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An Assessment of American plaice in NAFO Subdivision 3Ps

by

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Abstract

The present data base for this stock is not sufficient to permit an analytical assessment to be performed. Catch rates from the small directed fishery have increased over the period 1981-84. Estimates of abundance from research vessel surveys from 1972-85 have been highly variable, particularly in the last 2 years. With the commercial and research vessel indices showing the stock to be in good condition, continuation of the 5,000 t TAC is recommended for 1986.

Résumé

Nous ne possédons pas suffisamment de données sur ce stock pour l'évaluation quantitative détaillée. Le taux de capture par pêche spécifique, pêche peu pratiquée, a augmenté de 1981 à 1984. L'abondance, estimée d'après les résultats des relevés des navires de recherche, a beaucoup varié de 1972 à 1985 surtout les deux dernières années. Comme les indices déterminés en fonction de la pêche commerciale et des relevés des navires de recherche indiquent que le stock est bon, nous recommandons de garder le TPA à 5 000 t en 1986.

Introduction

This stock has been under TAC regulation since 1974, when the initial TAC of 11,000 t was established. Since then, the TAC has been between 4000 and 11,000 t, and has remained at 5000 t since 1980. This fishery has been conducted mainly by Canadian vessels, with the foreign fleet taking significant catches between 1966 and 1973 (Table 1). The nominal catch peaked at 14,769 t in 1973 but has been between 1500 and 3700 t each year since 1978. The fishery is carried out mainly by offshore trawlers, although there is a small inshore catch, mainly in the summer months (Table 2).

Assessment

Catch and effort data

Catch rates from Can(N) otter trawlers are shown in Table 3. After showing a slight increase over the period 1980-83, the catch rate increased 103% from 1983 to 1984, to a level of 0.94 t/hr. As can be seen from the CPUE series in Table 3, a change of this magnitude has not been recorded previously in this fishery, and the 1984 value is by far the highest in the catch rate series. Table 2 shows that there was a significant change in the fishery in 1984, with almost 2000 t being taken in February, compared to an average of only 36 t in the same month of the three preceding years. The large catch in February 1984 was taken almost exclusively in the directed offshore fishery and accounts for virtually all of the catch on which the CPUE calculations were based. However, the value of 0.94 t/hr is still significantly higher than the catch rates observed in January-March of previous years.

Sampling data

Table 4 lists the commercial sampling data used to calculate mean lengths and weights at age as well as catch numbers at age in the 1984 fishery (Table 5). The numbers caught at age from 1973-84 are given in Table 6.

Research vessel survey data

Table 7 shows the mean weight per tow, by stratum (Fig. 1), for plaice caught in stratified random surveys over the period 1972-85. This table lists the number of sets in these surveys and gives the total mean weight per tow as well as the total estimated biomass. The biomass estimates have shown large fluctuations, which in many instances can be attributed to considerable discrepancies in survey coverage. To try and account for these differences, ten strata were selected, these being the ones common to most surveys, and mean numbers and weights per tow as well as the corresponding abundance and biomass estimates were calculated (Tables 10 and 11 respectively). However, as is obvious from comparing the biomass estimates in Table 11 with those in Table 7, the strata common to most of the surveys usually contain less than a third of the total

estimated biomass. Therefore these estimates from selected strata may not represent accurately any trends in overall stock abundance.

A further complicating factor in the analysis of the survey data is the presence of trips conducted by different research vessels. Table 7 indicates that the surveys from 1972 to 1982 were carried out by the A. T. Cameron, while the 1983-1985 trips were conducted by either the Alfred Needler or the Wilfred Templeman. Since the latter vessels are virtually identical and used the same gear in the 1983-85 surveys, results from these years are considered to be comparable. However, Gavaris and Brodie (1984) showed that there were differences in the fishing power of the A. T. Cameron and the Wilfred Templeman with respect to American plaice catches. To make the survey estimates comparable, plaice less than 28 cm caught by the A. T. Cameron were multiplied by 0.5 while those greater than or equal to 28 cm were multiplied by 1.3. Table 8 contains the original data, by age, for the selected strata while Table 9 shows the converted data. It can be seen from these tables that the total numbers per set are not widely different for the original versus converted data. It should also be noted that since the conversion involves two changes to the length frequencies, the estimates of total abundance and biomass in Table 11 can not be converted accurately by this method.

The inconsistent survey coverage and the A. T. Cameron conversion factor make analysis of the survey data difficult. Although the total estimated stock biomass (Table 7) has been relatively high since 1980, there have been noticeable fluctuations and the last 3 estimates in this series were derived from trips by different vessels. The data from selected strata (Tables 8-11) tend to be quite variable, which is not surprising considering the smaller portion of the total stock these strata represent. Of particular interest in this series are the low estimates obtained from the 1984 survey and the very high estimates, particularly for biomass, obtained from the 1985 survey (Tables 10-11).

Sequential population analysis (SPA)

The last time an SPA was presented for this stock was in 1981 (Brodie and Pitt 1981). That assessment presented a series of SPA runs and the authors were unable to tune the analysis. In subsequent years, the data base was not considered to have improved to the point where SPA could be used. With the absence of accurate yearly weights at age and with the considerable variability in the survey data, it was again felt that the use of SPA would not be feasible.

Conclusions

With the increase in the commercial catch rate and the high biomass level observed in the 1985 survey, this stock appears to be in good condition. However, in view of the fact that these large increases occurred over a one year period (1983-84 for CPUE, 1984-85 for surveys), and that increases of this magnitude are most unusual for plaice stocks with a large number of year classes present, it is recommended that the current TAC of 5000 t be maintained for 1986.

References

- Brodie, W. B., and T. K. Pitt. 1981. An assessment of American plaice in Subdivision 3Ps. CAFSAC Res. Doc. 81/37.
- Gavaris, S., and W. Brodie. 1984. Results of comparative fishing between the A. T. Cameron and the Wilfred Templeman during July-August 1983. CAFSAC Res. Doc. 84/41.

Table 1. Catches and TAC's (tons) of American plaice in NAFO Subdivision 3Ps, 1960-84.

Year	Canada		France(SP)	USSR	Other	Total	TAC
	[Nfld.]	M&Q Total]					
1960	422	405	827	60	-	887	-
1961	764	660	1424	31	-	1455	-
1962	659	363	1022	2	-	1024	-
1963	504	25	529	208	1	754	-
1964	1132	230	1362	152	-	1542	-
1965	574	1275	1849	162	-	2022	-
1966	1162	1332	2494	667	218	3406	-
1967	2201	1074	3275	533	678	4494	-
1968	4007	1516	5523	524	8233	14280	-
1969	2888	1178	4066	245	2180	6491	-
1970	7368	4227	11595	397	336	12328	-
1971	4667	1286	5953	820	409	7182	-
1972	4301	1621	5922	383	220	6538	-
1973	10972	1840	12812	547	1368	14769	-
1974	5887	443	6330	166	-	6598	11,000
1975	2517	1301	3818	65	128	4211	11,000
1976	5302	128	5430	5	9	5458	8,000
1977	4235	307	4542	63	-	4605	6,000
1978	3419	192	3611	47	-	3658	4,000
1979	3405	187	3592	49	-	3666	4,000
1980	2516	213	2729	107	-	2935	5,000
1981	2703	57	2760	326	-	3217	5,000
1982	1823	46	1869	265	-	2186	5,000
1983 ^a	1421	83	1504	69	-	1573	5,000
1984 ^a	2484	138	2622	388	-	3010	5,000

^aProvisional.

Table 2. Nominal catch by month, American plaice in Subdivision 3Ps, 1972-84.

Year	Jan.	Feb	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	UNK	Total
1972	1118	105	311	161	110	109	391	520	604	880	1044	1185	-	6538
1973	1681	500	2599	1527	96	350	969	2607	931	504	2237	768	-	14769
1974	162	133	1576	2575	123	137	165	399	567	128	364	269	-	6598
1975	6	6	1495	616	332	280	186	115	120	82	441	532	-	4211
1976	98	254	461	191	91	284	439	512	353	433	984	1358	-	5458
1977	28	547	663	339	309	287	414	204	105	261	712	736	-	4605
1978	250	141	185	1066	853	121	433	427	40	41	55	46	-	3658
1979	467	376	1086	212	189	262	225	265	124	161	246	53	-	3666
1980	14	464	180	63	216	359	166	170	170	191	256	686	-	2935
1981	423	57	236	371	363	331	302	156	214	263	273	228	-	3217
1982	53	4	285	315	181	156	133	195	125	95	463	181	-	2186
1983 ^a	94	47	161	62	44	138	151	91	326	287	100	3	69	1573
1984 ^a	130	1933	101	19	127	123	152	60	31	193	55	86	-	3010

^aProvisional.

Table 3. Catch and effort for American plaice in Subdivision 3Ps. Catch rates calculated from Canada (N) OT catch and effort data.

Year	Total catch (tons)	CPUE (t/hr)	Calculated effort (hr)	Directed catch (tons)
1967	4,494	0.740	6,073	1,342
1968	14,280	0.677	21,093	2,735
1969	6,491	0.553	11,738	1,754
1970	12,328	0.679	18,156	5,539
1971	7,182	0.530	13,551	2,778
1972	6,538	0.494	13,235	3,212
1973	14,769	0.506	29,188	9,542
1974	6,598	0.331	19,934	4,218
1975	4,211	0.307	13,717	1,797
1976	5,458	0.311	17,550	4,340
1977	4,605	0.326	14,126	3,045
1978	3,658	0.302	12,113	2,361
1979	3,666	0.407	9,007	2,276
1980	2,935	0.317	9,259	1,175
1981	3,217	0.396	8,124	1,303
1982	2,186	0.452	4,836	1,148
1983 ^a	1,573	0.460	3,420	866
1984 ^a	3,010	0.935	3,219	2,192

^aProvisional.

Table 4. List of commercial sampling by quarter and division available for 1984, for American plaice in Subdivision 3Ps as collected by the St. John's Commercial Sampling Section.

	Quarter				Total
	1	2	3	4	
Can(N) Catch (t)	2157	96	143	88	2482
Samples	13	1	-	2	16
Measured	5290	669	-	970	6929
Otoliths	705	117	-	242	1064

Table 5. Average weights (kg) and lengths (cm) at age, and catch numbers ($\times 10^{-3}$) at age and associated statistics for American plaice in the commercial fishery in Subdivision 3Ps in 1984.

AGE	AVERAGE		CATCH		
	WEIGHT	LENGTH	MEAN	STD. ERR.	C. V.
5	0.257	30.901	3	1.84	0.62
6	0.278	31.642	4	2.09	0.57
7	0.303	32.515	14	4.25	0.31
8	0.357	34.225	109	21.78	0.20
9	0.421	35.960	613	53.42	0.09
10	0.515	38.165	1170	74.84	0.06
11	0.638	40.649	1223	78.58	0.06
12	0.841	44.138	667	59.54	0.09
13	1.074	47.592	357	37.45	0.11
14	1.314	50.611	234	23.21	0.10
15	1.766	55.340	112	12.08	0.11
16	2.423	60.720	43	6.10	0.14
17	2.610	62.332	12	2.81	0.24
18	3.116	65.636	6	1.94	0.32
19	3.297	67.000		0.37	1.17

Table 6. Catch numbers ($\times 10^{-3}$) at age for American plaice in Subdiv. 3Ps, 1973-84.

AGE	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
6	46	312	264	121	24	53	97	2	9	2	5	4
7	568	783	619	442	150	206	182	148	115	29	77	14
8	823	957	613	1110	370	498	545	609	510	193	371	109
9	1170	1165	570	1499	896	994	900	925	929	390	440	613
10	941	1221	422	1249	917	1033	845	897	539	801	620	1170
11	2003	777	403	963	1055	769	654	720	429	1142	463	1223
12	1344	880	480	705	384	729	382	633	214	463	303	667
13	1272	844	401	454	280	329	241	401	114	198	237	357
14	1140	490	239	219	249	228	162	73	90	125	82	234
15	974	220	77	161	191	120	133	87	70	44	14	112
16	827	173	100	127	209	76	48	50	34	22	11	43
17	426	96	95	99	138	21	25	21	18	12	3	12
18	377	145	64	42	91	11	3	12	7	5	1	6
19	239	61	60	3	31	5	1	1	3	1	1	1

Table 7. Mean weight (kg) of American plaice per tow, by stratum, from R. V. surveys in Subdivision 3Ps. Numbers in parentheses are the number of successful 30 minute tows in each stratum. The stratified mean weight per tow and the biomass estimates, along with their approximate 95% confidence limits, are given at the bottom of the table. Strata marked with an asterisk were used in the calculation of abundance and biomass in Tables 8 and 9.

Depth (fm)	Stratum	Year - Survey													
		1972 ATC 197	1973 ATC 207	1974 ATC 221	1975 ATC 234	1976 ATC 247	1977 ATC 261	1978 ATC 275	1979 ATC 287	1980 ATC 302	1981 ATC 316	1982 ATC 330	1983 AN 9	1984 AN 26	1985 WT 26
101-150	306	-	-	0.3(6)	0.4(4)	0.6(2)	0.5(6)	1.0(6)	1.4(5)	1.1(2)	0.6(3)	0.5(3)	0.2(4)	0.1(2)	2.7(2)
51-100	307*	0.0(3)	0.0(5)	1.9(7)	0.4(4)	1.4(4)	1.1(4)	0.1(4)	0.1(4)	1.6(2)	0.9(3)	2.5(4)	1.3(4)	0.0(2)	0.1(3)
	310*	-	0.7(2)	28.1(2)	17.3(4)	16.3(2)	18.8(4)	-	0.7(4)	4.0(2)	306.5(2)	49.3(2)	101.2(3)	1.5(2)	3.7(2)
101-150	309*	0.0(2)	1.2(3)	0.1(4)	2.6(6)	0.5(3)	1.1(6)	1.3(6)	3.9(6)	0.7(2)	1.5(2)	0.4(2)	0.3(3)	7.3(2)	1.6(3)
101-150	310*	-	-	0.2(3)	1.5(6)	-	0.3(6)	0.5(6)	1.7(6)	3.0(2)	3.0(2)	1.0(3)	0.2(3)	0.5(2)	4.2(3)
51-100	311*	8.1(4)	109.1(9)	13.4(8)	8.8(4)	12.6(6)	3.9(4)	5.9(4)	40.4(4)	108.5(2)	10.0(2)	2.7(3)	2.0(3)	2.6(2)	16.2(4)
31-50	312	249.5(2)	-	43.3(2)	18.4(3)	20.6(5)	12.5(4)	-	0.1(3)	-	1.2(2)	5.3(2)	12.2(3)	0.6(2)	1.5(2)
101-150	313*	0.5(2)	168.3(2)	0.7(5)	0.4(3)	1.2(3)	0.5(10)	4.1(2)	4.0(5)	2.6(2)	21.5(2)	1.2(2)	2.9(3)	0.7(2)	0.9(2)
0-30	314	28.6(2)	-	0.2(2)	-	1.1(2)	16.3(4)	-	-	0.5(2)	0.3(5)	23.3(5)	11.9(7)	5.3(4)	0.5(7)
31-50	315	71.7(2)	48.3(2)	103.0(2)	-	32.7(2)	27.2(4)	-	5.3(3)	48.1(4)	33.0(2)	53.5(3)	61.4(8)	35.3(5)	40.9(7)
101-150	316*	3.2(2)	23.0(3)	0.4(6)	-	0.8(4)	3.7(6)	4.0(6)	12.0(3)	7.5(2)	18.9(2)	-	5.3(4)	1.7(2)	3.8(3)
51-100	317*	64.9(4)	161.7(7)	30.2(8)	9.9(4)	5.1(4)	1.4(4)	51.3(4)	249.6(3)	318.4(2)	56.0(2)	34.2(3)	52.0(3)	6.0(2)	1312.8(2)
101-150	318*	-	134.3(2)	1.8(2)	0.0(4)	1.9(2)	0.7(6)	10.9(2)	3.9(2)	8.9(2)	-	0.3(2)	3.6(3)	7.3(2)	-
51-100	319*	14.0(4)	15.6(5)	61.2(2)	11.8(4)	63.0(4)	48.6(6)	34.2(4)	8.1(2)	39.3(4)	79.5(2)	33.0(7)	112.1(7)	43.3(6)	26.5(2)
0-30	320	-	2.7(2)	-	-	11.2(3)	-	-	-	12.3(6)	7.0(2)	18.8(4)	34.0(14)	9.4(8)	38.3(5)
31-50	321	90.5(2)	3.4(2)	-	-	88.5(2)	-	-	-	30.5(5)	45.5(2)	27.3(4)	47.2(10)	28.0(6)	23.1(7)
51-100	322	-	-	-	-	75.1(4)	-	-	2.8(2)	67.1(8)	21.5(2)	58.0(8)	71.2(11)	64.3(8)	179.2(13)
51-100	323	222.6(3)	-	-	-	111.0(4)	34.5(2)	-	-	162.5(3)	108.5(2)	256.5(2)	125.7(6)	44.4(4)	68.0(3)
51-100	324	-	-	-	-	53.6(2)	-	-	4.0(2)	26.8(2)	-	71.3(2)	91.5(4)	15.5(3)	202.3(2)
31-50	325	-	-	-	-	60.4(2)	-	-	2.7(2)	7.7(4)	4.6(2)	41.4(5)	53.4(8)	27.0(5)	25.7(3)
31-50	326	-	-	-	-	-	-	-	15.7(2)	13.9(2)	1.9(2)	44.3(2)	40.8(3)	29.8(2)	-
151-200	705	0.9(2)	1.4(2)	0.8(4)	0.3(2)	2.2(2)	1.1(4)	0.2(3)	2.8(4)	0.5(2)	0.9(2)	0.6(2)	0.5(3)	0.4(2)	3.5(2)
151-200	706	4.4(2)	8.2(2)	2.2(7)	-	-	3.1(4)	1.6(2)	5.6(3)	1.4(2)	6.8(2)	0.6(4)	1.9(5)	0.3(2)	1.8(4)
151-200	707	14.9(2)	-	0.0(2)	0.4(4)	0.1(2)	0.0(4)	3.6(2)	2.1(2)	4.5(2)	-	-	0.0(3)	8.1(2)	-
201-300	708	-	-	-	0.0(3)	-	0.2(4)	-	0.5(2)	0.6(2)	-	-	0.2(2)	1.4(2)	-
301-400	709	-	-	-	-	-	-	-	-	-	-	-	0.2(2)	0.0(2)	-
301-400	710	-	-	-	-	-	-	-	-	-	-	-	0.0(3)	2.5(2)	1.3(2)
201-300	711	-	-	-	-	-	-	-	-	0.2(2)	0.7(2)	0.0(2)	0.8(8)	0.9(5)	1.0(8)
201-300	712	-	-	-	-	-	-	-	1.4(2)	0.0(2)	0.2(2)	0.0(3)	0.9(7)	-	1.0(6)
201-300	713	-	-	-	0.6(3)	-	-	-	-	0.2(2)	0.9(6)	0.3(2)	0.4(7)	-	0.4(8)
201-300	714	-	-	-	-	-	-	0.0(2)	-	1.0(2)	0.1(8)	0.0(6)	0.3(10)	-	-
151-200	715	0.0(2)	-	0.0(4)	0.0(2)	0.2(2)	0.2(4)	0.3(4)	0.4(3)	0.5(2)	0.3(2)	0.2(2)	0.8(3)	0.0(2)	-
151-200	716	0.0(2)	-	0.1(3)	-	-	0.9(6)	0.4(4)	2.1(4)	0.5(2)	1.8(4)	0.4(2)	1.5(4)	0.2(3)	4.2(5)
Upper		96.2	50.7	177.7	7.8	68.2	25.2	23.2	17.8	43.6	44.3	50.8	41.8	31.1	90.8
Mean (No. sets)		56.8(42)	26.8(48)	25.2(79)	5.1(60)	42.3(66)	15.8(102)	8.6(61)	9.5(78)	27.8(80)	21.0(71)	30.7(91)	34.5(171)	20.8(95)	54.9(110)
Lower		17.4	2.9	-127.3	2.4	16.3	6.4	-6.1	1.2	11.9	-2.4	10.7	27.1	10.5	19.0
Upper		57,275	25,815	91,649	2,899	60,921	14,526	10,251	13,533	56,174	54,888	64,601	54,823	33,730	106,650
Biomass (+)		33,826	13,654	12,999	1,901	37,757	9,109	3,785	7,236	35,776	25,974	39,076	45,200	22,549	64,494
Lower		10,378	1,494	-65,651	902	14,593	3,692	-2,681	938	15,378	-2,940	13,551	35,577	11,368	22,337

Table 8. Mean number of American plaice per tow from R.V. surveys in NAFO Subdivision 3Ps (with approximate 95% confidence intervals). The same strata were used in the calculations for each year.

Age	ATC207 1973	ATC221 1974	ATC234 1975	ATC247 1976	ATC261 1977	ATC275 1978	ATC287 1979	ATC302 1980	ATC316 1981	ATC330 1982	AN9 1983	AN9 1984
1	-	-	-	-	-	-	-	-	-	-	-	-
2	0.03	0.66	0.02	-	0.03	-	0.16	0.90	0.18	0.09	0.01	-
3	3.74	4.47	1.04	0.55	0.18	1.33	0.56	4.24	1.97	1.29	0.22	-
4	7.62	8.89	2.70	7.23	0.74	1.46	2.98	5.56	8.76	3.65	0.96	0.11
5	15.57	11.97	4.89	10.96	5.86	6.78	7.79	16.71	10.88	4.26	4.40	0.23
6	25.58	7.52	4.52	18.10	5.27	10.05	12.43	27.99	17.43	4.80	12.25	1.38
7	23.41	7.17	3.08	9.58	7.99	9.03	24.41	61.61	29.84	6.51	17.81	3.31
8	14.29	5.42	2.25	8.80	6.16	8.03	14.60	43.02	33.89	7.34	20.05	4.99
9	12.62	6.76	0.75	6.81	4.15	8.23	6.88	23.65	19.01	8.64	19.45	5.05
10	10.27	4.90	0.78	7.21	2.68	3.69	2.38	13.98	6.45	4.62	9.85	4.61
11	6.37	4.28	0.71	4.70	1.74	3.94	2.20	5.09	1.48	1.83	5.84	2.70
12	3.08	4.49	0.74	1.91	0.64	2.81	2.09	2.94	1.27	1.53	2.05	1.32
13	3.96	3.45	0.37	0.91	0.10	1.32	1.21	1.35	1.46	0.77	1.24	0.53
14	2.50	0.65	0.16	0.33	0.24	0.46	0.84	0.51	1.77	0.60	0.68	0.39
15	2.16	1.42	0.13	0.29	0.10	0.16	0.66	0.02	0.45	0.23	0.51	0.19
16	1.14	0.25	0.17	0.35	0.06	0.44	0.42	0.23	0.70	0.12	0.59	0.05
17	0.75	0.43	0.04	0.05	0.02	0.10	0.07	0.01	0.23	0.06	0.14	0.02
18	0.61	0.11	0.05	0.09	0.01	-	-	0.03	0.47	0.11	0.09	0.02
19	0.25	0.14	0.02	0.01	0.01	-	-	-	0.49	0.02	0.06	-
20	0.08	0.03	-	0.03	-	-	-	-	-	0.02	-	-
21	0.18	-	-	-	-	-	-	-	-	-	-	-
22	0.14	0.02	-	-	-	-	-	-	-	-	-	-
23	0.05	-	-	-	-	-	-	-	-	-	-	-
Unknown	-	-	0.02	-	0.03	0.53	-	0.02	-	-	-	-
Upper	271.97	489.35	39.55	160.14	66.87	154.48	176.42	1171.29	1334.89	77.25	168.23	46.69
Mean	134.40	73.03	22.44	77.91	36.01	58.36	79.68	207.86	136.73	46.49	96.20	24.90
Lower	-3.11	-343.32	5.34	-4.33	5.11	-37.72	-17.03	-755.59	-1061.39	15.74	24.15	3.12
No. Sets	39	47	40	33	56	38	39	22	19	29	36	24

Table 9. Mean number per tow from R.V. surveys in Subdivision 3Ps (with approximate 95% confidence intervals). The same strata were used in the calculations for each year. Values for the trips by the A. T. Cameron, 1973-82 were adjusted by the appropriate conversion factors so that these trips would be comparable to those of the A. Needler, 1983-84.

Age	YEAR-SURVEY											
	ATC207 1973	ATC221 1974	ATC234 1975	ATC247 1976	ATC261 1977	ATC275 1978	ATC287 1979	ATC302 1980	ATC316 1981	ATC330 1982	AN9 1983	AN26 1984
1	-	-	-	-	-	-	-	-	-	-	-	-
2	0.02	0.33	0.01	-	0.01	-	0.08	0.45	0.09	0.05	0.01	-
3	1.88	2.24	0.52	0.28	0.09	0.67	0.28	2.12	0.99	0.64	0.22	-
4	3.80	4.44	1.35	3.60	0.38	0.73	1.49	2.78	4.38	1.83	0.96	0.11
5	8.71	6.06	2.63	5.54	3.28	3.39	3.90	8.35	5.57	2.40	4.40	0.23
6	16.46	4.72	3.70	13.11	3.55	5.27	7.40	17.32	11.50	3.19	12.25	1.38
7	22.12	6.90	3.70	10.51	7.59	7.67	20.37	52.05	31.42	5.11	17.81	3.31
8	17.03	6.71	2.92	11.15	7.63	9.85	17.37	47.85	42.71	8.35	20.05	4.99
9	15.80	8.79	0.98	8.70	5.39	10.70	8.73	30.14	24.72	11.07	19.45	5.05
10	12.52	6.38	1.01	9.38	3.48	4.81	3.09	17.58	8.39	6.00	9.85	4.61
11	8.28	5.57	0.92	6.11	2.25	5.12	2.85	6.61	1.92	2.39	5.84	2.70
12	4.00	5.83	0.96	2.48	0.83	3.66	2.71	3.82	1.65	1.99	2.05	1.32
13	5.14	4.48	0.48	1.18	0.14	1.72	1.57	1.76	1.90	1.00	1.24	0.53
14	3.26	0.84	0.20	0.42	0.31	0.60	1.09	0.66	2.30	0.77	0.68	0.39
15	2.81	1.85	0.17	0.38	0.13	0.20	0.85	0.02	0.59	0.29	0.51	0.19
16	1.49	0.32	0.22	0.46	0.07	0.57	0.54	0.29	0.91	0.15	0.59	0.05
17	0.98	0.55	0.06	0.08	0.02	0.14	0.09	0.02	0.30	0.08	0.14	0.02
18	0.79	0.14	0.07	0.12	0.02	-	-	0.03	0.61	0.15	0.09	0.02
19	0.32	0.18	0.03	0.03	0.01	-	-	-	0.64	0.03	0.06	-
20	0.10	0.04	-	0.04	-	-	-	-	-	0.02	-	-
21	0.24	-	-	-	-	-	-	-	-	-	-	-
22	0.18	0.03	-	-	-	-	-	-	-	-	-	-
23	0.06	-	-	-	-	-	-	-	-	-	-	-
Unknown	-	-	0.02	-	0.01	0.58	-	0.02	-	-	-	-
Upper	246.75	531.64	36.01	169.15	64.15	157.99	188.33	1596.35	1394.71	73.99	168.23	46.69
Mean	125.99(39)	66.40(47)	19.95(40)	73.57(33)	35.19(56)	55.68(38)	72.41(39)	191.87(22)	140.59(19)	45.51(29)	96.20(36)	24.90(24)
Lower	5.25	-398.82	3.89	-22.01	6.23	-46.66	-43.42	-1212.60	-1113.55	17.06	24.15	3.12

Table 10. Mean number and weight per 30 minute tow, with 95% confidence intervals, of American plaice from research vessel survey data from selected strata in Subdivision 3Ps.

Year	Number/tow			No. sets	Missing strata	Weight (kg)/tow		
	Upper	Mean	Lower			Upper	Mean	Lower
1972	64.1	26.9	-10.4	23	308,310,318	25.9	11.6	-2.7
1973	267.2	137.4	7.7	39	310	90.0	46.9	3.8
1974	502.1	77.3	-347.5	47		236.3	25.4	-185.6
1975	39.5	22.7	5.9	40	316	11.9	7.1	2.3
1976	160.1	77.9	-4.3	33	310	60.2	25.2	-9.8
1977	66.4	36.0	5.6	56		42.5	18.0	-6.5
1978	159.2	58.2	-42.8	38	308	49.2	17.2	-14.9
1979	177.1	79.9	-17.3	39		61.6	25.1	-11.4
1980	1682.6	206.9	-1268.8	22		365.5	47.3	-271.0
1981	1333.7	136.8	-1060.2	19	318	410.9	47.8	-315.2
1982	76.9	46.5	16.1	29	316	28.2	17.0	5.9
1983	167.9	96.2	24.5	36		78.0	45.8	13.7
1984	46.5	24.9	3.3	24		30.9	16.4	1.9
1985	183.1	51.9	-79.3	24	318	421.4	101.8	-217.8

Table 11. Abundance and biomass estimates, with 95% confidence intervals, for American plaice from research vessel survey data from selected strata in Subdivision 3Ps.

Year	Number ($\times 10^{-6}$)			No. sets	Missing Strata	Biomass ($\text{kg} \times 10^{-6}$)		
	Upper	Mean	Lower			Upper	Mean	Lower
1972	12.2	5.1	-2.0	23	308,310,318	4.9	2.2	-0.5
1973	55.6	28.6	1.6	39	310	18.8	9.8	0.8
1974	111.0	17.1	-76.8	47		52.2	5.6	-41.0
1975	8.2	4.7	1.2	40	316	2.5	1.5	0.5
1976	33.4	16.2	-0.9	33	310	12.6	5.3	-2.0
1977	14.7	8.0	1.2	56		9.4	4.0	-1.4
1978	33.8	12.4	-9.1	38	308	10.5	3.7	-3.2
1979	39.2	17.7	-3.8	39		13.6	5.6	-2.5
1980	371.8	45.7	-280.4	22		80.8	10.5	-59.9
1981	282.4	29.0	-224.5	19	318	87.0	10.1	-66.7
1982	15.9	9.6	3.3	29	316	5.8	3.5	1.2
1983	37.1	21.3	5.4	36		17.2	10.1	3.0
1984	10.3	5.5	0.7	24		6.8	3.6	0.4
1985	38.8	11.0	-16.8	24	318	89.2	21.6	-46.1

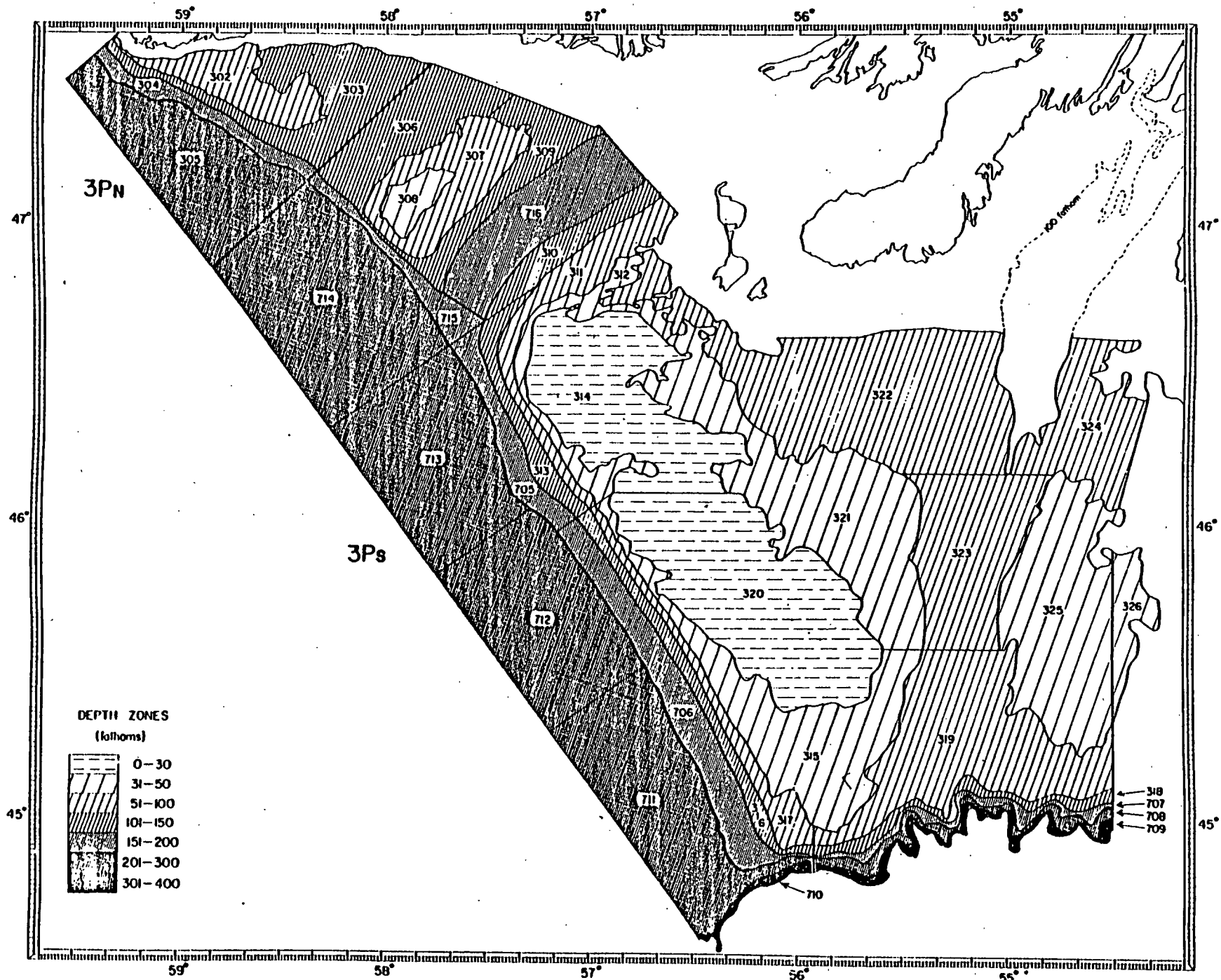


Fig. 1. Stratification scheme used by Canadian research vessel surveys in NAFO Subdivision 3Ps.