	51,338	68,214	102,982	90,270	77,980
101-150	344	1,494	7,784	20,366	19,398	10,172	50,712	19,583	648	8,032	1,023	1,121	5,808
	347	983	1,128	8,492	7,705	16,019	8,043	21,435	3,416	10,419	4,919	8,818	2,386
	366	1,394	6,211	(13,281)	11,509	5,912	81,497	21,817	45,178	30,705	19,201	7,551	13,823
	369	961	2,050	999	2,448	7,406	9,378	4,959	19,297	11,488	11,564	16,889	9,252
	386	983	1,228	251	2,881	2,361	4,593	1,279	3,877	1,906	4,368	3,274	6,748
	389	821	1,343	1,063	1,098	6,923	478	1,664	6,169	900	647	692	612
	391	282	634	356	1,048	2,064	1,212	95	429	826	201	41	95
Total		6,918	20,378	44,844	46,087	50,857	155,913	70,832	79,014	64,276	41,923	38,386	38,724
151-200	345	1,432	13,271	10,687	4,844	11,674	29,493	6,060	2,939	17,444	28,741	11,340	18,456
	346	865	990	(2,124)	2,137	2,154	4,307	1,223	341	20,427	8,298	5,203	4,496
	368	334	404	(732)	239	796	1,761	809	1,536	6,412	7,166	652	2,503
	387	718	122	184	459	256	243	2,353	21,491	6,555	195	520	2,506
	388	361	1,181	181	349	108	190	1,321	346	1,572	10	179	122
	392	145	30	66	189	0	128	256	2,237	435	3	98	57
Total		3,855	15,998	13,974	8,217	14,988	36,122	12,022	28,890	52,845	44,413	17,992	28,140
TOTAL			70,877	94,482	129,111	139,518	220,956	140,579	266,632	239,859	257,566	259082	192,713
Mean wt. per tow			25.67	34.22	46.77	50.54	80.04	50.92	96.58	86.88	93.30	93.85	69.81
TOTAL			70,877	78,118	129,117	139,030	218,214	140,578	266,628	239,857	257,565	259,080	192,713
Upper limit			93,640	100,261	154,966	166,965	405,205	171,826	337,779	278,797	321,059	325,467	226,139
Lower limit			48,114	55,974	103,267	111,094	31,224	109,329	195,476	200,916	194,071	192,693	159,288

Table 17. Biomass estimates (000't) of cod from autumn research vessel surveys in NAFO Div. 2J, 3K and 3L.

Div.	1981	1982	1983	1984	1985	1986	1987	1988	1989	
2J	228.8	216.5	267.1	181.7	136.7	404.6	174.8	252.9	145.5	
3K	185.4	142.2	183.7	181.9	86.0	356.4	123.3	75.4	219.2	
3L	114.5	89.1	157.0	190.5	164.7	191.2	151.9	139.7	84.3	
Total	528.7	447.8	607.8	554.1	387.4	952.2	450.0	468.0	449.0	
Percentage										Ave.
2J	43	48	44	33	35	43	39	54	32	41
3K	35	32	30	33	22	37	27	16	49	31
3L	22	20	26	34	43	20	34	30	19	28
Total	100	100	100	100	100	100	100	100	100	100

Table 18. Evaluation of 2-stage survey design used for Div. 2J3KL during the Autumn of 1989.

Number of Sets

Division	Survey	Stage-2	Total
3L	174	21	195
3K	151	28	179
2J	125	20	145
Total	**450**	**69**	**519**

Parameter Estimates and Variance

	Estimates		Variance	
	Abundance	Biomass	Abundance	Biomass
3L				
survey	48578 E3	73514 E3	57098 E10	70610 E10
+stage-2	52644 E3	84320 E3	47600 E10	83163 E10
3K				
survey	210462 E3	291064 E3	3793670 E10	12208971 E10
+stage-2	160833 E3	219193 E3	2046420 E10	8865739 E10
2J				
survey	105699 E3	141098 E3	259402 E10	612718 E10
+stage-2	109567 E3	145504 E3	238569 E10	629220 E10
TOTAL				
survey	364739 E3	505676 E3	4110170 E10	12892299 E10
+stage-2	323094 E3	449017 E3	2332589 E10	9578122 E10
Difference	**-11.4%**	**-11.2%**	**-43.3%**	**-25.7%**

TABLE 19 . MEAN NUMBER (ADJUSTED FOR MISSING STRATA) PER TOW OF COD AT AGE FROM RV SURVEYS CONDUCTED IN DIVISION 2J DURING AUTUMN.

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
1	0.00	0.00	0.00	0.36	0.00	1.06	1.99	0.52	0.06	0.03	0.08	0.76	0.25
2	3.34	0.51	0.31	1.54	4.16	3.09	14.10	5.30	1.51	2.28	0.41	2.57	13.32
3	9.66	7.56	1.37	1.32	3.06	18.26	16.83	16.75	9.06	8.49	1.93	2.66	8.38
4	29.13	13.95	11.53	4.49	2.29	6.42	25.91	16.55	22.06	31.24	4.43	4.67	6.09
5	13.33	28.20	16.91	20.40	4.22	4.47	16.46	26.70	13.64	70.31	24.93	7.83	5.90
6	2.93	9.65	16.29	20.84	17.00	4.28	8.85	10.19	16.54	41.29	25.16	25.56	8.13
7	1.36	2.14	2.32	12.36	15.22	13.24	4.54	2.46	7.32	21.61	7.37	29.66	13.74
8	1.23	0.78	0.73	1.79	9.62	11.65	12.34	1.55	1.26	8.71	5.29	5.56	9.33
9	0.96	0.61	0.50	0.52	2.00	7.91	5.61	3.50	0.86	0.72	2.21	3.95	1.33
10	0.53	0.44	0.29	0.38	0.51	1.33	3.56	1.50	1.18	0.66	0.38	1.95	0.69
11	0.20	0.24	0.29	0.24	0.08	0.36	0.74	0.66	0.43	0.60	0.05	0.31	0.35
12	0.10	0.11	0.11	0.29	0.14	0.17	0.24	0.32	0.22	0.35	0.18	0.14	0.12
13	0.04	0.14	0.04	0.09	0.15	0.10	0.11	0.05	0.03	0.11	0.08	0.08	0.00
14	0.06	0.21	0.08	0.31	0.21	0.22	0.13	0.02	0.02	0.11	0.09	0.02	0.00
1+	62.86	64.54	50.77	64.94	58.66	72.55	111.40	86.10	74.20	186.50	72.57	85.72	67.64
2+	62.86	64.54	50.77	64.58	58.66	71.49	109.41	85.58	74.14	186.47	72.49	84.96	67.39
3+	59.52	64.03	50.46	63.04	54.50	68.40	95.31	80.27	72.64	184.19	72.08	82.39	54.07
4+	49.86	56.47	49.08	61.72	51.45	50.14	78.49	63.52	63.58	175.70	70.16	79.73	45.69
5+	20.73	42.53	37.55	57.23	49.16	43.72	52.57	46.97	41.51	144.46	65.72	75.06	39.60
6+	7.41	14.33	20.64	36.82	44.93	39.25	36.12	20.26	27.87	74.15	40.80	67.23	33.70

TABLE 20 . MEAN NUMBER (ADJUSTED FOR MISSING STRATA) PER TOW OF COD AT AGE FROM RV SURVEYS CONDUCTED IN DIVISION 3K DURING AUTUMN.

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
1	0.00	0.00	0.18	0.01	0.23	0.86	0.26	0.01	0.35	0.38	1.14	1.37
2	0.25	0.13	1.04	1.29	1.78	3.48	3.25	0.65	2.42	0.90	2.43	11.01
3	2.67	2.19	1.42	5.31	1.72	7.55	5.62	2.96	4.84	2.15	4.12	12.12
4	11.66	14.90	2.04	3.33	4.90	6.39	9.71	4.56	24.10	3.88	3.18	12.20
5	14.22	24.52	11.51	3.63	4.83	11.26	7.83	6.21	29.08	9.38	3.91	9.19
6	6.52	14.58	12.58	12.12	2.71	3.44	8.04	3.09	20.18	7.26	5.36	8.08
7	2.08	3.74	2.72	8.77	5.71	2.33	2.98	2.98	10.33	3.48	2.89	8.90
8	0.97	1.88	1.31	2.72	5.57	4.10	1.49	0.92	6.22	2.44	0.97	5.08
9	0.60	0.46	0.49	0.50	1.62	3.18	2.39	0.69	2.38	1.25	0.46	2.30
10	0.47	0.39	0.33	0.23	0.63	1.11	1.44	0.64	0.79	0.62	0.27	1.67
11	0.03	0.27	0.03	0.19	0.17	0.39	0.59	0.54	0.98	0.32	0.07	0.72
12	0.10	0.06	0.20	0.20	0.08	0.17	0.28	0.16	0.68	0.17	0.09	0.27
13	0.03	0.04	0.07	0.06	0.06	0.07	0.10	0.06	0.25	0.11	0.03	0.20
14	0.03	0.12	0.14	0.12	0.13	0.24	0.22	0.05	0.18	0.23	0.07	0.13
1+	39.65	63.29	34.07	38.48	30.11	44.55	44.21	23.52	102.78	32.58	24.99	73.26
2+	39.65	63.29	33.89	38.47	29.88	43.69	43.95	23.51	102.43	32.20	23.85	71.89
3+	39.40	63.16	32.84	37.18	28.10	40.21	40.70	22.87	100.02	31.30	21.41	60.87
4+	36.73	60.97	31.43	31.87	26.38	32.66	35.08	19.90	95.18	29.15	17.30	48.75
5+	25.07	46.07	29.38	28.54	21.49	26.28	25.36	15.34	71.07	25.27	14.12	36.54
6+	10.85	21.55	17.87	24.91	16.66	15.02	17.53	9.13	41.99	15.89	10.22	27.35

TABLE 21. MEAN NUMBER (ADJUSTED FOR MISSING STRATA) PER TOW OF COD AT AGE FROM RV SURVEYS CONDUCTED IN DIVISION 3L DURING AUTUMN.

	1981	1982	1983	1984	1985	1986	1987	1988	1989
1	0.38	0.42	0.66	0.36	0.01	0.04	0.16	0.05	0.02
2	0.37	2.76	3.59	7.58	1.22	1.15	2.77	1.68	0.75
3	6.44	1.98	13.69	11.43	9.66	2.53	2.02	4.54	4.42
4	2.68	6.63	5.28	18.89	12.85	11.82	3.91	2.38	3.99
5	2.55	2.82	7.63	5.18	10.92	10.19	9.43	4.96	2.05
6	3.82	2.08	1.42	10.52	5.18	10.44	7.13	6.09	2.77
7	5.37	1.73	1.36	1.69	3.43	3.27	3.33	4.62	2.81
8	1.00	1.57	2.37	1.18	0.71	2.47	1.31	2.16	1.08
9	0.20	0.29	1.27	1.03	0.81	0.96	1.00	1.03	0.77
10	0.07	0.09	0.45	1.08	0.40	0.38	0.10	0.54	0.23
11	0.04	0.05	0.13	0.43	0.29	0.48	0.13	0.13	0.09
12	0.03	0.06	0.06	0.25	0.11	0.26	0.22	0.10	0.04
13	0.12	0.06	0.19	0.18	0.07	0.18	0.18	0.13	0.03
1+	23.07	20.53	38.09	59.78	45.67	44.17	31.70	28.41	19.07
2+	22.69	20.11	37.43	59.42	45.66	44.13	31.54	28.36	19.05
3+	22.33	17.36	33.84	51.85	44.44	42.98	28.77	26.68	18.30
4+	15.88	15.37	20.16	40.42	34.78	40.45	26.75	22.15	13.87
5+	13.20	8.74	14.87	21.53	21.93	28.63	22.83	19.77	9.88
6+	10.65	5.92	7.24	16.35	11.01	18.44	13.41	14.81	7.83

TABLE 22. MEAN NUMBER (ADJUSTED FOR MISSING STRATA) PER TOW OF COD AT AGE FROM RV SURVEYS CONDUCTED IN DIVISION 3L DURING SPRING.

	1977	1978	1979	1980	1981	1982	1985	1986	1987	1988	1989
1	0.00	0.00	0.06	0.09	0.18	0.03	0.00	0.00	0.01	0.00	0.00
2	0.89	0.08	0.08	1.90	0.50	1.72	1.39	0.25	0.42	0.28	0.30
3	4.04	4.01	0.84	0.88	9.01	1.56	12.16	3.43	2.39	5.13	4.20
4	5.81	7.49	9.16	3.41	7.22	9.25	18.21	12.60	5.23	4.48	8.33
5	4.51	5.96	13.89	10.43	6.43	2.34	16.42	12.71	13.41	7.45	3.54
6	2.11	3.86	6.48	8.42	11.00	2.96	8.24	9.25	12.60	16.61	3.34
7	0.63	1.73	1.53	2.13	11.22	4.15	8.15	4.38	6.67	8.00	8.96
8	0.65	0.56	0.46	0.77	2.98	3.08	1.72	3.48	2.34	4.08	6.70
9	0.43	0.47	0.12	0.15	0.77	0.93	0.76	0.77	1.83	1.46	1.87
10	0.15	0.28	0.19	0.07	0.25	0.20	1.08	0.65	0.67	1.21	0.76
11	0.10	0.21	0.08	0.12	0.08	0.07	1.20	1.11	0.48	0.34	0.65
12	0.06	0.15	0.04	0.07	0.08	0.05	0.40	0.70	0.61	0.40	0.15
13	0.16	0.21	0.18	0.14	0.08	0.26	0.32	0.41	0.56	0.83	0.21
1+	19.54	25.01	33.11	28.57	49.79	26.60	70.03	49.74	47.21	50.26	39.03
2+	19.54	25.01	33.05	28.48	49.61	26.57	70.03	49.74	47.20	50.26	39.03
3+	18.65	24.93	32.97	26.59	49.12	24.85	68.64	49.49	46.78	49.98	38.73
4+	14.61	20.91	32.13	25.71	40.11	23.29	56.49	46.06	44.39	44.85	34.52
5+	8.80	13.42	22.97	22.30	32.89	14.04	38.28	33.46	39.16	40.37	26.19
6+	4.28	7.46	9.08	11.87	26.46	11.70	21.86	20.76	25.75	32.92	22.65

TABLE 23. MEAN NUMBERS PER TOW OF COD AND COEFFICIENTS OF VARIATION FROM AUTUMN RV SURVEYS IN DIVISIONS 2J3KL.

MEAN NUMBERS PER TOW

}	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
1 }	0.02	0.41	0.27	0.16	0.51	1.05	0.36	0.02	0.14	0.21	0.59	0.53
2 }	0.40	0.32	3.02	1.61	2.51	6.14	5.57	1.10	1.85	1.56	2.15	7.27
3 }	5.52	1.96	2.50	5.23	5.90	12.41	10.80	7.27	4.77	2.04	3.94	7.97
4 }	11.82	11.93	3.85	2.80	6.00	10.73	15.25	12.35	20.70	4.03	3.21	7.25
5 }	14.30	17.04	13.37	3.32	3.90	11.01	11.36	10.02	31.29	13.23	5.31	5.38
6 }	5.68	10.69	13.45	9.84	2.83	3.92	9.61	7.28	21.29	11.61	10.64	5.87
7 }	1.68	2.30	5.03	8.93	5.89	2.47	2.31	4.24	10.14	4.38	10.21	7.54
8 }	0.66	0.94	1.20	3.70	5.38	5.40	1.38	0.92	5.26	2.67	2.60	4.44
9 }	0.49	0.32	0.38	0.74	2.61	2.98	2.09	0.78	1.37	1.38	1.56	1.42
10 }	0.34	0.27	0.23	0.23	0.57	1.43	1.31	0.67	0.58	0.34	0.80	0.83
11 }	0.12	0.19	0.11	0.10	0.16	0.37	0.54	0.41	0.68	0.17	0.15	0.36
12 }	0.13	0.08	0.17	0.11	0.09	0.14	0.28	0.15	0.42	0.19	0.11	0.14
13 }	0.09	0.05	0.07	0.11	0.07	0.13	0.12	0.06	0.19	0.13	0.08	0.08
1+}	41.25	46.50	43.65	36.89	36.43	58.18	60.97	45.27	98.69	41.95	41.35	49.08
2+}	41.23	46.09	43.38	36.73	35.92	57.13	60.61	45.25	98.55	41.74	40.76	48.55
3+}	40.83	45.77	40.36	35.12	33.41	50.99	55.04	44.15	96.70	40.18	38.61	41.28
4+}	35.31	43.81	37.86	29.89	27.51	38.58	44.24	36.87	91.93	38.14	34.67	33.31
5+}	23.49	31.88	34.01	27.08	21.51	27.85	28.99	24.52	71.23	34.11	31.46	26.06
6+}	9.19	14.84	20.64	23.76	17.61	16.83	17.63	14.51	39.93	20.88	26.15	20.68

COEFFICIENTS OF VARIATION - PERCENT

}	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
1 }	25	18	32	33	23	45	26	64	28	38	33	28
2 }	26	22	39	21	23	28	17	16	18	24	12	16
3 }	20	17	53	21	18	19	16	20	16	15	17	16
4 }	20	22	38	20	14	23	16	18	24	13	21	18
5 }	23	25	27	24	17	26	20	16	31	16	19	22
6 }	25	31	28	29	19	28	15	14	35	18	17	22
7 }	24	33	24	29	20	24	15	12	36	18	17	23
8 }	21	32	20	32	17	25	14	9	33	18	14	27
9 }	20	24	21	27	16	22	13	9	32	16	14	37
10 }	19	25	23	25	11	25	12	9	29	17	13	53
11 }	26	23	33	23	15	25	12	10	25	16	13	51
12 }	23	19	24	23	26	24	13	11	30	15	14	61
13 }	29	23	24	20	15	6	13	13	23	13	13	85

TABLE 24. ANALYSIS OF VARIANCE FROM THE REGRESSION OF LN CATCH RATE FOR COD IN DIVISIONS 2J3KL FOR THE YEARS 1962-79.

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.773
MULTIPLE R SQUARED..... 0.598

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	4.687E0	4.687E0	
REGRESSION	34	3.925E2	1.154E1	66.194
TYPE 1	4	6.528E1	1.632E1	93.587
TYPE 2	2	1.767E1	8.834E0	50.660
TYPE 3	11	1.182E2	1.075E1	61.639
TYPE 4	17	2.010E2	1.182E1	67.803
RESIDUALS	1515	2.642E2	1.744E-1	
TOTAL	1550	6.613E2		

TYPE 1 - CATEGORY 1 - COUNTRY/GEAR/TONNAGE CLASS
TYPE 2 - CATEGORY 2 - NAFO DIVISIONS
TYPE 3 - CATEGORY 3 - MONTHS
TYPE 4 - CATEGORY 4 - YEARS

NOTE: SEE TABLE OF REGRESSION COEFFICIENTS FOR CATEGORY NUMBERS

TABLE 25. REGRESSION COEFFICIENTS FROM THE REGRESSION OF LN CATCH RATE FOR COD IN NAFO DIVISIONS 2J3KL FOR THE YEARS 1962-79.

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
1	3125	INTERCEPT	0.793	0.079	1550
2	23				
3	2				
4	62				
1	3124	1	-0.333	0.065	94
	17126	2	0.333	0.043	555
	17127	3	0.663	0.047	307
	19126	4	0.244	0.045	436
2	31	5	-0.161	0.029	471
	32	6	-0.275	0.027	674
3	1	7	-0.052	0.060	94
	3	8	-0.222	0.051	155
	4	9	-0.108	0.050	165
	5	10	-0.322	0.051	150
	6	11	-0.546	0.052	147
	7	12	-0.751	0.057	105
	8	13	-0.752	0.056	106
	9	14	-0.761	0.054	119
	10	15	-0.776	0.053	127
	11	16	-0.706	0.053	135
	12	17	-0.569	0.057	119
4	63	18	0.046	0.070	63
	64	19	-0.021	0.069	68
	65	20	-0.184	0.069	75
	66	21	-0.128	0.066	98
	67	22	-0.037	0.065	112
	68	23	-0.089	0.065	113
	69	24	-0.289	0.065	111
	70	25	-0.435	0.067	99
	71	26	-0.613	0.067	109
	72	27	-0.731	0.068	108
	73	28	-0.740	0.071	85
	74	29	-0.629	0.074	73
	75	30	-0.583	0.071	92
	76	31	-0.804	0.081	52
	77	32	-1.329	0.073	92
	78	33	-1.310	0.079	70
	79	34	-0.653	0.077	76

CODE 03124 - CAN-N/OTTER TRAWL/TC 4
CODE 03125 - CAN-N/OTTER TRAWL/TC 5
CODE 17126 - PORTUGAL/OTTER TRAWL/TC 6
CODE 17127 - PORTUGAL/OTTER TRAWL/TC 7
CODE 19126 - SPAIN/OTTER TRAWL/TC 6

TABLE 26. COMMERCIAL CATCH RATE INDEX FOR COD IN DIV 2J3KL FOR 1962-79.

PREDICTED CATCH RATE

	LN TRANSFORM		RETRANSFORMED			
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT
1962	0.7408	0.0067	2.281	0.187	364241	159680
1963	0.7867	0.0064	2.389	0.190	364661	152656
1964	0.7194	0.0062	2.233	0.176	471323	211027
1965	0.5564	0.0060	1.898	0.147	434508	228953
1966	0.6129	0.0056	2.008	0.150	413662	205957
1967	0.7033	0.0052	2.199	0.159	509905	231895
1968	0.6518	0.0048	2.089	0.145	708977	339416
1969	0.4517	0.0050	1.710	0.120	656466	383905
1970	0.3057	0.0052	1.477	0.106	443638	300276
1971	0.1279	0.0052	1.237	0.089	376979	304808
1972	0.0093	0.0054	1.098	0.081	396243	360757
1973	0.0007	0.0060	1.089	0.085	312861	287388
1974	0.1114	0.0065	1.216	0.098	337469	277582
1975	0.1578	0.0059	1.274	0.098	246295	193341
1976	-0.0629	0.0076	1.021	0.089	154281	151147
1977	-0.5887	0.0056	0.604	0.045	100097	165731
1978	-0.5693	0.0063	0.616	0.049	57104	92764
1979	0.0876	0.0058	1.188	0.091	81077	68267

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.076

TABLE 27. ANALYSIS OF VARIANCE FROM THE REGRESSION OF LN CATCH RATE FOR COD IN DIV 2J3KL FOR THE YEARS 1978-89.

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.832
MULTIPLE R SQUARED..... 0.693

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	2.495E2	2.495E2	
REGRESSION	31	4.700E2	1.516E1	59.553
TYPE 1	7	5.604E1	8.005E0	31.444
TYPE 2	2	4.856E1	2.428E1	95.359
TYPE 3	11	1.441E2	1.310E1	51.456
TYPE 4	11	5.514E1	5.012E0	19.687
RESIDUALS	819	2.085E2	2.546E-1	
TOTAL	851	9.280E2		

TYPE 1 - CATEGORY 1 - COUNTRY/GEAR/TONNAGE CLASS
TYPE 2 - CATEGORY 2 - NAFO DIVISIONS
TYPE 3 - CATEGORY 3 - MONTHS
TYPE 4 - CATEGORY 4 - YEARS

NOTE: SEE TABLE OF REGRESSION COEFFICIENTS FOR CATEGORY NUMBERS

TABLE 28. REGRESSION COEFFICIENTS FROM THE REGRESSION OF LN CATCH RATE FOR COD IN DIVISIONS 2J3KL FOR THE YEARS 1978-89.

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
1	27124	INTERCEPT	0.520	0.154	851
2	23				
3	1				
4	78				
1	3124	1	-0.100	0.117	136
	3125	2	0.023	0.109	300
	3126	3	1.067	0.169	19
	17126	4	-0.183	0.123	86
	17127	5	-0.414	0.190	16
	27125	6	0.374	0.111	194
	27126	7	0.712	0.127	64
2	31	8	-0.231	0.050	283
	32	9	-0.640	0.049	391
3	2	10	0.132	0.076	97
	3	11	-0.267	0.077	87
	4	12	-0.317	0.074	105
	5	13	-0.741	0.074	109
	6	14	-0.984	0.081	81
	7	15	-1.154	0.097	41
	8	16	-1.176	0.113	29
	9	17	-1.175	0.109	32
	10	18	-1.109	0.097	47
	11	19	-0.988	0.092	54
	12	20	-0.733	0.081	86
4	79	21	0.319	0.114	60
	80	22	0.522	0.117	50
	81	23	0.731	0.113	61
	82	24	0.669	0.108	80
	83	25	0.861	0.106	84
	84	26	0.986	0.106	85
	85	27	1.130	0.108	80
	86	28	1.013	0.109	70
	87	29	0.830	0.107	83
	88	30	0.998	0.106	85
	89	31	0.981	0.108	79

CODE 27124 - CAN-M/OTTER TRAWL/TC 4
CODE 27125 - CAN-M/OTTER TRAWL/TC 5
CODE 27126 - CAN-M/OTTER TRAWL/TC 6
CODE 03124 - CAN-N/OTTER TRAWL/TC 4
CODE 03125 - CAN-N/OTTER TRAWL/TC 5
CODE 03126 - CAN-N/OTTER TRAWL/TC 6
CODE 17126 - PORTUGAL/OTTER TRAWL/TC 6
CODE 17127 - PORTUGAL/OTTER TRAWL/TC 7

TABLE 29. COMMERCIAL CATCH RATE INDEX FOR COD IN DIV 2J3KL FOR 1978-89.

PREDICTED CATCH RATE

	LN TRANSFORM		RETRANSFORMED			
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT
1978	0.3119	0.0119	1.542	0.168	57104	37021
1979	0.6305	0.0086	2.125	0.197	81007	38126
1980	0.8339	0.0098	2.602	0.257	79265	30459
1981	1.0428	0.0078	3.210	0.282	90674	28246
1982	0.9805	0.0074	3.017	0.260	116725	38689
1983	1.1729	0.0068	3.658	0.300	125922	34420
1984	1.2977	0.0066	4.145	0.335	134750	32511
1985	1.4417	0.0071	4.786	0.403	151410	31639
1986	1.3245	0.0068	4.257	0.351	179137	42081
1987	1.1422	0.0071	3.547	0.299	156263	44056
1988	1.3098	0.0068	4.195	0.346	164770	39281
1989	1.2928	0.0072	4.123	0.349	140924	34178

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.088

TABLE 30. ANALYSIS OF VARIANCE FROM THE REGRESSION OF LN CATCH RATE FOT COD IN DIVISION 2J FOR THE YEARS 1978-89.

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.872
MULTIPLE R SQUARED..... 0.761

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	2.124E2	2.124E2	
REGRESSION	29	8.770E1	3.024E0	16.158
TYPE 1	7	1.674E1	2.391E0	12.775
TYPE 2	11	3.384E1	3.076E0	16.437
TYPE 3	11	2.254E1	2.050E0	10.951
RESIDUALS	147	2.751E1	1.872E-1	
TOTAL	177	3.277E2		

TYPE 1 - CATEGORY 1 - COUNTRY/GEAR/TONNAGE CLASS
TYPE 2 - CATEGORY 3 - MONTHS
TYPE 3 - CATEGORY 4 - YEARS

NOTE: SEE TABLE OF REGRESSION COEFFICIENTS FOR CATEGORY NUMBERS

TABLE 31. REGRESSION COEFFICIENTS FROM THE REGRESSION OF LN CATCH RATE FOR COD IN DIVISION 2J FOR THE YEARS 1978-89.

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
1	27124	INTERCEPT	-0.760	0.375	177
3	1				
4	78				
1	3124	1	0.823	0.344	15
	3125	2	0.814	0.319	61
	3126	3	1.784	0.366	9
	17126	4	0.109	0.332	22
	17127	5	0.283	0.395	5
	27125	6	1.069	0.320	46
	27126	7	1.281	0.341	16
3	2	8	-0.007	0.130	28
	3	9	-0.141	0.133	23
	4	10	-0.014	0.125	31
	5	11	-0.533	0.147	19
	6	12	-0.880	0.160	15
	7	13	-1.341	0.220	5
	8	14	-1.469	0.394	2
	9	15	-1.978	0.549	1
	10	16	-1.722	0.287	3
	11	17	-1.439	0.199	9
	12	18	-0.868	0.162	17
4	79	19	0.841	0.236	11
	80	20	0.941	0.220	13
	81	21	1.621	0.235	11
	82	22	1.402	0.207	26
	83	23	1.875	0.207	23
	84	24	1.615	0.219	16
	85	25	1.489	0.273	7
	86	26	1.568	0.267	8
	87	27	1.099	0.212	18
	88	28	1.238	0.213	20
	89	29	1.437	0.224	19

CODE 27124 - CAN-M/OTTER TRAWL/TC 4
CODE 27125 - CAN-M/OTTER TRAWL/TC 5
CODE 27126 - CAN-M/OTTER TRAWL/TC 6
CODE 03124 - CAN-N/OTTER TRAWL/TC 4
CODE 03125 - CAN-N/OTTER TRAWL/TC 5
CODE 03126 - CAN-N/OTTER TRAWL/TC 6
CODE 17126 - PORTUGAL/OTTER TRAWL/TC 6
CODE 17127 - PORTUGAL/OTTER TRAWL/TC 7

TABLE 32. ANALYSIS OF VARIANCE FROM THE REGRESSION OF LN CATCH RATE FOR COD IN DIVISION 3K FOR THE YEARS 1978-89.

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.871
MULTIPLE R SQUARED..... 0.759

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	2.164E2	2.164E2	
REGRESSION	29	1.495E2	5.157E0	27.418
TYPE 1	7	1.076E1	1.536E0	8.169
TYPE 2	11	5.630E1	5.118E0	27.213
TYPE 3	11	4.850E1	4.409E0	23.441
RESIDUALS	253	4.758E1	1.881E-1	
TOTAL	283	4.136E2		

TYPE 1 - CATEGORY 1 - COUNTRY/GEAR/TONNAGE CLASS
TYPE 2 - CATEGORY 3 - MONTHS
TYPE 3 - CATEGORY 4 - YEARS

NOTE: SEE TABLE OF REGRESSION COEFFICIENTS FOR CATEGORY NUMBERS

TABLE 33. REGRESSION COEFFICIENTS FROM THE REGRESSION OF LN CATCH RATE FOR COD IN DIVISION 3K FOR THE YEARS 1978-89.

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
1	27124	INTERCEPT	-0.016	0.269	283
3	1				
4	78				
1	3124	1	0.114	0.239	36
	3125	2	0.099	0.223	107
	3126	3	0.801	0.302	5
	17126	4	-0.078	0.243	29
	17127	5	-0.458	0.320	7
	27125	6	0.326	0.225	59
	27126	7	0.642	0.237	32
3	2	8	0.034	0.099	41
	3	9	-0.443	0.104	34
	4	10	-0.463	0.103	40
	5	11	-0.715	0.099	44
	6	12	-0.854	0.119	26
	7	13	-1.299	0.206	6
	8	14	-1.609	0.229	6
	9	15	-1.732	0.244	7
	10	16	-1.603	0.182	14
	11	17	-1.278	0.196	10
	12	18	-1.124	0.129	25
4	79	19	0.595	0.157	25
	80	20	0.736	0.172	14
	81	21	1.062	0.168	20
	82	22	0.861	0.170	19
	83	23	1.011	0.159	24
	84	24	1.589	0.150	31
	85	25	1.649	0.148	36
	86	26	1.210	0.151	26
	87	27	1.447	0.156	27
	88	28	1.615	0.163	25
	89	29	1.622	0.161	22

CODE 27124 - CAN-M/OTTER TRAWL/TC 4
CODE 27125 - CAN-M/OTTER TRAWL/TC 5
CODE 27126 - CAN-M/OTTER TRAWL/TC 6
CODE 03124 - CAN-N/OTTER TRAWL/TC 4
CODE 03125 - CAN-N/OTTER TRAWL/TC 5
CODE 03126 - CAN-N/OTTER TRAWL/TC 6
CODE 17126 - PORTUGAL/OTTER TRAWL/TC 6
CODE 17127 - PORTUGAL/OTTER TRAWL/TC 7

TABLE 34. ANALYSIS OF VARIANCE FROM THE REGRESSION OF LN CATCH RATE FOR COD IN DIVISION 3L FOR THE YEARS 1978-89.

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.830
MULTIPLE R SQUARED..... 0.688

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	1.661E0	1.661E0	
REGRESSION	29	1.164E2	4.015E0	27.470
TYPE 1	7	2.495E1	3.565E0	24.390
TYPE 2	11	6.516E1	5.923E0	40.529
TYPE 3	11	1.003E1	9.116E-1	6.237
RESIDUALS	361	5.276E1	1.461E-1	
TOTAL	391	1.708E2		

TYPE 1 - CATEGORY 1 - COUNTRY/GEAR/TONNAGE CLASS
TYPE 2 - CATEGORY 3 - MONTHS
TYPE 3 - CATEGORY 4 - YEARS

NOTE: SEE TABLE OF REGRESSION COEFFICIENTS FOR CATEGORY NUMBERS

TABLE 35. REGRESSION COEFFICIENTS FROM THE REGRESSION OF LN CATCH RATE FOR COD IN DIVISION 3L FOR THE YEARS 1978-89.

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
1	27124	INTERCEPT	0.340	0.180	391
3	1				
4	78				
1	3124	1	-0.299	0.130	85
	3125	2	-0.101	0.117	132
	3126	3	1.170	0.281	5
	17126	4	-0.069	0.142	35
	17127	5	-0.491	0.308	4
	27125	6	0.425	0.123	89
	27126	7	0.704	0.173	16
3	2	8	0.489	0.118	28
	3	9	-0.065	0.109	30
	4	10	-0.256	0.102	34
	5	11	-0.761	0.098	46
	6	12	-1.068	0.100	40
	7	13	-0.974	0.109	30
	8	14	-0.927	0.116	21
	9	15	-0.940	0.111	24
	10	16	-0.895	0.106	30
	11	17	-0.703	0.100	35
	12	18	-0.374	0.097	44
4	79	19	-0.053	0.146	24
	80	20	0.126	0.148	23
	81	21	0.197	0.140	30
	82	22	0.112	0.137	35
	83	23	0.255	0.136	37
	84	24	0.257	0.135	38
	85	25	0.478	0.137	37
	86	26	0.570	0.134	36
	87	27	0.331	0.136	38
	88	28	0.406	0.134	40
	89	29	0.397	0.135	38

CODE 27124 - CAN-M/OTTER TRAWL/TC 4
CODE 27125 - CAN-M/OTTER TRAWL/TC 5
CODE 27126 - CAN-M/OTTER TRAWL/TC 6
CODE 03124 - CAN-N/OTTER TRAWL/TC 4
CODE 03125 - CAN-N/OTTER TRAWL/TC 5
CODE 03126 - CAN-N/OTTER TRAWL/TC 6
CODE 17126 - PORTUGAL/OTTER TRAWL/TC 6
CODE 17127 - PORTUGAL/OTTER TRAWL/TC 7

TABLE 36. COMMERCIAL CATCH RATE INDEX FOR COD IN DIV 2J FOR 1978-89.

PREDICTED CATCH RATE

	LN TRANSFORM		RETRANSFORMED			
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT
1978	0.0541	0.0456	1.134	0.240	22228	19610
1979	0.8954	0.0332	2.646	0.480	15731	5946
1980	0.9948	0.0270	2.931	0.480	21029	7174
1981	1.6752	0.0254	5.793	0.921	26885	4641
1982	1.4561	0.0204	4.665	0.665	67307	14429
1983	1.9289	0.0172	7.497	0.981	41439	5527
1984	1.6688	0.0256	5.755	0.917	12013	2087
1985	1.5427	0.0498	5.012	1.108	1546	308
1986	1.6218	0.0354	5.464	1.022	12011	2198
1987	1.1528	0.0204	3.444	0.491	41836	12146
1988	1.2921	0.0184	3.963	0.537	41474	10465
1989	1.4911	0.0224	4.826	0.720	22709	4705

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.165

TABLE 37. COMMERCIAL CATCH RATE INDEX FOR COD IN DIV 3K FOR 1978-89.

PREDICTED CATCH RATE

	LN TRANSFORM		RETRANSFORMED			
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT
1978	0.0833	0.0228	1.181	0.178	13400	11347
1979	0.6783	0.0154	2.149	0.266	38469	17902
1980	0.8190	0.0202	2.468	0.350	28750	11651
1981	1.1456	0.0173	3.426	0.449	26959	7869
1982	0.9445	0.0185	2.800	0.380	12955	4627
1983	1.0943	0.0149	3.259	0.397	34438	10569
1984	1.6723	0.0118	5.817	0.632	59173	10173
1985	1.7322	0.0115	6.177	0.663	81825	13246
1986	1.2934	0.0116	3.983	0.428	60465	15182
1987	1.5300	0.0135	5.041	0.585	45359	8997
1988	1.6983	0.0141	5.963	0.706	39983	6705
1989	1.7058	0.0146	6.007	0.724	35082	5840

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.124

TABLE 38. COMMERCIAL CATCH RATE INDEX FOR COD IN DIV 3L FOR 1978-89.

PREDICTED CATCH RATE

	LN TRANSFORM		RETRANSFORMED			
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT
1978	0.2389	0.0206	1.352	0.193	21476	15880
1979	0.1863	0.0136	1.288	0.150	26877	20874
1980	0.3650	0.0144	1.539	0.184	29486	19160
1981	0.4355	0.0109	1.654	0.172	36830	22264
1982	0.3506	0.0098	1.520	0.150	36463	23982
1983	0.4942	0.0096	1.755	0.172	50044	28509
1984	0.4956	0.0095	1.758	0.172	63564	36160
1985	0.7171	0.0110	2.192	0.230	68039	31038
1986	0.8089	0.0097	2.404	0.237	106672	44367
1987	0.5701	0.0111	1.892	0.199	69068	36500
1988	0.6446	0.0103	2.040	0.206	83313	40849
1989	0.6355	0.0100	2.021	0.202	71234	35241

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.107

TABLE 39. COMMERCIAL CATCH RATE INDEX (NUMBERS AT AGE) FOR COD IN DIVISIONS 2J3KL FOR THE YEARS 1978-89.

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
3	0.33	0.13	0.08	0.33	0.09	0.46	0.21	0.28	0.02	0.02	0.09	0.09
4	4.75	3.93	1.41	1.46	3.91	2.19	3.48	3.69	2.72	0.60	0.55	3.23
5	11.94	13.57	13.10	5.44	4.12	14.10	11.81	15.17	13.67	10.97	4.19	5.18
6	6.64	11.42	15.28	14.83	4.35	7.13	18.43	18.48	21.04	21.05	20.53	9.62
7	1.98	3.00	6.26	12.40	11.23	4.44	5.68	15.62	12.05	11.32	20.86	16.42
8	0.84	0.62	1.17	4.86	6.70	6.79	3.12	3.71	6.94	8.46	8.00	13.13
9	0.37	0.23	0.25	1.01	5.19	4.24	4.98	2.04	1.38	1.90	3.93	4.29
10	0.29	0.14	0.14	0.21	0.55	3.62	2.11	3.16	0.96	0.47	1.92	1.70
11	0.14	0.10	0.06	0.09	0.09	0.44	1.37	1.76	0.95	0.26	0.24	0.86
12	0.05	0.03	0.05	0.05	0.05	0.07	0.24	1.11	0.54	0.33	0.16	0.29
13	0.02	0.02	0.02	0.04	0.02	0.04	0.06	0.16	0.29	0.16	0.15	0.12
3+	27.35	33.19	37.81	40.72	36.30	43.51	51.49	65.18	60.55	55.53	60.61	54.94
4+	27.02	33.06	37.74	40.39	36.21	43.05	51.28	64.90	60.53	55.52	60.52	54.85
5+	22.26	29.13	36.33	38.93	32.30	40.86	47.80	61.21	57.81	54.92	59.97	51.62
6+	10.32	15.56	23.23	33.49	28.19	26.77	35.99	46.04	44.14	43.95	55.78	46.43
7+	3.68	4.14	7.95	18.66	23.84	19.64	17.56	27.56	23.11	22.90	35.25	36.81

Table 40. Analysis of variance from the regression of ln catch rate for cod in Div. 2J3KL for the years 1980-89. (Data collected by observers)

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.850
MULTIPLE R SQUARED..... 0.722

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	2.306E2	2.306E2	
REGRESSION	27	1.536E2	5.688E0	21.469
TYPE 1	5	1.375E1	2.751E0	10.382
TYPE 2	2	1.456E1	7.279E0	27.471
TYPE 3	11	5.849E1	5.317E0	20.067
TYPE 4	9	7.256E0	8.062E-1	3.043
RESIDUALS	223	5.909E1	2.650E-1	
TOTAL	251	4.433E2		

Table 41. Regression coefficients from the regression of ln catch rate for cod in Div. 2J3KL for the years 1980-89. (Data collected by observers)

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
1	3125	INTERCEPT	0.971	0.199	251
2	31				
3	1				
4	80				
1	2124	1	0.155	0.162	14
	2125	2	0.004	0.105	36
	2126	3	0.647	0.182	10
	3124	4	-0.104	0.120	27
	3126	5	0.774	0.125	25
2	23	6	0.098	0.091	57
	32	7	-0.500	0.080	110
3	2	8	0.182	0.118	35
	3	9	-0.247	0.115	40
	4	10	-0.326	0.113	45
	5	11	-1.005	0.129	30
	6	12	-1.305	0.175	13
	7	13	-1.269	0.222	8
	8	14	-1.555	0.268	5
	9	15	-1.185	0.215	8
	10	16	-1.139	0.185	12
	11	17	-1.296	0.207	9
	12	18	-1.008	0.253	6
4	81	19	0.132	0.243	11
	82	20	0.387	0.213	18
	83	21	0.448	0.199	32
	84	22	0.481	0.217	19
	85	23	0.840	0.243	10
	86	24	0.442	0.205	22
	87	25	0.472	0.204	27
	88	26	0.687	0.189	78
	89	27	0.662	0.208	24

Table 42. Commercial catch rate index for cod in Div. 2J3KL for 1980-89. (Data collected by observers)

PREDICTED CATCH RATE

	LN TRANSFORM		RETRANSFORMED			
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT
1980	0.9713	0.0398	2.958	0.585	96523	32636
1981	1.1032	0.0314	3.389	0.597	80038	23619
1982	1.3581	0.0264	4.384	0.709	113049	25788
1983	1.4188	0.0180	4.678	0.625	106423	22749
1984	1.4520	0.0233	4.823	0.733	97721	20262
1985	1.8109	0.0377	6.855	1.321	79883	11653
1986	1.4137	0.0192	4.651	0.643	72369	15560
1987	1.4433	0.0182	4.793	0.645	78747	16429
1988	1.6586	0.0131	5.960	0.683	101649	17054
1989	1.6334	0.0198	5.792	0.813	99241	17134

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.154

TABLE 43. PARAMETER ESTIMATES FROM ADAPT USING RV AGES 3-12 AND C/E AGES 5-8 (1983-89) IN A ONE ANALYSIS FOR COD IN DIV. 2J3KL WITH .50 DOME.

ESTIMATED PARAMETERS AND STANDARD ERRORS
APPROXIMATE STATISTICS ASSUMING LINEARITY NEAR SOLUTION

ORTHOGONALITY OFFSET..... 0.000133
MEAN SQUARE RESIDUALS 0.100088

AGE	PARAMETER	ESTIMATE	STD. ERR.	T-STATISTIC	C.V.
3	ABUNDANCE	4.75961E5	1.57328E5	3.02527E0	0.33
4	ABUNDANCE	2.09177E5	4.68155E4	4.46810E0	0.22
5	ABUNDANCE	8.86375E4	1.39183E4	6.36841E0	0.16
6	ABUNDANCE	7.55338E4	1.02006E4	7.40488E0	0.14
7	ABUNDANCE	9.72633E4	1.20796E4	8.05188E0	0.12
8	ABUNDANCE	6.28597E4	7.81286E3	8.04566E0	0.12
9	ABUNDANCE	1.94261E4	2.78019E3	6.98734E0	0.14
10	ABUNDANCE	9.11463E3	1.46992E3	6.20075E0	0.16
11	ABUNDANCE	4.89723E3	8.30403E2	5.89742E0	0.17
12	ABUNDANCE	1.47248E3	2.31519E2	6.36007E0	0.16
3	RV SLOPE	2.02218E-5	2.01998E-6	1.00109E1	0.10
4	RV SLOPE	4.23026E-5	4.06453E-6	1.04077E1	0.10
5	RV SLOPE	8.06717E-5	7.64465E-6	1.05527E1	0.09
6	RV SLOPE	1.20408E-4	1.13726E-5	1.05876E1	0.09
7	RV SLOPE	1.40611E-4	1.33183E-5	1.05577E1	0.09
8	RV SLOPE	1.56089E-4	1.49695E-5	1.04271E1	0.10
9	RV SLOPE	1.62277E-4	1.58009E-5	1.02701E1	0.10
11	RV SLOPE	1.54624E-4	1.51508E-5	1.02057E1	0.10
11	RV SLOPE	1.29484E-4	1.26153E-5	1.02640E1	0.10
12	RV SLOPE	1.48196E-4	1.43011E-5	1.03626E1	0.10
5	C/E SLOPE	5.40408E-5	6.72495E-6	8.03587E0	0.12
6	C/E SLOPE	1.27354E-4	1.56634E-5	8.13068E0	0.12
7	C/E SLOPE	1.59248E-4	1.95415E-5	8.14922E0	0.12
8	C/E SLOPE	1.85248E-4	2.28191E-5	8.11812E0	0.12

TABLE 44. PARAMETER CORRELATION MATRIX FROM ADAPT USING RV AGES 3-12 AND C/E AGES 5-8 (1983-89) FOR COD IN DIV. 2J3KL WITH .50 DOME ON AGE 13.

	1	2	3	4	5	6	7	8	9	10	11	12
1	1.00	0.07	0.05	0.04	0.03	0.02	0.01	0.01	0.01	0.01	-0.30	-0.03
2	0.07	1.00	0.07	0.05	0.04	0.03	0.02	0.02	0.01	0.01	-0.22	-0.23
3	0.05	0.07	1.00	0.09	0.06	0.05	0.03	0.03	0.02	0.02	-0.15	-0.17
4	0.04	0.05	0.09	1.00	0.09	0.06	0.04	0.04	0.03	0.02	-0.13	-0.13
5	0.03	0.04	0.06	0.09	1.00	0.04	0.05	0.06	0.06	0.06	-0.10	-0.10
6	0.02	0.03	0.05	0.06	0.04	1.00	0.08	0.08	0.09	0.09	-0.07	-0.07
7	0.01	0.02	0.03	0.04	0.05	0.08	1.00	0.09	0.09	0.08	-0.05	-0.05
8	0.01	0.02	0.03	0.04	0.06	0.08	0.09	1.00	0.10	0.09	-0.04	-0.04
9	0.01	0.01	0.02	0.03	0.06	0.09	0.09	0.10	1.00	0.10	-0.03	-0.03
10	0.01	0.01	0.02	0.02	0.06	0.09	0.08	0.09	0.10	1.00	-0.03	-0.03
11	-0.30	-0.22	-0.15	-0.13	-0.10	-0.07	-0.05	-0.04	-0.03	-0.03	1.00	0.09
12	-0.03	-0.23	-0.17	-0.13	-0.10	-0.07	-0.05	-0.04	-0.03	-0.03	0.09	1.00
13	-0.02	-0.02	-0.20	-0.15	-0.11	-0.08	-0.06	-0.05	-0.04	-0.03	0.06	0.06
14	-0.01	-0.02	-0.03	-0.20	-0.14	-0.10	-0.07	-0.06	-0.05	-0.04	0.04	0.04
15	-0.01	-0.01	-0.02	-0.03	-0.20	-0.14	-0.10	-0.08	-0.07	-0.06	0.03	0.03
16	-0.01	-0.01	-0.02	-0.03	-0.04	-0.24	-0.17	-0.12	-0.11	-0.09	0.03	0.03
17	-0.01	-0.01	-0.02	-0.02	-0.05	-0.07	-0.28	-0.19	-0.14	-0.11	0.03	0.03
18	-0.01	-0.01	-0.02	-0.02	-0.07	-0.09	-0.08	-0.29	-0.21	-0.15	0.03	0.03
19	-0.01	-0.01	-0.02	-0.02	-0.08	-0.11	-0.09	-0.09	-0.29	-0.19	0.03	0.03
20	-0.01	-0.01	-0.02	-0.02	-0.09	-0.14	-0.11	-0.10	-0.09	-0.27	0.03	0.03
21	-0.02	-0.03	-0.21	-0.16	-0.12	-0.08	-0.06	-0.05	-0.04	-0.02	0.06	0.06
22	-0.01	-0.02	-0.03	-0.18	-0.13	-0.09	-0.06	-0.05	-0.04	-0.04	0.04	0.04
23	-0.01	-0.01	-0.02	-0.03	-0.17	-0.12	-0.09	-0.07	-0.06	-0.05	0.03	0.03
24	-0.01	-0.01	-0.02	-0.02	-0.03	-0.19	-0.13	-0.09	-0.08	-0.07	0.02	0.02

	13	14	15	16	17	18	19	20	21	22	23	24
1	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	-0.01	-0.01	-0.01
2	-0.02	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.03	-0.02	-0.01	-0.01
3	-0.20	-0.03	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.21	-0.03	-0.02	-0.02
4	-0.15	-0.20	-0.03	-0.03	-0.02	-0.02	-0.02	-0.02	-0.16	-0.18	-0.03	-0.02
5	-0.11	-0.14	-0.20	-0.04	-0.05	-0.07	-0.08	-0.09	-0.12	-0.13	-0.17	-0.03
6	-0.08	-0.10	-0.14	-0.24	-0.07	-0.09	-0.11	-0.14	-0.08	-0.09	-0.12	-0.19
7	-0.06	-0.07	-0.10	-0.17	-0.28	-0.08	-0.09	-0.11	-0.06	-0.06	-0.09	-0.13
8	-0.05	-0.06	-0.08	-0.12	-0.19	-0.29	-0.09	-0.10	-0.05	-0.05	-0.07	-0.09
9	-0.04	-0.05	-0.07	-0.11	-0.14	-0.21	-0.29	-0.09	-0.04	-0.04	-0.06	-0.08
10	-0.03	-0.04	-0.06	-0.09	-0.11	-0.15	-0.19	-0.27	-0.02	-0.04	-0.05	-0.07
11	0.06	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.06	0.04	0.03	0.02
12	0.06	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.06	0.04	0.03	0.02
13	1.00	0.05	0.04	0.03	0.03	0.03	0.03	0.03	0.07	0.05	0.03	0.03
14	0.05	1.00	0.05	0.04	0.04	0.04	0.04	0.04	0.05	0.06	0.04	0.03
15	0.04	0.05	1.00	0.06	0.06	0.05	0.06	0.06	0.04	0.04	0.06	0.05
16	0.03	0.04	0.06	1.00	0.08	0.07	0.07	0.07	0.03	0.04	0.05	0.07
17	0.03	0.04	0.06	0.08	1.00	0.10	0.08	0.08	0.03	0.04	0.05	0.06
18	0.03	0.04	0.05	0.07	0.10	1.00	0.10	0.08	0.03	0.03	0.05	0.06
19	0.03	0.04	0.06	0.07	0.08	0.10	1.00	0.09	0.03	0.03	0.05	0.06
20	0.03	0.04	0.06	0.07	0.08	0.08	0.09	1.00	0.03	0.04	0.05	0.06
21	0.07	0.05	0.04	0.03	0.03	0.03	0.03	0.03	1.00	0.05	0.03	0.03
22	0.05	0.06	0.04	0.04	0.04	0.03	0.03	0.04	0.05	1.00	0.04	0.03
23	0.03	0.04	0.06	0.05	0.05	0.05	0.05	0.05	0.03	0.04	1.00	0.04
24	0.03	0.03	0.05	0.07	0.06	0.06	0.06	0.06	0.03	0.03	0.04	1.00

TABLE 45. RESIDUALS FROM ADAPT USING RV AGES 3-12 AND C/E AGES 5-8 (1983-89) IN A SINGLE ANALYSIS FOR COD IN DIV. 2J3KL WITH .50 DOME ON AGE 13.

LOG RESIDUALS FOR RV SURVEY INDEX 28/ 5/90

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
3	-0.56	-0.72	0.13	-0.17	0.06	0.71	0.31	0.12	0.44	-0.22	-0.09	0.00
4	0.10	0.04	-0.15	-0.45	-0.46	0.17	0.43	-0.06	0.68	-0.20	-0.18	0.08
5	0.31	0.34	-0.01	-0.48	-0.35	-0.06	-0.05	-0.25	0.59	-0.07	-0.16	0.18
6	0.47	0.18	0.24	-0.09	-0.57	-0.18	-0.05	-0.40	0.68	-0.31	-0.13	0.14
7	0.46	0.23	-0.04	0.16	-0.17	-0.26	-0.20	-0.34	0.38	-0.40	0.10	0.07
8	0.38	0.42	0.04	-0.47	0.19	0.26	-0.29	-0.51	0.49	-0.27	-0.21	-0.03
9	0.19	0.08	0.15	-0.41	-0.22	0.22	-0.05	-0.22	0.54	-0.28	-0.01	-0.00
10	0.07	0.13	0.30	-0.24	-0.03	-0.11	0.06	-0.35	0.22	-0.21	0.01	0.16
11	0.30	0.14	-0.13	-0.08	0.01	0.27	-0.37	-0.19	0.52	-0.30	-0.25	0.07
12	0.11	-0.01	0.18	0.34	0.13	0.17	0.34	-1.16	0.33	-0.26	-0.42	0.22

SUM OF RV RESIDUALS : -0.0000007095 MEAN RESIDUAL : -0.0000000059

LOG RESIDUALS FOR COMMERCIAL C/E INDEX 28/ 5/90

	1983	1984	1985	1986	1987	1988	1989
5	0.21	0.07	0.24	-0.15	-0.15	-0.35	0.13
6	-0.12	0.08	0.06	0.12	-0.19	-0.01	0.06
7	0.31	0.02	0.26	-0.08	-0.12	0.10	0.13
8	-0.20	-0.20	0.11	-0.01	0.04	0.06	0.20

SUM OF C/E RESIDUALS : -0.0000001130 MEAN RESIDUAL : -0.0000000040

TABLE 46. PARAMETER ESTIMATES FROM ADAPT USING RV SURVEY AGES 3-12 FOR COD IN DIV. 2J3KL.

ESTIMATED PARAMETERS AND STANDARD ERRORS
APPROXIMATE STATISTICS ASSUMING LINEARITY NEAR SOLUTION

ORTHOGONALITY OFFSET..... 0.000430
MEAN SQUARE RESIDUALS 0.119759

AGE	PARAMETER	ESTIMATE	STD. ERR.	T-STATISTIC	C.V.
3	ABUNDANCE	4.69163E5	1.69704E5	2.76459E0	0.36
4	ABUNDANCE	2.06134E5	5.04701E4	4.08428E0	0.24
5	ABUNDANCE	8.41137E4	1.62355E4	5.18084E0	0.19
6	ABUNDANCE	7.78691E4	1.35375E4	5.75209E0	0.17
7	ABUNDANCE	1.02959E5	1.73617E4	5.93023E0	0.17
8	ABUNDANCE	5.69443E4	8.36767E3	6.80528E0	0.15
9	ABUNDANCE	1.68926E4	2.48353E3	6.80183E0	0.15
10	ABUNDANCE	7.97403E3	1.32021E3	6.03995E0	0.17
11	ABUNDANCE	3.60154E3	5.76335E2	6.24904E0	0.16
12	ABUNDANCE	1.02326E3	1.37426E2	7.44590E0	0.13
3	RV SLOPE	2.05159E-5	2.25278E-6	9.10695E0	0.11
4	RV SLOPE	4.30029E-5	4.54468E-6	9.46225E0	0.11
5	RV SLOPE	8.25534E-5	8.62783E-6	9.56827E0	0.10
6	RV SLOPE	1.23830E-4	1.28662E-5	9.62443E0	0.10
7	RV SLOPE	1.48717E-4	1.54286E-5	9.63900E0	0.10
8	RV SLOPE	1.75522E-4	1.83333E-5	9.57394E0	0.10
9	RV SLOPE	1.95350E-4	2.05866E-5	9.48920E0	0.11
10	RV SLOPE	2.07342E-4	2.18586E-5	9.48559E0	0.11
11	RV SLOPE	2.06730E-4	2.17619E-5	9.49959E0	0.11
12	RV SLOPE	3.04571E-4	3.20542E-5	9.50176E0	0.11

TABLE 47. COMMERCIAL C/E RESIDUALS FROM ADAPT USING RV SURVEY AND COMMERCIAL C/E FOR COD IN DIV. 2J3KL WITH A .50 DOME ON AGE 13. C/E FOR THIS ANALYSIS INCLUDED AGES 5-12 AND YEARS 1978-89.

LOG RESIDUALS FOR COMMERCIAL C/E INDEX 28/ 5/90

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
5	0.06	0.19	0.25	0.10	-0.27	0.19	0.03	0.18	-0.22	-0.22	-0.39	0.10
6	-0.03	-0.27	0.03	0.05	-0.45	0.01	0.20	0.16	0.20	-0.12	0.07	0.16
7	-0.23	-0.37	-0.57	0.13	0.04	-0.11	0.20	0.43	0.06	-0.01	0.20	0.23
8	-0.18	-0.66	-0.71	-0.39	0.03	0.12	0.14	0.43	0.28	0.29	0.25	0.38
9	-0.35	-0.68	-0.80	-0.27	0.20	0.28	0.49	0.44	0.21	-0.27	0.34	0.41
10	-0.39	-0.60	-0.51	-0.45	-0.28	0.51	0.24	0.73	0.39	-0.22	0.32	0.26
11	0.03	-0.72	-0.65	-0.25	-0.58	0.28	0.39	0.85	0.50	-0.07	-0.17	0.41
12	-0.46	-0.66	-0.78	-0.22	-0.31	-0.25	0.34	0.82	0.54	0.23	0.06	0.67

SUM OF C/E RESIDUALS : 0.0000002931 MEAN RESIDUAL : 0.0000000031

TABLE 48. PARAMETER ESTIMATES FROM ADAPT USING RV SURVEY AGES 3-12 FOR COD IN DIV. 2J3KL WITH A .50 DOME ON AGE 13 AND STANDARD ERROR WEIGHTING.

ESTIMATED PARAMETERS AND STANDARD ERRORS
APPROXIMATE STATISTICS ASSUMING LINEARITY NEAR SOLUTION

ORTHOGONALITY OFFSET..... 0.014809
MEAN SQUARE RESIDUALS 3.155096

AGE	PARAMETER	ESTIMATE	STD. ERR.	T-STATISTIC	C.V.
3	ABUNDANCE	6.44406E5	1.84083E5	3.50063E0	0.29
4	ABUNDANCE	2.69450E5	5.73664E4	4.69700E0	0.21
5	ABUNDANCE	1.02213E5	1.96108E4	5.21208E0	0.19
6	ABUNDANCE	9.08798E4	1.50426E4	6.04149E0	0.17
7	ABUNDANCE	1.22962E5	2.05661E4	5.97885E0	0.17
8	ABUNDANCE	7.38291E4	1.16270E4	6.34979E0	0.16
9	ABUNDANCE	1.98282E4	3.85060E3	5.14939E0	0.19
10	ABUNDANCE	1.06337E4	2.24778E3	4.73076E0	0.21
11	ABUNDANCE	4.21229E3	1.03388E3	4.07426E0	0.25
12	ABUNDANCE	1.18890E3	2.66039E2	4.46890E0	0.22
3	RV SLOPE	1.49300E-5	1.61780E-6	9.22860E0	0.11
4	RV SLOPE	3.34064E-5	3.44933E-6	9.68491E0	0.10
5	RV SLOPE	6.57393E-5	7.15028E-6	9.19395E0	0.11
6	RV SLOPE	8.93570E-5	9.78520E-6	9.13185E0	0.11
7	RV SLOPE	1.14670E-4	1.19183E-5	9.62137E0	0.10
8	RV SLOPE	1.17076E-4	1.14099E-5	1.02609E1	0.10
9	RV SLOPE	1.41443E-4	1.32034E-5	1.07126E1	0.09
10	RV SLOPE	1.40267E-4	1.20612E-5	1.16296E1	0.09
11	RV SLOPE	1.13128E-4	1.08295E-5	1.04463E1	0.10
12	RV SLOPE	8.05200E-5	8.87135E-6	9.07640E0	0.11

TABLE 49. RESIDUALS FROM ADAPT USING RV SURVEY AGES 3-12 FOR COD IN DIV. 2J3KL WITH A .50 DOME ON AGE 13 AND STANDARD ERROR WEIGHTING.

WEIGHTED RESIDUALS FOR RV SURVEY INDEX

	1978	1979	1980	1981	1982	1983	1984	1985	1986
3	-1.520	-3.325	0.719	0.682	1.723	3.586	2.828	1.318	3.024
4	1.532	1.190	0.222	-1.216	-1.804	1.492	3.249	0.646	2.390
5	1.917	1.813	0.723	-1.438	-0.893	0.590	0.679	-0.349	1.776
6	2.310	1.358	1.587	0.721	-1.781	0.512	1.689	-1.063	1.906
7	2.155	1.181	0.759	1.146	0.212	-0.316	0.260	-1.008	1.232
8	2.519	1.670	1.572	-0.550	2.428	1.825	-0.157	-2.086	1.829
9	1.587	0.924	1.210	-1.077	-0.271	1.488	0.853	-1.359	1.789
10	0.676	0.986	1.608	-0.808	1.039	0.232	1.364	-2.912	0.908
11	1.745	0.939	0.128	0.373	0.783	1.616	-1.277	-0.428	2.183
12	2.430	3.016	2.315	2.947	2.231	2.337	5.325	-4.812	2.223

	1987	1988	1989
3	-0.328	-0.234	-0.004
4	-1.021	-0.444	0.234
5	-0.204	-0.860	0.885
6	-0.691	-0.429	0.792
7	-1.341	0.840	-0.390
8	-0.392	0.423	-0.067
9	-0.401	-0.142	0.270
10	0.161	1.749	0.029
11	-1.564	0.756	0.765
12	2.501	0.925	1.240

SUM OF RV RESIDUALS : 78.8374671496 MEAN RESIDUAL : 0.6569788929

TABLE 50. FISHING MORTALITY MATRIX FOR COD IN DIV. 2J3KL FROM ACCEPTED FORMULATION OF ADAPT USING RV AND C/E INDICES.

	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
3	0.013	0.010	0.025	0.006	0.013	0.020	0.009	0.007	0.027	0.024	0.029	0.031	0.026	0.019	0.036
4	0.053	0.053	0.061	0.046	0.090	0.093	0.163	0.077	0.130	0.144	0.204	0.250	0.138	0.151	0.217
5	0.109	0.166	0.151	0.139	0.208	0.193	0.380	0.262	0.227	0.313	0.369	0.397	0.352	0.428	0.503
6	0.186	0.300	0.251	0.262	0.280	0.346	0.494	0.593	0.459	0.462	0.445	0.326	0.629	0.711	0.772
7	0.315	0.293	0.450	0.461	0.392	0.423	0.575	0.814	0.731	0.522	0.526	0.384	0.653	0.827	0.961
8	0.328	0.330	0.443	0.640	0.413	0.482	0.619	0.907	0.540	0.486	0.557	0.534	0.855	1.132	1.031
9	0.364	0.312	0.415	0.604	0.482	0.434	0.604	0.737	0.465	0.432	0.444	0.573	0.900	0.970	1.468
10	0.404	0.370	0.435	0.594	0.304	0.715	0.554	0.778	0.300	0.353	0.446	0.579	1.206	1.240	1.175
11	0.341	0.325	0.528	0.473	0.358	0.349	0.585	0.747	0.265	0.285	0.425	0.527	1.334	0.997	0.877
12	0.419	0.223	0.449	0.453	0.278	0.496	0.599	1.505	0.294	0.272	0.359	0.627	1.054	1.177	0.843
13	0.329	0.305	0.443	0.554	0.415	0.444	0.591	0.831	0.651	0.500	0.524	0.460	0.746	0.962	1.096

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
3	0.023	0.005	0.008	0.017	0.007	0.006	0.008	0.002	0.002	0.005	0.017	0.012	0.004
4	0.241	0.072	0.056	0.110	0.062	0.122	0.057	0.057	0.043	0.055	0.071	0.143	0.100
5	0.440	0.222	0.217	0.180	0.170	0.231	0.243	0.183	0.194	0.176	0.159	0.219	0.300
6	0.422	0.414	0.257	0.271	0.232	0.283	0.382	0.363	0.304	0.398	0.302	0.370	0.427
7	0.457	0.525	0.413	0.250	0.327	0.396	0.407	0.468	0.489	0.406	0.463	0.507	0.520
8	0.508	0.517	0.475	0.321	0.258	0.451	0.421	0.461	0.529	0.520	0.612	0.625	0.616
9	0.471	0.453	0.429	0.303	0.363	0.451	0.458	0.490	0.475	0.470	0.399	0.640	0.653
10	0.725	0.344	0.425	0.304	0.324	0.391	0.461	0.408	0.593	0.490	0.382	0.582	0.550
11	0.376	0.530	0.301	0.221	0.298	0.227	0.370	0.337	0.550	0.476	0.303	0.385	0.472
12	0.426	0.261	0.443	0.193	0.293	0.241	0.259	0.278	0.392	0.415	0.399	0.304	0.544
13	0.475	0.260	0.213	0.232	0.152	0.212	0.212	0.237	0.247	0.222	0.251	0.274	0.282

TABLE 51. POPULATION BIOMASS AT THE BEGINNING OF THE YEAR (TONS) FOR COD IN DIV. 2J3KL FROM ACCEPTED FORMULATION OF ADAPT USING RV AND C/E INDICES.

	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
3	194204	170891	235488	277558	319447	231092	195162	179205	197611	163162
4	243905	253816	224082	304318	365578	417580	300090	256073	235648	254636
5	510784	303019	316960	277779	382767	439987	501005	335915	312347	272556
6	400287	523957	314304	333705	296048	380453	444250	419674	316338	304899
7	284087	367097	436470	274974	288689	251690	302711	304912	260874	224809
8	206454	216732	294441	299157	186315	209626	177182	183117	145252	134943
9	175349	151579	160950	195126	162939	127245	133615	98507	76340	87428
10	175566	120123	111305	106617	106996	100873	82641	73233	47257	46085
11	143068	113527	81039	70383	57514	77130	48238	46381	32851	34207
12	104939	91954	76702	44706	41006	37609	50876	25133	20544	23577
13	152846	82497	76501	50901	29547	32275	23812	29063	5799	15908
3+	2591489	2395190	2328240	2235223	2236845	2305560	2259582	1951213	1650864	1564211
4+	2397285	2224299	2092752	1957665	1917399	2074468	2064421	1772008	1453253	1401049
5+	2153380	1970483	1868670	1653347	1551821	1656888	1764330	1515935	1217605	1146413
6+	1642596	1667464	1551710	1375568	1169054	1216901	1263325	1180021	905257	873858
7+	1242310	1143508	1237406	1041863	873006	836448	819076	760346	588919	568958

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
3	109143	31236	36438	91733	166700	123850	90204	55765	71849	164958	137714
4	203291	92679	52672	52326	99927	175504	158568	135976	75805	85086	204924
5	247616	196220	84988	65043	60067	96643	171619	191398	179221	88653	98544
6	228560	185168	156306	77505	48353	48295	82018	187665	194338	182482	92871
7	206694	145749	154110	95435	43234	28513	42171	70691	179754	170481	159377
8	143757	120927	97719	88438	46682	20929	23227	29957	57470	150062	125571
9	89194	77610	67439	44357	30986	21503	15683	15603	21761	42461	108122
10	57885	54030	40701	27026	19061	8725	16137	11136	10790	16064	26205
11	33821	33356	25938	12287	8564	7090	5179	12122	7676	7785	10549
12	23961	19772	16418	6375	4779	4470	5974	3358	9760	5842	5414
13	16956	15044	9654	5736	2261	2492	3550	5158	2282	7405	3893
3+	1360877	971791	742383	566260	530615	538013	614331	718830	810706	921280	973184
4+	1251734	940554	705945	474527	363915	414163	524127	663065	738857	756322	835470
5+	1048444	847875	653273	422202	263988	238659	365559	527089	663052	671236	630546
6+	800828	651656	568285	357159	203920	142017	193940	335691	483831	582583	532002
7+	572268	466488	411979	279654	155567	93722	111922	148026	289493	400101	439131

	1983	1984	1985	1986	1987	1988	1989
3	189770	250801	150758	82106	50354	102494	182214
4	184036	218798	253599	184800	86558	68808	125208
5	230111	214135	225369	263976	209777	96086	75582
6	95932	215767	187124	200973	243798	202891	93307
7	79974	73872	153575	140301	144105	187027	152956
8	110733	53930	46705	88312	88951	88970	115441
9	78217	70662	33156	25583	50126	45984	46339
10	62410	47474	39976	19097	15038	31318	24826
11	16271	37930	29195	20494	11675	10241	17041
12	8316	11195	25281	15373	12324	8883	7083
13	4183	6136	8412	15623	9880	8893	6710
3+	1059951	1200699	1153150	1056637	922587	851596	846710
4+	870182	949898	1002392	974531	872233	749102	664496
5+	686146	731100	748793	789731	785675	680294	539287
6+	456035	516965	523424	525755	575898	584208	463705
7+	360104	301199	336300	324783	332099	381317	370398

TABLE 52. AVERAGE POPULATION BIOMASS (TONS) FOR COD IN DIV. 2J3KL FROM ACCEPTED FORMULATION OF ADAPT USING RV AND C/E INDICES.

	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
3	222439	196047	268263	319103	365924	263871	223961	205866	224803	182505
4	272586	285176	250884	343097	403575	460297	320118	284497	255282	274004
5	519394	320999	338130	298044	397473	460253	480964	340195	321632	269639
6	385722	487466	299089	315908	278019	346616	378773	342603	273915	263643
7	250888	336719	372853	233696	253081	217592	244727	222630	197184	186032
8	178966	190155	245393	228762	157387	171705	136696	125150	116006	110351
9	147066	132407	134179	149650	131796	105145	102454	71345	62225	72316
10	143331	100472	90423	80754	92236	72548	63685	51267	40815	40531
11	116100	96030	62597	55693	47932	64534	36340	32592	28570	29467
12	94537	78787	59287	34493	34245	28469	36814	12671	17029	19743
13	143462	78261	68173	43199	26673	28752	19885	21919	4718	13827
3+	2474491	2302521	2189271	2102400	2188340	2219781	2044417	1710733	1542177	1462059
4+	2252052	2106474	1921009	1783297	1822416	1955910	1820457	1504868	1317375	1279553
5+	1979467	1821298	1670124	1440199	1418841	1495613	1500339	1220371	1062093	1005549
6+	1460072	1500298	1331994	1142156	1021369	1035361	1019375	880176	740461	735910
7+	1074351	1012832	1032905	826248	743350	688745	640602	537573	466546	472267

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
3	100795	40652	43758	95933	171443	140428	110943	65135	78342	184185	159480
4	208846	77135	65142	59215	95114	163854	175594	163155	84323	90817	216542
5	203680	171009	90861	57384	52426	90015	184288	196043	186691	91355	99302
6	186600	176335	132834	57930	36271	48044	78224	190879	190667	176177	90591
7	163328	121136	119264	66761	31146	27767	36517	65937	172839	151347	135834
8	114198	93250	66132	57192	32762	19039	19612	26239	53875	131958	100807
9	76384	54930	43645	31120	17100	20253	13801	13467	20259	33591	82620
10	47604	37270	24427	16157	12049	7491	14129	9427	9457	12885	20724
11	28034	23344	13974	7894	6217	6814	4180	10875	7088	6563	9241
12	19217	13178	9674	3743	3468	4294	5675	2932	9403	4727	4681
13	13243	11547	7114	4017	1646	2295	3271	4880	2023	6020	3396
3+	1161929	819786	616825	457347	459642	530293	646235	748968	814965	889626	923218
4+	1061134	779134	573067	361414	288199	389865	535291	683833	736623	705440	763738
5+	852288	701998	507925	302198	193085	226011	359697	520679	652301	614623	547196
6+	648608	530989	417064	244814	140659	135996	175408	324636	465610	523268	447894
7+	462008	354654	284230	186884	104388	87952	97185	133756	274943	347091	357303

	1983	1984	1985	1986	1987	1988	1989
3	204134	252624	167197	84450	58978	113496	202560
4	207915	229858	250390	199780	86264	75900	132934
5	233080	208901	208220	262658	210840	100393	70651
6	87817	192167	160424	178983	215956	179017	80043
7	68041	61511	119039	119698	116098	150790	125559
8	91966	43030	35818	67244	62205	65867	87857
9	62675	54359	26319	19602	41162	35474	34073
10	48605	38103	29230	14297	12455	22640	19158
11	13275	32456	21657	15937	10792	8651	14162
12	7487	10119	19672	12141	10248	7464	5559
13	3850	5169	7229	13807	8942	8415	6223
3+	1028844	1128296	1045196	988597	833940	768106	778780
4+	824709	875672	877999	904146	774962	654611	576220
5+	616794	645814	627609	704366	688697	578711	443287
6+	383715	436913	419389	441708	477858	478318	372635
7+	295898	244746	258965	262725	261901	299301	292592

TABLE 53. POPULATION NUMBERS AT THE BEGINNING OF THE YEAR (000s) FOR COD IN DIV. 2J3KL FROM ACCEPTED FORMULATION OF ADAPT USING RV AND C/E INDICES.

	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
3	726475	639266	880910	1038287	1194982	864465	730059	670369	739222	599153
4	560942	586946	518187	703730	845393	965649	693954	592164	544934	588842
5	686224	435559	455598	399280	550189	632437	720144	482844	448968	391771
6	378066	503618	302104	320751	284556	365685	427005	403384	304059	293064
7	193400	256906	305456	192435	202034	176140	211846	213387	182568	157328
8	108673	115531	156955	159469	99317	111744	94449	97613	77429	71933
9	72897	64072	68033	82479	68874	53786	56479	41639	32269	36956
10	60034	41458	38415	36797	36928	34814	28522	25275	16310	16596
11	39975	32832	23436	20354	16633	22306	13950	13413	9501	9893
12	30556	23278	19417	11318	10381	9521	12879	6362	5201	5969
13	30478	16450	15255	10150	5892	6436	4748	5795	1156	3172
3+	2887721	2715917	2783766	2975051	3315178	3242983	2994037	2552245	2361615	2174677
4+	2161246	2076651	1902856	1936764	2120196	2378518	2263978	1881877	1622394	1575524
5+	1600304	1489706	1384668	1233034	1274803	1412869	1570024	1289712	1077460	986682
6+	914080	1054146	929070	833754	724615	780432	849880	806869	628492	594910
7+	536014	550528	626966	513003	440058	414747	422874	403485	324433	301846

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
3	256368	142294	139675	237340	427752	348131	306725	156845	164457	370654	332908
4	478894	203801	112915	111433	190728	337757	278576	249928	127371	132335	301489
5	417356	319871	129954	80502	78474	125637	217256	212194	193439	93402	101857
6	234448	236232	176070	74794	42954	38869	66251	142399	139804	132303	64535
7	151166	123005	139570	76831	30086	16258	20869	35857	90164	87303	85880
8	76451	73108	68619	59493	27521	9421	8428	10109	19420	57517	51558
9	36223	35852	35108	23889	15695	8035	4641	4115	5146	11529	36371
10	19641	19025	16547	11684	7415	2959	4108	2415	2193	3112	6567
11	9543	10296	8731	4054	2767	1875	1173	2383	1292	1325	1843
12	6088	5110	4978	1884	1225	943	1054	565	1445	848	805
13	3722	3482	2236	1421	475	432	504	665	297	976	518
3+	1689901	1172078	834402	683325	825092	890318	909586	817475	745028	891304	984331
4+	1433533	1029784	694727	445984	397340	542187	602860	660630	580571	520649	651423
5+	954639	825983	581812	334552	206612	204430	324284	410702	453200	388314	349934
6+	537283	506112	451858	254050	128138	78793	107028	198508	259761	294912	248077
7+	302835	269879	275788	179256	85184	39923	40776	56109	119956	162609	183542

	1983	1984	1985	1986	1987	1988	1989
3	364654	472838	384668	183143	152578	257051	466506
4	271022	296214	386420	314351	149193	122813	207931
5	218529	209574	229064	302960	243598	113809	87165
6	66199	140369	142847	154412	208078	170179	74821
7	39810	36982	79976	86259	84918	125968	96250
8	47298	21696	18965	40138	47075	43765	62089
9	26893	25423	11207	9148	19541	20893	19184
10	18978	13935	12752	5704	4681	10735	9017
11	3636	9800	7584	5770	2861	2615	4911
12	1203	2056	5729	3581	2935	1730	1457
13	518	760	1275	3169	1935	1613	1046
3+	1058741	1229647	1280486	1108636	917394	871171	1030379
4+	694087	756808	895818	925493	764815	614119	563872
5+	423065	460594	509399	611142	615622	491306	355941
6+	204536	251021	280335	308181	372024	377497	268776
7+	138337	110652	137488	153770	163946	207318	193955

Table 54. Input data for yield-per-recruit analysis.

Age	Partial recruitment	Average weight
1	0	0.20
2	0	0.28
3	0.006	0.47
4	0.152	0.71
5	0.474	1.05
6	0.608	1.38
7	1.000	1.79
8	1.000	2.07
9	1.000	2.65
10	0.802	3.19
11	0.798	4.38
12	0.878	5.18
13	0.500	6.60
14	0.500	7.89
15	0.500	9.45
16	0.500	10.86

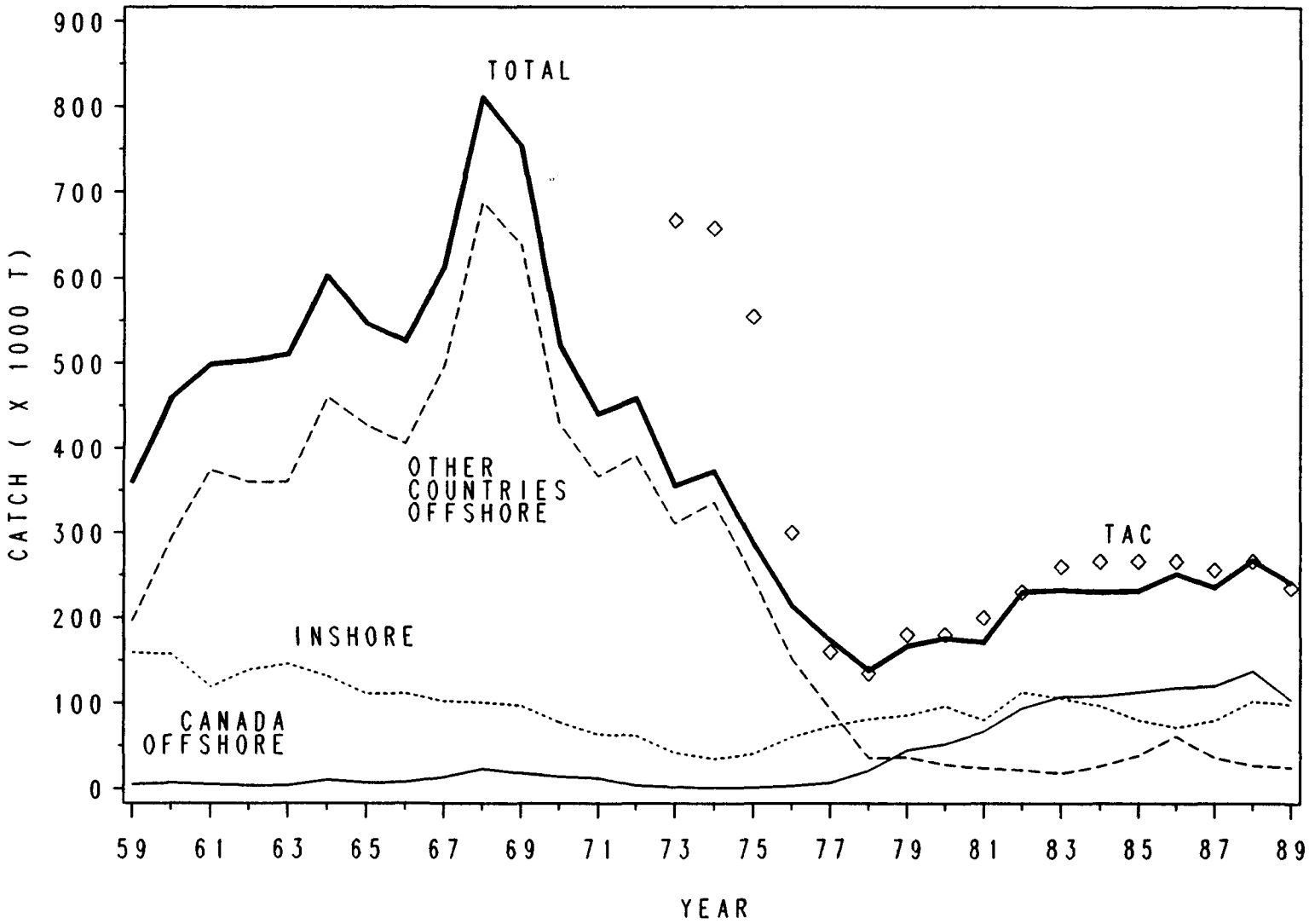

FIG. 1. CATCHES OF COD WITH ASSOCIATED TACS FROM DIVISIONS 2J3KL FOR THE 1959-89 PERIOD.

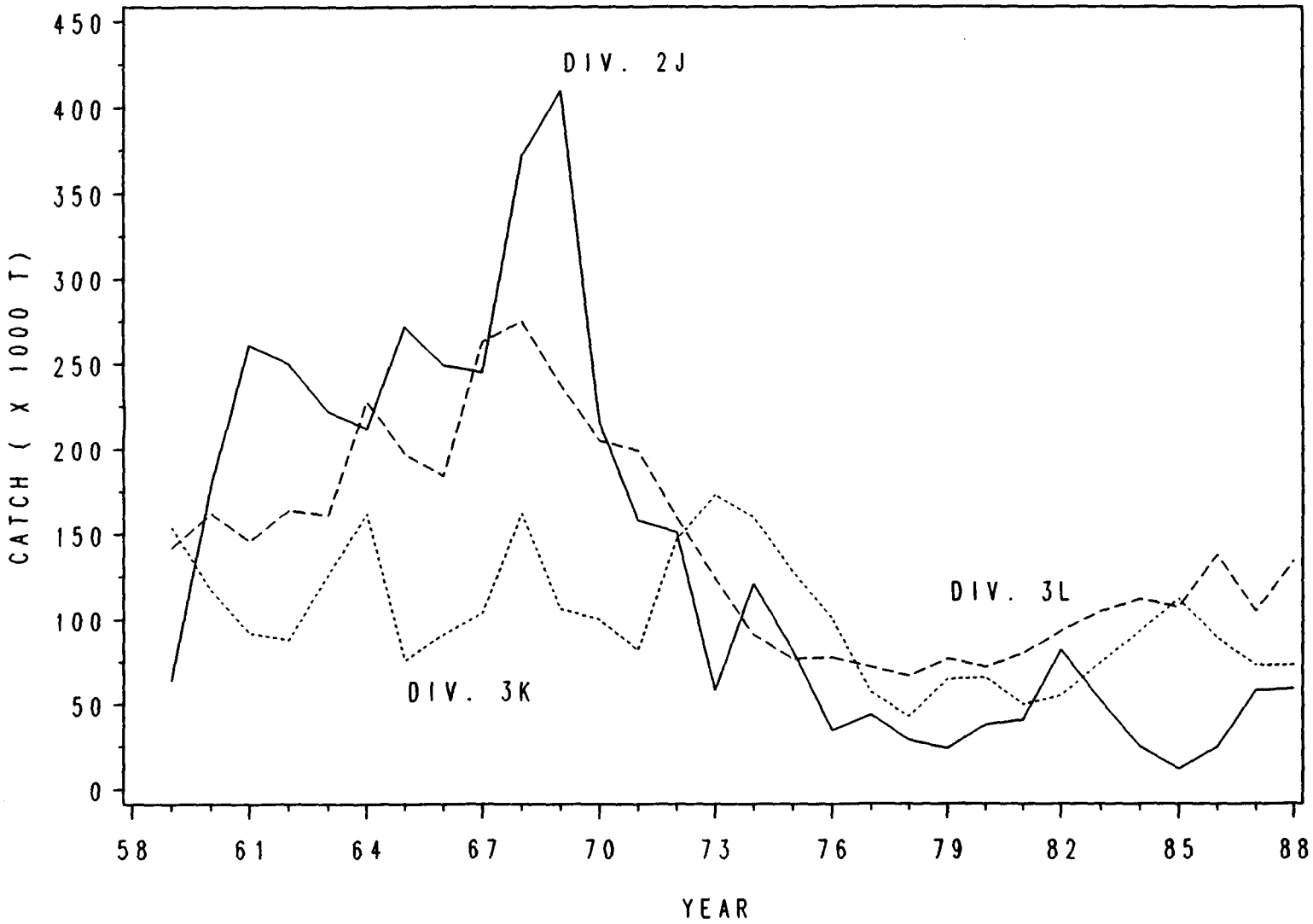

FIG. 2. CATCHES OF COD BY NAFO DIVISION (2J,3K,3L) FOR THE 1959-88 PERIOD.

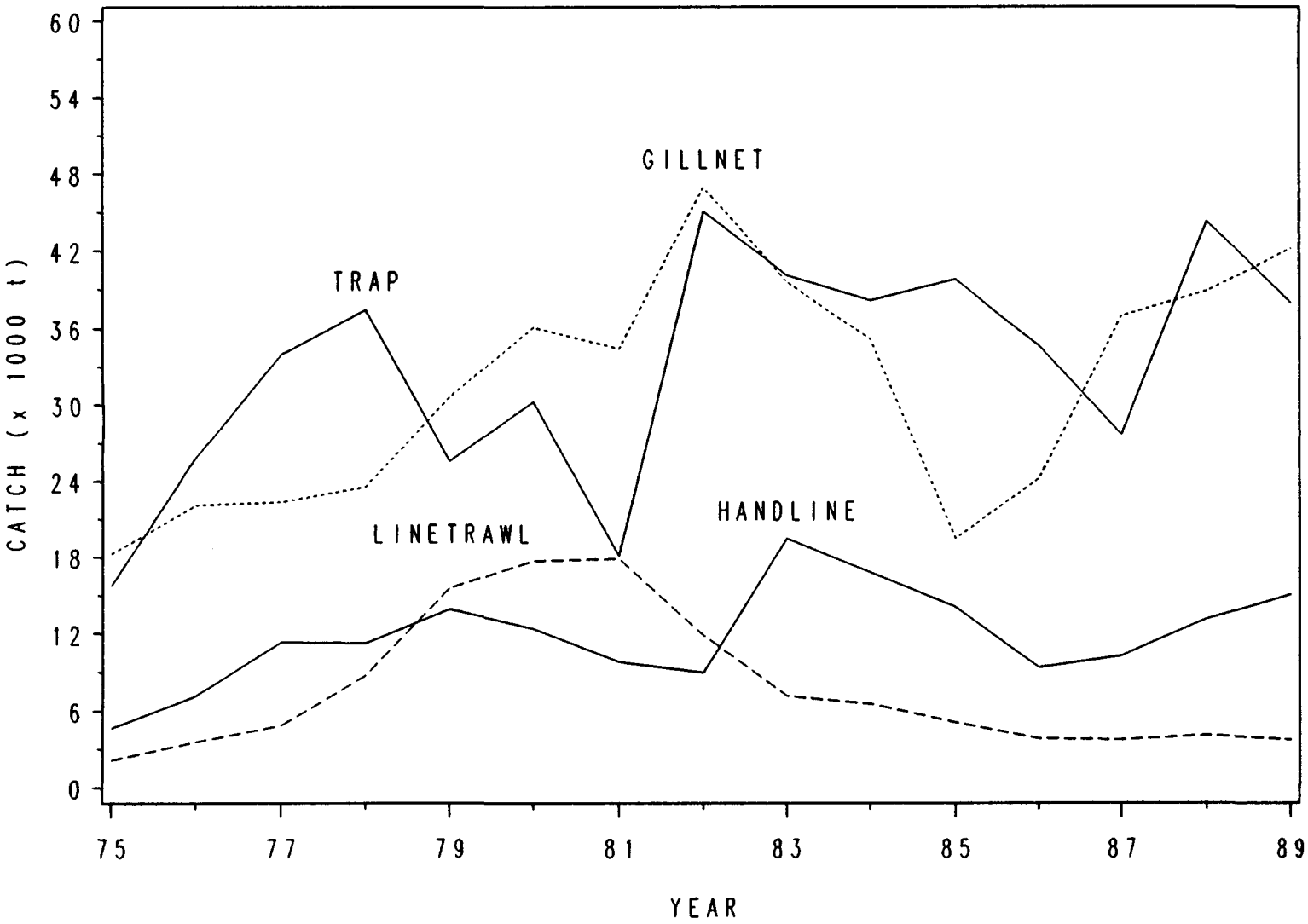

FIG. 3. INSHORE COD CATCHES BY GEAR TAKEN IN NAFO DIV. 2J3KL FOR THE PERIOD 1975-89.

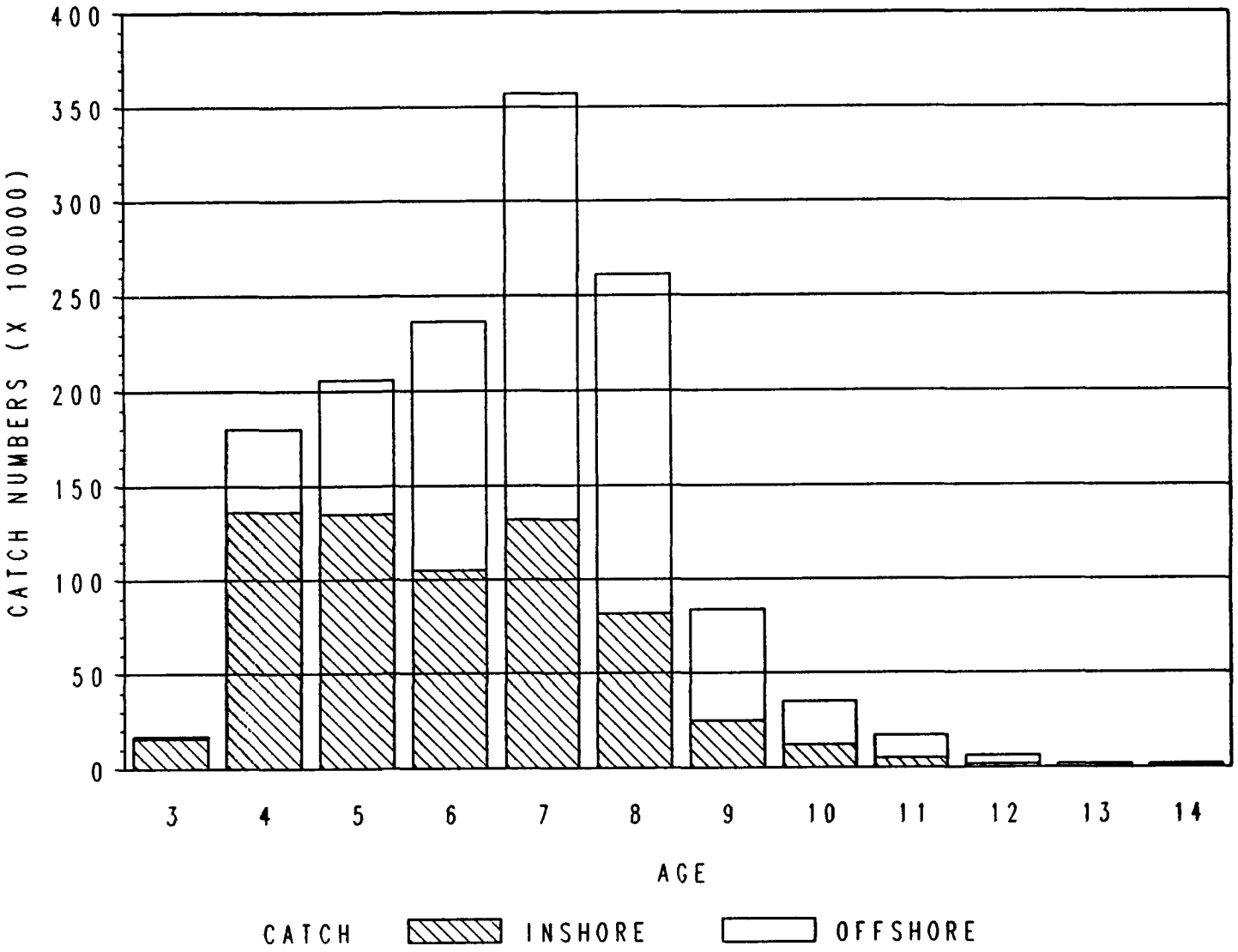

FIG. 4. AGE COMPOSITION OF THE COMMERCIAL CATCH FOR DIV. 2J3KL COD DURING 1989.

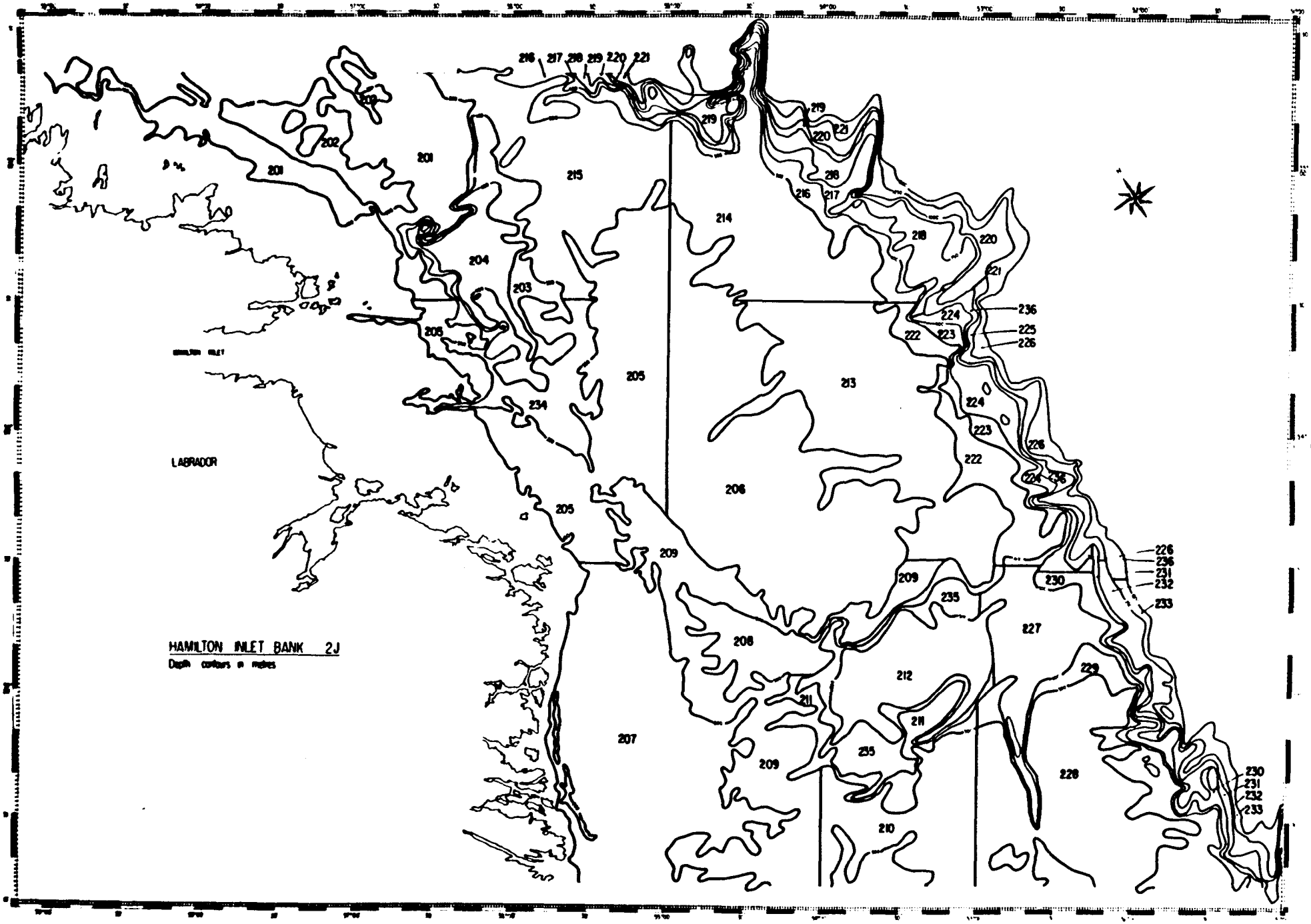

Figure 5. Area of stratification for RV surveys in Div. 2J.

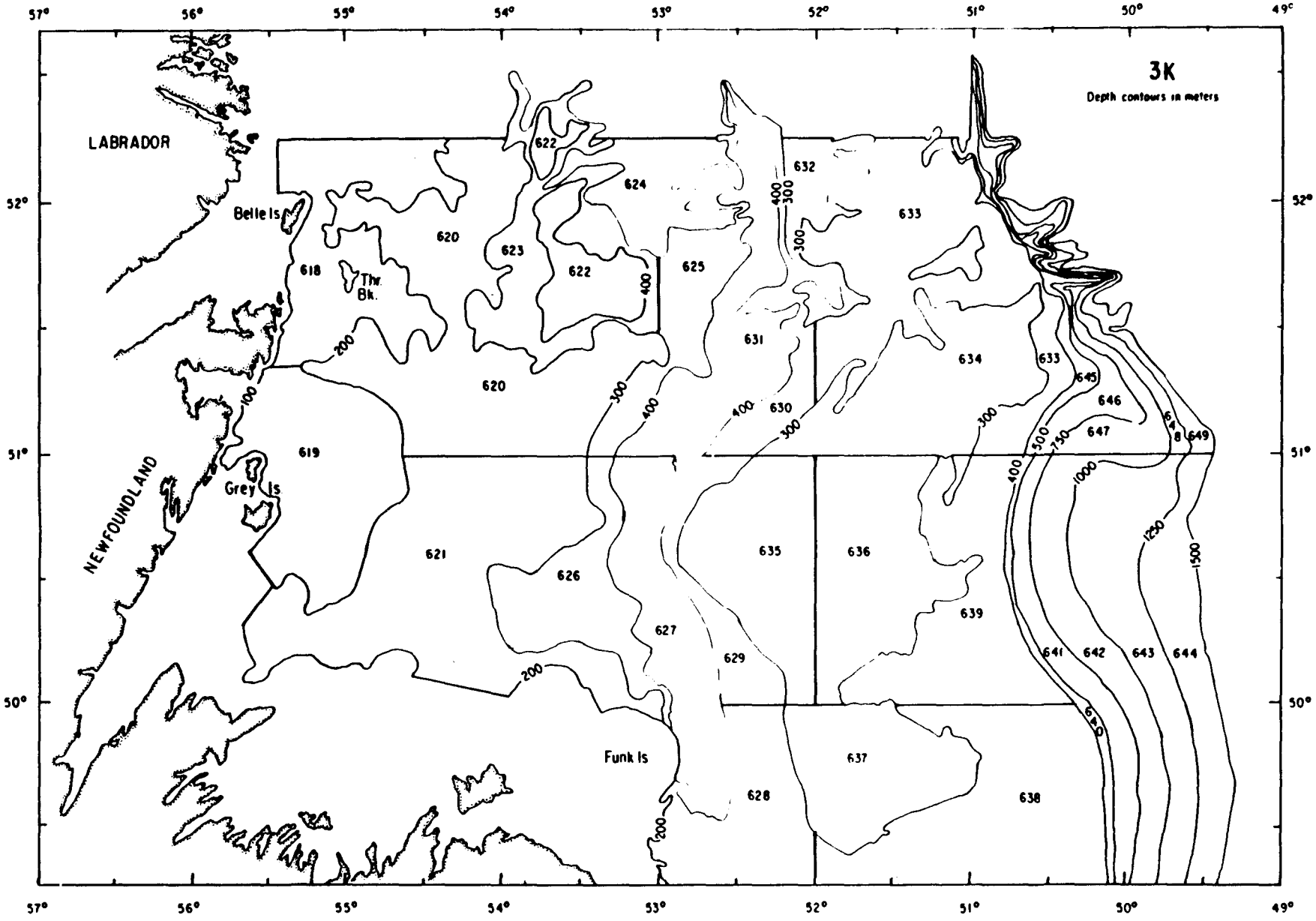

Figure 6. Area of stratification for RV surveys in Div. 3K.

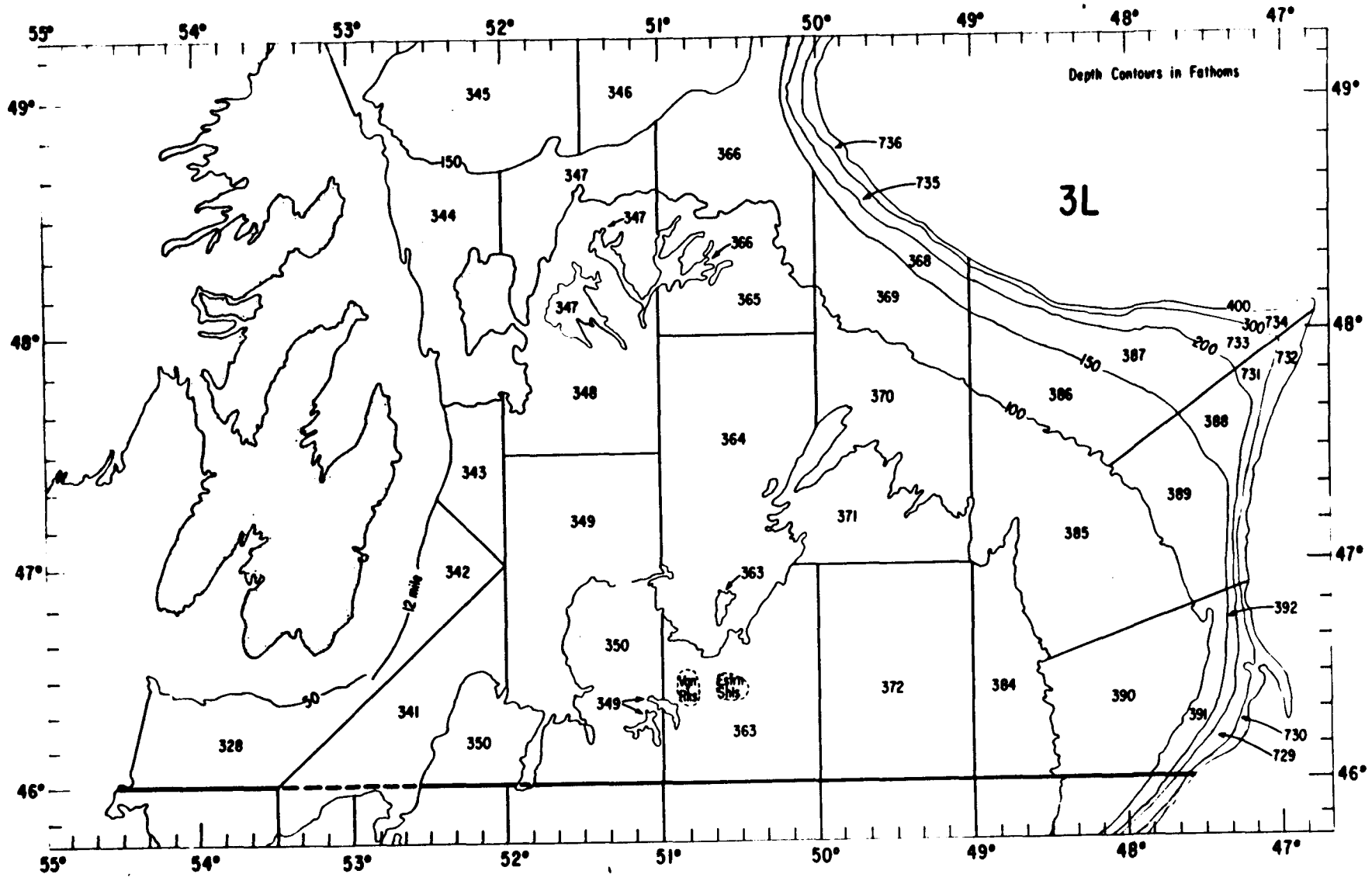

Figure 7. Area of stratification for RV surveys in Div. 3L.

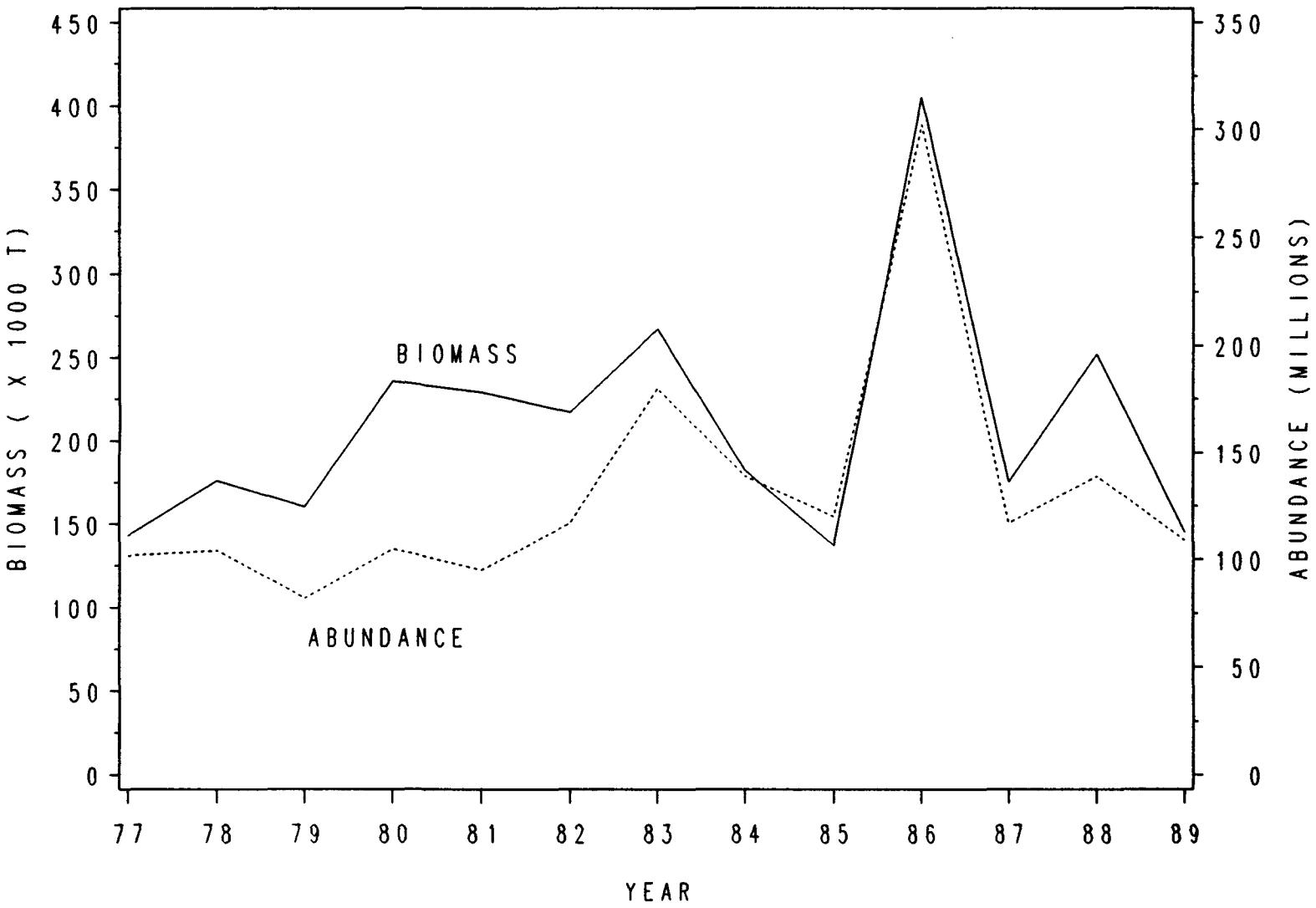

FIG. 8 . COD BIOMASS AND ABUNDANCE IN DIVISION 2J OBTAINED FROM AUTUMN RV SURVEYS.

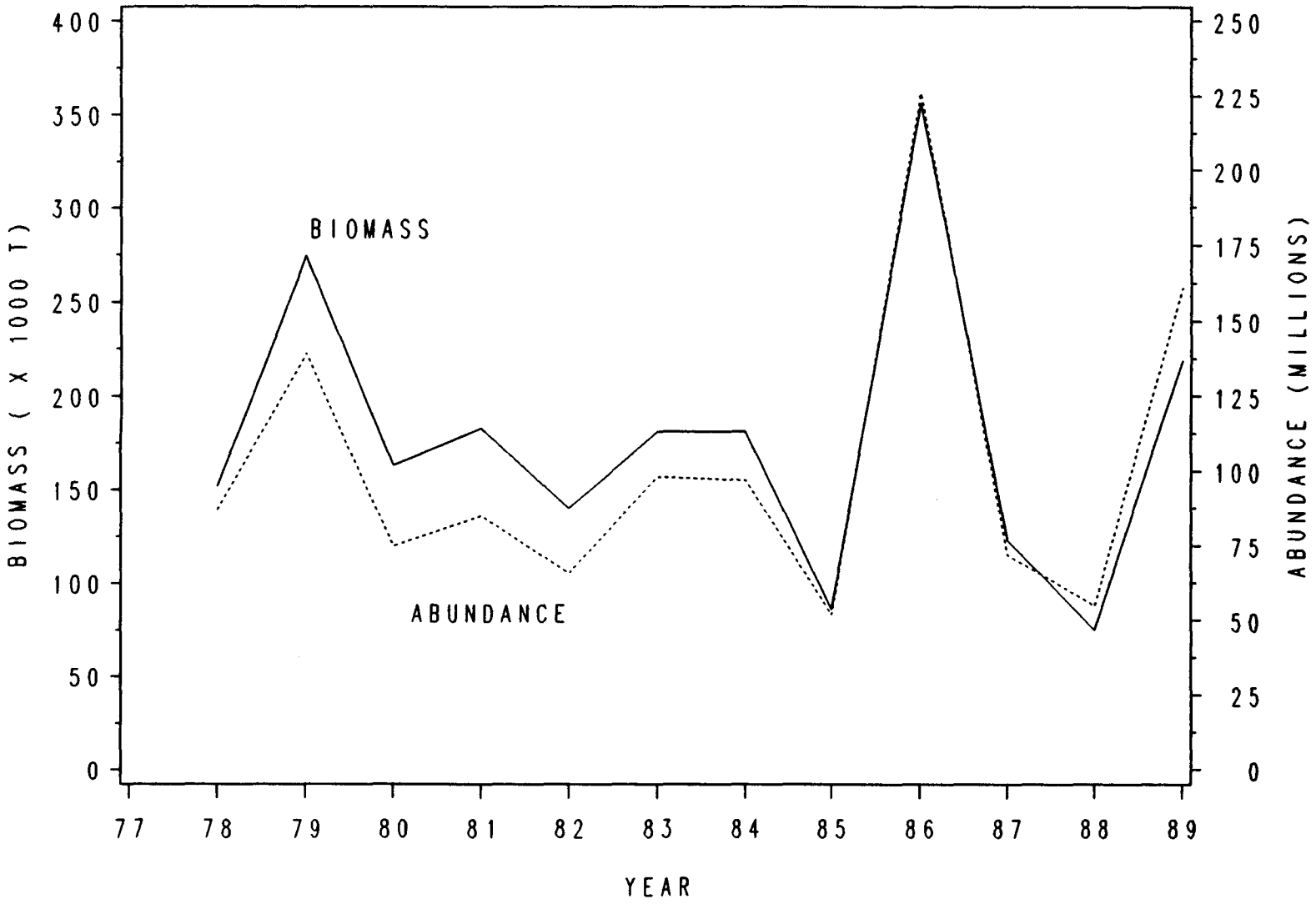

FIG. 9 . COD BIOMASS AND ABUNDANCE IN DIVISION 3k OBTAINED FROM AUTUMN RV SURVEYS.

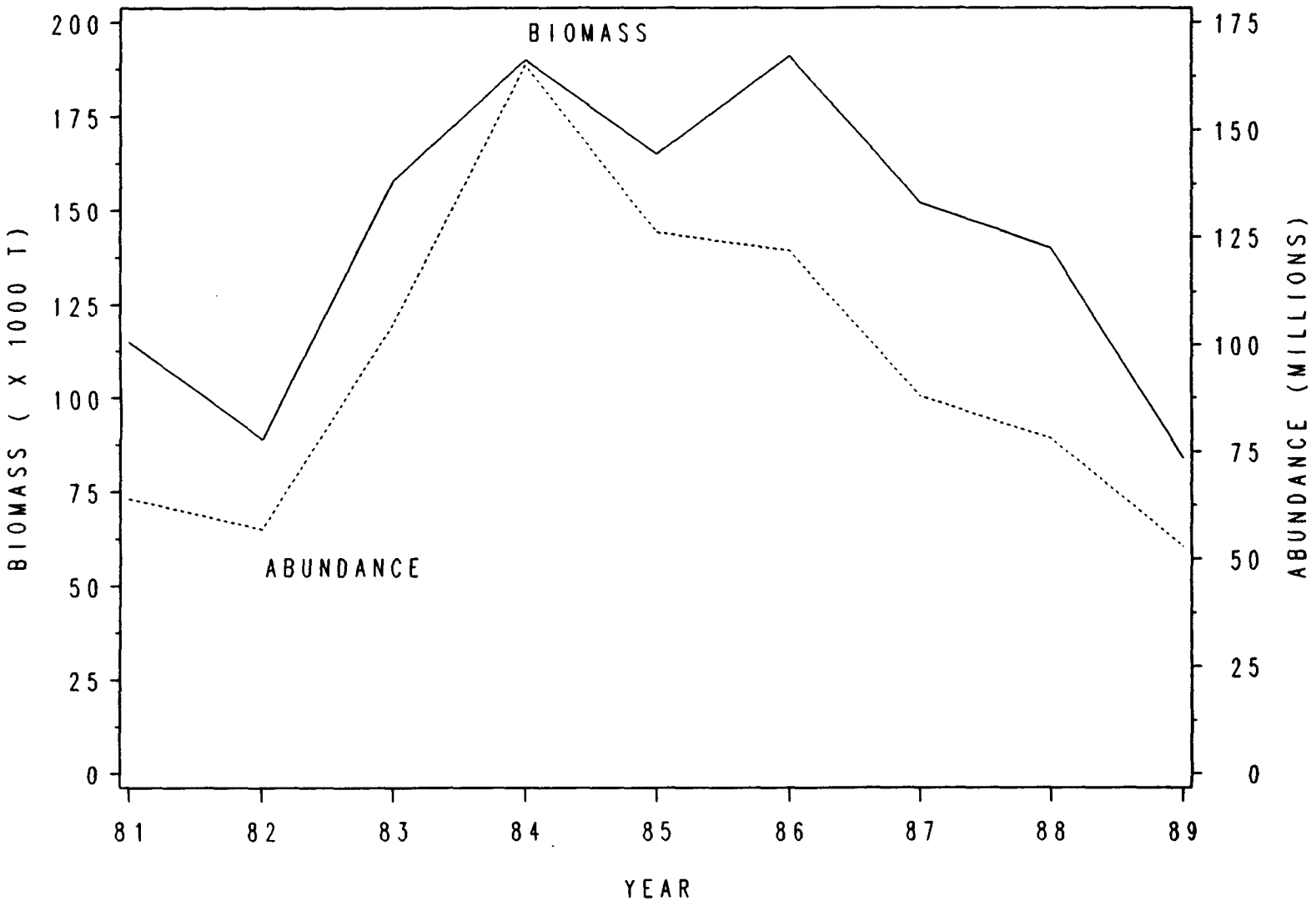

FIG. 10 . COD BIOMASS AND ABUNDANCE IN DIVISION 3L OBTAINED FROM AUTUMN RV SURVEYS.

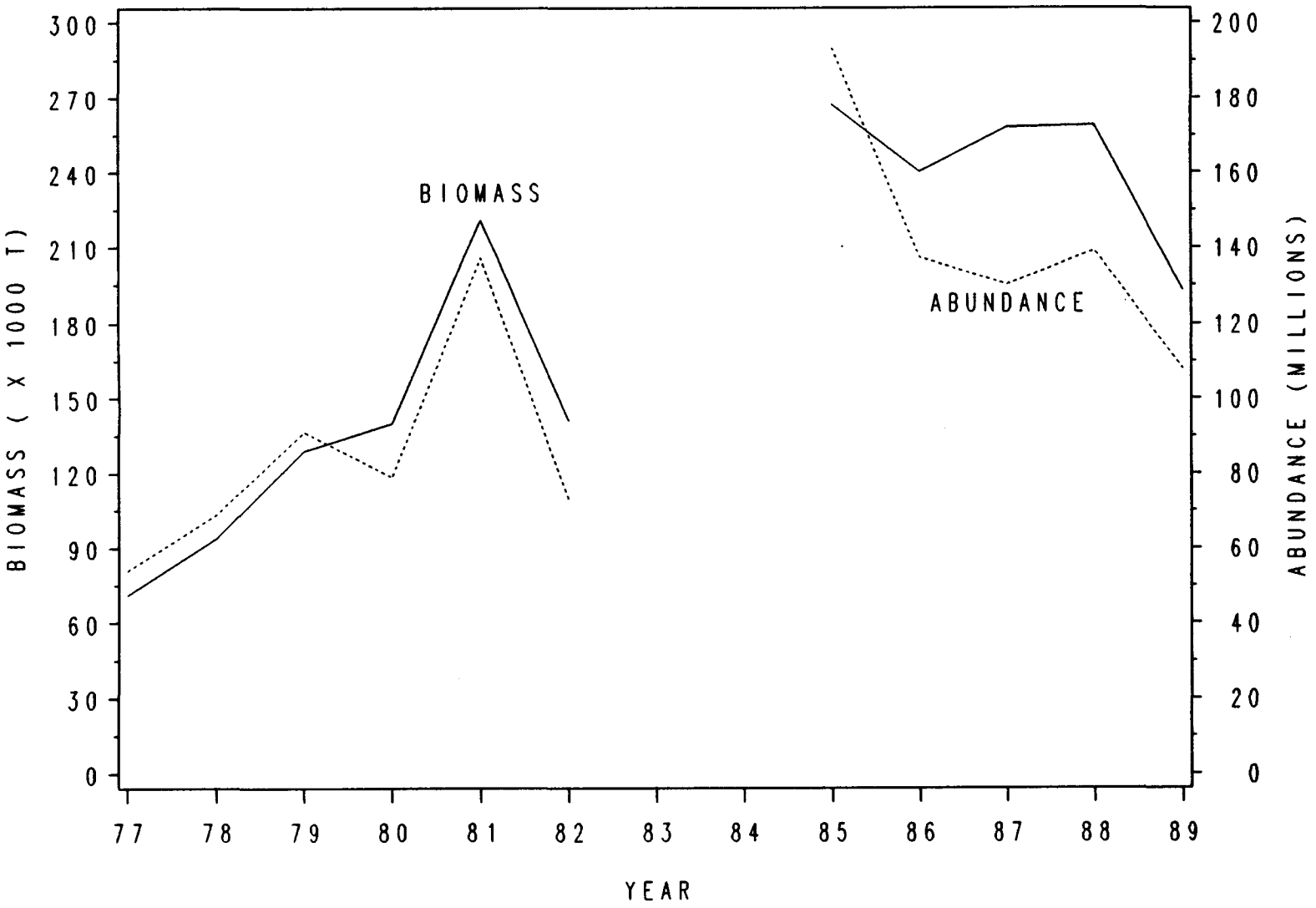

FIG. 11 . COD BIOMASS AND ABUNDANCE IN DIVISION 3L OBTAINED FROM SPRING RV SURVEYS.

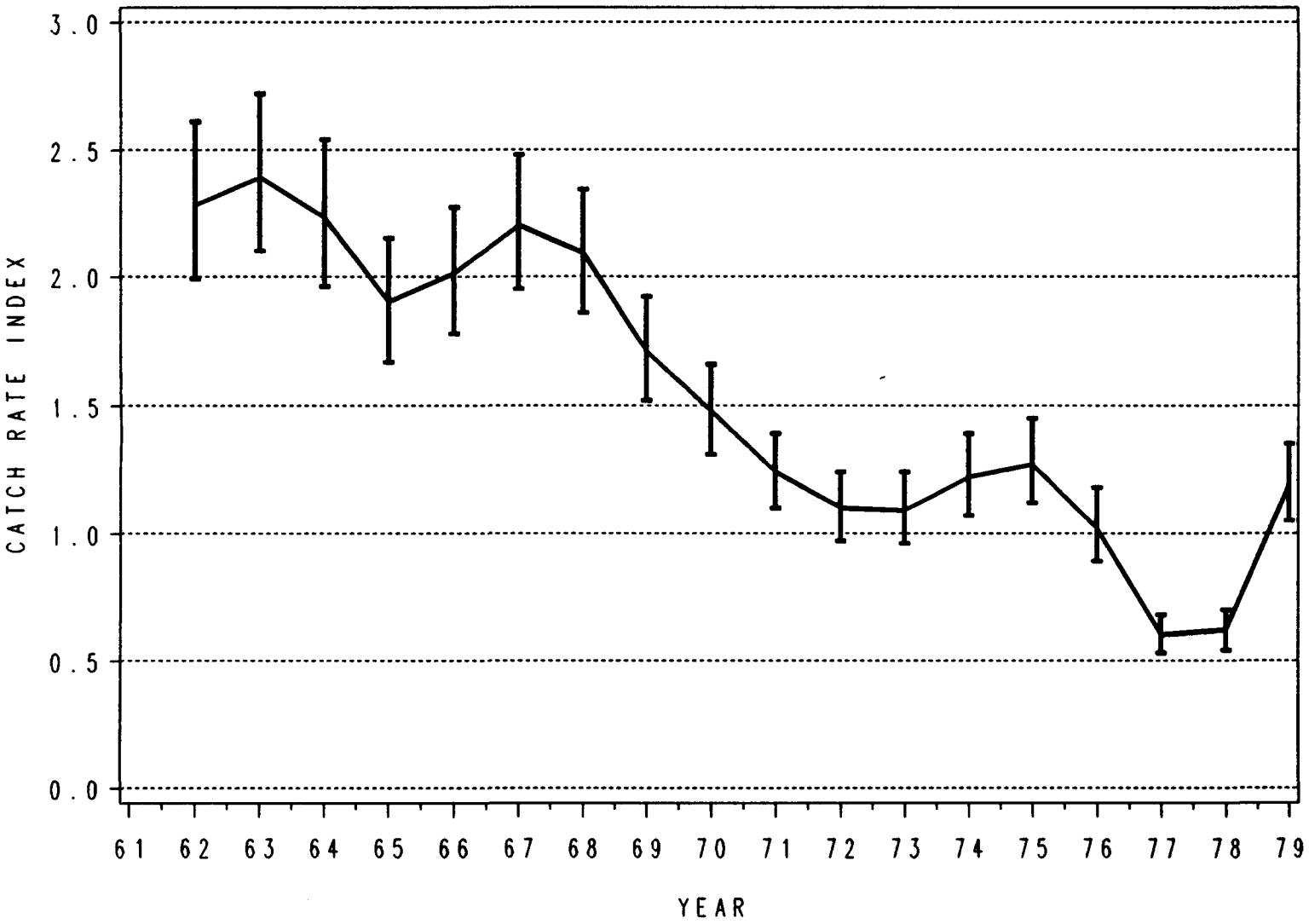

FIG 12. CATCH RATE INDEX WITH APPROXIMATE 90% C. I.
FOR DIV. 2J3KL COD (1962-79).

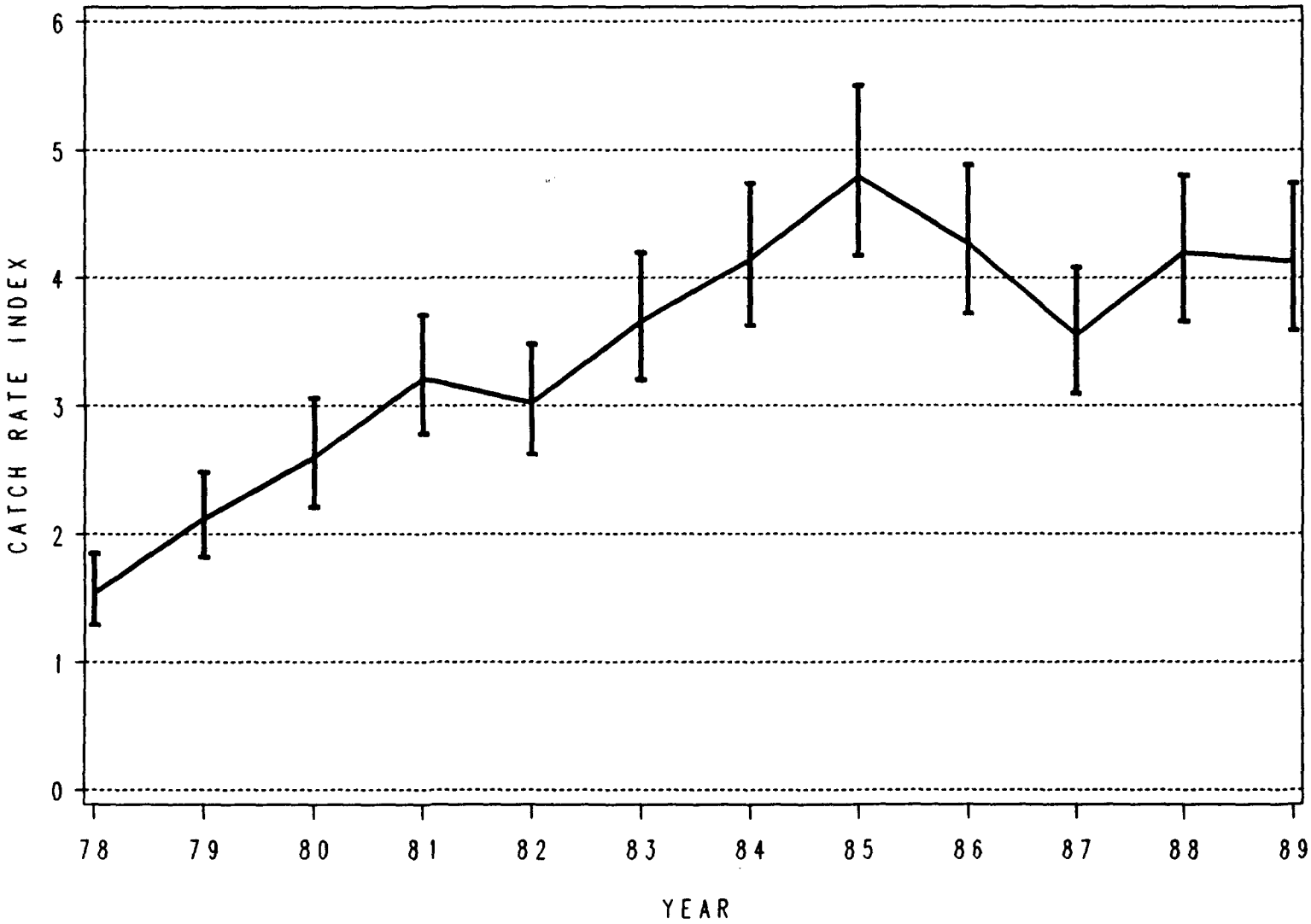

FIG 13. CATCH RATE INDEX WITH APPROXIMATE 90% C. I.
FOR DIV. 2J3KL COD (1978-89).

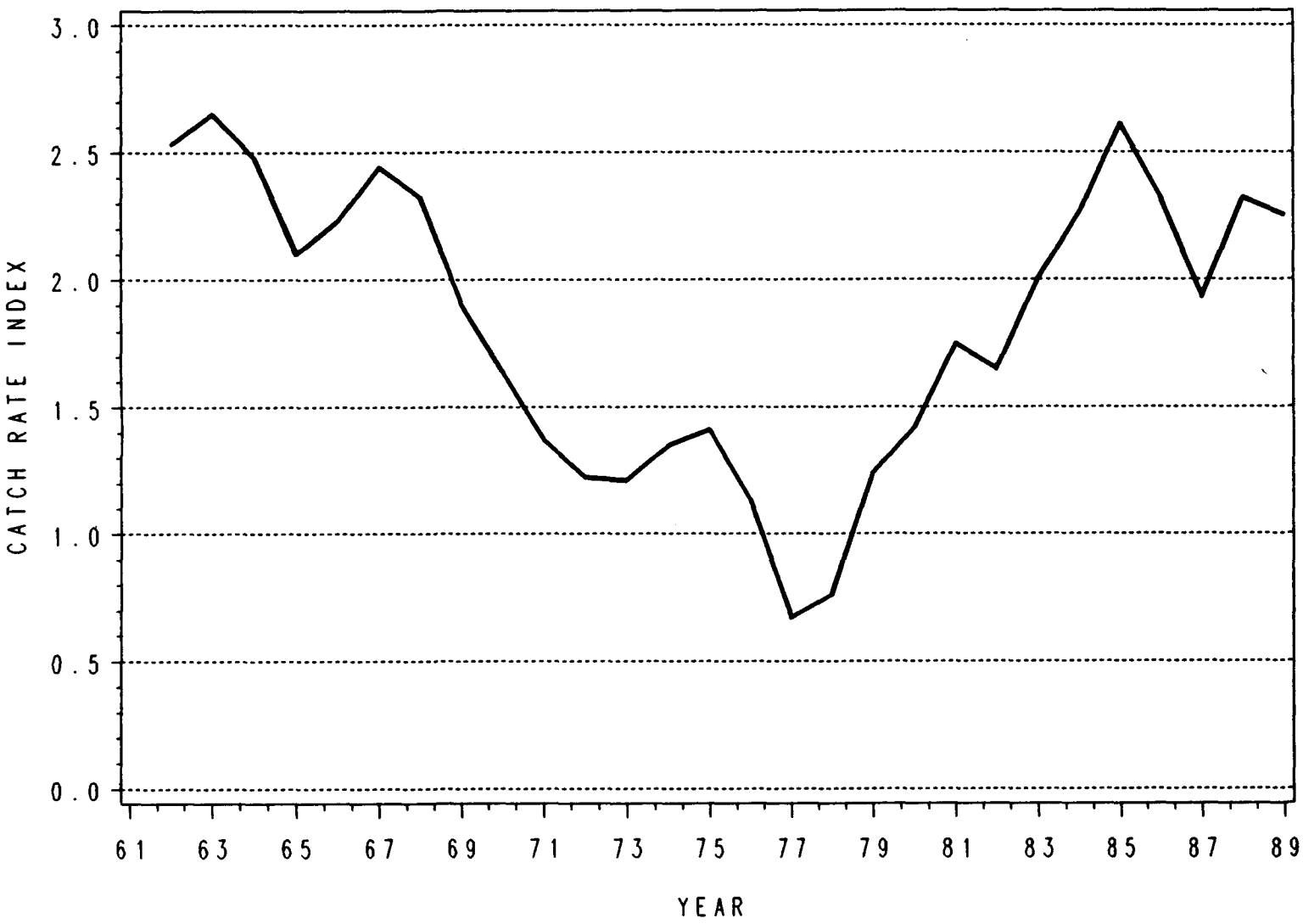

FIGURE 14. STANDARDIZED CATCH RATE INDICES FOR 2J3KL COD FOR THE PERIOD 1962-89.

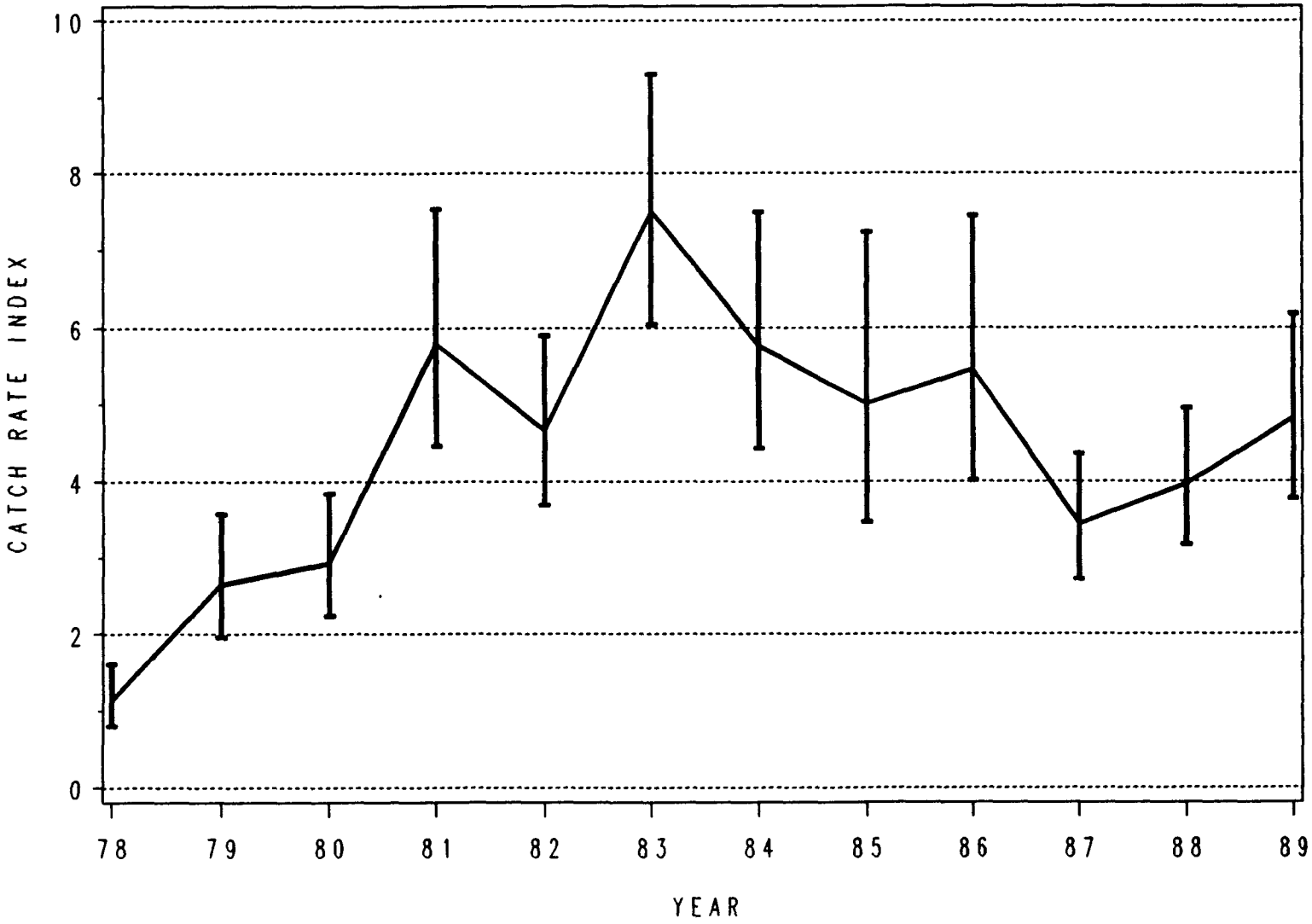

FIG 15. CATCH RATE INDEX WITH APPROXIMATE 90% C. I.
FOR DIV. 2J COD (1978-89).

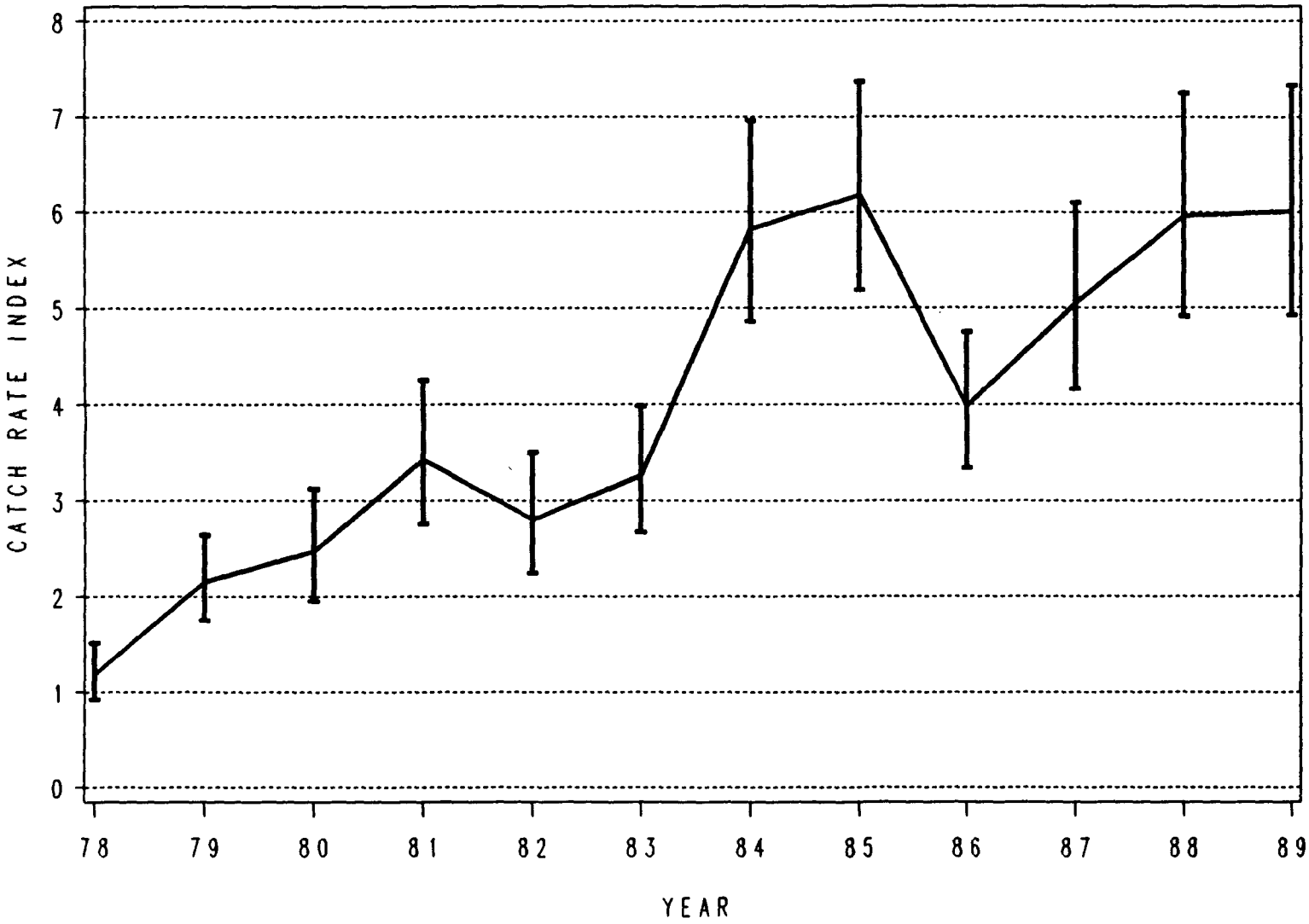

FIG 16. CATCH RATE INDEX WITH APPROXIMATE 90% C. I.
FOR DIV. 3K COD (1978-89).

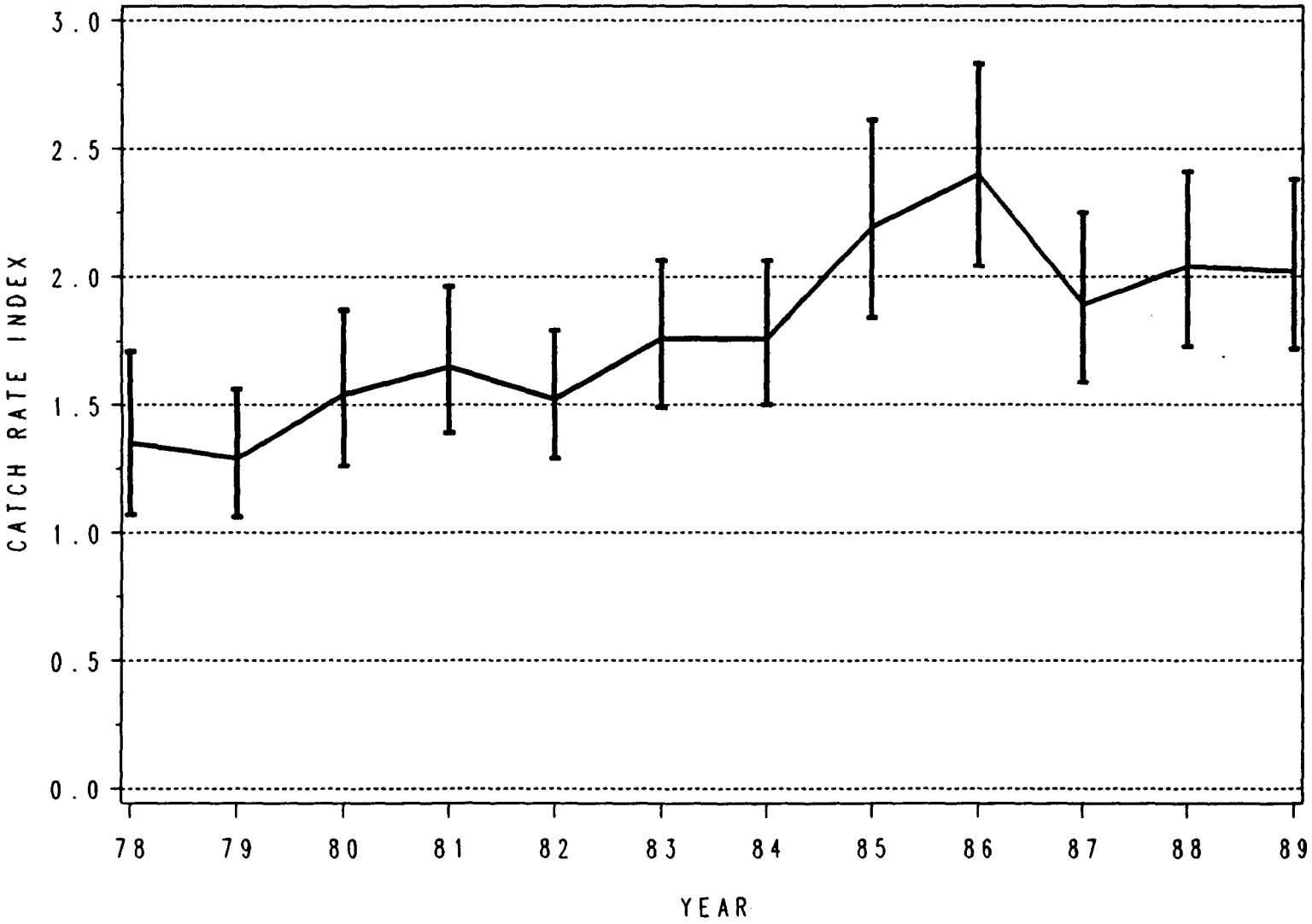

FIG 17. CATCH RATE INDEX WITH APPROXIMATE 90% C. I.
FOR DIV. 3L COD (1978-89).

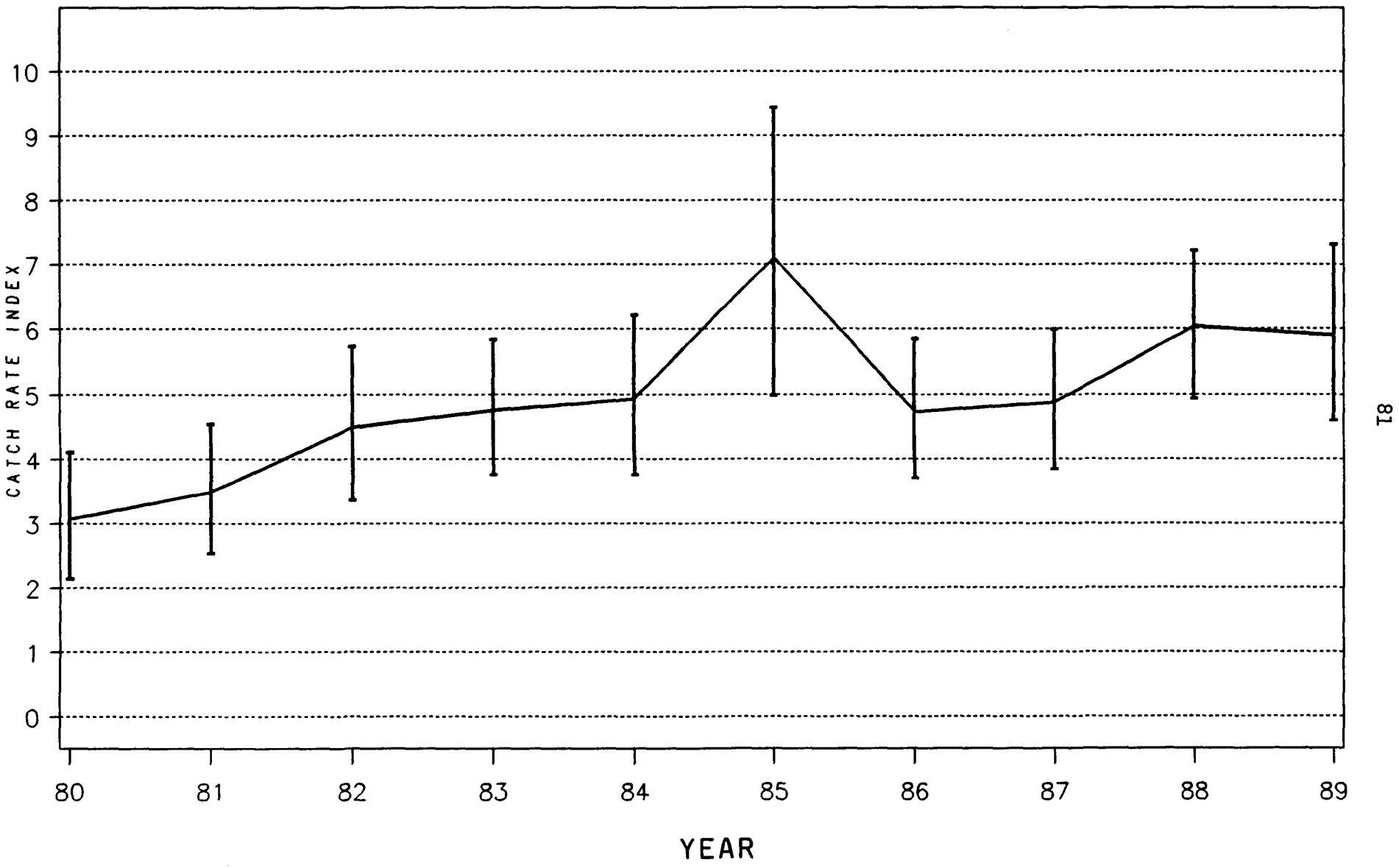

FIG. 18. CATCH RATE INDEX WITH APPROX. 90% C.I. FOR COD IN DIV. 2J3KL FROM 1980-89. DATA FROM OBSERVERS ON CANADIAN VESSELS.

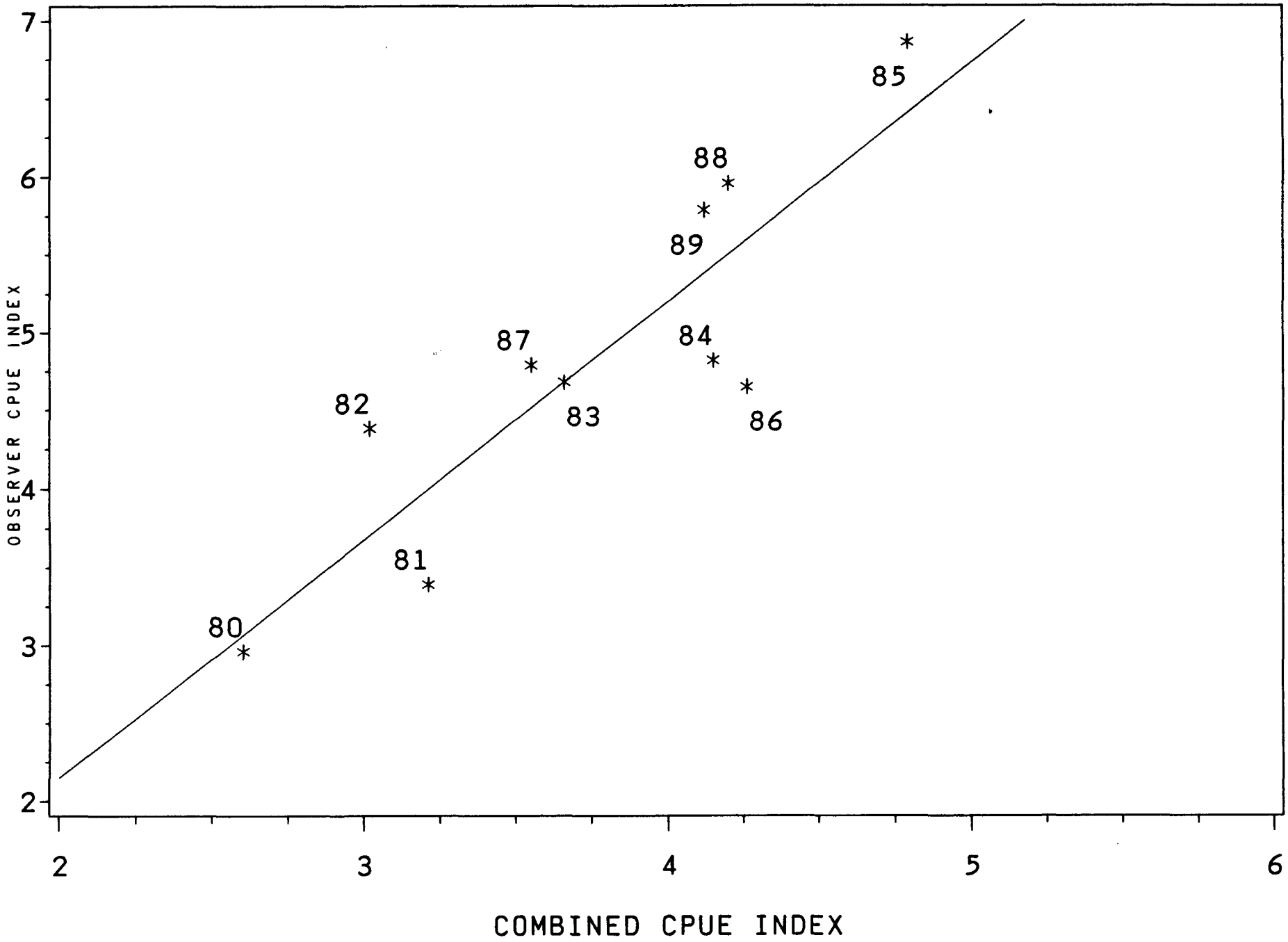

FIG 19. OBSERVER CPUE INDEX VS. COMBINED CPUE INDEX FOR COD IN DIV. 2K3KL FOR THE YEARS 1980-89

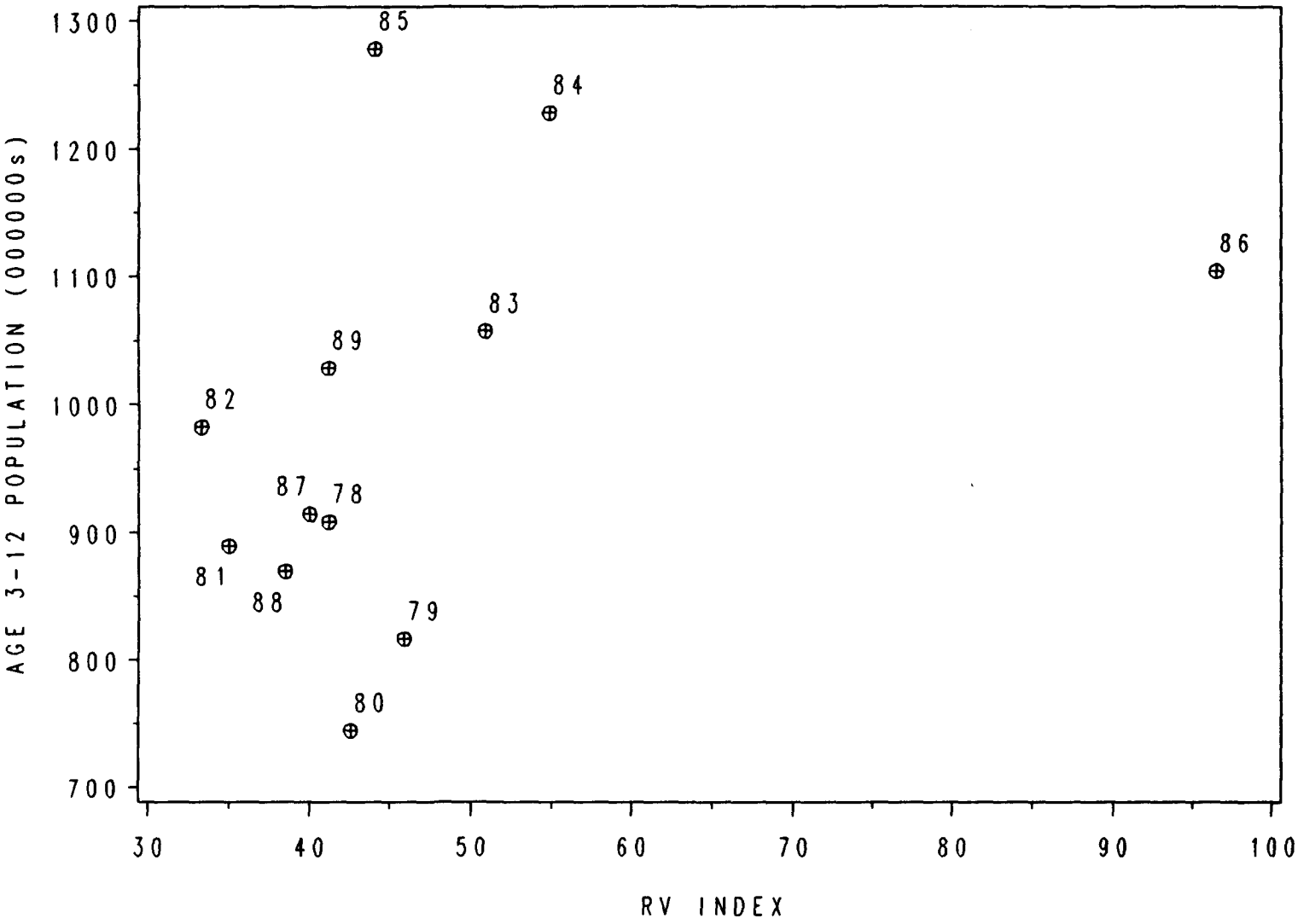

FIGURE 20. POPULATION NUMBERS VERSUS RV INDEX FOR AGES 3-12 FOR COD IN DIVISIONS 2J3KL.

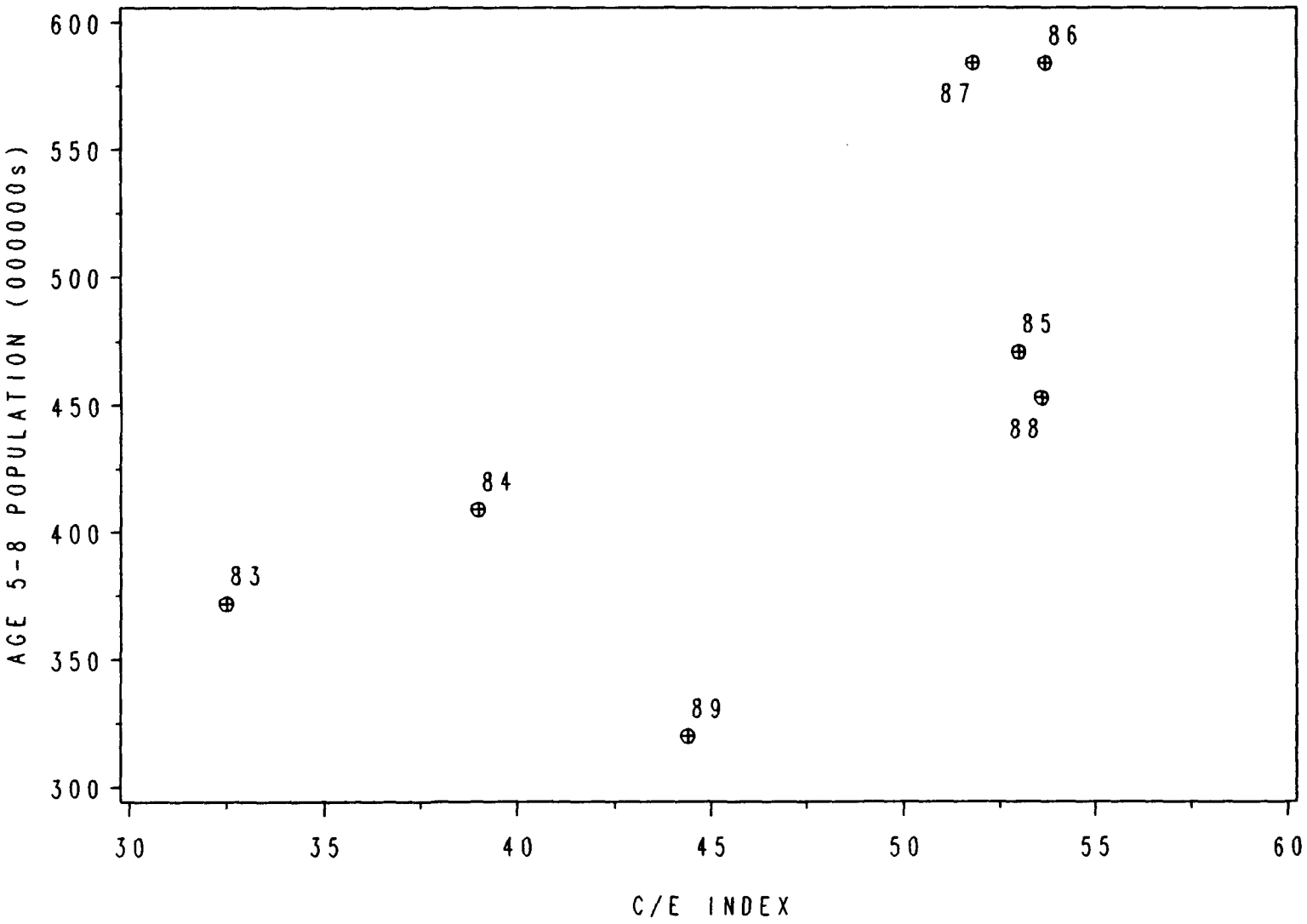

FIGURE 21. POPULATION NUMBERS VERSUS C/E INDEX FOR AGES 5-8 FOR COD IN DIVISIONS 2J3KL.

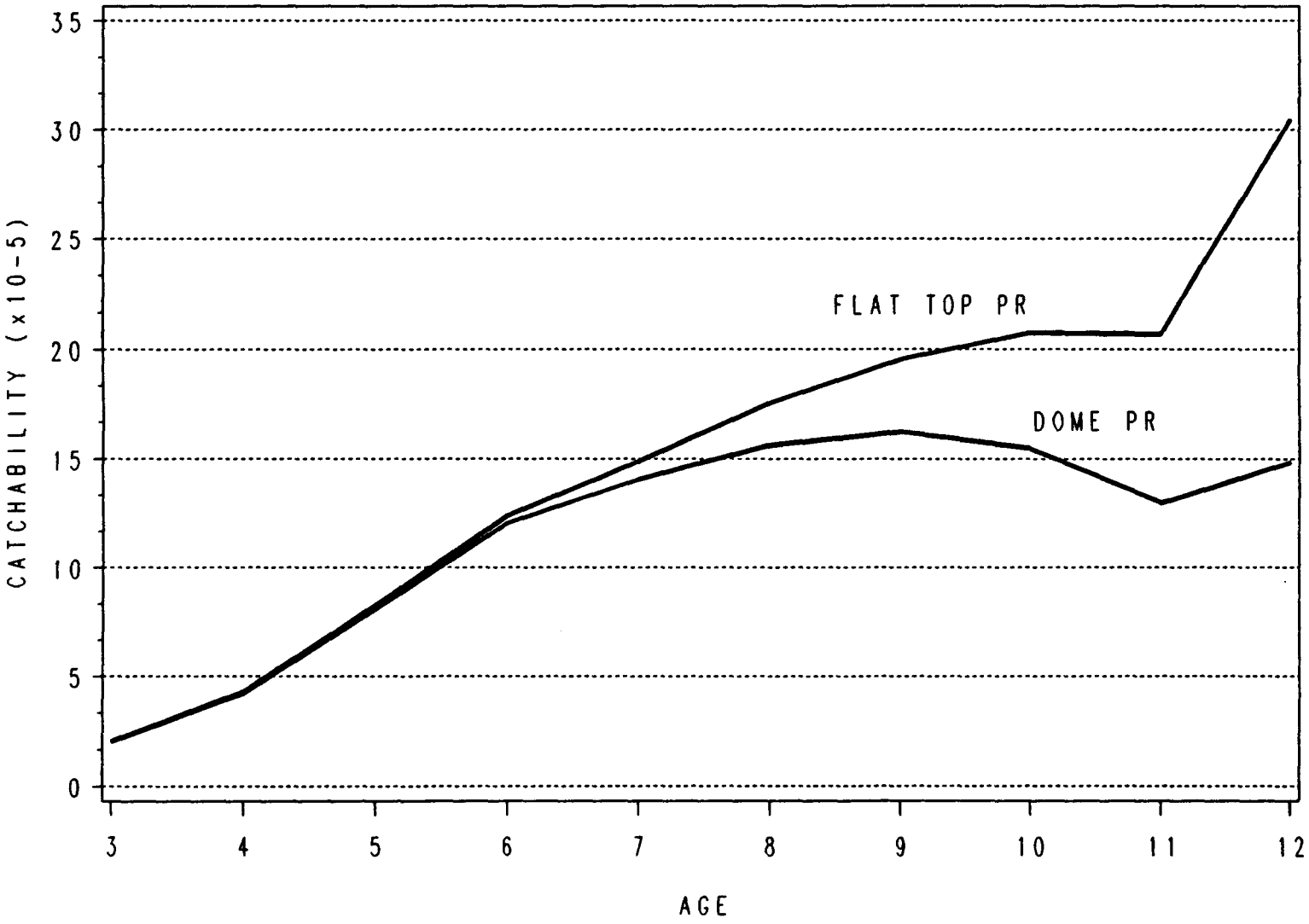

FIGURE 22. COMPARISON OF RV CATCHABILITIES DERIVED FROM ADAPT USING DOME SHAPE AND FLAT TOP PR FOR 2J3KL COD.

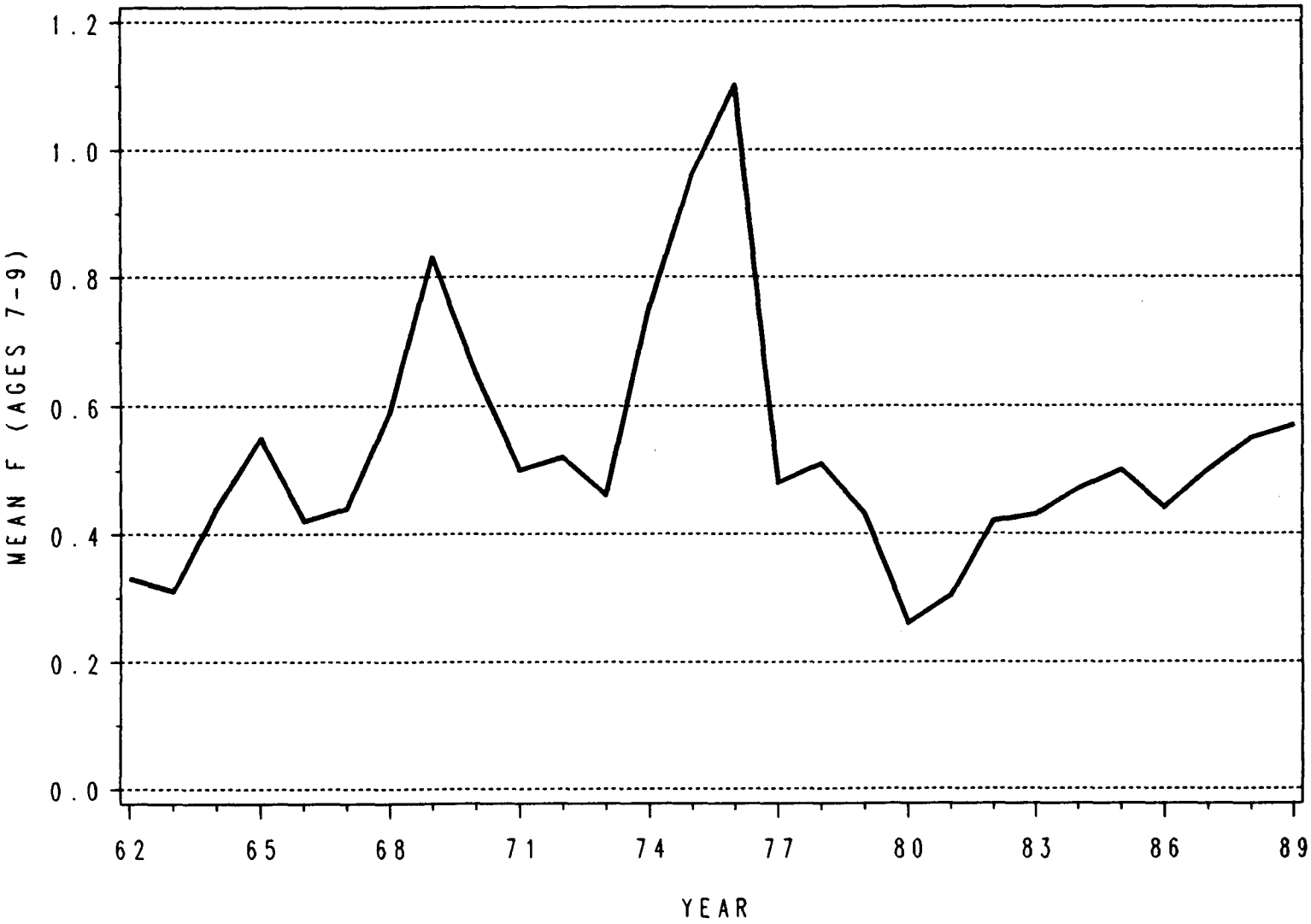

FIGURE 23. MEAN FISHING MORTALITY AT AGES 7-9 (WEIGHTED BY POPULATION NUMBERS FOR COD IN DIVISIONS 2J3KL.

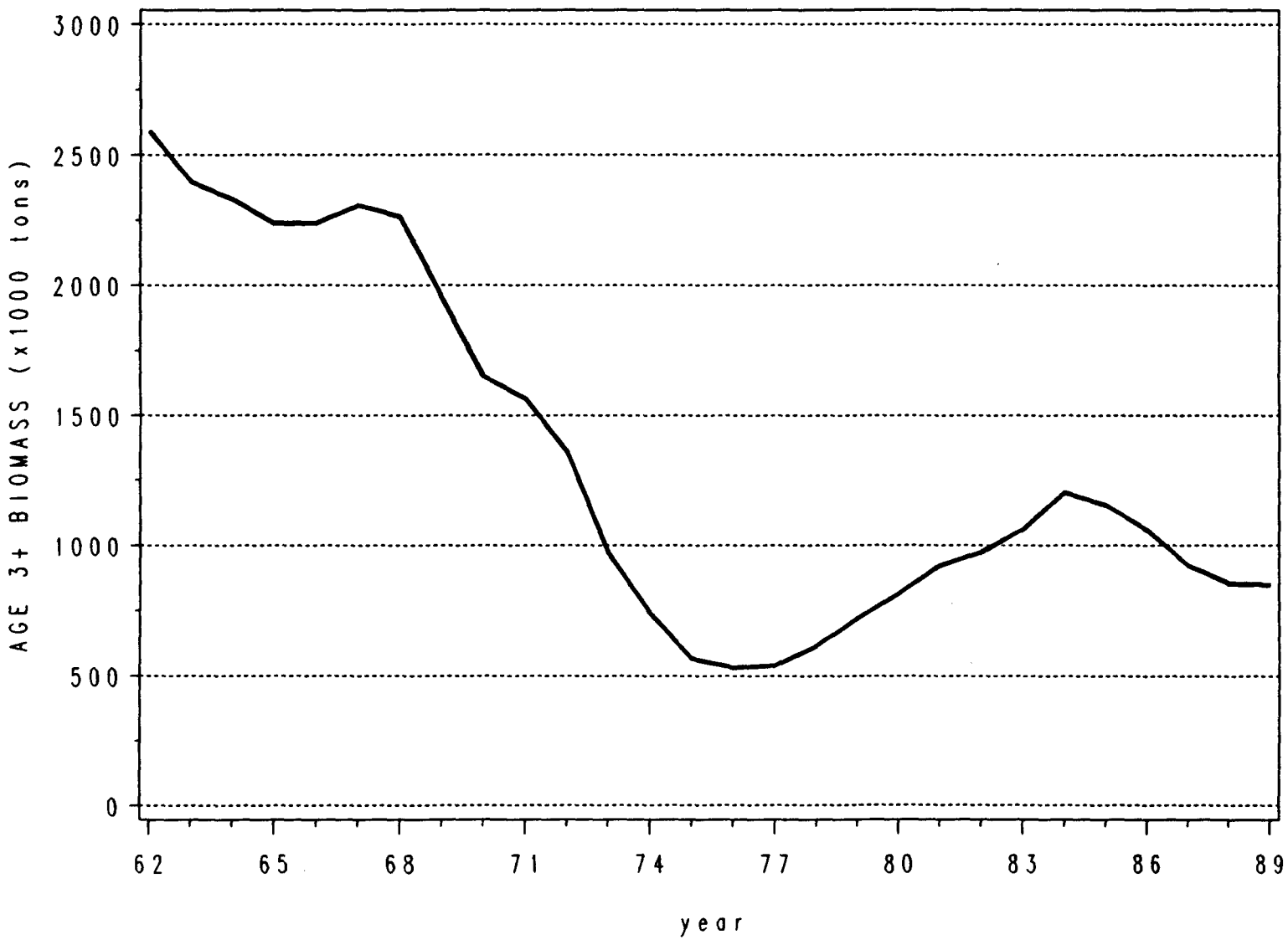

FIG. 24. POPULATION BIOMASS (JANUARY 1) FOR 2J3KL COD.

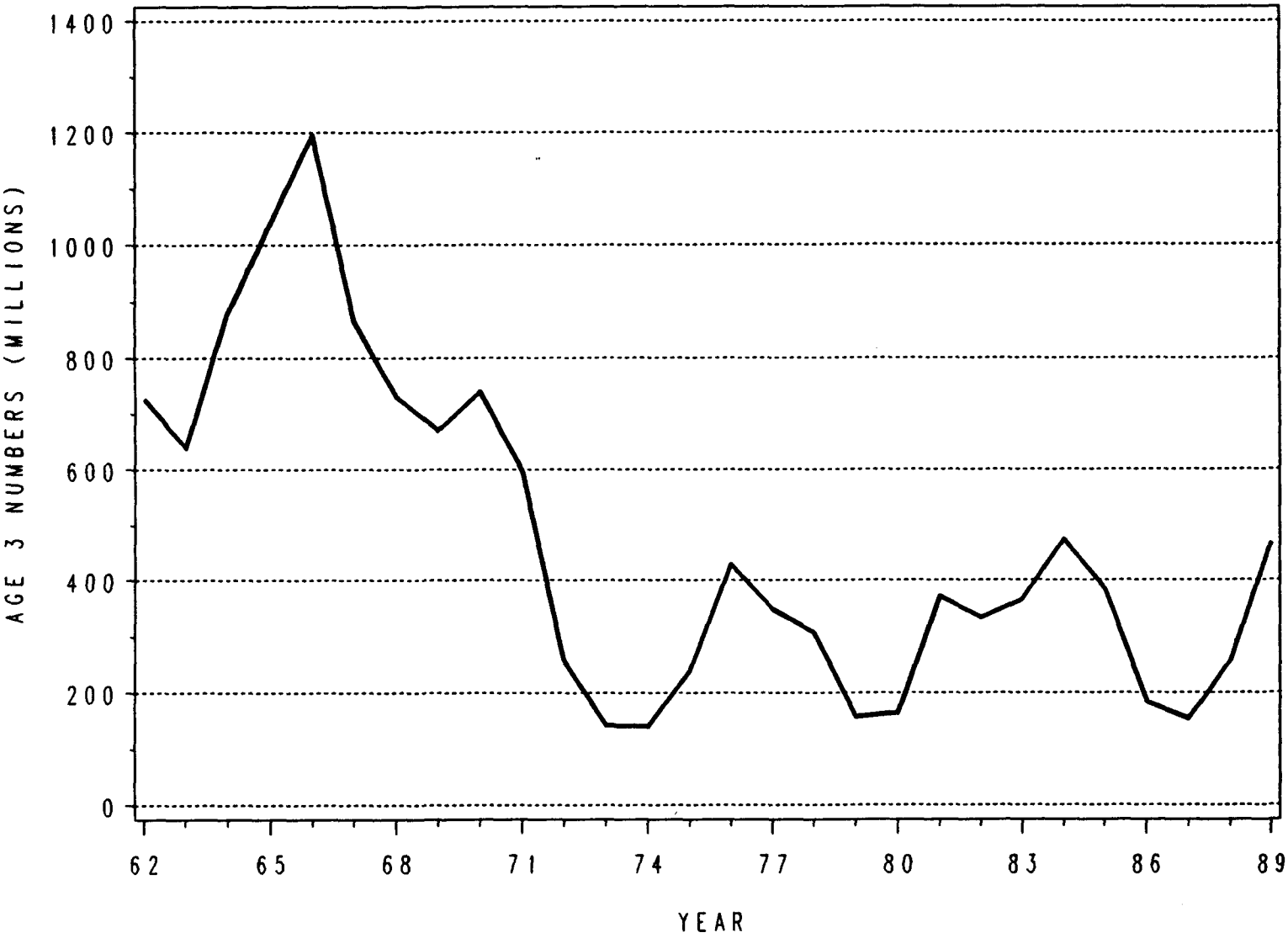

FIG. 25. JANUARY 1 POPULATION NUMBERS (AGE 3) FOR 2J3KL COD.

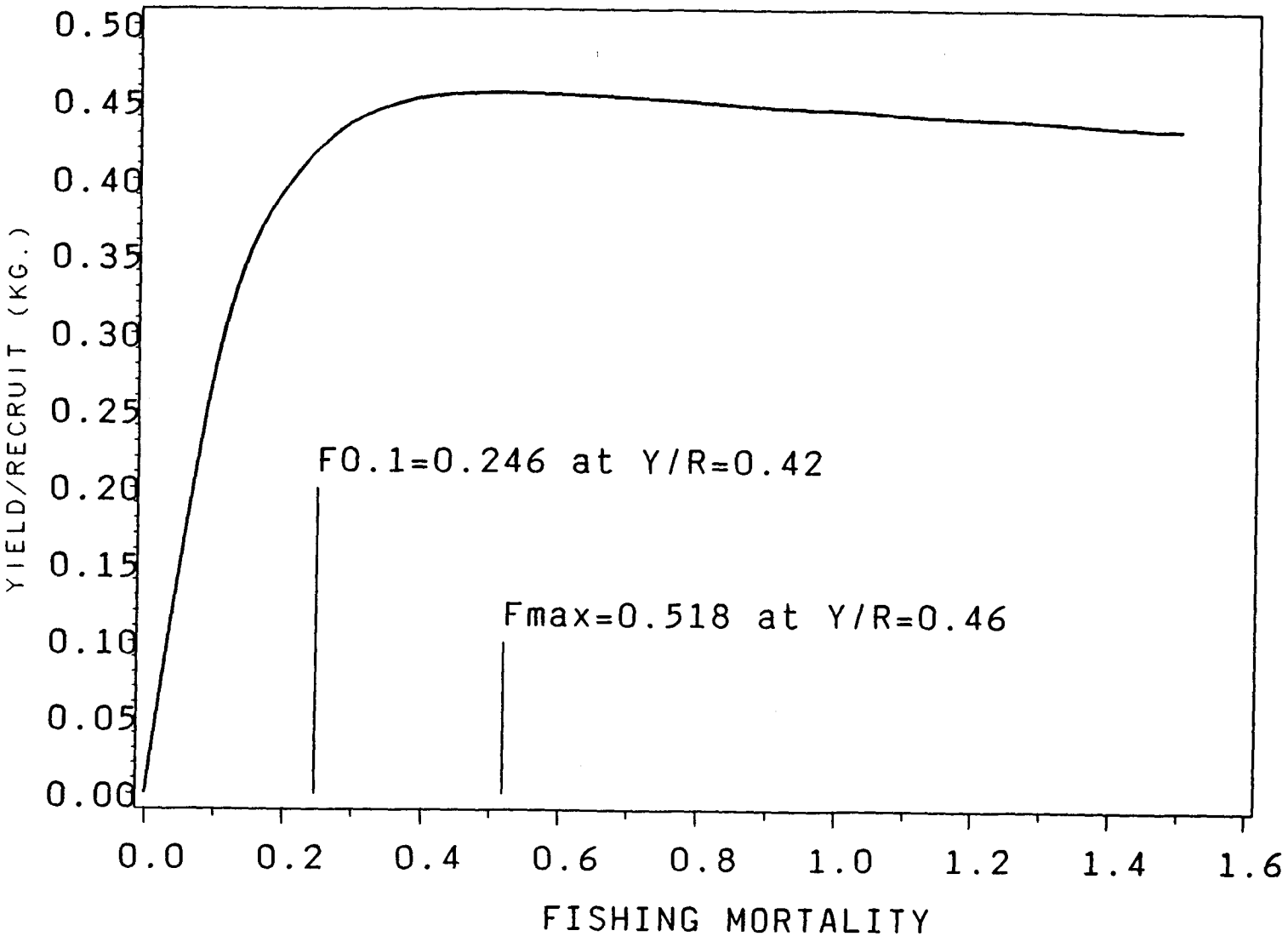

FIG 26. YIELD PER RECRUIT FOR A RANGE OF FISHING MORTALITIES FOR COD IN DIVISIONS 2J3KL.