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Assessment of the 4RS, 3Pn Cod Stock

by

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ABSTRACT

The 4RS, 3Pn cod stock landings reached a historic peak in 1983 (106 080 t) and have declined since. Preliminary figures for the 1985 fishery indicate a catch level of 86 895 t. A revision of catch and effort aggregation procedures within statistical offices in the regions have identified various sources of error and these were corrected. The catch rate series were standardized using the multiplicative model. These catch rates have stabilized since 1983 (1.091 t/hour in 1983 to 1.081 t/hour in 1986). Results from the groundfish survey indicate stable abundance since 1983.

A sequential population analysis was done and calibrated using the commercial catch rates values. Minimization of the sum of squares in residuals of last three year residuals in the regression between mean trawlable biomass and commercial catch rate was the basis for determining the value of terminal fishing mortality. Even though the current biomass level is high, it is now apparent that fishing mortality exerted on this stock is well above the target level ($F_{0.1}$) of 0.2; the 1985 fishing mortality is estimated to be at 0.4.

RESUME

Les débarquements pour le stock de morue des divisions 4RS, 3Pn de l'OPANO ont atteint un maximum historique en 1983 (106 080 t) et diminuent depuis (86 895 t pour 1985). Certaines sources d'erreurs relatives à la capture et l'effort de pêche ont été identifiées aux bureaux de la statistique du Ministère et celles-ci ont été corrigées. Les taux de captures standardisés indiquent une stabilité depuis 1983 (1.091 t/heure en 1983 et 1.081 t/heure en 1986). Les résultats provenant des missions d'évaluation indiquent une stabilité dans l'abondance depuis 1983.

Une analyse séquentielle de population a été faite et calibrée en utilisant les valeurs de taux de captures commerciaux. La valeur de mortalité par pêche pour 1985 a été déduite en minimisant la somme des carrés des résiduelles pour les trois dernières années entre les biomasses chalutables et les taux de captures standardisés. Même si la biomasse totale pour ce stock est élevée, il semble que la mortalité par pêche exercée sur ce stock dépasse le niveau cible ($F_{0.1}$) de 0.2; la mortalité par pêche en 1985 est estimée à 0.4.

INTRODUCTION

a) The Fishery

Since 1959, landings for this cod stock have ranged between 58,060 t in 1959 and 106,080 t in 1983. Before the extension of jurisdiction to 200 miles in 1977, the Canadian fleet accounted for 55% of the reported landings; this level now stands at 91%.

Since 1977, the 4RS, 3Pn cod stock has been exploited only by Canada except for a 15% allocation to the Saint-Pierre and Miquelon and the metropolitan France fleets. An offshore fishery takes place in the winter in southern 4R and subdivision 3Pn, and a summer fishery in divisions 4R and 4S relies mostly on fixed inshore gears and small (< 65') otter trawl vessels (Tables 1, 2 and 3).

b) Nominal catches

Recent landings and TAC's for the 4RS, 3Pn cod stock were as follows

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Nominal landings[1]	74	79	83	98	98	105	106	93[2]	87[2]	---
TAC's[1]	55	55	75	75	75	93.3	100	100	100	92.1

[1]in thousands of tons
[2]Provisional statistics

The 1985 nominal catches for this stock, broken down by division, gear and country are shown in Tables 4a to 4d. Data for the French fleet operating in the Gulf were obtained through the FLASH system. Landings made in Newfoundland, Quebec and Maritimes were obtained from the respective Statistics branches of the Department of Fisheries and Oceans.

The fleet allocation scheme and final reported landings (except for 1986) since 1980 are shown in Table 5. The reported catches shown in Table 5 might differ slightly from those in the preceding tables since they are based on the last weekly quota report of the year and values shown in Tables 1 to 4 are extracted from the NAFO Statistical Bulletins. The 1986 winter fishery in subdivision 3Pn and southern 4R was very successful: the French fleets from Saint-Pierre and Miquelon and metropolitan France (13 vessels) caught their allocation (13,500 t) in 128 days on the fishing grounds. Allocations for mobile gears sectors were usually reached, and a number of these (especially in the winter fishery) were closed at an earlier date in 1985. On the contrary catches by fixed gears continued a decline begun in 1984, and landings to September 10 in 1986 show a decrease over 40% from landings at the same date in 1984.

INPUT DATA

a) Commercial Fishery Data

Data on historical commercial catch and effort were obtained from various sources. From 1959 to 1983, foreign and domestic catch and effort data were obtained from the ICNAF and NAFO Statistical Bulletins. Data for the Quebec based vessels from 1975 to 1983 were obtained from the Ministère de l'agriculture des pêcheries et de l'alimentation du Québec (MAPAQ) (J.P. Lussia-Berdou, personal communication). Data were also available for the French fleets from the International Observer program (IOP) and they have proven especially valuable considering the paucity of data originating from other sources.

Data provided by the Gulf and Quebec regions for 1984 and 1985 were revised because of errors in keypunching and programming. These data are now correct and the algorithms used to compute catch and effort data from logbooks are now consistent throughout. However, changes in the statistical treatment of these data have occurred in the time series.

Currently, data are aggregated on a day by day basis (i.e. all catch and effort for one day combined). Data originating from the various D.F.O. regions were aggregated on a trip by trip basis until 1984 whereas data collected by the MAPAQ and IOP are left disaggregated on a set by set basis. Data used in this analysis are limited to data for which the main species sought was cod. Changes in the aggregation procedures will affect the determination of main species, as the proportion (by weights) of species in the catch is the basis for this assignment (for the MAPAQ data, this was determined from the indications of the fisherman in his logbook). The impact of these changes on the consistency of the catch rate series has not been fully assessed, but it is considered to be negligeable since cod is essentially the only groundfish species targetted by the fleets involved.

The catch rate data were standardized using the multiplicative model (Gavaris, 1980). Catch under 10 t and effort under 10 hours were deleted because of possible rounding errors. An exceptionally high catch rate was recorded in the French fleet in 1984, (22 t/h in February) and therefore all catch and effort data from the French fleet in 1984 were deleted from the analysis. A weighting factor (averaged on 5 levels of effort) based on the residuals of an unweighted regression was applied to the catch rate data.

Standardization of catch rate was conducted separately for the 1959 to 1974 and 1974 to 1986 time periods. This was done in order to eliminate any possible effect of the high catch rates of the Spanish and Portuguese fleets, only present in the first series, on the catch rate estimates calculated in the recent time period. The 1974 breaking point was chosen since it coincides with the first year of the catch-at-age matrix.

Results are presented in Tables 6 and 7 and in Figures 1a and 1b. Preliminary information of 1986 catch rates were available for the Quebec and French fleets but not for vessels reporting to the Gulf statistical branch. Catch rates were low in the mid-seventy's and increased rapidly between 1980 and 1981, at which level they have remained since.

b) Research Survey Data

Since 1978, stratified random groundfish surveys have been conducted in January on the GADUS ATLANTICA in the 4RST, 3Pn divisions. The stratification scheme is presented in Figure 2a. Complete coverage of the entire area has never been accomplished because of ice cover. The average number and average weight of cod caught per set for all strata are shown in Tables 8 and 9.

A standardized abundance index was first presented in Gascon and Fréchet (1985) which relied on all available length and age information adjusted to the population estimates from strata or combination of strata that had a continuous series. (Figure 2b). This was judged inappropriate because of possible spatial segregation of age groups. The estimated numbers at age shown in Table 10 are based on length and age information for the selected strata only. A comparison of both methods indicated that differences were minimal.

Distributions of cod catch were very variable from year to year. To illustrate this, Figures 3a to 3d show the set by set catches of cod on an identical scale. These interannual variations may be related to degree of progress of their annual winter migration. In 1986, the distribution of cod seemed restricted to few small areas but the catch rates in these areas were the highest in the eight year series (Tables 8 and 9).

The presence of unusually large sets in subdivision 3Pn in the 1986 January survey could indicate that the migration was more advanced than in previous years. Length distribution information from the research survey of Saint Pierre and Miquelon in the 3Ps subdivision in 1986 would indicate a possible influx of the 4RS, 3Pn cod stock on Burgeo Bank (Bishop and Baird, 1986).

A recruitment index based on survey mean number per tow was calculated and is presented in Table 11. Ages 3 and 4 were chosen since they are the youngest age groups used in the cohort. Values are normalized to the 1975 to 1977 and 1980 to 1982 means since survey estimates are available for fish at ages 3 and 4. The 1977 and 1980 year-class strengths do not show consistently. For the 1977 year-class at age 3, the normalized recruitment index is the highest of the eight values but the second lowest at age 4. This year-class was strong in subsequent surveys and in commercial catch data. It is perhaps the low biomass estimate for the 1981 survey that is responsible for this discrepency.

Similarly estimates at age 3 for the 1980 year-class is smaller than average, but this year-class has appeared very strong ever since in the surveys and commercial catch. Because of these discrepencies this index was not used.

Minimum exploitable biomass (Figure 4) estimated from the groundfish survey data since 1978 appears very variable but estimates since 1983 are higher than those of the 1978 to 1981 time period. These point estimates are generally accompanied by high confidence intervals caused by the presence of large catches which do not follow the assumed normality of distribution.

ESTIMATION OF PARAMETERS

Length frequencies and otoliths from the 1985 and 1986 (January to June) commercial landings were collected by the commercial sampling sections of the Québec and Gulf regions for the domestic fleet and by the International Observer Program in Gaspé and Halifax for the foreign fleet (Tables 12 and 13).

The catch at age for 1985 and 1986 was calculated following the procedures described in Fréchet and Gascon (1986). The grouping of age length keys and length information is done in order to estimate removals at age for the fixed and mobile gears. The selectivity of these gears can thus be accounted for when relating the mobile gear catch rate to biomass estimates.

Results are presented in Tables 14 and 15 for the quarterly age composition for the fixed and mobile fleets, and in Tables 16a, 16b and 17 for the yearly catch composition of fixed, mobile and total catch respectively. The aggregation procedure used to obtain the 1985 and 1986 catch at age is shown in Appendix 1 and 2.

Tables of catch at age, mean weight at age, mean length at age and coefficients of variation of the catch at age estimates are shown in Tables 18 for the total catch, 19 for the fixed gear, and 20 for the mobile gear. Since some commercial sampling data were available for the first six months of the 1986 fishery, comparable data on catch at age, average weight at age, and length at age are shown in Table 21a to 21c. The 1980 year-class has been the dominant year-class (by number) both in 1985 and 1986, even though it was still only partially recruited (32% and 65% respectively). It thus appears very large and it is currently sustaining the fishery.

a) Sequential Population Analysis

Preliminary cohort analyses (Pope, 1972) were performed using the catch at age shown in Table 18a using the "SPA" workspace (version 5.0). Midyear biomasses were calculated by using the average weights at age in Table 18b.

Natural mortality is assumed to be 0.2. Full recruitment of the 4RS 3Pn cod stock to the fishery was determined from the F ratio matrix (Table 22) to be at age 7. Partial recruitment for 1985 for ages 4 to 6 (Table 24) was estimated as the average for the years 1977 to 1984 of the ratio of fishing mortality at age to the weighted fishing mortality of ages 7 to 10. This method of historical averaging of the F ratio matrix to calculate partial recruitment implies that partial recruitments are homogeneous from 1977 to 1984 and have not changed since. Examination of the F-ratio matrix in the recent time period would support this hypothesis.

The partial recruitment (Table 25) to the mobile gears was obtained as above from the partial F matrix of the mobile gears. This matrix was obtained by multiplying the F matrix of the whole stock by the age/year specific proportions of catch by mobile gear to the total catch. This partial recruitment vector is dome shaped with a fully recruited age of 7 decreasing to 58 percent at age 15. This allows the calculation of trawlable biomasses which are considered more closely related to the catch rates experienced by the mobile gears.

A separate illustrative analysis was computed by incorporating the information of the catch at age and weights at age for the January to June period of 1986 (Tables 21a&b). A partial recruitment for the first half of the year was calculated by using end of year population numbers for 1985 and projecting using the known catch at age composition for 1986. The partial recruitment for the first half of 1986 was obtained as above from the fishing mortalities projected in 1986, and this partial recruitment was used in the cohort analysis with the catch-at-age data for the January to June period (Tables 31 to 33). It should be noted that the estimate of F for 1986 of 0.25 represents only the January to June fishing mortality.

ASSESSMENT RESULTS

a) Sequential Population Analysis

Commercial catch rate values and research survey abundance indices were used to determine fishing mortality in 1985. Preliminary cohort runs were made using terminal fishing mortalities ranging from 0.2 to 0.6 by increments of 0.1. In order to take advantage of the 1986 groundfish survey results, calibration of SPA was preformed by using end of year population

estimates for ages 6^+ and regressing them with ages 7^+ from the January surveys. Results of least squares regressions of mean trawlable biomass versus CPUE and 6^+ end of year population numbers from cohort analysis (Table 28) versus 7^+ survey numbers are presented in Tables 26 and 27.

Since catch rates of cod in Divisions 4RS, 3Pn have shown a rapid increase in the early 1980's, the distribution of points in the relationship between mean trawlable biomass and CPUE is made of two clusters: observations from the mid 1970's when biomass and CPUE were low (comprising the converged part of the SPA) and a second cluster comprising the recent observations with high CPUE's and biomasses. Correlations based on this relationship have little discriminatory power for various values of terminal fishing mortality since they are greatly influenced by the observations in the non-converged part of the matrix.

Commercial catch rates have been stable (with a high value in 1982) since 1981. Similarly, there were no indications of major change in level of effort exerted on the stock since 1981. The fully recruited fishing mortality (7+) (Table 30) ranged from 0.475 (in 1982) to 0.357 (in 1983) between 1981 and 1984 with $F_t = 0.40$. This stability is therefore used as a basis for calibration of the cohort analysis and was estimated by minimizing the sum of squares of residuals of mean trawlable biomass (Tables 25 and 29) and population estimates resulting from the cohort analysis in the last three years. These values are minimized at a terminal fishing mortality of 0.4 for the relationship between mean trawlable biomass and CPUE, and with less discrimination at a value of $F_t = 0.5$ for the relationship between 6+ end of year population estimate and 7+ research vessel survey population estimates (Tables 26 and 27). Plots of these regressions at a F_t of 0.4 are shown in Figures 7 and 8.

DEMOGRAPHIC CONSIDERATIONS

A generalized decrease of weight at age has been noticed for many cod stocks in the Atlantic coast (S.A. 1 cod (Hansen, 1986); 2J 3K cod (Wells, 1986) 4TVn and 4VsW (Anon. 1986). For the 4RS, 3Pn cod stock, the decrease of average length at age is evident in the commercial fishery, especially since 1984 for ages 4 to 9 (Figure 5). Year-classes from 1967 to 1973 appear to have a asymptotic length over 90 cm whereas year-classes since 1973 would reach a maximum length around 65 cm.

Recent survey information on length at age (Figure 6) indicates the same trend (1982 lacking) but with less importance. This would suggest that the decrease of length at age in the commercial fishery could be explained by changes in the fishing pattern. The other sources of the decline in mean length at age could be due to lower water temperature than normal, abundance of prey, density dependant growth, variation in migration pattern, or a combination of these.

PROGNOSES

a) Catch projections

The input parameters used for the projections are given in the Table below:

Age	1985 Population Numbers Ft = 0.4	1985 Catch Numbers	1983-85 Average Weights	Partial Recruitment
4	102 273	2 437	0.839	0.0666
5	136 658	15 227	1.100	0.3272
6	63 119	13 225	1.426	0.6540
7	34 467	10 367	1.769	1.0000
8	32 179	9 679	2.059	1.0000
9	10 465	3 148	2.320	1.0000
10	7 669	2 307	2.845	1.0000
11	2 805	844	3.542	1.0000
12	681	205	3.932	1.0000
13	285	86	5.269	1.0000
14	49	15	6.916	1.0000
15	52	16	7.795	1.0000

Catch projections were done using population numbers in 1985 from cohort analysis at Ft = 0.4. Recruitment at age 4 for 1986 to 1987 was set at the geometric mean of age 4 population numbers between 1974 and 1985 (111 x 10^6 fish). The average of 1983 to 1985 weights at age were used for the projections of biomass.

If the 1986 TAC of 92 100 t is caught, the $F_{0.1}$ = 0.2 catch in 1987 would be 56 000 t resulting in a fully recruiting fish mortality of 0.37 for 1986 (Table 34). If the $F_{0.1}$ catch of 53 000 t is taken in 1986, the $F_{0.1}$ catch in 1987 would be 62 000 t.

A strong 1980 year-class is the modal age in the 1985 and 1986 commercial catch and in the last three years of the research survey. Year-classes since 1980 appear weak (Table 11).

REFERENCES

Anon. 1986. Advice on the Management of Groundfish Stocks in 1987, CAFSAC Advisory Document 86/17

Bishop, C.A. and J.W. Baird. 1986. An Assessment of the Cod Stock in NAFO Subdivisions 3Ps. NAFO SCR Doc. 86/36: 1-31

Fréchet, A. and D. Gascon. 1986. Une nouvelle matrice de capture à l'âge pour le stock de morue des divisions 4R, 4S et 3Pn. CAFSAC Res. Doc. 86/ 104 : 1-33.

Gascon, D. and A. Fréchet. 1985. An assessment of the cod stock in NAFO Divisions 4R 4S and in subdivision 3Pn. CAFSAC Res. Doc. 85/107: 1-48.

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

Hansen, H.H., 1986. Changes in Size-at-age of Cod off West Greenland, 1979-84. NAFO Ser. Doc. 86/83

Pope, J.G. 1972. An investigation of the accuracy of virtual population analysis using COHORT analysis. ICNAF Res. Bull. 9: 65-74.

Wells, R. 1986. Declines in the average length at age of cod in Divisions 2J and 3K during 1977-85. NAFO Ser. Doc. 86/83.

Table 1: Historical monthly catch statistics for the 4RS 3Pn cod stock for the period 1961-1985. The pre-1961 data for 3Pn are too incomplete to allow monthly estimate for the stock as a whole.

MONTHS / YEARS	J	F	M	A	M	J	J	A	S	O	N	D	NK	TOTAL
1961*	364	12,375	44,543	8,745	1,473	5,761	14,341	6,752	2,490	1,408	1,305	453		100,010
1962*	316	12,903	24,720	4,656	1,565	6,951	16,717	11,738	3,513	1,535	1,016	291		85,921
1963*	649	7,661	13,336	2,478	1,623	17,419	14,870	10,698	3,104	1,916	692	300		74,746
1964	1,104	24,423	15,761	6,058	3,106	10,350	12,527	5,853	2,153	1,385	863	651		84,234
1965	792	12,506	21,171	3,698	2,216	5,267	10,422	5,945	3,636	1,359	927	990		68,929
1966	1,965	22,817	8,929	2,516	1,638	8,371	7,482	4,744	2,490	1,146	1,779	1,208		65,085
1967	7,872	7,028	14,792	8,447	2,017	7,525	12,664	5,232	7,154	3,315	1,356	1,909	1	79,312
1968	725	7,980	22,799	9,061	3,087	10,717	17,216	9,400	4,914	1,781	1,172	819		89,671
1969	875	4,654	9,675	4,220	5,192	10,958	12,103	8,639	7,866	3,557	2,035	1,366		71,140
1970	1,637	25,487	18,115	27,995	4,803	6,020	8,974	3,897	2,130	3,170	1,936	1,301		105,465
1971	845	44,590	7,580	5,250	2,338	5,839	8,420	3,039	2,374	1,616	1,004	915		83,810
1972	1,494	14,961	5,337	7,400	7,334	4,594	6,818	3,296	2,365	1,406	994	212	2,026	58,237
1973	16,472	10,556	7,586	4,826	3,235	5,860	5,125	4,145	2,365	1,459	1,016	567	2,593	65,805
1974	12,995	10,753	5,959	5,665	6,231	5,021	6,235	5,396	2,214	1,331	1,009	479	3,148	66,436
1975	8,232	19,486	2,702	2,616	5,316	5,122	5,042	4,488	2,767	1,267	819	704	1,672	60,233
1976	15,637	15,204	3,610	3,437	7,071	6,930	6,978	4,310	3,348	2,286	1,537	578	6,055	76,981
1977	11,143	8,603	3,790	11,312	10,057	7,368	8,133	5,780	3,361	1,751	1,814	454		73,566
1978	20,754	6,307	5,161	3,156	6,717	9,796	13,255	7,000	2,836	1,979	1,309	236		78,506
1979	15,543	4,273	6,475	6,647	8,517	12,890	12,085	8,660	2,971	2,449	1,816	451		82,777
1980	5,280	8,965	9,925	8,087	7,147	14,096	23,158	10,719	5,687	2,773	1,311	431		97,579
1981	9,156	15,368	3,170	3,763	12,835	17,257	16,344	10,343	5,676	2,550	1,172	277		97,911
1982	2,289	11,671	10,122	5,544	12,723	16,826	22,492	9,136	8,412	4,463	1,229	32		104,939
1983	4,152	10,213	11,335	6,251	21,049	18,341	16,228	8,173	5,698	3,956	530	154		106,080
1984+	5,435	10,428	9,008	3,605	12,797	12,883	17,112	10,898	4,504	4,298	802	1,048	4	92,822
1985+	1,053	16,945	7,914	4,883	6,446	12,554	13,405	10,832	7,150	2,848	954	1,911		86,895

* Incomplete data. Some statistics reported for div. 3P only.

+ Preliminary Statistics.

Table 2: Historical catch statistics for the 4RS 3Pn cod stock by division for the major participants involved in the fishery during the period 1970-1985.

3Pn

COUNTRIES / YEARS	CAN-N	CAN-M	CAN-Q	FR-M	FR-SPM	SPAIN	PORT.	OTHERS	TOTAL
1970	4,930			90	1	184			5,205
1971	6,661				26	167	990		7,844
1972	6,521			2,687	3	269	877		10,357
1973	5,885			1,008		515	3,841	51	11,300
1974	2,941	8		3,913	557	1,507	4,149	938	14,013
1975	2,758	18		2,612	295		538	12	6,233
1976	6,041	56		1,452	280			636	8,465
1977	7,109	247		167	42				7,565
1978	6,271	34		497					6,802
1979	10,208	151		557					10,916
1980	8,150	174		271	204				8,799
1981	11,191	60	3	2,869	1,006				15,130
1982	14,703	152	-	341	289	-	-	-	15,485
1983	11,959	104	-	4,044		-	-	-	16,107
1984+	4,842	178	-			-	-	-	(5,020)
1985+	22,194	555		533					(23,282)

4R

1970	23,337	11,337		30,303	120	8,053	17,993	3	91,146
1971	17,095	2,237		24,363	68	5,451	17,144	4	66,362
1972	11,664	3,348		10,608	3	1,357	8,144	2,459	37,583
1973	13,222	1,086		16,525	109	502	11,232	418	43,094
1974	16,348	5,538		11,679	395		5,302	184	39,446
1975	14,897	2,727		13,206	625		9,879	235	41,569
1976	20,004	6,648		15,392	918		9,034	4,034	56,030
1977	9,907	25,568		15,815	2,097				53,387
1978	35,376	6,290		13,252	2,022				56,940
1979	37,096	4,423	1,038	11,040	2,171				55,768
1980	52,358	2,822	582	8,275	646				64,683
1981	49,479	2,291	775	7,466	1,167				61,178
1982	51,248	2,024	882	9,875	1,458	-	-	-	65,487
1983	55,842	3,271	2	6,630		-	-	-	65,745
1984+	51,522	589	95			-	-	-	(52,206)
1985+	34,754	1,615	5	7,589					(43,963)

+ Preliminary Statistics. Without the French statistics.

Table 2: continued

4S

COUNTRIES / YEARS	CAN-N	CAN-M	CAN-Q	FR-M	FR-SPM	SPAIN	PORT.	OTHERS	TOTAL
1970	443	8,175				198	298		9,114
1971	182	9,161			1	259		1	9,604
1972	189	9,130		27		338	613		10,297
1973	434	7,942					911	2,124	11,411
1974	366	8,976		86	4		1,474	2,077	12,983
1975	381	7,808		401	16		2,400	1,425	12,431
1976	726	9,231		22	23		1,099	1,385	12,486
1977	171	12,426		10	7				12,614
1978	229	14,535							14,764
1979	47	851	15,194		1				16,093
1980	1,437	1,417	21,243						24,097
1981	336	229	21,038						21,603
1982	141	1,386	22,390	50	-	-	-	-	23,967
1983	505	1,328	22,385	19	-	-	-	-	24,237
1984+	227	436	21,707	-	-	-	-	-	22,370
1985+	68	774	18,808						19,650

TOTAL

1970	28,710	19,512		30,393	121	8,435	18,291	3	105,465
1971	23,938	11,398		24,363	95	5,877	18,134	5	83,810
1972	18,374	12,478		13,322	6	1,964	9,634	2,459	58,237
1973	19,541	9,028		17,533	109	1,017	15,984	2,593	65,805
1974	19,655	14,516		15,678	956	1,507	10,925	3,199	66,436
1975	18,036	10,553		16,219	936		12,817	1,672	60,233
1976	26,771	15,935		16,866	1,221		10,133	6,055	76,981
1977	17,187	38,241		15,992	2,146				73,566
1978	41,876	20,859		13,749	2,022				78,506
1979	47,351	5,425	16,232	11,597	2,172				82,777
1980	61,945	4,413	21,825	8,546	850				97,579
1981	61,006	2,580	21,816	10,335	2,173				97,911
1982	66,092	3,562	23,272	10,266	1,747	-	-	-	104,939
1983	68,306	4,703	22,387	10,684		-	-	-	106,080
1984+	56,591	1,203	21,802	13,226		-	-	-	92,822
1985+	57,016	2,944	18,813	8,122					86,895

+ Preliminary Statistics.

Table 3: Historical catch statistics for the 4RS 3Pn cod stock broken down into gear categories for the period 1970-1985. (DV, dory vessels; T, traps, GN, gillnets; HL, hand lines; LL long lines, IN misc, inshore, miscellaneous; DS, Danish seines; PT, pair trawls; ST, shrimp trawls; OT, otter trawls.)

3Pn

GEARS / YEARS	DV	T	GN	HL	LL	IN. MISC.	DS	PT	ST	OT	TOTAL
1970		46	643	675	3,378		5	62		396	5,205
1971			364	217	5,574	134		52		1,503	7,844
1972	17	10	181	98	5,593	20	545	176		3,717	10,357
1973	1,405		175	110	5,431	97	174	356		3,552	11,300
1974	128		297	52	2,460	915	58	1,507		8,596	14,013
1975			61	152	2,418	12	6			3,584	6,233
1976		9	163	225	4,467	636	163			2,802	8,465
1977		37	73	163	5,679		119			1,494	7,565
1978		7	34	103	5,323		17			1,318	6,802
1979		25	40	116	7,338		181			3,216	10,916
1980			13	83	6,443		18			2,242	8,799
1981		4	3	72	7,560		28			7,463	15,130
1982		1	8	87	7,670		12			7,707	15,485
1983		1	46	97	6,789		20	8		9,146	16,107
1984+		46	212	123	1,934		159		11	(2,778)	(5,263)
1985+		1	37	4	5,804		-	-	-	17,436	23,282

4R

1970	184	2,340	4,319	1,673	5,489	1,962	239	225	5	74,710	91,146
1971		3,786	3,718	1,295	3,076	436	247		224	53,580	66,362
1972		1,606	2,835	1,107	1,115	2,851	16	24	168	27,861	37,583
1973		2,007	3,154	1,007	2,564	3,050	120	84	545	30,563	43,094
1974		1,789	5,182	1,714	1,358	666	223		28,514		39,446
1975		2,032	6,462	1,413	978	490	221		29,973		41,569
1976		1,572	7,671	1,445	527	4,238	155		40,422		56,030
1977		2,414	7,866	1,591	1,429	147	147		39,793		53,387
1978		4,103	13,235	1,749	2,462		233		35,158		56,940
1979		3,071	11,479	3,138	5,031		311		32,738		55,768
1980		8,354	11,607	2,380	7,768		467		34,107		64,683
1981		5,408	5,796	2,096	8,936	327	384		38,231		61,178
1982		7,473	9,465	2,126	7,208		337		38,878		65,487
1983		3,415	11,849	5,047	6,614		473		2,906	35,441	65,745
1984+		3,167	6,508	3,025	8,077		233		1,038	(30,158)	(52,206)
1985+		3,138	4,393	1,668	6,802		315		552	27,088	43,956

+ Preliminary Statistics. Without the French statistics.

Table 3: continued

4S

GEARS / YEARS	DV	T	GN	HL	LL	IN. MISC.	DS	PT	ST	OT	TOTAL
1970	21	1,789	846	771	251				215	5,221	9,114
1971		2,410	963	503	565			1	309	4,853	9,604
1972		2,040	1,418	511	511				242	5,575	10,297
1973		885	1,774	470	402	2,248			477	5,155	11,411
1974		200	2,326	402	976	2,064			7,009		12,977
1975		579	2,072	2,337	136	1,425			5,882		12,431
1976		992	2,900	353	46	1,385			6,810		12,486
1977		861	4,089	303	36		2		7,323		12,614
1978		2,178	3,626	194	28		2		8,736		14,764
1979		1,043	6,578	467	148				7,857		16,093
1980			1,376		1,796	11,658			9,267		24,097
1981		3	364		2,678	12,554		51	5,953		21,603
1982		13	27	-	3,688	11,629	3	340	8,267		23,967
1983			622	2	3,890	11,245	174		2,353	5,942	24,228
1984+		667	8,861	924	4,325				2,159	5,411	22,347
1985+		1,211	6,147	872	4,284				2,160	4,972	19,650

TOTAL

1970	205	4,175	5,808	3,119	9,118	1,962	244	287	220	80,327	105,465
1971		6,196	5,045	2,015	9,215	570	247	53	533	59,936	83,810
1972	17	3,656	4,434	1,716	7,219	2,871	561	200	410	37,153	58,237
1973	1,405	2,892	5,103	1,587	8,397	5,395	294	440	1,022	39,270	65,805
1974	128	1,989	7,805	2,168	4,794	3,645	281	1,507	44,119		66,436
1975		2,611	8,595	3,902	3,532	1,927	227		39,439		60,233
1976		2,573	10,734	2,023	5,040	6,259	318		50,034		76,981
1977		3,312	12,028	2,057	7,144	147	268		48,610		73,566
1978		6,288	16,895	2,046	7,813		252		45,212		78,506
1979		4,139	18,097	3,721	12,517		492		43,811		82,777
1980		8,354	12,996	2,463	16,007	11,658	485		45,616		97,579
1981		5,415	6,163	2,168	19,174	12,881	463		51,647		97,911
1982		7,487	9,500	2,213	18,566	11,629	352	340	54,852		104,939
1983		3,416	12,517	5,146	17,293	11,245	667	8	5,259	50,529	106,080
1984+		3,880	15,581	4,072	14,336		392		3,208	*51,612	92,822
1985+		4,350	10,577	2,544	16,890		315		2,712	49,496	86,884

+ Preliminary Statistics.

* Includes catches made by France.

Table 4a. Preliminary catch statistics (t) for cod in NAFO Division 3Pn in 1985.

CANADA-NEWFOUNDLAND

Gear type	J	F	M	A	M	J	J	A	S	O	N	D	Total
Traps							1						1
Fixed gillnets					7	29	1						37
Handlines						2	1		1				4
Lines trawls	223	695	2247	885	635	271	152	93	168	132	159	144	5804
Otter trawls	118	9761	4226	1838	97	3	35	166	89	3	2	10	16348
Total	341	10456	6473	2723	739	305	190	259	258	135	161	154	22194

CANADA-MARITIME

Gear type	J	F	M	A	M	J	J	A	S	O	N	D	Total
Otter trawls	2		124	35	117		4	165				108	555
Total	2		124	35	117		4	165				108	555

FRANCE (M + SPM)

Gear type	J	F	M	A	M	J	J	A	S	O	N	D	Total
Otter trawls	47	133	173	180									533
Total	47	133	173	180									533

DIVISION TOTAL	390	10589	6770	2938	856	305	194	424	258	135	161	262	23282

Table 4b. Preliminary catch statistics (t) for cod in NAFO Division 4R in 1985.

CANADA-NEWFOUNDLAND

Gear type	J	F	M	A	M	J	J	A	S	O	N	D	Total
Traps					25	1149	1639	320	1	3	1		3138
Fixed gillnets	1		5		108	1024	2228	606	145	79	98	91	4385
Handlines	4	2			71	108	257	754	318	137	15		1666
Lines trawls	34	218	4	10	771	1074	1079	1731	1207	415	149	110	6802
Danish seine					43	115	34	32	31	20	22		297
Otter trawls	112	1203	346	308	1051	4074	4076	3136	2158	566	173	1256	18459
Others									1		6		7
Total	151	1423	355	318	2069	7544	9313	6579	3861	1220	464	1457	34754

CANADA-MARITIME

Gear type	J	F	M	A	M	J	J	A	S	O	N	D	Total
Fixed gillnets									6				6
Handlines					2				2				4
Danish seine								5	13				18
Otter trawls	2				411	908	16	14	95	42	10	89	1587
Total	2				413	908	16	19	116	42	10	89	1615

CANADA-QUEBEC

Gear type	J	F	M	A	M	J	J	A	S	O	N	D	Total
Otter trawls					5								5
Total					5								5

FRANCE

Gear type	J	F	M	A	M	J	J	A	S	O	N	D	Total
Otter trawls	510	4933	788	1358									7589
Total	510	4933	788	1358									7589

DIVISION TOTAL	663	6356	1143	1676	2487	8452	9329	6598	3977	1262	474	1546	43963

Table 4c. Preliminary catch statistics (t) for cod in NAFO Division 4S in 1985.

CANADA-NEWFOUNDLAND

Gear type	J	F	M	A	M	J	J	A	S	O	N	D	Total
Traps						3							3
Fixed gillnets						56							56
Otter trawls				4			1	1	2	1			9
Total				4		59	1	1	2	1			68

CANADA-MARITIME

Gear type	J	F	M	A	M	J	J	A	S	O	N	D	Total
Otter trawls					178	68	54	191	125	55	18	85	774
Total					178	68	54	191	125	55	18	85	774

CANADA-QUEBEC

Gear type	J	F	M	A	M	J	J	A	S	O	N	D	Total
Traps					5	36	750	355	62				1208
Fixed gillnets				45	998	1765	1388	832	728	236	27	2	6021
Drifting gillnets					10	14	14	10	14	8			70
Handlines					19	54	277	337	175	10			872
Lines trawls				92	803	603	652	963	782	352	37		4284
Otter trawls				128	1090	1195	746	1121	1027	788	237	16	6349
Others			1			3				1			5
Total			1	265	2925	3670	3827	3618	2788	1395	301	18	18808
DIVISION TOTAL			1	269	3103	3797	3882	3810	2915	1451	319	103	19650

Table 4d. Preliminary catch statistics (t) for cod in NAFO Divisions 3Pn, 4R, 4S in 1985

CANADA-NEWFOUNDLAND

Gear type	J	F	M	A	M	J	J	A	S	O	N	D	Total
Traps					25	1152	1640	320	1	3	1		3142
Fixed gillnets	1		5		115	1109	2229	606	145	79	98	91	4478
Handlines	4	2			71	110	258	754	319	137	15		1670
Lines trawls	257	913	2251	895	1406	1345	1231	1824	1375	547	308	254	12606
Danish seine					43	115	34	32	31	20	22		297
Otter trawls	230	10964	4572	2150	1148	4077	4112	3303	2249	570	175	1266	34816
Others									1		6		7
Total	492	11879	6828	3045	2808	7908	9504	6839	4121	1356	625	1611	57016

CANADA-MARITIME

Gear type	J	F	M	A	M	J	J	A	S	O	N	D	Total
Fixed gillnets									6				6
Handlines					2				2				4
Danish seines								5	13				18
Otter trawls	4		124	35	706	976	74	370	220	97	28	282	2916
Total	4		124	35	708	976	74	375	241	97	28	282	2944

CANADA-QUEBEC

Gear type	J	F	M	A	M	J	J	A	S	O	N	D	Total
Traps					5	36	750	355	62				1208
Fixed gillnets				45	998	1765	1388	832	728	236	27	2	6021
Drifting gillnets					10	14	14	10	14	8			70
Handlines					19	54	277	337	175	10			872
Line trawls				92	803	603	652	963	782	352	37		4284
Otter trawls				128	1095	1195	746	1121	1027	788	237	16	6354
Others			1			3				1			5
Total			1	265	2930	3670	3827	3618	2788	1395	301	18	18813

FRANCE (M+SPM)

Gear type	J	F	M	A	M	J	J	A	S	O	N	D	Total
Otter trawls	557	5066	961	1538									8122
GRAND TOTAL	1053	16945	7914	4883	6446	12554	13405	10832	7150	2848	954	1911	86895

Table 5. Recent allocation scheme and reported catches (t) for 4RS, 3Pn cod.

YEAR	FLEET	FINAL ALLOCATION	REPORTED CATCH	%
1980	Mobile >100' NGBV	8800	8589	98
	GBV	1000	1058	106
	Mobile 65-100'	3000	1817	61
	Mobile <65'	22200	27207	123
	Fixed <65'	28000	49349	176
	FRANCE	12000	9133	76
1981	Mobile >100' NGBV	4000	3157	79
	GBV	1000	846	85
	Mobile 65-100'	3000	2550	85
	Mobile <65' 1/1 to 12/7	22500	28948	129
	18/8 to 31/12	3000	3690	123
	Fixed <65'	28000	44720	160
	FRANCE	13500	14089	104
1982	Mobile >100' NGBV	5000	4233	85
	GBV	1000	1106	111
	Mobile 65-100' NGBV	500	333	67
	GBV	2000	2521	126
	Mobile <65' based 4S,4T	6500	4084	63
	based 4R 1/1 to 30/4	7884	7880	100
	1/5 to 31/12	19216	21101	110
	Fixed <65' 1/1 to 30/9	35000	46866	134
	1/10 to 31/12	2000	2264	113
	FRANCE	13500	12160	90
1983	Mobile >100' NGBV	5000	4173	83
	GBV	600	171	29
	Mobile 65-100' NGBV	500	199	40
	groundfish	1000	467	47
	shrimp	1500	1827	122
	Mobile <65' based 4S,4T groundfish	4500	3681	82
	shrimp	2000	1629	81
	based 4R,3Pn groundfish			
	1/1 to 30/4	1677	1677	100
	1/5 to 31/12	4023	4727	117
	based 4R,3Pn shrimp			
	1/1 to 30/4	3705	3705	100
	1/5 to 31/12	7018	7018	100
	based 4R groundfish	8500	9007	106
	based 3P, 4VWX	3800	3815	100
	Fixed <65' 1/1 to 30/9	38500	47666	124
	1/10 to 31/12	2000	1666	83
	FRANCE	13500	12107	90

Table 5. (continued)

1984	Mobile >100' NGBV	5000	3171	63		
	GBV	600	171	29		
	Mobile 65-100' NGBV	500	170	34		
	groundfish	800	886	111		
	shrimp	2250	1886	84		
	Mobile <65' based 4S,4T groundfish	4800	5588	116		
	shrimp	1200	1112	93		
	overlap	500	535	107		
	based 4R	29500	26060	88		
	Fixed <65' 1/1 to 30/9	38107	37073	97		
	1/10 to 31/12	3243	2858	88		
	FRANCE	13500	13224	98		
1985	Mobile >100' NGBV	4944	3270	66		
	GBV	1056	386	37		
	Mobile 65-100' NGBV	500	179	36		
	groundfish	1700	1561	92		
	shrimp	1500	1306	87		
	Mobile <65' based 4S,4T groundfish	5500	5195	94		
	shrimp	1800	1071	60		
	overlap	500	473	95		
	based 4R	30500	28910	95		
	Fixed <65' 1/1 to 30/9	36500	34551	95		
	1/10 to 31/12	2000	1149	57		
	FRANCE	13500	8122	60	To date (10 Sept.)	
					1985	1984
1986	Mobile >100' NGBV	4160	2898 *	70	2964	3023
	GBV	1240	773 *	62	179	166
	Mobile 65-100' NGBV	400	586 *	147	217	39
	groundfish	1700	1381 *	81	1157	595
	shrimp	1400	843 *	60	762	993
	Mobile <65'	27850	25656 *	92	24788	24747
	based 4S,4T groundfish					
	1/1 to 30/4	1000	1077 *	108	4291	3251
	1/5 to 31/12	4850	4034 *	83	-	-
	shrimp	1500	739 *	49	491	612
	overlap	500	505 *	101	473	497
	Fixed <65' 1/1 to 30/9	32000	20643 *	65	26281	35264
	1/10 to 31/12	2000	0 *	0	-	-
	FRANCE	13500	12577 **	93	8122	13224

NOTE: NGBV = Non Gulf Based Vessels
GBV = Gulf Based Vessels
* Gulf Quota Report 10 September 1986.
** FLASH Quota Report 11 August 1986.

Table 6. Results of the ANOVA from the regression of ln catch rates against dummy categorical variables for cod in NAFO Divisions 4RS, 3Pn. (1974 to 1986)

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... .906
MULTIPLE R SQUARED..... .820

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	2.886E0002	2.886E0002	
REGRESSION	32	5.250E0002	1.641E0001	84.066
TYPE 1	7	8.549E0001	1.221E0001	62.578
TYPE 2	11	7.009E0000	6.371E-001	3.265
TYPE 3	2	2.063E0000	1.032E0000	5.286
TYPE 4	12	5.836E0001	4.863E0000	24.919
RESIDUALS	589	1.149E0002	1.952E-001	
TOTAL	622	9.286E0002		

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
1	34	INTERCEPT	-0.516	0.127	622
2	1				
3	36				
4	1974				
1*	24	1	0.287	0.082	69
	25	2	0.760	0.073	73
	35	3	0.404	0.075	68
	42	4	-1.136	0.109	72
	43	5	-0.764	0.103	111
	44	6	1.035	0.130	24
	85	7	0.617	0.072	104
2	2	8	-0.065	0.075	115
	3	9	-0.282	0.090	65
	4	10	-0.257	0.081	95
	5	11	-0.288	0.083	100
	6	12	-0.304	0.103	41
	7	13	-0.391	0.111	31
	8	14	-0.502	0.118	26
	9	15	-0.459	0.116	27
	10	16	-0.511	0.116	28
	11	17	-0.400	0.129	24
	12	18	-0.363	0.220	7
3**	41	19	0.198	0.073	299
	42	20	0.055	0.096	240

*Codes for gear categories: Last digit refers to tonnage class and the first two digits refer to countries/provinces given below: 2: Maritimes 3: Newfoundland 4: Québec 8: France (Metro and St. Pierre)

** Codes for Divisions are 36=3Pn, 41=4R, 42=4S

Table 7. Results of the ANOVA from the regression of ln catch rates against dummy categorical variables for cod in Divisions 4RS, 3Pn. (1959 to 1974)

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... .797
MULTIPLE R SQUARED..... .636

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	5.164E0000	5.164E0000	
REGRESSION	35	1.643E0002	4.695E0000	27.394
TYPE 1	7	5.140E0001	7.343E0000	42.843
TYPE 2	11	3.515E0001	3.195E0000	18.642
TYPE 3	2	4.215E0000	2.107E0000	12.295
TYPE 4	15	2.283E0001	1.522E0000	8.879
RESIDUALS	549	9.410E0001	1.714E-001	
TOTAL	585	2.636E0002		

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
1	34	INTERCEPT	-0.366	0.099	585
2	1				
3	36				
4	1974				
1*	24	1	0.060	0.065	88
	25	2	0.442	0.078	46
	35	3	0.379	0.081	40
	154	4	0.905	0.121	28
	156	5	0.714	0.060	124
	216	6	0.743	0.059	108
	217	7	0.991	0.082	36
2	2	8	0.196	0.078	106
	3	9	-0.072	0.080	100
	4	10	-0.250	0.081	101
	5	11	-0.377	0.089	55
	6	12	-0.519	0.101	39
	7	13	-0.473	0.117	22
	8	14	-0.402	0.107	31
	9	15	-0.577	0.111	27
	10	16	-0.695	0.130	16
	11	17	-0.887	0.124	22
	12	18	-0.602	0.155	16
3	41	19	0.217	0.047	354
	42	20	0.060	0.073	77

* Codes as in Table 6, in addition Code 15 represents Portugal and Code 21 represents Spain.

Table 8: Average number of cod caught per set from research vessel surveys on the Gadus Atlantica in divisions 4RS, 3Pn.

TRIP No. / Year / Strata	GADUS 4 1978	GADUS 16 1979	GADUS 31 1980	GADUS 46 1981	GADUS 73 1983	GADUS 89 1984	GADUS 104 1985	GADUS 119 1986
Div.3Pn								
302	200.33	25.67	57.67	144.27	82.00	71.40	4.23	569.00
303	28.67	1.33	24.33	31.25	94.00	25.88	12.50	30.89
304	2.00	5.67	18.00	10.67	108.00	11.00	5.67	14.67
305	1.80	0.67	2.00	19.60	2.00	2.00	2.33	2.54
Div.4R								
801	4.67	81.33	14.00	6.00	55.33	55.00	46.00	25.33
802	19.00	1.50	89.00	22.50	2.57	4.00	0.33	7.43
809	61.00	64.27	98.33	151.50	27.17	52.60	57.87	430.57
810	30.33	5.67	262.25	139.58	38.40	22.00	3.00	57.71
811	199.92	71.20	954.50	631.50	126.00	1850.57	41.86	597.87
812	134.60	61.60	39.67	29.29	52.00	204.44	185.71	49.20
813	63.00	40.75	105.00	14.33	188.47	144.80	116.90	140.80
820	79.25	95.25	2632.75	1008.00	54.86	54.40	35.40	603.50
821	1359.25	81.25	341.50	340.50	77.57	451.00	71.60	1467.56
822	551.50	372.00	13.40	13.80	131.30	325.15	221.50	310.67
AB	556.00	24.20	7.60	0.00	126.00	281.43	214.50	65.40
Div.4S								
803	5.33		49.86	25.25	2.18	6.53	3.87	7.00
804	22.33		23.50	70.00	5.40	17.40	4.67	
807	32.00	5.00	12.33	12.00	67.49	12.67	12.17	26.40
808	48.33	42.40	95.00	160.67	80.88	239.17	17.50	1131.00
814	44.67	12.00	36.67	16.50	887.33	225.00	156.20	22.50
815	25.33	21.50	49.67	13.83	205.57	737.00	111.80	9.50
816	33.60	69.00	33.00	3.86	66.80	21.75	66.75	
819	28.50	79.00	12.00	5.50	276.67	195.50	545.43	10.40
827	25.00		1.00	14.40	125.50	8.20	4.60	0.67
833	3.33		0.00	0.00	51.50	147.00	34.67	
CD	23.00	282.50	4.50	5.17	109.33	5.25	139.50	0.75

AB Strata 823,824 combined

CD Strata 829,830 combined

Table 9: Average weight (kg) of cod caught per set from research vessel surveys on the Gadus Atlantica in divisions 4RS, 3Pn.

TRIP No. / year / Strata	GADUS 4 1978	GADUS 16 1979	GADUS 31 1980	GADUS 46 1981	GADUS 73 1983	GADUS 89 1984	GADUS 104 1985	GADUS 119 1986
Div.3Pn								
302	420.63	50.85	143.92	240.03	163.50	125.90	8.00	1010.74
303	66.00	2.57	74.83	41.25	173.47	59.63	24.50	91.46
304	11.94	10.23	60.92	33.50	176.40	5.00	39.30	30.33
305	5.06	3.18	9.50	103.10	6.31	0.50	14.52	7.75
Div.4R								
801	4.77	48.88	4.75	2.50	83.07	103.00	84.33	21.33
802	62.14	21.56	351.33	70.50	10.29	13.20	0.90	41.14
809	103.66	133.63	56.83	122.75	52.77	71.50	91.01	712.43
810	108.11	34.81	531.00	210.00	81.30	64.75	4.33	125.64
811	248.48	111.87	619.44	957.00	210.01	2328.86	69.57	753.87
812	157.62	73.10	8.67	10.50	81.27	352.78	240.00	84.40
813	86.03	6.24	18.19	3.08	290.63	244.70	156.70	99.15
820	173.50	135.29	3486.75	1526.78	106.71	123.40	83.50	768.75
821	2134.63	105.67	182.50	227.25	152.63	462.00	140.10	1743.00
822	842.44	534.93	3.16	4.40	232.93	495.15	348.35	502.61
AB	686.51	13.99	1.46	0.00	221.10	498.93	190.75	23.70
Div.4S								
803	10.43		121.61	45.00	7.61	16.00	12.40	12.03
804	9.45		19.00	37.33	9.32	15.00	5.17	
807	16.48	5.35	3.47	4.38	84.64	6.17	18.50	10.30
808	97.22	85.75	166.42	184.00	154.19	454.50	30.92	1404.30
814	23.74	2.72	4.23	4.10	1064.27	480.07	213.00	2.25
815	10.43	13.22	11.50	5.13	315.69	803.50	195.84	2.38
816	10.52	53.57	10.85	0.92	95.34	7.25	58.00	
819	9.89	84.22	2.50	0.75	379.00	305.75	728.93	2.16
827	2.49		0.13	0.49	160.07	3.86	1.54	0.07
833	10.13		0.00	0.00	75.00	211.00	26.83	
CD	4.99	244.36	0.87	1.15	196.48	0.81	143.83	0.13

AB Strata 823,824 combined
CD Strata 829,830 combined

Table 10: 4RS,3Pn COD. Research Survey Numbers at Age (Selected Strata) 5/11/86

I	1978	1979	1980	1981	1983	1984	1985	1986
1 I	116	58	0	715	0	64	0	0
2 I	2032	2983	2397	1594	837	1628	1923	197
3 I	7792	4544	20817	5101	9549	6114	10588	4077
4 I	26392	15478	27013	19223	13142	60257	14434	25153
5 I	34007	22817	47728	14729	16703	30097	26893	35443
6 I	43494	15222	37258	29331	49030	45000	14096	65919
7 I	12891	11259	18696	17200	23444	55182	15669	43201
8 I	4467	4977	10649	8114	15284	20221	18217	23629
9 I	1759	1005	4414	2293	6994	14043	7639	13143
10 I	2651	555	816	758	1674	4824	6445	4775
11 I	913	1156	682	75	1236	1730	1382	3122
12 I	1087	396	603	220	427	760	899	1162
13 I	405	301	505	93	240	397	474	566
14 I	270	192	397	245	74	186	100	151
15 I	12	109	112	60	107	55	56	86
16 I	0	71	70	30	58	126	32	25
17 I	0	15	7	11	56	37	5	27
18 I	11	0	28	30	0	150	14	0
19 I	0	7	14	0	5	31	8	6
20 I	11	0	0	15	9	0	0	14
21 I	4	14	0	0	0	0	8	0
22 I	0	0	0	0	0	30	5	0
23 I	0	0	0	0	0	0	6	0
1+I	138314	81158	172207	99834	138870	240929	118892	220696
2+I	138198	81100	172207	99119	138870	240865	118892	220696
3+I	136166	78117	169810	97525	138033	239238	116969	220498
4+I	128374	73573	148993	92424	128484	233124	106381	216421
5+I	101982	58095	121979	73202	115342	172867	91947	191268
6+I	67975	35278	74251	58473	98639	142771	65054	155826
7+I	24481	20056	36993	29142	49608	97771	50959	89907

Table 11. Recruitment index for 4RS, 3Pn cod based on mean number per tow from the winter surveys

Y/C	Age 3	4	3	4	Rec. Index
	Mean Number/tow		Normalized		
1974	--	16.34	--	0.93	0.93
1975	6.38	13.78	1.04	0.79	0.92
1976	4.01	13.74	0.66	0.79	0.73
1977	12.32	9.74	2.01	0.56	1.29
1978	2.61	--	0.43	--	0.43
1979	--	6.99	--	0.40	0.40
1980	5.33	45.98	0.87	2.63	1.75
1981	4.67	10.81	0.76	0.62	0.69
1982	7.51	21.46	1.23	1.23	1.23
1983	3.67	--	0.60	--	0.60
(75-77) and (80-82) Mean					
	6.12	17.5			

Table 12. 4RS 3Pn cod commercial sampling in 1985.

Gear *	Quarter	Country	Division	Length measurements	Otoliths
OTB	1	CAN (N)	3Pn	1797	204
			4R	258	32
		FRA (SPM)	3Pn	1128	207
			4R	10498	353
	2	CAN (N)	4R	5938	439
		CAN (M)	4R	734	98
		CAN (Q)	4S	3965	627
	3	CAN (N)	4R	7303	751
		CAN (M)	4S	531	70
		CAN (Q)	4R	473	108
			4S	6072	560
	4	CAN (N)	4R	4899	544
		CAN (M)	4S	540	61
		CAN (Q)	4RS	1342	300
SN	3	CAN (N)	4R	265	67
LL	1	CAN (N)	3Pn	3807	327
	2	CAN (N)	3Pn	3298	367
			4R	1149	227
		CAN (Q)	4S	1850	324
	3	CAN (N)	3Pn	157	35
			4R	4167	530
		CAN (Q)	4S	6065	463
	4	CAN (N)	4R	107	27
GN	2	CAN (N)	4R	2768	387
		CAN (Q)	4S	1574	237
	3	CAN (N)	4R	3956	485
		CAN (Q)	4S	1878	235
	4	CAN (N)	4R	268	79
FIX	2	CAN (N)	4R	1506	142
	3	CAN (N)	4R	759	71
Total				79052	8357

* OTB= otter trawl; ST= shrimp trawl; SN= danish /Scottish Seines; LL= longlines; GN= gillnets; Fix= cod traps

TABLE 13 4RS 3Pn cod commercial sampling in 1986 (January to June)

Gear *	Quarter	Country	Division	Length measurements	Otoliths
OTB	1	CAN (n)	3 Pn	1001	120
			4R	11533	393
		FRA	3 Pn	12860	262
			4R	7710	137
	2	CAN (N)	4R	7276	-
		CAN (Q)	4R	751	96
			4S	250	32
ST	2	CAN (Q)	4S	853	126
LL	1	CAN (N)	3 Pn	2764	462
	2	CAN (N)	3 Pn	3579	-
			4R	841	-
		CAN (Q)	4S	659	143
GN	2	CAN (N)	4R	2955	-
		CAN (Q)	4S	190	-
FIX	2	CAN (N)	4R	257	-
Total				53479	1771

* OTB= otter trawl; ST= shrimp trawl; SN= danish /Scottish Seines; LL= longlines; GN= gillnets; Fix= cod traps

Table 14. Quarterly catch at age for fixed gear for 4RS, 3Pn cod. in 1985*

Quarter 1

	AVERAGE		CATCH		
AGE	WEIGHT	LENGTH	MEAN	STD. ERR.	C. V.
4	0.840	45.117	53	23.77	0.45
5	0.869	45.658	441	56.42	0.13
6	1.189	50.723	774	84.84	0.11
7	1.403	53.607	740	80.85	0.11
8	1.898	59.339	214	39.21	0.18
9	1.803	58.051	100	32.07	0.32
10	2.214	62.452	22	10.59	0.48
11	1.644	55.185	41	23.67	0.58
12	5.083	81.245	4	1.90	0.44
13					
14					
15	11.240	109.000	1	0.01	0.01

TOTAL CATCH: 3433

Quarter 2

	AVERAGE		CATCH		
AGE	WEIGHT	LENGTH	MEAN	STD. ERR.	C. V.
3	0.459	37.000	1	0.55	0.74
4	0.738	43.298	92	22.47	0.24
5	0.929	46.543	1000	63.62	0.06
6	1.191	50.650	1516	78.90	0.05
7	1.673	56.704	1293	73.07	0.06
8	1.998	60.084	1295	67.63	0.05
9	2.079	60.547	466	44.51	0.10
10	2.427	63.692	325	34.74	0.11
11	2.529	64.403	200	26.52	0.13
12	4.124	75.747	52	9.36	0.18
13	4.424	76.672	31	7.84	0.25
14	6.887	90.929	7	2.03	0.28
15	6.591	87.970	6	2.27	0.41
16	7.713	94.692	4	1.42	0.34
17	9.459	102.590	1	0.74	0.63
18	13.162	114.411	2	0.85	0.42
19					
20					
21					
22	9.506	103.000		0.49	1.08

TOTAL CATCH: 10618

Quarter 3

	AVERAGE		CATCH		
AGE	WEIGHT	LENGTH	MEAN	STD. ERR.	C. V.
2	0.429	36.123	3	2.25	0.72
3	0.681	42.233	33	19.11	0.55
4	0.902	44.328	338	51.27	0.15
5	0.992	47.488	2324	113.37	0.05
6	1.280	51.453	2138	117.99	0.06
7	1.908	58.949	1935	100.19	0.05
8	2.301	62.695	1773	90.90	0.05
9	2.625	65.156	730	60.86	0.08
10	2.773	66.559	621	54.61	0.09
11	3.382	70.986	239	31.58	0.13
12	3.871	73.497	78	17.82	0.23
13	5.004	79.576	38	10.20	0.27
14	7.572	93.573	6	2.24	0.37
15	9.931	102.539	7	2.03	0.27
16	11.892	110.200	1	0.49	0.38
17	13.823	116.610	1	0.69	0.82
18	11.418	106.858	1	0.56	0.59
19	16.464	124.000		0.43	1.36
20	9.506	103.000		0.39	1.06
21	26.161	145.000			0.01

TOTAL CATCH: 18109

Quarter 4

	AVERAGE		CATCH		
AGE	WEIGHT	LENGTH	MEAN	STD. ERR.	C. V.
3	0.665	41.878	31	19.75	0.64
4	0.991	47.872	102	57.46	0.56
5	1.113	49.531	488	82.04	0.17
6	1.594	55.800	240	68.64	0.29
7	1.746	57.770	166	47.86	0.29
8	1.833	58.283	200	55.18	0.28
9	2.717	66.236	51	22.14	0.43
10	2.352	62.943	74	32.35	0.44
11	3.756	74.356	9	6.16	0.70
12	3.431	73.000	1	1.63	1.20

TOTAL CATCH: 2212

* For tables 14 to 21 weight is in kg, length is in cm and mean catch is in thousands.

Table 15. Quarterly catch at age for mobile gear for 4RS, 3Pn cod. in 1985

Quarter 1

AGE	AVERAGE WEIGHT	AVERAGE LENGTH	CATCH MEAN	CATCH STD. ERR.	CATCH C. V.
3	0.352	33.823	9	8.37	0.95
4	0.667	41.742	912	157.14	0.17
5	0.862	45.449	5533	315.37	0.06
6	1.147	49.955	4017	324.95	0.08
7	1.462	54.321	3495	282.15	0.08
8	1.708	57.167	2030	209.32	0.10
9	1.844	58.560	657	118.22	0.18
10	1.829	58.460	486	104.21	0.21
11	1.866	58.227	124	54.23	0.44
12	2.760	67.504	16	7.80	0.50
13	4.125	77.656	2	1.49	0.62
14	6.588	91.000		0.29	1.68
15					
16					
17	7.252	94.000	1		

TOTAL CATCH: 22479 t

Quarter 2

AGE	AVERAGE WEIGHT	AVERAGE LENGTH	CATCH MEAN	CATCH STD. ERR.	CATCH C. V.
4	0.823	44.917	86	22.11	0.26
5	1.104	49.551	1854	131.66	0.07
6	1.298	52.250	1984	151.79	0.08
7	1.653	56.676	1457	133.83	0.09
8	1.808	58.323	2435	151.37	0.06
9	2.080	61.032	638	78.48	0.12
10	2.275	62.696	406	59.76	0.15
11	2.453	64.027	136	34.32	0.25
12	3.822	73.251	26	9.05	0.35
13	8.677	96.125	2	1.02	0.49
14	7.252	94.000		0.26	1.70
15	4.335	79.000	1	0.58	1.02
16					
17					
18	3.880	75.468	1	1.16	0.91

TOTAL CATCH: 13206 t

Quarter 3

AGE	AVERAGE WEIGHT	AVERAGE LENGTH	CATCH MEAN	CATCH STD. ERR.	CATCH C. V.
2	0.201	28.000	2	1.68	0.67
3	0.507	37.361	50	13.22	0.26
4	0.859	45.396	605	71.33	0.12
5	1.085	49.199	2839	139.82	0.05
6	1.240	51.435	2112	136.55	0.06
7	1.676	56.896	1155	93.89	0.08
8	2.033	60.601	1355	81.10	0.06
9	2.247	62.421	394	46.26	0.12
10	2.443	64.293	287	35.66	0.12
11	2.744	66.813	76	16.56	0.22
12	3.597	72.298	16	5.26	0.33
13	2.769	67.576	6	3.80	0.64
14	11.128	105.416	1	0.42	0.41
15	7.959	97.000		0.38	1.30
16	16.464	124.000	1		

TOTAL CATCH: 13335 t

Quarter 4

AGE	AVERAGE WEIGHT	AVERAGE LENGTH	CATCH MEAN	CATCH STD. ERR.	CATCH C. V.
2	0.578	40.000	1	1.49	1.00
3	0.769	43.755	30	9.48	0.32
4	0.854	45.407	250	25.72	0.10
5	1.138	49.949	746	42.40	0.06
6	1.400	53.465	443	37.48	0.08
7	1.796	58.054	227	25.38	0.11
8	1.984	60.014	378	28.58	0.08
9	2.209	61.798	111	16.32	0.15
10	2.444	64.185	86	12.61	0.15
11	2.802	66.825	18	5.58	0.31
12	3.200	69.188	11	3.71	0.34
13	5.573	84.218	6	2.12	0.34
14					
15	8.710	100.000		0.54	1.11
16					
17	4.335	79.000		0.36	1.02

TOTAL CATCH: 3503 t

Table 16 Catch at age for mobile a) and fixed gear b) for 4RS, 3Pn cod in 1985.

a)

AGE	AVERAGE WEIGHT	AVERAGE LENGTH	CATCH MEAN	CATCH STD. ERR.	CATCH C. V.
2	0.342	32.479	4	2.25	0.56
3	0.580	39.160	89	18.30	0.21
4	0.762	43.578	1853	175.87	0.09
5	0.979	47.418	10972	371.67	0.03
6	1.218	51.035	8557	385.59	0.05
7	1.557	55.466	6333	327.07	0.05
8	1.835	58.546	6197	272.25	0.04
9	2.038	60.481	1800	150.13	0.08
10	2.153	61.533	1265	125.94	0.10
11	2.328	62.740	354	66.51	0.19
12	3.428	71.071	68	13.57	0.20
13	4.750	78.807	17	4.71	0.28
14	10.123	102.324	1	0.57	0.42
15	6.704	90.507	1	0.88	0.65
16	16.464	124.000	1		
17	6.518	90.226	1	0.36	0.26
18	3.880	75.468	1	1.16	0.91

TOTAL CATCH: 52523

b)

AGE	AVERAGE WEIGHT	AVERAGE LENGTH	CATCH MEAN	CATCH STD. ERR.	CATCH C. V.
2	0.429	36.123	3	2.25	0.72
3	0.671	42.003	64	26.80	0.42
4	0.828	44.857	584	83.67	0.14
5	0.978	47.310	4254	163.06	0.04
6	1.252	51.294	4668	179.04	0.04
7	1.733	57.201	4034	155.58	0.04
8	2.137	61.264	3482	131.98	0.04
9	2.378	63.073	1348	84.88	0.06
10	2.624	65.322	1042	73.13	0.07
11	2.895	67.040	489	47.95	0.10
12	4.002	74.602	137	20.28	0.15
13	4.743	78.269	69	12.87	0.19
14	7.196	92.166	13	3.02	0.23
15	8.749	97.452	14	3.04	0.21
16	8.710	98.389	5	1.50	0.28
17	11.278	108.435	2	1.00	0.50
18	12.608	112.010	3	1.02	0.34
19	16.464	124.000		0.48	1.36
20	9.506	103.000		0.39	1.06
21	26.161	145.000			0.01
22	9.506	103.000		0.49	1.08

TOTAL CATCH: 34372

Table 17. Catch at age, average weights, lengths and variance for cod in NAFO Divisions 4RS, 3Pn in 1985.

	AVERAGE		CATCH		
AGE	WEIGHT	LENGTH	MEAN	STD. ERR.	C. V.
2	0.380	34.085	7	3.18	0.45
3	0.618	40.353	153	32.45	0.21
4	0.778	43.885	2437	194.76	0.08
5	0.979	47.388	15227	405.87	0.03
6	1.230	51.126	13225	425.13	0.03
7	1.625	56.141	10367	362.19	0.03
8	1.944	59.524	9679	302.56	0.03
9	2.184	61.591	3148	172.47	0.05
10	2.366	63.244	2307	145.64	0.06
11	2.657	65.234	844	81.99	0.10
12	3.811	73.423	205	24.40	0.12
13	4.744	78.374	86	13.70	0.16
14	7.468	93.110	15	3.08	0.21
15	8.573	96.852	16	3.17	0.20
16	9.508	101.026	6	1.50	0.25
17	9.330	100.983	3	1.06	0.31
18	9.983	101.022	4	1.55	0.36
19	16.464	124.000		0.48	1.36
20	9.506	103.000		0.39	1.06
21	26.161	145.000			0.01
22	9.506	103.000		0.49	1.08

TOTAL CATCH: 86895

	NAME	NO. MEASURED	NO. AGED
INPUT:	AGE△OTB△TOT	45743	4382
	AGE△INA△TOT	33309	3975
OUTPUT:	AGE△TOT△1985	79052	8357

Table 18 a: 4RS 3Pn COD Catch at age 2/ 7/86

I	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
1 I	0	0	0	0	0	0	0	0	0	0	0	0
2 I	0	12	3	0	0	0	1	2	12	116	0	7
3 I	741	35	217	14	61	70	605	316	229	840	30	153
4 I	4069	4313	5210	2672	2678	3404	3390	6689	3231	4901	2501	2437
5 I	9607	7707	12535	10124	10794	13995	17515	8999	18782	15255	6996	15227
6 I	13498	5091	6323	12756	17616	12871	20196	20054	12747	18451	11943	13225
7 I	5303	7185	4244	7943	9292	12592	11624	13971	13768	10206	17873	10367
8 I	6658	2930	5750	2628	2163	4822	7064	4730	8673	6002	6620	9679
9 I	2794	2757	1991	3274	1064	1429	1531	2154	3372	3061	5126	3148
10 I	1509	1719	2561	1098	1261	721	483	939	2109	1161	1911	2307
11 I	413	740	993	894	538	543	289	294	618	817	745	844
12 I	173	316	395	394	441	300	324	172	145	211	388	205
13 I	82	135	147	291	235	141	77	163	74	214	137	86
14 I	31	89	69	84	128	88	78	74	42	32	29	15
15 I	23	28	45	20	27	29	30	71	24	20	23	16
16 I	32	16	6	22	11	21	18	44	13	17	35	6
17 I	3	5	0	16	5	5	9	25	14	25	7	3
18 I	6	5	3	7	6	0	2	9	7	2	2	4
19 I	0	0	0	2	0	2	3	0	1	1	2	0
20 I	0	5	0	2	0	2	1	0	1	1	1	0
21 I	0	0	0	5	0	1	0	0	0	0	0	0
22 I	0	0	0	0	1	0	0	0	0	0	0	0
23 I	0	0	0	0	0	0	0	0	0	0	1	0
24 I	0	0	0	0	0	0	1	0	0	0	0	0

Table 18 b: 4RS 3Pn COD Mean weight at age 2/ 7/86

I	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
1 I	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2 I	.00	.06	.20	.00	.00	.00	.27	.32	.12	.13	.00	.38
3 I	.46	.40	.44	.46	.57	.35	.51	.57	.45	.38	.42	.62
4 I	.64	.72	.76	.65	.75	.65	.62	.79	.85	.93	.81	.78
5 I	.99	1.00	1.13	1.02	.96	.93	.93	.98	1.11	1.30	1.02	.98
6 I	1.31	1.52	1.68	1.48	1.44	1.42	1.43	1.32	1.44	1.60	1.44	1.23
7 I	1.67	1.89	2.15	2.02	1.98	1.87	1.91	1.85	1.76	1.90	1.78	1.63
8 I	1.98	2.34	2.60	2.52	2.63	2.58	2.41	2.49	2.12	2.18	2.05	1.94
9 I	2.51	2.61	2.90	2.77	3.22	3.40	3.41	3.34	2.66	2.45	2.32	2.18
10 I	2.89	3.08	3.11	3.17	3.32	3.84	4.15	4.55	3.13	3.47	2.70	2.37
11 I	4.46	4.16	3.91	3.35	3.22	3.96	4.41	6.04	3.88	4.52	3.45	2.66
12 I	5.59	4.50	4.83	4.23	3.86	5.23	3.87	7.43	5.70	4.37	3.61	3.81
13 I	5.57	4.30	6.90	4.13	5.12	5.38	5.42	5.93	6.02	6.66	4.40	4.74
14 I	6.61	6.56	5.26	4.48	5.90	5.37	4.17	7.96	6.41	5.94	7.34	7.47
15 I	8.64	6.53	7.40	8.08	7.34	6.25	7.93	5.34	6.04	6.68	8.13	8.57
16 I	7.81	5.02	9.86	9.57	6.48	7.28	5.19	8.94	7.32	6.19	6.23	9.51
17 I	5.97	3.43	.00	13.14	6.67	7.36	6.04	12.42	7.46	5.64	7.36	9.33
18 I	12.22	9.51	8.71	7.51	5.69	.00	15.21	9.48	11.00	6.00	14.17	9.98
19 I	.00	.00	.00	5.97	.00	3.87	8.96	7.96	15.31	15.39	14.46	16.46
20 I	.00	9.51	.00	4.84	.00	11.63	17.67	8.07	13.87	14.17	11.94	9.51
21 I	.00	.00	.00	10.35	.00	16.46	.00	.00	.00	.00	20.02	26.16
22 I	.00	.00	.00	.00	15.31	.00	.00	.00	.00	.00	.00	9.51
23 I	.00	.00	.00	.00	.00	16.46	.00	.00	.00	.00	24.93	.00
24 I	.00	.00	.00	.00	.00	.00	18.94	.00	.00	18.94	.00	.00

Table 18 c: 4RS 3Pn COD Length at age 2/ 7/86

I	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
1 I	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2 I	.00	19.00	28.00	.00	.00	.00	31.00	32.71	23.50	23.70	.00	34.08
3 I	36.78	35.17	36.11	37.00	39.24	33.25	38.17	39.26	36.49	33.44	35.77	40.35
4 I	41.06	42.76	43.64	41.35	43.30	41.14	40.67	44.01	44.94	46.37	44.48	43.88
5 I	47.59	47.91	49.82	48.08	47.21	46.62	46.49	47.47	49.50	52.06	48.13	47.39
6 I	52.40	54.96	56.85	54.45	53.91	53.67	53.79	52.49	53.95	55.96	54.09	51.13
7 I	56.69	59.15	61.83	60.53	60.03	58.85	59.20	58.30	57.79	59.08	58.03	56.14
8 I	59.95	63.23	65.85	65.14	66.13	65.27	63.91	63.96	61.32	61.48	60.63	59.52
9 I	64.72	65.57	68.24	67.22	70.50	71.65	71.62	69.95	65.82	63.81	62.95	61.59
10 I	67.16	68.98	69.83	70.09	70.97	74.13	76.39	77.75	69.06	70.99	65.94	63.24
11 I	78.00	76.55	75.00	71.23	69.68	75.19	77.99	86.78	74.47	77.97	71.46	65.23
12 I	84.78	78.01	80.20	76.82	74.89	81.82	74.40	93.17	85.27	76.01	72.35	73.42
13 I	83.13	76.17	90.65	76.70	81.29	83.78	84.17	86.79	87.26	88.68	76.09	78.37
14 I	90.48	88.39	83.10	78.93	84.75	83.35	76.08	95.84	88.81	85.19	92.28	93.11
15 I	98.00	89.10	93.35	96.18	92.37	86.86	94.70	83.11	88.01	90.03	95.88	96.85
16 I	94.67	82.43	103.46	102.79	89.86	92.57	82.25	98.05	93.09	87.81	84.82	101.03
17 I	88.00	73.00	.00	112.12	91.28	92.99	87.72	111.44	94.18	85.86	92.83	100.98
18 I	111.69	103.00	100.00	91.86	86.26	.00	120.72	102.90	105.31	84.14	117.20	101.02
19 I	.00	.00	.00	88.00	.00	76.00	99.60	97.00	121.00	120.23	116.63	124.00
20 I	.00	103.00	.00	82.00	.00	110.18	127.00	96.70	115.33	117.77	110.76	103.00
21 I	.00	.00	.00	106.00	.00	124.00	.00	.00	.00	.00	132.40	145.00
22 I	.00	.00	.00	.00	121.00	.00	.00	.00	.00	.00	.00	103.00
23 I	.00	.00	.00	.00	.00	124.00	.00	.00	.00	.00	142.60	.00
24 I	.00	.00	.00	.00	.00	.00	130.00	.00	.00	130.00	.00	.00

Table 18 d: 4RS 3Pn COD Coefficient of variation of catch at age 2/ 7/86

I	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
1 I	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
2 I	.000	.007	1.111	.000	.000	.000	.014	.508	.004	.304	.000	.447
3 I	.189	.588	.197	.901	.677	.234	.362	.209	.144	.094	.265	.212
4 I	.078	.072	.066	.066	.114	.071	.136	.051	.075	.059	.049	.080
5 I	.061	.058	.040	.038	.058	.030	.044	.051	.032	.031	.034	.027
6 I	.052	.083	.072	.034	.045	.037	.037	.030	.045	.031	.035	.032
7 I	.094	.062	.088	.044	.062	.034	.045	.037	.039	.045	.026	.035
8 I	.073	.099	.068	.076	.101	.057	.048	.056	.048	.064	.047	.031
9 I	.098	.096	.128	.061	.134	.089	.090	.080	.074	.089	.049	.055
10 I	.139	.113	.105	.099	.125	.132	.125	.117	.094	.143	.073	.063
11 I	.143	.142	.151	.108	.246	.127	.151	.177	.147	.139	.094	.097
12 I	.176	.202	.193	.133	.209	.132	.181	.194	.217	.318	.139	.119
13 I	.371	.373	.212	.150	.174	.188	.176	.221	.314	.452	.295	.160
14 I	.356	.282	.386	.244	.233	.231	.298	.315	.295	.514	.213	.210
15 I	.427	.356	.324	.409	.284	.296	.218	.327	.386	.462	.170	.203
16 I	.369	.375	.748	.467	.439	.426	.492	.369	.424	.345	.400	.248
17 I	1.027	1.008	.000	.295	.605	.537	.435	.387	.461	.939	.261	.314
18 I	.516	1.013	1.024	.559	.715	.000	.010	1.059	.441	.965	.447	.364
19 I	.000	.000	.000	1.042	.000	1.004	.730	1.022	.007	.876	.646	1.357
20 I	.000	1.013	.000	1.043	.000	.918	.003	.665	.271	.686	.756	1.056
21 I	.000	.000	.000	1.103	.000	1.325	.000	.000	.000	.000	1.119	.005
22 I	.000	.000	.000	.000	.006	.000	.000	.000	.000	.000	.000	1.079
23 I	.000	.000	.000	.000	.000	.003	.000	.000	.000	.000	.574	.000
24 I	.000	.000	.000	.000	.000	.000	.008	.000	.000	.009	.000	.000

Table 19a: 4RS 3Pn COD Catch at age (fixed gear) 2/ 7/86

	I	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
1	I	0	0	0	0	0	0	0	0	0	0	0	0
2	I	0	0	0	0	0	0	1	2	0	0	0	3
3	I	688	0	0	1	48	31	566	283	10	111	26	64
4	I	2829	19	8	364	1223	1692	2596	2767	1566	2797	1427	584
5	I	4990	53	245	2175	3555	5804	10028	2250	6217	6152	3712	4254
6	I	3968	626	931	3392	4372	4211	9412	4851	5398	7373	4337	4668
7	I	1216	1332	1555	2700	3442	4352	5379	5909	5362	4270	5922	4034
8	I	1175	1300	2339	1021	1167	2411	3443	1944	4042	2481	2553	3482
9	I	716	1064	1193	1189	635	813	953	1330	1967	1381	2126	1348
10	I	326	763	1469	284	594	513	262	664	1574	801	987	1042
11	I	212	545	573	265	178	290	170	261	536	598	434	489
12	I	41	185	224	141	216	191	161	142	86	178	177	137
13	I	17	65	98	92	154	96	36	151	64	194	69	69
14	I	15	67	54	27	52	54	23	69	33	28	21	13
15	I	6	10	35	19	11	22	17	54	13	17	10	14
16	I	0	0	4	5	5	16	13	40	13	9	15	5
17	I	3	0	0	5	1	3	4	23	10	25	7	2
18	I	6	5	3	1	1	0	2	9	5	2	1	3
19	I	0	0	0	0	0	0	3	0	1	0	2	0
20	I	0	5	3	0	0	1	0	0	0	1	1	0
21	I	0	0	0	0	0	1	0	0	0	0	0	0
22	I	0	0	0	0	1	0	0	0	0	0	0	0
23	I	0	0	0	0	0	0	0	0	0	0	1	0
24	I	0	0	0	0	0	0	1	0	0	0	0	0

Table 19b: 4RS 3Pn COD Mean weight at age (fixed gear) 2/ 7/86

	I	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
1	I	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	I	.00	.00	.00	.00	.00	.00	.27	.32	.00	.00	.00	.43
3	I	.47	.00	.00	.46	.65	.43	.51	.59	.43	.51	.40	.67
4	I	.63	.91	.58	.66	.81	.70	.61	.81	.95	.84	.75	.83
5	I	.97	1.10	1.71	.98	1.08	.96	.91	1.09	1.15	1.18	.95	.98
6	I	1.34	2.22	2.22	1.60	1.73	1.62	1.51	1.53	1.58	1.64	1.38	1.25
7	I	1.77	2.53	2.52	2.31	2.28	2.16	2.02	2.19	1.84	2.04	1.84	1.73
8	I	2.39	2.81	2.95	2.90	2.81	3.00	2.65	3.21	2.21	2.48	2.12	2.14
9	I	2.91	3.21	3.16	3.14	3.49	3.88	3.59	3.94	2.76	2.89	2.42	2.38
10	I	4.04	3.87	3.32	3.44	3.83	4.09	4.58	5.18	3.03	3.80	2.85	2.62
11	I	4.49	4.36	4.43	3.84	4.20	4.79	4.97	6.26	3.79	5.04	3.53	2.90
12	I	6.32	5.55	5.46	4.59	4.33	6.28	4.25	8.02	6.09	4.20	3.90	4.00
13	I	7.64	5.21	7.39	4.07	5.68	5.94	6.26	5.92	6.12	6.54	5.20	4.74
14	I	6.96	7.22	5.51	4.64	8.81	6.29	5.29	8.11	7.02	5.85	6.96	7.20
15	I	8.78	7.96	8.34	8.05	6.81	6.65	9.35	5.76	6.01	6.54	6.28	8.75
16	I	.00	.00	7.96	11.03	7.03	8.12	5.11	9.37	7.32	6.40	8.19	8.71
17	I	5.97	.00	.00	6.46	7.63	8.40	5.29	12.98	8.09	5.51	7.36	11.28
18	I	12.22	9.51	8.71	9.16	7.96	.00	15.21	9.48	13.11	6.00	14.58	12.61
19	I	.00	.00	.00	.00	.00	.00	8.90	7.96	15.31	24.59	14.46	16.46
20	I	.00	9.51	8.71	.00	.00	11.24	.00	7.33	6.59	14.17	11.94	9.51
21	I	.00	.00	.00	.00	.00	16.46	.00	.00	.00	.00	20.02	26.16
22	I	.00	.00	.00	.00	15.31	.00	.00	.00	.00	.00	.00	9.51
23	I	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	24.93	.00
24	I	.00	.00	.00	.00	.00	.00	18.94	.00	.00	18.94	.00	.00

Table19.c: 4RS 3Pn COD Length at age (fixed gear) 2/ 7/86

I	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	.00	.00	.00	.00	.00	.00	31.00	32.71	.00	.00	.00	36.12
3	37.01	.00	.00	37.00	41.39	36.00	38.34	39.84	36.08	38.15	35.34	42.00
4	40.83	46.39	40.00	41.56	44.45	42.37	40.51	44.35	46.93	44.98	43.41	44.86
5	47.29	49.41	57.41	47.20	49.01	46.94	46.18	49.29	50.13	50.35	46.98	47.31
6	52.80	62.65	62.68	55.69	57.47	56.03	54.69	55.00	55.65	56.29	53.15	51.29
7	57.70	65.55	65.43	63.40	62.98	61.94	60.18	61.56	58.61	60.47	58.46	57.20
8	63.79	67.62	68.98	68.39	67.55	68.74	65.93	69.48	62.08	64.00	61.11	61.26
9	68.20	70.48	70.34	70.08	72.58	74.96	72.66	74.16	66.62	67.44	63.54	63.07
10	75.55	74.57	71.25	72.22	74.37	75.83	79.02	81.61	68.38	73.05	67.03	65.32
11	77.55	77.74	78.34	74.26	76.89	80.67	81.32	87.99	73.80	81.49	71.99	67.04
12	88.10	84.37	83.54	79.05	78.19	87.68	76.18	96.27	87.14	75.00	74.06	74.60
13	94.71	81.95	93.53	76.07	83.82	86.97	88.68	86.73	87.78	88.22	80.80	78.27
14	92.33	91.40	84.42	79.84	98.70	88.54	83.95	96.56	92.04	84.55	90.47	92.17
15	98.42	97.00	98.17	95.99	91.02	88.47	100.11	85.78	87.90	89.16	87.59	97.45
16	.00	.00	97.00	107.42	91.81	97.28	81.67	99.74	93.09	88.73	94.09	98.39
17	88.00	.00	.00	90.34	95.60	96.61	84.37	113.75	96.76	85.40	92.83	108.43
18	111.69	103.00	100.00	101.71	97.00	.00	120.72	102.90	113.91	84.14	117.38	112.01
19	.00	.00	.00	.00	.00	.00	99.34	97.00	121.00	142.00	116.63	124.00
20	.00	103.00	.00	.00	.00	109.00	.00	93.95	91.00	117.77	110.76	103.00
21	.00	.00	.00	.00	.00	124.00	.00	.00	.00	.00	132.40	145.00
22	.00	.00	.00	.00	121.00	.00	.00	.00	.00	.00	.00	103.00
23	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	142.60	.00
24	.00	.00	.00	.00	.00	.00	130.00	.00	.00	130.00	.00	.00

Table 19d: 4RS 3Pn COD Coefficient of variation of catch at age (fixed gear) 2/ 7/86

I	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
1	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
2	.000	.000	.000	.000	.000	.000	.014	.508	.000	.000	.000	.717
3	.201	.000	.000	1.025	.831	.324	.386	.230	.479	.346	.298	.417
4	.097	.188	.570	.228	.155	.121	.174	.079	.123	.083	.062	.143
5	.077	.215	.269	.067	.083	.048	.070	.116	.066	.050	.037	.038
6	.086	.203	.201	.051	.070	.062	.066	.074	.074	.045	.037	.038
7	.161	.136	.157	.059	.073	.057	.077	.057	.071	.060	.027	.039
8	.114	.138	.121	.103	.113	.081	.074	.083	.078	.087	.044	.038
9	.117	.145	.182	.088	.148	.129	.128	.105	.105	.096	.046	.063
10	.157	.171	.158	.157	.168	.166	.187	.150	.118	.174	.063	.070
11	.202	.180	.221	.190	.193	.180	.202	.197	.167	.150	.085	.098
12	.326	.252	.293	.203	.286	.167	.307	.228	.330	.371	.131	.149
13	.447	.546	.241	.316	.197	.248	.253	.237	.351	.498	.181	.186
14	.491	.344	.456	.496	.152	.318	.342	.337	.343	.590	.220	.228
15	.671	.686	.330	.423	.344	.370	.313	.405	.589	.545	.292	.213
16	.000	.000	1.019	.985	.512	.487	.667	.406	.424	.502	.259	.277
17	1.027	.000	.000	.937	.733	.785	.729	.415	.531	.948	.261	.502
18	.516	1.013	1.024	.890	1.024	.000	.010	1.059	.489	.965	.375	.344
19	.000	.000	.000	.000	.000	.000	.755	1.022	.007	.009	.646	1.357
20	.000	1.013	.000	.000	.000	1.057	.000	.720	1.031	.686	.756	1.056
21	.000	.000	.000	.000	.000	1.325	.000	.000	.000	.000	1.119	.005
22	.000	.000	.000	.000	.006	.000	.000	.000	.000	.000	.000	1.079
23	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.574	.000
24	.000	.000	.000	.000	.000	.000	.008	.000	.000	.009	.000	.000

Table 20a: 4RS 3Pn COD Catch at age (mobile gear) 2/ 7/86

	I	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
1	I	0	0	0	0	0	0	0	0	0	0	0	0
2	I	0	12	3	0	0	0	0	0	12	116	0	4
3	I	53	35	217	13	12	39	38	32	219	729	4	89
4	I	1240	4294	5202	2309	1421	1712	794	3922	1665	2103	1074	1853
5	I	4618	7653	12290	7949	7101	8191	7487	6749	12565	9103	3284	10972
6	I	9531	4466	5392	9364	13019	8661	10784	15204	7350	11078	7606	8557
7	I	4087	5853	2689	5243	5732	8240	6245	8063	8406	5936	11951	6333
8	I	5482	1629	3411	1608	968	2411	3620	2785	4631	3521	4067	6197
9	I	2078	1692	798	2085	415	616	578	824	1405	1681	3000	1800
10	I	1183	956	1092	814	651	209	221	275	535	360	924	1265
11	I	201	195	420	628	353	253	119	34	82	218	311	354
12	I	132	131	171	253	219	109	163	31	59	33	212	68
13	I	64	69	49	199	78	45	41	12	11	20	68	17
14	I	16	22	15	57	74	33	55	5	8	4	9	1
15	I	17	18	9	1	15	7	14	17	11	3	13	1
16	I	32	16	2	17	6	4	5	4	0	8	19	1
17	I	0	5	0	11	3	3	5	2	4	0	0	1
18	I	0	0	0	7	6	0	0	0	2	0	1	1
19	I	0	0	0	2	0	2	0	0	0	0	0	0
20	I	0	0	0	2	0	0	1	0	1	0	0	0
21	I	0	0	0	5	0	0	0	0	0	0	0	0
22	I	0	0	0	0	0	0	0	0	0	0	0	0
23	I	0	0	0	0	0	0	0	0	0	0	0	0
24	I	0	0	0	0	0	0	0	0	0	0	0	0

Table 20b: 4RS 3Pn COD Mean weight at age (mobile gear) 2/ 7/86

	I	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
1	I	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	I	.00	.06	.20	.00	.00	.00	.00	.00	.12	.13	.00	.34
3	I	.36	.40	.44	.46	.26	.28	.42	.38	.45	.36	.53	.58
4	I	.66	.72	.76	.65	.70	.59	.65	.77	.74	1.05	.89	.76
5	I	1.01	1.00	1.12	1.03	.91	.92	.95	.94	1.09	1.38	1.10	.98
6	I	1.30	1.42	1.58	1.43	1.34	1.33	1.37	1.26	1.34	1.58	1.48	1.22
7	I	1.64	1.75	1.94	1.87	1.80	1.71	1.82	1.60	1.71	1.79	1.76	1.56
8	I	1.90	1.96	2.36	2.28	2.41	2.17	2.19	1.99	2.05	1.96	2.01	1.84
9	I	2.37	2.23	2.51	2.56	2.80	2.77	3.13	2.37	2.52	2.09	2.25	2.04
10	I	2.57	2.45	2.84	3.08	2.86	3.21	3.64	3.02	3.43	2.75	2.53	2.15
11	I	4.43	3.59	3.21	3.14	2.72	3.01	3.60	4.31	4.46	3.07	3.34	2.33
12	I	5.36	3.01	4.00	4.03	3.40	3.38	3.50	4.68	5.13	5.28	3.38	3.43
13	I	5.02	3.44	5.93	4.16	4.01	4.16	4.68	6.02	5.42	7.80	3.59	4.75
14	I	6.29	4.55	4.37	4.41	3.85	3.86	3.70	5.90	3.98	6.49	8.24	10.12
15	I	8.59	5.71	3.73	8.80	7.71	5.06	6.20	4.01	6.08	7.40	9.51	6.70
16	I	7.81	5.02	13.16	9.13	6.06	4.04	5.36	5.02	.00	5.93	4.63	16.46
17	I	.00	3.43	.00	15.86	6.29	6.30	6.76	5.47	5.97	18.94	.00	6.52
18	I	.00	.00	.00	7.33	5.39	.00	.00	.00	6.92	.00	13.90	3.88
19	I	.00	.00	.00	5.97	.00	3.87	10.35	.00	.00	13.17	.00	.00
20	I	.00	.00	.00	4.84	.00	14.22	17.67	12.18	16.46	.00	.00	.00
21	I	.00	.00	.00	10.35	.00	.00	.00	.00	.00	.00	.00	.00
22	I	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
23	I	.00	.00	.00	.00	.00	16.46	.00	.00	.00	.00	.00	.00
24	I	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

Table 20c: 4RS 3Pn COD Length at age (mobile gear) 2/ 7/86

I	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
1 I	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2 I	.00	19.00	28.00	.00	.00	.00	.00	.00	23.50	23.70	.00	32.48
3 I	33.83	35.17	36.11	37.00	30.64	31.09	35.67	34.22	36.51	32.72	38.65	39.16
4 I	41.59	42.75	43.65	41.32	42.31	39.92	41.20	43.77	43.08	48.20	45.90	43.58
5 I	47.91	47.90	49.67	48.32	46.30	46.38	46.91	46.86	49.19	53.22	49.44	47.42
6 I	52.23	53.88	55.84	54.00	52.71	52.52	53.01	51.69	52.70	55.75	54.63	51.03
7 I	56.39	57.70	59.75	59.06	58.26	57.21	58.37	55.91	57.27	58.08	57.83	55.47
8 I	59.13	59.72	63.71	63.08	64.41	61.80	61.98	60.10	60.65	59.71	60.33	58.55
9 I	63.52	62.48	65.11	65.60	67.31	67.28	69.89	63.16	64.69	60.83	62.53	60.48
10 I	64.84	64.52	67.91	69.35	67.86	69.96	73.28	68.40	71.07	66.41	64.78	61.53
11 I	78.47	73.24	70.44	69.95	66.05	68.92	73.22	77.44	78.83	68.33	70.73	62.74
12 I	83.75	68.99	75.83	75.57	71.64	71.63	72.65	78.91	82.54	81.42	70.92	71.07
13 I	80.01	70.72	84.87	76.99	76.30	76.88	80.14	87.50	84.15	93.11	71.32	78.81
14 I	88.79	79.13	78.43	78.51	74.89	74.82	72.80	86.10	76.09	89.35	96.55	102.32
15 I	97.85	84.55	74.66	100.00	93.32	82.05	88.12	74.84	88.13	94.40	102.06	90.51
16 I	94.67	82.43	114.62	101.38	88.35	74.48	83.63	82.49	.00	86.71	77.28	124.00
17 I	.00	73.00	.00	120.95	89.54	89.28	90.88	82.83	88.00	130.00	.00	90.23
18 I	.00	.00	.00	90.77	84.84	.00	.00	.00	88.69	.00	117.08	75.47
19 I	.00	.00	.00	88.00	.00	76.00	106.00	.00	.00	115.00	.00	.00
20 I	.00	.00	.00	82.00	.00	118.00	127.00	112.00	124.00	.00	.00	.00
21 I	.00	.00	.00	106.00	.00	.00	.00	.00	.00	.00	.00	.00
22 I	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
23 I	.00	.00	.00	.00	.00	124.00	.00	.00	.00	.00	.00	.00
24 I	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

Table 20d: 4RS 3Pn COD Coefficient of variation of catch at age (mobile gear) 2/ 7/86

I	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
1 I	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
2 I	.000	.007	1.111	.000	.000	.000	.000	.000	.004	.304	.000	.565
3 I	.381	.588	.197	.946	.657	.330	.315	.344	.149	.094	.417	.206
4 I	.130	.072	.066	.067	.166	.075	.122	.067	.088	.082	.077	.095
5 I	.097	.059	.041	.044	.076	.039	.042	.057	.034	.039	.060	.034
6 I	.064	.090	.077	.043	.055	.045	.037	.033	.056	.043	.051	.045
7 I	.112	.069	.106	.059	.089	.043	.050	.048	.045	.064	.036	.052
8 I	.086	.140	.078	.106	.177	.081	.062	.076	.059	.090	.071	.044
9 I	.126	.127	.169	.082	.253	.119	.109	.123	.099	.142	.077	.083
10 I	.172	.150	.124	.121	.184	.204	.160	.168	.133	.247	.134	.100
11 I	.204	.195	.193	.131	.356	.176	.228	.230	.193	.317	.191	.188
12 I	.208	.333	.226	.173	.304	.214	.194	.279	.231	.353	.230	.198
13 I	.455	.511	.414	.164	.340	.260	.246	.260	.613	.335	.565	.283
14 I	.512	.449	.677	.273	.382	.316	.397	.398	.545	.435	.495	.421
15 I	.526	.397	.928	1.497	.420	.415	.298	.472	.479	.483	.203	.651
16 I	.369	.375	1.031	.530	.672	.864	.477	.411	.000	.464	.694	.004
17 I	.000	1.008	.000	.168	.796	.732	.493	.664	.912	1.277	.000	.256
18 I	.000	.000	.000	.613	.798	.000	.000	.000	.882	.000	.703	.910
19 I	.000	.000	.000	1.042	.000	1.004	1.934	.000	.000	1.086	.000	.000
20 I	.000	.000	.000	1.043	.000	.003	.003	1.740	.003	.000	.000	.000
21 I	.000	.000	.000	1.103	.000	.000	.000	.000	.000	.000	.000	.000
22 I	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
23 I	.000	.000	.000	.000	.000	.003	.000	.000	.000	.000	.000	.000
24 I	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

Table 21a: 4RS,3Pn Cod: Midyear catch at age [Jan-June] 12/ 9/86

I	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	12	116	0	0	3
3	1	10	3806	36	28	195	630	17	10	6
4	804	1231	2732	696	3363	2324	1968	908	1142	517
5	7710	6211	9754	6369	5857	12644	8595	3294	8829	4432
6	10280	12366	8907	10420	13840	7736	11373	7851	8292	11555
7	5777	6739	8802	7409	8589	8064	6900	11414	6985	7646
8	1818	1753	3033	4971	3428	4698	4574	4040	5973	3550
9	2431	824	893	1085	1546	1624	2543	2817	1861	4755
10	916	908	459	360	631	822	977	1064	1239	1367
11	705	439	353	223	187	241	717	402	501	1152
12	302	321	182	256	91	71	180	268	98	366
13	217	163	89	60	108	28	200	84	36	231
14	61	87	55	64	36	26	30	16	8	37
15	6	23	26	22	58	17	19	17	7	19
16	17	10	10	8	23	10	10	23	4	6
17	11	4	5	8	3	10	25	4	2	15
18	7	5	0	0	0	7	0	2	3	3
19	2	0	1	3	0	1	1	1	0	0
20	2	0	1	1	0	1	1	0	0	0
21	5	0	1	0	0	0	0	0	0	0
22	0	1	0	0	0	0	0	0	0	0
23	0	1	0	0	0	0	0	0	0	0
24	0	0	0	1	0	0	0	0	0	0

Table 21b : 4RS,3Pn Cod: Midyear average weight at age [Jan-June] 12/ 9/86

I	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
2	.000	.000	.000	.000	.000	.121	.131	.000	.000	.357
3	.459	.263	.116	.414	.381	.449	.348	.392	.361	.530
4	.651	.699	.530	.637	.774	.775	1.038	.765	.693	.616
5	1.013	.914	.926	.951	.951	1.065	1.335	.968	.921	.905
6	1.426	1.387	1.371	1.406	1.281	1.358	1.567	1.437	1.195	1.095
7	1.896	1.914	1.818	1.894	1.757	1.712	1.807	1.753	1.534	1.372
8	2.322	2.537	2.448	2.302	2.386	2.081	2.133	2.042	1.818	1.683
9	2.617	2.997	3.160	3.157	3.419	2.599	2.304	2.297	1.982	1.956
10	3.077	3.112	3.695	3.842	4.572	3.359	3.435	2.761	2.139	2.240
11	3.262	3.083	3.811	4.132	5.923	4.174	4.602	3.460	2.272	2.421
12	3.973	3.758	4.379	3.804	6.247	5.711	3.765	3.391	3.870	2.864
13	4.285	4.075	5.400	5.419	5.193	5.727	6.568	4.119	4.654	2.694
14	4.368	4.622	4.911	4.233	5.930	6.467	5.979	7.584	6.888	4.342
15	8.603	7.301	6.297	7.560	5.651	6.070	6.733	8.955	7.228	6.260
16	8.947	6.519	6.285	6.287	5.617	7.343	6.791	5.244	7.713	8.332
17	15.421	6.717	7.449	5.938	5.963	7.862	5.644	6.415	8.420	6.369
18	7.506	5.737	.000	14.216	7.959	10.871	16.464	13.044	9.573	9.272
19	5.966	.000	3.866	8.945	7.959	15.312	15.386	7.959	.000	.000
20	4.840	.000	11.499	17.671	7.947	14.039	14.173	9.506	.000	.000
21	10.349	.000	16.464	.000	.000	.000	.000	.000	.000	12.181
22	.000	15.312	.000	.000	.000	.000	.000	.000	9.506	.000
23	.000	15.312	16.464	.000	.000	.000	.000	.000	.000	.000
24	.000	.000	16.464	18.935	.000	.000	18.935	.000	.000	.000

Table 21c : 4RS,3Pn Cod: Midyear length at age [Jan-June] 12/ 9/86

I	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1 I	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2 I	.00	.00	.00	.00	.00	23.50	23.70	.00	.00	34.00
3 I	37.00	30.64	22.84	35.40	34.18	36.43	32.28	35.01	34.07	38.78
4 I	41.40	42.22	38.08	40.92	43.78	43.68	47.91	43.63	42.26	40.67
5 I	47.97	46.42	46.48	46.93	46.98	48.82	52.61	47.31	46.44	46.21
6 I	53.90	53.33	53.02	53.49	51.95	52.88	55.60	54.03	50.70	49.30
7 I	59.37	59.47	58.32	59.14	57.34	57.21	58.23	57.70	55.18	53.14
8 I	63.44	65.45	64.20	63.06	63.17	60.87	61.08	60.54	58.35	56.78
9 I	65.96	68.97	69.93	69.92	70.50	65.28	62.68	62.77	59.88	59.55
10 I	69.32	69.63	73.26	74.55	78.31	70.55	70.65	66.57	61.29	62.31
11 I	70.69	68.89	74.09	76.55	86.37	76.22	78.67	71.40	62.02	63.50
12 I	75.19	74.05	77.38	73.98	88.05	85.38	72.76	70.88	74.02	67.30
13 I	77.71	75.93	83.62	84.20	83.37	85.72	88.27	74.53	77.88	66.06
14 I	78.24	79.00	80.84	76.56	87.08	88.63	85.30	93.68	90.99	76.90
15 I	98.26	92.28	87.04	93.30	84.74	88.02	90.19	99.67	90.94	85.47
16 I	100.60	90.00	87.52	88.57	85.69	92.83	90.33	80.48	94.69	98.35
17 I	119.46	91.49	93.25	87.25	86.11	95.82	85.86	89.17	98.55	89.76
18 I	91.83	86.47	.00	118.00	97.00	104.79	124.00	114.30	99.35	102.12
19 I	88.00	.00	76.00	99.54	97.00	121.00	120.23	97.00	.00	.00
20 I	82.00	.00	109.78	127.00	96.26	115.90	117.77	103.00	.00	.00
21 I	106.00	.00	124.00	.00	.00	.00	.00	.00	.00	112.00
22 I	.00	121.00	.00	.00	.00	.00	.00	.00	103.00	.00
23 I	.00	.00	124.00	.00	.00	.00	.00	.00	.00	.00
24 I	.00	.00	.00	130.00	.00	.00	130.00	.00	.00	.00

Table 22. 4RS 3Pn COD F-ratio (F/F[7-10]) 30/ 6/86

I	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
4 I	.194	.160	.110	.049	.044	.048	.065	.094	.067	.130	.036	.067
5 I	.783	.623	.488	.212	.336	.292	.328	.290	.344	.602	.214	.327
6 I	.878	.828	.599	.610	.728	.599	.651	.744	.583	.688	.630	.654
7 I	.900	.977	.898	1.092	1.093	.939	.989	1.031	.845	1.060	.952	1.000
8 I	1.097	1.058	1.092	.802	.810	1.205	1.083	1.011	1.216	.863	1.062	1.000
9 I	1.001	1.002	.999	.995	.794	1.003	.791	.822	1.420	1.142	1.112	1.000
10 I	1.118	1.425	1.392	.818	1.072	1.006	.636	1.194	1.562	1.422	1.130	1.000
11 I	.886	1.269	1.312	.793	1.049	.908	.785	.854	1.705	1.968	1.646	1.000
12 I	.959	1.565	.974	.844	1.002	1.237	1.115	1.138	.691	1.958	1.939	1.000
13 I	.600	1.825	1.153	1.170	1.454	.568	.635	1.648	.898	3.199	3.143	1.000
14 I	.574	1.367	1.787	1.105	1.798	1.308	.508	1.543	.861	.918	.966	1.000
15 I	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Table 23. 4RS 3Pn COD Partial F (mobile gear) 30/ 6/86

I	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
4 I	.025	.056	.052	.027	.012	.013	.008	.023	.015	.017	.005	.015
5 I	.159	.219	.227	.107	.112	.090	.075	.091	.100	.112	.035	.071
6 I	.262	.257	.242	.287	.273	.213	.185	.236	.146	.129	.140	.127
7 I	.293	.282	.270	.462	.342	.324	.284	.249	.224	.192	.222	.183
8 I	.382	.208	.307	.314	.184	.318	.296	.250	.282	.158	.228	.192
9 I	.315	.218	.190	.406	.158	.228	.159	.132	.257	.195	.227	.172
10 I	.371	.281	.281	.389	.281	.153	.156	.146	.172	.137	.191	.164
11 I	.182	.118	.263	.357	.350	.223	.172	.041	.099	.164	.240	.126
12 I	.310	.229	.200	.347	.253	.238	.300	.085	.122	.096	.369	.100
13 I	.200	.332	.182	.514	.246	.095	.179	.050	.056	.094	.546	.058
14 I	.127	.119	.187	.484	.529	.261	.191	.045	.076	.038	.100	.028
15 I	.314	.225	.097	.030	.293	.133	.241	.102	.202	.052	.200	.026

Table 24. 4RS 3Pn COD Partial recruitment 30/ 6/86

I	4	5	6	7	8	9	10	11	12	13	14	15
I	.0666	.3272	.6540	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Table 25. 4RS 3Pn COD Partial recruitment (mobile) 30/ 6/86

I	4	5	6	7	8	9	10	11	12	13	14	15
I	.0809	.4199	.7505	1.0000	.9373	.7981	.8180	.7018	.7961	.7664	.6564	.5754

Table 26. Results of the regression analysis between standardized CPUE and trawlable biomass estimated from cohort analysis.

Terminal F	0.2	0.3	0.4	0.5	0.6
Correlation	.879	.915	.912	.844	.717
Origin	-2.79E4	3.86E4	7.19E4	9.19E4	1.05E5
Slope	2.65E5	1.63E5	1.11E5	8.00E4	5.94E4
Sum of squares last 3 years residuals	1.41E10	2.54E9	1.17E9	1.76E9	2.75E9

Table 27. Results of the regression analysis between 6+ end of year population estimates and 7+ survey numbers in the next year.

Terminal F	0.2	0.3	0.4	0.5	0.6
Correlation	.867	.890	.873	.770	.575
Origin	2.46E4	3.69E4	4.31E4	4.68E4	4.92E4
Slope	1.67	.955	.600	.389	.249
Sum of squares last 3 years residuals	4.63E9	9.42E8	2.85E8	2.68E8	4.10E8

Table 28: 4RS, 3Pn COD. Population Numbers ('000 's) 6/10/86

I	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
4 I	56957	86538	112915	94891	132198	143817	102192	170773	106657	109023	169679	102273
5 I	37559	42951	66949	87733	75272	105811	114667	80600	133765	84399	84826	136658
6 I	48022	22058	28192	43472	62669	51861	73967	78033	57847	92523	55297	63119
7 I	18488	27103	13452	17360	24050	35370	30814	42285	45743	35827	59056	34467
8 I	19788	10339	15689	7174	7026	11282	17565	14710	21978	24993	20098	32179
9 I	8941	10176	5814	7642	3496	3796	4874	7989	7764	10147	15032	10465
10 I	4426	4792	5837	2958	3294	1899	1815	2605	4592	3305	5537	7669
11 I	1458	2258	2367	2462	1429	1556	903	1049	1283	1852	1656	2805
12 I	573	820	1179	1040	1207	683	783	478	592	491	777	681
13 I	402	312	386	608	495	589	287	347	235	354	211	285
14 I	159	255	134	183	235	193	355	166	137	125	96	49
15 I	71	102	129	47	73	77	79	220	69	74	74	52
4+I	196843	207704	253043	265569	311443	356933	348300	399256	380662	363113	412339	390702
5+I	139886	121166	140128	170678	179245	213116	246108	228483	274005	254091	242660	288428
6+I	102327	78215	73179	82945	103973	107305	131441	147882	140241	169691	157834	151770
7+I	54305	56157	44987	39473	41304	55444	57473	69849	82394	77168	102537	88651

Table 29: 4RS, 3Pn COD. Mean Biomass t. 6/10/86

I	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
4 I	31772	54711	75861	55022	89209	83253	56402	119189	80515	89849	123234	71212
5 I	28780	35186	61564	76191	60572	83132	88117	67240	124008	89473	74924	113907
6 I	48002	26372	37433	48416	68542	57562	81252	80094	66213	119574	63602	62183
7 I	23466	39538	21472	23038	33349	47480	41624	57415	60581	51611	79008	42128
8 I	28653	18367	29043	12894	13787	19736	29324	27086	32509	42679	30323	47033
9 I	16684	20342	12249	14325	8415	9132	12367	20498	13895	18673	25421	17186
10 I	9303	10587	12177	6661	7692	5144	5800	8488	9457	8284	10834	13643
11 I	4944	6903	6311	5897	3249	4456	2944	4825	3200	5589	3789	5604
12 I	2400	2591	4163	3103	3325	2387	2076	2541	2638	1450	1772	1952
13 I	1800	906	1876	1622	1640	2485	1199	1340	1049	1316	488	1016
14 I	846	1212	436	537	835	684	1176	877	657	577	526	274
15 I	459	510	691	256	386	340	440	867	302	381	445	335
4+I	197108	217226	263276	247961	291000	315791	322720	390458	395023	429456	414366	376473
5+I	165337	162514	187415	192939	201791	232538	266318	271269	314508	339607	291132	305261
6+I	136557	127328	125851	116749	141218	149406	178200	204029	190500	250134	216208	191354
7+I	88555	100956	88418	68333	72677	91844	96948	123935	124287	130560	152606	129171

Table 30: 4RS, 3Pn COD. Fishing Mortality 6/10/86

I	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
4 I	.082	.057	.052	.032	.023	.027	.037	.044	.034	.051	.016	.027
5 I	.332	.221	.232	.136	.173	.158	.185	.132	.169	.223	.096	.131
6 I	.372	.295	.285	.392	.372	.321	.359	.334	.279	.249	.273	.262
7 I	.381	.347	.429	.705	.557	.500	.539	.454	.404	.378	.407	.400
8 I	.465	.376	.519	.519	.416	.639	.588	.439	.573	.308	.453	.400
9 I	.424	.356	.476	.642	.410	.538	.426	.354	.654	.406	.473	.400
10 I	.473	.505	.663	.528	.550	.544	.348	.508	.708	.491	.480	.400
11 I	.375	.450	.623	.513	.539	.487	.437	.371	.760	.668	.688	.400
12 I	.406	.555	.462	.542	.517	.665	.613	.509	.315	.645	.804	.400
13 I	.254	.647	.548	.751	.743	.307	.350	.731	.430	1.105	1.266	.400
14 I	.243	.485	.850	.711	.918	.697	.280	.682	.411	.330	.413	.400
15 I	.424	.355	.476	.645	.511	.532	.544	.438	.475	.357	.427	.400

Table 31: 4RS, 3Pn COD. Population Numbers ('000 's) 6/10/86

I	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
4 I	56496	86352	112107	98587	132209	148114	104165	183520	101748	102529	172546	104291	113217
5 I	37316	42584	66807	87084	78303	105825	118192	82222	144216	80387	79521	139009	83186
6 I	47601	21921	27929	43417	62174	54385	74033	80993	59206	101151	52089	58797	100086
7 I	18336	26854	13371	17181	24098	35088	32958	42476	48291	37010	66210	31910	36248
8 I	19638	10252	15533	7141	6974	11411	17447	16567	22249	27177	21137	38156	16828
9 I	8868	10110	5763	7567	3492	3769	5031	7964	9318	10452	16854	11367	22544
10 I	4383	4754	5802	2934	3269	1905	1807	2746	4586	4608	5810	9199	6480
11 I	1445	2236	2352	2461	1419	1547	914	1046	1406	1872	2730	3044	5459
12 I	569	813	1167	1038	1214	680	781	489	592	599	803	1566	1734
13 I	391	311	383	602	497	599	289	349	246	354	301	310	1097
14 I	153	246	134	181	233	197	364	167	140	134	100	124	177
15 I	71	98	122	48	73	77	83	228	71	77	82	55	88
4+I	195267	206531	251470	268241	313955	363597	356064	418767	392069	366350	418183	397828	387144
5+I	138771	120179	139363	169654	181746	215483	251899	235247	290321	263821	245637	293537	273927
6+I	101455	77595	72556	82570	103443	109658	133707	153025	146105	183434	166116	154528	190741
7+I	53854	55674	44627	39153	41269	55273	59674	72032	86899	82283	114027	95731	90655

Table 32: 4RS, 3Pn COD. Midyear Biomass t 6/10/86

I	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
4 I	31403	54445	75110	57073	89035	85594	57380	127975	76573	84143	125091	72481	62849
5 I	28263	34616	60985	75252	62901	82731	90582	68393	133872	84121	69762	115476	64335
6 I	46929	25945	36705	47734	67080	60279	80419	82852	67437	131277	58846	56783	87179
7 I	22947	38676	21008	22073	32785	46183	44660	56877	63930	53054	89712	37665	35048
8 I	27934	17961	28146	12585	13474	19586	28438	30961	32385	46621	31841	57006	19964
9 I	16285	19956	11918	13790	8293	8877	12690	20194	17439	19120	28932	18743	31078
10 I	9042	10297	11769	6468	7465	5065	5707	8933	9183	12312	11340	16765	10226
11 I	4832	6716	6111	5791	3160	4352	2946	4750	3559	5535	7138	6105	9314
12 I	2349	2508	4046	3036	3294	2315	2021	2575	2609	1855	1804	4995	3501
13 I	1729	877	1819	1548	1603	2512	1191	1311	1094	1252	850	1113	2083
14 I	809	1138	421	518	793	689	1201	865	667	622	546	780	542
15 I	449	480	634	256	378	336	465	891	307	394	497	357	389
4+I	192969	213615	258673	246125	290259	318518	327700	406576	409056	440305	426358	388269	326508
5+I	161566	159170	183563	189052	201224	232925	270321	278601	332483	356163	301268	315788	263660
6+I	133304	124554	122578	113800	138323	150194	179739	210208	198611	272041	231506	200312	199324
7+I	86375	98610	85873	66066	71243	89914	99320	127356	131174	140764	172660	143529	112145

Table 33: 4RS, 3Pn COD. Fishing Mortality 6/10/86

I	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986*
4 I	.083	.057	.053	.030	.023	.026	.037	.041	.036	.054	.016	.026	.005
5 I	.332	.222	.231	.137	.164	.157	.178	.128	.155	.234	.102	.129	.058
6 I	.372	.294	.286	.389	.372	.301	.356	.317	.270	.224	.290	.284	.129
7 I	.381	.347	.427	.702	.548	.499	.488	.447	.375	.360	.351	.440	.250
8 I	.464	.376	.519	.515	.415	.619	.584	.375	.555	.278	.420	.326	.250
9 I	.423	.355	.475	.639	.406	.535	.406	.352	.504	.387	.405	.362	.250
10 I	.473	.504	.658	.526	.548	.535	.347	.469	.696	.324	.447	.322	.250
11 I	.375	.450	.618	.506	.536	.484	.425	.369	.654	.647	.356	.362	.250
12 I	.405	.554	.463	.536	.506	.657	.605	.488	.313	.488	.750	.156	.250
13 I	.261	.641	.546	.748	.723	.298	.345	.712	.403	1.066	.688	.360	.250
14 I	.251	.502	.829	.704	.904	.662	.270	.662	.395	.301	.389	.140	.250
15 I	.427	.372	.509	.627	.511	.528	.504	.419	.457	.341	.377	.370	.250

* Represents half year fishing mortality

Table 34. Projections of population abundance, biomass and catch biomass assuming a catch of 92 100 t (the TAC) in 1986 and $F_{0.1} = 0.2$ in 1987 for a terminal fish mortality of 0.4 in 1985.

POPULATION NUMBERS 29/ 9/86

	1985	1986	1987
4	102273	111000	111000
5	136658	81534	88680
6	63119	98161	59183
7	34467	39782	63179
8	32179	18916	22544
9	10465	17660	10719
10	7669	5743	10007
11	2805	4209	3255
12	681	1539	2385
13	285	374	872
14	49	156	212
15	52	27	89
4+	390702	379102	372124
5+	288428	268102	261124
6+	151770	186568	172444
7+	88651	88407	113262

CATCH BIOMASS 29/ 9/86

	1985	1986	1987
4	2045	2044	1117
5	16745	9236	5605
6	18857	27240	9397
7	18340	19757	18423
8	19927	10933	7651
9	7304	11504	4100
10	6562	4586	4693
11	2988	4185	1900
12	806	1699	1546
13	451	553	758
14	101	303	242
15	122	59	114
4+	94249	92100	55545
5+	92204	90056	54428
6+	75458	80819	48823
7+	56601	53579	39425

POPULATION BIOMASS (AVERAGE) 29/ 9/86

	1985	1986	1987
4	76801.16	83439.86	83890.64
5	127954.97	76720.72	85654.54
6	72084.64	113195.98	71847.10
7	45850.93	53692.82	92116.53
8	49817.29	29711.61	38253.09
9	18259.34	31262.53	20499.47
10	16404.85	12464.23	23462.64
11	7470.28	11373.54	9500.82
12	2014.51	4617.56	7729.36
13	1128.45	1503.11	3787.98
14	253.39	824.74	1207.81
15	304.52	159.03	569.09
4+	418344.33	418965.73	438519.06
5+	341543.17	335525.88	354628.43
6+	213588.20	258805.16	268973.89
7+	141503.56	145609.17	197126.79

FISHING MORTALITY 29/ 9/86

	1985	1986	1987
4	.027	.025	.013
5	.131	.120	.065
6	.262	.241	.131
7	.400	.368	.200
8	.400	.368	.200
9	.400	.368	.200
10	.400	.368	.200
11	.400	.368	.200
12	.400	.368	.200
13	.400	.368	.200
14	.400	.368	.200
15	.400	.368	.200
4+	.186	.181	.101

PREDICTED CATCH RATE

STANDARDS USED VARIABLE NUMBERS: 34 1 36

YEAR	TOTAL CATCH	PROP.	CATCH RATE MEAN	S.E.	EFFORT
1974	66436	0.145	0.653	0.083	101746
1975	60233	0.054	0.451	0.062	133541
1976	76981	0.142	0.495	0.056	155457
1977	73566	0.273	0.538	0.060	136642
1978	78506	0.220	0.549	0.062	143029
1979	82777	0.210	0.590	0.068	140217
1980	97579	0.199	0.633	0.071	154252
1981	97911	0.166	1.083	0.128	90376
1982	104939	0.179	1.190	0.142	88203
1983	106080	0.167	1.091	0.136	97189
1984	92822	0.053	1.066	0.139	87078
1985	86895	0.158	1.093	0.130	79469
1986	50218	0.274	1.021	0.123	49200

AVERAGE C.V. FOR THE MEAN: .120

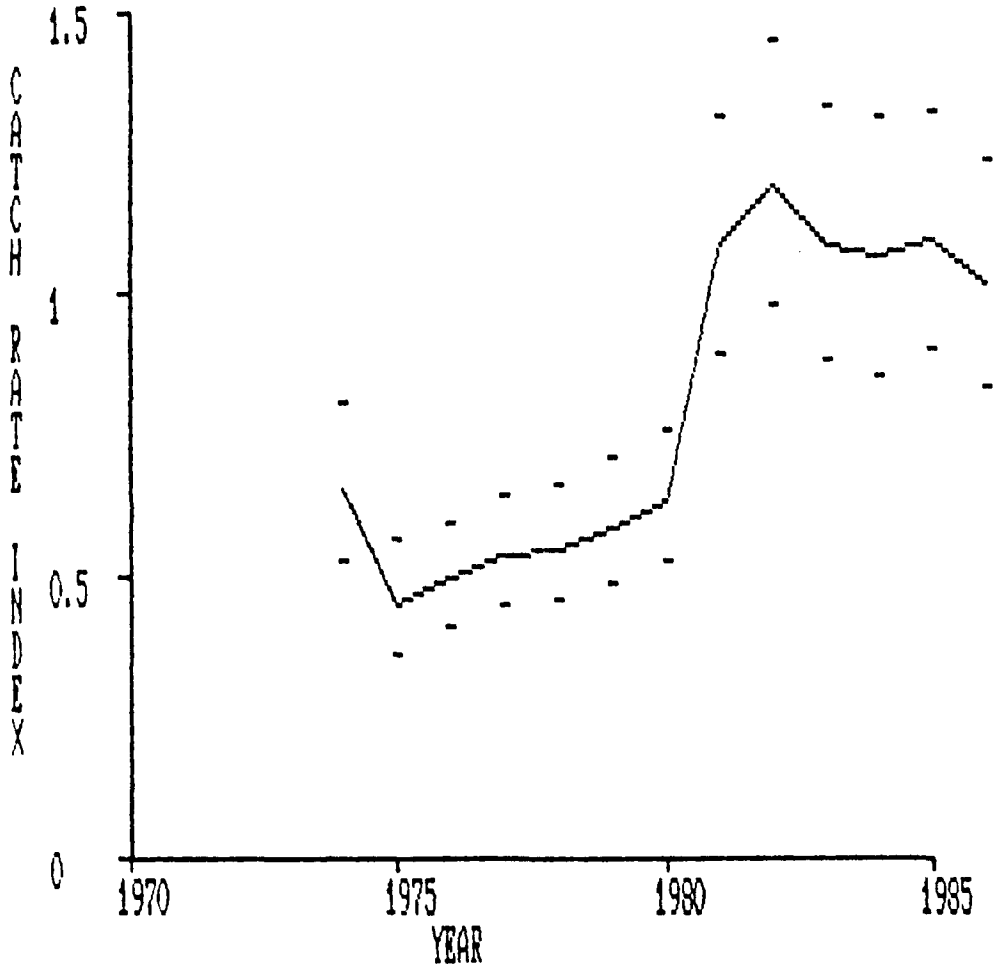


Figure 1a. Mean catch rate indices for cod in NAFO Divisions 4R, 4S and 3Pn (1974-1986)

PREDICTED CATCH RATE

STANDARDS USED VARIABLE NUMBERS: 34 1 36

YEAR	TOTAL CATCH	PROP.	CATCH RATE MEAN	S.E.	EFFORT
1959	58060	0.034	0.752	0.075	77233
1960	94350	0.251	0.754	0.128	125157
1961	100010	0.363	0.801	0.108	124780
1962	85921	0.335	1.052	0.129	81672
1963	74746	0.283	1.007	0.125	74227
1964	84234	0.282	1.199	0.156	70271
1965	68929	0.276	1.075	0.136	64106
1966	65085	0.312	0.904	0.098	71994
1967	79312	0.237	0.861	0.090	92117
1968	89671	0.235	0.795	0.080	112776
1969	71140	0.203	0.895	0.095	79487
1970	105465	0.398	0.833	0.090	126631
1971	83810	0.353	0.757	0.081	110685
1972	58237	0.301	0.509	0.056	114394
1973	65805	0.262	0.608	0.068	108197
1974	66436	0.303	0.525	0.056	126521

AVERAGE C.V. FOR THE MEAN: .117

Figure 1b. Mean catch rate indices for cod in NAFO Divisions 4R, 4S and 3Pn (1959-1974)

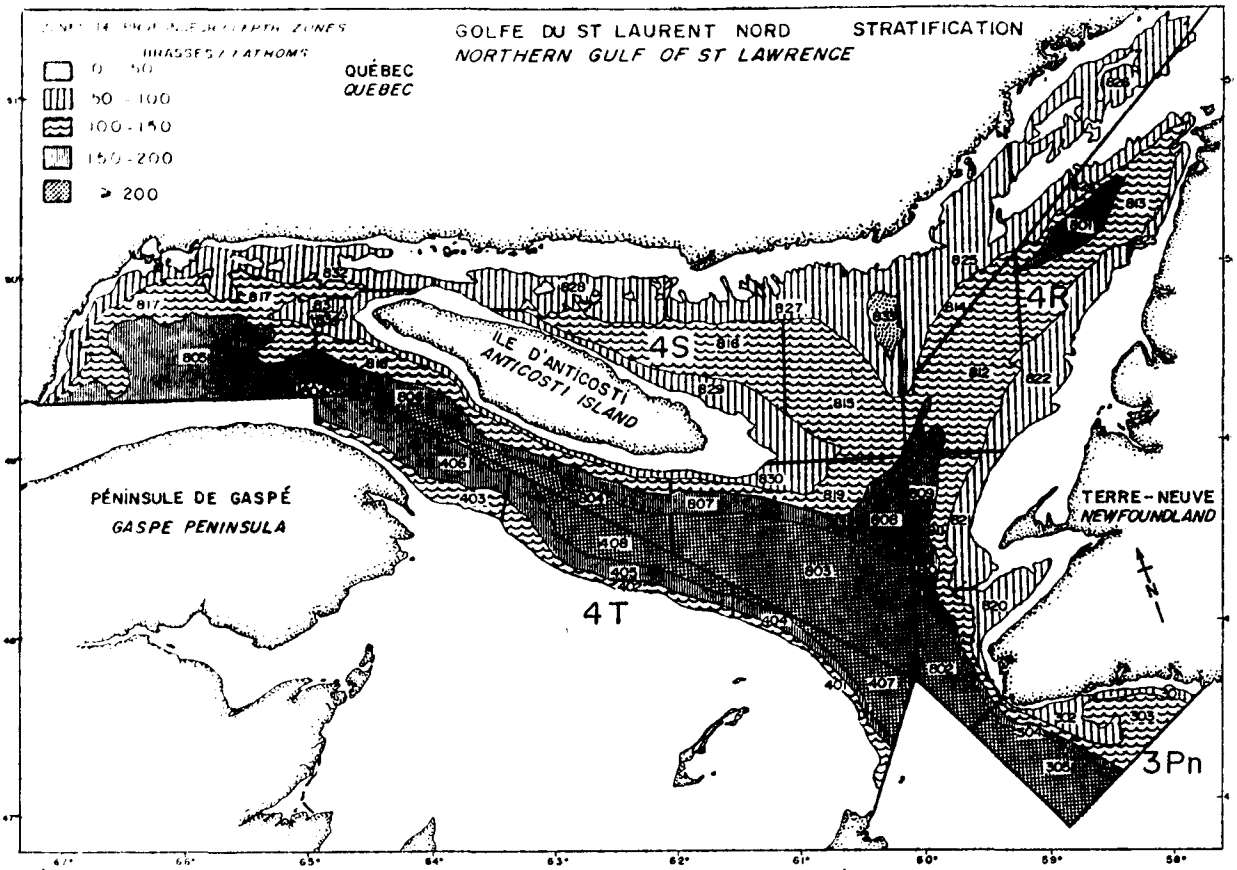


Figure 2a. Stratification scheme used for the groundfish surveys.

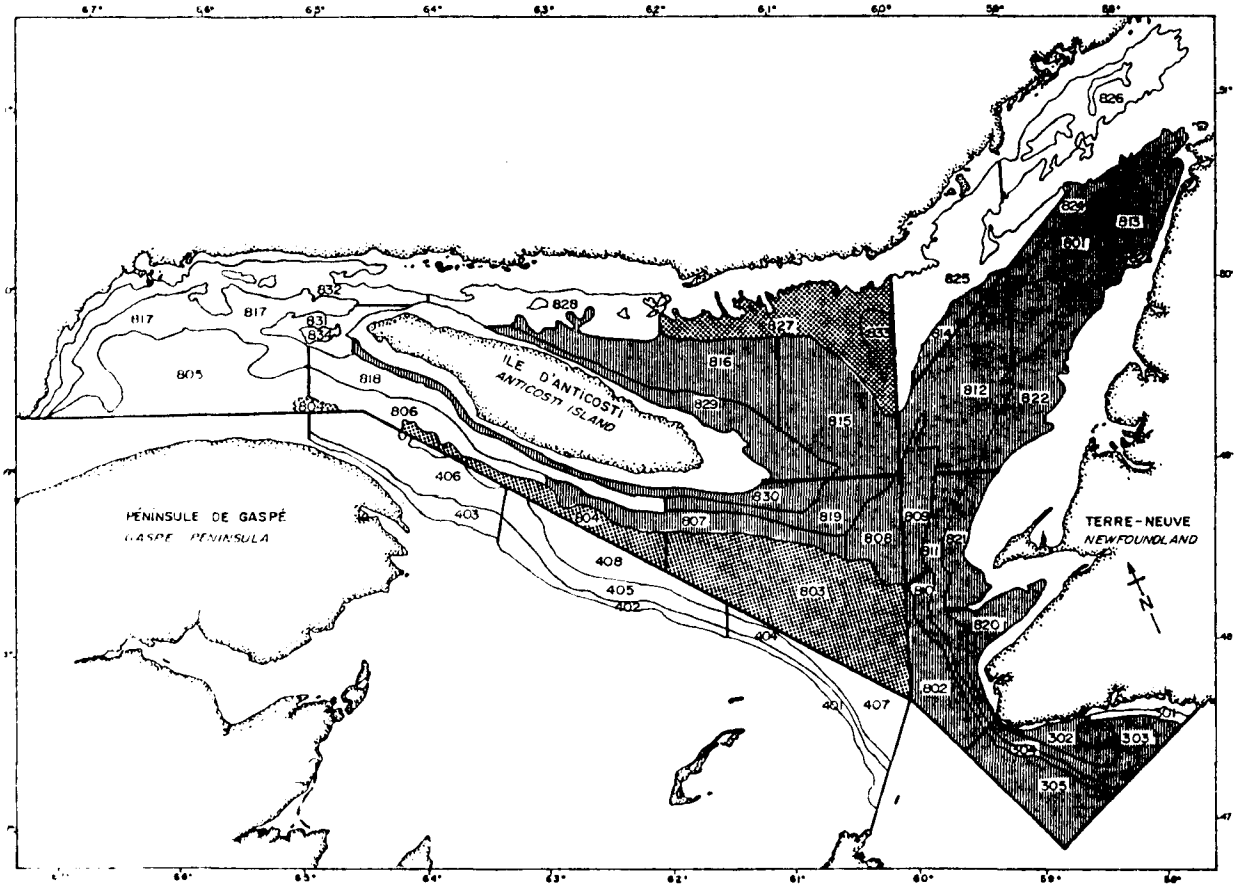


Figure 2b. Strata retained for the standardized survey results.

3a)

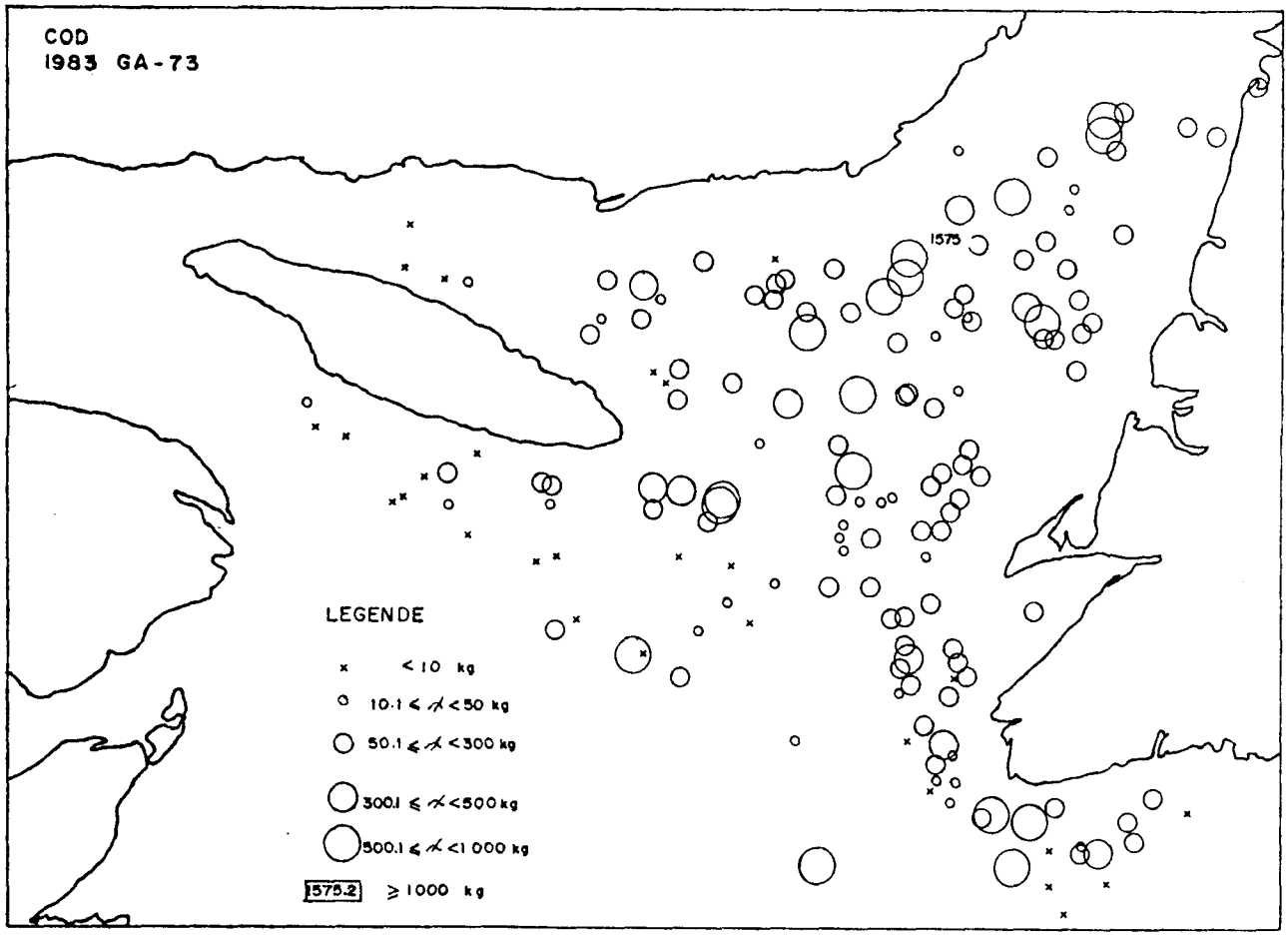
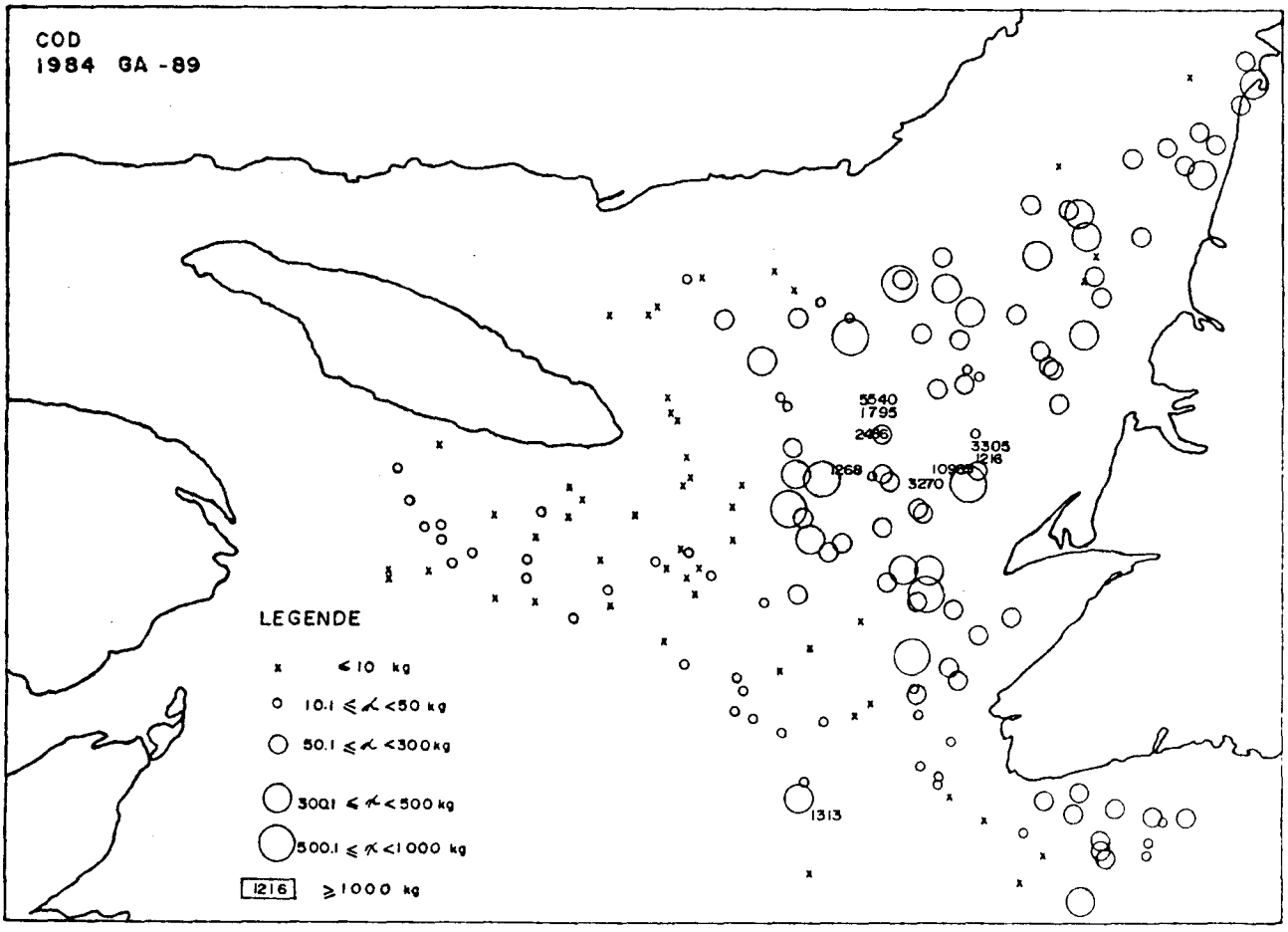


Figure 3a.b. Distribution and catch rate (kg/30 min. tow) of cod in research surveys on the Gadus Atlantica in January in 1983 and 1984.

3b)



3c)

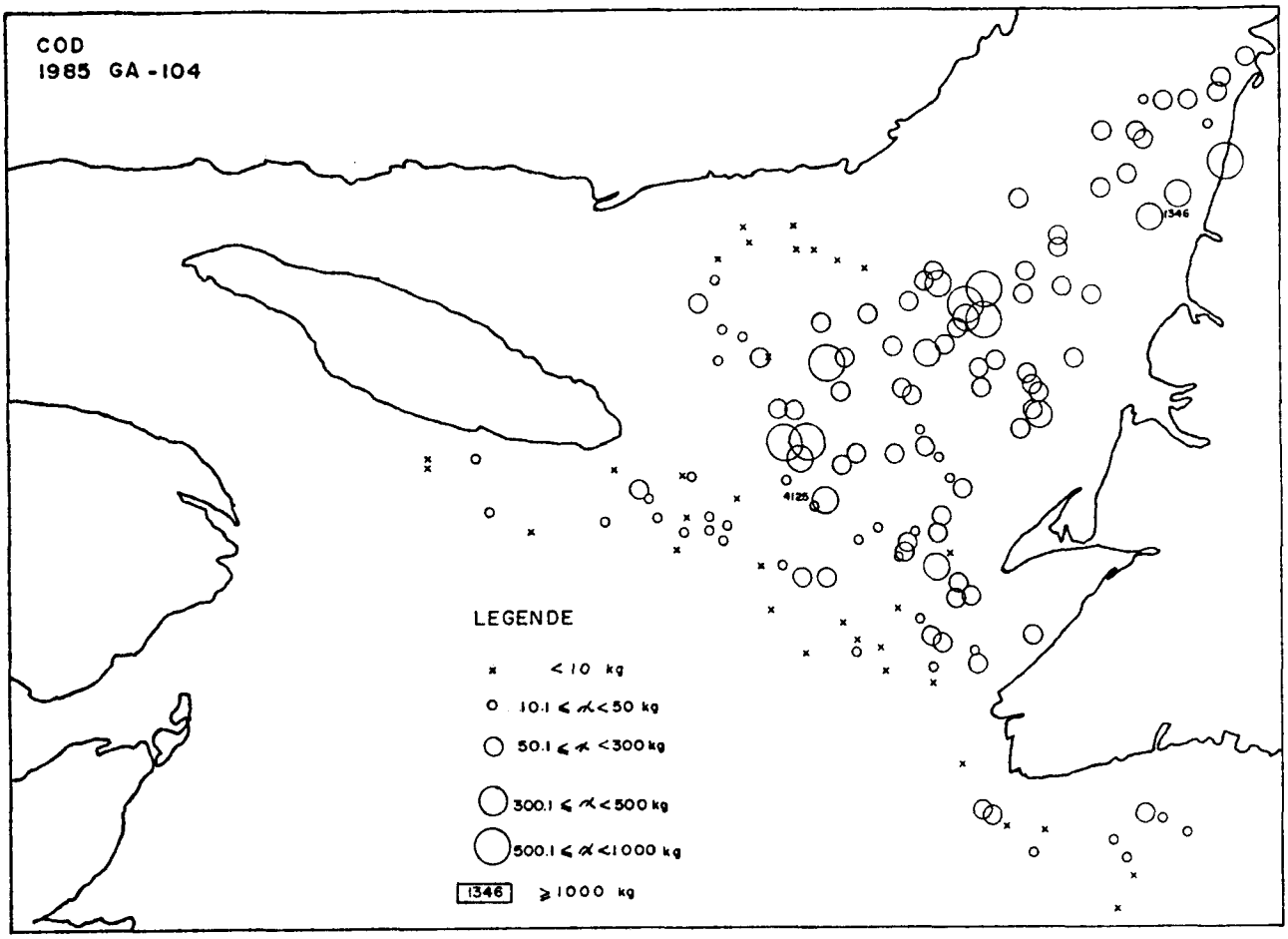
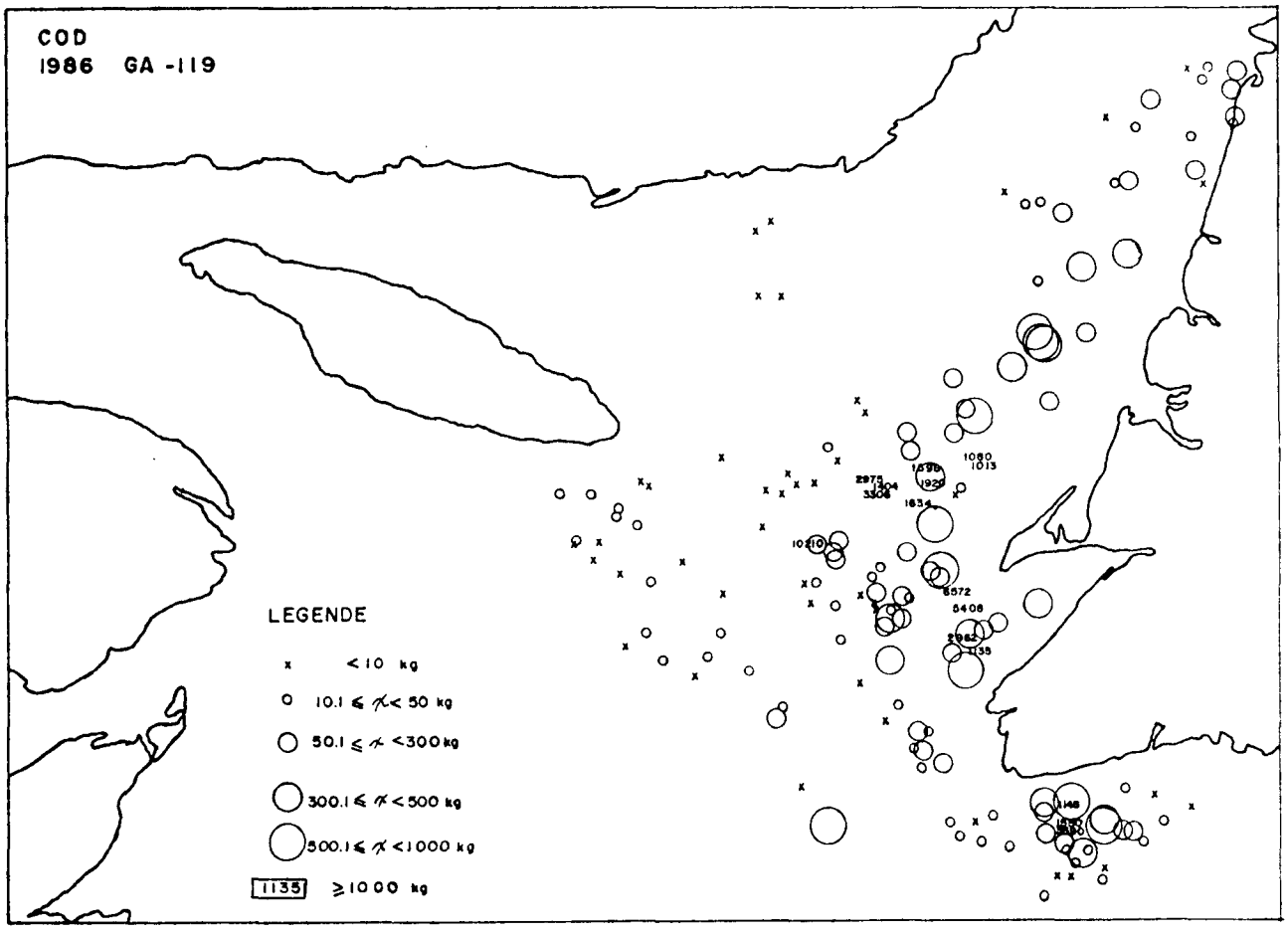


Figure 3.c.d. Distribution and catch rate (kg/30 min. tow) of cod in research surveys on the Gadus Atlantica in 1985 and 1986.

3d)



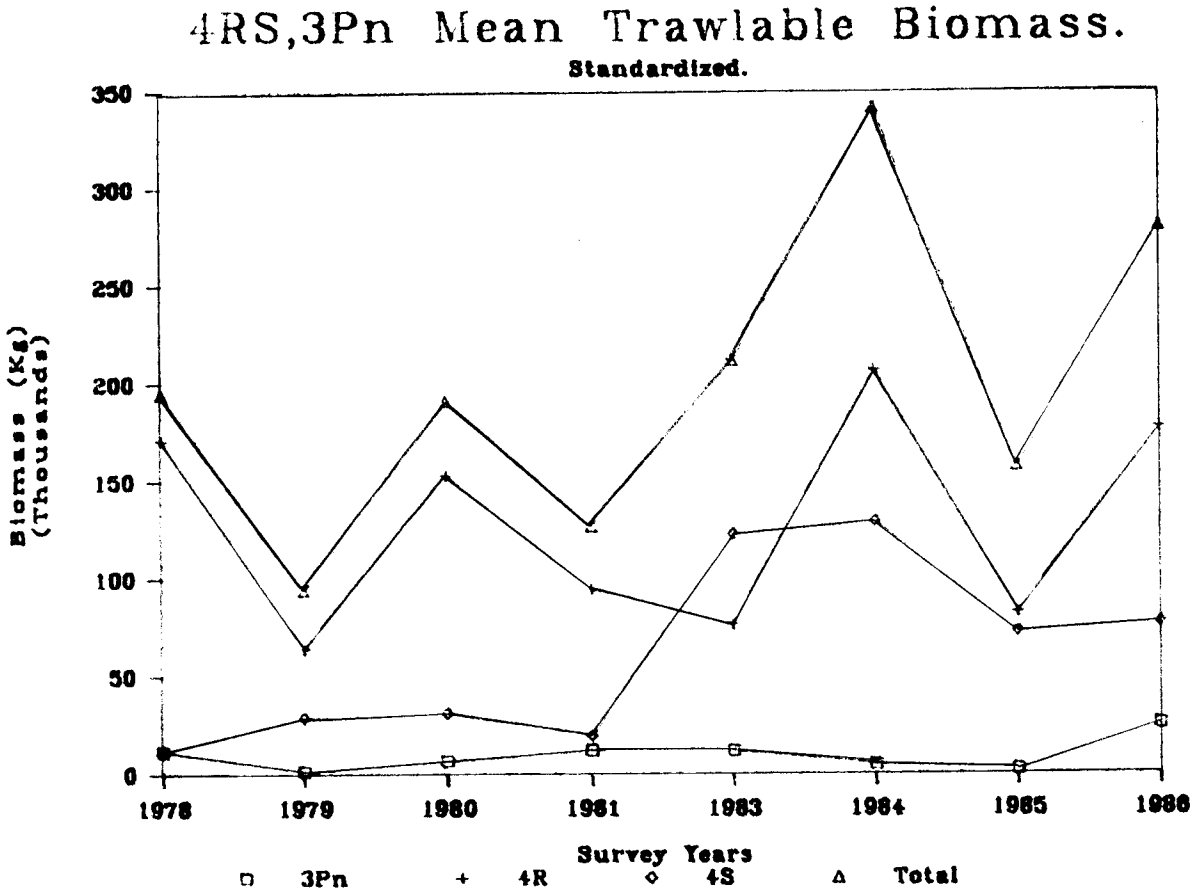


Figure 4. Mean trawlable biomass of cod in NAFO Divisions 4RS, 3Pn as estimated by random stratified surveys on the Gadus Atlantica.

Figure 5. 4RS, 3 Pn Cod: Changes in average length at age from the commercial fishery sampling

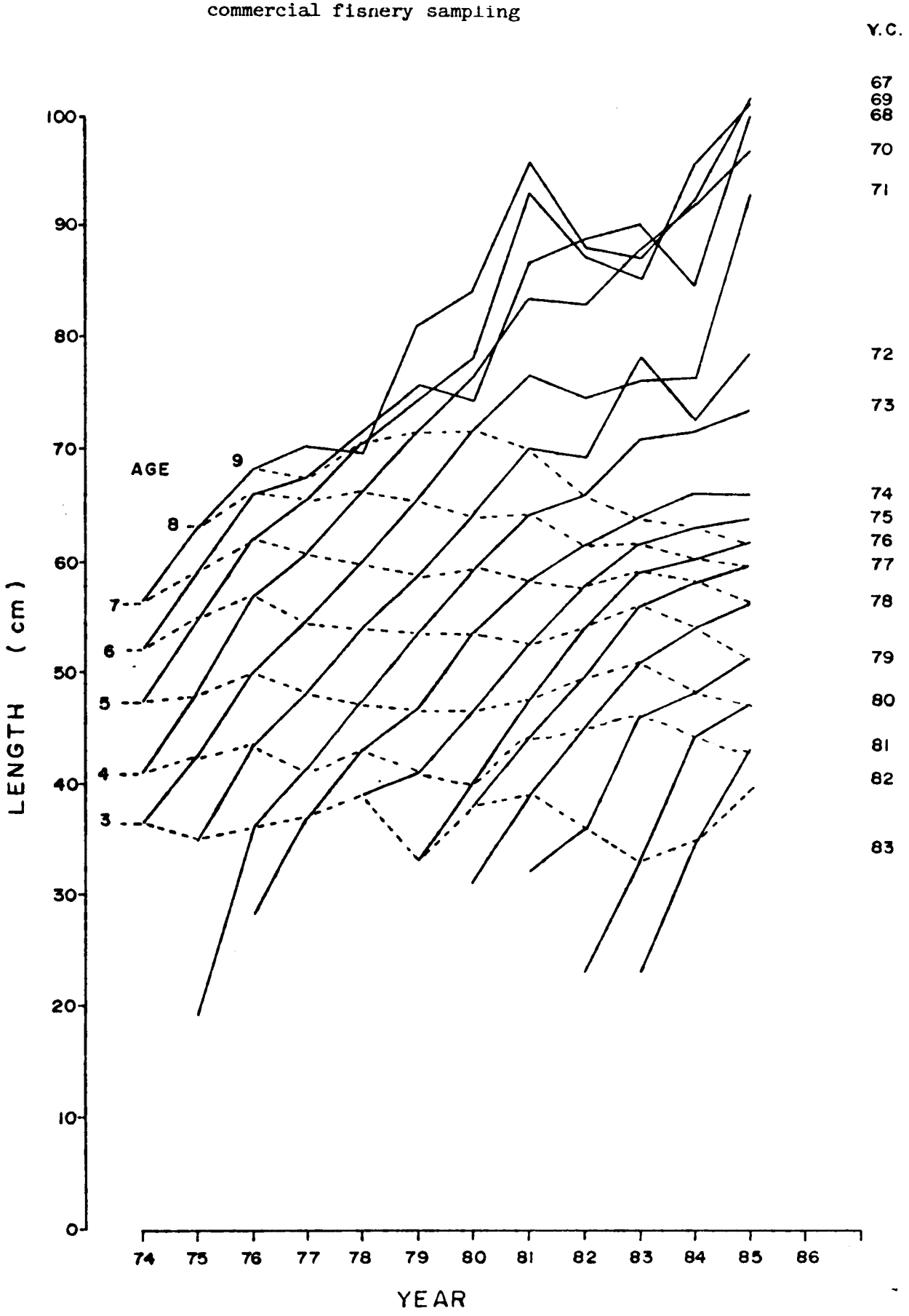


Figure 6. 4RS, 3 Pn Cod: Changes in average length at age from the winter research surveys

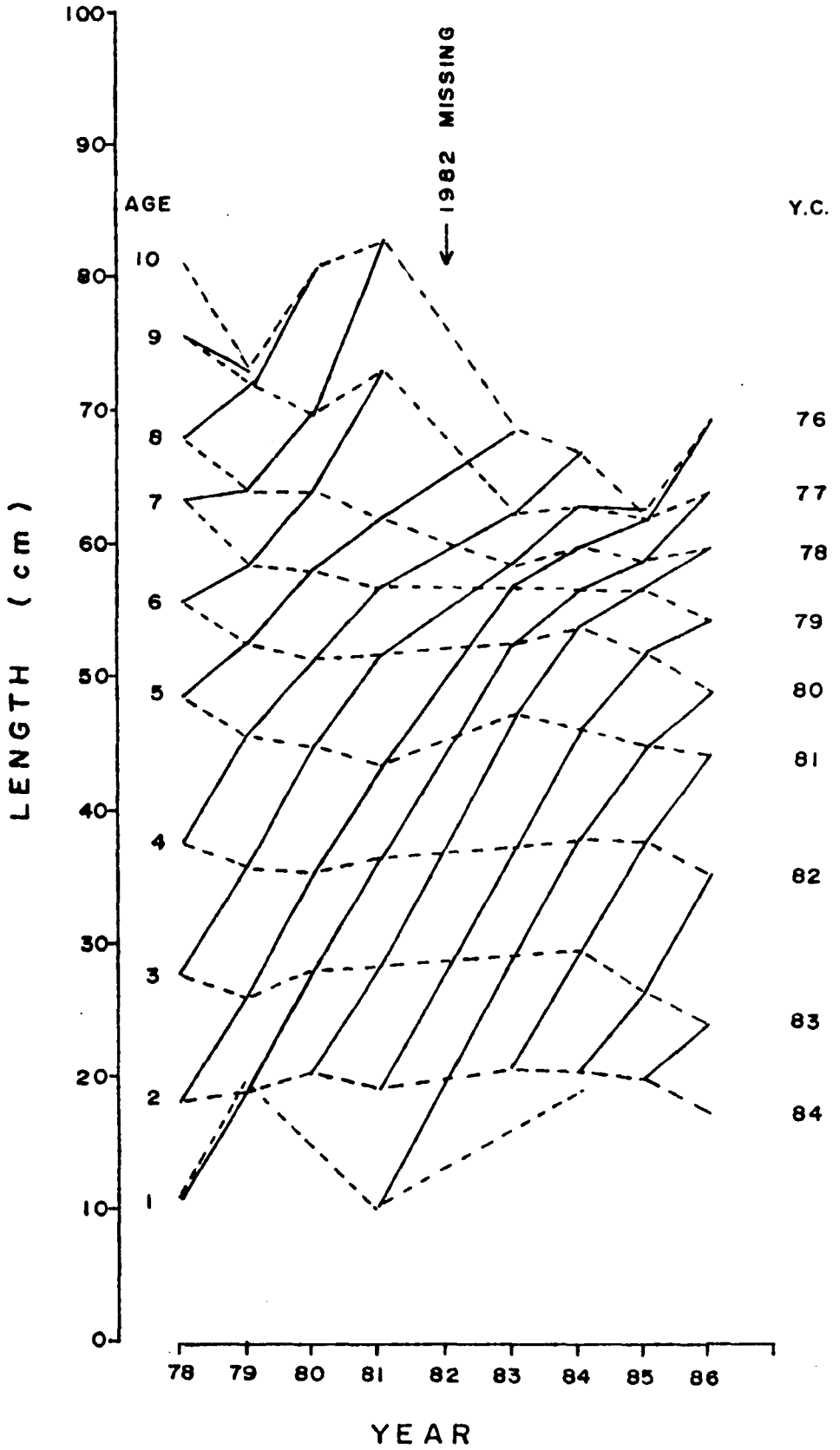


Figure 7. Calibration plot of catch rate to mean trawlable biomass for 4RS, 3Pn Cod at F_t = 0.4

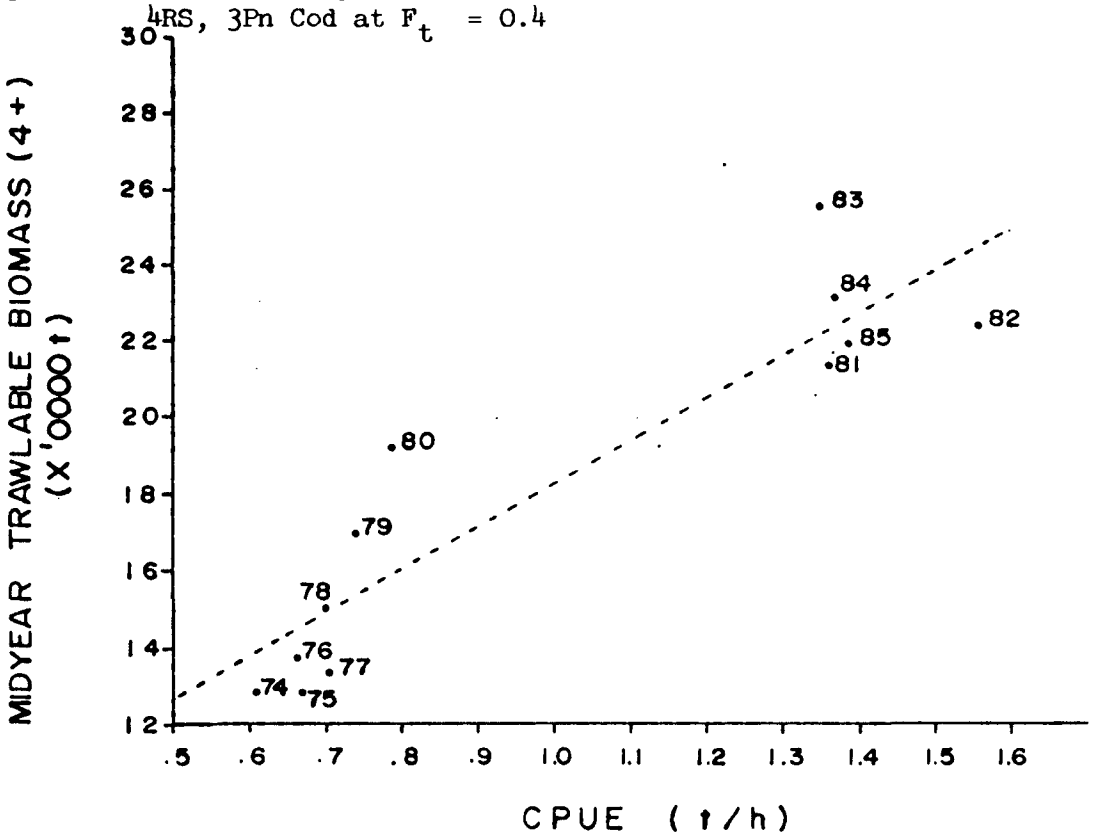
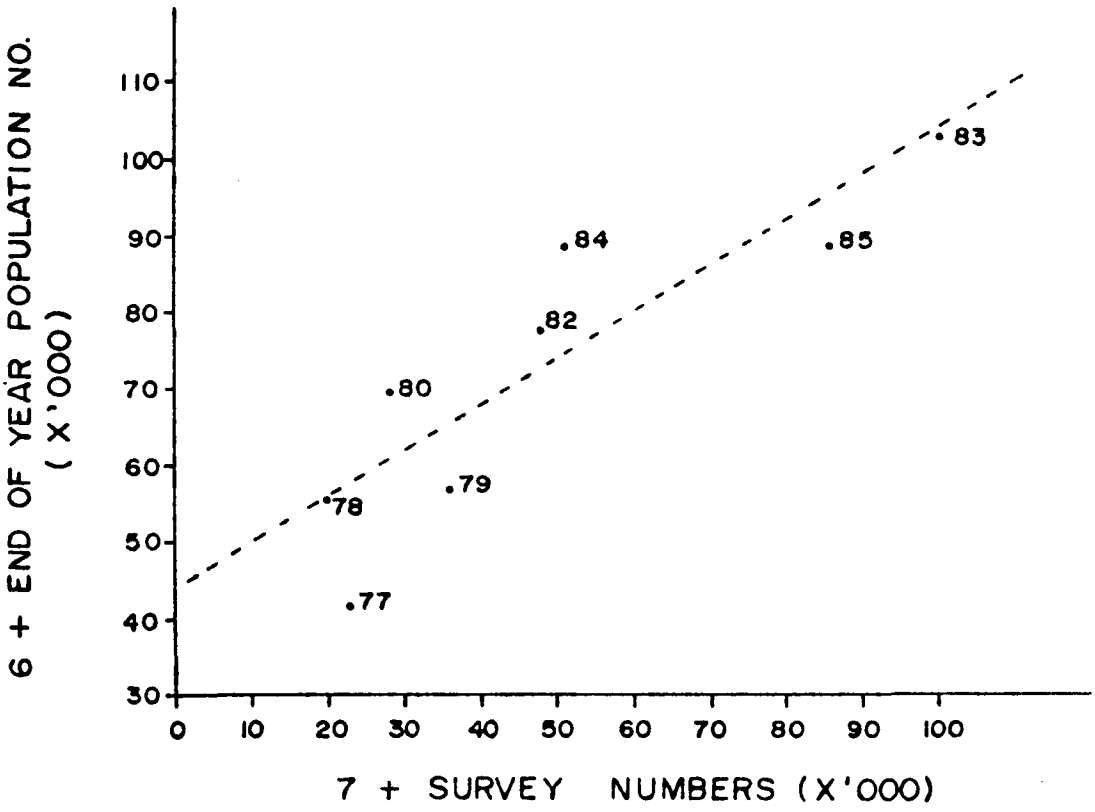
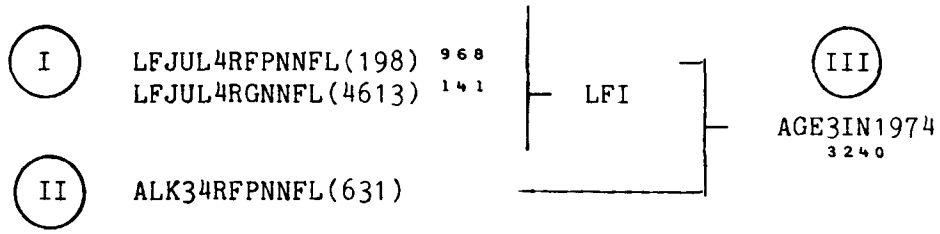


Figure 8. Calibration plot of estimated 7+ survey numbers to cohort end of year 6+ population estimate.



APPENDIX 1

Description of the following diagrams is as follows :



I $\quad \underline{LF}_{a} \quad \underline{JUL}_{b} \quad \underline{4R}_{c} \quad \underline{FPN}_{d} \quad \underline{NFL}_{e} \quad \underline{(198)}_{f} \quad \underline{^{968}}_{g}$

a: Length frequency	LF
b: Month	July
c: NAFO Division	4R
d: Fishing gear	Trap
e: Province	Newfoundland
f: Number of fish measured	198
g: Weighting factor	968

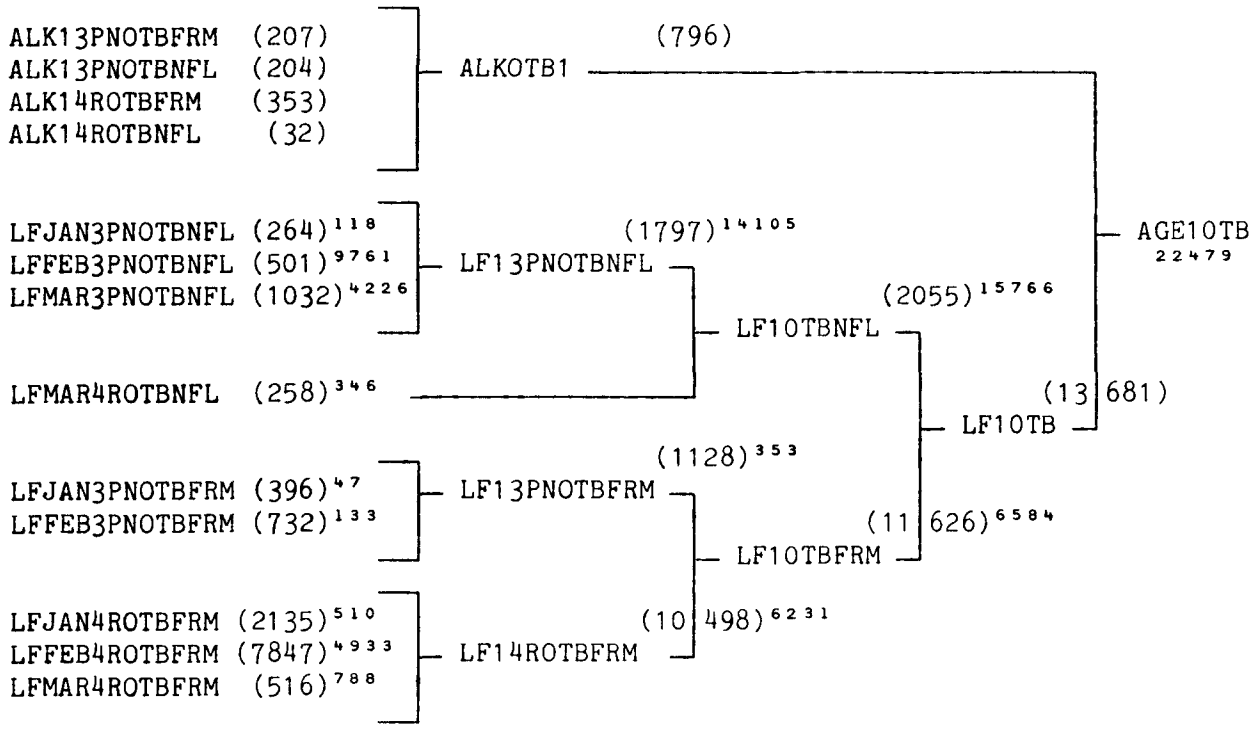
II $\quad \underline{ALK}_{a} \quad \underline{3}_{b} \quad \underline{4R}_{c} \quad \underline{FPN}_{d} \quad \underline{NFL}_{e} \quad \underline{(631)}_{f}$

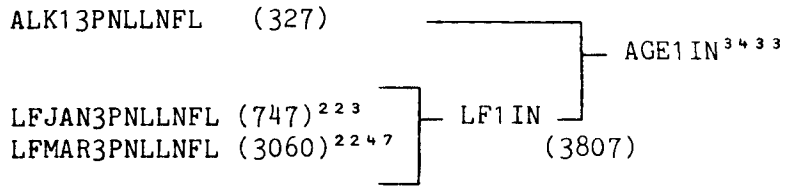
a: Age length key	ALK
b: Quarter	July to September
c: NAFO Division	4R
d: Fishing gearhe	Trap
e: Province	Newfoundland
f: Number of fish aged	631

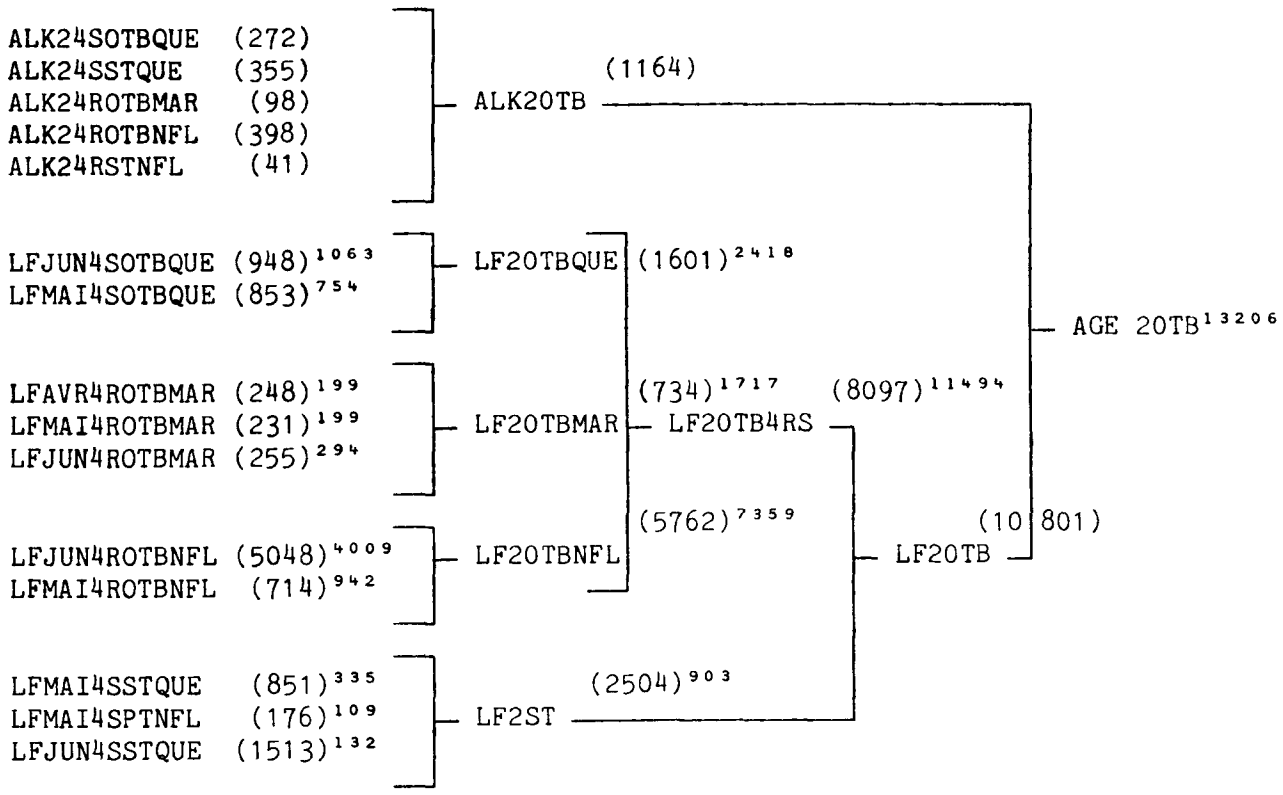
III $\quad \underline{AGE}_{a} \quad \underline{3}_{b} \quad \underline{IN}_{c} \quad \underline{1974}_{d} \quad \underline{^{3240}}_{e}$

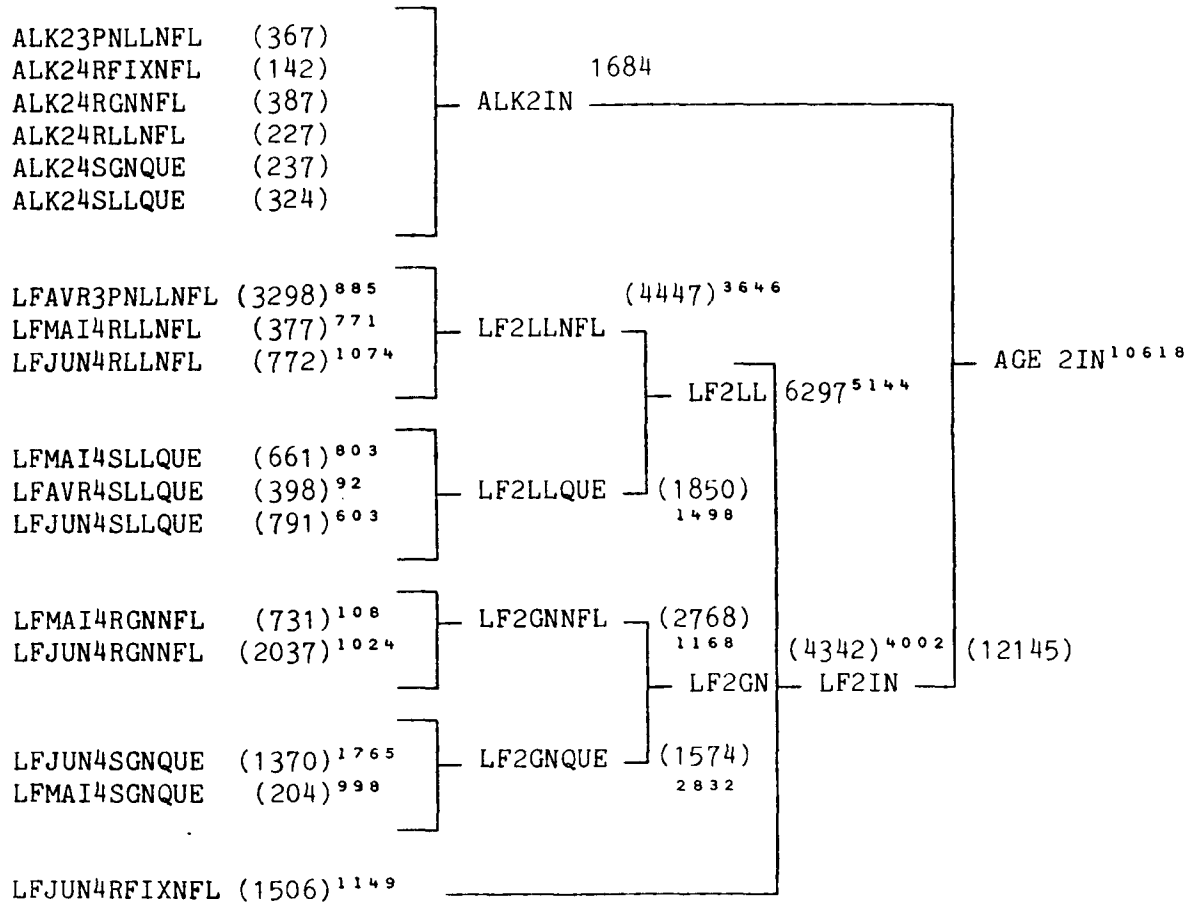
a: Indicates that catch numbers (and variance) mean length and weight at age have been calculated	AGE
b. Quarter	July to September
c. Fixed or mobile fishing gear	Fixed
d. Year	1974
e. Weighting (landings)	3240

- 1985 -

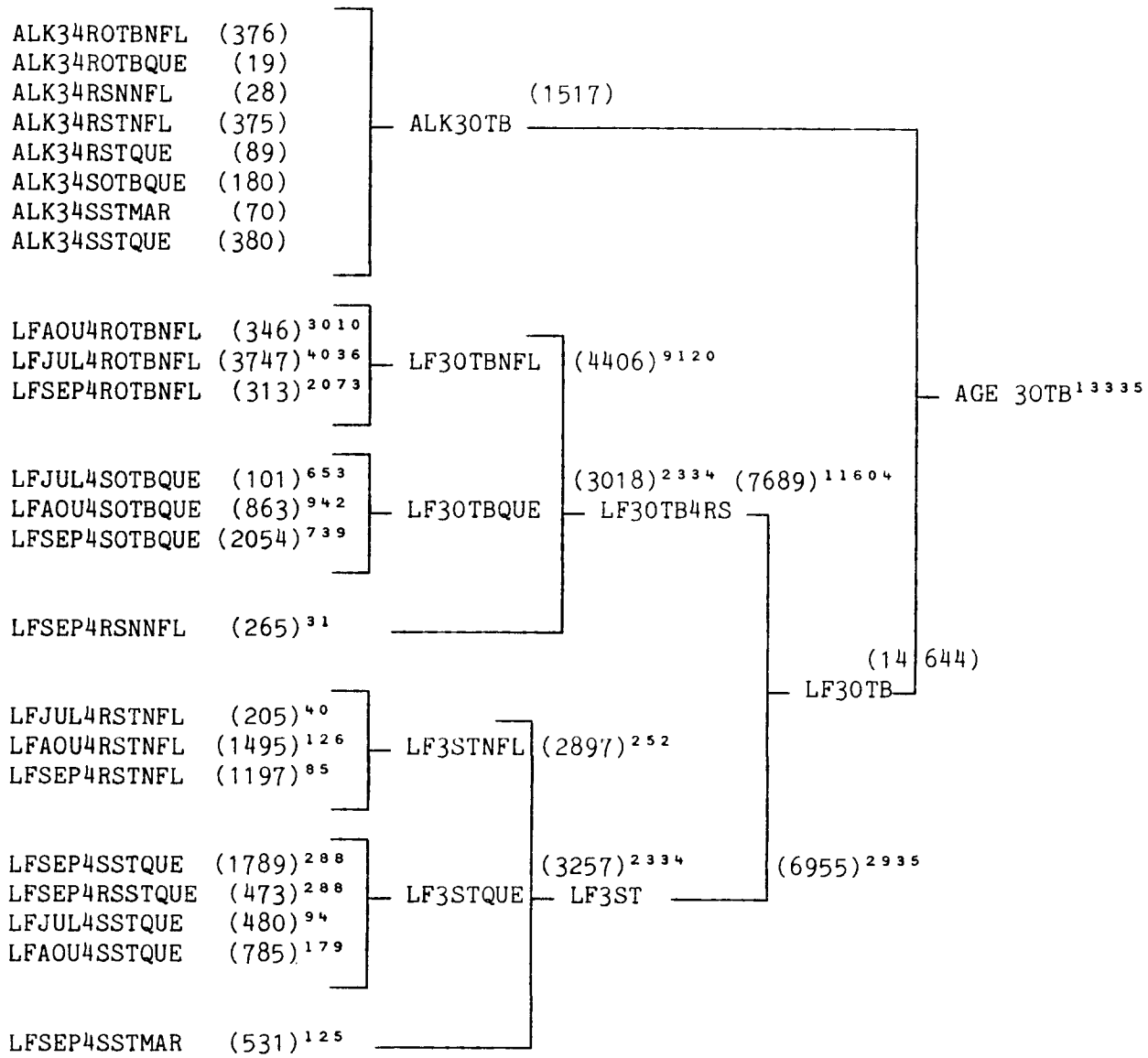

ALK13PNOTBFRM (207)
ALK13PNOTBNFL (204)
ALK14ROTBFRM (353)
ALK14ROTBNFL (32)
ALKOTB1
(796)
LFJAN3PNOTBNFL (264)118
LFFEB3PNOTBNFL (501)9761
LFMAR3PNOTBNFL (1032)4226
LF13PNOTBNFL
(1797)14105
AGE10TB
22479
(2055)15766
LF10TBNFL
LFMAR4ROTBNFL (258)346
(13 681)
LF10TB
(1128)353
LFJAN3PNOTBFRM (396)47
LFFEB3PNOTBFRM (732)133
LF13PNOTBFRM
(11 626)6584
LF10TBFRM
LFJAN4ROTBFRM (2135)510
LFFEB4ROTBFRM (7847)4933
LFMAR4ROTBFRM (516)788
LF14ROTBFRM
(10 498)6231


ALK13PNLLNFL (327)
AGE1IN3433
LFJAN3PNLLNFL (747)223
LFMAR3PNLLNFL (3060)2247
LF1IN
(3807)

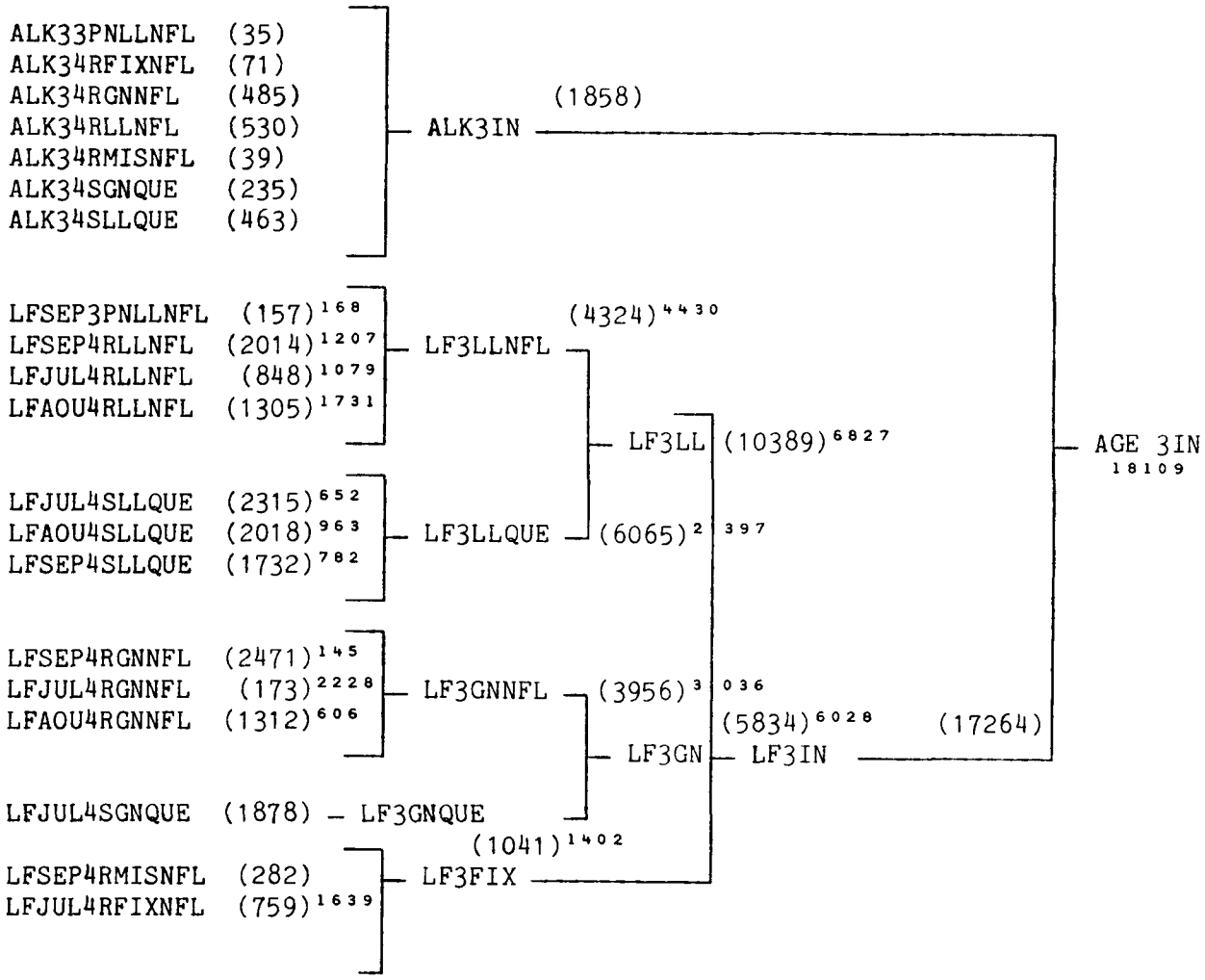

ALK24SOTBQUE (272)
ALK24SSTQUE (355)
ALK24ROTBMAR (98)
ALK24ROTBNFL (398)
ALK24RSTNFL (41)
ALK20TB
(1164)
LFJUN4SOTBQUE (948)1063
LFMAI4SOTBQUE (853)754
LF20TBQUE
(1601)2418
LFAVR4ROTBMAR (248)199
LFMAI4ROTBMAR (231)199
LFJUN4ROTBMAR (255)294
LF20TBMAR
(734)1717
LF20TB4RS
(8097)11494
AGE 20TB13206
LFJUN4ROTBNFL (5048)4009
LFMAI4ROTBNFL (714)942
LF20TBNFL
(5762)7359
(10801)
LF20TB
LFMAI4SSTQUE (851)335
LFMAI4SPTNFL (176)109
LFJUN4SSTQUE (1513)132
LF2ST
(2504)903


ALK23PNLLNFL (367)
ALK24RFIXNFL (142)
ALK24RGNNFL (387)
ALK24RLLNFL (227)
ALK24SGNQUE (237)
ALK24SLLQUE (324)
ALK2IN
1684
LFAVR3PNLLNFL (3298)885
LFMAI4RLLNFL (377)771
LFJUN4RLLNFL (772)1074
LF2LLNFL
(4447)3646
LF2LL
6297 5144
AGE 2IN10618
LFMAI4SLLQUE (661)803
LFAVR4SLLQUE (398)92
LFJUN4SLLQUE (791)603
LF2LLQUE
(1850)
1498
LFMAI4RGNNFL (731)108
LFJUN4RGNNFL (2037)1024
LF2GNNFL
(2768)
1168
(4342)4002
(12145)
LF2GN
LF2IN
LFJUN4SGNQUE (1370)1765
LFMAI4SGNQUE (204)998
LF2GNQUE
(1574)
2832
LFJUN4RFIXNFL (1506)1149

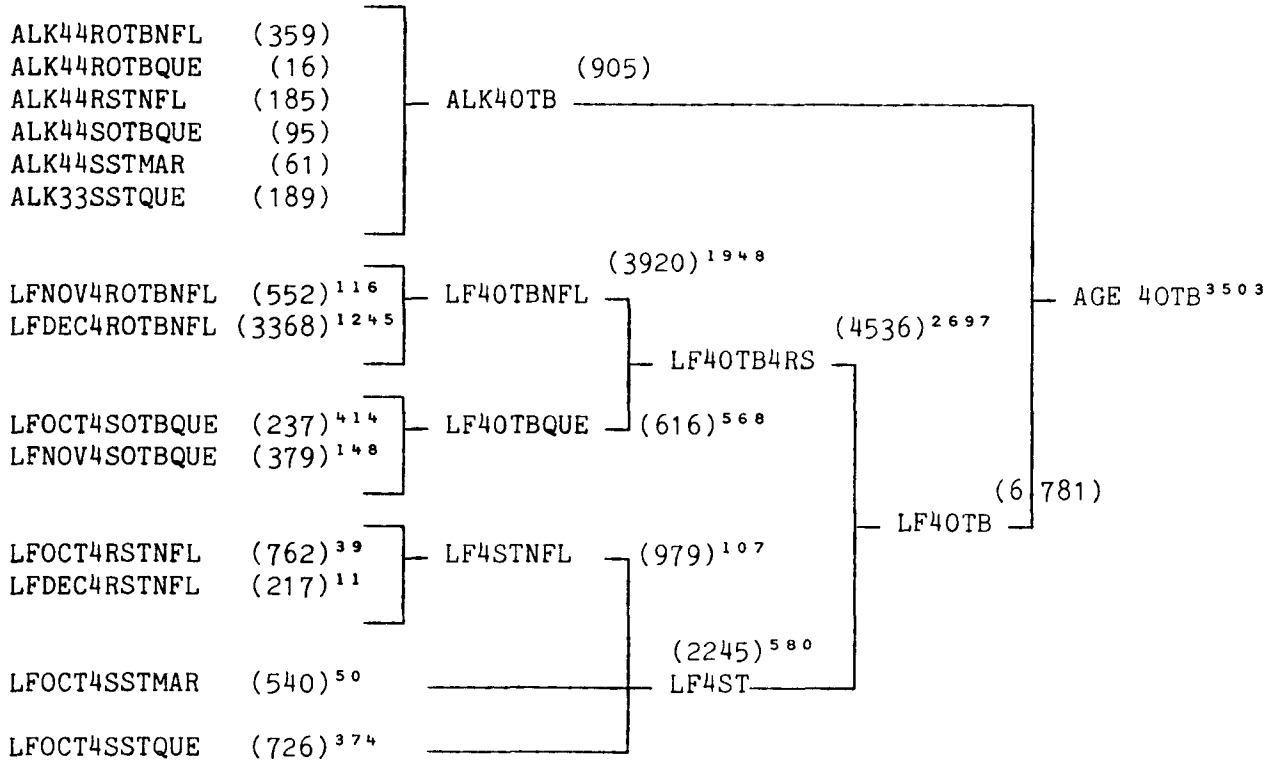
Appendix 1 (continued)

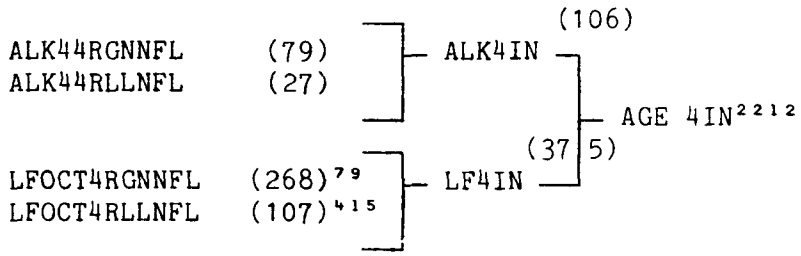


Appendix 1 (continued)

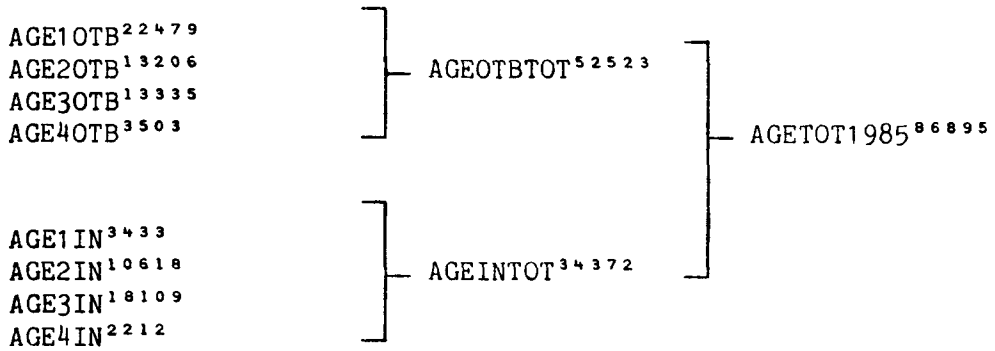


Appendix 1 (continued)





And finally:



Appendix 2

- 1986 -