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Status of the American Plaice Stock in NAFO Subarea 2 and
Division 3K

by

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Abstract

The database for this stock is not sufficient to permit an analytical assessment. Catches in some recent years have been less than 10% of the TAC of 10,000 t. Catches by offshore trawlers are too low in many years to permit the associated CPUE to be used as an index of stock abundance. Research vessel surveys continue to indicate a decline in biomass in Subarea 2, despite negligible catches. The biomass in Div. 3K has remained relatively stable. Despite the decline in overall abundance, continuation of the current TAC is recommended for 1989.

Résumé

Le base de données concernant ce stock n'est pas suffisante pour permettre une évaluation analytique. Les prises enregistrées au cours des quelques dernières années ont été inférieures à 10 % du TPA de 10 000 t. Pendant plusieurs années, les prises des chalutiers hauturiers ont été trop faibles pour permettre l'utilisation de la CPUE associée comme indice de l'abondance du stock. Les campagnes de recherche continuent d'indiquer une diminution de la biomasse dans la sous-zone 2 malgré le nombre négligeable de prises. La biomasse de la division 3K est demeurée relativement stable. En dépit de la baisse de l'abondance générale, on recommande pour 1989 d'observer le TPA actuel.

Introduction

TAC regulation and assessment history

The first TAC for this stock was introduced in 1974, at a level of 10,000 t. For 1975-77, the TAC was set at 8,000 t, based on average catches and yield per recruit calculations. For 1978, the TAC was reduced to 6000 t based on the calculation that fishing mortality was around $F_{0.1}$ from 1966 to 1976, when catches averaged about 6300 t. This level remained until 1982, when it was raised to 10,000 t, based on sequential population analysis (SPA) carried out in 1981. At that time, it was noted that the shortness of the time series for the commercial catch at age, CPUE, and research vessel series precluded calibration of the SPA, so terminal F was chosen based on survival estimates from commercial and research vessel data in the 1978-80 period. A further influence on the choice of F_T from the lower end of the range proposed was the increase in catch and CPUE experienced by the offshore fleet, which had exceeded the 1981 TAC of 6000 t by April of that year, while doubling its catch rate from the previous year. This magnitude of offshore effort has not occurred since that time, and one of the reasons may be the introduction of enterprise allocations, which had a marked effect on the distribution of trawler effort in Div. 2J and 3K in the winter months. SPA was attempted in 1982, but rejected because of difficulties in determining partial recruitment and terminal F. The TAC has remained at 10,000 t since that time, and further attempts have not been made at using SPA for this stock. With offshore trawler catches being negligible in some years and total catches being around 1000 t in recent years, it is doubtful if SPA would be useful for this stock in the near future.

Catch trends

The largest nominal catch reported for this stock was 12,686 t in 1970. From 1971 to 1981, catches averaged about 5500 t; however, since then, catches have been much lower, exceeding 1900 t only in 1986 (3000 t). The 1987 catch of 980 t is the second lowest since 1966 (Fig. 1). Prior to 1977, catches by foreign vessels comprised a substantial portion of the landings, but have dwindled to negligible amounts in recent years. Catches in the inshore sector have comprised the majority of the landings in most recent years. Catches by Canadian offshore trawlers continue to show large fluctuations, declining from a six-year high of 1895 t in 1986 to 200 t in 1987 (Table 1).

Catches from Subarea 2 have not exceeded 325 t since 1976, and totaled 145 t in 1987 (Table 2). Table 3 indicates that in most recent years, with the exception of 1986, peak catches have been taken in the summer months, largely in the inshore fishery. In years where the offshore catch was substantial, e.g. 1977, 1980-81, 1986, peak catches have occurred in the February to April period.

Catch/effort

CPUE data are available from Canadian offshore trawlers for the period 1976-87 (Table 4). However, in 3 of the past 4 years, the directed catch of American plaice by this fleet has been less than 25 t, and in 8 of the 12 years, less than 725 t. Therefore no significance can be given to these values as an index of stock abundance.

Stock Assessment

Length and age sampling

All samples taken from this stock (Table 5) were from the Canadian catch in Div. 3K, which comprised 81% of the total landings. The catch in 1987 (Table 6a) was made up mainly of fish aged 10-12 years. A comparison of catch at age and average weights at age for the years 1984-87 is shown in Table 6b. Catch and weight at age data are not available for some years prior to 1984, because sampling was not available for portions of the catch in some years, often due to the low total catches landed by some segments of the fishery in these years.

Research vessel survey data

The mean catch per tow by stratum, from Canadian surveys is shown in Tables 7a and 8a for Div. 2J and 3K respectively. The stratification scheme used in these surveys is shown in Fig. 2 and 3. Surveys were also conducted in Div. 2G and 2H from 1978 to 1981, and these results are contained in Tables 12 and 13. The 1986 and 1987 surveys in Div. 2GH were carried out using the stratification scheme shown in Fig. 4 and 5. The earlier surveys in these areas were done using a different scheme, and the results in Tables 12 and 13 were obtained by post-stratification of these surveys to the new stratification scheme.

The biomass in Div. 2J has declined steadily from a level of about 90,000 t in 1982-83 to 23,000 t in 1987. The biomass in Div. 3K has been relatively stable since 1979, although the 1987 value of 24,000 t is the lowest in the series (Fig. 6). Surveys in Div. 2G have not covered the entire area, but it appears that only a small population of American plaice exists there (Table 12). Table 13 indicates that the biomass in Div. 2H has declined from 15,000-17,000 t in 1979-81 to about 6,000 t in 1987, a rate of decline similar to that of Div. 2J.

To examine possible changes in distribution of American plaice in Div. 2J and 3K, biomass estimates by depth zone were examined for 1983-87 (Tables 7b, 8b). There is no evidence to suggest a movement of American plaice out of the survey range in Div. 2J, nor do the data indicate a migration to deeper water in Div. 2J (Table 7b). In Div. 3K, where the biomass has not declined as in 2J despite yielding 80% or more of the landings from this stock, higher percentages of the biomass were found in deeper water in 1986 and 1987 (Table 8b).

Tables 9 and 10 contain the mean number per tow, at age, from selected strata in the surveys in Div. 2J and 3K respectively. The trends in the total numbers per tow in these strata, which are similar to the trends in the total biomass, can be seen in Fig. 7. A comparison of the biomass estimates from the selected strata and the total area surveyed in Div. 2J and 3K can be seen in Table 11.

The survey catches are dominated by fish aged 7-9 in most years. In the 1987 assessment, it was noted that the catch per tow of American plaice aged 3 and 4 in Div. 3K in 1986, comprised a higher percentage of the catch per tow than in previous years. These year-classes again showed up as relatively strong at ages 4 and 5 in 1987, although these fish were still not fully recruited to the survey gear and the numbers at age were not out of the range of recent observations.

Discussion

The decline in biomass in Div. 2J, discussed in some detail in the last assessment of this stock, continued in 1987, with the result that the estimate for Div. 2J in 1987 was lower than the estimate for Div. 3K, for the first time in the 10-year time series. The commercial catch from 2J during the period of decline (1983-87) has averaged about 100 t per year. Therefore, it is not possible that the fishery has had any significant effect on the stock. Virtually the same situation exists in Div. 2H, where catches have been even lower, yet the biomass estimate declined by about two-thirds from 1979-81 to 1987.

A possible explanation for the decline (environmental conditions) was suggested in the 1987 assessment, noting positive correlations between biomass and water temperatures for the stock of American plaice on the Grand Bank. However the mechanism (higher mortality, decreased availability, migration) remains unknown. It was noted in the last assessment that the cooling trend observed in 1983-85 appeared to have ended in 1986, however the temperatures in the 1987 survey were similar to those observed in the coldest years of 1984 and 1985. In any case, it appears that the decline in biomass in Div. 2J continued in 1987 and the magnitude of the four-year decline (70%) is cause for concern in this stock. The biomass in Div. 3K has remained relatively stable in recent years, despite the fact that the fishery usually takes 80-90% of the landings from the stock from this area. In relating the distribution of the biomass in Div. 3K to that of Div. 2J, it is interesting to note the increased biomass in 1986-87 in the deeper waters of Div. 3K, an occurrence which did not happen in Div. 2J.

In the 1987 assessment, several sources of data were used to calculate total mortalities for this stock. However, given the highly variable results both within and between years, these estimates were not considered reliable. Therefore, no such estimates are presented in this paper,

In advising a continuation of the 10,000 t TAC for 1988, CAFSAC noted a number of positive indications for this stock, despite the declining abundance in Div. 2J. These were:

- 1) The biomass of American plaice in Div. 3K has remained relatively constant, although over 90% of the removals in recent years have come from this Division.
- 2) There appears to be a significant American plaice population in Div. 2H. Two of nine sets in depths less than 300 m indicated commercial concentrations of American plaice.
- 3) American plaice landings increased markedly from 1985 to 1986, with the directed fishery offshore taking its highest catch since 1981 while experiencing good catch rates.

- 4) If the apparent decline in biomass in Div. 2J has been environmentally induced, then the increase in water temperatures observed in 1986 may halt or reverse the trend.
- 5) The ratio of catch to biomass (from surveys) has been very low in recent years, and the 1986 biomass estimate in Div. 2J+3K was about 70,000 t.

Given the results presented here, only 1) and 5) still apply, and the total biomass in Div. 2J+3K in 1987 was down from 70,000 t to 47,000 t. Although there is a population of American plaice in Div. 2H, it is not extensive and may be 60-70% lower than it was in the late 1970s and early 1980s. The landings of American plaice in 1987 returned to the level observed in 1984 and 1985, and the offshore fishery was again negligible on this stock. And finally, as noted earlier, the increase in water temperatures observed in the 1986 survey did not continue in 1987, and the biomass in Div. 2J continued to decrease.

Despite the concerns about declining biomass, the total biomass estimated from R. V. surveys in 1987 for the stock was over 50,000 t. Therefore, it is unlikely that continuation of the 10,000 t TAC for 1989 will result in a fishing mortality level greater than $F_{0.1}$.

Table 1. Nominal catches and TAC's (t), American plaice, NAFO Subarea 2 plus Division 3K, 1967-88.

Year	[Inshore	Canada Offshore ^a	Total]	Poland	USSR	Other	Total	TAC
1967	395	-	395	1,134	1,701	414	3,644	
1968	1,023	-	1,023	1,889	2,911	128	5,951	
1969	1,689	-	1,689	867	4,129	217	6,902	
1970	3,751	-	3,751	378	8,160	397	12,686	
1971	2,486	-	2,486	233	2,597	32	5,348	
1972	1,188	9	1,197	849	6,760	315	9,121	
1973	1,368	16	1,384	225	3,011	520	5,140	
1974	462	106	568	91	4,643	318	5,620	10,000
1975	813	46	859	95	4,449	344	5,747	8,000
1976	1,741	736	2,477	118	3,373	139	6,107	8,000
1977	1,925	4,691	6,616	27	698	184	7,525	8,000
1978	1,723	1,452	3,175	138	123	86	3,522	6,000
1979	1,792	1,058	2,850	31	39	45	2,965	6,000
1980	1,140	3,746	4,886	39	26	89	5,040	6,000
1981	1,069	6,332	7,401	58	56	30	7,545	6,000
1982	576	1,265	1,841	13	8	38	1,900	10,000
1983	445	863	1,308	266	11	48	1,633	10,000
1984	559	502	1,061	81	6	27	1,175	10,000
1985 ^b	558	160	718	14	7	14	753	10,000
1986 ^b	1,006	1,895	2,901	1	39	68	3,009	10,000
1987 ^b	734	200	934	38	3	5	980	10,000
1988								10,000

^aIncludes some catches by inshore otter trawlers.

^bProvisional.

Table 2. Nominal catch by Division, American plaice in Subarea 2 plus Division 3K, 1972-87.

	2G	2H	2J	3K	Unknown	Total
1972	1	196	4,818	4,106		9,121
1973	0	26	1,788	3,326		5,140
1974	0	11	938	4,671		5,620
1975	73	0	1,101	4,573		5,747
1976	24	43	645	5,395		6,107
1977	0	0	224	7,301		7,525
1978	1	49	145	3,327		3,522
1979	0	11	221	2,733		2,965
1980	0	36	142	4,862		5,040
1981	0	38	96	7,411		7,545
1982	0	108	204	1,588		1,900
1983	0	124	168	1,341		1,633
1984	0	54	92	1,029		1,175
1985	0	11	34	708		753
1986 ^a	0	4	101	2,904		3,009
1987 ^a	0	0	145	789	46	980

^aProvisional.

Table 3. Nominal catch by month, American plaice in Subarea 2 plus Division 3K, 1972-87.

	Jan.	Feb.	Mar.	Apr.	May	June	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Unk.	Total
1972	1089	924	297	2688	321	423	849	1313	334	169	13	701		9121
1973	1570	1133	106	519	232	347	491	403	181	30	20	108		5140
1974	373	371	50	1	1425	1799	116	224	141	508	340	272		5620
1975	555	768	648	331	26	161	867	847	181	124	342	897		5747
1976	1517	579	30	156	382	657	592	549	429	413	274	529		6107
1977	64	641	2778	1488	675	691	665	425	67	20	2	9		7525
1978	469	748	259	119	394	534	479	401	63	22	5	29		3522
1979	62	328	66	146	609	707	603	284	47	13	0	100		2965
1980	3	137	796	2454	643	334	352	143	93	62	1	22		5040
1981	717	524	4380	507	411	246	306	253	51	11	8	131		7545
1982	36	298	178	327	377	204	147	148	143	7	2	33		1900
1983	236	118	30	18	179	223	231	181	72	201	105	39		1633
1984	51	20	78	36	84	217	280	251	103	16	8	31		1175
1985	11	3	8	22	53	67	130	242	161	36	7	13		753
1986 ^a	61	640	1097	61	136	249	337	229	71	6	8	114		3009
1987 ^a	34	27	24	6	27	138	273	217	67	23	2	142		980

^aProvisional.

Table 4. Catch and effort, Can(N) offshore trawlers, American plaice, Subarea 2 plus Division 3K, 1976-87.

Year	Total catch (t) from stock	Directed CPUE (t/hr)	Directed catch (t)
1976	6,107	0.395	701
1977	7,525	0.402	3,628
1978	3,522	0.375	652
1979	2,965	0.467	315
1980	5,040	0.525	2,151
1981	7,545	0.970	4,998
1982	1,900	0.505	500
1983	1,633	0.480	310
1984	1,175	0.419	21
1985 ^a	753	0.161	13
1986 ^a	3,009	0.808	950
1987 ^a	980	0.232	10

^aProvisional.

Table 5. List of commercial sampling by quarter and division available for 1987, for American plaice in Subarea 2 and Division 3K as collected by the St. John's Commercial Sampling Section.

	Quarter				Total
	1	2	3	4	
Offshore					
Can(N) Catch (t)	50	5	1	54	110
Samples	-	-	-	-	-
Measured	-	-	-	-	-
Otoliths	-	-	-	-	-
Inshore					
Catch (t)	-	24	626	84	734
Samples	-	4	12	-	16
Measured	-	1148	2472	-	3620
Otoliths	-	349	539	-	888

Table 6a. Catch and weight at age of American plaice in the commercial fishery in NAFO Subarea 2 + Div. 3K in 1987.

AGE	AVERAGE		CATCH		
	WEIGHT	LENGTH	MEAN	STD. ERR.	C. V.
*7	0.116	25.500		0.00	0.01
8	0.193	29.500	1	0.65	0.50
9	0.294	33.294	127	11.71	0.09
10	0.407	36.604	486	24.63	0.05
11	0.570	40.422	524	26.21	0.05
12	0.778	44.345	273	17.47	0.06
*13	1.000	47.746	127	11.79	0.09
14	1.226	50.669	58	7.84	0.13
*15	1.622	55.078	21	3.69	0.18
*16	1.934	58.038	4	1.33	0.34

Table 6b. Catch at age, weight at age of American plaice in the commercial fishery from 1984 to 1987.

CATCH AT AGE, 2+3K A, PLAICE, 1984-87

WEIGHTS AT AGE, 2+3K A, PLAICE, 1984-87

AGE	1984	1985	1986	1987	ase	1984	1985	1986	1987
7	7	4	1	1	7	0.218	0.291	0.241	0.116
8	122	16	29	1	8	0.307	0.344	0.313	0.193
9	241	115	293	127	9	0.397	0.414	0.358	0.294
10	331	237	1209	486	10	0.493	0.491	0.443	0.407
11	280	285	1372	524	11	0.651	0.611	0.601	0.570
12	199	207	876	273	12	0.779	0.793	0.816	0.778
13	182	110	461	127	13	0.905	1.070	1.088	1.000
14	158	44	205	58	14	1.224	1.384	1.420	1.226
15	70	15	63	21	15	1.618	1.705	1.776	1.622
16	23	2	27	4	16	1.969	1.997	2.142	1.934
17	14	0	2	0	17	2.114	2.296	2.617	2.237
18	2	1	3	0	18	2.100	2.617	3.343	2.531

Table 7a. Mean weight of American plaice per tow, by stratum, from research vessel surveys in Division 2J. Numbers in parentheses are the number of successful 30 minute tows in each stratum. The stratified mean weight per tow, the total number of sets in each year, and the biomass estimates are given at the bottom of the table. Strata marked with an asterisk were used in the calculation of abundance and biomass in Tables 9-11. (GA = R/V GADUS ATLANTICA.)

Depth (m)	Stratum	Year-survey										
		1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
		GA3	GA15	GA29	GA44	GA58	GA71 GA72	GA86 GA87 GA88	GA101 GA102 GA103	GA116 GA117 GA118	GA131 GA132 GA133	G145 G146 G147
101-200	201*	52.7(2)	56.5(3)	69.4(2)	121.2(3)	71.2(5)	151.0(6)	81.0(6)	59.5(3)	41.2(6)	29.5(5)	47.6(6)
201-300	202*	45.9(2)	14.5(2)	7.0(2)	17.8(2)	18.8(2)	46.8(2)	51.5(2)	7.0(2)	7.0(2)	14.3(2)	3.6(2)
301-400	203	7.4(2)	-	-	16.0(2)	2.3(2)	0.9(3)	0.7(3)	1.5(2)	0.3(3)	17.8(2)	0.9(3)
401-500	204	16.3(2)	-	-	-	6.9(2)	2.7(3)	9.0(3)	4.3(2)	2.9(2)	12.9(2)	4.0(2)
101-200	205*	75.3(4)	13.7(4)	51.7(2)	27.9(4)	74.9(8)	181.8(12)	67.1(8)	23.6(8)	31.5(8)	11.2(7)	9.7(10)
101-200	206*	253.3(11)	129.4(7)	31.0(8)	62.5(7)	131.0(11)	120.7(18)	213.6(14)	150.3(11)	50.8(14)	60.6(11)	27.0(14)
101-200	207*	72.6(5)	21.9(4)	30.0(5)	10.3(5)	22.3(9)	68.7(15)	33.7(10)	25.9(7)	21.6(13)	3.4(7)	12.3(11)
301-400	208*	16.9(4)	15.3(3)	25.4(2)	15.8(2)	15.0(2)	3.3(3)	3.5(2)	2.2(3)	10.1(3)	34.5(2)	4.6(2)
201-300	209*	54.1(7)	20.5(4)	21.9(5)	66.3(4)	52.0(6)	22.4(11)	15.8(7)	22.6(7)	21.4(9)	34.8(7)	36.1(8)
201-300	210*	12.8(6)	40.9(4)	18.8(2)	16.3(3)	13.4(3)	17.5(6)	272.8(2)	20.8(4)	9.1(4)	38.7(3)	2.8(4)
301-400	211	8.9(2)	24.7(2)	28.6(2)	44.4(3)	1.6(2)	2.5(2)	7.5(2)	2.3(2)	10.0(3)	8.5(2)	3.4(2)
501-750	212	2.2(4)	-	-	-	0.3(2)	0.1(5)	0.1(3)	0.1(3)	0.3(4)	6.7(3)	1.6(4)
201-300	213*	61.8(8)	48.4(4)	17.9(4)	100.2(5)	43.1(6)	45.5(10)	37.1(10)	12.0(5)	56.1(9)	52.2(9)	14.3(9)
201-300	214*	23.6(6)	26.6(4)	11.7(4)	11.5(3)	13.1(5)	4.0(8)	36.4(8)	39.6(4)	79.6(6)	2.7(6)	2.3(6)
201-300	215*	27.8(4)	59.0(5)	26.8(4)	4.0(2)	12.0(5)	4.1(9)	11.6(8)	1.5(3)	3.8(6)	3.3(5)	2.0(7)
301-400	216	0.6(2)	-	2.0(2)	0.2(2)	0.5(2)	0.5(2)	0.0(3)	1.3(2)	0.3(2)	0.3(2)	1.2(2)
401-500	217	0.2(3)	-	-	-	0.0(2)	0.0(2)	0.0(2)	-	0.0(2)	0.0(2)	0.7(2)
501-750	218	0.0(2)	-	-	-	0.0(2)	0.0(2)	0.0(2)	-	0.0(2)	0.0(2)	0.0(2)
751-1000	219	-	-	-	-	0.0(2)	-	0.0(2)	-	0.0(2)	0.0(2)	0.0(2)
1001-1250	220	-	-	-	-	-	-	-	-	-	-	-
1251-1500	221	-	-	-	-	-	-	-	-	-	-	-
301-400	222*	3.2(4)	2.7(3)	4.1(2)	8.0(2)	0.4(2)	2.3(3)	0.0(3)	0.2(3)	0.5(2)	0.0(2)	0.2(2)
401-500	223	0.0(2)	-	-	-	0.1(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
501-750	224	0.0(2)	-	-	-	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
1001-1250	225	0.0(2)	-	-	-	-	-	-	-	-	-	-
1251-1500	226	-	-	-	-	-	-	-	-	-	-	-
401-500	227	0.6(4)	-	-	-	0.2(2)	1.0(5)	0.3(4)	0.0(3)	0.1(4)	0.4(3)	0.7(4)
201-300	228	21.9(8)	-	8.3(4)	6.2(3)	8.8(6)	3.9(10)	4.5(6)	5.0(7)	9.1(7)	28.8(6)	13.3(7)
301-400	229*	7.0(4)	0.5(2)	1.6(2)	1.5(2)	0.1(2)	0.9(4)	1.3(4)	0.2(3)	0.1(3)	1.0(3)	0.4(3)
501-750	230	0.0(3)	-	-	-	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.3(2)
751-1000	231	0.0(2)	-	-	-	-	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)
1001-1250	232	0.0(2)	-	-	-	-	-	-	-	-	-	-
1251-1500	233	-	-	-	-	-	-	-	-	-	-	-
201-300	234	23.6(2)	9.8(2)	6.4(2)	32.8(2)	5.0(2)	3.5(3)	14.5(3)	14.7(2)	1.7(3)	3.3(2)	1.9(3)
401-500	235	14.3(4)	-	-	-	16.8(2)	1.3(3)	2.3(2)	1.2(3)	0.0(2)	8.0(2)	0.9(2)
751-1000	236	0.0(2)	-	-	-	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.0(2)	0.2(2)	0.0(2)
Mean (#set)		58.4(117)	44.4(53)	26.7(54)	40.0(56)	36.9(102)	50.6(157)	53.6(129)	31.6(99)	23.6(131)	21.1(109)	12.8(129)
Biomass(t)		104,542	57,867	38,383	58,989	65,110	88,996	95,259	53,942	41,929	37,444	22,714

Table 7b. Biomass estimates (t) of *A. plaice*, by depth zone, in NAFO Div. 2J from 1983-87 surveys. Numbers in parentheses are the percentages of biomass in each depth zone.

Depth range (m)	Year				
	1983	1984	1985	1986	1987
101-200	69,418 (74.4)	46,055 (80.6)	22,037 (52.3)	18,502 (47.2)	13,738 (60.5)
201-300	23,082 (24.8)	10,690 (18.7)	19,184 (45.6)	17,916 (45.8)	8,381 (36.9)
301-400	344 (0.4)	236 (0.4)	786 (1.9)	1,915 (4.9)	329 (1.5)
401-500	360 (0.4)	148 (0.3)	75 (0.2)	559 (1.4)	185 (0.8)
501-750	4 (0.0)	4 (0.0)	12 (0.0)	265 (0.7)	81 (0.4)
751-1000	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.0)	0 (0.0)
Total	93,208	57,133	42,094	39,159	22,714

Table 8a. Mean weight of American plaice per tow, by stratum, from research vessel surveys in Division 3K. Numbers in parentheses are the number of successful 30 minute tows in each stratum. The stratified mean weight per tow, the total numbers of sets in each year, and the biomass estimates are given at the bottom of the table. Strata marked with an asterisk were used in the calculation of abundance and biomass in Tables 9-11.

Depth (m)	Stratum	Year-survey									
		1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
		GA15	GA29	GA44	GA58 GA59	GA71 GA72	GA86 GA87 GA88	GA101 GA102 GA103	GA116 GA117 GA118	GA131 GA132 GA133	GA145 GA146 GA147
101-200	618	-	-	-	-	-	-	23.3(5)	25.5(6)	3.2(5)	2.8(7)
101-200	619	-	-	-	-	-	-	10.7(7)	4.3(7)	0.8(5)	0.5(8)
201-300	620*	112.9(7)	29.5(7)	50.2(9)	33.5(10)	37.9(9)	38.4(10)	51.9(13)	21.8(14)	24.7(9)	19.9(4)
201-300	621*	92.8(7)	64.3(8)	21.0(10)	66.0(11)	29.4(14)	39.7(12)	41.7(14)	39.8(15)	10.3(14)	12.4(12)
401-500	622	-	-	-	9.5(2)	16.2(3)	8.3(2)	9.4(4)	1.2(4)	28.0(2)	6.1(3)
301-400	623*	50.4(3)	16.0(3)	88.4(4)	50.2(4)	15.0(5)	23.3(6)	18.7(5)	3.3(6)	23.6(4)	19.6(5)
201-300	624*	18.3(3)	11.3(2)	5.0(2)	25.3(2)	17.0(4)	13.9(4)	17.6(4)	16.1(4)	9.0(2)	17.8(4)
301-400	625*	12.3(3)	7.7(3)	5.3(4)	9.9(4)	7.3(2)	16.8(3)	10.3(5)	11.6(5)	12.7(3)	8.6(3)
301-400	626*	7.2(4)	21.2(3)	40.5(3)	58.4(5)	20.3(5)	31.8(4)	38.5(6)	17.3(5)	85.8(4)	23.6(5)
401-500	627	-	-	-	14.6(6)	6.1(7)	6.2(6)	12.5(8)	11.4(7)	41.7(5)	20.2(6)
301-400	628*	5.6(5)	22.2(2)	6.6(4)	3.9(6)	2.3(6)	16.3(6)	17.0(7)	11.8(6)	7.9(4)	13.8(5)
301-400	629*	6.8(3)	6.6(2)	8.0(3)	7.5(3)	3.3(2)	8.8(3)	5.3(4)	4.5(4)	16.9(3)	11.3(3)
301-400	630*	-	5.4(2)	24.9(2)	8.5(2)	-	4.3(2)	4.9(3)	3.6(4)	3.4(2)	4.7(3)
401-500	631	-	-	-	7.4(5)	4.0(2)	3.8(5)	6.9(5)	7.9(7)	24.8(4)	20.8(6)
201-300	632*	9.2(3)	14.1(2)	6.4(2)	8.5(2)	5.3(3)	10.2(3)	-	5.3(3)	3.5(2)	2.5(2)
301-400	633*	5.9(5)	4.8(6)	2.3(7)	2.6(8)	3.2(7)	2.4(12)	1.7(10)	1.3(12)	14.3(8)	2.4(11)
201-300	634*	5.5(5)	4.3(6)	4.6(5)	6.5(7)	5.3(11)	2.4(5)	4.5(7)	2.2(9)	3.8(5)	4.1(11)
201-300	635*	10.5(5)	7.5(5)	13.8(4)	13.2(5)	16.8(5)	26.5(6)	18.8(8)	4.9(7)	7.5(6)	5.7(6)
201-300	636*	14.2(3)	7.0(5)	4.7(5)	4.4(6)	8.3(10)	11.4(6)	14.4(8)	6.5(8)	4.7(4)	8.1(7)
201-300	637*	7.5(4)	7.0(4)	7.3(4)	9.0(6)	16.9(7)	9.5(5)	15.6(6)	4.1(7)	7.0(4)	13.6(6)
301-400	638*	11.8(5)	10.1(7)	10.0(6)	12.1(8)	5.6(15)	8.0(11)	5.9(10)	12.3(11)	13.9(4)	16.6(10)
301-400	639*	6.4(5)	1.0(2)	5.2(4)	2.1(6)	3.9(10)	1.0(7)	6.0(8)	1.4(8)	5.8(6)	2.9(7)
401-500	640	-	-	-	0.0(2)	0.0(2)	-	0.0(2)	0.3(3)	4.1(2)	3.2(2)
501-750	641	-	-	-	0.0(2)	0.0(4)	0.0(3)	0.0(3)	0.3(4)	-	1.1(3)
751-1000	642	-	-	-	0.0(3)	0.0(6)	-	0.0(6)	0.0(5)	-	0.1(5)
1001-1250	643	-	-	-	-	-	-	-	-	-	-
1251-1500	644	-	-	-	-	-	-	-	-	-	-
401-500	645	-	-	-	0.0(2)	0.0(3)	0.1(2)	0.0(2)	0.1(3)	-	1.5(2)
501-750	646	-	-	-	0.0(2)	0.0(2)	0.3(2)	0.0(2)	0.0(3)	-	0.0(2)
751-1000	647	-	-	-	0.0(2)	0.0(2)	-	-	0.0(3)	-	-
1001-1250	648	-	-	-	-	-	-	-	-	-	-
1251-1500	649	-	-	-	-	-	-	-	-	-	-
Mean (#sets)		34.3(70)	18.3(69)	19.0(78)	18.8(121)	12.6(146)	15.9(125)	17.4(162)	11.2(180)	15.1(107)	10.3(159)
Biomass(t)		57,314	31,354	32,480	40,222	26,455	32,167	40,026	26,548	32,923	24,035

Table 8b. Biomass estimates (t) of *A. plaice* by depth zone, in NAFO Div. 3K from 1983-87 surveys. Numbers in parentheses are the percentages of biomass in each depth zone.

Depth range (m)	Year				
	1983	1984	1985	1986	1987
101-200	-	3,826 (9.6)	3,293 (12.4)	439 (1.3)	359 (1.5)
201-300	22,249 (69.2)	25,626 (64.0)	15,734 (59.3)	10,075 (30.6)	10,302 (42.9)
301-400	8,624 (26.8)	8,400 (21.0)	5,727 (21.6)	15,076 (45.8)	9,292 (38.7)
401-500	1,288 (4.0)	2,179 (5.4)	1,785 (6.7)	7,332 (22.3)	4,030 (16.8)
501-700	6 (0.0)	0 (0.0)	11 (0.0)	-	50 (0.2)
751-1000	-	0 (0.0)	0 (0.0)	-	4 (0.0)
Total	32,167	40,031	26,550	32,922	24,037

Table 9. Mean number of American plaice per tow from R.V. surveys in Division 2J. The same strata were used in the calculations for each year.

Age	GA 3	GA 15	GA 29	GA 44	GA 58-59	GA 71,72	GA 86-88	GA 101-103	GA 116-118	GA 131-133	GA 145-147
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	0.01	0.01	-	-	0.01	-	0.01
3	-	0.03	-	-	0.01	0.17	0.06	-	0.05	0.10	0.08
4	0.20	0.57	0.32	0.07	0.81	0.38	0.85	0.34	0.16	0.23	0.41
5	8.54	5.24	2.20	0.66	3.41	3.86	1.88	1.34	1.65	1.20	0.62
6	17.56	15.90	9.45	5.42	21.19	10.83	10.32	4.62	6.50	4.59	4.30
7	34.54	24.24	16.99	27.48	29.15	33.06	32.13	16.20	15.24	11.05	6.23
8	48.43	20.35	17.62	21.65	22.98	38.34	41.28	23.38	19.11	12.05	7.60
9	27.63	15.47	10.64	13.08	8.92	38.63	23.81	18.76	17.34	11.68	5.80
10	12.77	9.80	5.89	8.69	5.99	17.06	17.09	8.04	5.99	5.05	4.09
11	8.13	5.50	2.66	4.82	2.15	6.81	8.80	4.17	2.24	1.28	1.16
12	5.62	4.42	3.55	4.41	0.87	4.18	2.50	1.36	1.40	1.01	0.72
13	3.71	3.71	2.11	1.96	0.07	2.56	1.62	1.14	0.69	0.40	0.26
14	2.10	1.70	0.62	1.16	-	1.13	0.42	0.21	0.11	0.08	0.06
15	0.87	1.22	0.16	0.34	-	0.22	0.16	0.08	-	0.04	0.01
16	-	0.58	0.06	0.15	-	0.11	-	-	-	-	-
17	-	0.20	-	0.05	-	0.02	0.01	-	-	-	-
18	-	0.01	-	0.02	-	-	-	-	-	-	-
19	-	0.01	-	-	-	-	-	-	-	-	-
UNK	-	-	-	-	0.08	0.03	0.01	0.01	0.01	-	0.02
Mean ^a	170.10	108.95	72.27	89.96	95.64	157.40	140.94	79.65	70.50	48.76	31.37
No.Sets	67	49	44	44	66	107	84	63	85	69	84

^aDiffers slightly from column totals.

Table 10. Mean number of American plaice per tow from R.V. surveys in Division 3K. The same strata were used in the calculations for each year.

Age	GA 15	GA 29	GA 44	GA 58,59	GA 71,72	GA 86-88	GA 101-103	GA 116-118	GA 131-133	GA 145-147
	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1	-	0.01	-	-	-	-	0.01	-	0.02	0.02
2	-	-	0.01	-	0.02	0.01	0.07	0.18	0.09	0.04
3	0.24	0.01	0.08	0.16	0.31	0.57	0.17	0.21	1.34	0.45
4	4.02	0.40	0.12	0.23	0.55	0.79	1.70	0.66	1.98	2.27
5	10.28	2.31	1.19	1.09	1.20	2.97	2.38	1.90	2.36	2.53
6	15.12	5.06	4.01	2.33	2.95	5.46	6.78	2.75	4.47	4.03
7	13.59	6.89	10.31	8.18	5.75	9.46	7.00	5.10	4.69	4.52
8	10.05	7.51	7.25	11.65	7.69	9.72	12.44	5.70	5.91	4.63
9	8.65	6.11	5.29	6.71	6.29	4.00	6.96	4.46	5.17	4.17
10	7.23	4.45	4.49	7.19	3.27	3.10	3.35	2.23	2.62	1.60
11	4.33	2.07	2.62	2.24	2.18	1.13	2.03	1.00	1.09	0.77
12	3.72	2.64	2.09	3.03	1.06	1.18	1.39	1.06	0.87	0.50
13	3.23	1.32	1.03	1.45	0.86	0.56	0.67	0.52	0.41	0.18
14	1.67	0.43	0.66	0.61	0.42	0.30	0.30	0.11	0.17	0.13
15	1.30	0.17	0.26	0.37	0.22	0.12	0.20	0.08	0.04	0.08
16	0.67	0.15	0.10	0.26	0.07	0.03	0.05	0.03	-	0.03
17	0.25	0.01	0.05	-	0.05	-	0.02	-	-	-
18	0.08	0.03	0.03	0.04	0.01	-	-	-	-	-
19	0.01	-	-	-	-	-	-	-	-	-
UNK	0.04	0.02	-	0.01	0.01	0.04	-	-	0.01	0.01
Mean ^a	84.48	39.59	39.59	45.55	32.91	39.44	45.51	25.99	31.24	26.05
No.Sets	70	69	78	95	115	105	119	128	84	114

^aDiffers slightly from column totals.

Table 11. Biomass estimates (t) for American plaice from random stratified surveys in Division 2J and 3K, 1978-87. The same strata were used in the calculations shown in the first three rows of the table. The last row gives the total estimated biomass for all strata surveyed.

Division	Year									
	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
2J	56,881	36,487	55,398	63,101	88,164	93,685	52,549	40,524	32,423	20,800
3K	57,314	31,354	32,480	37,807	24,787	30,873	34,022	21,459	25,151	19,592
Total for selected strata	114,195	67,841	87,878	100,908	112,951	124,558	86,571	61,983	57,574	40,392
Total for all strata	115,181	69,737	91,469	105,331	115,451	127,426	93,968 ^a	68,477 ^a	70,367 ^a	46,749 ^a

^aIncludes strata 618 and 619 added in 1984.

Table 12. Biomass (t) of *A. plaice*, by stratum, from R. V. surveys in Div. 2G

Stratum	Depth (m)	Year-Trip			
		GA13 1978	GA24 1979	GA57 1981	GA143 1987
901	201-300	459	318	310	223
902	301-400	-	-	-	0
903	401-500	-	1	0	0
904	501-750	-	-	0	0
905	751-1000	-	-	-	-
906	1001-1250	-	-	-	0
907	1251-1500	-	-	-	-
908	201-300	100	33	0	12
909	≤200	1563	272	1184	-
910	≤200	887	174	303	-
911	201-300	142	38	104	42
912	301-400	-	-	-	0
913	401-500	-	-	-	0
914	501-750	-	-	-	0
915	751-1000	-	-	-	-
916	1001-1250	-	-	-	-
917	1251-1500	-	-	-	-
918	1251-1500	-	-	-	-
919	1001-1250	-	-	-	-
920	751-1000	-	-	-	0
921	501-750	-	0	-	0
922	401-500	0	-	0	-
923	301-400	0	-	3	0
924	201-300	52	103	71	11
925	≤200	645	200	158	-
926	201-300	-	-	-	-
927	301-400	-	-	-	0
928	401-500	-	-	-	0
929	501-750	-	0	16	0
Total biomass ^a		3848	1140	2148	288
# sets		53	59	52	54

^aColumn totals slightly different due to rounding.

Table 13. Biomass (t) of *A. plaice*, by stratum, from R. V. surveys in Div. 2H.

Stratum	Depth (m)	Year-Trip				
		GA13 1978	GA24 1979	GA57 1981	WT52 1986	GA143 1987
930	≤200	2908	7614	9969	5324	672
931	201-300	577	1919	86	21	289
932	301-400	-	-	-	-	1
933	401-500	-	-	-	-	-
934	501-750	-	0	-	0	0
935	751-1000	-	-	-	-	0
936	1001-1250	-	-	-	-	0
937	1251-1500	-	-	-	-	-
938	1251-1500	-	-	-	-	-
939	1001-1250	-	-	-	-	0
940	751-1000	-	-	-	-	0
941	501-750	-	-	-	0	0
942	401-500	-	0	0	0	0
943	201-300	235	2099	286	47	19
944	301-400	57	353	46	124	14
945	401-500	-	143	13	-	115
946	501-750	197	442	155	-	50
947	501-750	-	58	75	-	9
948	401-500	-	-	-	-	-
949	301-400	-	-	-	-	-
950	201-300	-	-	-	-	-
951	401-500	8	36	14	-	26
952	301-400	-	18	169	-	115
953	201-300	208	1320	117	-	3360
954	≤200	452	410	3614	-	286
955	201-300	93	172	10	-	33
956	≤200	1027	370	1824	-	900
957	≤200	2271	475	1149	-	469
958	201-300	-	80	0	-	22
959	301-400	-	11	0	-	0
960	401-500	-	0	0	-	7
961	501-750	-	0	0	-	0
962	751-1000	-	-	-	-	0
963	1001-1250	-	-	-	-	0
964	1251-1500	-	-	-	-	-
Total biomass ^a		8031	15522	17527	5516	6388
# sets		51	75	83	20	121

^aColumn totals slightly different due to rounding.

Nominal Catch of Am. Plaice in NAFO SA2+Div. 3K

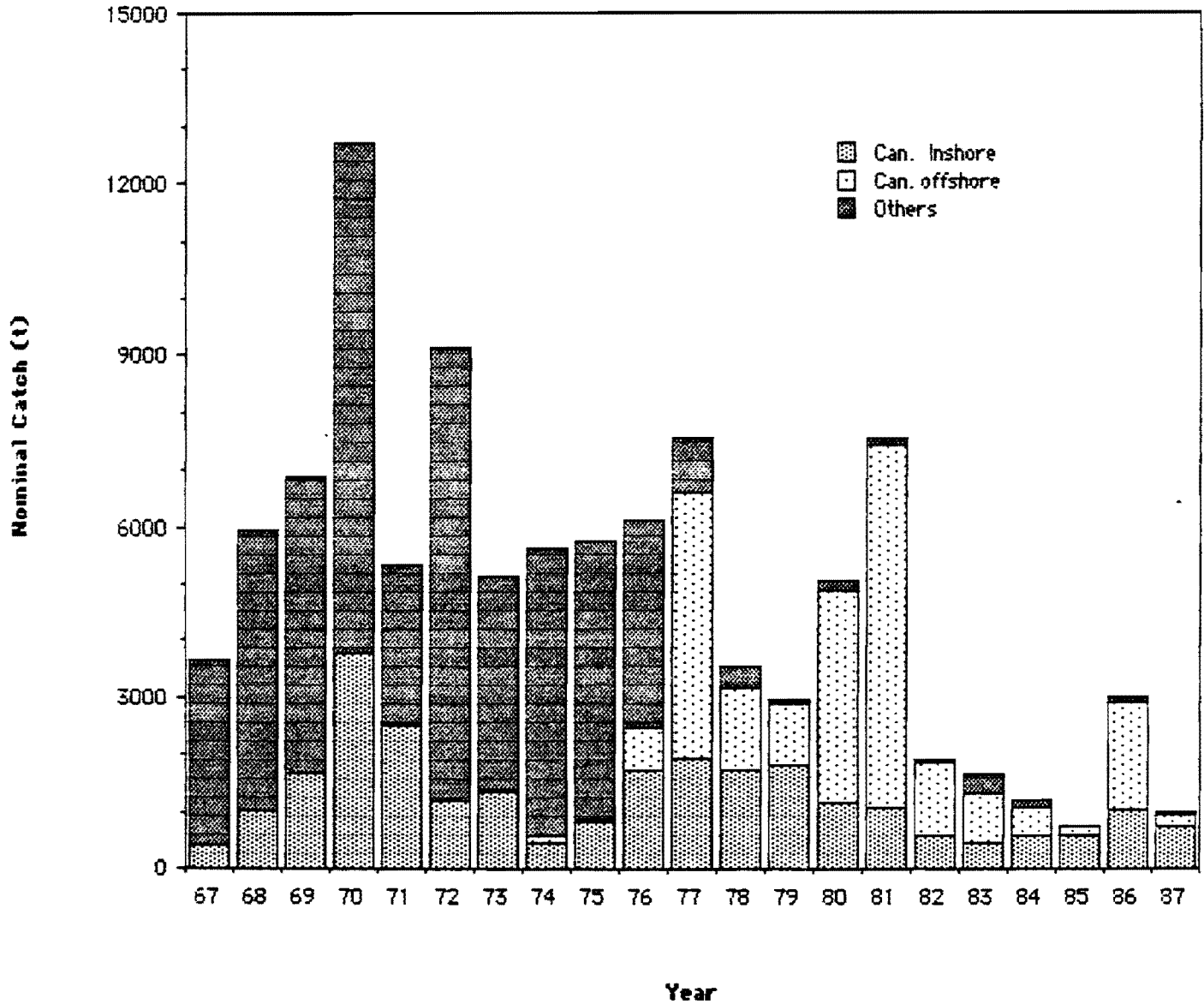
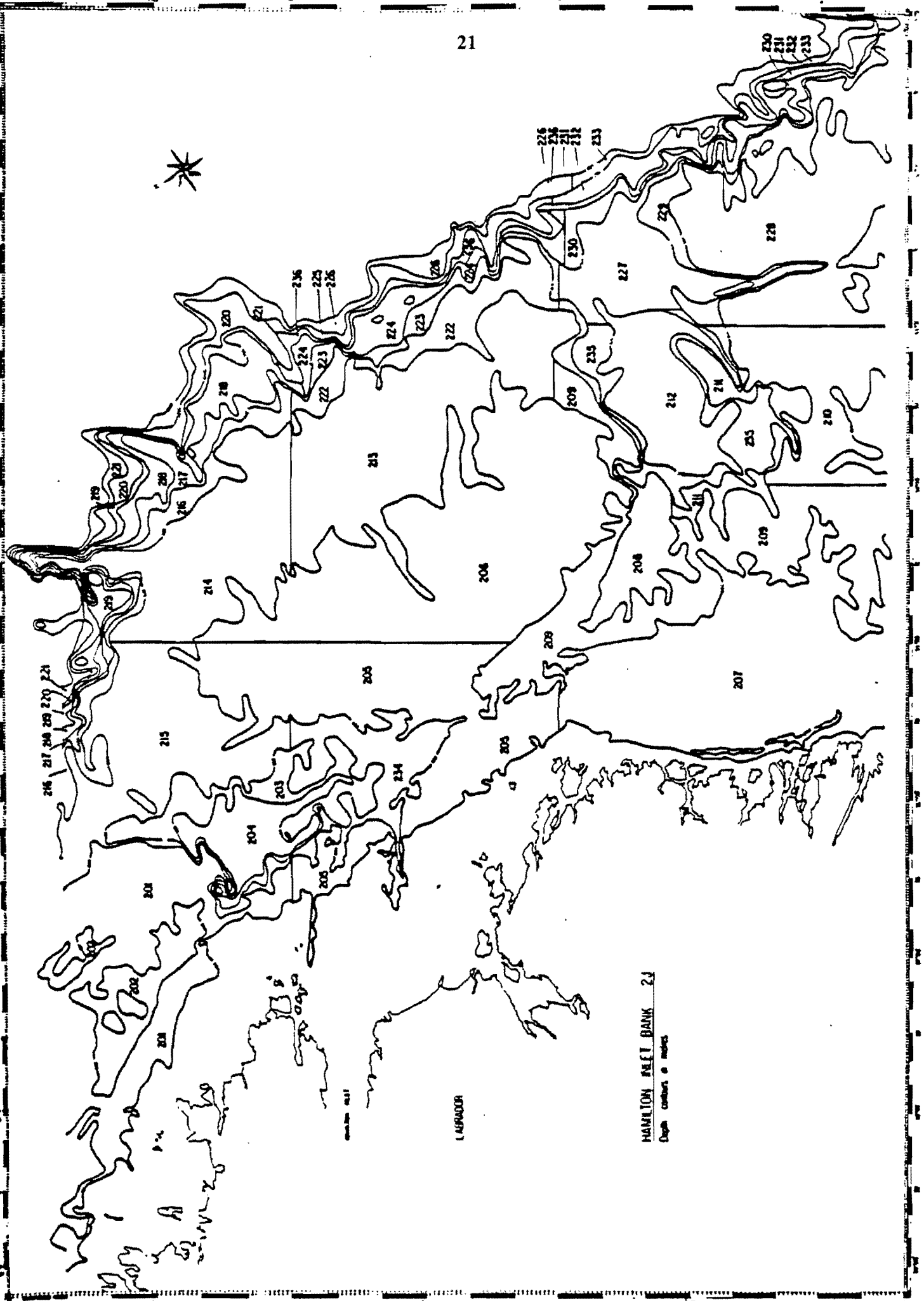


Fig.1 Nominal catch of American plaice in NAFO SA2+3K during 1967-1987.



HAMILTON INLET BANK 21
 Depth contours in meters

LABRADOR

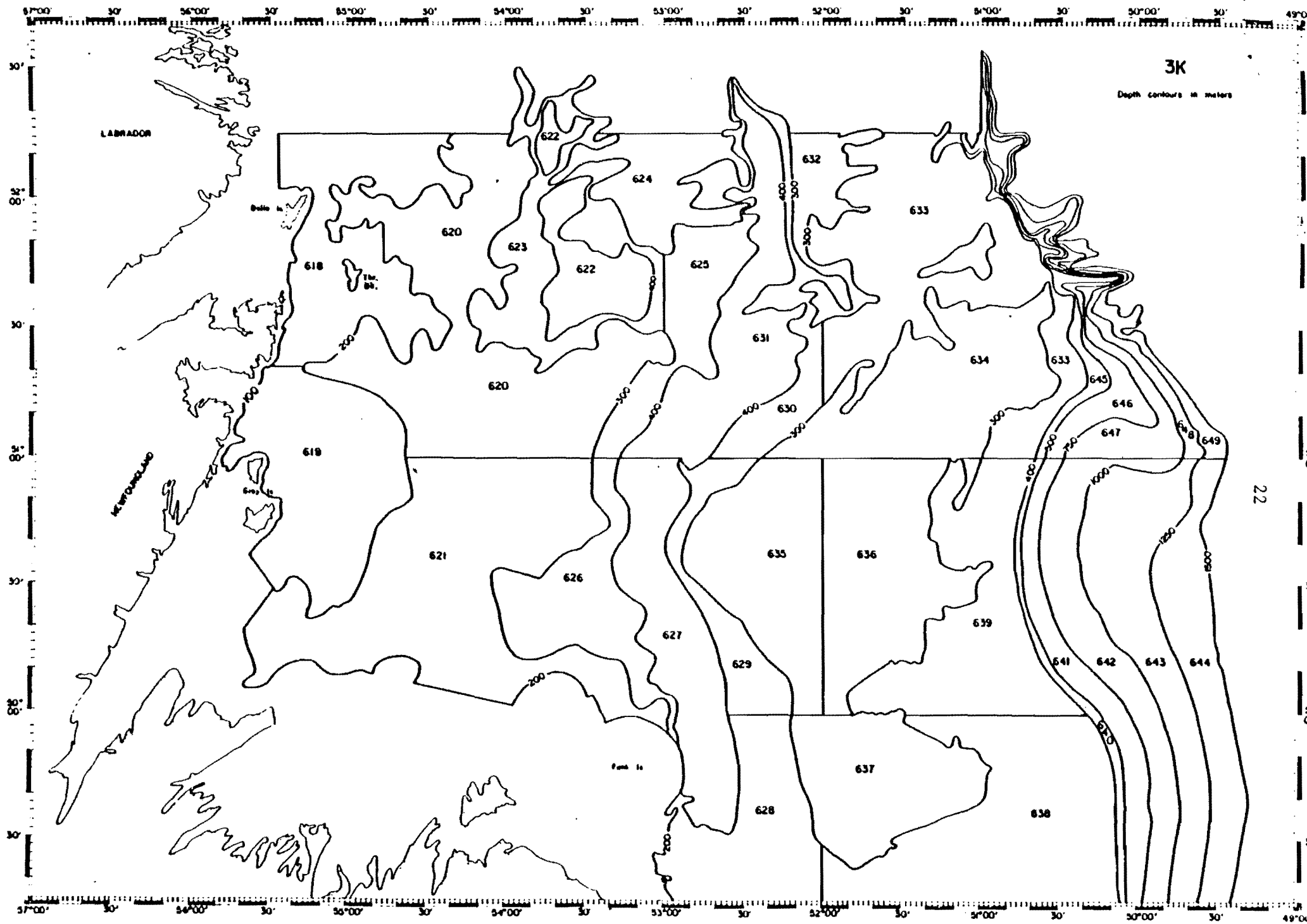


Fig. 3. Stratification scheme used for Canadian surveys in Division 3K.

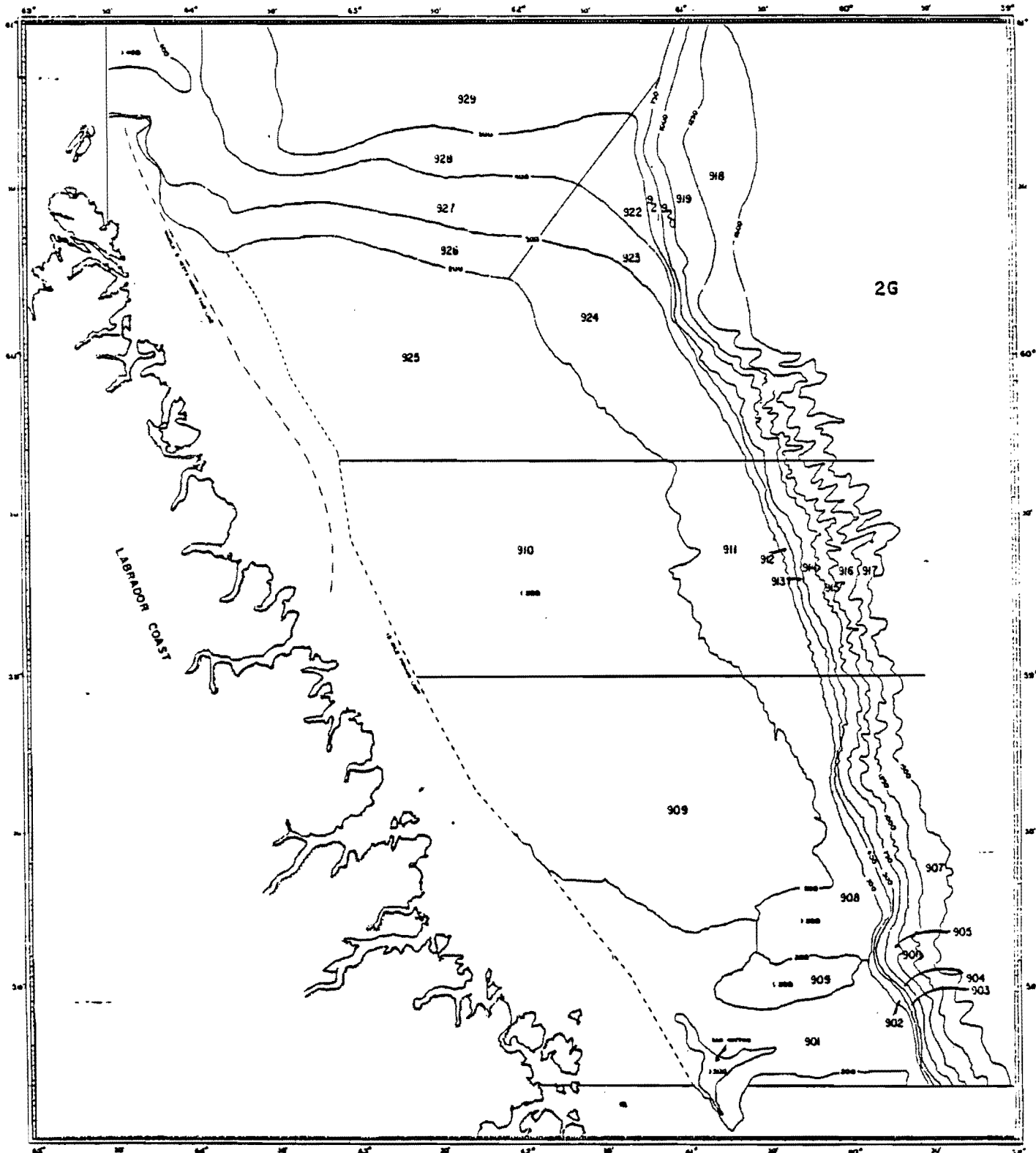


Fig. 4. Stratification scheme used for Canadian surveys in Div. 2G.

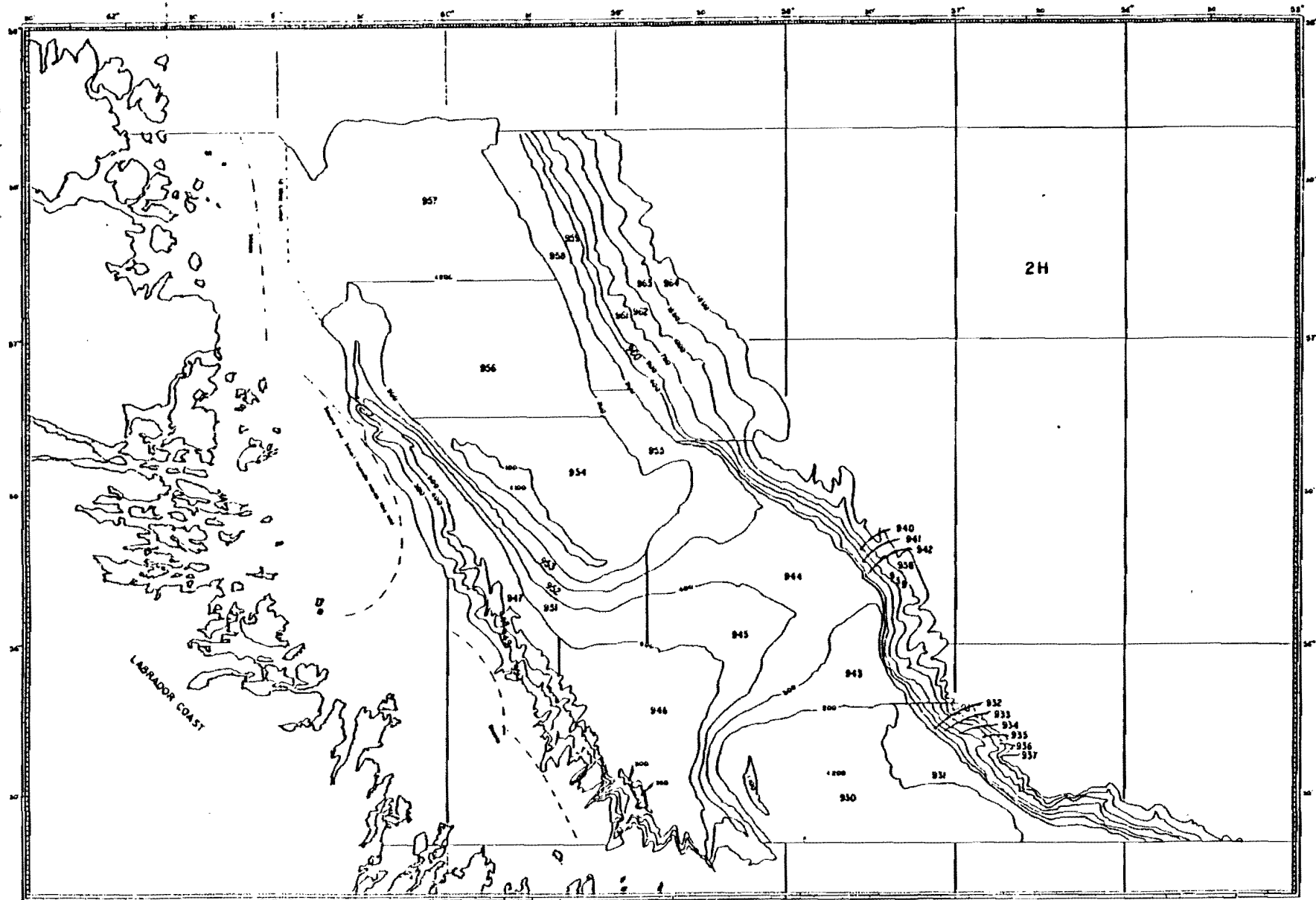


Fig. 5. Stratification scheme used for Canadian surveys in Div. 2H.

American plaice in NAFO SA2+Div. 3K

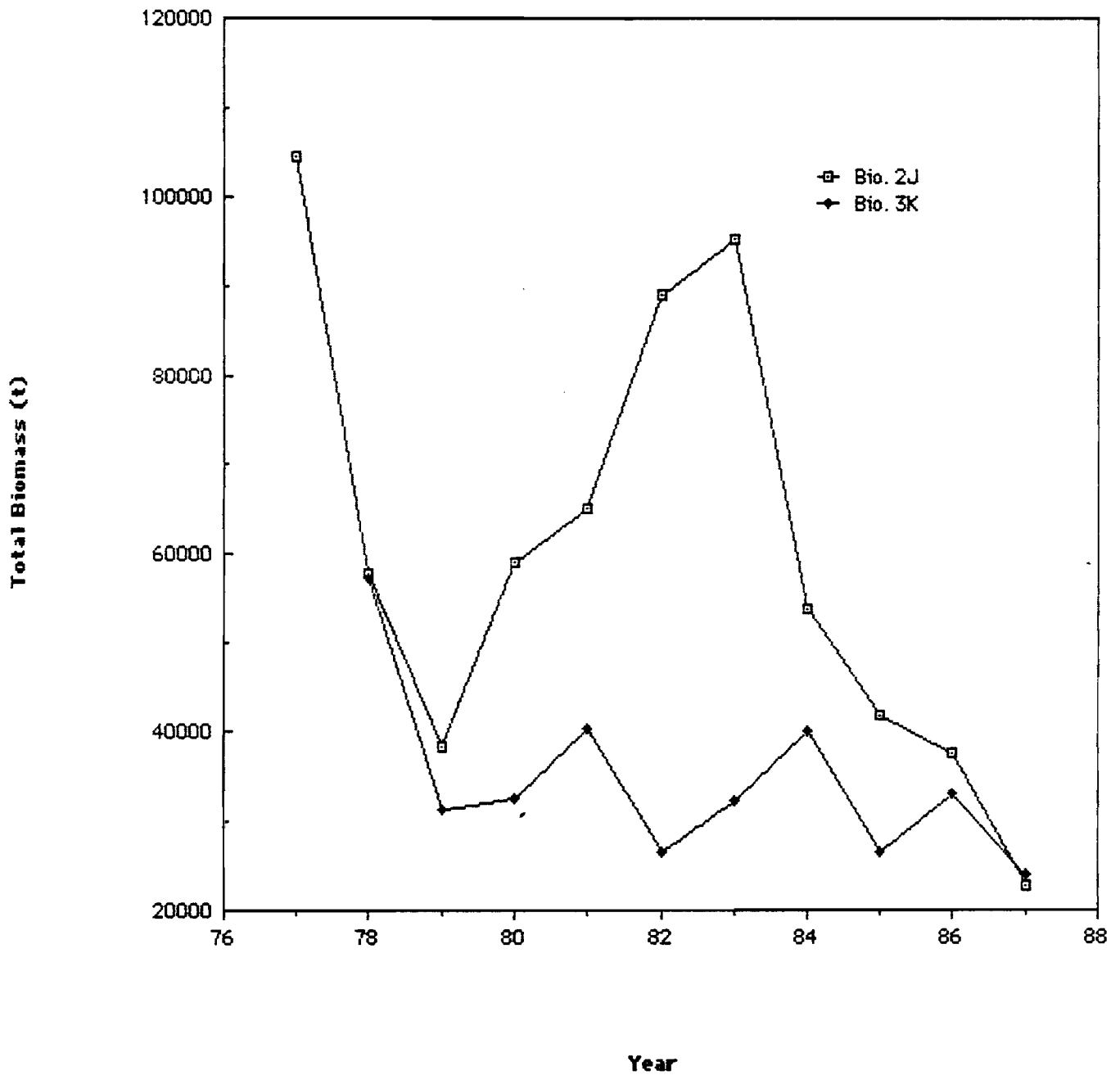


Fig. 6 Total biomass of American plaice estimated from research vessel surveys in NAFO Div. 2J,3K in 1977-87.

American plaice in NAFO SA2+Div. 3K

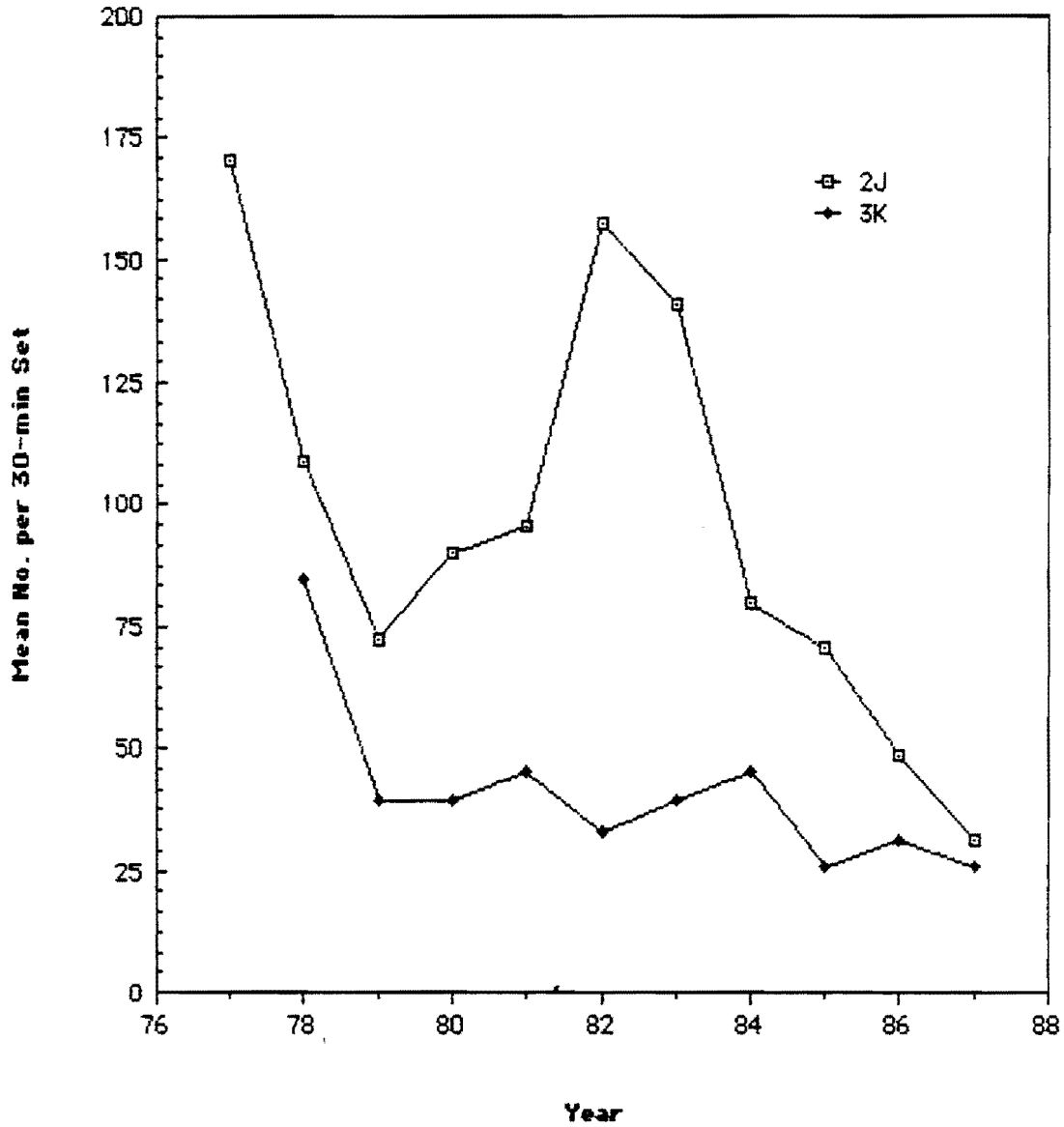


Fig.7 Mean no. per set of American plaice, from research vessel surveys in NAFO Div. 2J in 1977-87 and in Div 3K in 1978-87.