An Assessment of the Cod Stock in NAFO Subdivision 3Ps

by

C. A. Bishop, J. W. Baird, and E. F. Murphy
Science Branch
Department of Fisheries and Oceans
P. O. Box 5667
St. John's, Newfoundland   A1C 5X1

Abstract

Catches of cod from NAFO Subdiv. 3Ps have ranged from a high of 84,000 t in 1961 to a low of 27,000 t in 1978. Since 1976 catches have been obtained only by Canada and France and, in recent years, total catches have been relatively stable at about 41,000 t. Research vessel indices of abundance from Canadian and French surveys, along with French commercial catch rates were used on a disaggregated basis in a single ADAPT calibration analysis to estimate fishing mortality and stock size for 1990. The assessment indicated that the fully recruited (ages 7-9) fishing mortality in 1990 was about 0.30. The age 3+ biomass at the beginning of 1990 was estimated to be about 215,000 t, among the highest observed in the time series.

Résumé

Les prises de morue dans la subdivision 3Ps de l'OPANO se sont échelonnées entre un maximum de 84 000 t en 1961 et un minimum de 27 000 t en 1978. Depuis 1976, ces prises proviennent exclusivement de navires canadiens et français. Ces dernières années, les prises totales ont été relativement stables, se situant autour des 41 000 t. On a utilisé les indices d'abondance obtenus lors des campagnes d'évaluation effectuées par les navires scientifiques canadiens et français ainsi que les prises commerciales des navires français, sous forme désagrégée, dans une seule analyse d'étalonnage ADAPT afin d'estimer la mortalité due à la pêche et la grosseur du stock pour 1990. L'évaluation a révélé que la mortalité due à la pêche dans le stock pleinement recruté (âges 7 - 9) était d'environ 0,30 en 1990. On a chiffré à environ 215 000 t la biomasse d'âge 3 + au début de 1990, ce qui représente le plus haut niveau de la série chronologique.

Nominal catch

Nominal catches have ranged from a high of 84,000 t in 1961 to a low of 27,000 t in 1978 (Table 1, Fig. 1). In the period from 1959 to 1974, catches were highest, being in excess of 44,000 t (Ave. 62,000 t) and were followed by a decline to about 35,000 t in 1975, a general level that persisted until 1984. From 1985 to 1987, catches averaged 55,000 t mainly as a result of increased catches by France. Since 1988, catches have been relatively stable at about 41,000 t.

Since 1976, only Canada and France have participated in the fishery. Catches by inshore gears (trap, gillnet, longline, and handline) have traditionally taken the largest proportion of the Canadian catches and have ranged between 20,000 t and 29,000 t since 1976. Catches by gear (Fig. 2) indicate a declining trend for longline in recent years, an increase in gillnet catches from 1978 to 1987 with a subsequent decline, and variable catches for cod trap since the early 1980s ranging from 2400 t to 5700 t. French catches since 1959 have been taken by a metropolitan France freezer fleet and by inshore and offshore fleets based in St. Pierre and Miquelon (SPM). From 1959 to 1977, most of the SPM catch was obtained by an inshore fleet, with a peak catch of 3800 t in 1961. Inshore catches in 1990 are the lowest in the 1959-90 period. Offshore catches by SPM trawlers increased from about 200 t in 1975-76 to between 10,000 t and 15,000 t since 1985. Metropolitan France catches peaked in 1986 at about 12,000 t but have since declined with no fishing activity reported for 1990.

Nominal catches reported for 1990 (Table 2) were obtained from the Department of Fisheries and Oceans (Canada) and from French scientists at the IFREMER laboratory at St. Pierre (France).

Catch and average weights-at-age

A summary of the sampling used to derive the Canadian catch-at-age in 1990 is given in Table 3. The following relationship was applied in deriving the average weights-at-age: log weight = 3.0879 log length - 5.2106. The discrepancy between reported and calculated catch from these average weights in 1990 was approximately 3%. Catch numbers and average lengths and weights-at-age and by gear are shown in Tables 4 and 5. The 1985 and 1986 year-classes were most abundant in the total catch. Similar data (Table 6) for the French catch were provided by the St. Pierre laboratory and indicated, as well, a predominance of the same year-classes (Table 6, Fig. 3). Average weights-at-age from French catches were somewhat higher at the earlier ages (2-4) and lower at ages 5 and older.

Tables 7 and 8 show catch and average weights-at-age for the 1959-90 period. Average weights-at-age have been stable in recent years with no evident trend.

Research vessel surveys

Stratified-random surveys have been conducted in Subdiv. 3Ps by France since 1978 and by Canada since 1972. The survey series are similar with regard to the stratification scheme used (Fig. 4), method of sampling, and analysis of results but differ in the type of fishing gear used and daily

timing of the survey (daylight h only for French survey). Canadian surveys
have covered strata in depth ranges to 300 fath. since 1980 while similar
coverage by the French surveys occurred only in 1981, 1983, and 1990-91. To
account for incomplete coverage of strata in certain years for both surveys,
estimates of biomass and abundance for non-sampled strata were obtained using
a multiplicative model. Results from both survey series are highly variable.

Biomass estimates from Canadian surveys increased from about 24,000 t in
1984 to 85,000 t in 1988, declined substantially to 43,000 t in 1989, but have
since shown a moderate increase (Table 9, Fig. 5). Abundance estimates
(Table 10, Fig. 6) showed a similar pattern with the increases in 1990 and
1991 being more pronounced because of incoming strong year-classes.

French surveys (Table 13-14) showed a peak in 1986 for both biomass and
abundance followed by declines to 1989 for biomass and 1988 for abundance.
Both biomass and abundance have increased since that time.

Both survey series have indicated that a substantial portion of the
biomass was found in depths greater than 200 fath. in both 1990 and 1991.

Bottom temperatures from the Canadian surveys in 1991 (Table 12)
indicated the persistence of temperatures less than 0.0°C over depths 50 fath.
and shallower. In 1990 and 1991, temperatures less than 0.0°C were also
recorded in the 50-100 fath. depth range.

Mean number-per-tow estimates from the Canadian surveys (Table 11)
indicated that in 1991 the 1985-87 year-classes were most abundant. As stated
previously, French surveys have only covered depths from 200 fath. to
300 fath. in 4 of the 14 surveys. These surveys in 1990 and 1991 indicated
that a considerable portion of the total biomass occurred in the deeper waters
in 1990 and 1991, particularly in strata bordering the Laurentian Channel
(711-714). This pattern was similar to that observed in the Canadian surveys.
Mean number-per-tow estimates previously provided by French scientists have
not included data from the deeper waters (with the exception of stratum 708).
For the current assessment, age compositions for the deeper strata were
provided for 1990 and 1991 and are included in Table 15. Because information
was not available for previous years, it was assumed that either (1) there was
no catch in the deeper water strata in the earlier years (Table 15) or
(2) that the proportion of numbers in the unsurveyed area was the same as that
observed in the Canadian surveys when there had been coverage (Table 16). It
was felt that the latter was probably a more reasonable assumption and the
resulting data were used as an index for assessment purposes. The French
survey indicated that the 1986 and 1987 year-classes were most abundant and
that the abundance of the 1989 year-class was substantial.

Commercial catch and effort data

Catch rate data (t/h) for the Canadian fleet during the period 1977-90
and French (SPM) fleet during the 1978-90 period were included in separate
multiplicative analyses. Data for the Canadian fishery were obtained from
NAFO Statistical Bulletins (1977-88) and by the Department of Fisheries and
Oceans, Canada (1989-90). Data for the French fishery was provided by the
French (SPM) laboratory. To reduce the possible effects of rounding and

truncation errors, data with less that 10 t catch or 10 h effort were excluded in both analyses.

For the Canadian catch rates, the model explained 58% of the variation in the data (Table 17) and all categories were significant. There were no strong seasonal trends (Table 18) but catch rates were somewhat better in the first quarter of the year. Catch rates (Table 19, Fig. 7) increased from 1980 to 1984 but declined substantially in 1986 and have been stable since that time.

The model explained 67% of the variation in the data (Table 22) for French catch rates and all categories were significant. Catch rates were also best in the winter months (Table 23). French catch rates (Table 24, Fig. 8) increased from 1981 to 1986, then declined till 1989 but have increased in 1990.

For previous assessments, catch-at-age data for the otter trawler fleets was available only for SPM and Metro combined. For the current assessment, catch-at-age data was provided for the SPM otter trawl fleet from 1981 to 1990 (Table 25). Estimates for the 1978-80 period were obtained using the proportion of SPM otter trawl catch to total French otter trawl catch for those years. The proportion caught at age was more consistent than that of the Canadian series, but there has been a tendency to catch more younger fish in recent years.

Using effort data from the C/E analysis and the offshore catch-at-age data, catch rate-at-age indices were obtained. Canadian catch rate-at-age data (Tables 20-21) indicated substantial fluctuations in recent years with that for 1989 being substantially different. Ages 5-7 were dominant in 1988, 7-9 in 1989, and 5-9 in 1990. In the most recent assessment (September 1990), this variability was considered sufficient to preclude the use of the index in the assessment model (ADAPT). French catch rate-at-age based on SPM otter trawl data (Table 26) indicates that ages 4 and 5 were the dominant ages.

Estimation of stock size

Stock size was estimated using a formulation of the adaptive framework using Canadian and French research vessel and French catch rate indices. The Canadian catch rate index was not used because of anomalies in age compositions described earlier.

Canadian survey data prior to 1978 were not used for calibration mainly because strata coverage was incomplete in the earlier years. Each of the three indices used was not sufficient on its own to estimate abundance reliably. The formulations used combined all of the information from the three indices. The structure imposed for the analysis was as follows:

- Natural mortality was assumed to be 0.20
- Error in the catch at age assumed negligible
- F on the oldest age groups (14) was calculated as 20% of the total F for age groups 7-9
- Intercepts were not fitted
- F on age 13 in 1990 was set equal to the F for age 12

As was the case in the previous assessment, fishing mortality on the oldest age (14) set at 20% that of fully recruited ages (7-9) produced stable catchabilities for RV ages 8+.

Catch-at-age by the St. Pierre otter trawl fleet was, in recent years, mainly from ages 4 to 8. Only these ages were used in the French disaggregated catch rate index in the ADAPT formulation.

Parameters of the ADAPT framework

- Year-class estimates: $N_{i,1990}$ $\qquad$ i = 3 to 12

- Calibration coefficients for Canadian and French RV numbers and C/E

$K_{i,1}$	i = 3 to 12	(Canadian RV)
$K_{i,2}$	i = 3 to 12	(French RV)
$K_{i,3}$	i = 4 to 8	(French C/E)

Input

- $C_{i,t}$	i = 3 to 12	t = 1978-90
- $RV1_{i,t}$ (Canada)	i = 3 to 12	t = 1978-91
- $RV2_{i,t}$ (France)	i = 3 to 12	t = 1978-91
- $C/E_{i,t}$ (France)	i = 4 to 8	t = 1978-90

The winter surveys and catch rates were related to population at the beginning of the year.

Objective function

- Minimize

$$\sum_i\sum_t\{obs(lnRV1_{i,t})-pred(lnRV1_{i,t})\}^2 + \sum_i\sum_t\{obs(lnRV2_{i,t})-pred(lnRV2_{i,t})\}^2$$

$$+ \quad \sum_i\sum_t\{obs(lnC/E_{i,t})-pred(lnC/E_{i,t})\}^2$$

Summary

- Number of observations = 345
- Number of parameters = 25

Population numbers estimated for the terminal year by ADAPT for ages 4 to 12 all were associated with coefficients of variation between 23% and 28%. The age 3 population was estimated with a CV of 35% (Table 27). All RV and C/E catchabilities were estimated with CVs of 18% or 19%. Residual patterns indicated year-effects for each of the three indices used in the calibration (Table 28). All correlations were suitably low (Table 29). Population numbers, biomass and fishing mortality derived from this formulation are presented in Tables 30, 31, and 32 respectively.

The French RV index was also adjusted assuming zero catch in the non-surveyed strata in the 201-300 fath. depth range. This index was included with the Canadian RV and the French C/E in an ADAPT formulation. The parameter estimates and population tables are given in Tables 33 and 34 respectively. Results were similar to those from the original ADAPT formulation.

The French C/E index was estimated using offshore St. Pierre data for the 1981-90 period. The catch at age was not available for St. Pierre trawlers for the 1978-80 period so it was assumed that the catch at age during these three years was in the same proportion at the total (St. Pierre + Metro) French fleet. As well, residual patterns from the initial ADAPT formulation indicated positive year effects for each of 1978, 1979, and 1980, the years when catch-at-age data was not available. An additional formulation was, therefore, attempted using St. Pierre C/E for 1981-90 with the French and Canadian RV. Again, results were very similar (Tables 35-36) to those obtained in the original formulation.

Assessment results

The results of the analysis indicates that the age 3+ population abundance in 1990 was just over 300 million fish (Table 30). About 75% of this estimate is comprised of age 3- and 4-year-old cod, the 1986 and 1987 year-classes (Fig. 11). These two year-classes at age 3 in 1989 and 1990 were estimated at 123 million and 136 million fish respectively. The size of the age 3+ abundance and of these two year-classes at age 3 are higher than any previously observed in the 32-year time series available for this stock. The age 5 estimate for 1990 (the 1985 year-class) is estimated to be about the same size as the strong 1980 year-class. The 1983 and 1984 year-classes are weak.

Age 3+ population biomass at the beginning of the year was at its lowest level in the mid-1970s at about 80,000 t (Table 31, Fig. 9). A regular increase occurred until about 1985 to about 225,000 t with a subsequent decline to about 160,000 t in 1987-88. This recent decline can be attributed to the weak 1983-84 year-classes. Biomass is currently higher than any previously observed because of the high estimates of the 1986 and 1987 year-classes. If these two year-classes were set at the level of the 1985 year-class (80 million), the current biomass would be about 215,000 t, still among the highest biomass estimates in the time series but within the range of those previously observed.

The age 6+ biomass increased from the low levels of the mid-1970s and peaked at about 120,000 t in 1986. The decline in recent years has resulted partly from the incoming weak 1983 and 1984 year-classes.

Fully-recruited fishing mortality (ages 7-9) for this stock has been as high as 1.2 in 1975 but has generally been in the range of 0.30 to 0.70. The fully-recruited fishing mortality in 1990 was approximately 0.30, lower than the previous few years but about the same as that estimated for 1984.

Projections

The parameters used for the projection of the 1992 catch are as follows:

Age	January 1991 population Nos. ('000)	Average weight (1988-90) (kg)	Partial recruitment
3	50,000	0.61	0.03
4	63,687	0.83	0.31
5	45,065	1.17	0.76
6	29,319	1.72	0.97
7	9,329	2.29	1.00
8	3,176	3.10	1.00
9	3,665	3.97	1.00
10	1,900	5.08	0.60
11	844	6.08	0.43
12	546	7.17	0.36
13	467	7.84	0.34
14	211	9.34	0.20
15	328	12.08	0.20
16	0	13.74	0.20

The weights at age are averages of the values for the 1988-90 period. The partial recruitment vector was determined from the average fishing mortalities for the 1986-90 period with full recruitment at ages 7-9 years. Natural mortality was assumed to be 0.20. The 1988 and 1989 year-classes at age 3 in 1991 and 1992 were assumed to be 50 million fish, the geometric mean of the age 3 population numbers for the 1978-88 period.

The results of the assessment indicated that the 1986 and 1987 year-classes at age 3 (Fig. 11) were outside the range of any previously observed recruitment for this stock. Therefore, for the purposes of projection, these two year-classes were set at the size of the next highest year-class in the calibrated period, the 1985 year-class at 80 million fish.

Projections for 1992 were completed assuming a catch for 1991 of 44,475 t. This catch, comprised of the Canadian allocation of 29,875 t and the French unilateral quota of 14,600 t, generates a fishing mortality on fully-recruited ages in 1991 of about 0.34. Projections of catch and beginning of the year biomass for 1992 are provided for the following options:

1) $F_{0.1}$ (0.27)
2) 50% Rule (0.31)
3) Catch in 1992 = 44,475 t (Same as 1991 TAC)

Option	F in 1992	Catch in 1992 (t)	Biomass (t) January 1, 1992	January 1, 1993
1	0.270	39,170	228,100	235,500
2	0.310	44,300	228,100	230,200
3	0.313	44,475	228,100	230,000

Table 1. Cod catches (MT) from Subdivision 3Ps, 1959-90.

| | Can(N) | | | France | | | | | | |
| | Offshore (mobile) | Inshore (fixed gear) | Can(M) | STPM M Ins. | Off. | Metro | Spain | Portugal | Other | Total |
Year										
1959	2,726	32,718	4,784	3,078	–	4,952	7,794	3,647	471	60,170
1960	1,780	40,059	5,095	3,424	210	2,460	17,223	262	2,123	72,636
1961	2,167	32,506	3,883	3,793	347	11,490	21,015	4,985	3,434	83,620
1962	1,176	29,888	1,474	2,171	70	4,138	10,289	1,873	1,560	52,639
1963	1,099	30,447	331	1,112	645	324	10,826	209	6,828	51,821
1964	2,161	23,897	370	1,002	1,095	2,777	15,216	169	9,880	56,567
1965	2,459	25,902	1,203	1,863	707	1,781	13,404	–	4,535	51,854
1966	5,473	23,785	583	1,157	2,050	4,607	23,678	519	4,355	66,207
1967	3,861	26,331	1,259	2,244		3,204	20,851	980	4,044	62,774
1968	6,538	22,938	585	–	880	1,126	26,868	8	18,611	77,556
1969	4,269	20,009	849	1,415	1,062	15	28,141	57	7,982	63,799
1970	4,650	23,410	2,166	1,307	663	35	35,750	143	8,734	76,858
1971	8,657	26,651	731	1,196	455	2,730	19,169	81	2,778	62,448
1972	3,323	19,276	252	990	446	–	18,550	109	1,267	44,213
1973	3,107	21,349	181	976	189	–	19,952	1,180	5,707	52,641
1974	3,770	15,999	657	600	348	5,366	14,937	1,246	3,789	46,712
1975	741	14,332	122	586	189	3,549	12,234	1,350	2,270	35,373
1976	2,013	20,978	317	722	182	1,501	9,236	177	2,007	37,133
1977	3,333	23,755	2,171	845	407	1,734	–	–	–	32,245
1978	2,082	19,560	700	360	1,614	2,860	–	–	45	27,221
1979	2,381	23,413	863	495	3,794	2,060	–	–	–	33,006
1980	2,809	29,427	715	214	1,722	2,681	–	–	–	37,568
1981	2,696	26,068	2,321	333	3,768	3,706	–	–	–	38,892
1982	2,639	21,351	2,948	1,009	3,771	2,184	–	–	–	33,902
1983	2,100	23,915	2,580	843	4,775	4,238	–	–	–	38,451
1984	895	22,865	1,969	777	6,773	3,671	–	–	–	36,950
1985	4,529	24,854	3,476	642	9,422	8,444	–	–	–	51,367
1986	4,981	24,208	2,120	389	13,653	11,939	–	–	–	57,290
1987	3,693	26,589	2,517	551	15,214	8,737	–	–	–	57,301
1988	3,662	19,742	2,303	282	10,011	7,373	–	–	4	43,377
1989[a]	2,716	22,962	2,361	333	9,646	892	–	–	–	38,910
1990[a]	2,990	20,047	3,289	158	14,769	–	–	–	–	41,253

[a]Provisional.

Table 2. Cod landings (t) by Canada in 1990 from NAFO Subdivision 3Ps by month and gear.

Month	Can(N)						Can(SF)			Can(G)				Can Total
	OT	MWT	Trap	GN	HL	LL	OT	GN	LL	OT	DS	GN	LL	Total
Jan	257	1		109	9	388	276		49	17				1106
Feb	665	13		27	3	340	194		68		3			1313
Mar	846	42		23	11	687	358		180	1	12			2160
Apr	882	46		116	19	447	165		48	16	1			1740
May	189		37	293	62	117	109	6	8	14				835
Jun	3		2170	1192	406	376	6	39	8	10	37	1		4248
Jul	4		1513	2532	537	514		142	225	23	1	11		5502
Aug	6		55	895	598	933		58	321	6	4	1		2877
Sep	4		1	418	356	1421	10		281		7			2498
Oct	3		1	220	163	998	6		78		36		3	1508
Nov	11			308	65	695	1		96					1176
Dec	28			500	17	475	333		20					1373
	2898	102	3777	6633	2246	7391	1458	245	1382	87	101	13	3	26336

Catch by month for France.

	OT	Inshore	Total
Jan	1201		1201
Feb	875	1	876
Mar	2679	4	2683
Apr	2179	2	2181
May	1183	6	1189
Jun	393	69	462
Jul	1	34	35
Aug		25	25
Sep		12	12
Oct	590	4	594
Nov	2493	1	2494
Dec	3175		3175
TOT	14769	158	14927

Table 3. Commercial cod sampling by Can(N) in NAFO Subdivision 3Ps in 1990.

Quarter	Gear	No. aged	Month	No. measured	Landings (t) Month	Landings (t) Total
1	OT	679[a]	Jan.	165	257	550
			Feb.	239	665	862
			Mar.	1970	846	1217
2	OT	175	Apr.	845	1064	1432
			May	199	312	
1-4		854		3418		4544
1	MWT	679[a]	Feb.	395	13	102
1	Longline	534	Jan.	3528	388	437
	"		Feb.	3315	340	408
		534		6843		845
2	Longline	651	March	3196	867	1487
	"		Apr.	2363	495	
	Cod trap		May	1160	37	37
	Gillnet		May	370	293	574
		651		7089		2098
3	Longline	655	Aug.	2588	1254	2377
	Cod trap		June	6376	2170	3740
	"		July	3872	1513	
	Gillnet		June	3247	1192	1232
	"		July	1206	2532	2685
	"		Aug.	422	895	954
	Handline		Aug.	2565	598	1645
		655		20276		12633
4	Longline	851	Sept.	6499	1702	4067
	"		Oct.	3133	1079	
	"		Nov.	4227	791	
	Gillnet		Sept.	402	418	1446
	"		Nov.	277	308	
	Handline		Sept.	1565	356	601
		851		16103		6114
1-4	All	3545		54124		26336

[a]Combined OT and MWT key.

Table 4. Cod catch and average weight at age by gear from the Canadian fishery in NAFO Subdivision 3Ps during 1990.

Age	Mobile Gear	Cod Trap	Gillnet	Handline	Longline	Total
			Numbers $(x10^3)$			
2		1		1		2
3	1	593	6	267	586	1453
4	22	2585	156	860	1675	5299
5	291	1189	792	658	1918	4848
6	235	149	796	162	835	2177
7	188	29	452	49	343	1061
8	234	4	157	19	203	616
9	195	1	105	7	113	420
10	100		63	3	65	232
11	47		31	1	26	105
12	39		28	1	16	83
13	19		16		8	44
14	7		6		4	18
15	9		10		7	26
16	13		8		4	24
17	6		3		6	15
18	4				2	6
19	1				1	2
20+	3					3
#	1414	4551	2629	2028	5812	16434
wt	4646	3777	6891	2246	8776	26336
			Average Weight (kg)			
2		.25		.25		.25
3	.28	.54	.77	.52	.54	.54
4	.87	.68	1.14	.77	.84	.76
5	1.40	1.02	1.74	1.20	1.28	1.29
6	1.86	1.57	2.18	1.76	1.78	1.92
7	2.44	2.02	2.61	2.32	2.39	2.48
8	3.18	2.38	3.55	2.50	2.97	3.18
9	4.31	2.68	4.76	3.59	3.99	4.32
10	5.30		5.74	3.93	4.51	5.17
11	6.91		6.91	4.82	4.94	6.39
12	7.94		7.88	5.31	6.82	7.69
13	7.99		9.11		7.69	8.36
14	10.27		10.86		9.30	10.27
15	10.23		10.47		10.66	10.43
16	10.15		11.15		12.73	10.90
17	12.59		12.43		17.04	14.41
18	14.21				13.87	13.96
19	18.03				20.28	17.15
20+	23.06					23.06

TABLE 5. CATCH, AVERAGE WEIGHT AND LENGTH AT AGE FOR THE COMMERCIAL FISHERY FOR COD BY CANADA IN SUBDIV. 3PS (1990)

	AVERAGE		CATCH		
AGE	WEIGHT	LENGTH	MEAN	STD. ERR.	C. V.
2	0.236	30.450	1	0.72	0.50
3	0.535	39.489	1453	135.50	0.09
4	0.763	44.151	5299	197.53	0.04
5	1.289	52.194	4848	173.90	0.04
6	1.917	59.561	2177	92.85	0.04
7	2.480	64.698	1061	66.39	0.06
8	3.181	69.411	616	39.46	0.06
9	4.323	77.017	420	25.89	0.06
10	5.174	81.484	232	14.56	0.06
11	6.388	87.092	105	9.01	0.09
12	7.692	93.030	83	7.40	0.09
13	8.355	94.693	44	5.40	0.12
14	10.274	102.419	18	3.01	0.17
15	10.433	102.341	26	4.04	0.15
16	10.896	103.797	24	3.67	0.15
17	14.412	114.118	15	2.52	0.17
18	13.961	112.982	6	1.89	0.29
19	17.153	121.483	2	0.80	0.44
20	12.122	108.715	1	0.61	0.73
21	18.718	125.671		0.40	0.85
22	26.226	140.144	1	0.19	0.31
23	30.971	148.000	1	0.02	0.02
24	19.308	127.000	1	0.51	0.97

Table 6.   Catch and average weight at age of cod from NAFO
Subdiv. 3Ps from the fisheries by Canada and France in 1990.

Age	Canada			France			Total	
	No	Av Wt	No	Av Wt	Av Len	No	Av wt
2	2	0.25	23	0.57	38.69	25	0.54
3	1453	0.54	553	0.70	41.68	2006	0.58
4	5299	0.76	3323	1.01	47.83	8622	0.86
5	4848	1.29	3347	1.23	51.15	8195	1.27
6	2177	1.92	1152	1.72	57.75	3329	1.85
7	1061	2.48	422	2.38	64.50	1483	2.45
8	616	3.18	621	2.83	67.75	1237	3.00
9	420	4.32	272	4.06	76.19	692	4.22
10	232	5.17	118	4.92	81.09	350	5.09
11	105	6.39	37	6.23	88.03	142	6.35
12	83	7.69	21	7.22	92.07	104	7.60
13	44	8.36	3	7.63	94.50	47	8.31
14	18	10.27	4	10.82	104.86	22	10.37
15	26	10.43				26	10.43
16	24	10.90				24	10.90
17	15	14.41				15	14.41
18	6	13.96				6	13.96
19	2	17.15				2	17.15
20+	3	23.06				3	23.05
#	16434		9896			26330	
wt	26336		14927			41263	

TABLE 7. CATCH NUMBERS AT AGE (000s) OF COD IN SUBDIVISION 3Ps FOR 1959-1990.

	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
3	1001	567	450	1245	961	1906	2314	949	2871	1143	774	756	2884	731	945	1887
4	13940	5496	5586	6749	4499	5785	9636	13662	10913	12602	7098	8114	6444	4944	4707	6042
5	7525	23704	10357	9003	7091	5635	5799	13065	12900	13135	11585	12916	8574	4591	11386	9987
6	7265	6714	15960	4533	5275	5179	3609	4621	6392	5853	7178	9763	7266	3552	4010	6365
7	4875	3476	3616	5715	2527	2945	3254	5119	2349	3572	4554	6374	8218	4603	4022	2540
8	942	3484	4680	1367	3030	1881	2055	1586	1364	1308	1757	2456	3131	2636	2201	1857
9	1252	1020	1849	791	898	1891	1218	1833	604	549	792	730	1275	833	2019	1149
10	1260	827	1376	571	292	652	1033	1039	316	425	717	214	541	463	515	538
11	631	406	446	187	143	339	327	517	380	222	61	178	85	205	172	249
12	545	407	265	140	99	329	68	389	95	111	120	77	125	117	110	80
13	44	283	560	135	107	54	122	32	149	5	67	121	62	48	14	32
14	0	27	58	241	92	27	36	22	3	107	110	14	57	45	29	17
3+	39280	46411	45203	30677	25014	26623	29471	42834	38336	39032	34813	41713	38662	22768	30130	30743
4+	38279	45844	44753	29432	24053	24717	27157	41885	35465	37889	34039	40957	35778	22037	29185	28856
5+	24339	40348	39167	22683	19554	18932	17521	28223	24552	25287	26941	32843	29334	17093	24478	22814
6+	16814	16644	28810	13680	12463	13297	11722	15158	11652	12152	15356	19927	20760	12502	13092	12827

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
3	1840	4110	935	502	135	368	1022	130	760	203	206	306	585	935	1071	2006
4	7329	12139	9156	5146	3072	1625	2888	5092	2682	4521	4718	5103	2956	4951	8995	8622
5	5397	7923	8326	6096	10321	5054	3136	4430	9174	4538	11473	10253	11023	4971	7842	8195
6	4541	2875	3209	4006	5066	8156	4652	2348	4080	7018	6118	11228	9763	6471	2863	3329
7	5867	1305	920	1753	2353	3379	5855	2861	1752	2221	5072	4283	5453	5046	2549	1483
8	723	495	395	653	721	1254	1622	2939	1150	584	1496	2167	1416	1793	1112	1237
9	1196	140	265	235	233	327	539	640	1041	542	417	650	1107	630	600	692
10	105	53	117	178	84	114	175	243	244	338	377	224	341	284	223	350
11	174	17	57	72	53	56	67	83	91	134	333	171	149	123	141	142
12	52	21	43	27	24	45	35	30	37	35	131	143	78	75	57	104
13	6	4	31	17	13	21	18	11	18	8	24	79	135	53	29	47
14	2	3	11	10	10	25	2	7	8	8	12	23	50	31	26	22
3+	27232	29085	23465	18695	22085	20424	20011	18814	21037	20150	30377	34630	33056	25363	25508	26229
4+	25392	24975	22530	18193	21950	20056	18989	18684	20277	19947	30171	34324	32471	24428	24437	24223
5+	18063	12836	13374	13047	18878	18431	16101	13592	17595	15426	25453	29221	29515	19477	15442	15601
6+	12666	4913	5048	6951	8557	13377	12965	9162	8421	10888	13980	18968	18492	14506	7600	7406

TABLE 8. AVERAGE WEIGHTS AT AGE FOR COD IN SUBDIV. 3PS FOR 1959-1990.

	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
3	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.55
4	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.68
5	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.30
6	1.68	1.68	1.68	1.68	1.68	1.68	1.68	1.68	1.68	1.68	1.68	1.68	1.68	1.68	1.68	1.68	1.68	1.68	1.86
7	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.67
8	3.21	3.21	3.21	3.21	3.21	3.21	3.21	3.21	3.21	3.21	3.21	3.21	3.21	3.21	3.21	3.21	3.21	3.21	3.42
9	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.19
10	5.08	5.08	5.08	5.08	5.08	5.08	5.08	5.08	5.08	5.08	5.08	5.08	5.08	5.08	5.08	5.08	5.08	5.08	4.94
11	6.03	6.03	6.03	6.03	6.03	6.03	6.03	6.03	6.03	6.03	6.03	6.03	6.03	6.03	6.03	6.03	6.03	6.03	5.92
12	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	6.76
13	8.05	8.05	8.05	8.05	8.05	8.05	8.05	8.05	8.05	8.05	8.05	8.05	8.05	8.05	8.05	8.05	8.05	8.05	8.78
14	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	10.90

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
3	0.45	0.41	0.52	0.48	0.45	0.58	0.66	0.64	0.54	0.56	0.63	0.63	0.58
4	0.70	0.65	0.72	0.79	0.77	0.84	1.04	0.98	0.75	0.77	0.82	0.81	0.86
5	1.08	1.01	1.13	1.32	1.17	1.33	1.40	1.36	1.18	1.21	1.09	1.16	1.27
6	1.75	1.65	1.66	1.80	1.78	1.99	1.97	1.93	1.84	1.63	1.67	1.63	1.85
7	2.45	2.55	2.48	2.30	2.36	2.58	2.64	2.51	2.43	2.31	2.17	2.25	2.45
8	2.99	3.68	3.60	3.27	2.88	3.26	3.77	3.43	3.15	3.02	2.92	3.37	3.00
9	4.10	4.30	5.40	4.36	3.91	3.77	4.75	4.35	4.30	4.33	3.58	4.11	4.22
10	5.16	6.49	6.95	5.68	5.28	5.04	5.56	5.06	5.50	5.11	4.98	5.18	5.09
11	5.17	7.00	7.29	7.41	6.18	6.56	6.01	5.42	6.19	6.20	5.61	6.29	6.35
12	7.20	8.20	8.64	9.04	8.62	8.45	9.04	9.37	8.72	6.98	6.60	7.30	7.60
13	7.75	9.53	9.33	8.39	8.64	10.06	11.20	11.95	8.05	7.08	7.46	7.75	8.31
14	8.72	10.84	9.58	9.56	11.41	11.82	10.40	10.85	11.91	8.34	8.92	8.73	10.37

Table 9. Cod biomass estimates (T) from research vessel surveys in NAFO Division 3Ps. Numbers in brackets are estimates for non-sampled strata.

Depth range (fath)	Strata	Area	ATC 197 1972	ATC 207 1973	ATC 221 1974	ATC 234 1975	ATC 247 1976	ATC 261 1977	ATC 273 1978	ATC 287 1979	ATC 302 1980	ATC 316 1981	ATC 330 1982	AN 9 1983	AN 26 1984	WT 26 1985	WT 45 1986	WT 55+56 1987	WT 68 1988	WT 81 1989	WT 91 1990	WT 103 1991
0-30	314	974	0	(6)	1326	(17)	2355	249	0	(243)	432	369	2028	13103	567	25	0	0	24	8	139	0
	320	1320	(1560)	707	(872)	(306)	1333	(676)	(1096)	(1793)	2946	23087	1920	5618	5456	5259	284	495	1729	1026	0	121
Total		2294	1560	713	2198	323	3688	925	1096	2036	3378	23456	3948	18721	6023	5284	284	495	1753	1034	139	121
31-50	308	112	(79)	175	278	205	193	311	38	125	240	305	490	766	681	1024	0	3	4	2	2	1
	312	272	204	(18)	243	334	456	1047	343	151	(116)	165	766	524	674	1016	61	33	3	3	0	4
	315	827	1436	0	591	(150)	1746	1549	(553)	1836	235	0	528	2451	1893	329	2762	885	1247	1641	523	367
	321	1189	1862	0	(366)	(114)	1741	(279)	2035	(775)	1880	1419	2845	2419	1183	89	335	723	1738	367	2	59
	325	944	(106)	(0)	(46)	(0)	2	(28)	180	820	28	1240	95	329	502	0	35	130	31	7	26	57
	326	166	(6)	(0)	(1)	(0)	(6)	(0)	0	2	3	0	53	322	0	(6)	0	16	28	0	3	16
Total		3510	3693	193	1525	803	4144	3214	3149	3709	2502	3129	4777	6811	4933	2464	3193	1290	3051	2020	556	504
51-100	307	395	2833	5955	3916	883	1126	2095	3219	4105	1763	13723	3028	892	771	5189	12339	2688	13936	3138	340	20
	311	317	3774	573	2430	763	627	410	154	1106	3792	761	1943	3256	863	4870	399	4331	593	361	18	24
	317	193	102	278	589	164	550	491	(310)	368	536	268	1582	3685	30	14064	2180	886	109	243	0	552
	319	984	4473	643	477	481	3099	2490	(2723)	10637	1652	15068	3548	3799	3995	1282	10189	7784	12609	10170	(1754)	650
	322	1567	(672)	(69)	(360)	(103)	5178	(271)	490	14	2599	26	3705	4932	2597	1073	2004	1503	369	52	38	35
	323	696	715	(86)	(340)	(115)	367	63	1651	(706)	775	491	1215	858	2247	1263	2881	18047	143	281	3	24
	324	494	(103)	(3)	(51)	(8)	8	(36)	(68)	29	0	(101)	430	618	136	10756	230	187	125	0	6	22
Total		4646	12672	7607	8163	2517	10955	5856	8615	16965	11117	30438	15451	18040	10639	38497	30222	35426	27884	14245	2159	1327
101-150	306	419	(730)	(115)	433	1077	214	161	416	710	457	2652	1211	1250	236	590	755	11032	3589	267	779	24
	309	296	998	437	204	311	178	192	103	1558	863	2983	1178	926	156	1611	3216	2539	2722	1900	1415	299
	310	170	(148)	(21)	83	2181	(151)	0	154	119	0	817	608	134	134	268	332	198	417	147	194	32
	313	165	202	25	144	242	142	41	50	1036	127	446	283	74	130	250	0	279	69	570	105	26
	316	189	6	441	63	(19)	77	17	(76)	65	61	25	(96)	207	170	85	71	71	25	2847	4707	79
	318	123	(53)	6	4	0	0	6	(37)	36	790	(52)	136	11	0	(51)	81	782	106	13266	(22)	874
Total		1362	2137	1045	931	3830	762	417	836	3524	2298	6975	3512	2602	826	2855	4455	14901	6928	18997	7222	1334
151-200	705	195	146	0	66	0	0	60	1	91	674	1310	22	27	0	542	611	121	501	18	123	1
	706	476	369	0	23	(34)	(221)	76	(149)	356	827	304	30	32	0	2068	447	8319	1134	130	69	100
	707	93	48	(10)	5	0	0	227	(52)	326	190	(73)	(66)	7	0	(72)	3124	1529	6667	370	(33)	799
	715	132	2200	(37)	153	1	1	31	142	352	499	168	154	338	54	(225)	1523	810	4575	220	298	7435
	716	539	1532	(61)	147	(82)	(450)	92	780	303	248	1608	168	147	15	344	3464	1544	2379	384	570	115
Total		1435	4295	108	394	117	672	486	1124	1428	2438	3463	440	551	69	3251	9169	12323	15256	1122	1093	8450
201-300	708	117	(122)	(18)	(68)	0	(124)	11	(85)	177	4633	(119)	(107)	0	0	(117)	327	8816	27852	57	(54)	555
	711	961	(355)	(32)	(188)	(50)	(361)	(140)	(242)	(411)	1113	0	0	7	87	109	6949	477	502	361	303	21714
	712	973	(425)	(44)	(228)	(66)	(433)	(172)	(292)	9077	282	259	353	0	(414)	993	300	128	692	184	748	626
	713	950	(355)	(33)	(188)	0	(361)	(140)	(242)	(411)	0	850	0	36	(345)	87	271	1339	332	535	17075	3009
	714	1195	(764)	(97)	(419)	(134)	(778)	(320)	(531)	(882)	0	161	0	163	(745)	(735)	1857	258	700	4090	19821	17344
Total		4196	2021	224	1091	250	2057	783	1392	10958	6028	1389	460	206	1591	2041	9704	11018	30078	5227	38001	43248
Total all depths			26378	9891	14301	7842	22281	11683	16214	38623	27765	68853	28587	46931	24078	54389	57029	75452	84949	42642	49170	54983
Mean wt/tow			20.15	7.55	10.92	5.99	17.02	8.92	12.38	29.50	21.21	52.59	21.83	35.84	18.39	41.54	43.56	57.63	64.88	32.57	37.55	41.99
Unadjusted total			20900	9242	11175	6643	19394	9619	9756	33402	27647	68507	28317	46929	22574	53184	57028	75451	84967	42662	47308	54997
Upper limit			33039	17506	14468	9171	29677	12282	15852	187818	52461	182556	35969	75189	30739	109270	85725	122747	447584	67528	90622	107637
Lower limit			8760	978	7883	4116	9112	6957	3660	-121014	2832	-45541	20666	18670	14408	-2903	28332	28156	-277649	17797	3993	2357

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

Depth range (fath)	Strata	Area	ATC 197 1972	ATC 207 1973	ATC 221 1974	ATC 234 1975	ATC 247 1976	ATC 261 1977	ATC 273 1978	ATC 287 1979	ATC 302 1980	ATC 316 1981	ATC 330 1982	AN 9 1983	AN 26 1984	WT 26 1985	WT 45 1986	WT 55+56 1987	WT 68 1988	WT 81 1989	WT 91 1990	WT 103 1991
0-30	314	974	0	(26)	1170	(12)	1060	73	0	(259)	279	307	2237	1859	91	21	0	0	42	8	24	0
	320	1320	(485)	545	(353)	(127)	941	(263)	(451)	(1015)	528	10354	1362	1589	1870	476	99	129	180	238	0	83
Total		2294	485	571	1523	139	2001	336	451	1274	807	10661	3599	3448	1961	497	99	129	222	246	24	83
31-50	308	112	(39)	34	122	65	34	166	21	74	59	46	235	238	395	563	0	13	13	4	8	4
	312	272	337	(43)	225	221	257	628	378	157	(106)	92	296	347	153	1644	31	51	20	7	0	10
	315	827	186	0	62	(41)	745	1304	(174)	621	171	0	145	489	410	177	786	147	103	133	217	35
	321	1189	223	0	(101)	(19)	312	(69)	179	(342)	196	402	1227	785	342	77	27	54	162	20	11	57
	325	944	(70)	(9)	(44)	(0)	35	(26)	567	850	35	213	85	124	71	0	27	47	24	18	35	102
	326	166	(5)	(0)	(3)	(0)	(8)	(1)	0	12	6	0	69	62	0	(5)	0	19	19	0	6	19
Total		3510	860	86	557	346	1391	2194	1319	2056	573	753	2057	2045	1371	2466	871	331	341	182	277	227
51-100	307	395	1621	2645	2622	431	778	1090	1186	2090	949	5505	2372	569	193	2006	5802	1433	4700	1710	395	79
	311	317	2261	822	2861	433	666	125	309	1124	3105	690	1888	1348	381	3692	127	2427	898	103	119	56
	317	193	275	354	761	127	971	199	(259)	309	1391	623	913	2062	14	1427	420	420	101	101	7	80
	319	984	1717	872	1182	638	4136	2945	(2314)	15068	2733	13000	3176	2058	1637	111	3241	6968	6795	2401	(1962)	936
	322	1567	(629)	(230)	(460)	(168)	2294	(344)	706	118	2641	471	2632	1882	509	860	1382	1082	206	260	154	210
	323	696	418	(114)	(226)	(84)	78	138	1097	(641)	261	78	392	383	901	871	2069	3466	199	112	13	70
	324	494	(123)	(41)	(88)	(28)	37	(64)	(114)	93	0	(160)	352	593	321	10476	178	111	185	0	15	111
Total		4646	7044	5078	8200	1909	8960	4905	5985	19443	11080	20527	11725	8895	3956	19443	13219	15907	13084	4687	2665	1542
101-150	306	419	(377)	(149)	173	472	110	65	115	440	204	2810	692	763	47	267	577	6172	1329	231	1342	86
	309	296	500	141	111	152	89	63	67	870	289	1811	700	496	56	933	1700	1067	1355	833	733	467
	310	170	(129)	(50)	64	2039	(161)	0	183	121	0	651	434	72	57	102	179	115	315	351	421	376
	313	165	142	111	89	215	54	26	17	1018	81	266	217	37	12	111	0	173	43	508	81	211
	316	189	7	880	76	(20)	110	14	(69)	85	35	21	(84)	128	78	38	14	38	24	634	5881	85
	318	123	(33)	9	5	0	0	5	(31)	503	379	(43)	92	3	0	(30)	14	374	9	3241	(25)	776
Total		1362	1188	1340	518	2898	524	173	482	3037	988	5602	2219	1499	250	1481	2484	7939	3075	5798	8483	2001
151-200	705	195	117	0	55	0	0	48	7	66	432	988	15	5	0	285	366	102	271	22	29	7
	706	476	286	0	5	(20)	(123)	46	(90)	202	518	250	9	7	0	697	241	5041	411	27	27	27
	707	93	24	(14)	3	0	0	171	(35)	91	122	(49)	(43)	2	0	(35)	565	565	1714	93	(30)	562
	715	132	381	(54)	42	10	30	20	149	221	248	84	45	106	25	(126)	817	367	2145	74	456	7124
	716	539	1153	(91)	40	(68)	(308)	20	587	334	223	1123	81	91	13	170	3004	1119	1432	212	162	113
Total		1435	1961	159	145	98	461	305	868	914	1543	2494	193	211	38	1313	4993	7194	5973	428	704	7833
201-300	708	117	(80)	(31)	(59)	0	(99)	9	(75)	92	3636	(102)	(91)	0	0	(74)	202	6148	9274	26	(63)	215
	711	961	(185)	(56)	(130)	(37)	(236)	(93)	(171)	(404)	649	0	0	9	14	54	4857	258	206	93	240	7033
	712	973	(192)	(59)	(136)	(39)	(245)	(97)	(178)	8180	146	73	97	0	(118)	426	162	37	313	82	555	530
	713	950	(181)	(55)	(128)	0	(231)	(91)	(168)	(397)	0	214	0	20	(111)	62	57	713	153	312	9352	2585
	714	1195	(355)	(123)	(256)	(87)	(448)	(189)	(330)	(752)	0	56	0	27	(225)	(325)	466	157	379	1749	11123	13488
Total		4196	993	324	709	163	1259	479	922	9825	4431	445	188	56	468	941	5744	7313	10325	2262	21333	23851
Total all depths			12535	7557	11652	5563	14597	8392	10026	36550	19422	40482	19981	16158	8046	26142	27410	38812	33021	13603	33487	35536
Mean #/tow			9.57	5.77	8.90	4.25	11.15	6.41	7.66	27.92	14.83	30.92	15.26	12.34	6.15	19.97	20.93	29.64	25.22	10.39	25.58	27.14
Unadjusted total			9650	6412	9668	4802	12738	7155	5566	32741	19316	40128	19763	16156	7592	25546	27410	38812	33025	13606	31408	35551
Upper limit			14975	10984	12638	6798	18812	9898	8367	236480	72479	108562	25828	21863	10760	165628	43048	63376	157954	22271	58781	68441
Lower limit			4325	1841	6697	2805	6665	4412	2766	-170999	-33847	-28307	13698	10449	4425	-114537	11772	14248	-91904	4942	4036	2660

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TABLE 11. MEAN NUMBERS PER TOW AT AGE ADJUSTED FOR MISSING STRATA
FOR COD IN SUBDIVISION 3PS FOR THE YEARS 1972-91.

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	0.02	0.01	0.52	0.17	0.17	0.01	0.00	0.85	0.16	0.03	0.51
2	0.62	0.64	1.58	0.34	2.44	0.15	0.48	0.35	4.52	0.53	1.95
3	1.09	0.75	1.56	0.97	1.59	1.95	0.74	0.52	1.38	3.02	0.99
4	2.24	1.15	1.12	0.88	2.93	1.70	2.70	5.42	0.97	4.97	4.91
5	1.50	1.28	1.51	0.54	1.83	1.31	1.16	16.00	3.29	5.46	2.25
6	1.00	0.36	1.40	0.50	0.83	0.67	0.83	3.36	2.91	7.04	1.05
7	1.33	0.72	0.39	0.45	0.51	0.21	0.60	0.75	0.53	6.62	1.42
8	0.78	0.28	0.31	0.17	0.47	0.10	0.42	0.36	0.49	1.33	1.47
9	0.33	0.38	0.25	0.11	0.11	0.16	0.24	0.13	0.14	1.31	0.40
10	0.20	0.09	0.12	0.07	0.09	0.06	0.23	0.10	0.13	0.31	0.11
11	0.08	0.02	0.04	0.02	0.06	0.01	0.08	0.03	0.10	0.06	0.08
12	0.05	0.02	0.03	0.01	0.06	0.03	0.03	0.01	0.11	0.08	0.03
13	0.03	0.00	0.02	0.01	0.00	0.03	0.03	0.01	0.04	0.08	0.02
14	0.05	0.01	0.02	0.00	0.00	0.01	0.00	0.01	0.00	0.05	0.02
15	0.03	0.00	0.00	0.01	0.02	0.01	0.03	0.00	0.02	0.01	0.03
16	0.09	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.03	0.02	0.02
1+	9.45	5.72	8.88	4.24	11.11	6.39	7.57	27.92	14.82	30.89	15.26
2+	9.42	5.71	8.36	4.07	10.94	6.39	7.57	27.07	14.66	30.86	14.75
3+	8.80	5.07	6.78	3.73	8.50	6.24	7.09	26.72	10.14	30.34	12.80
4+	7.72	4.32	5.22	2.76	6.90	4.29	6.35	26.20	8.77	27.32	11.81

	1983	1984	1985	1986	1987	1988	1989	1990	1991
1	0.25	0.01	0.01	0.01	0.04	0.02	0.02	0.00	0.05
2	0.47	0.20	0.27	0.26	0.37	0.42	0.28	0.06	1.18
3	1.02	0.32	1.69	0.54	0.83	0.78	0.68	1.32	0.73
4	0.55	0.57	4.34	2.54	2.01	1.18	1.33	5.01	3.87
5	3.05	0.43	5.62	5.40	10.26	1.79	0.97	6.25	7.33
6	1.56	1.84	2.59	5.83	8.01	5.90	1.01	4.18	5.26
7	0.54	0.74	2.42	2.28	3.82	6.14	2.29	3.14	2.88
8	1.06	0.38	0.76	1.71	1.60	4.13	1.42	2.91	1.78
9	1.99	0.47	0.45	0.99	0.97	1.85	0.82	1.25	1.53
10	0.92	0.74	0.43	0.34	0.39	1.04	0.46	0.67	1.06
11	0.45	0.18	0.44	0.28	0.31	0.90	0.51	0.36	0.78
12	0.17	0.13	0.49	0.32	0.24	0.44	0.15	0.16	0.30
13	0.07	0.05	0.20	0.18	0.24	0.18	0.13	0.12	0.15
14	0.06	0.03	0.11	0.11	0.24	0.18	0.06	0.08	0.10
15	0.05	0.00	0.03	0.07	0.09	0.11	0.11	0.01	0.05
16	0.04	0.04	0.04	0.03	0.06	0.11	0.06	0.04	0.04
1+	12.26	6.11	19.88	20.90	29.48	25.18	10.30	25.55	27.09
2+	12.01	6.11	19.87	20.89	29.44	25.16	10.28	25.55	27.04
3+	11.54	5.90	19.60	20.63	29.07	24.74	10.00	25.49	25.86
4+	10.52	5.59	17.91	20.09	28.24	23.96	9.31	24.17	25.14

Table 12. Mean bottom temperature (°C) by stratum from Canadian research vessel surveys in NAFO Subdivision 3Ps over the period 1978-90.

Depth range	Strata	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
0-30	314	0.20		-0.20	1.52	1.64	1.96	1.40	-1.23	-0.79	-0.52	0.14	-0.74	-0.84	-0.16
	320		-0.70	-0.22	1.60	1.72	2.53	1.88	-1.09	-0.74	-1.12	0.20	-0.35	-0.88	-0.33
Average		0.20	-0.70	-0.21	1.55	1.68	2.34	1.72	-1.17	-0.76	-0.85	0.17	-0.52	-0.90	-0.24
31-50	308	1.75	1.65	0.00	1.00	0.40	0.73	2.40	-0.25	-0.50	0.85	1.45	0.35	-0.50	-0.07
	312	0.75	0.13	0.00	1.30	1.45	1.60	2.80	-0.85	-0.80	-0.45	1.23	-0.37	-0.97	-0.13
	315		-0.80	-0.60	1.90	-0.67	1.14	1.44	-1.37	-0.80	-1.07	0.43	0.01	-0.85	-0.53
	321	0.53		-0.42	1.50	0.35	0.83	0.52	-1.21	-0.82	-0.73	0.19	-0.63	-0.70	-0.39
	325	0.55	-0.85	-0.95	2.05	0.7	-0.12	0.14	-1.50	-1.18	-0.79	-0.08	-0.56	-1.37	-0.68
	326	-0.50	-0.85	-1.05	-0.20	-0.90	-0.97	-1.00	-1.45	-0.90	-0.90	-0.35	-0.70	-1.00	-0.93
Average		.61	0.08	-0.58	1.19	-0.06	0.59	0.88	-1.15	-0.93	-0.73	0.37	-0.37	-0.81	-0.46
51-100	307	1.20	3.92	3.30	2.73	2.05	2.15	4.70	2.33	2.23	3.83	2.47	2.13	1.87	1.20
	311	1.32	1.48	1.60	4.35	0.07	1.50	1.20	-0.35	1.50	1.47	1.16	.80	-0.56	0.53
	317		-0.43	-0.35	2.40	-0.30	1.97	5.80	-0.15	-0.55	-0.40	0.40	0.20	0.20	-0.40
	319		5.20	0.45	2.70	0.74	0.60	3.27	2.90	2.40	0.17	1.59	0.88		0.31
	322	0.60		-0.32	-0.05	-0.46	-0.22	0.04	-1.32	-0.42	-0.47	0.18	-0.49	-0.48	-0.42
	323	0.27		-0.67	0.00	-0.70	-0.40	0.20	1.97	0.54	-0.65	-0.26	-0.60	-0.64	-0.55
	324		-0.50	-0.70		-0.95	-0.65	-1.03	-1.05	-1.40	-0.75	-0.05	-0.78	-0.70	-0.82
Average		0.91	1.98	0.21	2.08	0.22	0.40	1.52	0.02	0.55	0.11	0.71	0.03	-0.25	-0.02
101-150	306	2.90	6.06	6.05	6.15	5.30	4.60	5.95	7.15	7.10	6.25	6.02	5.10	4.40	3.95
	309	2.07	5.67	5.75	4.70	4.05	5.00	5.80	5.53	6.45	5.65	5.37	4.15	3.65	4.10
	310	3.83	5.27	6.20	6.50	4.70	5.47	6.10	7.27	7.50	6.40	5.67	2.30	3.77	3.25
	313	2.60	5.22	5.30	7.25	3.00	5.00	6.90	6.05	8.10	7.00	6.60	5.10	2.95	3.65
	316		6.60	6.70	7.95	5.40	5.15	5.60	4.80	8.15	5.03	6.93	5.20	4.40	4.20
	318		-7.45	6.20		5.60	5.53	7.95		6.90	4.70	5.00	2.90		5.30
Average		2.85	5.81	6.03	6.71	4.67	5.10	6.38	6.09	7.35	5.84	5.95	4.20	3.89	4.08
151-200	705	5.90	6.52	5.35	6.40	4.60	5.33	5.15	7.30	6.75	6.30	5.65	5.70	5.67	5.80
	706		6.10	5.50	6.30	4.72	5.28	6.60	7.40	7.10	4.96	5.90	5.38	6.03	5.80
	707		7.40	6.05			5.17	6.20		5.20	4.60	3.70	3.80		5.70
	715	5.30	6.00	5.80	6.30	4.45	5.03	6.25	6.30	7.00	6.25	5.60	5.75	5.55	2.85
	716	4.20	6.35	6.00	6.05	5.10	5.32	6.20	7.26	6.65	6.13	5.88	5.48	5.52	5.50
Average		5.13	6.41	5.74	6.21	4.72	5.24	6.08	7.23	6.64	5.54	5.66	5.28	5.68	5.13
201-300	708		5.60	4.95			4.95	5.95		4.75	4.20	3.85	4.60		5.0
	711			4.95	5.40	4.70	4.81	5.12	6.12	5.77	4.99	4.53	5.16	5.20	5.31
	712		5.40	4.85	5.50	4.20	4.99		5.65	5.62	4.90	4.76	5.15	4.88	4.83
	713			5.00	5.80	4.30	4.76		5.38	5.66	5.12	4.82	5.15	4.66	4.79
	714		5.20	4.95	5.15	4.50	4.71		6.30	5.62	5.28	4.84	5.12	4.69	4.72
Average			5.44	4.94	5.44	4.43	4.82	5.36	5.75	5.61	4.98	4.70	5.11	4.78	4.93
0-30		0.20	-0.70	-0.21	1.55	1.68	2.34	1.72	-1.17	-0.76	-0.85	0.17	-0.52	-0.90	-0.24
31-50		0.61	0.08	-0.58	1.19	-0.06	0.59	0.88	-1.15	-0.93	-0.73	0.37	-0.37	-0.81	-0.46
51-100		0.91	1.98	0.21	2.08	0.22	0.40	1.52	0.02	0.55	0.11	0.71	0.03	-0.25	-0.02
101-150		2.85	5.81	6.03	6.71	4.67	5.10	6.38	6.09	7.35	5.84	5.95	4.20	3.89	4.08
151-200		5.13	6.41	5.74	6.21	4.72	5.24	6.08	7.23	6.64	5.54	5.66	5.28	5.68	5.13
201-300			5.44	4.94	5.44	4.43	4.82	5.36	5.75	5.61	4.98	4.70	5.11	4.78	4.93

Table 13. Cod abundance (000's) from stratified-random cruises conducted by France in Subdivision 3Ps. Numbers in brackets are estimates for non-sampled strata.

Depth (m)	Strata	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
< 55	314	33	0	(73)	267	22	133	0	33	33	67	(354)	33	0	0
	320	36	241	(256)	784	90	572	663	136	45	(785)	0	90	181	0
	TOTAL	69	241	329	1051	112	705	663	169	78	352	354	123	181	0
56-90	308	189	12	35	35	161	46	157	50	134	31	38	65	0	12
	312	605	99	28	677	456	99	6837	155	298	0	75	56	5	360
	315	368	57	0	269	113	85	3597	28	321	868	265	28	28	0
	321	20	896	326	502	387	221	147	16	55	(628)	1222	0	0	0
	325	(108)	(152)	(138)	129	(567)	275	647	65	226	0	485	0	0	0
	TOTAL	1290	1216	527	1612	1684	726	11385	314	1034	1527	2085	149	33	372
91-180	307	1948	1154	3084	640	4662	2958	2624	785	21238	4694	1136	8852	1144	419
	311	402	1628	1158	4357	3995	4147	15162	1954	18038	9503	16231	5973	1040	265
	317	0	119	(697)	724	4940	1696	16436	989	1182	8457	5410	7993	859	2260
	319	1051	4583	1146	3262	3516	7666	5473	3909	2887	5695	3639	9413	13319	2186
	322	939	617	5742	1149	4916	5720	2603	4239	4883	11270	4776	6735	912	134
	323	349	226	318	1156	572	3671	3683	2670	4576	1907	1668	1621	95	24
	324	(479)	(611)	(570)	0	(1845)	2605	3147	1607	727	237	3164	1878	85	34
	TOTAL	5168	8938	12715	11288	24446	28463	49128	16153	53531	41763	36024	42465	17454	5322
181-270	306	765	870	698	9691	2841	6333	947	278	14560	2956	2589	3935	2759	535
	309	355	1642	264	1453	595	1500	1588	872	4906	831	2859	5852	13611	476
	310	396	186	15	489	1095	935	105	9513	175	382	2276	146	553	279
	313	130	328	11	859	814	678	83	2359	138	1432	23	1639	995	305
	316	65	95	39	165	423	30	173	4088	826	215	667	4871	6236	1458
	318	21	8	(191)	247	34	1182	604	576	5810	101	2786	1097	1936	1692
	TOTAL	1732	3129	1218	12904	5802	10658	3500	17686	26415	5917	11200	17540	26090	4745
271-365	705	254	982	27	423	3286	672	908	69	224	220	274	267	87	73
	706	22	0	98	672	3054	179	532	163	1981	8977	791	157	717	378
	707	(140)	586	(166)	13	2603	183	19	827	1172	81	80	51	73	105
	715	922	597	895	628	2473	588	1636	917	1132	961	882	276	2048	1311
	716	123	357	923	455	1772	1196	1058	25	2258	5353	4836	406	1707	1329
	TOTAL	1461	2522	2109	2191	13188	2818	4153	2001	6767	15592	6863	1157	4632	3196
366-545	708	(52)	(68)	(63)	45	353	8	4	315	381	1543	88	172	297	2472
	711				0		33						0	823	702
	712				0		133						0	2466	2666
	713				21								0	1854	2017
	714				137		0						0	9877	47664
	TOTAL	52	68	63	203	353	174	4	315	381	1543	88	172	15317	55521
0-545	TOTAL	9775	16115	16960	29249	45585	43544	68833	36638	88206	67194	56614	61608	63707	69156
Confidence		12225	22211	19582	41387	59497	52592	113553	49004	136843	91756	77558	82570		
Interval		7325	10019	14338	16795	31673	34164	24113	24272	39571	42632	35670	40648		

Table 14. Cod biomass (MT) from stratified-random cruises conducted by France in Subdivision 3Ps.

Depth (m)	Strata	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
< 55	314	17	0		1390	111	30	0	7	13	133		17	0	0
	320	108	814		3797	513	2803	3526	104	14	0	0	316	222	0
	TOTAL	125	814		5187	624	2833	3526	111	27	133	0	333	222	0
56-90	308	371	9	150	88	299	151	111	65	100	29	6	25	0	1
	312	820	270	112	2304	454	636	1403	145	343	0	28	55	2	11
	315	771	850	0	1076	821	326	16918	8	1813	2058	2134	198	41	0
	321	183	4785	3746	2199	3746	1362	1026	3	543	0	649	0	0	0
	325				2101		1332	1466	81	259	0	453	0	0	0
	TOTAL	2145	5914	4008	7768	5320	3807	20924	302	3058	2087	3270	278	43	12
91-180	307	3598	2714	4428	1876	9009	6269	5384	2976	23172	8089	565	6168	215	37
	311	87	3199	1136	5797	8202	3572	19599	1276	20627	1356	4815	675	267	8
	317	0	260		813	454	421	21353	1502	2562	1049	815	973	226	183
	319	997	5810	1303	4435	4078	11349	8101	2831	3179	5746	5434	5889	3067	1907
	322	605	1945	3381	1793	2404	967	1122	2388	5944	2734	215	864	172	11
	323	91	572	858	822	54	794	803	512	2399	953	311	60	10	19
	324				0		815	964	594	288	99	171	90	44	8
	TOTAL	5378	14500	11106	15536	24201	24187	57326	12079	58171	20026	12326	14719	4001	2173
181-270	306	3080	2660	2162	12197	3716	11967	2296	804	23131	8294	4041	4691	663	69
	309	167	2743	804	2176	1122	3318	3852	1581	7434	1901	4827	7947	6726	151
	310	411	190	19	481	1683	739	229	4675	169	503	739	164	93	33
	313	113	331	1	1099	1279	840	170	1753	142	562	26	373	240	18
	316	91	121	39	282	544	36	332	38395	695	334	320	2324	4464	481
	318	42	25		593	34	5282	786	1828	28349	259	4558	941	2096	2109
	TOTAL	3904	6070	3025	16828	8378	22182	7665	49036	59920	11853	14511	16440	14282	2861
271-365	705	321	1115	13	574	4550	984	1661	99	414	354	394	325	49	46
	706	11	0	293	952	4010	375	1141	333	3896	13845	1413	296	768	422
	707		1303		13	10980	652	49	2314	3338	134	102	118	193	125
	715	836	832	1564	827	4159	1261	3806	2282	2613	1908	1772	542	1759	783
	716	178	455	1169	554	2104	1934	2326	86	2775	5685	6264	439	1096	842
	TOTAL	1346	3705	3039	2920	25803	5206	8983	5114	13036	21926	9945	1720	3865	2218
365-545	708				85	373	44	8	593	849	6136	264	429	899	1771
	711				0		296						0	1058	954
	712				0		300						0	2926	3584
	713				108								0	2268	1789
	714				354		0						0	9607	58529
	TOTAL				547	373	640	8	593	849	6136	264	429	16758	66627
0-545	TOTAL	12899	31002	21178	48787	64699	58856	98433	67235	135061	62164	40316	33918	39169	73891

TABLE 15. MEAN NUMBER PER TOW AT AGE FROM SURVEYS CONDUCTED BY FRANCE.
    ZERO CATCHES ASSUMED FOR UNSURVEYED DEEP WATER STRATA.

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
1	0.00	0.05	0.00	0.05	0.79	3.56	0.02	0.10	0.06	2.52	4.02	1.43	0.29	0.81
2	0.57	0.33	5.25	0.14	9.16	8.31	8.87	4.25	5.55	15.80	11.34	18.89	2.39	12.14
3	1.22	0.30	1.22	3.78	1.50	4.16	5.85	11.21	3.23	8.82	11.36	12.25	18.26	7.08
4	2.39	1.61	0.36	3.81	6.35	2.29	11.54	5.78	11.64	2.17	7.03	6.27	20.11	12.96
5	1.59	5.65	1.90	3.96	6.08	5.55	6.69	3.04	20.28	6.36	2.76	4.44	7.66	12.68
6	0.93	2.53	3.21	5.74	4.63	4.70	14.53	0.82	16.59	9.57	4.98	2.66	2.46	7.56
7	0.69	1.41	1.18	4.35	3.47	3.50	4.28	1.51	6.99	6.38	3.58	3.39	0.73	2.42
8	0.40	0.74	0.48	1.23	4.05	2.13	1.63	0.88	5.34	2.26	1.22	1.55	1.00	1.07
9	0.23	0.29	0.21	0.92	1.21	1.60	2.37	0.60	2.95	1.49	0.60	0.77	0.44	0.91
10	0.17	0.17	0.16	0.36	0.66	0.58	1.69	0.67	0.61	0.73	0.27	0.21	0.26	0.62
11	0.02	0.22	0.13	0.12	0.32	0.19	0.47	0.84	0.45	0.15	0.27	0.10	0.11	0.06
12	0.03	0.07	0.08	0.11	0.11	0.15	0.12	1.02	0.55	0.28	0.12	0.05	0.09	0.15
13	0.01	0.08	0.06	0.05	0.16	0.06	0.10	0.09	0.17	0.11	0.11	0.05	0.03	0.03
14	0.02	0.17	0.13	0.10	0.08	0.05	0.09	0.18	0.25	0.22	0.25	0.06	0.06	0.03
1+	8.27	13.64	14.35	24.71	38.57	36.84	58.25	31.00	74.64	56.86	47.91	52.13	53.89	58.52
2+	8.27	13.59	14.35	24.66	37.78	33.28	58.23	30.90	74.58	54.34	43.89	50.70	53.60	57.71
3+	7.70	13.25	9.10	24.53	28.62	24.97	49.36	26.65	69.03	38.54	32.55	31.81	51.21	45.57
4+	6.49	12.95	7.88	20.74	27.13	20.81	43.51	15.44	65.81	29.72	21.19	19.56	32.95	38.49
5+	4.10	11.34	7.52	16.93	20.77	18.52	31.97	9.66	54.17	27.55	14.16	13.28	12.84	25.53

TABLE 16. MEAN NUMBER PER TOW AT AGE FROM SURVEYS CONDUCTED BY FRANCE. CATCHES
    FOR UNSURVEYED DEEP WATER STRATA ASSUMED SAME PROPORTION AS CANADIAN RV.

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
1	0.00	0.07	0.00	0.05	0.79	3.56	0.02	0.10	0.08	2.60	4.14	1.43	0.29	0.81
2	0.62	0.46	5.47	0.14	9.21	8.31	9.43	4.38	6.93	16.29	11.69	18.89	2.39	12.14
3	1.32	0.41	1.27	3.78	1.50	4.16	6.22	11.56	4.03	9.09	11.71	12.25	18.26	7.08
4	2.60	2.21	0.37	3.81	6.38	2.29	12.27	5.96	14.55	2.24	7.25	6.27	20.11	12.96
5	1.73	7.73	1.98	3.96	6.12	5.55	7.12	3.14	25.35	6.56	2.85	4.44	7.66	12.68
6	1.01	3.47	3.35	5.74	4.65	4.70	15.45	0.85	20.74	9.87	5.14	2.66	2.46	7.56
7	0.75	1.93	1.23	4.35	3.49	3.50	4.55	1.56	8.73	6.57	3.69	3.39	0.73	2.42
8	0.44	1.02	0.50	1.23	4.07	2.13	1.73	0.91	6.67	2.33	1.26	1.55	1.00	1.07
9	0.25	0.40	0.21	0.92	1.21	1.60	2.52	0.62	3.69	1.53	0.61	0.77	0.44	0.91
10	0.19	0.23	0.16	0.36	0.67	0.58	1.80	0.69	0.76	0.75	0.28	0.21	0.26	0.62
11	0.02	0.31	0.13	0.12	0.32	0.19	0.50	0.87	0.56	0.16	0.28	0.10	0.11	0.06
12	0.03	0.10	0.08	0.11	0.12	0.15	0.13	1.05	0.69	0.28	0.13	0.05	0.09	0.15
13	0.01	0.11	0.06	0.05	0.16	0.06	0.11	0.10	0.21	0.12	0.12	0.05	0.03	0.03
14	0.03	0.23	0.13	0.10	0.08	0.05	0.10	0.18	0.31	0.23	0.26	0.06	0.06	0.03
1+	8.99	18.68	14.95	24.71	38.77	36.84	61.96	31.96	93.30	58.62	49.39	52.13	53.89	58.52
2+	8.99	18.61	14.95	24.66	37.98	33.28	61.94	31.86	93.22	56.02	45.25	50.70	53.60	57.71
3+	8.37	18.15	9.48	24.53	28.77	24.97	52.50	27.48	86.29	39.73	33.56	31.81	51.21	45.57
4+	7.05	17.74	8.21	20.74	27.27	20.81	46.28	15.92	82.26	30.64	21.85	19.56	32.95	38.49
5+	4.45	15.53	7.84	16.93	20.88	18.52	34.01	9.96	67.71	28.40	14.60	13.28	12.84	25.53

TABLE 17. ANALYSIS OF VARIANCE FROM THE REGRESSION OF CANADIAN
LN CATCH RATE FOR COD IN SUBDIV. 3PS FOR THE YEARS 1977-90.

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R............. 0.764
MULTIPLE R SQUARED..... 0.584

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	$1.305E0$	$1.305E0$	
REGRESSION	27	$1.088E1$	$4.031E^{-1}$	12.008
TYPE 1	3	$1.173E0$	$3.910E^{-1}$	11.648
TYPE 2	11	$1.306E0$	$1.187E^{-1}$	3.536
TYPE 3	13	$7.223E0$	$5.556E^{-1}$	16.550
RESIDUALS	231	$7.755E0$	$3.357E^{-2}$	
TOTAL	259	$1.994E1$		

TABLE 18. REGRESSION COEFFICIENTS FROM THE REGRESSION OF CANADIAN
LN CATCH RATE FOR COD IN SUBDIV. 3PS FOR THE YEARS 1977-90.

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
1	3125	INTERCEPT	⁻0.467	0.145	259
3	1				
4	77				
1	3124	1	⁻0.234	0.086	75
	27124	2	0.166	0.120	40
	27125	3	0.343	0.085	65
3	2	4	⁻0.321	0.121	36
	3	5	⁻0.409	0.124	36
	4	6	⁻0.622	0.132	31
	5	7	⁻0.617	0.160	21
	6	8	⁻0.240	0.262	8
	7	9	⁻0.374	0.367	4
	8	10	⁻0.540	0.298	5
	9	11	⁻0.597	0.231	6
	10	12	⁻0.570	0.256	8
	11	13	⁻0.729	0.142	28
	12	14	⁻0.502	0.118	40
4	78	15	0.357	0.181	15
	79	16	0.216	0.165	22
	80	17	0.091	0.155	23
	81	18	0.515	0.183	15
	82	19	0.805	0.155	22
	83	20	0.874	0.159	21
	84	21	1.591	0.201	9
	85	22	1.745	0.156	16
	86	23	0.767	0.152	19
	87	24	0.875	0.156	21
	88	25	0.755	0.150	18
	89	26	1.003	0.172	15
	90	27	0.647	0.169	13

TABLE 19.   CANADIAN OTTER TRAWL CATCH RATE INDEX FOR COD IN
SUBDIV. 3PS FOR THE YEARS 1977-90.

PREDICTED CATCH RATE

	LN TRANSFORM		RETRANSFORMED			
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT
1977	⁻0.4669	0.0210	0.631	0.091	5494	8708
1978	⁻0.1094	0.0240	0.901	0.139	2699	2997
1979	⁻0.2507	0.0217	0.783	0.115	3074	3926
1980	⁻0.3754	0.0236	0.690	0.106	3505	5076
1981	0.0482	0.0221	1.055	0.156	3457	3276
1982	0.3385	0.0241	1.410	0.218	3555	2522
1983	0.4072	0.0227	1.511	0.227	3546	2347
1984	1.1241	0.0431	3.063	0.631	2660	868
1985	1.2782	0.0222	3.611	0.537	7671	2125
1986	0.3003	0.0188	1.360	0.186	6770	4977
1987	0.4079	0.0196	1.514	0.211	5468	3611
1988	0.2882	0.0172	1.345	0.176	5174	3847
1989	0.5364	0.0264	1.716	0.277	3752	2186
1990	0.1799	0.0245	1.203	0.187	4346	3614

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.152

TABLE 20. CATCH AT AGE (NUMBERS AND PERCENT) OF COD TAKEN BY CANADIAN
OTTER TRAWLERS IN SUBDIV. 3Ps FOR THE PERIOD 1978-90.

3PS CATCH AT AGE FOR CANADA OFFSHORE

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
3	0	0	20	52	1	8	46	0	0	6	4	0	1
4	124	112	93	142	150	33	511	137	35	35	196	8	22
5	429	1257	364	173	306	466	344	692	630	509	457	25	291
6	650	609	720	509	296	178	263	580	1104	717	950	33	235
7	237	164	603	578	465	130	117	731	664	595	641	247	188
8	97	30	131	261	477	185	40	190	348	172	255	401	234
9	15	20	22	62	143	159	42	127	168	171	88	211	195
10	12	0	0	17	64	33	33	102	49	59	61	116	100
11	3	0	0	8	26	16	6	54	45	25	27	50	47
12	1	0	0	7	6	1	3	12	36	18	15	8	39
13	2	0	0	1	2	1	0	1	9	13	11	6	19
14	0	0	0	0	3	0	0	0	7	6	8	1	7
3+	1570	2192	1953	1810	1939	1210	1405	2626	3095	2326	2713	1106	1378

3PS PERCENT AT AGE FOR CANADA OFFSHORE

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
3	0	0	1	3	0	1	3	0	0	0	0	0	0
4	8	5	5	8	8	3	36	5	1	2	7	1	2
5	27	57	19	10	16	39	24	26	20	22	17	2	21
6	41	28	37	28	15	15	19	22	36	31	35	3	17
7	15	7	31	32	24	11	8	28	21	26	24	22	14
8	6	1	7	14	25	15	3	7	11	7	9	36	17
9	1	1	1	3	7	13	3	5	5	7	3	19	14
10	1	0	0	1	3	3	2	4	2	3	2	10	7
11	0	0	0	0	1	1	0	2	1	1	1	5	3
12	0	0	0	0	0	0	0	0	1	1	1	1	3
13	0	0	0	0	0	0	0	0	0	1	0	1	1
14	0	0	0	0	0	0	0	0	0	0	0	0	1

TABLE 21. CATCH RATE INDEX AT AGE IN NUMBERS FOR COD IN SUBDIV. 3PS FOR
CANADIAN OTTER TRAWLERS DURING THE PERIOD 1978-90.

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
3	0.00	0.00	0.04	0.16	0.00	0.03	0.53	0.00	0.00	0.02	0.01	0.00	0.00
4	0.41	0.29	0.18	0.43	0.59	0.14	5.89	0.64	0.07	0.10	0.51	0.04	0.06
5	1.43	3.20	0.72	0.53	1.21	1.99	3.96	3.26	1.27	1.41	1.19	0.11	0.81
6	2.17	1.55	1.42	1.55	1.17	0.76	3.03	2.73	2.22	1.99	2.47	0.15	0.65
7	0.79	0.42	1.19	1.76	1.84	0.55	1.35	3.44	1.33	1.65	1.67	1.13	0.52
8	0.32	0.08	0.26	0.80	1.89	0.79	0.46	0.89	0.70	0.48	0.66	1.83	0.65
9	0.05	0.05	0.04	0.19	0.57	0.68	0.48	0.60	0.34	0.47	0.23	0.97	0.54
10	0.04	0.00	0.00	0.05	0.25	0.14	0.38	0.48	0.10	0.16	0.16	0.53	0.28
11	0.01	0.00	0.00	0.02	0.10	0.07	0.07	0.25	0.09	0.07	0.07	0.23	0.13
12	0.00	0.00	0.00	0.02	0.02	0.00	0.03	0.06	0.07	0.05	0.04	0.04	0.11
13	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.04	0.03	0.03	0.05
14	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.02	0.02	0.00	0.02
3+	5.24	5.58	3.85	5.53	7.69	5.16	16.19	12.36	6.22	6.44	7.05	5.06	3.81

TABLE 22. ANALYSIS OF VARIANCE FROM THE REGRESSION OF FRENCH
LN CATCH RATE FOR COD IN SUBDIV. 3PS FOR THE YEARS 1978-90.

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R.............   0.819
MULTIPLE R SQUARED.....   0.671

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	$1.796E^{-2}$	$1.796E^{-2}$	
REGRESSION	22	$5.821E0$	$2.646E^{-1}$	8.424
TYPE 1	10	$4.285E0$	$4.285E^{-1}$	13.642
TYPE 2	12	$1.490E0$	$1.241E^{-1}$	3.953
RESIDUALS	91	$2.858E0$	$3.141E^{-2}$	
TOTAL	114	$8.697E0$		

TABLE 23. REGRESSION COEFFICIENTS FROM THE REGRESSION OF FRENCH
LN CATCH RATE FOR COD IN SUBDIV. 3PS FOR THE YEARS 1978-90.

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
3	1	INTERCEPT	1.158	0.290	114
4	78				
3	2	1	⁻0.949	0.233	8
	3	2	⁻0.822	0.210	9
	4	3	⁻0.605	0.194	12
	5	4	⁻1.129	0.191	12
	6	5	⁻1.868	0.214	10
	7	6	⁻1.757	0.328	6
	9	7	⁻1.608	0.329	6
	10	8	⁻1.358	0.186	13
	11	9	⁻0.479	0.180	13
	12	10	⁻0.433	0.196	13
4	79	11	⁻0.009	0.325	7
	80	12	⁻0.083	0.374	7
	81	13	⁻0.547	0.319	8
	82	14	⁻0.439	0.313	8
	83	15	⁻0.272	0.313	8
	84	16	0.073	0.305	8
	85	17	0.088	0.286	11
	86	18	0.118	0.283	11
	87	19	⁻0.087	0.286	10
	88	20	⁻0.666	0.286	10
	89	21	⁻0.769	0.285	11
	90	22	⁻0.258	0.282	9

TABLE 24. ST. PIERRE OTTER TRAWL CATCH RATE INDEX FOR COD IN
     SUBDIVISION 3PS FOR THE YEARS 1978-90

                    PREDICTED CATCH RATE

| | LN TRANSFORM | | RETRANSFORMED | | | |
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT
1978	1.1580	0.0843	3.100	0.886	1614	521
1979	1.1491	0.0627	3.106	0.770	3794	1222
1980	1.0748	0.0917	2.841	0.846	1722	606
1981	0.6114	0.0596	1.817	0.439	3768	2074
1982	0.7189	0.0536	2.029	0.466	3771	1858
1983	0.8858	0.0538	2.398	0.552	4775	1992
1984	1.2307	0.0492	3.393	0.748	6773	1996
1985	1.2461	0.0353	3.470	0.649	9422	2715
1986	1.2756	0.0340	3.576	0.658	13653	3818
1987	1.0707	0.0357	2.911	0.548	15214	5227
1988	0.4923	0.0359	1.632	0.308	10011	6133
1989	0.3891	0.0355	1.473	0.276	9646	6550
1990	0.9004	0.0340	2.457	0.452	14769	6010

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.221

TABLE 25. CATCH AT AGE (NUMBERS AND PERCENT) OF COD TAKEN BY ST PIERRE
OTTER TRAWLERS IN SUBDIV. 3Ps FOR THE PERIOD 1978-90.

3PS CATCH AT AGE FOR ST. PIERRE OFFSHORE

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
3	105	16	45	38	15	53	32	49	19	78	112	575	553
4	402	620	69	158	427	242	692	1128	1048	517	1358	3202	3323
5	529	1395	252	289	511	1145	674	2428	3153	3278	1409	2486	3347
6	336	775	462	471	396	671	1107	1126	3021	3241	1163	987	1152
7	120	254	156	624	338	297	555	830	1056	1356	1332	565	422
8	31	78	47	111	288	142	156	237	374	396	529	120	621
9	6	19	10	20	37	81	152	63	108	270	203	73	272
10	4	12	2	4	3	11	68	64	32	64	47	35	118
11	2	3	0	1	0	4	24	66	22	35	12	11	37
12	1	3	0	1	0	0	7	31	19	5	11	4	21
13	0	1	0	1	0	0	1	4	14	13	8	7	3
14	0	0	0	0	0	0	0	4	0	0	1	5	4
3+	1536	3176	1043	1718	2015	2646	3468	6030	8866	9253	6185	8070	9873

3PS PERCENT AT AGE FOR ST. PIERRE OFFSHORE

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
3	7	1	4	2	1	2	1	1	0	1	2	7	6
4	26	20	7	9	21	9	20	19	12	6	22	40	34
5	34	44	24	17	25	43	19	40	36	35	23	31	34
6	22	24	44	27	20	25	32	19	34	35	19	12	12
7	8	8	15	36	17	11	16	14	12	15	22	7	4
8	2	2	5	6	14	5	4	4	4	4	9	1	6
9	0	1	1	1	2	3	4	1	1	3	3	1	3
10	0	0	0	0	0	0	2	1	0	1	1	0	1
11	0	0	0	0	0	0	1	1	0	0	0	0	0
12	0	0	0	0	0	0	0	1	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 26. CATCH RATE INDEX AT AGE IN NUMBERS FOR COD IN SUBDIV. 3PS FOR
ST. PIERRE OTTER TRAWLERS DURING THE PERIOD 1978-90.

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
3	2.02	0.13	0.74	0.18	0.08	0.27	0.16	0.18	0.05	0.15	0.18	0.88	0.92
4	7.72	5.07	1.14	0.76	2.30	1.21	3.47	4.15	2.74	0.99	2.21	4.89	5.53
5	10.15	11.42	4.16	1.39	2.75	5.75	3.38	8.94	8.26	6.27	2.30	3.80	5.57
6	6.45	6.34	7.62	2.27	2.13	3.37	5.55	4.15	7.91	6.20	1.90	1.51	1.92
7	2.30	2.08	2.57	3.01	1.82	1.49	2.78	3.06	2.77	2.59	2.17	0.86	0.70
8	0.60	0.64	0.78	0.54	1.55	0.71	0.78	0.87	0.98	0.76	0.86	0.18	1.03
9	0.12	0.16	0.17	0.10	0.20	0.41	0.76	0.23	0.28	0.52	0.33	0.11	0.45
10	0.08	0.10	0.03	0.02	0.02	0.06	0.34	0.24	0.08	0.12	0.08	0.05	0.20
11	0.04	0.02	0.00	0.00	0.00	0.02	0.12	0.24	0.06	0.07	0.02	0.02	0.06
12	0.02	0.02	0.00	0.00	0.00	0.00	0.04	0.11	0.05	0.01	0.02	0.01	0.03
13	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.04	0.02	0.01	0.01	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.01
3+	29.48	25.99	17.21	8.28	10.84	13.28	17.37	22.21	23.22	17.70	10.08	12.32	16.43

TABLE 27. PARAMETER ESTIMATES FROM ADAPT USING CANADIAN AND FRENCH RV(AGES 3-12)
AND FRENCH C/E AGES 4-8 FOR COD IN SUBDIV 3Ps. FRENCH RV IN 201-300 FATHOMS
ASSUMED TO BE THE SAME PROPORTION AS CANADIAN RV.

ESTIMATED PARAMETERS AND STANDARD ERRORS
APPROXIMATE STATISTICS ASSUMING LINEARITY NEAR SOLUTION

ORTHOGONALITY OFFSET......... 0.062514
MEAN SQUARE RESIDUALS 0.452897

AGE	PARAMETER	ESTIMATE	STD. ERR.	T-STATISTIC	C.V.
3	ABUNDANCE	1.36574E5	4.75837E4	2.87017E0	0.35
4	ABUNDANCE	1.00165E5	2.58813E4	3.87016E0	0.26
5	ABUNDANCE	4.50612E4	1.01760E4	4.42820E0	0.23
6	ABUNDANCE	1.51460E4	3.44323E3	4.39878E0	0.23
7	ABUNDANCE	5.54726E3	1.21373E3	4.57043E0	0.22
8	ABUNDANCE	5.87093E3	1.33118E3	4.41033E0	0.23
9	ABUNDANCE	3.09969E3	7.86947E2	3.93889E0	0.25
10	ABUNDANCE	1.42530E3	3.78984E2	3.76083E0	0.27
11	ABUNDANCE	8.27207E2	2.23130E2	3.70729E0	0.27
12	ABUNDANCE	6.88689E2	1.92904E2	3.57011E0	0.28
3	RV1 SLOPE	1.57585E⁻5	3.02345E⁻6	5.21210E0	0.19
4	RV1 SLOPE	4.68449E⁻5	8.65061E⁻6	5.41522E0	0.18
5	RV1 SLOPE	1.04173E⁻4	1.90939E⁻5	5.45584E0	0.18
6	RV1 SLOPE	1.59672E⁻4	2.92991E⁻5	5.44974E0	0.18
7	RV1 SLOPE	1.94490E⁻4	3.58734E⁻5	5.42155E0	0.18
8	RV1 SLOPE	2.59608E⁻4	4.85290E⁻5	5.34955E0	0.19
9	RV1 SLOPE	2.97578E⁻4	5.64804E⁻5	5.26870E0	0.19
10	RV1 SLOPE	3.24655E⁻4	6.26656E⁻5	5.18075E0	0.19
11	RV1 SLOPE	3.25547E⁻4	6.33700E⁻5	5.13724E0	0.19
12	RV1 SLOPE	2.97823E⁻4	5.79488E⁻5	5.13941E0	0.19
3	RV2 SLOPE	7.25173E⁻5	1.39133E⁻5	5.21210E0	0.19
4	RV2 SLOPE	1.00770E⁻4	1.86087E⁻5	5.41522E0	0.18
5	RV2 SLOPE	1.65757E⁻4	3.03816E⁻5	5.45584E0	0.18
6	RV2 SLOPE	2.43470E⁻4	4.46756E⁻5	5.44974E0	0.18
7	RV2 SLOPE	2.95628E⁻4	5.45284E⁻5	5.42155E0	0.18
8	RV2 SLOPE	3.32883E⁻4	6.22263E⁻5	5.34955E0	0.19
9	RV2 SLOPE	3.73792E⁻4	7.09458E⁻5	5.26870E0	0.19
10	RV2 SLOPE	3.61853E⁻4	6.98456E⁻5	5.18075E0	0.19
11	RV2 SLOPE	2.75008E⁻4	5.35323E⁻5	5.13724E0	0.19
12	RV2 SLOPE	3.27846E⁻4	6.37906E⁻5	5.13941E0	0.19
4	CE1 SLOPE	5.78487E⁻5	1.09682E⁻5	5.27422E0	0.19
5	CE1 SLOPE	1.59566E⁻4	3.01348E⁻5	5.29509E0	0.19
6	CE1 SLOPE	2.16962E⁻4	4.10232E⁻5	5.28877E0	0.19
7	CE1 SLOPE	2.23373E⁻4	4.24105E⁻5	5.26692E0	0.19
8	CE1 SLOPE	1.66760E⁻4	3.20153E⁻5	5.20877E0	0.19

TABLE 28. RESIDUALS FROM ADAPT USING CANADIAN AND FRENCH RV (AGES 3-12) AND FRENCH C/E AGES 4-8. FRENCH RV IN 201-300 FATHOMS ASSUMED TO BE SAME PROPORTION AS CANADIAN RV.

LOG RESIDUALS FOR CANADIAN RV SURVEY INDEX

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
3	0.10	0.23	0.86	1.06	0.32	−0.15	−1.24	0.57	0.12	0.10	−0.48	−1.04	−0.49	0.00
4	−0.07	1.21	−0.03	1.26	0.67	−1.16	−1.61	0.50	0.10	0.55	−0.42	−0.82	0.07	−0.28
5	−0.96	1.20	0.22	1.19	−0.02	−0.29	−1.92	0.16	0.21	1.01	−0.02	−1.07	0.29	−0.05
6	−0.92	0.14	−0.44	1.00	−0.44	−0.36	−0.73	−0.15	0.30	0.69	0.65	−0.45	0.55	0.12
7	−0.43	−0.60	−1.33	0.77	−0.22	−0.82	−0.71	−0.06	0.16	0.49	0.99	0.17	1.08	0.46
8	−0.21	−0.48	−0.65	−0.07	−0.30	−0.17	−0.89	−0.39	0.07	0.36	1.18	0.09	0.65	0.77
9	−0.11	−0.86	−0.95	0.87	−0.80	0.61	−0.63	−0.46	0.42	0.05	1.03	0.14	0.31	0.34
10	0.22	−0.52	−0.47	0.31	−1.13	0.41	0.12	−0.37	−0.41	0.00	0.74	0.13	0.38	0.54
11	0.27	−1.36	−0.18	−0.86	−0.52	0.80	−0.90	0.00	−0.36	−0.13	1.41	0.46	0.29	1.04
12	−1.65	−0.73	0.57	0.03	−1.04	0.79	0.04	0.53	0.29	−0.06	0.67	0.14	−0.25	0.62

SUM OF RV 1 RESIDUALS :   −0.4105287623 MEAN RESIDUAL :   −0.0029534443

LOG RESIDUALS FOR FRENCH RV SURVEY INDEX

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
3	−0.85	−1.53	−0.75	−0.24	−0.79	−0.27	0.22	0.97	0.60	0.97	0.70	0.32	0.61	0.00
4	−0.88	−0.45	−1.76	0.23	0.17	−0.49	0.69	0.05	1.07	−0.11	0.63	−0.04	0.69	0.16
5	−1.03	0.01	−0.76	0.40	0.52	−0.16	0.42	−0.88	1.29	0.10	−0.02	−0.01	0.03	0.03
6	−1.14	−0.25	−0.72	0.37	0.62	0.33	0.98	−1.70	1.15	0.48	0.09	0.10	−0.40	0.06
7	−0.62	−0.08	−0.92	−0.07	0.26	0.63	0.69	−0.91	1.09	0.62	0.07	0.14	−0.80	−0.13
8	−0.41	0.30	−0.89	−0.39	0.47	0.27	0.38	−0.46	1.18	0.49	−0.26	−0.07	−0.66	0.01
9	−0.30	0.04	−0.74	0.28	0.07	0.17	0.83	−0.36	1.51	0.28	−0.30	−0.15	−0.96	−0.41
10	−0.12	0.18	−0.34	0.37	0.59	−0.17	0.90	−0.01	0.28	0.55	−0.70	−0.79	−0.68	−0.10
11	−1.13	1.28	0.28	0.01	1.05	0.12	0.31	0.85	0.51	−0.64	0.39	−1.01	−0.72	−1.35
12	−1.64	1.17	0.18	0.28	0.23	0.54	−0.07	1.20	0.96	0.02	−0.68	−1.15	−0.92	−0.18

SUM OF RV 2 RESIDUALS :   −0.4105857043 MEAN RESIDUAL :   −0.0029538540

LOG RESIDUALS FOR FRENCH COMMERCIAL C/E INDEX

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
4	0.77	0.93	−0.08	−0.82	−0.30	−0.58	−0.02	0.24	−0.04	−0.37	−0.01	0.27	−0.04
5	0.78	0.44	0.02	−0.61	−0.24	−0.08	−0.28	0.20	0.21	0.09	−0.20	−0.13	−0.25
6	0.82	0.47	0.21	−0.44	−0.04	0.11	0.07	0.01	0.30	0.13	−0.79	−0.35	−0.53
7	0.78	0.28	0.10	−0.16	−0.11	0.06	0.48	0.04	0.22	−0.03	−0.18	−0.95	−0.56
8	0.59	0.52	0.24	−0.53	0.19	−0.13	0.27	0.19	−0.05	0.06	0.05	−1.51	0.06

SUM OF C/E RESIDUALS :   −0.2056001117 MEAN RESIDUAL :   −0.0031630786

TABLE 29. PARAMETER CORRELATION MATRIX FROM ADAPT USING CANADIAN AND FRENCH RV AGES 3-12
FRENCH COMMERCIAL C/E AGES 4-8.   FRENCH RV IN 201-300 FATHOMS ASSUMED TO BE THE SAME
PROPORTION AS CANADIAN RV.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.00	0.07	0.05	0.04	0.03	0.03	0.02	0.02	0.02	0.03	-0.16	-0.15	-0.02	-0.02	-0.01	-0.01	-0.01	-0.01
2	0.07	1.00	0.07	0.05	0.05	0.04	0.03	0.03	0.03	0.03	-0.13	-0.12	-0.13	-0.02	-0.02	-0.02	-0.02	-0.02
3	0.05	0.07	1.00	0.07	0.06	0.05	0.04	0.03	0.03	0.04	-0.10	-0.10	-0.11	-0.13	-0.02	-0.02	-0.02	-0.03
4	0.04	0.05	0.07	1.00	0.08	0.07	0.06	0.05	0.05	0.06	-0.08	-0.08	-0.08	-0.11	-0.14	-0.03	-0.03	-0.03
5	0.03	0.05	0.06	0.08	1.00	0.06	0.07	0.08	0.08	0.11	-0.07	-0.06	-0.07	-0.09	-0.12	-0.16	-0.06	-0.07
6	0.03	0.04	0.05	0.07	0.06	1.00	0.10	0.12	0.15	0.19	-0.06	-0.06	-0.06	-0.08	-0.12	-0.18	-0.21	-0.13
7	0.02	0.03	0.04	0.06	0.07	0.10	1.00	0.15	0.16	0.21	-0.05	-0.05	-0.05	-0.06	-0.09	-0.14	-0.19	-0.24
8	0.02	0.03	0.03	0.05	0.08	0.12	0.15	1.00	0.17	0.22	-0.04	-0.04	-0.04	-0.05	-0.07	-0.12	-0.17	-0.21
9	0.02	0.03	0.03	0.05	0.08	0.15	0.16	0.17	1.00	0.24	-0.04	-0.04	-0.04	-0.05	-0.07	-0.11	-0.15	-0.19
10	0.03	0.03	0.04	0.06	0.11	0.19	0.21	0.22	0.24	1.00	-0.05	-0.05	-0.05	-0.07	-0.09	-0.14	-0.19	-0.25
11	-0.16	-0.13	-0.10	-0.08	-0.07	-0.06	-0.05	-0.04	-0.04	-0.05	1.00	0.05	0.04	0.03	0.03	0.03	0.03	0.03
12	-0.15	-0.12	-0.10	-0.08	-0.06	-0.06	-0.05	-0.04	-0.04	-0.05	0.05	1.00	0.03	0.03	0.03	0.03	0.03	0.03
13	-0.02	-0.13	-0.11	-0.08	-0.07	-0.06	-0.05	-0.04	-0.04	-0.05	0.04	0.03	1.00	0.03	0.03	0.03	0.03	0.03
14	-0.02	-0.02	-0.13	-0.11	-0.09	-0.08	-0.06	-0.05	-0.05	-0.07	0.03	0.03	0.03	1.00	0.04	0.04	0.04	0.04
15	-0.01	-0.02	-0.02	-0.14	-0.12	-0.12	-0.09	-0.07	-0.07	-0.09	0.03	0.03	0.03	0.04	1.00	0.05	0.05	0.05
16	-0.01	-0.02	-0.02	-0.03	-0.16	-0.16	-0.14	-0.12	-0.11	-0.14	0.03	0.03	0.03	0.04	0.05	1.00	0.08	0.08
17	-0.01	-0.02	-0.02	-0.03	-0.06	-0.21	-0.19	-0.17	-0.15	-0.19	0.03	0.03	0.03	0.04	0.05	0.08	1.00	0.11
18	-0.01	-0.02	-0.03	-0.03	-0.07	-0.13	-0.24	-0.21	-0.19	-0.25	0.03	0.03	0.03	0.04	0.05	0.08	0.11	1.00
19	-0.02	-0.02	-0.03	-0.03	-0.08	-0.15	-0.15	-0.25	-0.22	-0.29	0.03	0.03	0.03	0.04	0.06	0.08	0.11	0.13
20	-0.02	-0.02	-0.03	-0.03	-0.08	-0.16	-0.16	-0.15	-0.24	-0.32	0.03	0.03	0.03	0.04	0.06	0.08	0.11	0.13
21	-0.16	-0.13	-0.10	-0.08	-0.07	-0.06	-0.05	-0.04	-0.04	-0.05	0.05	0.05	0.04	0.03	0.03	0.03	0.03	0.03
22	-0.15	-0.12	-0.10	-0.08	-0.06	-0.06	-0.05	-0.04	-0.04	-0.05	0.05	0.05	0.03	0.03	0.03	0.03	0.03	0.03
23	-0.02	-0.13	-0.11	-0.08	-0.07	-0.06	-0.05	-0.04	-0.04	-0.05	0.04	0.03	0.04	0.03	0.03	0.03	0.03	0.03
24	-0.02	-0.02	-0.13	-0.11	-0.09	-0.08	-0.06	-0.05	-0.05	-0.07	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04
25	-0.01	-0.02	-0.02	-0.14	-0.12	-0.12	-0.09	-0.07	-0.07	-0.09	0.03	0.03	0.03	0.04	0.05	0.05	0.05	0.05
26	-0.01	-0.02	-0.02	-0.03	-0.16	-0.16	-0.14	-0.12	-0.11	-0.14	0.03	0.03	0.03	0.04	0.05	0.07	0.08	0.08
27	-0.01	-0.02	-0.02	-0.03	-0.06	-0.21	-0.19	-0.17	-0.15	-0.19	0.03	0.03	0.03	0.04	0.05	0.08	0.10	0.11
28	-0.01	-0.02	-0.03	-0.03	-0.07	-0.13	-0.24	-0.21	-0.19	-0.25	0.03	0.03	0.03	0.04	0.05	0.08	0.11	0.13
29	-0.02	-0.02	-0.03	-0.03	-0.08	-0.15	-0.15	-0.25	-0.22	-0.29	0.03	0.03	0.03	0.04	0.06	0.08	0.11	0.13
30	-0.02	-0.02	-0.03	-0.03	-0.08	-0.16	-0.16	-0.15	-0.24	-0.32	0.03	0.03	0.03	0.04	0.06	0.08	0.11	0.13
31	-0.02	-0.12	-0.10	-0.07	-0.06	-0.06	-0.04	-0.04	-0.04	-0.05	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
32	-0.01	-0.02	-0.10	-0.08	-0.07	-0.06	-0.05	-0.04	-0.04	-0.05	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03
33	-0.01	-0.01	-0.02	-0.11	-0.09	-0.08	-0.06	-0.05	-0.05	-0.06	0.02	0.02	0.02	0.03	0.04	0.04	0.04	0.04
34	-0.01	-0.01	-0.02	-0.02	-0.12	-0.11	-0.09	-0.07	-0.07	-0.09	0.02	0.02	0.02	0.02	0.03	0.05	0.05	0.05
35	-0.01	-0.01	-0.02	-0.02	-0.04	-0.16	-0.14	-0.12	-0.11	-0.13	0.02	0.02	0.02	0.03	0.04	0.06	0.07	0.08

TABLE 29. CONTINUED.

	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1	‾0.02	‾0.02	‾0.16	‾0.15	‾0.02	‾0.02	‾0.01	‾0.01	‾0.01	‾0.01	‾0.02	‾0.02	‾0.02	‾0.01	‾0.01	‾0.01	‾0.01
2	‾0.02	‾0.02	‾0.13	‾0.12	‾0.13	‾0.02	‾0.02	‾0.02	‾0.02	‾0.02	‾0.02	‾0.02	‾0.12	‾0.02	‾0.01	‾0.01	‾0.01
3	‾0.03	‾0.03	‾0.10	‾0.10	‾0.11	‾0.13	‾0.02	‾0.02	‾0.02	‾0.03	‾0.03	‾0.03	‾0.10	‾0.10	‾0.02	‾0.02	‾0.02
4	‾0.03	‾0.03	‾0.08	‾0.08	‾0.08	‾0.11	‾0.14	‾0.03	‾0.03	‾0.03	‾0.03	‾0.03	‾0.07	‾0.08	‾0.11	‾0.02	‾0.02
5	‾0.08	‾0.08	‾0.07	‾0.06	‾0.07	‾0.09	‾0.12	‾0.16	‾0.06	‾0.07	‾0.08	‾0.08	‾0.06	‾0.07	‾0.09	‾0.12	‾0.04
6	‾0.15	‾0.16	‾0.06	‾0.06	‾0.06	‾0.08	‾0.12	‾0.16	‾0.21	‾0.13	‾0.15	‾0.16	‾0.06	‾0.06	‾0.08	‾0.11	‾0.16
7	‾0.15	‾0.16	‾0.05	‾0.05	‾0.05	‾0.06	‾0.09	‾0.14	‾0.19	‾0.24	‾0.15	‾0.16	‾0.04	‾0.05	‾0.06	‾0.09	‾0.14
8	‾0.25	‾0.15	‾0.04	‾0.04	‾0.04	‾0.05	‾0.07	‾0.12	‾0.17	‾0.21	‾0.25	‾0.15	‾0.04	‾0.04	‾0.05	‾0.07	‾0.12
9	‾0.22	‾0.24	‾0.04	‾0.04	‾0.04	‾0.05	‾0.07	‾0.11	‾0.15	‾0.19	‾0.22	‾0.24	‾0.04	‾0.04	‾0.05	‾0.07	‾0.11
10	‾0.29	‾0.32	‾0.05	‾0.05	‾0.05	‾0.07	‾0.09	‾0.14	‾0.19	‾0.25	‾0.29	‾0.32	‾0.05	‾0.05	‾0.06	‾0.09	‾0.13
11	0.03	0.03	0.05	0.05	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02
12	0.03	0.03	0.05	0.05	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02
13	0.03	0.03	0.04	0.03	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02
14	0.04	0.04	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.02	0.03
15	0.06	0.06	0.03	0.03	0.03	0.04	0.05	0.05	0.05	0.05	0.06	0.06	0.03	0.03	0.04	0.03	0.04
16	0.08	0.08	0.03	0.03	0.03	0.04	0.05	0.07	0.08	0.08	0.08	0.08	0.03	0.03	0.04	0.05	0.06
17	0.11	0.11	0.03	0.03	0.03	0.04	0.05	0.08	0.10	0.11	0.11	0.11	0.03	0.03	0.04	0.05	0.07
18	0.13	0.13	0.03	0.03	0.03	0.04	0.05	0.08	0.11	0.13	0.13	0.13	0.03	0.03	0.04	0.05	0.08
19	1.00	0.14	0.03	0.03	0.03	0.04	0.06	0.08	0.11	0.13	0.15	0.14	0.03	0.03	0.04	0.05	0.08
20	0.14	1.00	0.03	0.03	0.03	0.04	0.06	0.08	0.11	0.13	0.14	0.15	0.03	0.03	0.04	0.05	0.08
21	0.03	0.03	1.00	0.05	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02
22	0.03	0.03	0.05	1.00	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02
23	0.03	0.03	0.04	0.03	1.00	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02
24	0.04	0.04	0.03	0.03	0.03	1.00	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.02	0.03
25	0.06	0.06	0.03	0.03	0.03	0.04	1.00	0.05	0.05	0.05	0.06	0.06	0.03	0.03	0.04	0.03	0.04
26	0.08	0.08	0.03	0.03	0.03	0.04	0.05	1.00	0.08	0.08	0.08	0.08	0.03	0.03	0.04	0.05	0.06
27	0.11	0.11	0.03	0.03	0.03	0.04	0.05	0.08	1.00	0.11	0.11	0.11	0.03	0.03	0.04	0.05	0.07
28	0.13	0.13	0.03	0.03	0.03	0.04	0.05	0.08	0.11	1.00	0.13	0.13	0.03	0.03	0.04	0.05	0.08
29	0.15	0.14	0.03	0.03	0.03	0.04	0.06	0.08	0.11	0.13	1.00	0.14	0.03	0.03	0.04	0.05	0.08
30	0.14	0.15	0.03	0.03	0.03	0.04	0.06	0.08	0.11	0.13	0.14	1.00	0.03	0.03	0.04	0.05	0.08
31	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	1.00	0.02	0.02	0.02	0.02
32	0.03	0.03	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	1.00	0.02	0.02	0.02
33	0.04	0.04	0.02	0.02	0.02	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.02	0.02	1.00	0.02	0.03
34	0.05	0.05	0.02	0.02	0.02	0.02	0.03	0.05	0.05	0.05	0.05	0.05	0.02	0.02	0.02	1.00	0.04
35	0.08	0.08	0.02	0.02	0.02	0.03	0.04	0.06	0.07	0.08	0.08	0.08	0.02	0.02	0.03	0.04	1.00

TABLE 30. POPULATION NUMBERS DERIVED FROM ADAPT USING CANADIAN AND FRENCH RV AGES 3-12 AND FRENCH C/E AGES 4-8. FRENCH RV IN 201-300 FATHOMS ASSUMED IN SAME PROPORTION AS CANADIAN RV.

$$(x10^3)$$

	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
3	59385	59276	50995	48717	42982	70840	80990	84453	99320	71100	56712
4	107095	47715	48018	41344	38759	34321	56275	64215	68286	78719	57178
5	35835	75068	34092	34259	27743	27663	22865	37355	40213	46033	53047
6	24205	22530	40012	18541	19903	16298	17549	13473	18762	21251	25804
7	16271	13244	12371	18318	11079	11522	8657	11103	6850	9577	12103
8	5817	8911	7698	6857	9827	6784	6769	4144	4458	3483	4609
9	4035	3910	4143	2068	4377	5304	3852	3682	1957	2416	1668
10	3441	2171	2279	1719	977	2771	2631	2052	1356	1056	1481
11	3664	1677	1029	621	891	536	1679	1220	740	825	480
12	1178	2429	1005	439	339	600	132	1078	531	262	474
13	154	471	1620	583	233	188	193	47	531	349	114
14	0	86	130	820	356	94	105	48	9	300	281
3+	261079	237487	203392	174285	157464	176919	201697	222869	243013	235370	213950

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
3	35577	60684	40214	31540	41988	55908	60344	76667	42667	26229	37039
4	45731	28444	47075	32263	24968	32670	44108	45687	61923	34479	21352
5	40391	30100	17457	34068	22156	14975	20116	25129	29121	46042	25449
6	32948	21382	16885	10139	17590	9103	7377	9301	13040	18326	28357
7	14631	18142	10932	10611	4673	8642	3344	3438	4711	7052	10420
8	5788	6212	7417	4785	5048	1527	1767	1557	1983	2271	3644
9	2184	2517	2253	3688	1926	2453	596	999	917	1032	1207
10	649	1127	907	1091	1192	537	926	361	578	538	634
11	564	338	433	324	427	489	345	710	190	312	365
12	338	301	199	169	109	124	243	267	530	90	208
13	280	207	133	57	39	17	55	180	180	409	52
14	33	119	113	66	34	3	9	41	119	132	323
3+	179114	169573	144019	128800	120150	126448	139230	164337	155960	136913	129051

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
3	66499	45742	75209	69135	60453	30543	47684	80037	123118	136309
4	29992	53520	37332	60888	56420	49308	24730	38511	64683	99832
5	16011	21942	39211	28138	45760	41923	35753	17572	27050	44819
6	16263	10271	13956	23802	18932	27084	25047	19298	9889	15051
7	15837	9106	6285	7735	13138	9964	12015	11673	9944	5506
8	5474	7669	4866	3560	4323	6167	4283	4903	4991	5835
9	1849	3014	3619	2944	2387	2186	3088	2225	2392	3080
10	692	1026	1889	2021	1920	1577	1201	1527	1252	1415
11	416	408	620	1325	1349	1231	1088	675	993	823
12	248	280	259	426	964	803	853	756	441	685
13	129	171	202	179	317	671	528	628	551	310
14	24	90	130	149	139	238	478	310	466	425
3+	153435	153239	183580	200304	206100	171694	156747	178114	245771	314091

TABLE 31. POPULATION BIOMASS (JAN 1) FROM ADAPT USING CANADIAN AND FRENCH RV AGES 3-12 AND
FRENCH C/E AGES 4-8. FRENCH RV IN 201-300 FATHOMS ASSUMED IN SAME PROPORTION AS CANADIAN RV.

	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
3	14934	14966	12880	12194	10777	17718	20238	21303	24814	17888	14287
4	62193	27961	28119	23524	22701	19462	31858	35384	38937	44878	33326
5	30963	60171	27575	28549	23237	24002	19178	29160	32110	37744	45579
6	30537	28469	46649	24345	25759	20290	23656	16449	22946	27300	33083
7	29337	24531	22426	32723	21015	21446	14702	17477	11947	16303	20547
8	15411	19984	13749	17733	23542	16629	16275	9358	10700	7912	10422
9	12329	12388	11297	5965	14403	15631	11718	9549	5989	7834	4425
10	12466	7770	6475	6399	3732	11071	9326	6533	5428	3712	4825
11	18115	7915	4176	2807	4436	1738	8180	4992	2774	3819	2441
12	5398	13981	5428	2274	1792	2514	574	5409	3033	1244	2579
13	942	2130	9458	3704	1230	1146	840	185	3256	2523	523
14	0	590	793	5675	2523	651	700	290	62	1980	1803
3+	232626	220855	189025	165892	155145	152298	157243	156088	161995	173137	173840

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
3	8926	15006	10106	7875	10398	13937	14749	37968	17293	9720	17364
4	25787	15529	27753	18556	13488	17862	23276	25013	37514	19328	13359
5	32276	24688	14546	26922	15848	11590	15142	23957	25173	36853	23181
6	41686	26169	22690	11855	21152	9661	8668	12551	17047	23105	35678
7	23587	28778	17856	17971	6751	10395	5610	7059	8193	13163	19055
8	12609	12529	17132	10085	11542	3177	4322	4135	4354	6194	9526
9	6551	6467	6568	9061	4460	6426	1923	3223	2915	3514	5000
10	2420	3688	2876	3595	4010	2205	4131	1317	2226	2894	3598
11	2524	1583	1695	1191	1479	2123	1835	3644	694	1794	2206
12	1870	1439	799	622	348	593	1471	1491	3362	572	1428
13	1516	1252	767	362	115	100	383	1297	1197	3475	339
14	203	711	724	402	201	15	57	346	901	1242	2690
3+	159955	137839	123512	108499	89791	78085	81568	122001	120869	121855	133423

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
3	28692	18628	39322	41291	35002	14869	24043	45415	69973	71091
4	20348	35416	27316	55083	47837	31626	16130	26604	43857	74175
5	17067	20649	41055	32524	48429	38661	32289	14567	23743	46384
6	22213	14446	20977	35352	26965	34114	28552	23561	12200	22132
7	25906	15968	12369	15482	23135	16349	18330	17065	17344	10375
8	13480	15531	12469	11063	10749	14022	9490	10216	13341	13999
9	6093	9414	10341	11378	8499	7072	9598	6057	7650	10307
10	3055	4257	8016	9244	7841	7246	4666	6179	5296	5627
11	2547	2028	3390	6822	5705	6377	5655	3085	5219	4286
12	1874	2061	1830	3331	7575	5721	5127	4278	2713	4329
13	907	1295	1755	1771	3289	4578	2900	4049	3762	2139
14	198	886	1350	1366	1305	2430	3405	2372	3576	3884
3+	142381	140581	180191	224707	226331	183065	160183	163450	208673	268727

TABLE 32. FISHING MORTALITY DERIVED FROM ADAPT USING CANADIAN AND FRENCH RV AGES 3-12 AND FRENCH C/E AGES 4-8. FRENCH RV IN 201-300 FATHOMS ASSUMED IN SAME PROPORTION AS CANADIAN RV.

	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
3	0.019	0.011	0.010	0.029	0.025	0.030	0.032	0.012	0.032	0.018	0.015	0.024	0.054	0.020
4	0.155	0.136	0.138	0.199	0.137	0.206	0.210	0.268	0.194	0.195	0.148	0.218	0.288	0.123
5	0.264	0.429	0.409	0.343	0.332	0.255	0.329	0.489	0.438	0.379	0.276	0.436	0.378	0.343
6	0.403	0.399	0.581	0.315	0.347	0.433	0.258	0.477	0.472	0.363	0.367	0.397	0.471	0.265
7	0.402	0.343	0.390	0.423	0.290	0.332	0.537	0.712	0.476	0.531	0.538	0.657	0.694	0.626
8	0.197	0.566	1.114	0.249	0.417	0.366	0.409	0.550	0.413	0.536	0.547	0.633	0.814	0.499
9	0.420	0.340	0.680	0.550	0.257	0.501	0.430	0.799	0.417	0.289	0.744	0.461	0.821	0.525
10	0.519	0.547	1.101	0.457	0.401	0.301	0.569	0.820	0.298	0.588	0.766	0.453	0.756	0.830
11	0.211	0.311	0.652	0.405	0.195	1.201	0.242	0.632	0.839	0.353	0.151	0.429	0.326	0.740
12	0.716	0.205	0.344	0.435	0.390	0.932	0.843	0.509	0.220	0.632	0.328	0.290	0.615	1.045
13	0.379	1.090	0.481	0.295	0.710	0.382	1.195	1.428	0.371	0.016	1.050	0.650	0.402	0.509
14	0.359	0.419	0.670	0.389	0.334	0.380	0.471	0.694	0.446	0.495	0.559	0.632	0.734	0.569

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
3	0.034	0.051	0.037	0.078	0.014	0.013	0.006	0.011	0.017	0.003	0.011	0.003	0.004	0.011
4	0.176	0.311	0.285	0.363	0.250	0.096	0.104	0.088	0.113	0.111	0.083	0.086	0.097	0.121
5	0.461	0.690	0.508	0.571	0.456	0.263	0.285	0.248	0.244	0.252	0.299	0.196	0.324	0.315
6	0.575	0.511	0.801	0.563	0.480	0.415	0.365	0.383	0.380	0.291	0.390	0.394	0.442	0.613
7	0.543	0.918	1.387	0.564	0.351	0.530	0.460	0.444	0.525	0.427	0.368	0.382	0.556	0.644
8	0.710	0.522	0.741	0.371	0.329	0.453	0.432	0.478	0.397	0.551	0.303	0.200	0.482	0.492
9	0.929	1.077	0.774	0.300	0.347	0.333	0.287	0.356	0.389	0.267	0.383	0.228	0.215	0.398
10	0.738	0.691	0.243	0.065	0.443	0.416	0.189	0.221	0.328	0.303	0.154	0.204	0.245	0.171
11	0.885	1.034	0.499	0.056	0.093	0.542	0.208	0.186	0.196	0.254	0.177	0.118	0.319	0.167
12	1.265	1.653	0.621	0.100	0.196	0.058	0.347	0.274	0.170	0.126	0.172	0.095	0.163	0.219
13	0.314	2.334	0.489	0.084	0.211	0.110	0.036	0.585	0.167	0.074	0.104	0.051	0.087	0.139
14	0.660	0.774	1.192	0.481	0.347	0.097	0.087	0.089	0.097	0.090	0.070	0.061	0.100	0.113

	1987	1988	1989	1990
3	0.014	0.013	0.010	0.016
4	0.142	0.153	0.167	0.100
5	0.417	0.375	0.386	0.224
6	0.564	0.463	0.386	0.278
7	0.696	0.650	0.333	0.350
8	0.455	0.518	0.283	0.265
9	0.504	0.375	0.325	0.283
10	0.376	0.230	0.219	0.317
11	0.164	0.225	0.171	0.210
12	0.107	0.116	0.154	0.183
13	0.332	0.098	0.060	0.183
14	0.122	0.117	0.063	0.059

TABLE 33. PARAMETER ESTIMATES FROM ADAPT USING CANADIAN AND FRENCH RV(AGES 3-12)
AND FRENCH C/E AGES 4-8 FOR COD IN SUBDIV 3Ps. FRENCH RV IN 201-300 FATHOMS
ASSUMED NO CATCH.

ESTIMATED PARAMETERS AND STANDARD ERRORS
APPROXIMATE STATISTICS ASSUMING LINEARITY NEAR SOLUTION

ORTHOGONALITY OFFSET.........   0.060463
MEAN SQUARE RESIDUALS 0.444476

AGE	PARAMETER	ESTIMATE	STD. ERR.	T-STATISTIC	C.V.
3	ABUNDANCE	1.43070E5	4.94085E4	2.89566E0	0.35
4	ABUNDANCE	1.04067E5	2.66788E4	3.90073E0	0.26
5	ABUNDANCE	4.66020E4	1.04386E4	4.46438E0	0.22
6	ABUNDANCE	1.56920E4	3.53572E3	4.43814E0	0.23
7	ABUNDANCE	5.69392E3	1.23666E3	4.60427E0	0.22
8	ABUNDANCE	6.07851E3	1.36575E3	4.45069E0	0.22
9	ABUNDANCE	3.23921E3	8.17024E2	3.96464E0	0.25
10	ABUNDANCE	1.50899E3	4.00298E2	3.76968E0	0.27
11	ABUNDANCE	8.74430E2	2.33932E2	3.73796E0	0.27
12	ABUNDANCE	7.41965E2	2.03320E2	3.64926E0	0.27
3	RV1 SLOPE	$1.55294E^-5$	$2.95325E^-6$	5.25840E0	0.19
4	RV1 SLOPE	$4.62013E^-5$	$8.45628E^-6$	5.46354E0	0.18
5	RV1 SLOPE	$1.02932E^-4$	$1.86988E^-5$	5.50477E0	0.18
6	RV1 SLOPE	$1.57734E^-4$	$2.86881E^-5$	5.49823E0	0.18
7	RV1 SLOPE	$1.91847E^-4$	$3.50855E^-5$	5.46798E0	0.18
8	RV1 SLOPE	$2.55283E^-4$	$4.73541E^-5$	5.39094E0	0.19
9	RV1 SLOPE	$2.91426E^-4$	$5.49327E^-5$	5.30515E0	0.19
10	RV1 SLOPE	$3.16685E^-4$	$6.07242E^-5$	5.21513E0	0.19
11	RV1 SLOPE	$3.16941E^-4$	$6.12573E^-5$	5.17393E0	0.19
12	RV1 SLOPE	$2.90170E^-4$	$5.60305E^-5$	5.17878E0	0.19
3	RV2 SLOPE	$6.70923E^-5$	$1.27591E^-5$	5.25840E0	0.19
4	RV2 SLOPE	$9.37292E^-5$	$1.71554E^-5$	5.46354E0	0.18
5	RV2 SLOPE	$1.54461E^-4$	$2.80595E^-5$	5.50477E0	0.18
6	RV2 SLOPE	$2.26826E^-4$	$4.12543E^-5$	5.49823E0	0.18
7	RV2 SLOPE	$2.75015E^-4$	$5.02955E^-5$	5.46798E0	0.18
8	RV2 SLOPE	$3.08707E^-4$	$5.72641E^-5$	5.39094E0	0.19
9	RV2 SLOPE	$3.45230E^-4$	$6.50746E^-5$	5.30515E0	0.19
10	RV2 SLOPE	$3.32881E^-4$	$6.38298E^-5$	5.21513E0	0.19
11	RV2 SLOPE	$2.52501E^-4$	$4.88025E^-5$	5.17393E0	0.19
12	RV2 SLOPE	$3.01242E^-4$	$5.81686E^-5$	5.17878E0	0.19
4	CE1 SLOPE	$5.72003E^-5$	$1.07491E^-5$	5.32141E0	0.19
5	CE1 SLOPE	$1.58033E^-4$	$2.95800E^-5$	5.34256E0	0.19
6	CE1 SLOPE	$2.14820E^-4$	$4.02621E^-5$	5.33554E0	0.19
7	CE1 SLOPE	$2.20898E^-4$	$4.15888E^-5$	5.31147E0	0.19
8	CE1 SLOPE	$1.64237E^-4$	$3.12901E^-5$	5.24886E0	0.19

*TABLE 34. BEGINNING OF THE YEAR POPULATION NUMBERS AND FISHING MORTALITY FROM ADAPT USING USING CANADIAN AND FRENCH RV SURVEY (AGES 3-12) AND FRENCH C/E AGES 4-8. FRENCH RV IN 201-300 FATHOMS ASSUMED NO CATCH.

POPULATION NUMBERS (000S)

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
3	42813	26396	37216	66821	45975	75548	69598	61016	30869	48678	82333	127877	142795
4	61986	34598	21489	30137	53784	37524	61166	56798	49770	24997	39325	66562	103728
5	29184	46093	25547	16123	22061	39427	28295	45988	42234	36130	17791	27716	46358
6	13062	18378	28399	16343	10363	14054	23979	19060	27270	25301	19607	10068	15597
7	4720	7070	10463	15871	9171	6360	7814	13282	10069	12168	11880	10198	5653
8	1990	2278	3659	5509	7697	4920	3622	4388	6285	4368	5028	5161	6043
9	921	1038	1213	1861	3043	3642	2988	2437	2239	3185	2295	2494	3219
10	579	542	639	697	1036	1912	2040	1956	1618	1245	1606	1309	1499
11	190	313	368	420	413	628	1345	1364	1260	1122	711	1058	870
12	532	91	209	250	283	263	432	980	816	877	784	471	739
13	180	411	52	130	173	205	182	322	683	538	647	574	334
14	120	132	325	24	90	132	151	141	242	488	319	482	444
3+	156279	137341	129579	154188	154089	184614	201612	207733	173356	159097	182326	253970	327277

FISHING MORTALITY

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
3	0.013	0.006	0.011	0.017	0.003	0.011	0.003	0.004	0.011	0.013	0.013	0.009	0.016
4	0.096	0.103	0.087	0.112	0.111	0.082	0.085	0.096	0.120	0.140	0.150	0.162	0.096
5	0.262	0.284	0.247	0.242	0.251	0.297	0.195	0.323	0.312	0.411	0.369	0.375	0.216
6	0.414	0.363	0.382	0.378	0.288	0.387	0.391	0.438	0.607	0.556	0.454	0.377	0.267
7	0.528	0.459	0.441	0.524	0.423	0.363	0.377	0.548	0.635	0.684	0.634	0.323	0.339
8	0.450	0.430	0.476	0.394	0.548	0.299	0.196	0.473	0.480	0.444	0.501	0.272	0.255
9	0.331	0.285	0.354	0.386	0.265	0.380	0.224	0.210	0.387	0.485	0.361	0.309	0.269
10	0.415	0.188	0.220	0.325	0.300	0.152	0.202	0.240	0.166	0.360	0.217	0.209	0.296
11	0.542	0.207	0.184	0.194	0.252	0.174	0.117	0.314	0.163	0.159	0.212	0.159	0.198
12	0.058	0.346	0.272	0.168	0.124	0.169	0.094	0.160	0.215	0.103	0.112	0.144	0.168
13	0.110	0.036	0.584	0.166	0.073	0.102	0.050	0.086	0.137	0.324	0.095	0.057	0.168
14	0.096	0.087	0.089	0.096	0.089	0.069	0.060	0.098	0.111	0.120	0.113	0.061	0.056

TABLE 35. PARAMETER ESTIMATES FROM ADAPT USING CANADIAN AND FRENCH RV(AGES 3-12)
     AND FRENCH C/E AGES 4-8 (1981-90) FOR COD IN SUBDIV 3Ps.   FRENCH RV IN 201-300
     FATHOMS ASSUMED IN SAME PROPORTION AS CANADIAN RV.

ESTIMATED PARAMETERS AND STANDARD ERRORS
APPROXIMATE STATISTICS ASSUMING LINEARITY NEAR SOLUTION

ORTHOGONALITY OFFSET.........   0.060899
MEAN SQUARE RESIDUALS 0.456514

AGE	PARAMETER	ESTIMATE	STD. ERR.	T-STATISTIC	C.V.
3	ABUNDANCE	1.39048E5	4.86616E4	2.85746E0	0.35
4	ABUNDANCE	1.04064E5	2.70987E4	3.84019E0	0.26
5	ABUNDANCE	4.70751E4	1.07235E4	4.38992E0	0.23
6	ABUNDANCE	1.59946E4	3.66565E3	4.36338E0	0.23
7	ABUNDANCE	5.86905E3	1.29841E3	4.52019E0	0.22
8	ABUNDANCE	6.31389E3	1.44328E3	4.37468E0	0.23
9	ABUNDANCE	3.31383E3	8.50906E2	3.89447E0	0.26
10	ABUNDANCE	1.50624E3	4.05929E2	3.71059E0	0.27
11	ABUNDANCE	8.69075E2	2.36160E2	3.68002E0	0.27
12	ABUNDANCE	7.40138E2	2.06257E2	3.58843E0	0.28
3	RV1 SLOPE	1.55007E$^-$5	2.98914E$^-$6	5.18567E0	0.19
4	RV1 SLOPE	4.61211E$^-$5	8.55986E$^-$6	5.38806E0	0.19
5	RV1 SLOPE	1.02487E$^-$4	1.88793E$^-$5	5.42853E0	0.18
6	RV1 SLOPE	1.56782E$^-$4	2.89180E$^-$5	5.42162E0	0.18
7	RV1 SLOPE	1.90421E$^-$4	3.53212E$^-$5	5.39111E0	0.19
8	RV1 SLOPE	2.53175E$^-$4	4.76412E$^-$5	5.31420E0	0.19
9	RV1 SLOPE	2.89418E$^-$4	5.53527E$^-$5	5.22862E0	0.19
10	RV1 SLOPE	3.15302E$^-$4	6.13507E$^-$5	5.13933E0	0.19
11	RV1 SLOPE	3.16080E$^-$4	6.20004E$^-$5	5.09803E0	0.20
12	RV1 SLOPE	2.89177E$^-$4	5.66715E$^-$5	5.10268E0	0.20
3	RV2 SLOPE	7.13307E$^-$5	1.37553E$^-$5	5.18567E0	0.19
4	RV2 SLOPE	9.92130E$^-$5	1.84135E$^-$5	5.38806E0	0.19
5	RV2 SLOPE	1.63074E$^-$4	3.00402E$^-$5	5.42853E0	0.18
6	RV2 SLOPE	2.39064E$^-$4	4.40945E$^-$5	5.42162E0	0.18
7	RV2 SLOPE	2.89444E$^-$4	5.36890E$^-$5	5.39111E0	0.19
8	RV2 SLOPE	3.24634E$^-$4	6.10880E$^-$5	5.31420E0	0.19
9	RV2 SLOPE	3.63542E$^-$4	6.95293E$^-$5	5.22862E0	0.19
10	RV2 SLOPE	3.51428E$^-$4	6.83800E$^-$5	5.13933E0	0.19
11	RV2 SLOPE	2.67011E$^-$4	5.23754E$^-$5	5.09803E0	0.20
12	RV2 SLOPE	3.18328E$^-$4	6.23845E$^-$5	5.10268E0	0.20
4	CE1 SLOPE	4.83131E$^-$5	1.05285E$^-$5	4.58878E0	0.22
5	CE1 SLOPE	1.38410E$^-$4	3.00303E$^-$5	4.60900E0	0.22
6	CE1 SLOPE	1.83039E$^-$4	3.97924E$^-$5	4.59984E0	0.22
7	CE1 SLOPE	1.94631E$^-$4	4.25319E$^-$5	4.57612E0	0.22
8	CE1 SLOPE	1.41918E$^-$4	3.14415E$^-$5	4.51373E0	0.22

TABLE 36. BEGINNING OF THE YEAR POPULATION NUMBERS AND FISHING MORTALITY FROM ADAPT USING CANADIAN
AND FRENCH RV SURVEY (AGES 3-12) AND FRENCH C/E AGES 4-8 (1981-90). FRENCH RV IN 201-300 FATHOMS
ASSUMED IN SAME PROPORTION AS CANADIAN RV.

POPULATION NUMBERS (000S)

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
3	42917	26515	37210	66810	45949	75537	69846	61655	31259	49228	83038	127874	138780
4	62003	34683	21587	30132	53775	37502	61157	57001	50293	25316	39776	87139	103725
5	29181	46107	25617	16203	22057	39420	28277	45980	42399	36559	18052	28086	46830
6	13061	18375	28411	16400	10429	14050	23973	19045	27264	25436	19958	10282	15899
7	4721	7069	10461	15881	9218	6414	7812	13277	10057	12163	11992	10485	5828
8	1992	2279	3658	5507	7704	4958	3666	4386	6281	4359	5024	5252	6278
9	924	1040	1214	1860	3041	3648	3019	2473	2237	3182	2287	2491	3294
10	580	544	641	698	1035	1911	2045	1981	1647	1244	1603	1303	1496
11	190	314	369	422	413	628	1344	1369	1281	1146	710	1056	865
12	532	91	209	252	285	263	432	979	819	894	803	470	737
13	180	411	53	130	174	206	182	322	683	541	661	590	333
14	120	132	325	24	90	133	152	142	242	488	321	494	457
3+	156402	137561	129753	154319	154170	184669	201903	208610	174463	160555	184225	255520	324521

FISHING MORTALITY

|	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
3	0.013	0.006	0.011	0.017	0.003	0.011	0.003	0.004	0.011	0.013	0.013	0.009	0.016
4	0.096	0.103	0.087	0.112	0.111	0.082	0.085	0.096	0.119	0.138	0.148	0.160	0.096
5	0.263	0.284	0.246	0.241	0.251	0.297	0.195	0.323	0.311	0.405	0.363	0.369	0.214
6	0.414	0.363	0.382	0.376	0.286	0.387	0.391	0.439	0.607	0.552	0.444	0.368	0.261
7	0.528	0.459	0.442	0.523	0.420	0.359	0.377	0.548	0.636	0.684	0.626	0.313	0.327
8	0.450	0.430	0.476	0.394	0.547	0.296	0.194	0.473	0.480	0.445	0.502	0.267	0.244
9	0.330	0.284	0.354	0.386	0.265	0.379	0.221	0.206	0.387	0.485	0.363	0.310	0.262
10	0.414	0.187	0.219	0.325	0.300	0.152	0.202	0.236	0.163	0.361	0.218	0.210	0.297
11	0.542	0.207	0.183	0.193	0.251	0.175	0.117	0.313	0.160	0.155	0.213	0.160	0.199
12	0.058	0.346	0.272	0.167	0.124	0.169	0.094	0.160	0.214	0.101	0.109	0.144	0.169
13	0.110	0.036	0.583	0.166	0.072	0.102	0.050	0.086	0.137	0.322	0.093	0.056	0.169
14	0.096	0.087	0.089	0.096	0.089	0.069	0.060	0.098	0.111	0.120	0.112	0.060	0.055
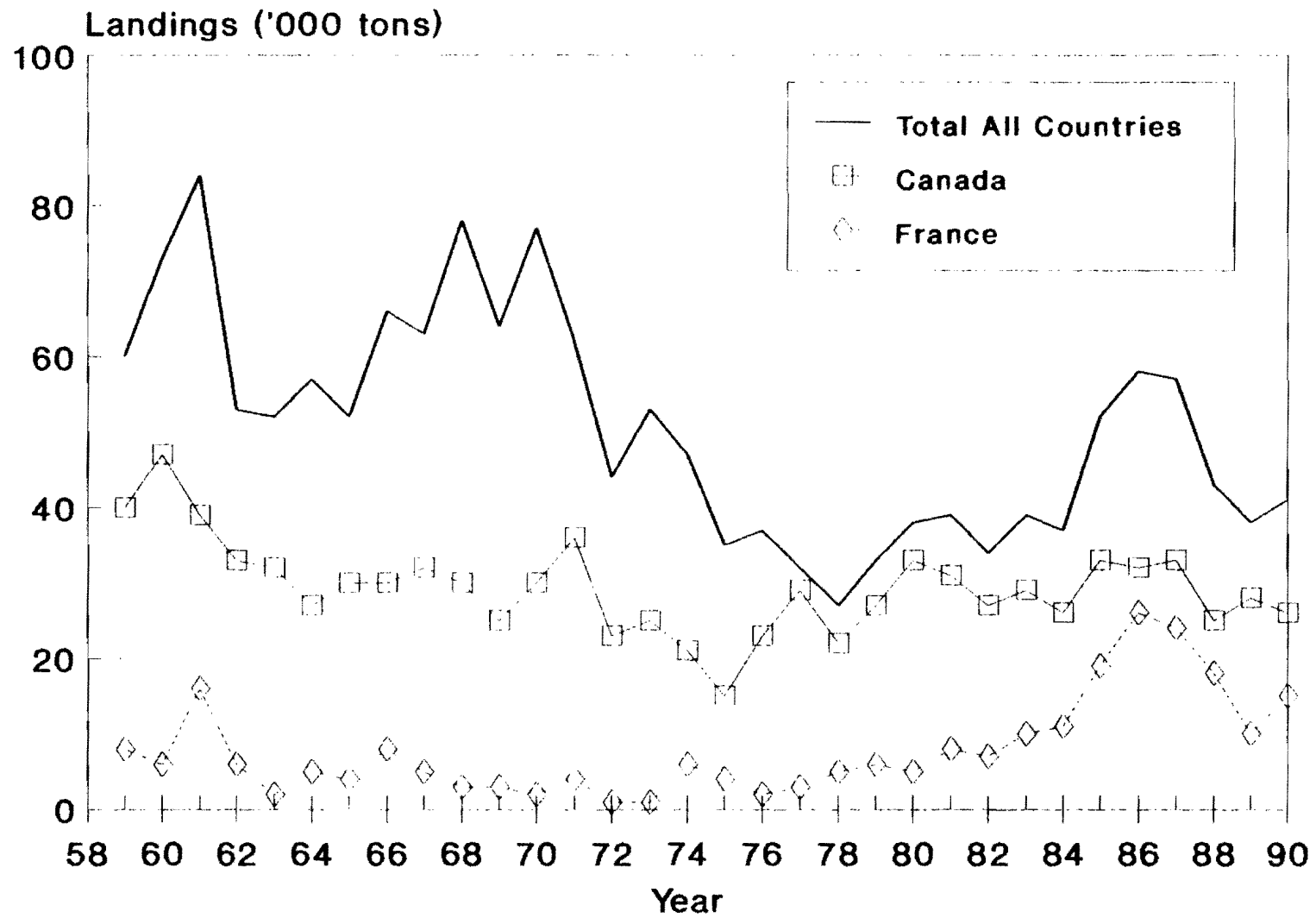
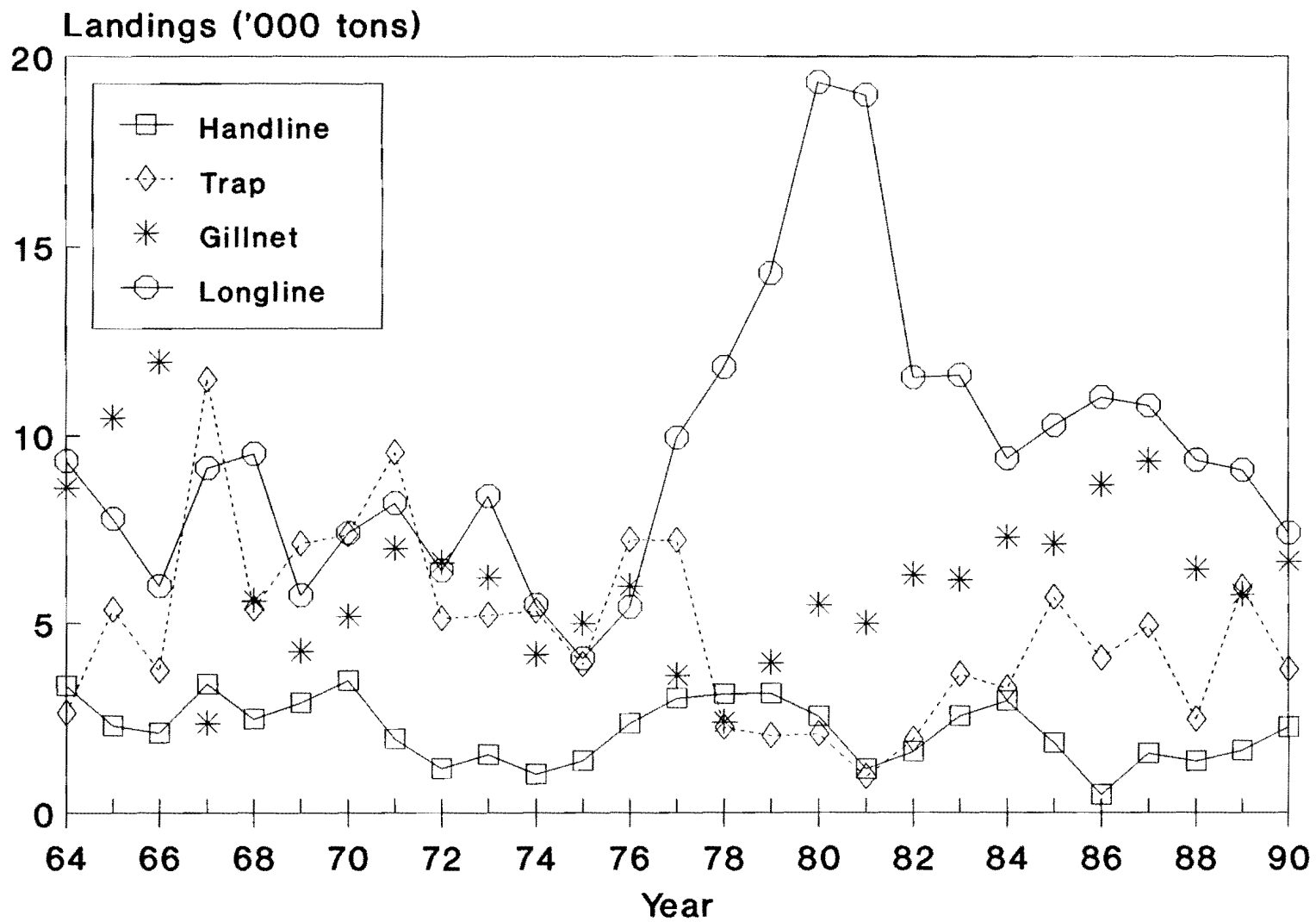Figure 1. Cod landings from Subdivision
3Ps for the period 1959-90.

Figure 2. Fixed gear cod landings by
Canada in Subdivision 3Ps.
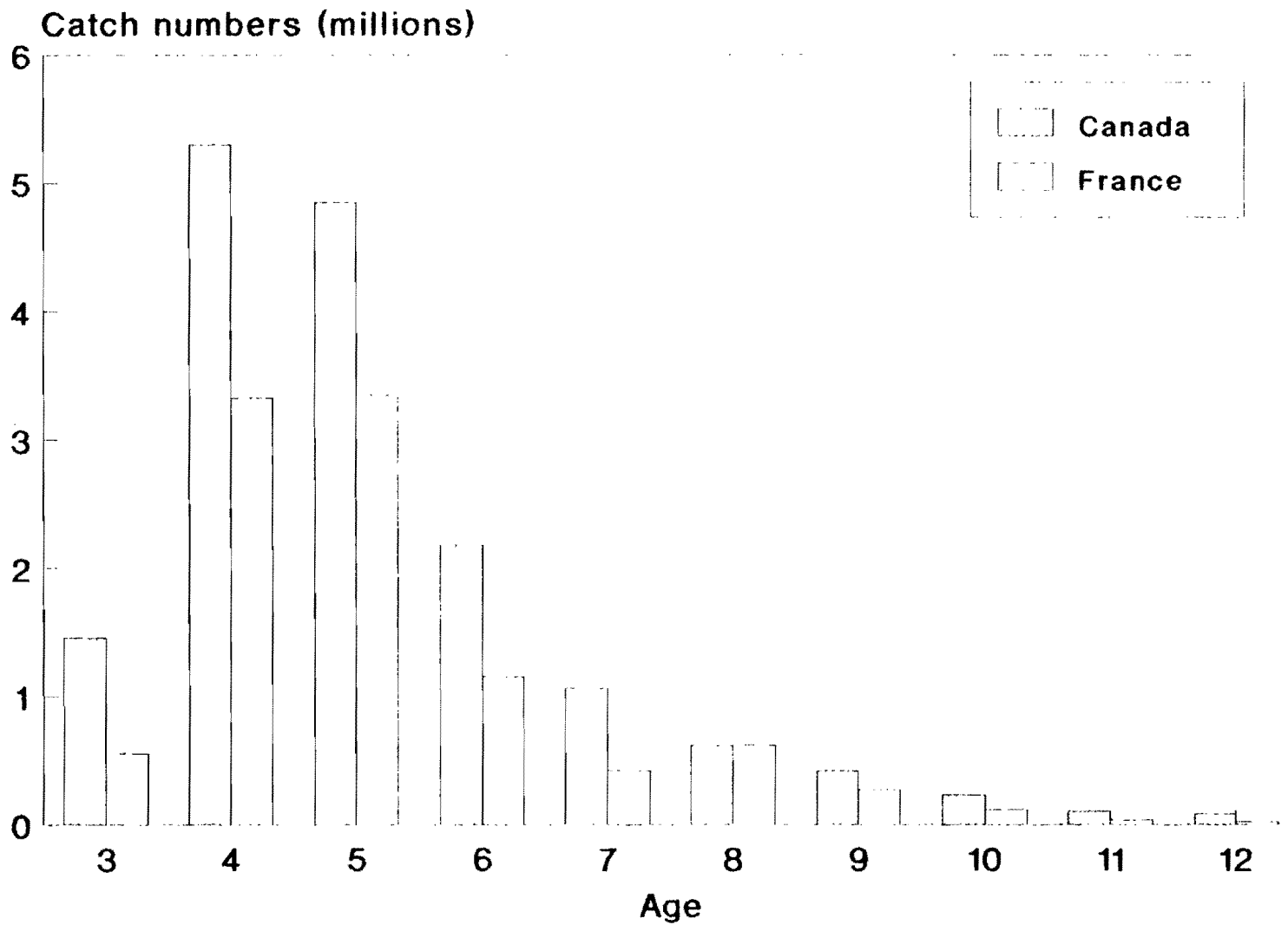
Catch numbers (millions)

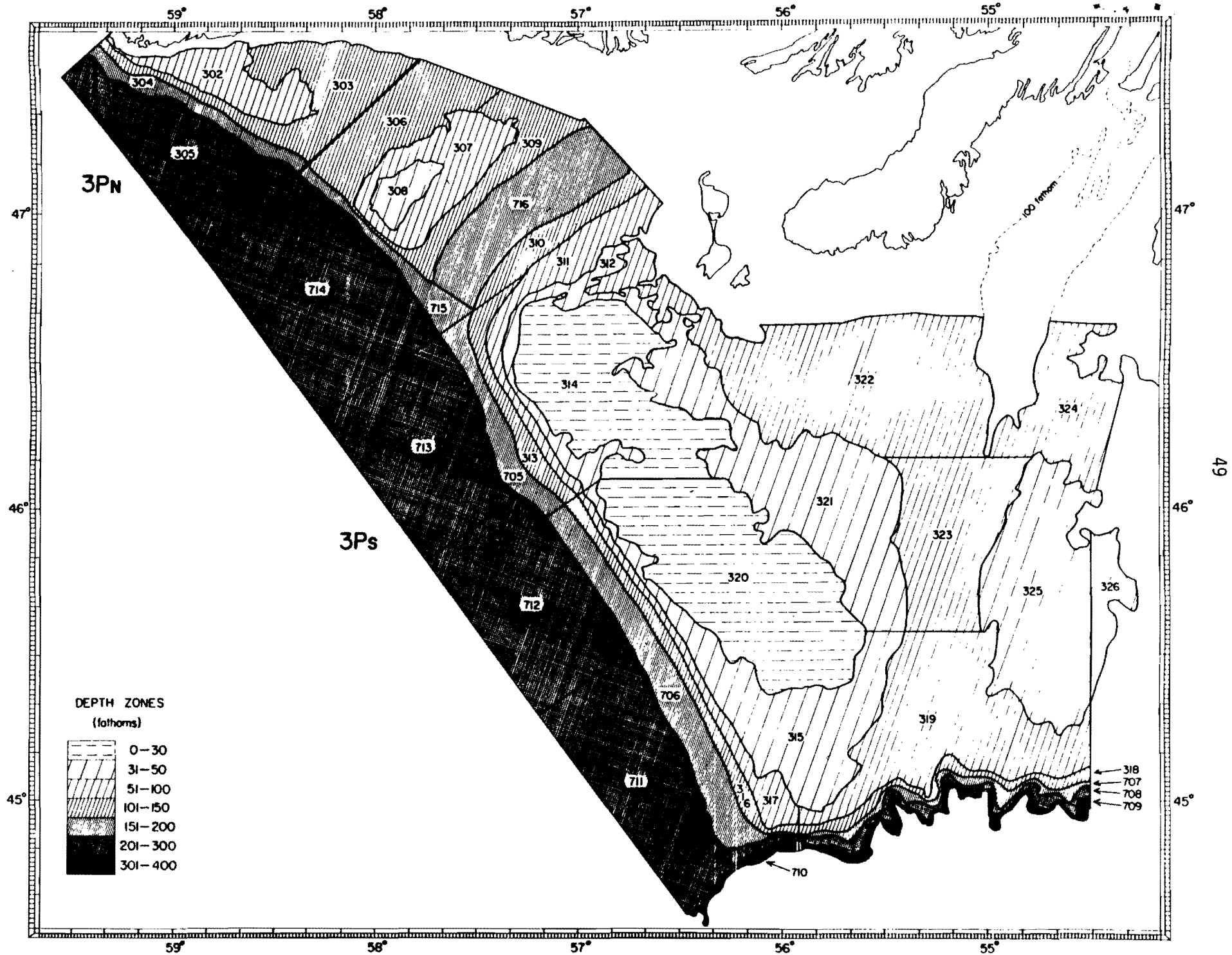Fig 3. Canadian and French commercial age compositions for 1990.

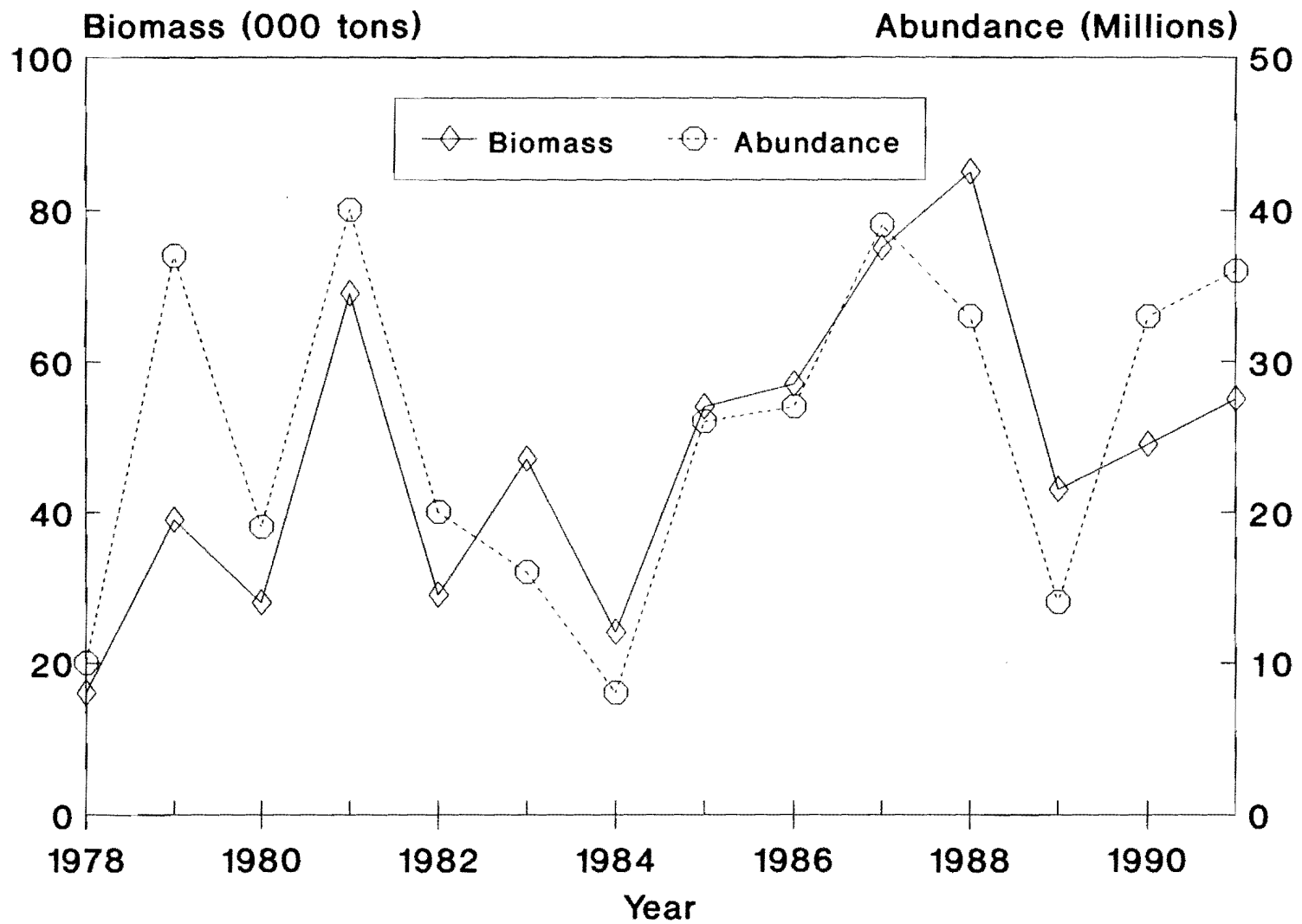FIGURE 4. STRATIFICATION SCHEME USED FOR RANDOM-STRATIFIED RESEARCH VESSEL SURVEYS IN SUBDIVISION 3PS.

Fig 5. Biomass and abundance of cod in
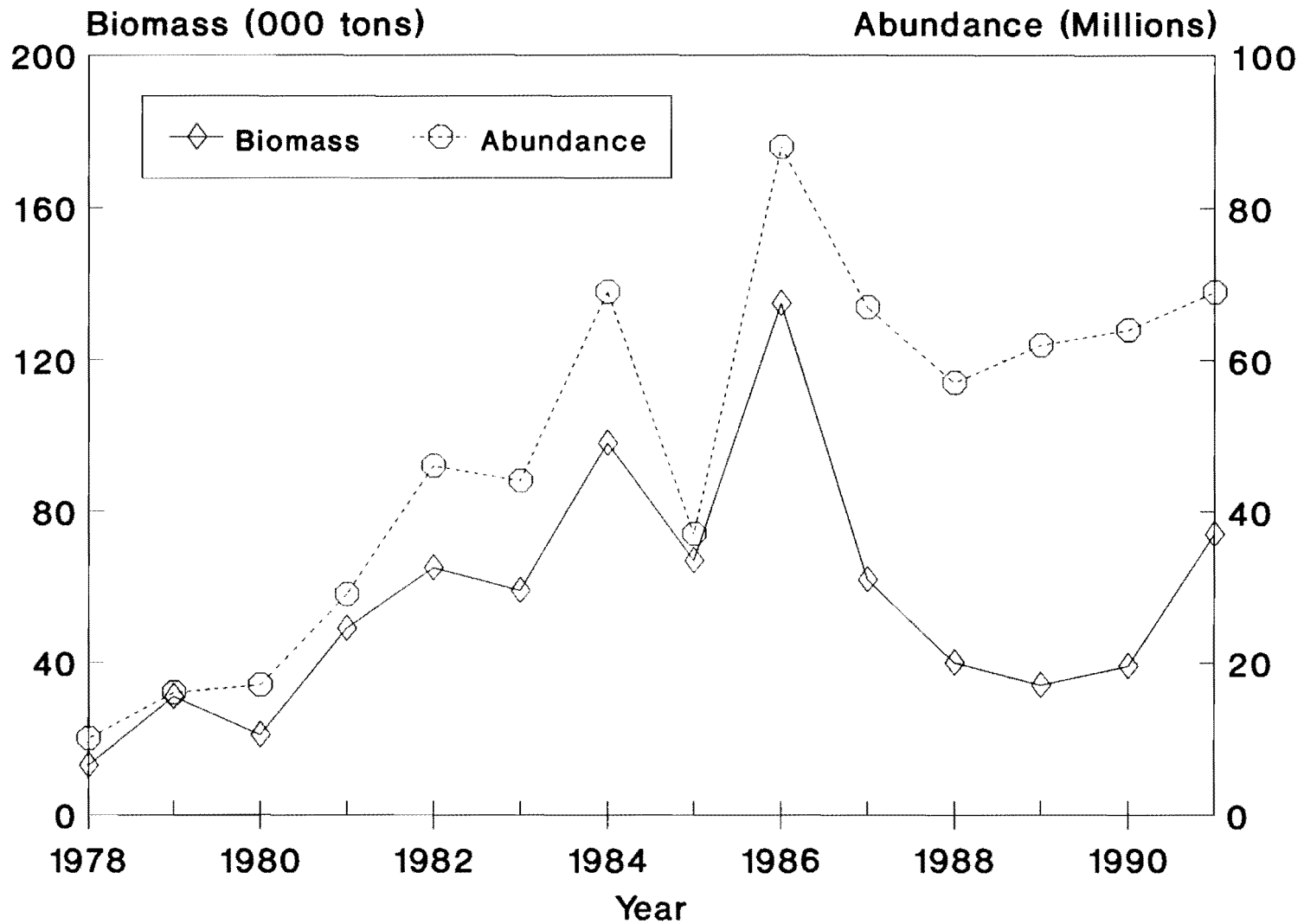Subdiv. 3Ps estimated by Canadian RV.

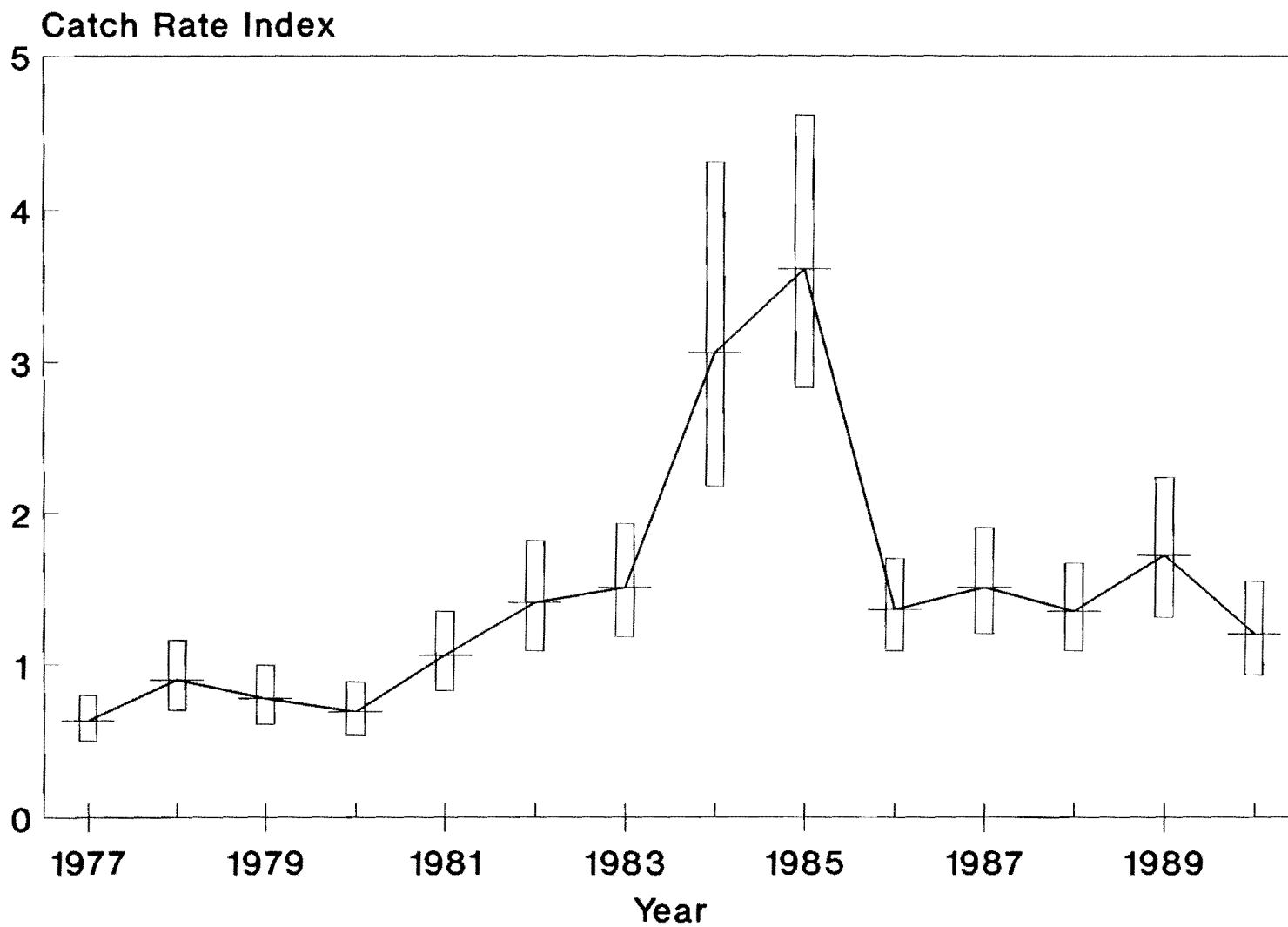Fig 6. Biomass and abundance of cod in
Subdiv. 3Ps estimated by French RV.

Figure 7. Catch rate index of Canadian
otter trawlers for cod in Subdiv. 3Ps.
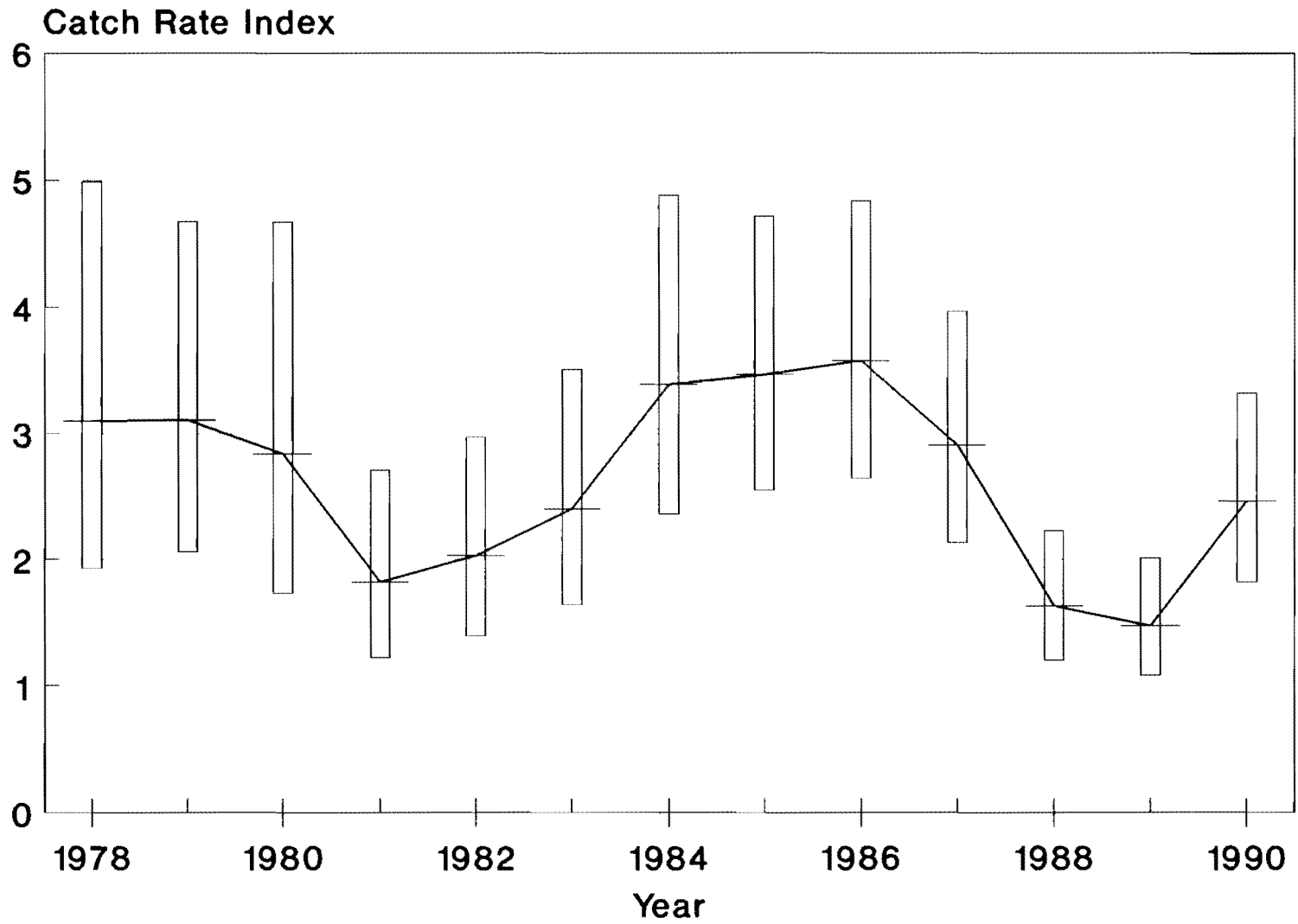
Catch Rate Index

Fig 8. Catch rate index of St Pierre
otter trawlers for cod in Subdiv. 3Ps.
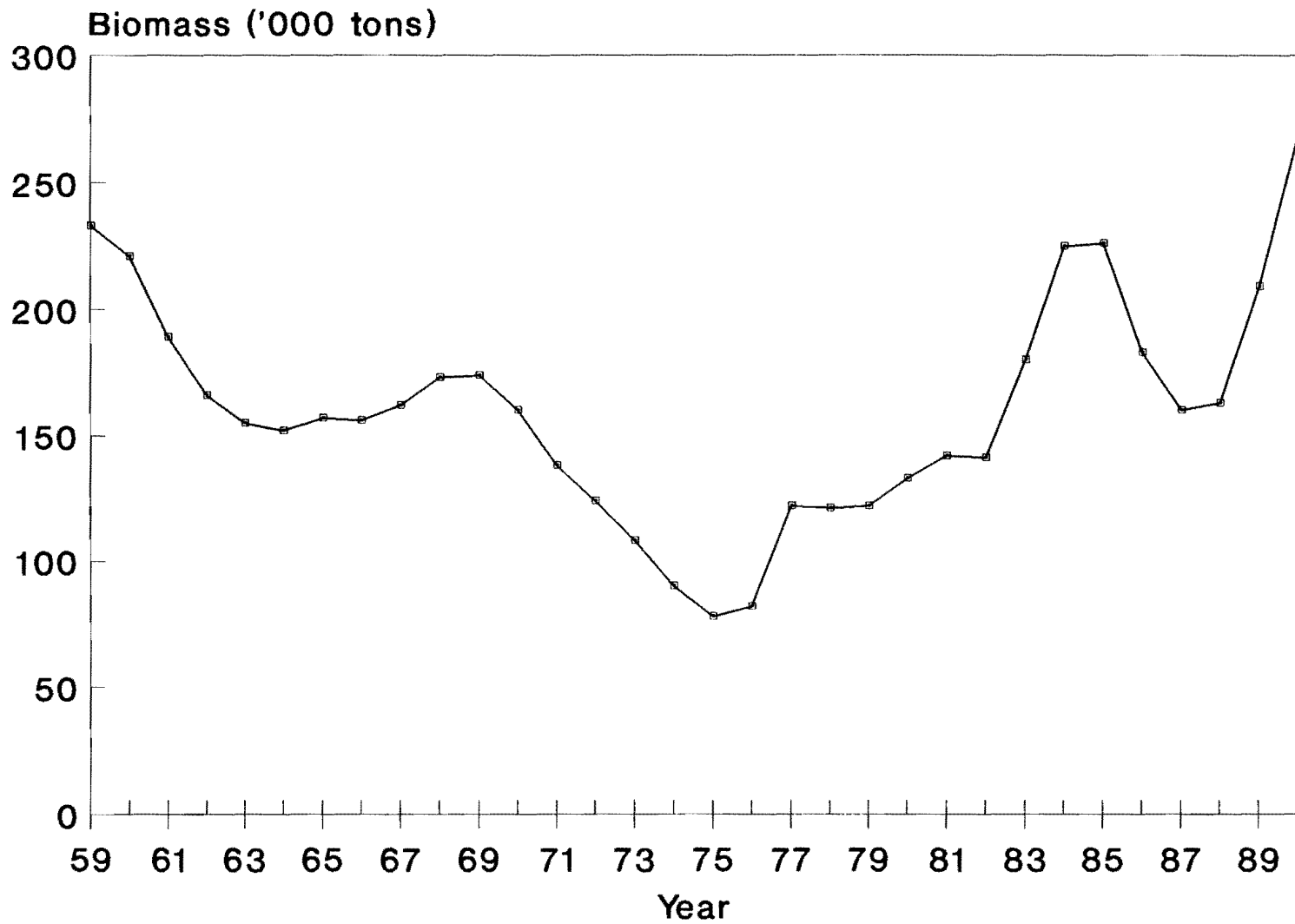
Figure 9. January 1 age 3+ population
biomass for cod in Subdivision 3Ps.
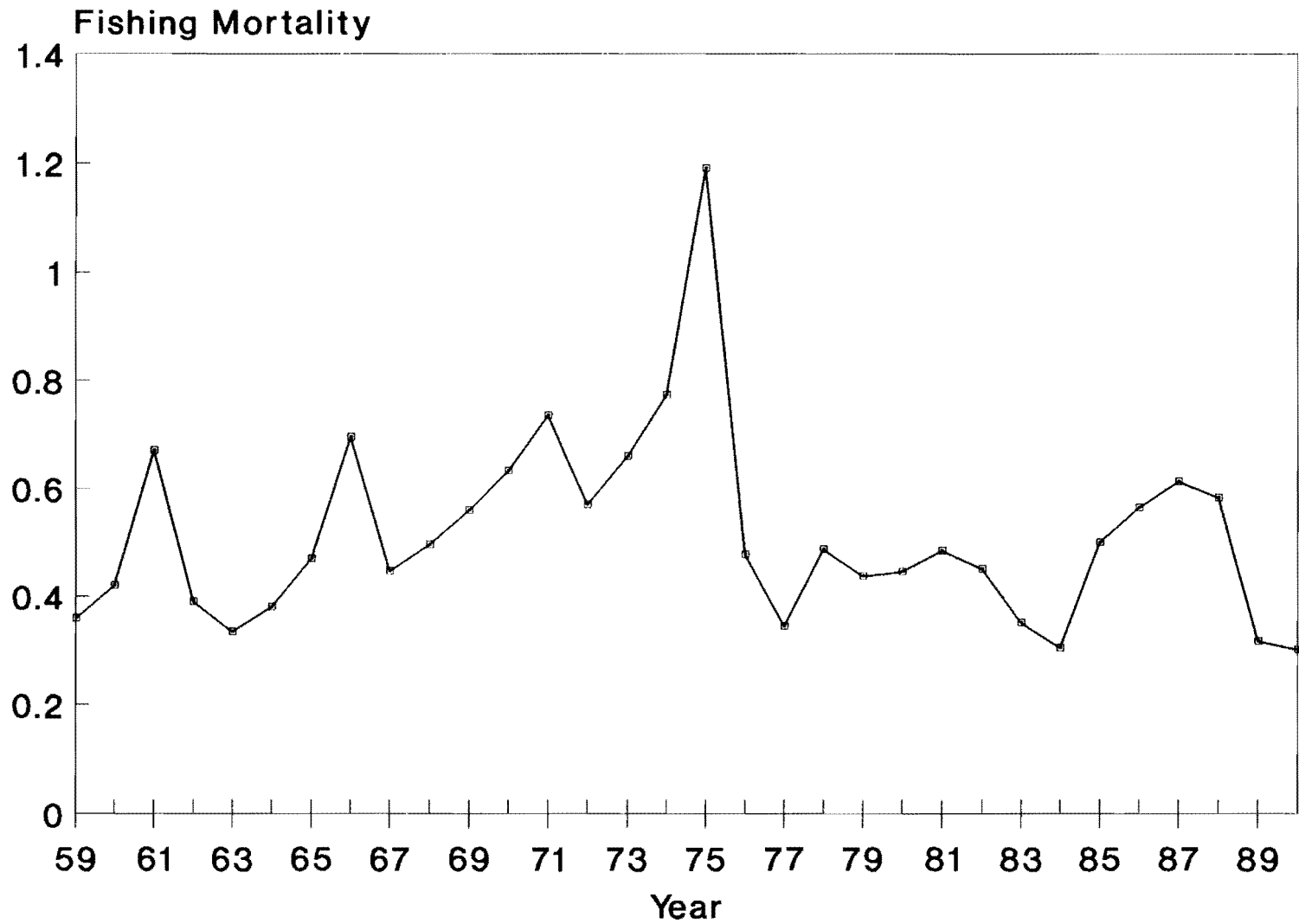
Figure 10. Fishing mortality (age 7-9)
for cod in Subdivision 3Ps.
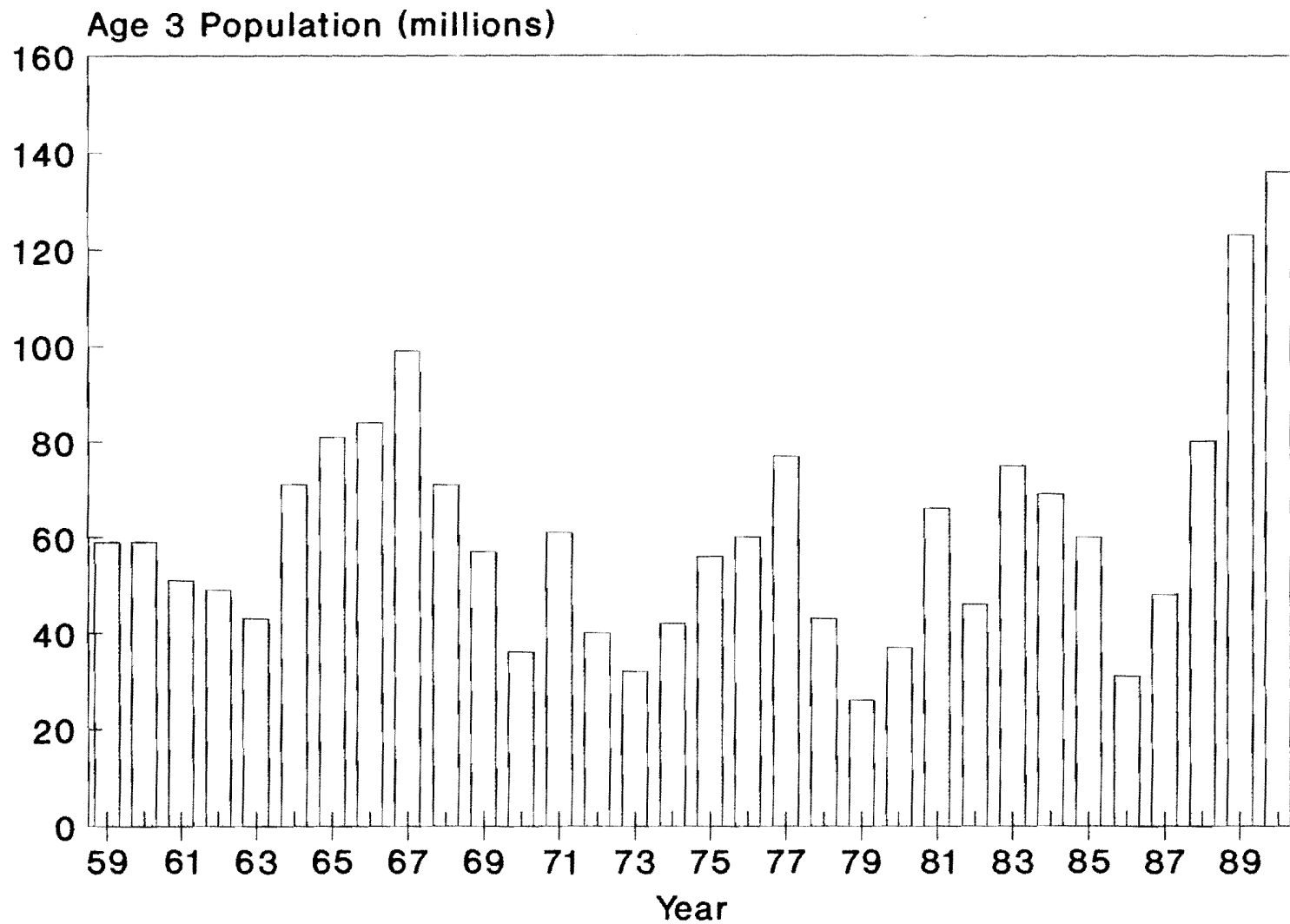
Age 3 Population (millions)

Figure 11. Age 3 population numbers
(recruits) for cod in Subdivision 3Ps.