An Assessment of the American Plaice Stock in NAFO Subdivision 3Ps

by

W. B. Brodie
Science Branch
Department of Fisheries and Oceans
P. O. Box 5667
St. John's, Newfoundland A1C 5X1

Abstract

Catches have increased in recent years to a level just over 5,000 t in 1986-87. With a large increase in the gillnet catch in 1987, the catch at age shifted towards larger fish, and an estimate of partial recruitment could not be determined accurately.

With commercial CPUE and research vessel surveys indicating relative stock stability, continuation of the current TAC of 5,000 t is recommended.

Résumé

Au cours des dernières années, les prises ont augmenté pour atteindre un niveau qui se situe juste au-dessus de 5 000 t en 1986-87. En raison d'une augmentation importante des prises au filet maillant en 1987, les prises par âge se sont déplacées vers les poissons de grande taille et l'on n'a pu faire une évaluation précise du recrutement partial.

Les PUE commerciales et les relevés des navires de recherche indiquant une stabilité relative du stock, il est recommandé de maintenir le TPA actuel de 5 000 t.

Introduction

TAC - catch history

This stock has been under TAC regulation since 1974, when a TAC of 11,000 t was set, based mainly on average catches. The TAC has been 5000 t since 1980, with this level being confirmed in the 1987 assessment which used a sequential population analysis approach for the first time in several years for this stock.

Catches from this stock were highest in 1968-73, exceeding 12,000 t three times in this period (Table 1, Fig. 1). This was also the period which saw the highest level of foreign involvement in the fishery. Canada has taken the large majority of the landings since 1974, although the catch by French offshore trawlers has been increasing in recent years (Table 1). In NAFO SCS Doc 88/01, a catch of 4,068 t was reported by France for 1986. However, there is some doubt about the accuracy of this figure, particularly when compared to the levels of catch and effort reported for 1985 and 1987. In any case, this catch was not known at the time this assessment was conducted (May 13, 1988), and a figure of 615 t was used. Should the figure of 4,068 t be correct, the assessments conducted in 1987 and 1988 would have underestimated the 1986 catch by about 3,500 t. Figure 2 shows the recent increase in catches in the Canadian inshore fishery, to a level of about 2,000 t in 1987, Virtually all of this increase has come in the gillnet sector (Table 3). After a decline in the early 1980s, the catch by Canadian offshore trawlers increased in 1984-87 with peak catches being taken in the first quarter (Table 2). Preliminary estimates for 1988 show the catch in this component to be somewhat lower than the 2-3 thousand t caught in this quarter in 1984-87. Overall, catches of American plaice in Subdiv. 3Ps have been steadily increasing since 1983, and exceeded the TACs in both 1986 and 1987 (Fig. 2).

Assessment

Catch and weight at age

In the 1987 assessment of this stock, revised estimates of catch and weight at age for 1973-81 were presented. At that time, the 1981 data were pointed out as possibly being anomalous. Further analysis of these data, which included re-examination of many of the otoliths, did produce a change for most of the catch at age and weight at age values, however the values are still quite different from those in other years. The reason for this difference is the presence of many older, slower-growing fish found in the sampling of the inshore fishery. These fish had a substantially lower average length at age than most other fish sampled in this stock, which is not unusual for American plaice taken in some inshore bays. It is not possible to determine if this is a sampling artifact, or whether these fish were actually present in the inshore catch in high proportions in 1981. The Canadian (offshore) catch and weights at age appear reasonable for 1981, and the catch from this segment comprised about 45% of the landings, compared to 36% for the Canadian (inshore) catch.

The commercial sampling available for this stock in 1987 is shown in Table 4a. No sampling was available for the French catch, but the Canadian (N) offshore catch at age was adjusted up to include the French landings. The catch at age and average lengths and weights at age for 1987 are shown in Table 4b. As usual, ages 10-13 dominate the catch, although there is a much higher proportion of fish aged 14 and over in the catch in 1987 compared to all other years (Tables 5a, 5b). The weights at age for 1973-86 for the stock (Table 5c) have been revised slightly to correct for an error in the

calculation of average lengths used in the years prior to 1987. The 'old' average weights were calculated using a length which was 0.5 cm too high; however, the resulting changes were in the order of a 2-7% decrease in the average weights.

Catch effort data

The 1987 assessment of this stock presented a CPUE series for Canadian offshore trawlers which was calculated using the multiplicative model of Gavaris (1980). The trends in this series (1974-86) agreed with those found in the 'old' CPUE series calculated in previous years, although there were differences in the magnitude of some recent changes. In the analysis conducted here, essentially the same procedure was followed as in 1987, with the data base from last year modified only to include the current data. The following points show differences in the analysis presented here and that used in the last assessment:

1) After deleting records of catch and effort <10, all records for Can (M+Q) side trawlers, TC4 (eight records in total) were deleted.

2) Records for Can (M+Q) stern TC5 and Can (M) stern TC5 were combined. These different categories were due only to a coding change.

3) The remaining four CGT categories (Table 6) were left as individual categories, rather than combining them into two groups, as was done last year.

4) Months were used as individual categories; no combinations were used.

5) The regression (Table 6) used a weighting vector of log (catch x effort). The analysis in 1987 used an unweighted regression.

With the exception of July and August, when catches tend to be lower (e.g. only 3 records out of 20 for August had a directed catch >80 t), CPUE is highest in the winter months. This is reflected in the offshore landings of the past few years, when virtually all the catch from offshore vessels came in the first quarter.

The resulting CPUE series can be seen in Table 7 and in Fig. 3. The changes described above had little effect on the trends in the CPUE series from 1974 to 1986. The 1987 CPUE declined slightly from 1986, but is still among the highest values in the series. The 1984 and 1985 points remain well above the remainder of the values. Overall, Fig. 3 shows the CPUE to have been relatively stable from 1974 to 1980, increasing from 1980 to 1985, then decreasing in 1986-87 to a level similar to that in 1982-83, which was before the large increases occurred in 1984 and 1985.

Using the unweighted formulation, as was done in 1987, the 1986 and 1987 points are almost equal. There were no major differences in the trends in the two series (weighted and unweighted).

Research vessel survey data

Stratified random surveys have been conducted by Canada in Subdiv. 3Ps in each year from 1972 to 1988, using the stratification scheme shown in Fig. 4. Table 8 shows the results from these surveys, and from this it can be seen that the survey coverage was incomplete in many years prior to 1980. As well it has been noted in past assessments of this stock that large fluctuations in biomass have occurred between many years, despite relatively equal survey coverage (e.g. 1983-86). Despite this, the

biomass estimates from the last three surveys (1986-88) have been relatively stable between 27,000 and 34,000 t.

Table 9 shows the distribution of biomass by depth range from 1983 onward, which are the years that the survey has been conducted by the stern trawler research vessels **WILFRED TEMPLEMAN** and **ALFRED NEEDLER**. Prior to 1983, the surveys were conducted by the research vessel **A.T. CAMERON**, a side trawler which used a different otter trawl from that used by the stern trawlers. Although there is some between-stratum variation, in all years between 61 and 83 percent of the biomass was found in the 51-100 fathom (93-183 m) depth range. The biomass in the strata beyond this depth was generally less than 10 percent of the total. It is interesting to note that a contributing factor to the very high biomass estimate (64,500 t) in 1985 was the estimate of 19,000 t in stratum 317, an area of normally low abundance of American plaice.

Given the previously noted problem of the two different vessel-gear combinations used in these surveys, conversion factors have been developed to make the earlier data comparable to that of recent years. These are applied to the length frequencies of the American plaice catches and have been used in the past several assessments of this stock and the American plaice stock in Div. 3LNO. In the past, strata which were common to most surveys were chosen to calculate an index of abundance at age for the stock. However, the poor coverage in many years prior to 1980 limited the choice to only a few strata, and concern had been expressed that these may not be representative of overall abundance. Therefore in this assessment it was decided to use the data shown in Table 10 as an index of abundance, given that survey coverage was relatively complete in the years 1980-87 (Table 8). While it may be possible to extend this analysis to other years, the number of important strata missed is relatively high in most years from 1972 to 1979. The use of a multiplicative model to provide an index of abundance from the r.v. surveys will be investigated for the next assessment of this stock.

Figure 5 shows trends in the survey numbers at age from Table 10. The numbers fluctuate widely over the series, although the 1984, 1986, and 1987 values are relatively stable. The 1985 survey results were influenced by two catches of old, large fish in stratum 317, although these year-classes did not show up in similar numbers in the surveys before or after 1985.

Yield per recruit

A series of yield per recruit analyses was conducted for this stock, using a range of partial recruitment (PR) vectors and average weights at age. All analyses showed $F_{0.1}$ to be in the range of 0.20 to 0.23, lower than the 0.25 value used in the 1987 assessment, which was an estimate based on the value used in the neighboring stock of American plaice (Div. 3LNO). For that stock, the long-term average values of PR and weights have been used to calculate yield per recruit, with $F_{0.1}$ set at 0.26. Table 11 shows the results for 3Ps American plaice using the long-term average PR (fully recruited at age 13, calculated from the 1973-86 fishing mortalities in the 1987 assessment) and the 1973-87 average weights at age. The resulting value for $F_{0.1}$ is 0.21. However, further work on yield per recruit, in conjunction with that proposed for several other species/stocks, will be conducted on this stock before definitive values for $F_{0.1}$ and F_{max} can be proposed.

Partial Recruitment (PR)

In the 1987 assessment, an iterative procedure was used to calculate the average PR from fishing mortalities (1983-86) from SPA. With the substantial change in the pattern of catch at age from these years to 1987, this technique did not prove useful for calculation of a PR vector for the 1987 fishery. An examination of the percent catch at age (Table 5b) shows a substantially higher percentage of older fish (13+) in the catch in 1987 than in any other year. This is mainly attributable to the increase in gillnet landings, although is also found to some extent in the offshore trawler catch at age. In any case, there is no comparable year to 1987 in Table 5b from which an estimate of PR could be made.

While there was a small increase from 1986 to 1987 in the survey catch/tow at some of the older ages, the larger increases found in the commercial catch are certainly not reflected (Table 10). In any case, a comparison of survey catch at age to the commercial catch at age was rejected as an acceptable method for deriving PR, based on past experiences with this stock and with Div. 3LNØ A. plaice.

The following table shows a comparison of some PR vectors for this stock. PR 81 was used in the 1981 assessment, PR 87 was used in the 1987 assessment, and PRAV is the long-term (1973-86) average, as calculated from the SPA in 1987.

Age	6	7	8	9	10	11	12	13-19
PR81	.01	.03	.10	.28	.40	.55	.78	1.00
PR87	.002	.024	.20	.49	.79	1.00	1.00	1.00
PRAV	.017	.06	.17	.41	.65	.85	.91	1.00

SPA

For illustrative purposes, SPA was conducted over a range of terminal F (Ft) values, using PRAV. Fig. 6 shows that there was no relationship between 8+ SPA nos (from the SPA at Ft 0.28). Fig. 7 shows the relationship between 8+ SPA biomass and CPUE (1984-85 omitted) for Ft 0.28. This relationship, with intercept close to zero, was used to calibrate the SPA in 1987. Fig. 8 shows the same relationship, with 1984 and 1985 points included in the regression.

Table 12 presents the SPA results at Ft=0.28. The resulting population structure resulting from this analysis is substantially different for recent years than that determined in the 1987 assessment. The changes are large enough to suggest that the input PR is not correct. Given that no suitable PR was determined, SPA could not be used as the basis for projections in this stock.

Catch projections/prognosis

The CPUE index for this stock remained high in 1987, comparable to the 1982, '83, and '86 points; and lower than only the very high values in 1984 and 1985. The 1988 research vessel survey indicates stock biomass to be close to the levels observed in 1986 and 1987 - around 30,000 t. The 1987 assessment SPA showed F in 1983-86 to be less than $F_{0.1}$. Based on these considerations, and recent catches, continuation of the 5,000 t TAC for 1989 is recommended.

References

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

Table 1. Catches and TACs (tons) of American plaice in NAFO Subdivision 3Ps, 1960-87.

Year	Canada			France	USSR	Other	Total	TAC
	Nfld	M&Q	Total					
1960	422	405	827	60	-	-	887	-
1961	764	660	1,424	31	-	-	1,455	-
1962	659	363	1,022	2	-	-	1,024	-
1963	504	25	529	208	1	16	754	-
1964	1,132	230	1,362	152	-	28	1,542	-
1965	574	1,275	1,849	162	-	11	2,022	-
1966	1,162	1,332	2,494	667	218	27	3,406	-
1967	2,201	1,074	3,275	533	678	8	4,494	-
1968	4,007	1,516	5,523	524	8,233	-	14,280	-
1969	2,888	1,178	4,066	245	2,180	-	6,491	-
1970	7,368	4,227	11,595	397	336	-	12,328	-
1971	4,667	1,286	5,953	820	409	-	7,182	-
1972	4,301	1,621	5,922	383	220	13	6,538	-
1973	10,972	1,840	12,812	547	1,368	42	14,769	-
1974	5,887	443	6,330	268	-	-	6,598	11,000
1975	2,517	1,301	3,818	65	128	200	4,211	11,000
1976	5,302	128	5,430	5	9	14	5,458	8,000
1977	4,235	307	4,542	63	-	-	4,605	6,000
1978	3,419	192	3,611	47	-	-	3,658	4,000
1979	3,405	187	3,592	74	-	-	3,666	4,000
1980	2,516	213	2,729	206	-	-	2,935	5,000
1981	2,703	57	2,760	457	-	-	3,217	5,000
1982	1,823	46	1,869	317	-	-	2,186	5,000
1983	1,421	83	1,504	222	-	-	1,726	5,000
1984	2,487	138	2,625	338	-	-	2,963	5,000
1985	3,608	206	3,814	406[b]	-	-	4,220	5,000
1986[a]	4,355	97	4,452	615[b]	-	-	5,067	5,000
1987[a]	4,644	87	4,731	533	-	-	5,264	5,000
1988								5,000

[a] Provisional
[b] St. Pierre vessels only. Catch of 4,068 t reported in NAFO SCS Doc 88/01.

Table 2. Nominal catch by month, American plaice in Subdivision 3Ps, 1972-87.

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	98	47	161	71	61	155	169	91	327	372	149	25	-	1726
1984	128	1933	101	43	125	126	85	60	31	194	94	43	-	2963
1985	3	55	2814	240	35	154	134	80	199	146	343	17	-	4220
1986[a]	1960	447	498	51	148	333	444	491	299	251	80	65	-	5067
1987[a]	452	257	1170	302	208	427	631	571	195	78	211	229	533	5264

[a]Provisional

Table 3. Catches by Canadian inshore vessels, 3Ps American plaice, 1972-87.

Year	Gear						Total
	Seines	Gillnets	Longline	Handline	Trap	Other	
1972	11	174	143	2	4	1	335
1973	63	233	212	3	2	12	525
1974	3	195	235	2	6	12	453
1975	62	322	127	4	58	1	574
1976	28	245	44	5	8	-	330
1977	140	291	119	14	3	-	567
1978	65	256	185	11	15	3	535
1979	117	292	176	5	8	-	598
1980	17	373	266	10	5	-	671
1981	84	671	370	16	3	-	1144
1982	35	265	199	3	1	-	503
1983	9	113	219	8	1	-	350
1984	-	86	102	13	1	1	203
1985	2	118	273	5	1	-	399
1986[a]	1	887	350	13	4	1	1256
1987[a]	-	1631	289	53	10	-	1983

[a]Provisional

Table 4a. List of commercial sampling by quarter available for 1987, for American plaice in Subdivision 3Ps.

	Quarter				Total
	1	2	3	4	
Can(N) Offshore catch (t)	1802	341	77	445	2665
Samples	12	-	-	1	13
Measured	4086	-	-	444	4530
Otoliths	838	-	-	121	959
Can(N) Inshore catch (t)	5	176	1574	224	1979
Samples	-	4	3	-	7
Measured	-	1537	784	-	2321
Otoliths	-	445	233	-	678

Table 4b. Catch at age and average weights at age with associated statistics for American plaice in the commercial fishery in Subdiv. 3Ps in 1987.

	AVERAGE		CATCH		
AGE	WEIGHT	LENGTH	MEAN	STD. ERR.	C. V.
6	0.235	30.259	5	3.03	0.64
7	0.320	33.207	90	20.13	0.22
* 8	0.400	35.426	277	35.77	0.13
* 9	0.513	38.206	349	36.41	0.10
*10	0.623	40.400	521	30.49	0.06
11	0.738	42.448	621	36.77	0.06
12	0.938	45.618	834	46.93	0.06
*13	1.168	48.729	681	48.64	0.07
14	1.497	52.525	580	46.39	0.08
*15	1.901	56.532	396	34.37	0.09
*16	2.450	61.146	195	18.59	0.10
17	3.107	67.675	95	10.57	0.11
*18	3.511	68.211	53	7.57	0.14
*19	4.116	71.387	1	0.79	0.67

Table 5a. CATCH AT AGE, A,PLAICE IN SUBDIVISION 3PS,

AGE	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
6	1	326	391	121	18	49	130	2	8	2	5	4	3	3	5
7	11	903	839	445	133	196	240	121	89	28	83	14	28	90	90
8	864	889	721	1117	330	482	574	491	434	186	401	107	378	357	277
9	2874	1140	644	1514	803	964	908	737	1032	377	476	603	995	613	349
10	4516	1263	383	1266	905	1011	820	725	670	774	670	1151	1214	949	521
11	4207	717	423	979	952	756	608	600	466	1103	501	1203	1008	1133	621
12	2433	792	490	715	343	726	349	545	291	447	328	656	579	917	834
13	1095	801	361	460	288	324	225	364	297	191	256	351	290	397	681
14	667	422	258	223	245	225	149	71	369	121	89	230	193	335	580
15	294	186	61	162	223	123	117	81	341	43	15	110	130	175	396
16	125	198	91	127	235	75	43	50	143	21	12	42	68	72	195
17	66	132	79	50	157	20	23	23	104	12	3	12	45	21	95
18	19	137	51	41	102	11	3	14	38	5	1	6	17	7	53
19	4	57	44	2	34	6	1	1	20	1	1	1	4	1	1

Table 5b. PERCENT CATCH AT AGE,

AGE	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
6	0.0	4.1	8.1	1.7	0.4	1.0	3.1	0.1	0.2	0.1	0.2	0.1	0.1	0.1	0.1
7	0.1	11.3	17.3	6.2	2.8	3.9	5.7	3.2	2.1	0.8	2.9	0.3	0.6	1.8	1.9
8	5.0	11.2	14.9	15.5	6.9	9.7	13.7	12.8	10.1	5.6	14.1	2.4	7.6	7.0	5.9
9	16.7	14.3	13.3	21.0	16.8	19.4	21.7	19.3	24.0	11.4	16.8	13.4	20.1	12.1	7.4
10	26.3	15.9	7.9	17.5	19.0	20.4	19.6	19.0	15.6	23.4	23.6	25.6	24.5	18.7	11.1
11	24.5	9.0	8.7	13.6	20.0	15.2	14.5	15.7	10.8	33.3	17.6	26.8	20.4	22.3	13.2
12	14.2	9.9	10.1	9.9	7.2	14.6	8.3	14.2	6.8	13.5	11.5	14.6	11.7	18.1	17.8
13	6.4	10.1	7.5	6.4	6.0	6.5	5.4	9.5	6.9	5.8	9.0	7.8	5.9	7.8	14.5
14	3.9	5.3	5.3	3.1	5.1	4.5	3.6	1.9	8.6	3.7	3.1	5.1	3.9	6.6	12.3
15	1.7	2.3	1.3	2.2	4.7	2.5	2.8	2.1	7.9	1.3	0.5	2.4	2.6	3.5	8.4
16	0.7	2.5	1.9	1.8	4.9	1.5	1.0	1.3	3.3	0.6	0.4	0.9	1.4	1.4	4.2
17	0.4	1.7	1.6	0.7	3.3	0.4	0.5	0.6	2.4	0.4	0.1	0.3	0.9	0.4	2.0
18	0.1	1.7	1.1	0.6	2.1	0.2	0.1	0.4	0.9	0.2	0.0	0.1	0.3	0.1	1.1
19	0.0	0.7	0.9	0.0	0.7	0.1	0.0	0.0	0.5	0.0	0.0	0.0	0.1	0.0	0.0

Table 5c. AVERAGE WEIGHTS AT AGE, 3PS A,PLAICE,

AGE	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
6	0.276	0.276	0.277	0.285	0.250	0.295	0.348	0.151	0.283	0.288	0.271	0.263	0.192	0.278	0.235
7	0.276	0.343	0.381	0.335	0.301	0.306	0.428	0.316	0.301	0.405	0.396	0.288	0.259	0.346	0.320
8	0.349	0.414	0.515	0.419	0.330	0.370	0.453	0.372	0.362	0.400	0.438	0.340	0.341	0.427	0.400
9	0.460	0.516	0.561	0.522	0.415	0.469	0.560	0.469	0.433	0.428	0.534	0.401	0.462	0.533	0.513
10	0.625	0.685	0.760	0.626	0.620	0.551	0.731	0.547	0.604	0.491	0.645	0.492	0.620	0.673	0.623
11	0.844	0.855	0.852	0.797	0.747	0.783	0.989	0.756	0.756	0.629	0.686	0.612	0.851	0.819	0.738
12	1.142	1.109	1.220	0.998	1.011	0.940	1.290	0.938	0.922	0.890	0.824	0.809	1.172	1.113	0.938
13	1.401	1.377	1.368	1.238	1.362	1.105	1.729	1.313	0.862	1.143	0.913	1.036	1.475	1.407	1.168
14	1.763	1.790	1.621	1.474	1.560	1.197	2.084	2.025	0.958	1.492	1.458	1.270	1.850	1.805	1.497
15	2.195	2.004	1.997	1.682	1.779	1.716	2.320	2.037	1.164	1.919	1.866	1.712	2.289	2.252	1.901
16	2.569	2.540	2.334	1.981	2.010	2.409	2.902	2.453	1.619	2.273	2.348	2.355	2.665	2.762	2.450
17	3.022	2.530	2.613	2.367	2.294	2.624	3.124	2.898	1.849	2.665	2.781	2.538	3.139	3.478	3.107
18	3.129	3.163	2.963	2.932	2.662	2.662	2.902	3.103	2.204	3.244	3.640	3.034	3.366	3.772	3.511
19	3.545	3.740	2.890	3.352	3.159	4.021	3.124	3.103	2.633	3.568	4.687	3.212	3.545	5.118	4.116

Table 6. Results of multiplicative analysis of commercial catch rates, Subdiv. 3Ps American plaice, for the years 1974-87.

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.752
MULTIPLE R SQUARED..... 0.566

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	2.690E2	2.690E2	
REGRESSION	27	3.369E1	1.248E0	11.098
TYPE 1	3	2.478E0	8.259E-1	7.346
TYPE 3	11	1.179E1	1.072E0	9.533
TYPE 4	13	1.258E1	9.675E-1	8.606
RESIDUALS	230	2.586E1	1.124E-1	
TOTAL	258	3.285E2		

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
1	3125	INTERCEPT	-0.741	0.088	258
3	3				
4	74				
1	2125	1	0.069	0.091	20
	3114	2	-0.238	0.057	55
	3124	3	-0.135	0.054	61
3	1	4	-0.167	0.100	17
	2	5	-0.146	0.093	22
	4	6	-0.370	0.082	33
	5	7	-0.767	0.104	16
	6	8	-0.512	0.111	16
	7	9	0.025	0.111	15
	8	10	-0.096	0.101	20
	9	11	-0.412	0.105	16
	10	12	-0.553	0.092	26
	11	13	-0.408	0.089	24
	12	14	-0.270	0.092	22
4	75	15	0.029	0.100	18
	76	16	-0.151	0.090	26
	77	17	-0.058	0.091	26
	78	18	-0.095	0.098	22
	79	19	0.049	0.092	27
	80	20	-0.073	0.101	21
	81	21	0.126	0.103	19
	82	22	0.325	0.108	16
	83	23	0.222	0.114	14
	84	24	0.598	0.143	8
	85	25	0.893	0.136	8
	86	26	0.382	0.123	11
	87	27	0.276	0.111	14

Table 7. Results of multiplicative analysis of commercial catch rates, Subdiv. 3Ps American plaice, for the years 1974-87.

PREDICTED CATCH RATE

STANDARDS USED VARIABLE NUMBERS: 3125 3

YEAR	LN TRANSFORM MEAN	LN TRANSFORM S.E.	RETRANSFORMED MEAN	RETRANSFORMED S.E.	CATCH	EFFORT
1974	-0.7413	0.0077	0.502	0.044	6598	13137
1975	-0.7126	0.0097	0.516	0.051	4211	8155
1976	-0.8918	0.0078	0.432	0.038	5458	12634
1977	-0.7990	0.0078	0.474	0.042	4605	9714
1978	-0.8365	0.0091	0.456	0.043	3658	8017
1979	-0.6921	0.0078	0.528	0.047	3666	6950
1980	-0.8145	0.0101	0.466	0.047	2935	6296
1981	-0.6156	0.0103	0.569	0.058	3217	5656
1982	-0.4160	0.0111	0.694	0.073	2186	3149
1983	-0.5192	0.0129	0.626	0.071	1726	2759
1984	-0.1432	0.0194	0.908	0.126	2963	3263
1985	-0.1518	0.0153	1.222	0.151	4220	3453
1986	-0.3595	0.0136	0.734	0.085	5067	6908
1987	-0.4652	0.0107	0.661	0.068	5381	8142

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.104

Table 8. 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 are given at the bottom of the table. (ATC, AN, WT, refers to the research vessels, A.T. CAMERON, A.T. NEEDLER, and W. TEMPLEMAN respectively).

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
101-150	306	-	-	0.3(6)	0.4(4)	0.6(2)	0.5(6)	1.0(6)	1.4(5)	1.1(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)
31-50	308	-	0.7(2)	28.1(2)	17.3(4)	16.3(2)	18.8(4)	-	0.7(4)	4.0(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)
101-150	310	-	-	0.2(3)	1.5(6)	-	0.3(6)	0.5(6)	1.7(6)	3.0(2)
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)
31-50	312	249.5(2)	-	43.3(2)	18.4(3)	20.6(5)	12.5(4)	-	0.1(3)	-
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)
0-30	314	28.6(2)	-	0.2(2)	-	1.1(2)	16.3(4)	-	-	0.5(2)
31-50	315	71.7(2)	48.3(2)	103.0(2)	-	32.7(2)	27.2(4)	-	5.3(3)	48.1(4)
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)
51-100	317	64.9(4)	161.7(7)	30.2(8)	9.9(4)	5.1(4)	3.7(6)	4.0(6)	12.0(3)	318.4(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)
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)
0-30	320	-	2.7(2)	-	-	11.2(3)	-	-	-	12.3(6)
31-50	321	90.5(2)	3.4(2)	-	-	88.5(2)	-	-	-	30.5(5)
51-100	322	-	-	-	-	75.1(4)	-	-	2.8(2)	67.1(8)
51-100	323	222.6(3)	-	-	-	111.0(4)	34.5(2)	-	-	162.5(3)
51-100	324	-	-	-	-	53.6(2)	-	-	4.0(2)	26.8(2)
31-50	325	-	-	-	-	60.4(2)	-	-	2.7(2)	7.7(4)
31-50	326	-	-	-	-	-	-	-	15.7(2)	13.9(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)
151-200	706	4.4(2)	8.2(2)	2.2(7)	-	-	3.1(4)	1.6(2)	5.6(3)	1.4(2)
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)
201-300	708	-	-	-	0.0(3)	-	0.2(4)	-	0.5(2)	0.6(2)
301-400	709	-	-	-	-	-	-	-	-	-
301-400	710	-	-	-	-	-	-	-	-	-
201-300	711	-	-	-	-	-	-	-	-	0.2(2)
201-300	712	-	-	-	-	-	-	-	1.4(2)	0.0(2)
201-300	713	-	-	-	0.6(3)	-	-	-	-	0.2(2)
201-300	714	-	-	-	-	-	-	0.9(2)	-	1.0(2)
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)
151-200	716	0.0(2)	-	0.1(3)	-	-	0.9(6)	0.4(4)	2.1(4)	0.5(2)
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)
Biomass (t)		33,826	13,654	12,999	1,901	37,757	9,109	3,785	7,236	35,776

Table 8 (cont'd)

Depth (fm)	Stratum	Year - Survey 1981 ATC 316	1982 ATC 330	1983 AN 9	1984 AN 26	1985 WT 26	1986 WT 45	1987 WT 55, 56	1988 WT 68
101-150	306	0.6(3)	0.5(3)	0.2(4)	0.1(2)	2.7(2)	0.6(3)	0.2(4)	0.3(4)
51-100	307	0.9(3)	2.5(4)	1.3(4)	0.0(2)	0.1(3)	1.0(3)	0.4(3)	0.9(4)
31-50	308	306.5(2)	49.3(2)	101.2(3)	1.5(2)	3.7(2)	0.0(2)	0.0(2)	0.5(2)
101-150	309	1.5(2)	0.4(2)	0.3(3)	7.3(2)	1.6(3)	0.2(2)	0.5(2)	1.1(3)
101-150	310	3.0(2)	1.0(3)	0.2(3)	0.5(2)	4.2(3)	2.0(2)	3.5(2)	5.7(3)
51-100	311	10.0(2)	2.7(3)	2.0(3)	2.6(2)	16.2(4)	77.0(3)	27.0(2)	74.1(4)
31-50	312	1.2(2)	5.3(2)	12.2(3)	0.6(2)	1.5(2)	4.0(2)	2.8(2)	0.0(2)
101-150	313	21.5(2)	1.2(2)	2.9(3)	0.7(2)	0.9(2)	9.7(2)	1.6(2)	8.5(2)
0-30	314	0.3(5)	23.3(5)	11.9(7)	5.3(4)	0.5(7)	2.0(8)	6.0(5)	0.0(7)
31-50	315	33.0(2)	53.5(3)	61.4(8)	35.3(5)	40.9(7)	62.5(6)	33.1(8)	39.5(6)
101-150	316	18.9(2)	-	5.3(4)	1.7(2)	3.8(3)	7.0(2)	196.8(3)	19.8(3)
51-100	317	56.0(2)	34.2(3)	52.0(3)	6.0(2)	1312.8(2)	29.3(2)	80.0(3)	62.5(2)
101-150	318	-	0.3(2)	3.6(3)	7.3(2)	-	7.0(2)	37.1(2)	70.0(2)
51-100	319	79.5(2)	33.0(7)	112.1(7)	43.3(6)	26.5(2)	27.1(8)	104.3(9)	8.9(8)
0-30	320	7.0(2)	18.8(4)	34.0(14)	9.4(8)	38.3(5)	17.0(9)	7.0(11)	4.5(11)
31-50	321	45.5(2)	27.3(4)	47.2(10)	28.0(6)	23.1(7)	26.9(10)	21.8(10)	5.7(11)
51-100	322	21.5(2)	58.0(8)	71.2(11)	64.3(8)	179.2(13)	55.5(12)	22.9(10)	9.4(12)
51-100	323	108.5(2)	256.5(2)	125.7(6)	44.4(4)	68.0(3)	170.5(5)	164.8(6)	324.0(5)
51-100	324	-	71.3(2)	91.5(4)	15.5(3)	202.3(2)	7.5(5)	95.7(4)	0.3(4)
31-50	325	4.6(2)	41.4(5)	53.4(8)	27.0(5)	25.7(3)	6.5(8)	1.6(6)	2.6(6)
31-50	326	1.9(2)	44.3(2)	40.8(3)	29.8(2)	-	8.0(2)	14.3(2)	0.6(2)
151-200	705	0.9(2)	0.6(2)	0.5(3)	0.4(2)	3.5(2)	2.2(2)	3.5(2)	6.5(2)
151-200	706	6.8(2)	0.6(4)	1.9(5)	0.3(2)	1.8(4)	7.3(4)	9.7(5)	13.5(4)
151-200	707	-	-	0.0(3)	8.1(2)	-	4.0(2)	1.0(2)	10.3(2)
201-300	708	-	-	0.2(2)	1.4(2)	-	3.6(2)	1.5(2)	0.0(2)
301-400	709	-	-	0.2(2)	0.0(2)	-	-	-	-
301-400	710	-	-	0.0(3)	2.5(2)	1.3(2)	0.7(2)	-	36.0(2)
201-300	711	0.7(2)	0.0(2)	0.8(8)	0.9(5)	1.0(8)	1.4(9)	2.2(7)	23.1(7)
201-300	712	0.2(2)	0.0(3)	0.9(7)	-	1.0(6)	0.4(9)	0.3(4)	13.2(7)
201-300	713	0.9(6)	0.3(2)	0.4(7)	-	0.4(8)	0.1(5)	1.0(4)	7.5(7)
201-300	714	0.1(8)	0.0(6)	0.3(10)	-	-	8.8(5)	0.5(4)	16.5(9)
151-200	715	0.3(2)	0.2(2)	0.8(3)	0.0(2)	-	1.8(2)	0.4(2)	0.0(2)
151-200	716	1.8(4)	0.4(2)	1.5(4)	0.2(3)	4.2(5)	1.8(4)	3.8(3)	33.0(5)
Mean (No. sets)		21.0(71)	30.7(91)	34.7(171)	20.8(95)	54.9(110)	23.2(144)	25.9(134)	20.8(152)
Biomass (t)		25,974	39,076	45,200	22,549	64,494	30,450	33,923	27,326

Table 9. American plaice biomass by stratum and depth range, from surveys in Subdivision 3Ps from 1983 to 1988. Numbers in parentheses represent the percentages of the total, and asterisks indicate <0.1%.

Depth (fm)	Stratum	1983		1984		1985		1986		1987		1988	
0-30	314	870	(1.9)	384	(1.7)	37	(0.1)	149	(0.5)	436	(1.3)	0	
	320	3365	(7.4)	930	(4.1)	3797	(5.9)	1684	(5.5)	689	(2.0)	443	(1.6)
Total		4235	(9.3)	1314	(5.8)	3834	(6.0)	1833	(6.0)	1125	(3.3)	443	(1.6)
31-50	308	851	(1.9)	13	(0.1)	31	(*)	0		0		4	(*)
	312	248	(0.5)	12	(0.1)	31	(*)	82	(0.3)	57	(0.2)	0	
	315	3810	(8.4)	2191	(9.7)	2536	(3.9)	3880	(12.7)	2056	(6.1)	2453	(9.0)
	321	4213	(9.3)	2499	(11.1)	2059	(3.2)	2399	(7.9)	1944	(5.7)	512	(1.9)
	325	3385	(7.5)	1913	(8.5)	1819	(2.8)	457	(1.5)	110	(0.3)	185	(0.7)
	326	515	(1.1)	371	(1.6)	-		100	(0.3)	178	(0.5)	7	(*)
Total		13022	(28.7)	6999	(31.1)	6476	(9.9)	6918	(22.7)	4345	(12.8)	3161	(11.6)
51-100	307	39	(0.1)	0		3	(*)	30	(0.1)	11	(*)	27	(0.1)
	311	47	(0.1)	62	(0.3)	385	(0.6)	1832	(6.0)	642	(1.9)	1764	(6.5)
	317	753	(1.7)	87	(0.4)	19018	(29.5)	424	(1.4)	1159	(3.4)	905	(3.3)
	319	8283	(18.3)	3195	(14.2)	1957	(3.0)	2004	(6.6)	7704	(22.7)	654	(2.4)
	322	8378	(18.5)	7568	(33.6)	21073	(32.7)	6525	(21.4)	2696	(7.9)	1110	(4.1)
	323	6565	(14.5)	2318	(10.3)	3553	(5.5)	8908	(29.3)	8612	(25.4)	16927	(61.9)
	324	3393	(7.5)	575	(2.6)	7500	(11.6)	278	(0.9)	3550	(10.5)	11	(*)
Total		27458	(60.7)	13805	(61.4)	53489	(82.9)	20001	(65.7)	24374	(71.8)	21398	(78.3)
101-150	306	6	(*)	2	(*)	83	(0.1)	19	(0.1)	6	(*)	10	(*)
	309	7	(*)	161	(0.7)	35	(0.1)	3	(*)	11	(*)	25	(0.1)
	310	2	(80	6	(*)	53	(0.1	26	(0.1)	45	(0.1)	72	(0.3)
	313	36	(0.1)	9	(*)	11	(*)	120	(1.4)	19	(0.1)	105	(0.4)
	316	74	(0.2)	23	(0.1)	54	(0.1)	99	(0.3)	2792	(8.2)	281	(1.0)
	318	33	(0.1)	67	(0.3)	-		65	(0.2)	343	(1.0)	646	(2.4)
Total		158	(0.4)	268	(1.1)	236	(0.4)	332	(1.1)	3216	(9.4)	1139	(4.2)
151-200	705	8	(*)	6	(*)	51	(0.1)	31	(0.1)	51	(0.2)	94	(0.3)
	706	66	(0.1)	11	(*)	65	(0.1)	259	(0.9)	347	(1.0)	121	(0.4)
	707	0		57	(0.3)	-		28	(0.1)	7	(*)	36	(0.1)
	715	8	(*)	0		-		17	(0.1)	4	(*)	0	
	716	61	(0.1)	8	(*)	171	(0.3)	72	(0.2)	152	(0.4)	267	(1.0)
Total		143	(0.2)	82	(0.3)	287	(0.9)	407	(1.4)	561	(1.6)	518	(1.8)
201-300	708	1	(*)	12	(0.1)	-		32	(0.1)	13	(*)	0	
	711	59	(0.1)	63	(0.3)	72	(0.1)	103	(0.3)	156	(0.5)	238	(0.9)
	712	67	(0.1)	-		69	(0.1)	26	(0.1)	18	(0.1)	138	(0.5)
	713	31	(0.1)	-		27	(*)	4	(*)	71	(0.2)	76	(0.3)
	714	26	(0.1)	-		-		793	(2.6)	45	(0.1)	164	(0.6)
Total		184	(0.4)	75	(0.4)	168	(0.2)	958	(3.1)	303	(0.9)	616	(2.3)
301-400	709	0		0		-		-		-		-	
	710	0		7	(*)	3	(*)	2	(*)	-		49	(0.2)
Total		0		7	(*)	3	(*)	2	(*)	-		49	(0.2)
Total		45200		22550		64493		30451		33924		27324	

Table 10. Mean number of American plaice per tow from R.V. surveys in Subdivision 3Ps (all strata). Values for the trips by the A.T. CAMERON were adjusted by the appropriate conversion factors so that these data would be comparable to those from the A. NEEDLER and W. TEMPLEMAN trips.

	Year-Survey							
Age	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
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.38	0.07	0.05	0.00	0.01	0.00	0.00	0.00
3	1.84	0.44	1.20	0.12	0.00	0.02	0.04	0.09
4	2.47	2.77	5.17	0.91	0.17	0.36	0.49	0.29
5	6.25	3.31	6.81	5.39	1.79	2.33	1.66	1.49
6	9.99	5.31	8.23	12.60	6.94	6.49	6.64	4.22
7	25.56	10.99	12.03	14.84	8.28	12.33	11.60	9.07
8	24.57	14.78	17.03	14.21	7.48	8.80	8.14	11.38
9	17.15	9.78	20.99	12.12	6.03	8.91	4.48	7.38
10	10.99	5.65	10.18	6.05	4.98	7.99	3.57	5.24
11	4.42	2.25	4.25	3.90	2.74	4.77	2.07	2.44
12	2.73	1.86	3.51	2.06	1.53	3.31	1.72	2.14
13	1.23	0.80	1.73	1.32	0.64	3.24	1.27	1.35
14	0.60	0.69	1.10	0.80	0.45	2.23	0.68	0.86
15	0.07	0.25	0.54	0.51	0.31	2.15	0.72	0.76
16	0.33	0.37	0.40	0.53	0.14	1.82	0.47	0.51
17	0.09	0.13	0.24	0.17	0.10	0.99	0.18	0.17
18	0.18	0.26	0.44	0.10	0.07	1.09	0.14	0.11
19	0.05	0.17	0.03	0.08	0.01	0.06	0.02	0.02
20	-	-	0.02	-	-	0.03	-	-
UNK	-	-	0.03	-	0.01	0.06	-	-
Totals - 1+	108.90	59.88	93.98	75.71	41.68	66.98	43.89	47.52
- 4+	106.98	59.37	92.73	75.59	41.67	66.96	43.85	47.43
- 6+	97.96	53.29	80.75	69.29	39.71	64.27	41.70	45.65
- 8+	62.41	36.99	60.49	41.85	24.49	45.45	23.46	32.36
- 10+	20.69	12.43	22.47	15.52	10.98	27.74	10.84	13.60
- 12+	5.28	4.53	8.04	5.57	3.26	14.98	5.20	5.92

Table 11. Yield per recruit analysis for American plaice in Subdiv. 3Ps, using long-term average weights and partial recruitment.

	FISHING MORTALITY	CATCH (NUMBER)	YIELD (KG)	AVG. WEIGHT (KG)	YIELD PER UNIT EFFORT
	0.1000	0.158	0.191	1.214	1.548
	0.2000	0.247	0.256	1.036	1.033
F0.1---	0.2091	0.253	0.259	1.022	1.000
	0.3000	0.303	0.276	0.910	0.744
	0.4000	0.343	0.282	0.820	0.569
FMAX---	0.4691	0.365	0.282	0.774	0.486
	0.5000	0.373	0.282	0.756	0.456
	0.6000	0.397	0.281	0.708	0.379
	0.7000	0.417	0.280	0.671	0.323
	0.8000	0.433	0.278	0.642	0.281
	0.9000	0.448	0.277	0.619	0.249
	1.0000	0.461	0.276	0.600	0.223
	1.1000	0.472	0.275	0.584	0.202
	1.2000	0.482	0.275	0.570	0.185
	1.3000	0.492	0.274	0.558	0.170
	1.4000	0.500	0.274	0.547	0.158
	1.5000	0.508	0.273	0.538	0.147

AGE	WEIGHT-AT-AGE	PARTIAL RECRUITMENT
$$$	$$$$$$$$$$$$$	$$$$$$$ $$$$$$$$$$$
6	0.294	0.017
7	0.368	0.060
8	0.434	0.170
9	0.530	0.410
10	0.673	0.650
11	0.843	0.850
12	1.096	0.910
13	1.347	1.000
14	1.692	1.000
15	2.039	1.000
16	2.513	1.000
17	2.884	1.000
18	3.248	1.000
19	3.768	1.000
20	4.300	1.000

NATURAL MORTALITY RATE : 0.2
F0.1 COMPUTED AS 0.2091 AT Y/R OF 0.2586
FMAX COMPUTED AS 0.4691 AT Y/R OF 0.2822

Table 12. Results of SPA using Ft=0.28 and long term average PR.

POPULATION NUMBERS

AGE	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
6	15724	14317	13876	15479	19159	22988	23866	23030	21837	13387
7	12769	12872	11427	11007	12563	15670	18777	19422	18854	17871
8	8725	10444	9722	8596	8609	10166	12652	15156	15792	15355
9	9712	6362	7747	7307	6027	6750	7887	9839	11964	12537
10	9150	5351	4177	5760	4613	4208	4654	5636	7389	8862
11	7805	3405	3238	3074	3570	2958	2531	3068	3958	5443
12	5187	2583	2139	2269	1631	2062	1738	1522	1969	2819
13	2567	2045	1398	1308	1210	1025	1031	1107	753	1349
14	1525	1111	950	818	655	730	546	641	577	348
15	897	645	527	544	468	314	394	312	460	138
16	412	468	360	377	299	182	146	217	182	68
17	443	224	204	212	193	32	81	81	133	20
18	167	303	64	96	128	16	8	45	45	14
19	19	120	124	6	41	13	3	4	24	3
6+	75101	60251	55953	56852	59167	67113	74313	80079	83937	78215
7+	59377	45934	42077	41373	40008	44125	50447	57049	62100	64827
8+	46608	33061	30651	30366	27445	28455	31670	37627	43247	46956
9+	37883	22617	20928	21770	18836	18289	19018	22471	27455	31601

AGE	1983	1984	1985	1986	1987
6	9547	7088	9925	7281	1162
7	10959	7812	5799	8123	5959
8	14606	8897	6383	4723	6569
9	12404	11596	7188	4884	3544
10	9923	9725	8948	4984	3444
11	6555	7518	6920	6228	3222
12	3458	4914	5067	4754	4074
13	1903	2535	3429	3624	3062
14	932	1327	1758	2545	2608
15	175	682	878	1264	1781
16	74	130	459	601	877
17	37	50	68	314	427
18	5	27	30	15	238
19	7	3	17	9	6
6+	70587	62304	56871	49352	36973
7+	61040	55216	46945	42071	35812
8+	50081	47404	41146	33947	29853
9+	35474	38507	34763	29224	23284

Table 12. Continued.

MEAN POPULATION BIOMASS

AGE	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
6	4364	3925	3806	4409	4829	6805	8280	3572	6204	3867
7	3543	4239	4167	3605	3772	4773	7920	6118	5679	7199
8	2880	4100	4748	3323	2783	3651	5542	5516	5618	6065
9	3677	2921	4095	3336	2305	2891	4084	4388	4907	5238
10	3945	3119	2955	3112	2509	1977	3010	2827	4177	4098
11	4297	2509	2502	1959	2217	1939	2108	2026	2744	2968
12	4130	2295	2206	1806	1415	1504	1929	1103	1626	2233
13	2598	2099	1580	1250	1381	900	1508	1141	487	1381
14	1916	1489	1255	985	771	698	923	1170	316	400
15	1532	1038	948	732	572	400	729	521	256	210
16	836	853	690	577	254	317	337	444	126	122
17	1171	341	395	417	174	48	202	187	104	31
18	468	666	77	200	141	23	18	110	35	36
19	58	306	272	16	53	35	8	10	27	7
6+	35415	29899	29696	25727	23177	25963	36596	29133	32306	33875
7+	31050	25974	25890	21319	18348	19158	28316	25561	26102	30008
8+	27508	21735	21723	17714	14576	14385	20396	19443	20423	22809
9+	24628	17635	16975	14390	11792	10734	14854	13927	14805	16744

AGE	1983	1984	1985	1986	1987
6	2604	1880	1942	2034	275
7	4298	2254	1508	2795	1896
8	6260	3001	2104	1919	2553
9	6407	4502	3044	2395	1700
10	6059	4432	5056	2945	1937
11	4228	4127	5291	4482	2082
12	2641	3602	5404	4588	3304
13	1570	2360	4662	4635	3040
14	1245	1476	2940	4102	3303
15	300	1025	1770	2523	2853
16	152	238	1074	1483	1803
17	94	105	116	1004	1110
18	16	70	63	39	698
19	30	9	50	42	21
6+	35905	29081	35024	34985	26575
7+	33301	27201	33082	32951	26300
8+	29002	24947	31574	30156	24404
9+	22742	21946	29470	28237	21851

Table 12. Continued.

FISHING MORTALITY

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
6	0.000	0.025	0.032	0.009	0.001	0.002	0.006	0.000	0.000	0.000	0.001
7	0.001	0.081	0.085	0.046	0.012	0.014	0.014	0.007	0.005	0.002	0.008
8	0.116	0.099	0.086	0.155	0.043	0.054	0.051	0.036	0.031	0.013	0.031
9	0.396	0.221	0.096	0.260	0.159	0.172	0.136	0.086	0.100	0.034	0.043
10	0.788	0.302	0.107	0.278	0.244	0.309	0.217	0.153	0.106	0.102	0.078
11	0.906	0.265	0.156	0.434	0.349	0.332	0.309	0.243	0.139	0.254	0.088
12	0.731	0.414	0.292	0.428	0.265	0.493	0.251	0.504	0.178	0.193	0.111
13	0.638	0.567	0.336	0.492	0.305	0.430	0.276	0.452	0.573	0.170	0.161
14	0.661	0.545	0.357	0.358	0.534	0.416	0.359	0.131	1.228	0.486	0.112
15	0.450	0.384	0.137	0.399	0.747	0.566	0.397	0.338	1.709	0.421	0.099
16	0.409	0.630	0.328	0.466	2.034	0.610	0.394	0.294	2.023	0.416	0.196
17	0.180	1.053	0.558	0.302	2.275	1.174	0.378	0.378	2.021	1.116	0.094
18	0.134	0.694	2.130	0.641	2.103	1.373	0.527	0.418	2.632	0.485	0.234
19	0.258	0.731	0.493	0.434	2.118	0.713	0.393	0.329	2.081	0.529	0.165
13+	0.551	0.578	0.361	0.434	0.826	0.477	0.331	0.334	1.257	0.266	0.143

	1984	1985	1986	1987
6	0.001	0.000	0.000	0.005
7	0.002	0.005	0.012	0.017
8	0.013	0.068	0.087	0.048
9	0.059	0.166	0.149	0.115
10	0.140	0.162	0.236	0.182
11	0.195	0.176	0.224	0.238
12	0.160	0.135	0.240	0.255
13	0.166	0.098	0.129	0.280
14	0.213	0.129	0.157	0.280
15	0.196	0.179	0.166	0.280
16	0.443	0.179	0.142	0.280
17	0.308	1.305	0.077	0.280
18	0.277	0.978	0.715	0.280
19	0.386	0.298	0.126	0.280
13+	0.193	0.140	0.143	0.280

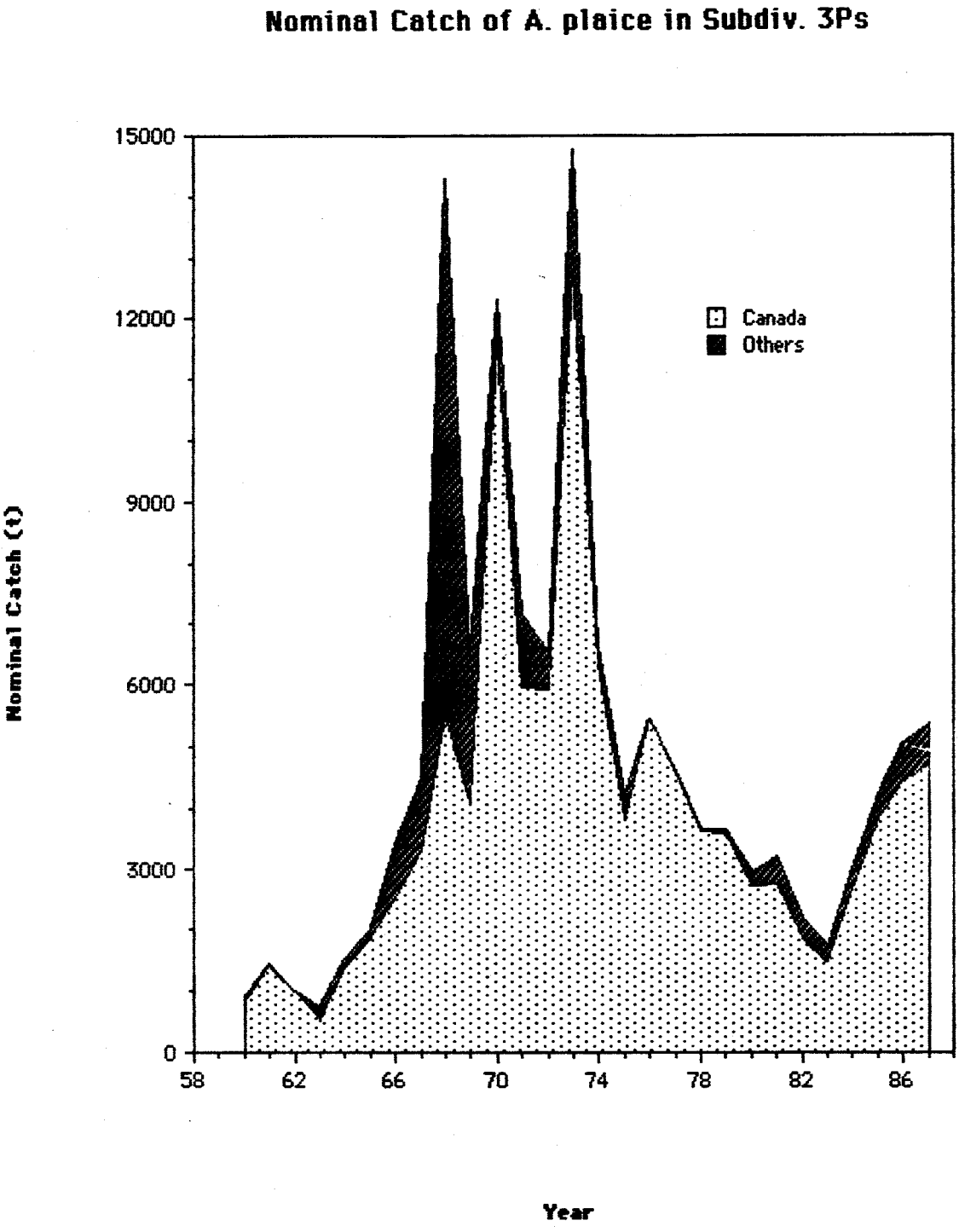


Fig. 1. Nominal catch of American plaice in subdivsision 3Ps from 1960-1987.

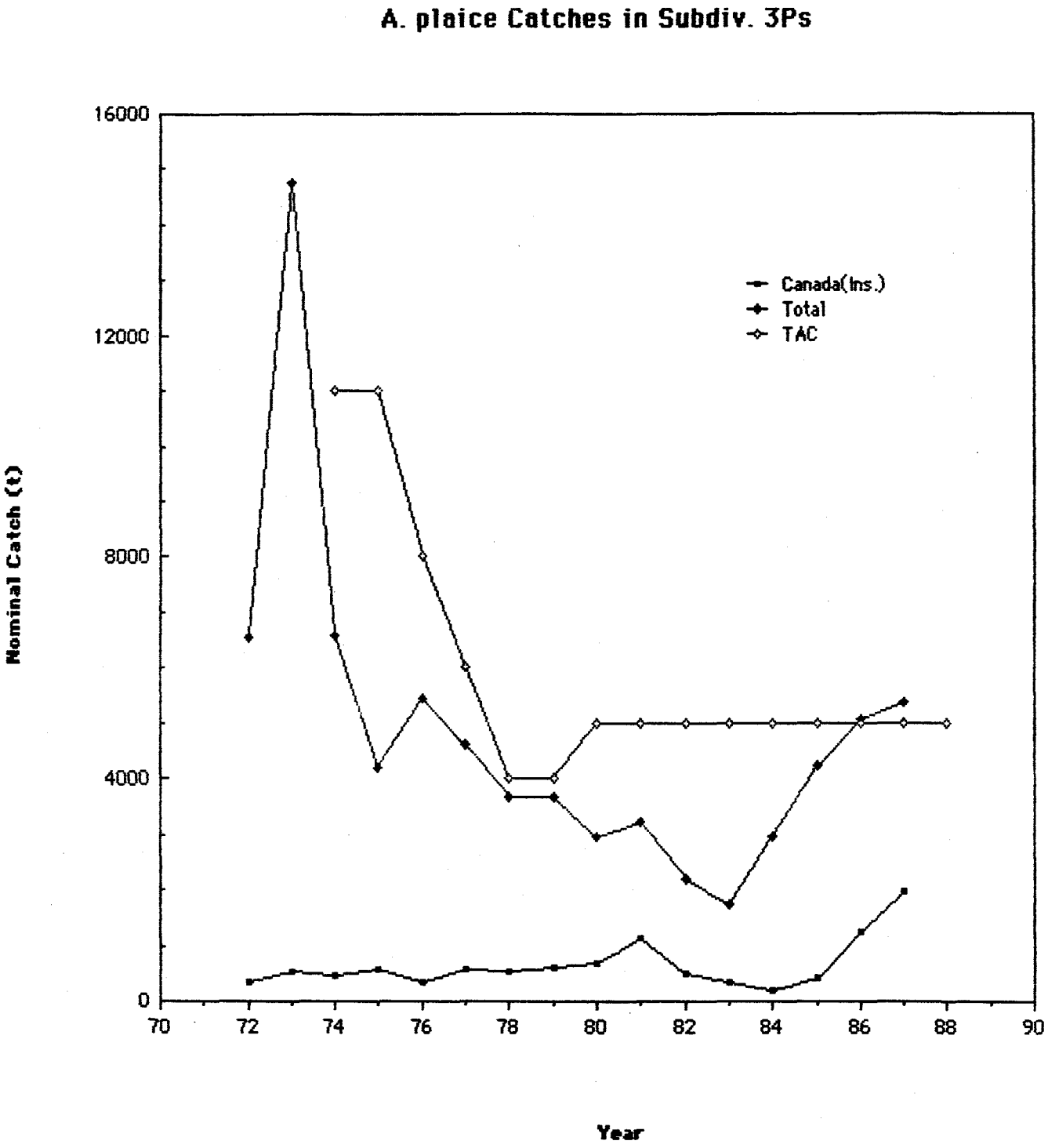
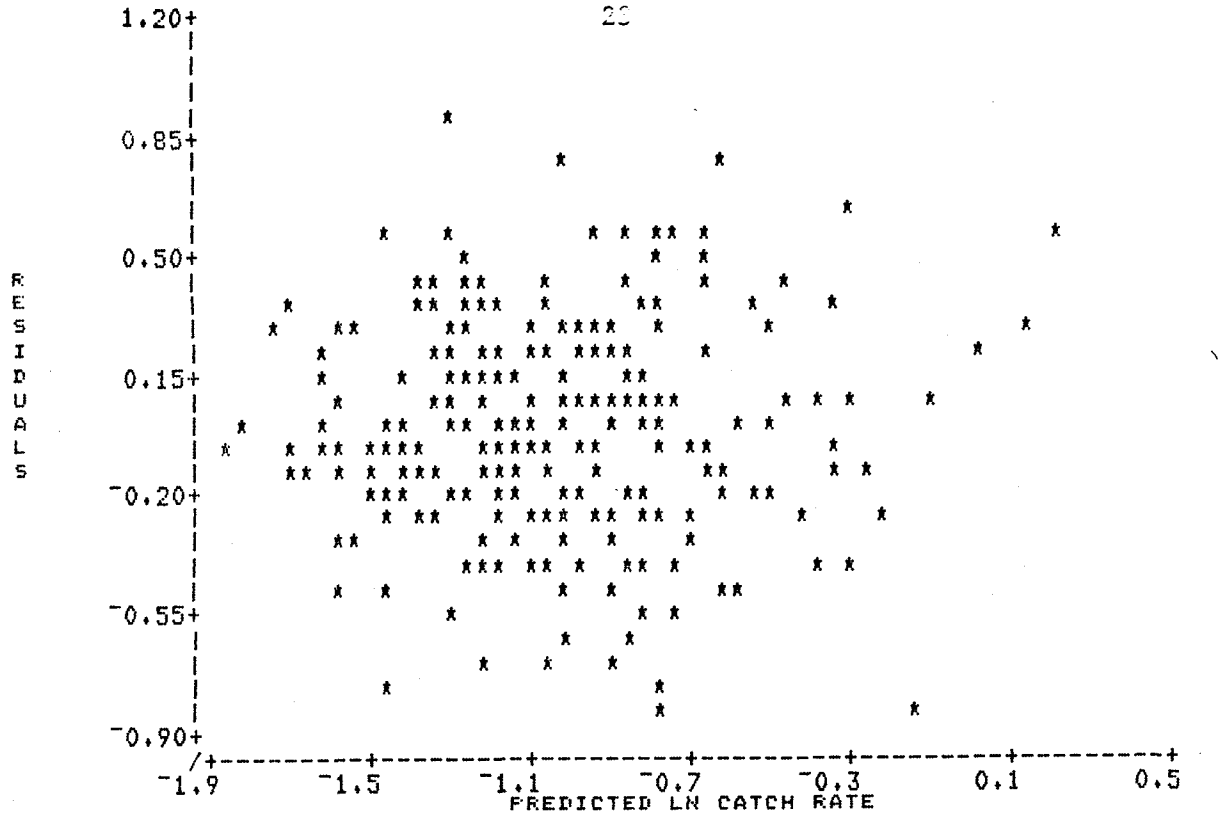


Fig. 2. Total (all countries) and Canadian inshore catches in Subdiv. 3Ps from 1972-87.



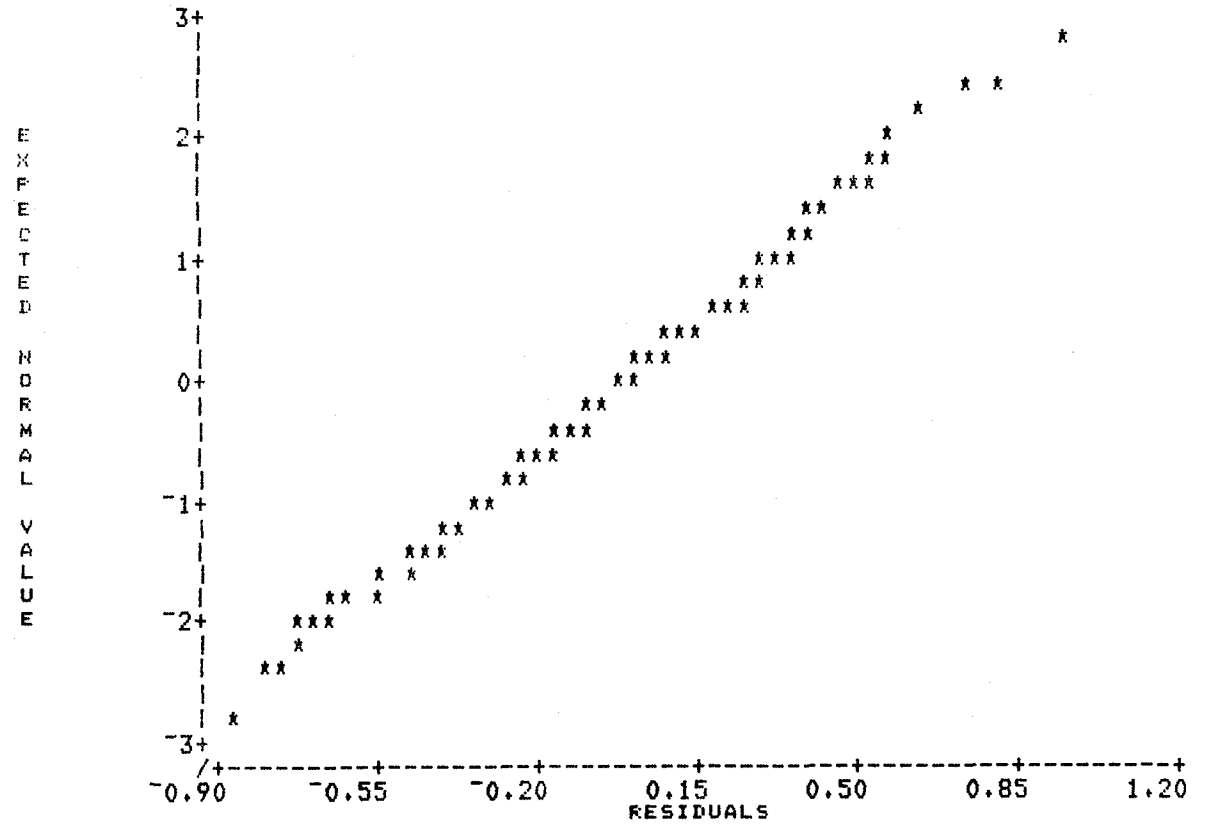


Fig. 3a. Residual plots from multiplicative analysis of catch rates.

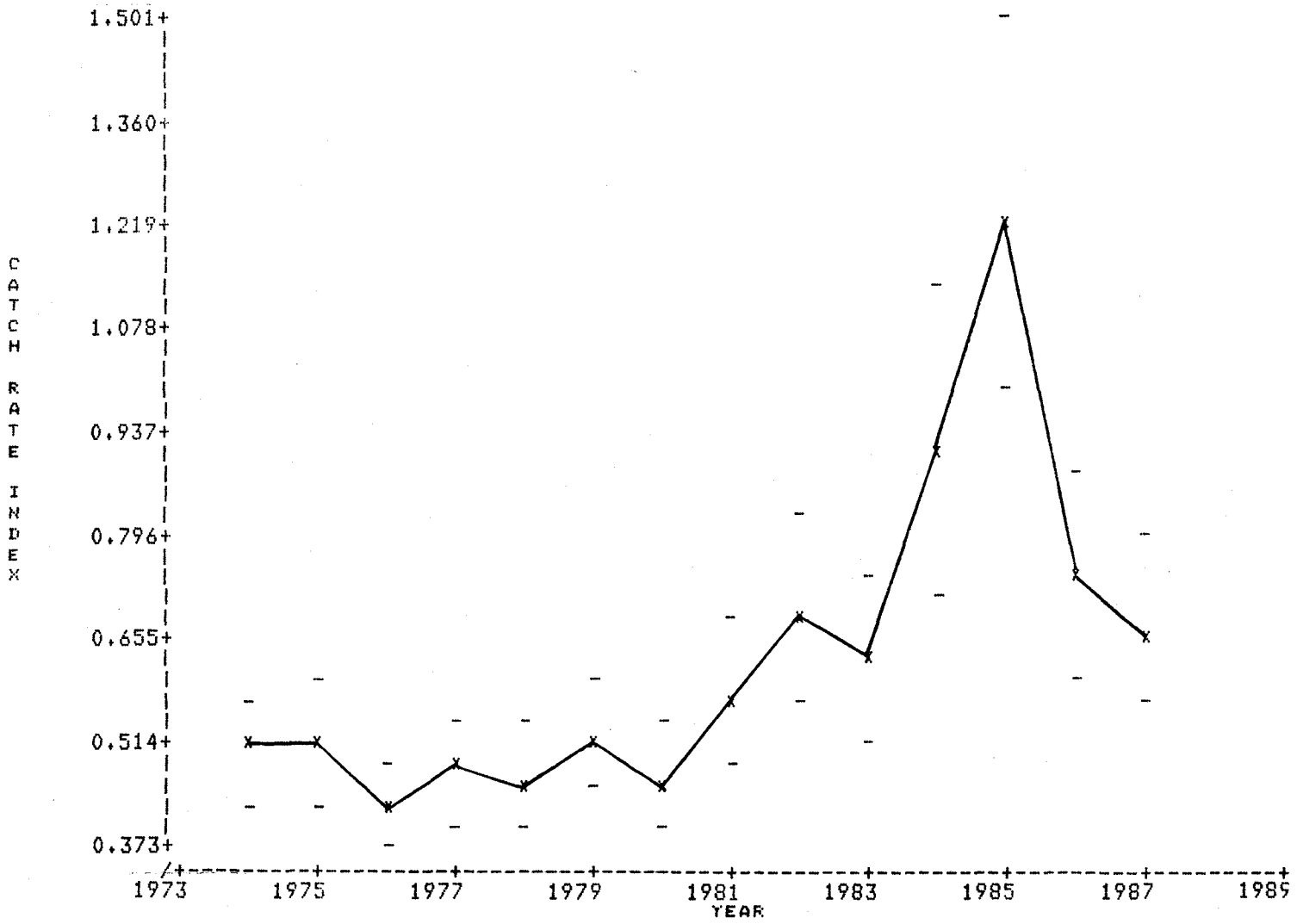


Fig. 3b. CPUE series for American plaice in Subdiv. 3Ps, for 1974-87.

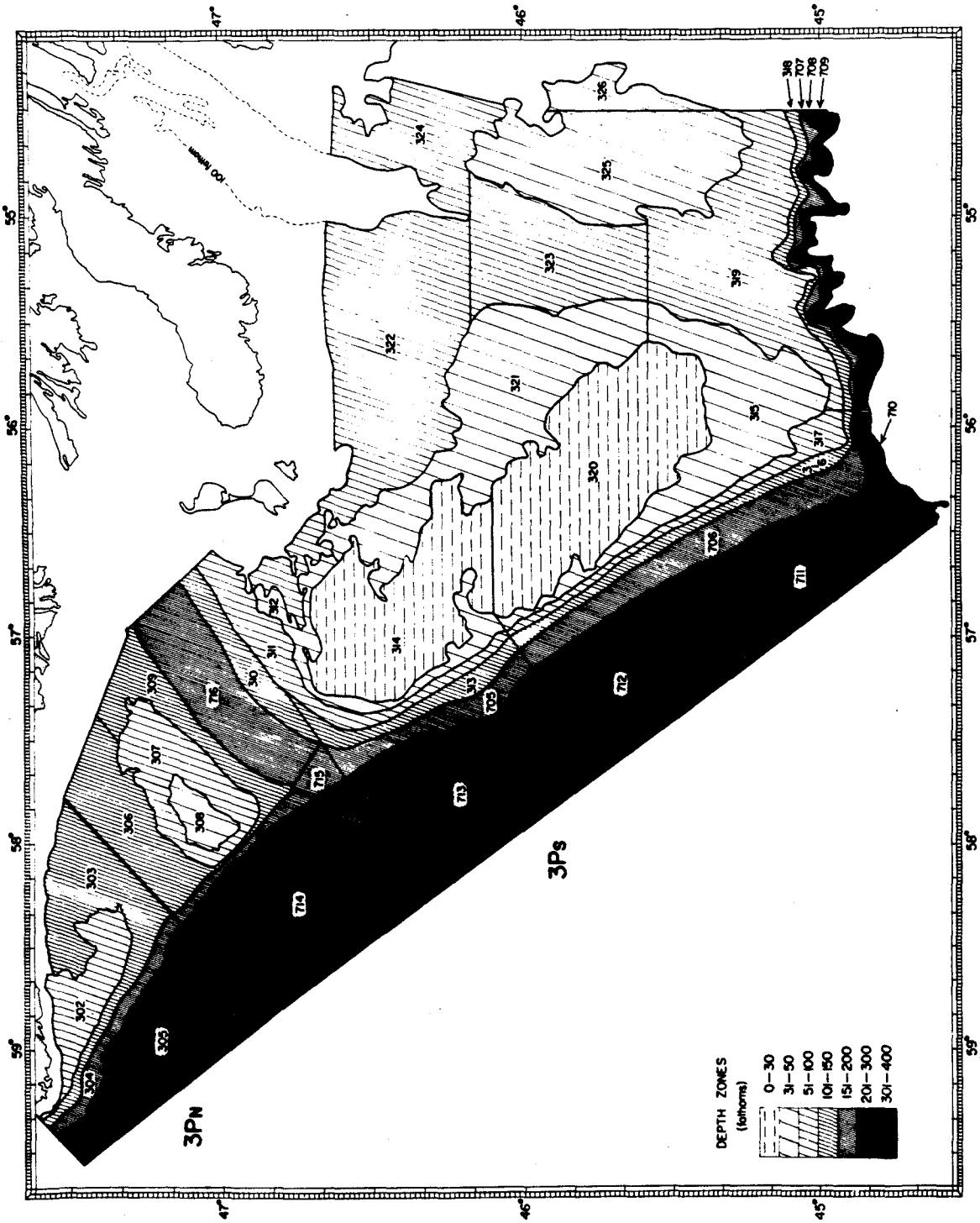


Fig. 4. Strata map of St. Pierre Bank (NAFO Subdivision 3Ps)

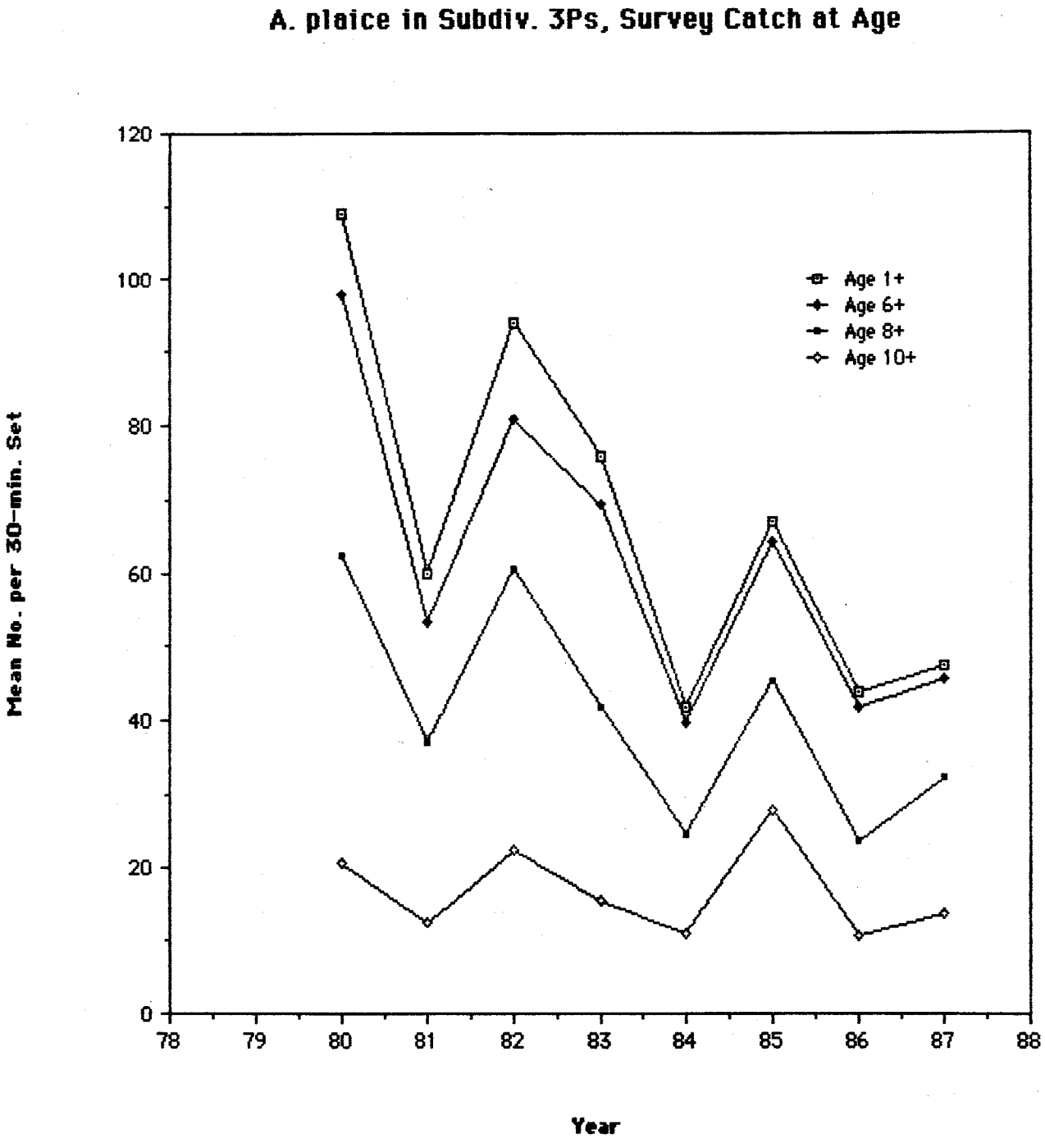


Fig. 5. Mean no. of A. plaice per age group from surveys in NAFO Subdivision 3Ps from 1980-87.

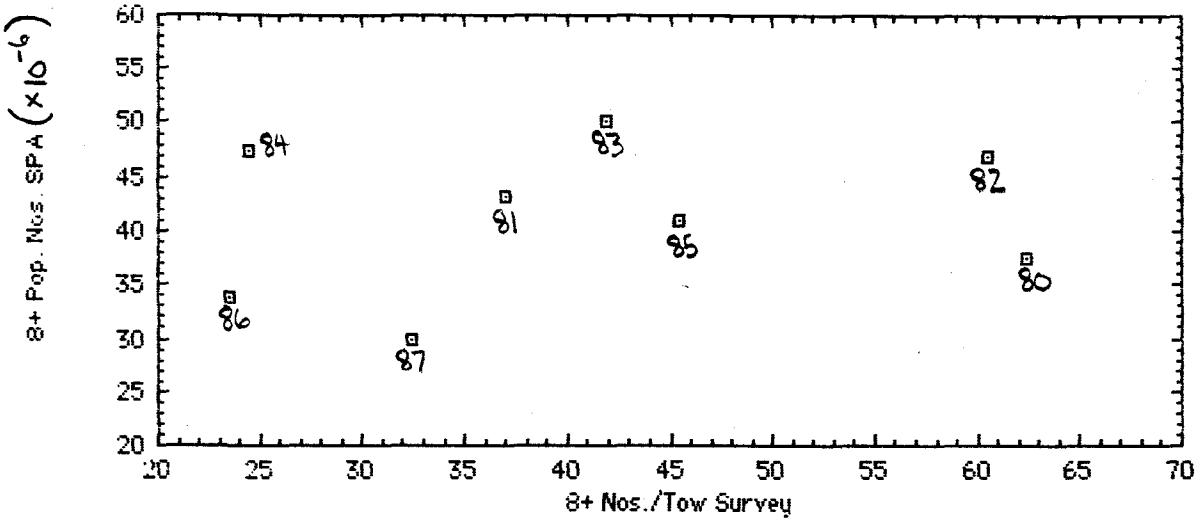


Fig. 6: 8+ SPA numbers vs. 8+ survey no/tow

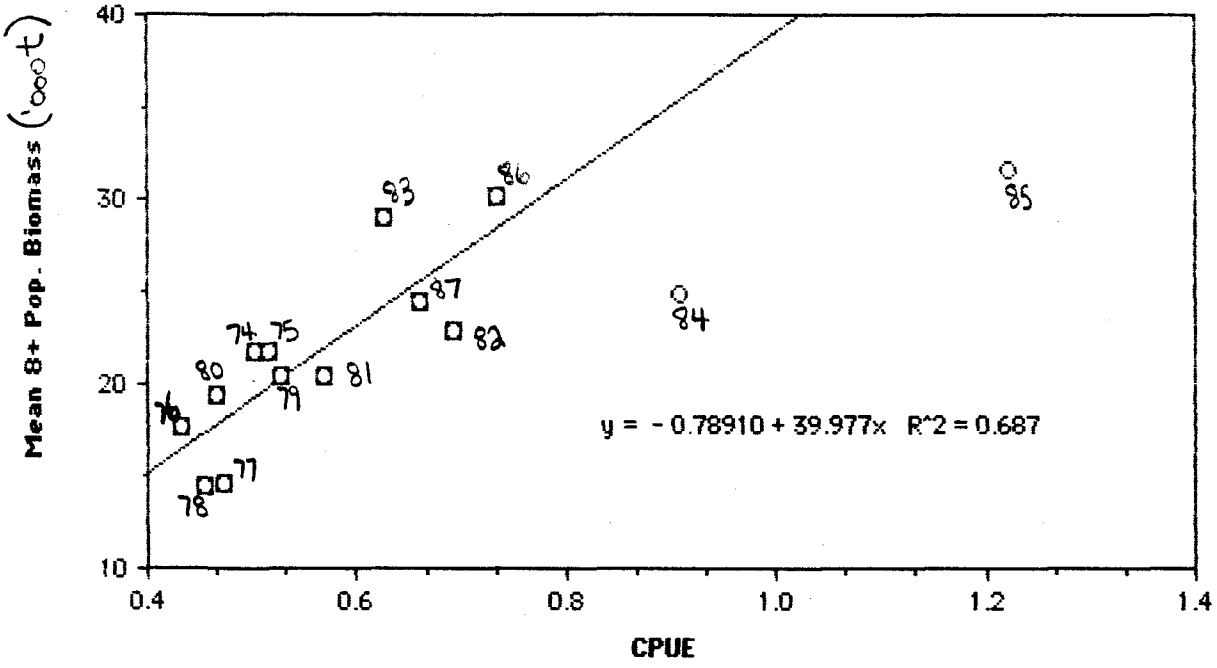


Fig. 7: Mean 8+ pop. biomass from SPA vs CPUE (1984 and 1985 points excluded).

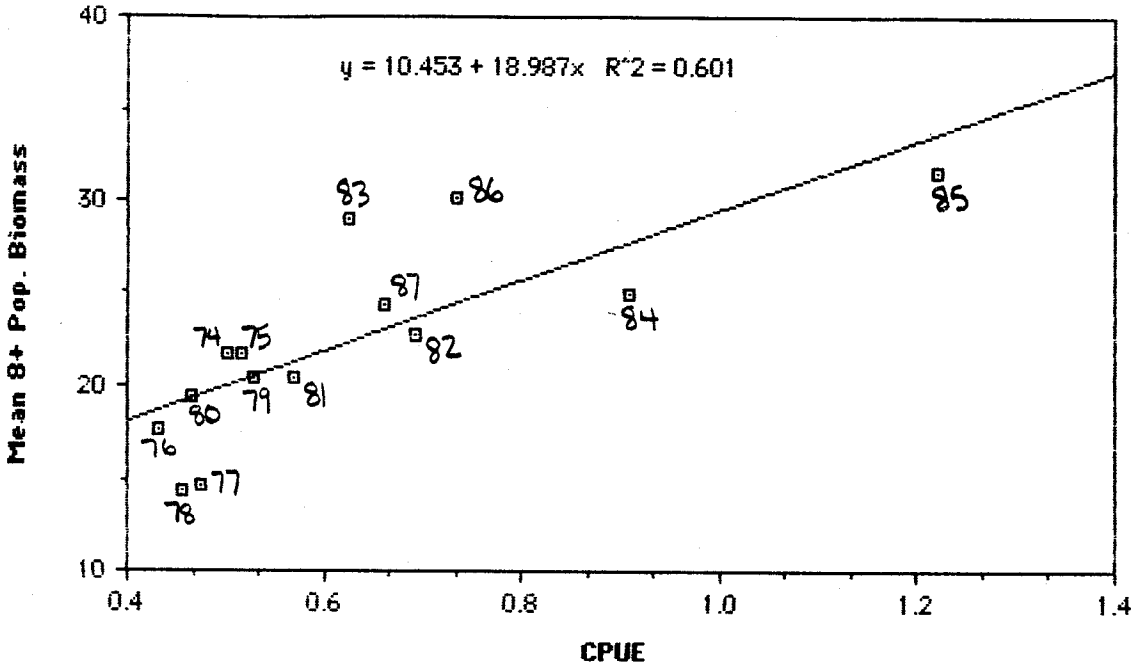


Fig. 8: Mean 8+ pop. biomass from SPA vs CPUE (all years included).