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An Assessment of the American Plaice Stock in Divisions 3LNO

by

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TAC regulation

This stock has been under TAC regulation since 1973 when a TAC of 60,000 t was established. From 1973 to 1987, the TAC varied between 47,000 and 60,000 t. However, in 1988, the TAC was set at 33,585 t, following a marked decline in stock abundance. In 1989 and 1990 the TAC was set at 30,300 t and 24,900 t respectively.

Catch trends

Catches from 1960 to 1989 and TAC's from 1973 to 1990 are shown in Table 1. From Fig. 1, it can be seen that the nominal catch peaked at 94,000 t in 1967, was relatively stable around 45,000-50,000 t in the 1973-82 period, then declined to about 39,000 t in 1983-84. Catches then increased, with the 1986 value of 65,000 t being the highest since 1971. Recent catches have declined to about 42,000 t, with the Canadian catches in 1988 and 1989 of around 27,000 t being the lowest by this country since 1963.

From 1977 to 1982, the catch was taken almost exclusively by Canadian vessels, but the catch by other nations increased from about 1400 t in 1982 to 31,000 t in 1986, as new freezer trawler fisheries for A. plaice began in the NAFO Regulatory Area (Table 2). Catches by these fleets have also declined in recent years, to about 15,000 t in 1988-89. Catches by Portugal alone have declined from over 9,000 t in 1986 to about 600 t in 1989 (Table 2).

Since the last assessment of this stock in 1989, final catch statistics have become available for 1986 and 1987 and revised estimates of catch by non-member countries were also available. As a result, revisions to the catches for 1984-88 were necessary. For 1984-85, the changes were less than 180 t each year, but for 1986 amounted to an upward revision of 3,680 t. For 1987 and 1988, the catches were increased by 2319 t and 3369 t respectively. The corrections for 1986-88 were due to revised estimates of the South Korean catch from breakdowns of unspecified flounder catches reported to NAFO. For 1982-84, a ratio of 60% yellowtail and 40% A. plaice was assumed in the S. Korean catches of unspecified flounder, but for 1985-88, the actual ratios of catches of flatfish reported by species was used to adjust the unspecified flounder catches. A catch of 3000 t, similar to the 1987-88 levels, was assumed for 1989. Estimates from surveillance for catches by other nonmember nations were not available for 1989, so it was assumed that flounder catches were minimal, which was the case in 1987-88, as these fleets directed at redfish.

Table 3 indicates that the catch in Div. 3L in 1988-89 declined to the lowest level since 1975. In Div. 3N, catches in 1987-89 were between 16,300 t and 18,300 t, down sharply from 34,000 t in 1986, which was close to the highest catch on record from this division. In Div. 3O, catches from 1982 to 1989 have been between 4000 and 5800 t each year.

In 1989, Canada and Spain accounted for 64% and 25% respectively of the nominal catch. Most of the Spanish catch came in the freezer trawler fishery in Div. 3N (7,746 t), while the largest component in the Canadian catch was the otter trawl catch in Div. 3L of 15,652 t (Table 4). The USA accounted for 1133 t, 96% of which was taken in Div. 3N. The catches by inshore gears in Div. 3L in 1989 were similar to the 1988 levels (Table 5).

Commercial CPUE data

As in recent years, a multiplicative analysis was carried out in the catch/effort data from the Canadian offshore otter trawler fleet from 1956 to 1989 (Table 6). In some years in

the late 1970's and early 1980's, these were the only catch data from which a CPUE series could be derived. Results from the multiplicative model are shown in Table 7, along with the resulting CPUE series. Fig. 2 shows that the CPUE declined steadily from 1956 to 1976, then increased to a relatively stable level from 1980 to 1985. This was followed by a sharp decline in 1986 and a stabilizing of the catch rates at a level similar to the lowest observed in the series (1975-77).

Catch sampling, 1989

Canada: Length frequencies and otoliths were available from the Canadian fishery in Div. 3LNO in 1988. As in previous years, the level of sampling from this fishery was high (Table 8). Table 9 shows the catch at age and mean weights at age from this segment of the fishery. Ages 9-11 were dominant in the catch, as is common in most years. The weights at age were similar to those observed in the Canadian catches in 1988. Table 10 shows a breakdown of the Canadian catch at age by Div. 3L (inshore and offshore), 3N, and 3Ø.

USA: Numbers caught at length were available from the USA catch in Div. 3NO for all months combined. To determine the age composition, an age length key (sexes combined) from the Canadian fishery in Div. 3N in the 3rd quarter was used; as this corresponded to the time and division where most of the USA catch was taken. The peak ages in the catch were 8-10, corresponding to the Canadian fishery in Div. 3N (Table 10). The weights at age were also in close agreement with those in the Canadian catch.

Spain: Numbers caught at age were available for months with samples from the Spanish freezer trawler catches in Div. 3L and Div. 3NO. These were adjusted to the total catch by the appropriate combining of monthly catches. The pattern in catch at age for this fishery is radically different from the Canadian and USA fisheries, with peak ages in the Spanish catches being 4-6 in Div. 3NO. In Div. 3L, the catch in numbers was spread somewhat evenly over ages 5-9 (Table 10).

In Div. 3NO, the weights at ages 7-9 were similar to those in the USA and Canadian fisheries (Div. 3N), but were somewhat more variable at older ages. There were few fish younger than age 7 in the Canadian and USA catches for comparison of the weights with the younger fish in the Spanish catch. In Div. 3L, the weights at age in the Spanish catch were higher than those in the Canadian offshore catch in Div. 3L; A. plaice in the Nose of the Bank area have a higher growth rate than those in most of the areas fished by the Canadian fleet.

Portugal: Length frequency data were available for several months from the Portuguese gillnet fishery in Div. 3NO. Examination of the modes suggest that the peak ages in the catch were 7-9, which agrees generally with the Canadian and USA catch at age. Because these length frequencies represented only about 40 t of catch, the data were not broken down with an age-length key for inclusion in the total stock catch at age.

Total for 1989

To derive the total catch at age for 1989, the 3NO catch for Spain and USA (Table 10) was combined and adjusted up to represent 12,255 t. This was then added to the remaining catch at age calculated for Divs. 3L, 3N and 3O to give the total catch at age in 1989 (Table 11). As can be seen from Table 10, there were large numbers of fish aged 3 and 4 not included in the catch matrix (approximately 2.2 million and 12.9 million respectively).

Adjustments to the catch at age, 1986-88

With the availability of the final statistics for 1986-87, revised statistics for 1988, and revised estimates of some non-member catches in these years, changes to the catch at age were required for these years. In addition, it was decided to adjust the non-sampled catches in Div. 3N to the total non-Canadian catch, rather than to the total available catch at age, as had been done previously. This change was based on the assumption that the portion of the catch for which little or no sampling was available would have a similar age composition to the sampled catch in the Regulatory Area. Given that the main component of the sampled catch in the Regulatory Area (Spain) is skewed toward younger fish, the resulting changes showed proportionally more fish at younger ages in 1986-88, as follows (changes from 1989 estimates in '000):

Age	4	5	6	7	8	9	10	11	12	13	14	15	16+
1986	177	596	1246	1394	1033	758	515	315	311	238	104	77	36
1987	65	138	309	444	343	229	296	174	125	66	35	29	16
1988	294	814	889	1148	1017	292	-147	-289	-74	-35	-15	7	11

Overall, the catch in recent years contains more fish at younger ages (Tables 11 and 12). In addition, there are considerable numbers of fish younger than age 5 appearing in the catch,

eg. at age 4: 1.3 million in 1986, 0.3 million in 1987, 1.1 million in 1988, and 12.9 million in 1989. Prior to 1986, when Canada took a larger portion of the catch, few, if any, fish younger than 5 were landed in most years, although some smaller fish did show up in discard samples in the early 1980's.

The mean weights at age, which were revised along with the catch at age for 1986-88, are shown in Table 13. The weights were variable at the younger ages in recent years, but were similar at ages 9+ from 1987 to 1989. Table 14 shows the catch biomass at age, and the totals compare favourably to the nominal catch in most years.

Research vessel surveys

Stratified random surveys have been carried out on the Grand Bank on Canadian vessels in the spring of each year from 1971 to 1990, with the exception of 1983. The mean weight per tow on a stratified basis is shown in Tables 15, 16, and 17 for Div. 3L, 3N, and 3O respectively, and the corresponding stratification scheme is displayed in Fig. 3.

In Div. 3L, the biomass was highest from 1977 to 1982, then declined to a lower but stable level from 1985 to 1988, with the 1989 value being somewhat lower (Table 15). The decline in biomass in Div. 3L can also be seen in the Canadian fall surveys, which showed the stock to be much larger in 1983-84 than at present (Fig. 4). However, the decline in biomass in 1989 was larger in the fall series than in the spring.

In Div. 3N, Table 16 also indicates a decline in biomass in recent years, from about 60,000 t in 1984-85 to 43,000 t in 1989. Table 18 shows that the biomass in the strata which comprise most of the area outside the 200 mile limit in Div. 3N has declined from about 26% of the total in Div. 3N in 1984-86 to about 13% in 1987-89.

For Div. 3O, the biomass has been somewhat more variable, but appears to be relatively stable in 1988-90 at around 50,000 t, compared to an average of about 65,000 t from 1984 to 1987 (Table 17).

To allow comparison of the trends in abundance at age for this stock over the 1971-89 period, a multiplicative analysis of mean catch number per stratum was again carried out, using the same methodology employed in the 1989 assessment of this stock. The resulting series is adjusted for the change in the vessel-gear used for the surveys and accounts for strata not surveyed in each year. Tables 19-21 show the abundance for Divs. 3L, 3N, and 3O respectively, with Table 22 containing the combined index.

It can be seen from Tables 19-21 that the portion of the stock in Div. 3L is larger than the portion in Div. 3NO combined. In Div. 3L, a number of strong year-classes dominated the catches in the late 1970's and early 1980's, after which time recruitment decreased. It was thought that the 1980 and 1981 year-classes may have been strong in Div. 3L based on the results of the 1987-88 surveys, but neither appeared to be strong in the 1989 surveys (both spring and fall) in Div. 3L.

The only sign of strong recruitment in the 1989 survey was at age 4, which was not surprising, given that the 1985 year-class has been identified as a strong one from several juvenile flatfish surveys on the Grand Bank. However, it should be noted that the majority of this estimate came from Div. 3N (Table 20), and that age 4 did not appear to unusually high in Divs. 3LO. Figure 5 shows that the 1985 year-class dominated the age structure in the survey sets in the Regulatory Area in Div. 3N, as well as being the peak age in the Spanish catch numbers in Div. 3N in 1989. This figure also shows that the age structure of the population inside 200 miles was drastically different, with ages 8 and 9 being dominant in the survey catches. These 2 ages, along with age 10, comprised the majority of the catch in numbers in the Canadian commercial fishery in 1989.

Overall, the abundance in Div. 3LNO combined has declined in recent years to about the level observed around 1973. From Table 22, it is obvious that there was a drastic decline in abundance from about 1 billion fish at ages 6+ in 1981-82 to about 500 million fish in 1985-86, after which time the abundance remained at the lower level. In addition, the number of older fish (age 12+) in the surveys has declined in 1987-89 to the lowest level observed. This is particularly the case in Div. 3L (Table 19), although the numbers of older fish in the catches in Div. 3NO are lower in recent years as well (Tables 20-21). It is unlikely that the fishery caused such a fast decline in a stock with such a wide age span, and work is presently being directed at the hypothesis that the very low temperatures observed on the Grand Bank in the mid 1980's caused an increase in natural mortality.

CPUE at age

Table 23 shows the index of abundance at age derived from the Canadian commercial fishery for A. plaice in Div. 3LNO. This was derived from the Canadian catch at age divided by the effort from the Canadian fishery. This effort was calculated from the multiplicative model

shown in Table 7, but substituting the Canadian catch for the total catch in the CPUE calculation. This index shows a lower stock size in 1986-89, particularly at ages 11+ compared to the estimates of the early to mid-1980's.

SPA - ADAPT

The catch at age from 1975-89 (Table 11) and the abundance indices in Tables 22 and 23 were used in the Adaptive framework. In the first formulation (Table 24), the RV survey data were used to estimate population numbers at ages 6-15. All parameter estimates were significant and the catchabilities (slopes) were relatively stable over ages 9-14. However, the estimates of fishing mortality at ages 9-12 were substantially higher than those observed at these ages in earlier years. The C/E data were used in a separate formulation, also to estimate population numbers at ages 6-15 (Table 25). Again, all parameters estimates were significant, although the CV's were higher than in the formulation with the RV data alone. For the younger ages (6-8), the fits of ln C/E vs ln SPA numbers were poor and took the form of 2-point regressions, with the 1989 point being separate from the other points. Examination of the population numbers in Table 25 shows the sizes of the 1981-83 year-classes to be substantially lower than historic values and were thus not considered to be realistic.

It was decided to use the two indices in a single formulation of ADAPT. For the RV surveys, ages 6-14 were chosen and for the C/E, ages 9-14 were chosen. Ages 15-18 were excluded from the calibration because there are few fish at these ages in either of the indices, and ages 6-8 were excluded from the C/E series for the reasons outlined above. The results are shown on 4 pages in Table 26. All parameters estimates were significant, with CV's on the abundance estimates at ages 8-13 of 20% or less. However, as can be seen in the tables of log residuals and in the calibration plots (Fig. 5 and 6), the fits generate patterns of residuals. There are no high correlations between parameters.

Fully-recruited fishing mortality from the combined RV - C/E formulation was estimated to be 0.62 in 1989, and the population sizes were similar to those in 1987-88 at ages 6-10, and somewhat lower at ages 11-13. A description of the ADAPT formulation used to derive the 1989 population estimates is given below.

Catch projections

Table 27 shows the parameters used to project catches for 1991. Table 28 contains the projection results for a catch of 24,900 t (TAC) in 1990 and Table 29 shows the results assuming a catch of 40,000 t in 1990. The $F_{0.1}$ and F_{max} reference points (0.27 and 0.51 respectively) came from the yield per recruit analysis done with the 1987-89 average PR and weights, for the age span 5-16 (Table 27).

Formulation of the Adaptive Framework used for A. plaice in Div. 3LNO (see Table 26 for results).

Parameters:

- year-class estimates

  N_i, 1989 i = 6 to 14

- calibration coefficients for RV numbers

  K_i^1 i = 6 to 14

- calibration coefficients for C/E numbers

  K_i^2 i = 9 to 14

Structure:

- M = 0.2
- Error on catch-at-age assumed negligible
- F on ages 16-18 set to mean F wtd. by population numbers on ages 12-15
- Age 5, 15 in 1989 estimated by PR
- Intercepts not fitted

Input:

- $C_{i,t}$ i = 5 to 18 t = 1975-89 Catch at age
- $RV_{i,t}$ i = 6 to 14 t = 1975-82, 1984-89 RV numbers at age
- $C/E_{i,t}$ i = 9 to 14 t = 1975-89 C/E at age

= RV survey data related to the population numbers at the same age, fished to the time of the survey (month = 5)
- C/E related to population numbers at the beginning of the year

Objective function:

- Minimize

$$\sum_i \sum_t [\text{obs } (\ln RV_{it}) - \text{pred } (\ln RV_{it})]^2 +$$

$$\sum_i \sum_t [\text{obs } (\ln C/E_{it}) - \text{pred } (\ln C/E_{it})]^2$$

Summary

Number of observations = 216
Number of parameters = 24

Table 1. Nominal catches (t) of American plaice for NAFO Divisions 3LNO, 1960-89 and TACs from 1973 to 1990.

Year	Canada	France	Poland	USSR	South Korea[a]	Other	Total	TAC
1960	21,352	2,106	-	569	-	20	24,047	-
1961	14,903	1,473	286	1,248	-	3	17,913	-
1962	15,217	973	171	1,841	-	4	18,206	-
1963	24,591	93	457	466	-	112	25,719	-
1964	35,474	1,582	539	680	-	292	38,567	-
1965	45,365	2,056	977	4,544	-	319	53,261	-
1966	51,225	1,246	860	11,484	-	196	65,011	-
1967	54,190	1,326	3,234	35,139	-	524	94,413	-
1968	48,674	406	203	23,751	-	133	73,167	-
1969	64,815	43	34	14,493	-	52	79,437	-
1970	54,929	389	40	10,232	-	1,055	66,645	-
1971	49,394	323	370	17,173	-	628	67,888	-
1972	41,605	322	2,515	14,164	-	755	59,361	-
1973	38,586	310	1,116	12,516	-	315	52,843	60,000
1974	35,101	418	615	10,074	-	89	46,297	60,000
1975	34,015	442	537	7,682	-	545	43,221	60,000
1976	47,806	305	5	3,280	-	429	51,825	47,000
1977	42,579	31	-	1,023	-	348	43,981	47,000
1978	48,634	168	-	1,048	-	178	50,028	47,000
1979	47,131	113	-	1,190	-	135	48,569	47,000
1980	48,296	183	-	336	-	271	49,086	47,000
1981	48,177	210	-	847	-	924	50,158	55,000
1982	49,620	133	-	67	715	517	51,052	55,000
1983	35,907	41	-	170	815	1,602	38,535	55,000
1984	33,756	140	1	360	1,582	3,606[b]	39,445	55,000
1985	40,024	-	4	81	2,483	11,620[b]	54,212	49,000
1986	33,409	46	-	188	3,952	26,975[b]	64,570	55,000
1987	33,967	17	-	47	2,741	18,240[b]	55,012	48,000
1988[c]	26,863	-	-	159	3,237	11,253[b]	41,512	33,585[d]
1989[c]	27,892	-	-	-	3,000[e]	12,711[b]	43,603	30,300
1990	-	-	-	-	-	-	-	24,900

[a]Includes a portion of catches reported as unspecified flounder. See text for details.

[b]Includes some catches estimated from surveillance reports.

[c]Provisional.

[d]Effective TAC.

[e]Assumed catch.

Table 2. Breakdown of catches from Table 1 listed as "other" for 1984-89.

Year	Spain	Portugal	Panama[b]	USA	Cayman Islands[b]	Other	Total
1984	1,622	-	1,800	-	-	184	3,606
1985	5,498	27	3,892	1,310	797	96	11,620
1986	11,882	9,240	3,756	1,506	572	19	26,975
1987	14,476	2,516	-	1,248	-	-	18,240
1988[a]	8,895	872	-	1,379	-	107[c]	11,253
1989[a]	10,895	583	-	1,133	-	100[d]	12,711

[a]Provisional.

[b]Not reported to NAFO. Catches estimated from surveillance reports.

[c]Includes some estimated catches.

[d]Assumed catch.

Table 3. Breakdown of plaice nominal catches (t) in Divisions 3LN0 by Division, for the years 1960-89.

Year	Division 3L	Division 3N	Division 30	UNK	Total
1960	19,397	3,912	738	-	24,047
1961	13,398	3,498	1,017	-	17,913
1962	13,584	3,923	699	-	18,206
1963	16,512	7,465	1,742	-	25,719
1964	21,391	14,587	2,589	-	38,567
1965	25,034	26,270	1,957	-	53,261
1966	18,572	34,698	11,741	-	65,011
1967	38,515	24,364	31,534	-	94,413
1968	39,126	20,038	14,003	-	73,167
1969	52,880	14,442	12,115	-	79,437
1970	39,347	21,032	6,266	-	66,645
1971	37,851	22,873	7,164	-	67,888
1972	33,330	17,387	8,644	-	59,361
1973	20,103	20,883	11,857	-	52,843
1974	16,610	21,126	8,561	-	46,297
1975	15,171	21,308	6,742	-	43,221
1976	25,122	18,623	8,080	-	51,825
1977	23,763	16,543	3,675	-	43,981
1978	30,145	13,443	6,440	-	50,028
1979	28,708	14,712	5,149	-	48,569
1980	31,717	15,119	2,250	-	49,086
1981	37,269	10,628	2,261	-	50,158
1982[a]	32,761	13,101	5,190	-	51,052
1983[a]	22,964	11,107	4,464	-	38,535
1984[a,b]	20,307	15,147	3,991	-	39,445
1985[a,b]	23,320	25,806	5,086	-	54,212
1986[a,b]	25,745	34,012	4,813	-	64,570
1987[a]	32,937	16,331	5,744	-	55,012
1988[a,b,c]	18,425	18,259	4,828	-	41,512
1989[b,c]	21,706	17,299	4,598	-	43,603

[a]Includes breakdown of unspecified flounder catches by S. Korea.

[b]Includes estimates of non-reported catch on the Tail of the Bank outside Canadian 200 mile limit. These catches are attributed 90%:10% to Divisions 3N:30.

[c]Provisional.

Table 4. Breakdown of Canadian (N+SF) catches by division, month, and gear, for American plaice in Division 3LNO in 1989.

	3L						3N						3Ø						
	OT		SS		Misc.[a]		OT		SS		Misc.[a]		OT		SS		Misc.[a]		
	Can(N)	(SF)	(N)	(SF)	(N)	(SF)	(N)	(SF)	(N)	(SF)	(N)	(SF)	(N)	(SF)	(N)	(SF)	(N)	(SF)	Total
Jan	8	7					2						1						18
Feb	2	3														19		1	25
Mar	6	1		1									5	2		11	1		27
Apr	255	12		3	35		7						66	1	123	31	1		534
May	1110	23	2	2	488	1	376	4	9		7	2	506	30	102		17	4	2683
Jun	3370	24	37		530	8	299	2	59		1		845	22	75		4	7	5283
Jul	2282	10	106		717	6	784	7	129			1	895	26	27			3	4993
Aug	2016		82		424	1	1420		115			1	575	6	23			1	4664
Sep	2965	1	17		45		743		2			1	202	8					3984
Oct	2202	5	26		7		600		33				376	27	20				3296
Nov	1008	15	9				385	7	29				317	5	44				1819
Dec	428						29						101	8					566
Subtotal	15652	101	279	6	2246	16	4645	20	376		8	5	3889	135	414	61	23	16	
Total	15763		285		2262		4665		376		13		4024		475		39		27892
				GN	2144						1						3		
		Misc.[a]		LL	55	16					7	5					20	16	
				HL	11														
				TC	36														

Table 5. Catches of American plaice by Canadian vessels using gears other than otter trawl, Div. 3L, 1972-89.

Year	Seines	Gillnets	Longline	Handline	Trap	Other	Total
1972		3359	28	19	16	31	3453
1973		2483	67	5	24	99	2678
1974		1386	45	4	249	3	1687
1975		2391	11	12	48	14	2476
1976	16	3430	15	8	35	5	3509
1977		3921	27	13	49		4010
1978		4084	51	18	72		4225
1979	230	4446	42	24	50		4792
1980		3339	45	6	24		3414
1981	25	4542	81	7	24		4679
1982		4267	106	6	23		4402
1983		3709	59	20	23		3811
1984	9	2567	58	16	17		2667
1985	17	2370	51	39	75		2552
1986	1	3670	69	3	71		3814
1987	264	3679	47	15	78		4083
1988[a]	149	2404	22	9	53		2637
1989[a]	285	2144	71	11	36		2547

[a]Provisional.

Table 6. Summary of Canadian catch (t) and effort (hrs) data used in the multiplicative model, for Divisions 3LNØ A. plaice CPUE calculations.

	Division 3L		Division 3N		Division 3Ø	
Year	Catch	Effort	Catch	Effort	Catch	Effort
1956	3862	3824	2114	2481	8	30
1957	3020	3383	2288	2663	20	36
1958	5095	5154	3098	4435	-	-
1959	5758	6780	3645	4738	31	59
1960	9791	11004	2584	3697	45	124
1961	6930	8790	2328	3615	50	70
1962	8278	12524	3419	6280	4	18
1963	11453	15543	6053	8410	221	503
1964	10277	14401	9082	10737	571	981
1965	11219	14487	18083	23677	962	1806
1966	8542	11560	20947	27769	2994	5220
1967	22106	30236	12262	15830	2193	3071
1968	24582	40128	6744	11389	359	782
1969	32196	59051	7054	14310	1246	2778
1970	19978	39158	3932	8147	3137	5273
1971	19998	41637	4442	9926	1622	3106
1972	17258	35232	5876	13452	874	2245
1973	12548	24721	7479	14354	6362	13137
1974	11278	26781	9609	21436	6722	16568
1975	10267	25395	11769	28294	2585	7929
1976	20132	45254	15569	38003	5151	17091
1977	18027	42580	14085	35295	2559	7738
1978	23687	48906	9961	24719	5067	13477
1979	20518	40603	10095	21629	3595	8536
1980	22639	37118	11930	22841	1446	3362
1981	28058	48719	6069	11741	1330	2917
1982	23503	40865	9541	18585	2928	6420
1983	12172	20711	6072	8739	2851	6102
1984	10318	17130	6368	11532	2191	4894
1985	14930	22476	10594	17641	1993	4666
1986	12665	27235	4969	12109	2167	5802
1987	14378	32932	1834	4858	1906	5506
1988	8441	20522	3357	8351	2911	8408
1989	11334	27512	3371	8699	2720	7325

TABLE 7. MULTIPLICATIVE ANALYSIS OF CANADIAN CPUE DATA.

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R,..... 0.767
MULTIPLE R SQUARED,..... 0.588

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	3.520E1	3.520E1	
REGRESSION	48	5.833E0	1.215E-1	47.003
TYPE 1	2	9.937E-1	4.969E-1	192.173
TYPE 2	2	2.692E-1	1.346E-1	52.058
TYPE 3	11	1.689E-1	1.536E-2	5.939
TYPE 4	33	4.978E0	1.509E-1	58.346
RESIDUALS	1582	4.090E0	2.586E-3	
TOTAL	1631	4.512E1		

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
1	3125	INTERCEPT	0.327	0.072	1631
2	32				
3	7				
4	56				
1	3114	1	-0.370	0.019	480
	3124	2	-0.115	0.018	374
2	34	3	-0.082	0.014	594
	35	4	-0.167	0.017	426
3	1	5	0.098	0.035	75
	2	6	0.101	0.033	89
	3	7	0.003	0.033	91
	4	8	-0.099	0.030	119
	5	9	-0.093	0.027	152
	6	10	-0.008	0.025	166
	8	11	0.003	0.026	163
	9	12	-0.015	0.026	169
	10	13	-0.054	0.026	149
	11	14	-0.004	0.026	155
	12	15	0.006	0.028	124
4	57	16	-0.051	0.097	13
	58	17	-0.074	0.089	16
	59	18	-0.122	0.085	17
	60	19	-0.145	0.085	18
	61	20	-0.232	0.088	16
	62	21	-0.406	0.083	19
	63	22	-0.276	0.081	22
	64	23	-0.254	0.079	33
	65	24	-0.316	0.075	55
	66	25	-0.334	0.073	68
	67	26	-0.421	0.073	70
	68	27	-0.731	0.075	59
	69	28	-0.876	0.074	70
	70	29	-0.914	0.076	59
	71	30	-1.001	0.076	59
	72	31	-1.011	0.075	63
	73	32	-0.917	0.075	69
	74	33	-1.138	0.075	63
	75	34	-1.190	0.076	59
	76	35	-1.207	0.074	70
	77	36	-1.179	0.075	59
	78	37	-1.111	0.074	75
	79	38	-1.023	0.075	61
	80	39	-0.871	0.075	60
	81	40	-0.874	0.075	62
	82	41	-0.856	0.076	60
	83	42	-0.798	0.077	52
	84	43	-0.904	0.079	45
	85	44	-0.836	0.077	50
	86	45	-1.147	0.077	48
	87	46	-1.178	0.080	43
	88	47	-1.169	0.079	41
	89	48	-1.166	0.080	43

TYPE 1 = VESSEL-GEAR-TC
3114=CAN(N),OTB1,TC4
3124=CAN(N),OTB2,TC4
3125=CAN(N),OTB2,TC5

TYPE 2 = DIVISION
32=3L,34=3N,35=3O

TYPE 3 = MONTH

TYPE 4 = YEAR

PREDICTED CATCH RATE

YEAR	LN TRANSFORM MEAN	LN TRANSFORM S.E.	RETRANSFORMED MEAN	RETRANSFORMED S.E.	CATCH	EFFORT
1956	0.3268	0.0052	1.385	0.099	1	1
1957	0.2758	0.0057	1.315	0.099	1	1
1958	0.2533	0.0042	1.287	0.083	1	1
1959	0.2049	0.0035	1.227	0.073	1	1
1960	0.1823	0.0036	1.199	0.071	24047	20050
1961	0.0953	0.0041	1.099	0.070	17913	16298
1962	-0.0795	0.0032	0.923	0.052	18206	19719
1963	0.0504	0.0029	1.052	0.057	25719	24459
1964	0.0725	0.0025	1.075	0.054	38567	35869
1965	0.0107	0.0016	1.011	0.041	53261	52671
1966	-0.0075	0.0014	0.993	0.037	65011	65462
1967	-0.0940	0.0012	0.911	0.032	94413	103645
1968	-0.4042	0.0014	0.668	0.025	73167	109545
1969	-0.5492	0.0012	0.578	0.020	79437	137479
1970	-0.5869	0.0014	0.556	0.021	66645	119790
1971	-0.6742	0.0014	0.510	0.019	67888	133152
1972	-0.6842	0.0013	0.505	0.018	59361	117588
1973	-0.5900	0.0013	0.555	0.020	52843	95268
1974	-0.8115	0.0013	0.445	0.016	46297	104155
1975	-0.8634	0.0014	0.422	0.016	43221	102423
1976	-0.8798	0.0011	0.415	0.014	51825	124827
1977	-0.8522	0.0013	0.427	0.015	43981	103058
1978	-0.7845	0.0011	0.457	0.015	50028	109551
1979	-0.6958	0.0012	0.499	0.017	48569	97325
1980	-0.5438	0.0013	0.581	0.021	49086	84504
1981	-0.5471	0.0014	0.579	0.021	50158	86635
1982	-0.5297	0.0014	0.589	0.022	51052	86652
1983	-0.4715	0.0016	0.624	0.025	38535	61719
1984	-0.5773	0.0017	0.562	0.023	39445	70233
1985	-0.5094	0.0015	0.601	0.023	54212	90180
1986	-0.8206	0.0016	0.440	0.017	64570	146621
1987	-0.8508	0.0019	0.427	0.019	55012	128770
1988	-0.8424	0.0018	0.431	0.018	41512	96351
1989	-0.8393	0.0019	0.432	0.019	43603	100898

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.044

Table 8. Samples used to calculate catch at age and average weights at age for American plaice in the Canadian fishery in Division 3LNO in 1989. Numbers in parentheses are the numbers of observations and n is the number of samples.

Age-length key	Length frequency	n	Catch (t)	Description
ALKIN2CN3L (875)	LFGNMAYCN3L (4548)	11	524	Misc. gears, 3L, Jan-May
ALKIN3CN3L (553)	JUN(3906)	9	538	" ", Jun
	JUL (222)	1	1200	" " Jul-Dec
	LFOTAPRCN3L (421)	1	298	OTB + Sc.S., 3L, Jan-Apr
ALKOF2CN3L (743)	MAY (2569)	6	1137	" " May
	JUN (2807)	7	3431	" " Jun
	JUL (4044)	9	2398	" " Jul
ALKOF3CN3L (783)	AUG (3399)	9	2098	" " Aug
	SEP (5880)	16	2983	" " Sep
	OCT (3561)	10	2233	" " Oct
LKOF4CN3L (689)	NOV (2647)	7	1032	" " Nov
	DEC (985)	3	428	" " Dec
ALKOF2CN3N (197)	LFOTMAYCN3N (678)	2	407	All gears, 3N, Jan-May
	JUN (454)	1	302	OTB + Misc., " Jun
	LFSCJULCN3N (317)	1	367	Sc. Seine, 3N, Jun-Dec
ALKOF3CN3N (464)	LFOTJUL (1730)	4	792	OTB + Misc., 3N, Jul
	AUG (706)	2	1421	" " Aug
	SEP (455)	1	744	" " Sep
ALKOF3CN3N (464)	OCT (1117)	3	600	" " Oct
+	NOV (357)	1	421	" " Nov-Dec
ALKOF4CN3N (197)				
ALKOF1CN3Ø (124)				
+	LFSCMARCN3Ø (398)	1	40	All gears, 3Ø, Jan-Mar
ALKOF2CN3Ø (568)				
	APR (428)	1	154	Sc. Seine " Apr
	MAY (306)	1	102	" " May
	JUN (366)	1	75	" " Jun
ALKOF2CN3Ø (568)	LFOTAPRCN3Ø (444)	1	68	OT + Misc. " Apr
	MAY (640)	2	557	" " May
	JUN (884)	3	878	" " Jun
	JUL (797)	2	951	All gears, 3Ø, Jul
ALKOF3CN3Ø (339)	AUG (373)	1	605	" " Aug
+	SEP (298)	1	210	" " Sep
ALKOF4CN3Ø (79)	LFSCNOVCN3Ø (324)	1	898	" " Oct-Dec

Inshore	3L	2,262 t
Offshore	3L	16,038
	3N	5,054
	3Ø	4,538
Total Canadian		27,892 t

TABLE 9. Catch at age (000) and mean weights at age (kg) of A.plaice in the Canadian fishery in 1989.

	AVERAGE		CATCH		
AGE	WEIGHT	LENGTH	MEAN	STD. ERR.	C. V.
* 4	0.031	16.500		0.00	0.01
* 5	0.244	30.350	22	6.29	0.29
* 6	0.316	32.873	153	23.44	0.15
* 7	0.358	34.079	1167	69.30	0.06
* 8	0.390	34.894	4942	188.47	0.04
9	0.459	36.732	9380	283.51	0.03
10	0.596	39.798	9818	288.35	0.03
11	0.796	43.456	7057	219.56	0.03
*12	1.077	47.627	4180	144.56	0.03
*13	1.395	51.509	1776	81.04	0.05
*14	1.814	55.785	855	41.66	0.05
15	2.303	59.967	441	24.40	0.06
*16	3.071	65.461	122	12.70	0.10
*17	3.885	70.285	14	3.89	0.27
*18	4.286	72.500	5	2.04	0.39

Table 10. Comparison of catch at age (000) and mean weights (kg) at age from the Canadian, Spanish, and USA fisheries for A. plaice in Div. 3LNO in 1989.

	Canada												USA			Spain					
	3L inshore			3L offshore			3N			3O			3NO[a]			3L			3NO[a]		
Age	Catch	%	Weight	Catch	%	Weight	Catch	%	Weight	Catch	%	Weight	Catch	%	Weight	Catch	%	Weight	Catch	%	Weight
2																			80	0.3	.009
3																			1475	5.0	.033
4																635	7.4	.135	8754	29.6	.099
5				1	0.0	.046	16	0.3	.257	5	0.1	.241	4	0.3	.236	1280	14.8	.116	7315	24.7	.193
6				10	0.0	.189	118	2.1	.327	25	0.5	.313	18	1.4	.319	1478	17.1	.224	6252	21.1	.251
7	11	0.3	.180	217	0.9	.250	639	11.3	.414	301	5.9	.322	114	8.6	.410	1468	17.0	.296	1994	6.7	.402
8	103	2.9	.261	2790	10.9	.321	1147	20.3	.557	901	17.7	.407	355	26.8	.569	1369	15.9	.485	2180	7.4	.550
9	436	12.4	.360	7056	27.5	.414	1037	18.4	.733	852	16.7	.554	306	23.1	.715	1280	14.8	.499	695	2.3	.793
10	963	27.3	.479	6936	27.0	.553	1059	18.7	.891	860	16.9	.715	239	18.0	.852	694	8.1	.649	346	1.2	1.036
11	1109	31.5	.646	4423	17.2	.752	752	13.3	1.144	773	15.1	.929	128	9.7	1.181	407	4.7	.617	191	0.6	1.398
12	571	16.2	.856	2628	10.2	1.025	494	8.7	1.476	488	9.6	1.209	88	6.6	1.551				141	0.5	1.800
13	246	7.0	1.113	969	3.8	1.320	222	3.9	1.804	338	6.6	1.547	42	3.2	1.806	10	0.1	–	96	0.3	1.795
14	65	1.9	1.438	403	1.6	1.666	114	2.0	2.222	273	5.4	1.951	22	1.7	2.197				72	0.2	1.995
15	17	0.5	1.835	188	0.7	2.086	35	0.6	2.790	200	3.9	2.461	7	0.5	2.981				15	0.1	2.484
16	1	0.0	2.440	30	0.1	2.677	18	0.3	3.326	73	1.4	3.185	2	0.2	3.363						
17				3	0.0	3.799	1	0.0	5.124	10	0.2	3.869									
18										5	0.1	4.286									
Total	3522			25654			5652			5104			1325			8620			29605		
Catch (t)		2262			16038			5054			4538			1131			2837			7746	
S.O.P. (t)		2253			16163			5056			4708			1117			3004			7681	

[a]Virtually all catch is from Div. 3N.

TABLE 11. A.PLAICE CATCH AT AGE (000) IN DIV. 3LNO

AGE	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
5	354	883	837	974	1558	1257	263	154	27	119	48	296	4407	2237	2908	12745
6	5955	3128	3907	6723	4467	6551	2977	554	314	991	397	798	9707	4941	3213	11553
7	10475	7220	8781	8743	9195	13532	9531	2248	1814	3053	1516	2362	12556	7691	4853	11432
8	10069	9433	19363	11730	10397	18747	12578	4786	4799	5797	3311	5652	12530	10893	7269	9652
9	7768	9234	16597	13559	12743	14977	14111	7921	8946	8343	5853	10694	13372	15867	10123	14180
10	9004	7903	12338	11157	13881	12506	14212	11425	12836	7707	9959	15741	13874	17640	10325	12387
11	7086	5701	8323	6520	9938	8791	11288	13565	15801	8493	12887	14528	14246	11404	9260	8405
12	4596	4732	5156	4257	6823	3775	8088	11872	14489	7517	8964	9233	10376	6986	6040	4972
13	3809	3788	3024	2369	3655	1843	3732	8693	7942	4588	5072	4108	5947	3076	2692	2029
14	2278	2617	2309	1493	2239	714	1565	5591	4224	2480	2515	1969	2637	1303	1156	1027
15	1141	1461	1347	1000	1472	342	645	2938	2000	1219	1090	1235	1416	768	656	550
16	651	763	584	342	649	159	265	1119	641	373	404	338	542	247	267	146
17	267	475	245	182	212	63	87	394	206	130	93	160	162	27	38	14
18	80	234	65	101	107	16	25	246	96	49	15	9	35	4	1	5
5+	63533	57572	82876	69150	77336	83273	79367	71506	74135	50859	52123	67162	101807	83085	58801	89097

TABLE 12. A.PLAICE CATCH AT AGE (000) IN DIV. 3LNO

AGE	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
5	0.6	1.5	1.0	1.4	2.0	1.5	0.3	0.2	0.0	0.2	0.1	0.4	4.3	2.7	4.9	14.3
6	9.4	5.4	4.7	9.7	5.8	7.9	3.8	0.8	0.4	1.9	0.8	1.2	9.5	5.9	5.5	13.0
7	16.5	12.5	10.6	12.6	11.9	16.3	12.0	3.1	2.4	6.0	2.9	3.5	12.3	9.3	8.3	12.8
8	15.8	16.4	23.4	17.0	13.4	22.5	15.8	6.7	6.5	11.4	6.4	8.4	12.3	13.1	12.4	10.8
9	12.2	16.0	20.0	19.6	16.5	18.0	17.8	11.1	12.1	16.4	11.2	15.9	13.1	19.1	17.2	15.9
10	14.2	13.7	14.9	16.1	17.9	15.0	17.9	16.0	17.3	15.2	19.1	23.4	13.6	21.2	17.6	13.9
11	11.2	9.9	10.0	9.4	12.9	10.6	14.2	19.0	21.3	16.7	24.7	21.6	14.0	13.7	15.7	9.4
12	7.2	8.2	6.2	6.2	8.8	4.5	10.2	16.6	19.5	14.8	17.2	13.7	10.2	8.4	10.3	5.6
13	6.0	6.6	3.6	3.4	4.7	2.2	4.7	12.2	10.7	9.0	9.7	6.1	5.8	3.7	4.6	2.3
14	3.6	4.5	2.8	2.2	2.9	0.9	2.0	7.8	5.7	4.9	4.8	2.9	2.6	1.6	2.0	1.2
15	1.8	2.5	1.6	1.4	1.9	0.4	0.8	4.1	2.7	2.4	2.1	1.8	1.4	0.9	1.1	0.6
16	1.0	1.3	0.7	0.5	0.8	0.2	0.3	1.6	0.9	0.7	0.8	0.6	0.5	0.3	0.5	0.2
17	0.4	0.8	0.3	0.3	0.3	0.1	0.1	0.6	0.3	0.3	0.2	0.2	0.2	0.0	0.1	0.0
18	0.1	0.4	0.1	0.1	0.1	0.0	0.0	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0

TABLE 13. A.PLAICE WEIGHTS (KG) AT AGE IN DIV. 3LNO

AGE	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
5	0.210	0.213	0.207	0.209	0.195	0.209	0.209	0.209	0.256	0.298	0.270	0.212	0.122	0.230	0.170	0.101
6	0.256	0.254	0.261	0.264	0.260	0.322	0.328	0.379	0.298	0.382	0.314	0.329	0.194	0.293	0.254	0.186
7	0.339	0.348	0.346	0.357	0.353	0.374	0.408	0.406	0.360	0.473	0.382	0.430	0.277	0.398	0.343	0.261
8	0.424	0.417	0.414	0.430	0.412	0.453	0.482	0.453	0.427	0.555	0.460	0.473	0.411	0.439	0.446	0.388
9	0.578	0.564	0.557	0.614	0.512	0.551	0.541	0.487	0.485	0.658	0.551	0.549	0.548	0.497	0.489	0.488
10	0.706	0.692	0.660	0.672	0.614	0.609	0.570	0.536	0.533	0.698	0.563	0.655	0.666	0.655	0.601	0.608
11	0.912	0.896	0.829	0.878	0.768	0.702	0.650	0.551	0.596	0.697	0.654	0.820	0.776	0.843	0.774	0.806
12	1.125	1.077	1.017	1.018	0.917	0.934	0.739	0.676	0.739	0.756	0.852	1.102	0.989	1.103	1.034	1.068
13	1.372	1.318	1.142	1.231	1.184	1.228	0.982	0.792	0.976	0.959	1.128	1.472	1.296	1.395	1.369	1.446
14	1.579	1.523	1.347	1.415	1.380	1.688	1.355	1.005	1.275	1.220	1.444	1.898	1.674	1.735	1.745	1.805
15	1.975	1.777	1.661	1.782	1.694	1.910	1.758	1.305	1.594	1.551	1.987	2.341	2.065	2.221	2.226	2.259
16	2.411	2.254	2.050	2.191	2.066	2.117	1.793	1.772	2.028	2.132	2.561	2.904	2.518	2.952	2.825	2.992
17	2.647	2.538	2.263	2.323	2.276	2.336	2.224	2.116	2.322	2.370	2.851	3.270	3.030	3.345	3.645	3.885
18	2.944	2.821	2.718	2.541	2.274	3.194	2.689	2.431	2.705	2.809	3.713	4.056	4.040	3.979	4.692	4.286

TABLE 14. A.PLAICE CATCH BIOMASS (T) AT AGE IN DIV. 3LNO

AGE	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
5	74	189	173	203	304	263	55	32	7	35	13	63	536	514	493	1289
6	1526	794	1019	1777	1160	2107	975	210	94	379	125	259	1883	1445	817	2153
7	3551	2510	3035	3117	3248	5067	3890	913	653	1445	579	1016	3481	3057	1662	2979
8	4265	3929	8017	5039	4280	8489	6060	2166	2047	3217	1523	2673	5150	4783	3242	3747
9	4491	5208	9241	8329	6526	8256	7634	3859	4343	5493	3227	5872	7325	7882	4951	6926
10	6354	5467	8139	7500	8518	7612	8106	6121	6837	5376	5609	10315	9242	11547	6203	7532
11	6461	5109	6898	5726	7636	6173	7341	7481	9412	5919	8426	11908	11058	9614	7164	6771
12	5170	5097	5245	4333	6255	3528	5979	8028	10701	5683	7639	10175	10262	7705	6243	5310
13	5227	4993	3452	2916	4327	2263	3665	6885	7749	4402	5720	6046	7708	4293	3685	2933
14	3598	3986	3110	2112	3089	1205	2121	5617	5387	3025	3632	3736	4413	2260	2017	1855
15	2254	2596	2238	1782	2494	653	1134	3835	3187	1891	2166	2893	2925	1706	1461	1242
16	1570	1720	1197	749	1341	337	475	1983	1300	795	1034	1126	1365	729	753	436
17	707	1206	554	423	482	147	193	834	478	308	265	525	490	91	140	54
18	236	660	177	257	243	51	67	598	260	138	56	35	141	15	5	21
5+	45483	43464	52496	44263	49903	46150	47694	48561	52455	38105	40013	56640	65978	55642	38836	43249

Table 15. Mean weight (kg) of American plaice per tow, by stratum, from R. V. surveys in Division 3L. Numbers in parentheses are the number of successful 30 minute tows in each stratum. The stratified mean weight per tow (kg/30 min.) and the biomass estimates (t x 10^{-3}), are given at the bottom of the table.

			Year - Trip								
Depth (fm)	Stratum	No. of trawlable units	1971 ATC 187	1972 ATC 199	1973 ATC 207, 208 209	1974 ATC 222	1975 ATC 233	1976 ATC 246	1977 ATC 262	1978 ATC 276	1979 ATC 289, 290, 291
51-100	328	114,023	-	-	-	-	-	-	26.9(3)	-	27.3(5)
51-100	341	116,151	-	-	48.4(3)	-	-	-	94.2(4)	43.8(4)	88.8(6)
51-100	342	43,913	-	-	-	-	-	-	75.4(2)	72.6(2)	59.5(4)
51-100	343	39,409	-	-	-	-	-	-	103.1(2)	112.6(3)	90.2(4)
101-150	344	112,146	-	-	-	-	-	92.3(4)	100.5(4)	62.4(4)	28.6(2)
151-200	345	107,492	-	-	-	-	-	22.8(4)	27.1(4)	56.3(2)	8.4(4)
151-200	346	64,931	-	-	-	-	45.9(2)	22.3(2)	8.4(3)	-	4.8(4)
101-150	347	73,788	28.8(2)	-	-	24.5(2)	61.9(2)	151.5(3)	91.1(3)	59.3(4)	58.3(4)
51-100	348	159,136	214.4(3)	92.3(3)	-	73.6(6)	47.5(4)	83.7(6)	211.6(6)	232.8(6)	150.2(6)
51-100	349	158,686	281.2(3)	46.8(4)	-	17.0(4)	23.6(2)	66.6(3)	124.3(6)	65.1(6)	105.7(7)
31-50	350	155,458	77.9(3)	56.5(2)	33.5(4)	82.3(3)	78.1(3)	99.0(4)	40.5(4)	44.3(6)	45.5(9)
31-50	363	133,614	56.3(3)	111.7(3)	50.1(4)	69.8(4)	21.5(3)	90.4(4)	103.1(5)	96.8(5)	88.0(8)
51-100	364	211,456	155.7(4)	138.8(3)	-	92.3(4)	99.4(2)	164.6(3)	236.1(7)	172.4(6)	195.5(8)
51-100	365	78,142	192.0(3)	158.5(2)	-	43.1(3)	79.0(2)	62.4(3)	243.7(3)	243.3(2)	161.6(4)
101-150	366	104,639	34.4(3)	-	-	63.0(3)	37.6(4)	40.8(4)	76.7(4)	-	7.2(4)
151-200	368	25,071	0.0(2)	-	-	4.8(2)	1.1(2)	29.0(3)	0.0(3)	-	0.7(4)
101-150	369	72,137	31.8(3)	-	-	14.2(3)	23.8(3)	52.9(4)	51.0(3)	18.6(2)	16.8(4)
51-100	370	99,085	44.0(2)	82.5(3)	-	90.5(3)	43.3(3)	93.1(3)	162.1(3)	70.7(3)	211.7(4)
31-50	371	84,147	95.8(3)	91.9(2)	-	63.1(3)	-	-	93.4(3)	114.1(3)	175.8(3)
31-50	372	184,658	27.1(4)	36.3(3)	124.1(3)	50.4(3)	36.1(3)	47.5(3)	35.0(6)	24.5(7)	38.4(9)
31-50	384	84,072	87.9(3)	69.5(2)	12.4(3)	26.6(3)	-	-	54.0(2)	54.5(3)	79.0(4)
51-100	385	176,851	139.5(4)	84.2(4)	34.5(3)	17.3(2)	72.1(4)	79.5(2)	168.0(6)	135.4(6)	102.2(7)
101-150	386	73,788	20.9(2)	-	-	24.1(3)	22.6(3)	51.7(2)	4.8(3)	19.5(3)	11.5(4)
151-200	387	53,896	1.2(3)	-	-	0.5(3)	0.0(2)	1.0(3)	2.5(2)	2.7(3)	1.0(4)
151-200	388	27,098	1.4(2)	-	12.2(2)	2.6(3)	0.2(2)	13.0(2)	0.7(2)	0.3(2)	0.6(3)
101-150	389	61,628	17.4(3)	17.0(2)	13.4(2)	14.5(3)	22.7(2)	38.8(2)	7.0(3)	8.2(3)	2.3(4)
51-100	390	111,170	236.2(3)	30.1(3)	9.7(3)	1.6(3)	278.2(3)	-	68.1(2)	66.1(4)	93.8(5)
101-150	391	21,168	-	24.1(2)	12.2(2)	43.3(3)	16.8(2)	-	45.4(2)	15.4(2)	17.2(4)
151-200	392	10,884	-	-	291.9(3)	1.8(4)	2.4(2)	-	3.1(2)	1.9(3)	4.2(2)
201-300	729	13,962	-	-	-	-	-	-	-	-	-
301-400	730	12,761	-	-	-	-	-	-	-	-	-
201-300	731	16,214	-	-	-	-	-	-	-	-	-
301-400	732	17,340	-	-	-	-	-	-	-	-	-
201-300	733	35,130	-	-	-	-	-	-	-	-	-
301-400	734	17,115	-	-	-	-	-	-	-	-	-
201-300	735	20,417	-	-	-	-	-	-	-	-	-
301-400	736	13,136	-	-	-	-	-	-	-	-	-
Mean (#sets)			109.4(58)	79.0(38)	49.2(32)	47.1(70)	60.7(55)	76.8(64)	98.3(102)	87.1(94)	80.9(140)
Biomass			232.8	135.8	53.3	101.7	124.8	163.9	271.3	213.7	223.4

						Year - Trip					
Stratum	1980 ATC 304, 305	1981 ATC 317, 318, 319	1982 ATC 327, 328, 329	1984 AN 28	1985 WT 28, 29, 30	1986 WT 48	1987 WT 58, 59, 60	1988 WT 70, 71	1989 WT 82, 83	1990[a] WT 96
328	-	52.5(2)	72.8(3)	12.5(2)	51.6(4)	51.2(9)	85.9(7)	23.3(2)	22.9(8)	-
341	47.0(6)	136.5(2)	146.6(5)	69.6(4)	40.3(9)	43.7(9)	82.5(6)	50.8(6)	31.4(8)	
342	77.0(4)	-	43.3(3)	60.1(4)	35.2(3)	53.5(3)	91.8(2)	94.0(2)	39.6(3)	
343	107.1(4)	177.5(2)	115.8(4)	-	12.7(3)	48.0(4)	111.5(3)	67.0(3)	135.3(3)	
344	105.5(3)	105.8(5)	58.0(4)	-	41.6(5)	80.3(8)	51.1(4)	83.2(6)	145.6(7)	
345	10.1(5)	32.5(4)	7.6(4)	-	23.3(5)	16.3(7)	11.0(4)	12.9(8)	7.6(9)	
346	2.8(3)	29.8(3)	5.3(3)	-	26.3(2)	33.1(5)	7.3(5)	8.8(4)	6.4(4)	
347	102.3(5)	86.1(4)	93.0(2)	-	42.1(5)	50.4(5)	43.5(3)	50.5(5)	63.3(6)	
348	168.7(7)	89.5(7)	118.3(4)	-	65.1(18)	104.9(12)	130.1(8)	142.3(11)	79.2(9)	
349	110.8(9)	72.8(4)	125.6(6)	89.5(6)	49.8(14)	58.3(14)	105.1(11)	135.9(8)	45.7(11)	
350	96.8(10)	114.5(3)	76.6(7)	108.2(6)	98.5(12)	99.5(11)	68.7(11)	86.1(8)	61.7(11)	
363	77.2(5)	62.3(3)	168.0(5)	92.2(5)	107.8(8)	138.4(10)	68.6(9)	97.0(7)	53.6(9)	
364	166.9(6)	172.3(3)	195.5(6)	144.4(5)	102.3(17)	87.4(17)	164.0(15)	136.1(10)	94.4(16)	
365	156.1(4)	141.5(2)	88.7(3)	-	54.1(7)	68.5(5)	107.9(5)	82.5(4)	88.0(6)	
366	70.5(4)	20.2(3)	8.3(5)	-	37.6(6)	21.4(8)	14.5(7)	18.8(6)	15.3(8)	
368	0.8(2)	6.3(2)	0.5(2)	-	30.5(2)	16.5(2)	1.7(3)	2.0(2)	1.6(3)	
369	13.7(3)	39.8(2)	20.5(2)	-	71.7(5)	16.1(6)	8.4(5)	6.3(4)	12.5(6)	
370	172.2(3)	54.0(2)	133.0(2)	-	56.6(8)	96.6(8)	69.8(7)	129.5(5)	77.3(8)	
371	147.0(3)	177.0(2)	102.9(4)	-	107.5(7)	68.0(6)	58.3(7)	147.8(5)	108.3(6)	
372	39.7(6)	95.8(4)	50.8(6)	63.7(5)	109.9(12)	69.6(14)	30.1(13)	58.3(11)	52.7(13)	
384	48.8(2)	60.5(2)	32.3(2)	-	100.3(6)	114.0(6)	56.4(7)	53.9(5)	102.0(6)	
385	224.4(4)	87.3(3)	70.8(3)	-	48.8(15)	62.8(13)	74.1(11)	46.3(10)	73.3(12)	
386	7.2(3)	20.8(2)	9.2(3)	-	26.0(5)	9.7(6)	7.5(5)	32.5(4)	12.7(6)	
387	0.7(2)	1.0(2)	1.3(3)	-	20.8(6)	3.0(4)	0.0(4)	1.2(4)	2.5(5)	
388	0.1(2)	0.1(2)	0.4(2)	-	25.5(2)	11.5(2)	1.4(2)	0.9(2)	2.0(3)	
389	4.8(3)	23.9(2)	4.5(2)	-	27.2(5)	27.7(5)	10.6(6)	19.7(3)	14.6(5)	
390	99.0(3)	18.5(2)	35.8(4)	-	15.0(9)	14.5(8)	28.0(7)	11.1(5)	9.4(8)	
391	11.0(2)	4.3(2)	10.3(2)	-	9.5(2)	61.0(2)	12.5(2)	27.8(2)	7.4(3)	
392	1.5(2)	2.8(2)	0.8(2)	-	13.8(2)	9.5(2)	0.6(2)	0.9(2)	1.5(3)	
729	-	-	-	-	0.5(2)	-	-	-	-	
730	-	-	-	-	0.3(2)	-	-	-	-	
731	-	-	-	-	326.0(2)	-	-	-	-	
732	-	-	-	-	0.3(2)	-	-	-	-	
733	-	-	-	-	21.4(3)	-	-	-	-	
734	-	-	-	-	1.5(3)	-	-	-	-	
735	-	0.0(2)	-	-	57.0(2)	-	-	-	-	
736	-	-	-	-	5.0(2)	-	-	-	-	
Mean (#sets)	95.3(115)	80.7(80)	80.4(103)	87.4(37)	60.3(221)	63.1(211)	65.5(161)	69.9(154)	55.4(205)	-(156)
Biomass	252.1	221.0	222.0	97.9	175.1	174.1	180.9	193.0	153.0	82.6

[a] Preliminary analysis

Table 16. Mean weight (kg) of American plaice per tow, by stratum, from R. V. surveys in Division 3N. Numbers in parentheses are the number of successful 30-minute tows in each stratum. The stratified mean weight per tow (kg/30 min.) and the biomass estimates (t x 10^{-3}) are given at the bottom of the table.

Depth (fm)	Stratum	No. of trawlable units	1971 ATC 187	1972 ATC 199	1973 ATC 208, 209	1974 ATC 222	1975 ATC 233	1976 ATC 245	1977 ATC 263	1978 ATC 277, 278	1979 ATC 289
151-200	357	12,317	-	-	0.0(2)	-	-	-	5.5(2)	-	2.4(3)
101-150	358	16,899	-	2.4(4)	6.5(3)	-	-	-	20.0(2)	-	2.1(2)
51-100	359	31,620	-	46.3(3)	31.3(3)	-	-	66.3(3)	114.4(2)	-	60.3(4)
31-50	360	224,717	-	34.1(4)	-	-	23.5(4)	44.3(4)	58.8(4)	106.7(4)	60.4(9)
31-50	361	139,171	17.3(2)	49.2(3)	25.2(4)	37.2(4)	46.3(4)	21.1(5)	22.1(3)	17.5(4)	20.3(8)
31-50	362	189,267	89.0(2)	110.4(4)	58.0(5)	40.8(4)	18.6(3)	38.7(5)	27.4(5)	27.6(4)	37.3(12)
31-50	373	189,267	93.1(4)	55.6(4)	27.6(4)	12.1(4)	-	75.5(5)	70.5(4)	70.3(5)	35.2(11)
31-50	374	69,924	64.7(2)	66.7(2)	45.1(4)	30.4(2)	21.3(2)	-	68.1(3)	89.9(3)	46.3(4)
$\leq$30	375	119,644	17.3(3)	15.7(3)	41.5(3)	35.6(3)	14.6(3)	-	61.3(4)	39.1(5)	17.7(5)
$\geq$30	376	112,584	-	16.3(2)	22.3(3)	-	23.6(2)	33.0(3)	59.0(3)	240.3(2)	25.4(4)
51-100	377	7,511	-	24.5(2)	52.2(2)	19.7(3)	165.3(2)	-	236.1(2)	28.6(2)	15.9(3)
101-150	378	10,440	23.2(2)	22.3(2)	42.7(2)	21.0(3)	-	-	7.8(2)	10.0(2)	6.9(3)
151-200	379	7,961	-	-	0.5(2)	12.0(3)	-	-	0.2(2)	0.3(2)	4.7(3)
151-200	380	8,712	-	0.9(2)	15.7(3)	3.4(2)	-	-	2.3(2)	-	1.5(2)
101-150	381	13,669	22.1(4)	3.6(4)	144.1(3)	19.5(4)	15.6(2)	-	15.3(2)	7.6(3)	19.1(3)
51-100	382	48,594	23.5(3)	4.5(4)	15.4(3)	6.1(3)	-	45.6(2)	39.0(3)	32.4(3)	174.9(3)
31-50	383	50,621	69.0(2)	59.9(2)	0.1(2)	51.8(2)	-	14.5(3)	62.7(3)	87.7(2)	25.6(3)
301-400	724	-	-	-	-	-	-	-	-	-	-
201-300	725	-	-	-	-	-	-	-	-	-	-
301-400	726	-	-	-	-	-	-	-	-	-	-
201-300	727	-	-	-	-	-	-	-	-	-	-
301-400	728	-	-	-	-	-	-	-	-	-	-
Mean (#sets)			58.5(24)	48.3(45)	34.2(48)	29.5(37)	25.8(22)	43.9(30)	51.7(48)	75.6(41)	40.4(82)
Biomass			48.6	59.5	35.1	25.2	22.6	43.1	64.5	89.4	50.6

Stratum	1980 ATC 304	1981 ATC 319	1982 ATC 328, 329	1984 AN 27	1985 WT 29 AN 43	1986 WT 47	1987 WT 58, 59, 60	1988 WT 70	1989 WT 82	1990[a] WT 95, 96
357	0.5(3)	0.0(2)	0.8(2)	0.0(2)	22.3(2)	0.0(2)	-	0.0(2)	0.0(2)	
358	1.8(3)	0.0(3)	3.5(2)	3.5(2)	180.5(2)	2.8(2)	1.5(2)	1.9(2)	0.8(2)	
359	36.0(4)	25.4(3)	28.5(2)	51.8(2)	28.0(2)	27.0(2)	5.9(2)	3.9(2)	17.5(2)	
360	39.9(11)	43.3(6)	37.8(7)	47.3(7)	38.2(16)	32.5(13)	15.3(15)	10.4(12)	22.2(15)	
361	33.7(7)	-	45.5(6)	39.0(5)	47.0(7)	22.7(10)	36.9(8)	26.5(7)	39.6(10)	
362	46.5(11)	75.8(5)	46.8(8)	89.9(7)	66.9(11)	82.6(14)	55.4(13)	50.6(10)	56.9(13)	
373	33.6(8)	83.4(5)	31.8(5)	66.1(7)	67.3(9)	26.4(14)	78.6(13)	44.1(10)	60.5(13)	
374	54.7(3)	170.0(3)	12.4(4)	112.1(3)	49.5(4)	15.0(6)	36.5(5)	20.2(5)	30.8(5)	
375	16.8(4)	10.5(4)	18.5(5)	46.2(5)	32.8(8)	45.6(8)	69.4(8)	36.8(6)	23.4(8)	
376	71.3(3)	22.0(4)	22.9(7)	10.6(4)	21.7(7)	22.4(9)	27.4(8)	6.0(6)	19.8(8)	
377	36.1(4)	215.3(3)	62.0(2)	319.5(2)	37.3(2)	34.0(2)	32.8(2)	26.8(2)	36.9(2)	
378	10.0(2)	3.8(2)	6.5(2)	21.5(2)	36.5(2)	68.1(2)	7.0(2)	10.5(2)	2.1(2)	
379	9.7(3)	3.5(3)	2.0(2)	4.5(2)	5.8(2)	1.0(2)	7.8(2)	0.1(2)	0.0(2)	
380	2.7(3)	0.3(3)	-	1.3(2)	10.8(2)	3.6(3)	0.0(2)	0.0(2)	2.6(2)	
381	13.1(4)	5.8(3)	5.6(2)	53.8(2)	26.3(2)	15.3(3)	2.4(2)	5.8(2)	7.6(2)	
382	25.5(4)	103.5(2)	56.8(2)	2.8(3)	63.4(4)	6.5(4)	50.3(3)	5.5(2)	15.7(3)	
383	33.0(4)	241.7(3)	19.8(2)	61.5(3)	22.2(3)	19.9(4)	36.3(3)	24.0(3)	22.0(3)	
723	-	-	-	-	-	-	-	-	-	
724	-	-	-	-	-	-	-	-	-	
725	-	-	-	-	-	-	-	-	-	
726	-	-	-	-	-	-	-	-	-	
727	-	-	-	-	-	-	-	-	-	
728	-	-	-	-	-	-	-	-	-	
Mean (#sets)	37.8(81)	67.6(54)	32.7(60)	54.7(60)	47.8(85)	35.0(101)	42.6(91)	25.9(77)	34.1(94)	-(87)
Biomass	47.4	75.3	40.7	68.4	59.9	43.8	52.8	32.4	42.8	30.1

[a]Preliminary analysis

Table 17. Mean weight (kg) of American plaice per tow, by stratum, from R. V. surveys in Division 3Ø. Numbers in parentheses are the number of successful 30-minute tows in each stratum. The stratified mean weight per tow (kg/30 min.) and the biomass estimates (t x 10^{-3}), are given at the bottom of the table.

			Year - Trip						
Depth (fm)	Stratum	No. of trawlable units	1973 ATC 207, 208, 209	1975 ATC 233	1976 ATC 245	1977 ATC 263	1978 ATC 276, 277	1979 ATC 289, 290, 291	1980 ATC 303
51-100	329	129,257	7.8(2)	-	91.7(2)	80.2(3)	16.6(5)	61.6(6)	45.8(2)
31-50	330	156,896	47.6(6)	25.7(3)	26.9(3)	101.1(3)	40.0(6)	78.4(7)	22.0(2)
31-50	331	34,248	28.6(2)	6.4(2)	41.2(2)	-	6.8(2)	28.9(3)	28.3(2)
51-100	332	78,636	-	23.6(2)	13.5(3)	10.3(3)	14.9(3)	12.9(4)	18.9(2)
101-150	333	11,341	-	5.7(2)	1.6(2)	4.3(2)	2.3(3)	5.3(2)	0.1(2)
151-200	334	6,910	-	-	0.0(2)	0.0(2)	0.0(3)	0.6(3)	0.0(2)
151-200	335	4,356	0.5(2)	-	13.3(3)	-	7.1(2)	4.1(2)	1.5(3)
101-150	336	9,088	4.8(3)	7.6(2)	30.9(2)	10.4(2)	6.8(2)	8.1(4)	0.3(2)
51-100	337	71,200	16.3(3)	3.0(3)	16.3(2)	21.8(2)	30.5(2)	1.3(4)	6.5(3)
31-50	338	142,551	38.8(5)	20.0(2)	62.7(3)	22.9(4)	7.6(5)	19.9(7)	30.2(5)
51-100	339	43,937	152.4(2)	47.2(2)	-	-	65.5(2)	262.4(3)	-
31-50	340	128,882	-	20.0(3)	81.2(6)	52.1(3)	18.0(3)	59.2(7)	85.8(2)
31-50	351	189,267	65.7(5)	73.5(4)	56.3(4)	62.7(5)	18.5(6)	46.8(11)	76.3(10)
31-50	352	193,773	25.8(5)	77.9(4)	61.1(4)	17.1(5)	8.4(4)	25.5(12)	38.0(11)
31-50	353	96,286	42.0(3)	72.0(3)	46.3(2)	42.4(3)	41.5(3)	36.0(5)	75.9(4)
51-100	354	35,600	49.0(3)	-	32.4(3)	34.5(2)	-	17.7(4)	101.8(3)
101-150	355	7,736	0.5(2)	3.6(2)	7.3(2)	-	-	16.8(4)	8.5(2)
151-200	356	4,581	0.9(2)	-	-	-	-	11.6(2)	4.8(2)
201-300	717	-	-	-	-	-	-	-	-
301-400	718	-	-	-	-	-	-	-	-
201-300	719	-	-	-	-	-	-	-	-
301-400	720	-	-	-	-	-	-	-	-
201-300	721	-	-	-	-	-	-	-	-
301-400	722	-	-	-	-	-	-	-	-
Mean (#sets)			41.2(45)	42.9(34)	52.2(45)	47.4(39)	21.2(51)	46.5(90)	46.5(59)
Biomass			46.1	49.1	67.6	59.2	27.5	62.5	60.1

				Year - Trip					
Stratum	1980 ATC 318, 319	1982 ATC 327, 328, 329	1984 AN 27	1985 AN 43	1986 WT 47	1987 WT 58, 59, 60	1988 WT 70	1989 WT 82	1990[a] WT 94, 95
329	157.0(2)	54.9(6)	25.7(5)	30.5(8)	23.4(8)	49.3(9)	8.2(7)	30.2(9)	
330	54.6(4)	24.2(7)	48.0(4)	118.4(10)	44.5(9)	56.1(11)	29.6(9)	40.1(11)	
331	-	24.0(4)	80.2(3)	98.8(3)	11.4(4)	46.8(2)	43.8(2)	10.7(2)	
332	-	16.3(4)	6.0(2)	24.3(5)	38.8(6)	59.4(5)	5.5(4)	16.8(5)	
333	-	1.3(4)	0.0(2)	0.0(2)	0.0(3)	0.4(2)	1.3(2)	0.2(2)	
334	-	0.1(4)	0.0(2)	1.5(2)	0.4(2)	0.8(2)	0.1(2)	0.4(2)	
335	-	0.7(2)	0.4(2)	0.7(2)	0.1(2)	0.4(2)	1.8(2)	0.1(2)	
336	-	2.5(2)	0.0(2)	1.3(2)	0.3(2)	0.0(2)	1.8(2)	0.5(2)	
337	-	22.3(3)	7.0(2)	15.8(5)	12.4(5)	14.3(6)	6.3(4)	10.5(5)	
338	-	13.2(5)	60.1(5)	59.6(9)	28.5(9)	26.7(9)	50.3(8)	21.3(10)	
339	96.5(2)	27.0(4)	160.0(2)	13.9(3)	5.5(3)	68.5(3)	29.2(3)	84.0(3)	
340	97.3(3)	35.3(6)	49.5(4)	43.9(9)	35.9(7)	93.7(9)	56.1(7)	26.3(9)	
351	180.0(4)	46.3(9)	92.9(6)	73.3(9)	80.3(14)	71.1(13)	76.9(10)	57.5(13)	
352	-	36.6(7)	27.0(7)	56.5(11)	34.2(14)	63.5(13)	52.2(11)	35.1(13)	
353	-	35.0(3)	48.5(2)	55.5(6)	29.2(7)	44.4(6)	21.0(5)	28.7(7)	
354	10.8(2)	34.8(2)	11.8(2)	73.2(3)	9.8(3)	17.3(2)	6.0(2)	14.0(2)	
356	30.5(2)	-	4.3(2)	7.0(2)	0.0(2)	1.2(2)	1.0(2)	0.0(2)	
717	-	-	-	-	-	-	-	-	
718	-	-	-	-	-	-	-	-	
719	-	-	-	-	-	-	-	-	
720	-	-	-	-	-	-	-	-	
721	-	-	-	-	-	-	-	-	
722	-	-	-	-	-	-	-	-	
Mean (#sets)	115.1(21)	31.8(74)	48.0(56)	57.0(93)	35.9(102)	53.4(100)	37.7(84)	32.6(101)	40.4(92)
Biomass	79.2	42.4	64.5	76.6	48.2	71.7	50.7	43.8	52.9

[a]Preliminary analysis.

Table 18. Biomass (000 t) of A. plaice in strata in Div. 3N, 1984-90.

Stratum	% Area outside 200-mi. limit	Biomass 1984	1985	1986	1987	1988	1989	1990
357	100	0	0.3	0	-	0	0	0.01
358	100	0.06	3.0	0.05	0.03	0.03	0.01	0.09
359	100	1.6	0.9	0.9	0.2	0.1	0.6	0.4
360	93	10.6	8.6	7.3	3.4	2.3	5.0	4.1
376	89	1.2	2.4	2.6	3.1	0.7	2.2	0.7
377	100	2.4	0.3	0.3	0.2	0.2	0.3	0.4
378	100	0.2	0.4	0.7	0.07	0.1	0.02	0.5
379	100	0.04	0.05	0.01	0.06	0.01	0	0.01
380	83	0.01	0.09	0.03	0	0	0.02	0.05
381	79	0.7	0.4	0.2	0.03	0.08	0.1	0.2
Total	above strata	16.8	16.4	12.1	7.1	3.5	8.3	6.5
Total	all other strata	51.6	43.5	31.7	45.7	28.9	34.5	23.6
Total	Div. 3N	68.4	59.9	43.8	52.8	32.4	42.8	30.1

TABLE 19. Abundance at age (millions) of A.plaice in Div.3L as estimated from Canadian surveys.

3L

AGE	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1984	1985	1986	1987	1988	1989
1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.2	0.0	0.0	0.0	0.0	0.1	0.0	0.0
2	0.0	0.1	0.0	0.0	0.6	0.5	0.3	0.5	0.4	1.3	0.4	0.1	0.0	0.0	0.1	0.3	0.2	0.1
3	1.6	0.3	1.1	0.2	2.3	7.4	2.4	10.7	0.9	4.1	4.1	2.6	0.0	0.5	0.2	0.6	1.0	1.0
4	9.4	10.6	8.4	3.6	3.7	14.1	10.6	15.8	12.9	7.2	4.4	9.6	0.5	1.7	1.5	2.7	4.7	4.7
5	38.7	22.1	40.2	5.5	9.8	15.0	34.5	60.7	42.0	39.7	15.8	10.6	1.5	9.2	6.5	13.2	19.2	12.3
6	58.4	50.2	46.5	21.0	27.1	16.4	70.8	70.5	71.0	77.0	45.6	30.1	16.9	29.5	40.0	50.6	58.7	49.1
7	117.0	74.2	63.6	34.7	49.8	52.1	131.4	111.1	105.3	100.2	66.3	56.5	66.2	83.2	101.2	119.5	108.9	76.4
8	62.3	77.5	39.1	49.5	91.9	116.1	207.0	169.7	167.9	199.6	178.8	120.5	100.1	97.3	94.2	124.8	104.8	83.3
9	115.9	49.7	30.8	55.0	99.5	136.9	151.1	136.9	139.7	172.0	173.4	186.8	110.4	66.5	74.5	65.0	90.8	63.6
10	52.6	53.7	41.1	57.5	87.2	144.1	155.7	105.1	123.7	112.6	106.9	152.9	61.9	42.0	35.9	35.9	32.6	26.1
11	47.8	32.3	35.2	32.4	44.6	92.0	68.0	36.1	62.6	49.9	57.8	90.5	28.4	22.9	14.7	12.1	17.8	13.4
12	44.7	34.1	30.4	28.7	32.6	54.0	45.8	25.2	27.0	32.0	23.2	39.8	17.7	11.6	9.9	10.5	10.9	7.7
13	33.6	15.9	16.6	16.9	15.8	25.6	19.0	11.2	9.9	16.5	10.6	21.5	6.6	6.7	6.4	5.0	5.5	4.3
14	23.4	12.8	11.5	9.2	8.9	7.3	7.2	7.2	5.3	6.3	3.7	10.4	4.0	3.3	2.4	2.1	3.2	2.6
15	11.7	10.5	4.3	5.4	3.9	5.6	5.4	3.0	3.3	3.7	2.9	3.3	1.6	1.8	1.4	1.1	1.8	1.8
16	8.1	7.3	2.6	1.9	3.4	2.7	3.1	1.5	1.6	2.9	2.0	2.5	0.8	1.3	0.9	0.4	0.8	0.6
17	4.6	2.4	0.5	0.3	0.9	1.9	1.4	0.8	0.7	0.8	1.1	1.3	0.4	0.3	0.2	0.1	0.2	0.2
18	2.6	0.7	1.4	0.0	0.3	0.6	0.9	0.2	0.2	0.4	0.2	0.1	0.2	0.1	0.1	0.1	0.0	0.1
19	0.5	0.3	0.0	0.1	0.0	0.2	0.2	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0
1+	632.7	454.7	373.3	322.0	482.1	692.3	914.8	765.9	774.8	826.3	697.3	739.2	417.3	378.1	390.2	444.2	461.2	347.3
2+	632.7	454.6	373.3	322.0	482.1	692.3	914.8	765.9	774.6	826.2	697.1	739.2	417.3	378.1	390.2	444.1	461.2	347.3
3+	632.7	454.5	373.3	322.0	481.5	691.8	914.5	765.4	774.2	824.9	696.7	739.1	417.3	378.1	390.1	443.8	461.0	347.2
4+	631.1	454.2	372.2	321.8	479.2	684.4	912.1	754.7	773.3	820.8	692.6	736.5	417.3	377.6	389.9	443.2	460.0	346.2
5+	621.7	443.6	363.8	318.2	475.6	670.4	901.5	739.0	760.4	813.6	688.2	726.9	416.8	375.9	388.4	440.5	455.3	341.5
6+	583.0	421.5	323.6	312.7	465.7	655.3	867.0	678.3	718.4	773.9	672.4	716.3	415.3	366.7	381.9	427.3	436.1	329.2
7+	524.6	371.3	277.1	291.7	438.7	638.9	796.2	607.8	647.4	696.9	626.8	686.2	398.4	337.2	341.9	376.7	377.4	280.1
8+	407.6	297.1	213.6	257.0	388.9	586.9	664.8	496.7	542.1	596.6	560.6	629.7	332.2	254.0	240.7	257.1	268.5	203.7
9+	345.3	219.6	174.4	207.5	297.0	470.8	457.8	327.0	374.1	397.0	381.8	509.2	232.1	156.6	146.5	132.4	163.7	120.4
10+	229.4	169.8	143.6	152.5	197.5	333.9	306.7	190.1	234.4	225.0	208.4	322.3	121.7	90.1	71.9	67.3	72.9	56.8
11+	176.8	116.2	102.5	95.0	110.4	189.8	151.0	85.1	110.7	112.5	101.5	169.4	59.8	48.1	36.0	31.5	40.2	30.8
12+	129.0	83.9	67.3	62.6	65.8	97.8	83.0	48.9	48.1	62.5	43.7	78.9	31.4	25.2	21.3	19.3	22.4	17.4

TABLE 20. Abundance at age (millions) of A.plaice in Div.3N as estimated from Canadian surveys.

3N

AGE	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1984	1985	1986	1987	1988	1989
1	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.3	0.0	0.1	0.0	0.0	0.0	0.0
2	0.0	0.2	0.1	0.0	0.9	0.2	0.1	0.4	0.4	0.1	1.0	0.6	0.1	0.1	0.1	0.9	0.2	0.3
3	2.7	0.4	0.4	0.9	4.9	3.1	1.6	5.1	1.2	0.7	4.9	1.8	1.0	1.8	0.7	3.9	2.4	2.7
4	2.8	2.3	0.9	2.6	9.8	5.6	9.5	13.9	2.8	2.1	7.5	6.6	2.5	8.2	2.9	7.2	5.5	18.6
5	4.8	5.6	5.3	5.3	8.4	12.0	14.4	42.9	11.0	6.1	5.2	7.5	5.8	8.6	7.8	7.0	6.0	10.0
6	3.1	8.6	9.3	10.0	7.6	12.0	28.7	61.0	18.5	13.0	12.2	7.9	11.3	11.3	10.3	10.5	5.4	7.9
7	11.4	5.0	10.8	11.1	13.7	11.9	25.3	69.5	29.4	26.4	41.1	8.8	13.9	9.6	9.7	10.4	5.7	6.7
8	7.9	8.4	8.0	10.5	9.4	14.9	22.3	38.2	33.2	22.2	41.8	15.8	13.2	10.7	7.6	8.7	6.2	8.6
9	13.5	10.2	5.3	6.9	5.3	9.7	18.3	17.4	18.0	17.1	30.8	17.7	14.8	10.3	7.6	8.6	5.9	8.0
10	13.5	13.7	7.7	7.2	3.0	8.9	11.8	17.8	13.7	9.5	20.3	11.4	16.7	11.0	7.2	6.2	4.7	3.5
11	12.3	8.9	9.0	5.0	2.7	4.7	9.1	7.7	5.7	4.8	8.9	6.4	7.9	8.4	4.0	3.8	2.7	2.6
12	9.2	6.5	6.2	3.2	1.5	5.0	5.2	5.1	3.0	3.4	5.3	3.7	5.2	5.0	3.3	2.9	1.9	2.2
13	4.4	4.3	4.4	3.1	1.9	3.4	2.9	2.5	1.2	1.7	3.0	1.2	3.2	2.6	2.3	2.4	1.6	1.8
14	2.9	3.2	1.3	1.2	0.8	1.7	2.1	1.3	1.0	1.2	1.0	1.7	1.8	1.6	1.2	1.8	1.1	1.4
15	1.9	1.2	1.1	1.3	0.7	2.2	1.0	1.1	0.9	0.9	1.9	0.9	1.5	1.3	1.2	1.6	1.1	1.6
16	1.9	0.9	0.9	0.4	0.5	1.3	0.7	0.3	0.4	0.7	0.9	0.9	1.4	0.4	0.7	0.9	0.5	0.6
17	0.7	0.2	0.9	0.2	0.1	0.7	0.2	0.2	0.1	0.8	0.5	0.8	0.7	0.1	0.5	0.4	0.4	0.5
18	1.6	0.2	0.3	0.1	0.1	0.1	0.1	0.1	0.0	0.2	0.4	0.4	0.3	0.0	0.1	0.2	0.2	0.2
19	0.6	0.2	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.1	0.1	0.1	0.1
1+	95.2	80.3	72.4	69.0	71.5	97.5	153.3	284.6	140.7	111.3	186.8	94.6	101.5	90.9	67.5	77.7	51.6	77.2
2+	95.2	80.2	72.4	69.0	71.5	97.4	153.3	284.5	140.6	111.2	186.7	94.3	101.5	90.8	67.5	77.7	51.6	77.2
3+	95.2	80.0	72.3	69.0	70.6	97.2	153.2	284.1	140.2	111.1	185.7	93.7	101.4	90.7	67.4	76.8	51.4	76.9
4+	92.5	79.6	71.9	68.1	65.6	94.1	151.6	279.0	139.0	110.4	180.8	91.9	100.4	88.9	66.7	72.9	49.0	74.2
5+	89.6	77.3	71.0	65.5	55.8	88.5	142.1	265.1	136.2	108.3	173.3	85.3	97.9	80.7	63.8	65.7	43.5	55.6
6+	84.9	71.7	65.7	60.2	47.4	76.5	127.7	222.2	125.2	102.2	168.0	77.8	92.1	72.1	55.9	58.7	37.5	45.6
7+	81.7	63.0	56.4	50.2	39.8	64.5	99.0	161.3	106.7	89.2	155.8	69.9	80.8	60.9	45.7	48.1	32.1	37.8
8+	70.3	58.0	45.5	39.1	26.1	52.6	73.7	91.8	77.3	62.7	114.7	61.1	66.9	51.3	36.0	37.7	26.4	31.1
9+	62.4	49.6	37.5	28.6	16.7	37.7	51.4	53.6	44.0	40.5	72.9	45.2	53.6	40.6	28.4	29.0	20.2	22.5
10+	49.0	39.3	32.2	21.7	11.4	28.1	33.1	36.1	26.0	23.3	42.1	27.5	38.8	30.3	20.7	20.4	14.3	14.5
11+	35.5	25.7	24.5	14.6	8.4	19.2	21.3	18.3	12.3	13.8	21.9	16.1	22.1	19.4	13.5	14.1	9.6	11.0
12+	23.3	16.8	15.6	9.6	5.7	14.4	12.2	10.6	6.6	9.0	13.0	9.7	14.2	11.0	9.5	10.3	6.9	8.4

TABLE 21. Abundance at age (millions) of A.plaice in Div.3O as estimated from Canadian surveys.

3O

AGE	1973	1975	1976	1977	1978	1979	1980	1981	1982	1984	1985	1986	1987	1988	1989
1	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.4	0.1	0.0	0.0	0.0	0.1	0.0	0.0
2	1.3	0.1	0.2	0.4	0.3	0.9	0.8	2.4	0.7	0.1	0.0	0.1	0.3	0.1	0.0
3	9.0	2.2	2.4	1.9	1.5	4.6	2.2	11.9	1.9	0.1	0.4	0.7	0.9	0.8	1.1
4	5.3	5.4	3.9	9.8	4.3	9.8	5.3	7.8	3.9	0.4	1.3	2.4	3.1	1.4	2.8
5	12.8	7.9	12.3	28.2	8.1	18.1	4.7	18.4	4.2	2.7	4.3	3.2	8.3	2.2	4.2
6	16.7	12.0	21.9	37.1	12.4	21.8	8.6	24.9	6.1	8.0	4.7	5.3	13.1	5.3	11.6
7	21.5	23.9	30.1	39.7	16.5	36.9	46.2	49.4	15.6	15.7	11.1	9.4	17.2	7.1	15.7
8	13.1	13.3	43.2	19.7	16.0	39.0	48.3	90.4	26.3	24.5	17.7	11.4	18.8	10.6	14.0
9	11.5	14.8	25.8	19.4	8.7	28.5	28.8	90.8	23.6	19.1	17.3	10.9	18.6	9.8	13.0
10	11.4	15.0	18.8	11.6	7.4	19.3	18.8	46.0	20.1	16.2	18.9	9.7	13.2	9.1	8.1
11	8.0	13.5	10.9	8.8	3.5	7.8	9.6	17.2	8.8	7.2	13.3	6.4	6.9	6.1	4.0
12	7.2	8.6	9.1	6.5	2.3	5.9	5.4	9.1	6.2	4.5	7.6	5.6	5.0	4.9	4.1
13	4.1	5.7	7.1	2.7	2.1	2.4	2.5	3.2	2.5	2.7	3.1	3.1	3.4	3.1	2.3
14	3.1	3.5	4.4	1.6	0.9	1.4	1.0	2.1	0.9	1.9	2.8	1.3	2.1	2.2	1.1
15	2.1	2.8	3.8	1.1	0.5	0.9	1.2	1.2	0.9	2.3	2.2	1.3	1.7	1.3	1.2
16	1.3	0.6	2.1	0.4	0.4	0.8	1.0	0.9	0.7	1.3	0.9	0.5	1.0	1.3	1.0
17	1.1	0.2	1.6	0.1	0.0	0.3	0.4	0.7	0.4	0.7	0.2	0.4	0.5	0.3	0.6
18	0.7	0.0	0.3	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.1	0.1	0.3	0.3	0.2
19	0.2	0.0	0.4	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0
1+	130.4	129.6	198.2	189.0	85.0	198.5	185.1	376.9	123.0	107.6	105.9	71.9	114.3	65.7	85.0
2+	130.3	129.6	198.1	189.0	85.0	198.4	185.1	376.5	122.9	107.6	105.9	71.9	114.2	65.7	85.0
3+	129.0	129.5	197.9	188.6	84.7	197.5	184.3	374.1	122.2	107.5	105.9	71.8	113.9	65.6	85.0
4+	120.0	127.3	195.5	186.7	83.2	192.9	182.1	362.2	120.3	107.4	105.5	71.1	113.0	64.8	83.9
5+	114.7	121.8	191.7	177.0	78.9	183.1	176.8	354.4	116.4	107.0	104.2	68.7	109.9	63.4	81.1
6+	101.9	114.0	179.4	148.8	70.8	165.0	172.1	336.0	112.2	104.3	99.9	65.5	101.6	61.2	76.9
7+	85.2	101.9	157.5	111.6	58.5	143.3	163.5	311.1	106.1	96.3	95.2	60.2	88.6	55.9	65.3
8+	63.6	78.1	127.4	71.9	42.0	106.4	117.4	261.8	90.5	80.6	84.1	50.8	71.4	48.9	49.6
9+	50.5	64.8	84.2	52.2	25.9	67.4	69.0	171.4	64.2	56.0	66.4	39.4	52.7	38.3	35.6
10+	39.0	50.0	58.4	32.8	17.2	39.0	40.2	80.6	40.7	37.0	49.1	28.5	34.1	28.6	22.6
11+	27.7	34.9	39.6	21.2	9.9	19.7	21.4	34.6	20.6	20.8	30.2	18.8	20.9	19.5	14.5
12+	19.7	21.5	28.7	12.4	6.4	11.9	11.8	17.3	11.8	13.6	16.9	12.4	14.1	13.4	10.5

TABLE 22. Abundance at age (millions) of A.plaice in Div.3LNO as estimated from Canadian surveys.

3LNO

AGE	1973	1975	1976	1977	1978	1979	1980	1981	1982	1984	1985	1986	1987	1988	1989
1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2	1	2	1	1	1	2	2	4	1	0	0	0	1	0	0
3	10	10	13	6	17	7	7	21	6	1	3	2	5	4	5
4	15	20	24	30	34	25	15	20	20	3	11	7	13	12	26
5	58	27	40	77	112	71	50	39	22	10	22	18	29	27	26
6	73	47	51	137	144	111	99	83	44	36	46	56	74	69	69
7	96	88	94	196	198	172	173	157	81	96	104	120	147	122	99
8	60	115	175	249	224	240	270	311	163	138	126	113	152	122	106
9	48	120	173	189	163	186	218	235	228	144	94	93	92	106	85
10	60	105	172	179	130	157	141	173	184	95	72	53	55	46	38
11	52	61	108	86	47	76	64	84	106	43	45	25	23	27	20
12	44	43	68	58	33	36	41	38	50	27	24	19	18	18	14
13	25	24	36	25	16	13	21	17	25	13	12	12	11	10	8
14	16	13	13	11	9	8	8	7	13	8	8	5	6	6	5
15	8	8	12	7	5	5	6	6	5	5	5	4	4	4	5
16	5	4	6	4	2	3	5	4	4	4	3	2	2	3	2
17	3	1	4	2	1	1	2	2	2	2	1	1	1	1	1
18	2	0	1	1	0	0	1	1	1	1	0	0	1	0	1
19	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
1+	576	688	991	1257	1138	1114	1122	1263	957	625	575	529	636	578	510
2+	576	688	991	1257	1138	1114	1122	1262	956	625	575	529	636	578	510
3+	575	687	990	1256	1137	1112	1120	1259	955	625	575	529	634	578	509
4+	564	677	977	1250	1120	1105	1113	1238	949	624	572	527	629	574	504
5+	549	657	954	1221	1086	1080	1098	1218	929	621	561	520	616	562	478
6+	491	631	914	1143	974	1009	1048	1178	906	611	539	503	587	535	452
7+	419	583	863	1007	829	897	949	1096	862	575	493	447	513	465	383
8+	323	495	769	810	631	726	777	938	781	479	389	327	366	344	284
9+	263	380	594	561	407	486	506	627	619	341	264	214	214	222	179
10+	215	260	421	373	244	299	289	332	391	197	170	121	122	116	94
11+	155	154	249	193	113	143	148	158	206	103	98	68	67	69	56
12+	103	93	141	108	66	67	83	74	100	59	53	43	44	43	36

TABLE 23. CPUE AT AGE (TENS OF FISH/HR) FROM CANADIAN FISHERY .

AGE	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
5	0.3	0.9	0.7	0.9	1.4	1.3	0.3	0.2	0.0	0.2	0.1	0.0	0.1	0.0	0.0	0.0
6	5.7	3.1	3.1	6.5	4.1	6.7	3.5	0.6	0.4	1.6	0.6	0.3	0.7	0.1	0.0	0.2
7	10.1	7.0	7.0	8.5	8.4	13.9	11.3	2.6	2.1	5.0	2.2	2.0	2.4	1.5	1.0	1.8
8	9.7	9.2	15.5	11.4	9.5	19.2	14.9	5.5	5.5	9.4	4.7	5.9	4.7	7.1	4.8	7.7
9	7.5	9.0	13.3	13.2	11.6	15.4	16.7	9.1	10.3	13.5	8.4	11.9	7.6	14.4	11.9	14.5
10	8.6	7.7	9.9	10.8	12.7	12.8	16.8	13.2	14.8	12.5	14.2	17.4	10.4	16.2	14.2	15.2
11	6.8	5.6	6.7	6.3	9.1	9.0	13.4	15.7	18.2	13.8	18.4	15.7	12.6	11.0	13.5	10.9
12	4.4	4.6	4.1	4.1	6.2	3.9	9.6	13.7	16.7	12.2	12.8	10.0	8.7	6.8	8.3	6.5
13	3.7	3.7	2.4	2.3	3.3	1.9	4.4	10.0	9.2	7.4	7.2	4.3	4.5	2.9	3.7	2.8
14	2.2	2.6	1.9	1.4	2.0	0.7	1.9	6.5	4.9	4.0	3.6	1.8	1.9	1.3	1.6	1.3
15	1.1	1.4	1.1	1.0	1.3	0.4	0.8	3.4	2.3	2.0	1.6	1.1	0.9	0.6	0.8	0.7
16	0.6	0.7	0.5	0.3	0.6	0.2	0.3	1.3	0.7	0.6	0.6	0.3	0.3	0.2	0.3	0.2
17	0.3	0.5	0.2	0.2	0.2	0.1	0.1	0.5	0.2	0.2	0.1	0.1	0.1	0.0	0.1	0.0
18	0.1	0.2	0.1	0.1	0.1	0.0	0.0	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
5+	61.0	56.2	66.4	67.1	70.6	85.5	93.9	82.5	85.4	82.5	74.4	70.9	55.0	62.2	60.2	61.9
6+	60.7	55.4	65.7	66.2	69.2	84.2	93.6	82.3	85.4	82.3	74.3	70.8	54.9	62.2	60.2	61.8
7+	54.9	52.3	62.6	59.6	65.1	77.4	90.1	81.7	85.0	80.7	73.8	70.5	54.2	62.1	60.2	61.6
8+	44.9	45.2	55.6	51.1	56.7	63.6	78.8	79.1	83.0	75.7	71.6	68.5	51.7	60.5	59.2	59.8
9+	35.2	36.0	40.1	39.8	47.2	44.3	63.9	73.6	77.4	66.3	66.9	62.6	47.0	53.5	54.4	52.1
10+	27.8	27.0	26.8	26.6	35.6	28.9	47.2	64.4	67.1	52.8	58.5	50.8	39.4	39.0	42.5	37.6
11+	19.1	19.3	16.9	15.8	22.9	16.1	30.4	51.3	52.3	40.3	44.3	33.3	29.0	22.8	28.3	22.4
12+	12.3	13.7	10.2	9.5	13.8	7.1	17.0	35.6	34.1	26.5	25.9	17.6	16.5	11.9	14.7	11.5
13+	7.9	9.1	6.1	5.3	7.6	3.2	7.5	21.9	17.4	14.3	13.1	7.7	7.7	5.0	6.5	5.0
14+	4.2	5.4	3.6	3.0	4.3	1.3	3.1	11.9	8.3	6.9	5.9	3.3	3.2	2.1	2.8	2.2

Table 24. Results of ADAPT using RV nos at ages 6-15.

APPROXIMATE STATISTICS ASSUMING LINEARITY NEAR SOLUTION

ORTHOGONALITY OFFSET..... 0.001352
MEAN SQUARE RESIDUALS 0.139217

AGE	PARAMETER	ESTIMATE	STD. ERR.	T-STATISTIC	C.V.
6	ABUNDANCE	1.68591E5	6.32790E4	2.66425E0	0.38
7	ABUNDANCE	1.20473E5	3.25370E4	3.70266E0	0.27
8	ABUNDANCE	9.07660E4	2.06267E4	4.40041E0	0.23
9	ABUNDANCE	6.05121E4	1.24162E4	4.87366E0	0.21
10	ABUNDANCE	3.19934E4	6.46431E3	4.94923E0	0.20
11	ABUNDANCE	1.51501E4	2.90289E3	5.21896E0	0.19
12	ABUNDANCE	8.80819E3	1.75420E3	5.02119E0	0.20
13	ABUNDANCE	4.37590E3	1.01738E3	4.30115E0	0.23
14	ABUNDANCE	2.72888E3	6.52909E2	4.17957E0	0.24
15	ABUNDANCE	1.59110E3	3.92153E2	4.05733E0	0.25
6	RV SLOPE	4.58358E_4	4.98860E_5	9.18811E0	0.11
7	RV SLOPE	1.02929E_3	1.08208E_4	9.51213E0	0.11
8	RV SLOPE	1.78692E_3	1.84654E_4	9.67715E0	0.10
9	RV SLOPE	2.16323E_3	2.21881E_4	9.74952E0	0.10
10	RV SLOPE	2.29674E_3	2.35517E_4	9.75190E0	0.10
11	RV SLOPE	1.95299E_3	2.01751E_4	9.68020E0	0.10
12	RV SLOPE	2.23390E_3	2.32003E_4	9.62876E0	0.10
13	RV SLOPE	2.25063E_3	2.34487E_4	9.59807E0	0.10
14	RV SLOPE	2.40272E_3	2.50720E_4	9.58329E0	0.10
15	RV SLOPE	4.01931E_3	4.17137E_4	9.63546E0	0.10

POPULATION NUMBERS (000S) 7/ 6/90

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
5	293628	279214	233591	219923	205236	192039	170578	170205	149282	154677	174528	184311	185905	208519	
6	229855	239604	227844	190367	178648	166896	156990	139518	139327	122114	126596	142624	146913	150181	168090
7	192315	185359	192636	180460	151817	140337	133949	128031	113943	113175	99619	102935	107987	115811	120051
8	124003	150921	143814	149806	139428	112053	106274	107634	103182	90526	91288	79424	72914	81454	90427
9	75130	92990	106043	107131	113243	97191	80360	82680	83781	79233	71121	69626	53690	49841	60111
10	43537	53156	61116	74552	76181	79164	66805	58626	59598	61045	59574	48552	44906	29601	31647
11	25377	28494	32356	39942	48478	51056	51954	44358	36385	41821	40969	34533	27197	20805	14892
12	16689	15618	15798	20592	23710	31736	31587	30262	22020	22104	22579	20397	15382	11948	8654
13	10712	9382	8122	9083	10685	15996	18665	15119	11667	11226	9987	10132	7311	6273	4317
14	5896	5342	4945	4506	4129	7081	9720	7416	5192	5400	4602	4460	2914	3202	2700
15	3060	2459	2285	2698	1663	2734	4381	2899	2250	2007	2146	1987	1265	1207	1576
16	1593	1183	795	966	877	1052	1655	929	564	739	657	639	345	341	395
17	691	614	440	341	203	574	622	343	180	124	239	187	32	59	38
18	506	136	281	196	87	110	391	153	94	30	17	51	7	2	14
5+	1022990	1064472	1030065	1000562	954387	898019	833932	788172	727464	704223	703923	699857	666771	679244	

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FISHING MORTALITY 7/ 6/90

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
5	0.003	0.003	0.005	0.008	0.007	0.002	0.001	0.000	0.001	0.000	0.002	0.027	0.013	0.016	0.001
6	0.015	0.018	0.033	0.026	0.041	0.020	0.004	0.002	0.008	0.004	0.007	0.078	0.038	0.024	0.079
7	0.042	0.054	0.051	0.058	0.104	0.078	0.019	0.016	0.030	0.015	0.027	0.145	0.082	0.047	0.111
8	0.088	0.153	0.094	0.080	0.161	0.132	0.051	0.051	0.064	0.041	0.071	0.192	0.180	0.104	0.125
9	0.146	0.220	0.152	0.141	0.158	0.175	0.115	0.127	0.117	0.085	0.182	0.239	0.395	0.254	0.300
10	0.224	0.296	0.225	0.230	0.200	0.221	0.209	0.277	0.154	0.199	0.345	0.380	0.569	0.487	0.558
11	0.285	0.390	0.252	0.322	0.224	0.280	0.340	0.500	0.298	0.416	0.497	0.609	0.623	0.677	0.950
12	0.376	0.454	0.354	0.456	0.194	0.331	0.537	0.753	0.474	0.595	0.601	0.826	0.697	0.818	0.978
13	0.496	0.440	0.389	0.588	0.211	0.298	0.723	0.869	0.570	0.692	0.606	1.046	0.626	0.643	0.718
14	0.674	0.649	0.406	0.797	0.212	0.280	1.010	0.993	0.750	0.723	0.640	1.060	0.681	0.509	0.538
15	0.750	0.930	0.661	0.924	0.258	0.302	1.351	1.438	0.913	0.917	1.011	1.550	1.111	0.918	0.481
16	0.754	0.789	0.646	1.358	0.224	0.326	1.375	1.439	1.314	0.927	1.056	2.779	1.566	1.996	0.517
17	1.428	0.582	0.611	1.161	0.419	0.183	1.205	1.092	1.595	1.764	1.350	3.093	2.527	1.271	0.517
18	0.702	0.739	0.500	0.902	0.225	0.290	1.143	1.144	0.836	0.789	0.785	1.352	0.869	0.720	0.517

Table 25. Results of ADAPT using C/E at ages 6-15.

APPROXIMATE STATISTICS ASSUMING LINEARITY NEAR SOLUTION

ORTHOGONALITY OFFSET..... 0.005565
MEAN SQUARE RESIDUALS 0.321672

AGE	PARAMETER	ESTIMATE	STD. ERR.	T-STATISTIC	C.V.
6	ABUNDANCE	3.96800E4	1.87657E4	2.11450E0	0.47
7	ABUNDANCE	2.66343E4	8.95767E3	2.97335E0	0.34
8	ABUNDANCE	3.59117E4	1.20001E4	2.99262E0	0.33
9	ABUNDANCE	5.28005E4	1.61660E4	3.26614E0	0.31
10	ABUNDANCE	4.11927E4	1.24233E4	3.31577E0	0.30
11	ABUNDANCE	2.75055E4	8.62125E3	3.19042E0	0.31
12	ABUNDANCE	1.69330E4	5.68148E3	2.98039E0	0.34
13	ABUNDANCE	7.10345E3	2.59359E3	2.73885E0	0.37
14	ABUNDANCE	3.64254E3	1.28747E3	2.82922E0	0.35
15	ABUNDANCE	1.48178E3	5.23574E2	2.83013E0	0.35
6	RV SLOPE	8.08206E-6	1.27850E-6	6.32151E0	0.16
7	RV SLOPE	3.64891E-5	5.66671E-6	6.43920E0	0.16
8	RV SLOPE	9.10999E-5	1.39137E-5	6.54748E0	0.15
9	RV SLOPE	1.71141E-4	2.59163E-5	6.60363E0	0.15
10	RV SLOPE	2.80813E-4	4.24133E-5	6.62089E0	0.15
11	RV SLOPE	4.08401E-4	6.16717E-5	6.62217E0	0.15
12	RV SLOPE	5.27681E-4	7.98382E-5	6.60938E0	0.15
13	RV SLOPE	5.80114E-4	8.81218E-5	6.58309E0	0.15
14	RV SLOPE	6.51606E-4	9.92517E-5	6.56518E0	0.15
15	RV SLOPE	8.72088E-4	1.32749E-4	6.56944E0	0.15

POPULATION NUMBERS (000S)

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
5	293629	279248	233668	220576	204428	197567	184099	203218	190387	179694	157378	84489	46058	51288	
6	229857	239604	227871	190430	179183	166234	161516	150588	166356	155768	147077	128583	65185	35685	39360
7	192316	185360	192636	180482	151869	140775	133407	131737	123007	135304	127173	119704	96492	48898	26309
8	124003	150922	143815	149806	139446	112095	106633	107191	106216	97947	109406	101983	86644	72042	35643
9	75130	92990	106044	107132	113243	97206	80395	82973	83418	81717	77196	84460	72160	61081	52406
10	43537	53156	61116	74553	76182	79164	66817	58654	59838	60748	61608	53526	57051	44722	40850
11	25377	28494	32356	39942	48479	51057	51954	44368	36408	42018	40726	36198	31270	30748	27273
12	16688	15618	15798	20592	23710	31737	31588	30262	22028	22123	22740	20198	16746	15283	16795
13	10711	9382	8122	9083	10685	15996	18665	15120	11667	11233	10002	10263	7148	7389	7047
14	5896	5342	4945	4506	4129	7081	9720	7416	5193	5400	4608	4472	3022	3069	3614
15	3059	2459	2285	2698	1663	2734	4381	2899	2250	2007	2146	1991	1276	1296	1466
16	1591	1183	794	966	877	1052	1655	929	564	739	657	639	349	349	467
17	690	613	440	341	203	574	622	343	180	124	239	187	33	62	45
18	503	135	280	195	87	109	391	153	94	30	17	51	7	2	16
5+	1022986	1064505	1030170	1001301	954184	903381	851844	835849	807605	794853	760975	646744	483439	371913	

FISHING MORTALITY 8/ 6/90

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
5	0.003	0.003	0.005	0.008	0.007	0.001	0.001	0.000	0.001	0.000	0.002	0.059	0.055	0.065	0.000
6	0.015	0.018	0.033	0.026	0.041	0.020	0.004	0.002	0.007	0.003	0.006	0.087	0.087	0.105	0.388
7	0.042	0.054	0.051	0.058	0.104	0.078	0.019	0.015	0.028	0.012	0.021	0.123	0.092	0.116	0.643
8	0.088	0.153	0.094	0.080	0.161	0.132	0.051	0.051	0.062	0.038	0.059	0.146	0.150	0.118	0.352
9	0.146	0.220	0.152	0.141	0.158	0.175	0.115	0.127	0.117	0.082	0.166	0.192	0.278	0.202	0.352
10	0.224	0.296	0.225	0.230	0.200	0.221	0.209	0.277	0.154	0.200	0.332	0.338	0.418	0.295	0.404
11	0.285	0.390	0.252	0.322	0.224	0.280	0.340	0.500	0.298	0.414	0.501	0.571	0.516	0.405	0.412
12	0.376	0.454	0.354	0.456	0.194	0.331	0.537	0.753	0.473	0.594	0.596	0.839	0.618	0.574	0.392
13	0.496	0.440	0.389	0.588	0.211	0.298	0.723	0.869	0.570	0.691	0.605	1.023	0.646	0.515	0.379
14	0.674	0.649	0.406	0.797	0.212	0.280	1.010	0.993	0.750	0.723	0.639	1.054	0.647	0.538	0.374
15	0.750	0.930	0.661	0.924	0.258	0.302	1.351	1.437	0.913	0.917	1.011	1.542	1.095	0.820	0.528
16	0.755	0.789	0.646	1.358	0.224	0.326	1.375	1.439	1.314	0.927	1.055	2.778	1.527	1.852	0.418
17	1.432	0.583	0.611	1.162	0.419	0.183	1.205	1.092	1.595	1.763	1.348	3.069	2.522	1.153	0.418
18	0.708	0.744	0.502	0.905	0.225	0.290	1.143	1.144	0.836	0.789	0.784	1.346	0.836	0.713	0.418

Table 26. Results of ADAPT using RV nos at ages 6-14 and C/E at ages 9-14.

ESTIMATED PARAMETERS AND STANDARD ERRORS
APPROXIMATE STATISTICS ASSUMING LINEARITY NEAR SOLUTION

ORTHOGONALITY OFFSET..... 0.017726
MEAN SQUARE RESIDUALS 0.148622

AGE	PARAMETER	ESTIMATE	STD. ERR.	T-STATISTIC	C.V.
6	ABUNDANCE	1.77061E5	6.87515E4	2.57537E0	0.39
7	ABUNDANCE	1.26672E5	3.53504E4	3.58331E0	0.28
8	ABUNDANCE	1.05262E5	2.13052E4	4.94066E0	0.20
9	ABUNDANCE	7.26327E4	1.24769E4	5.82138E0	0.17
10	ABUNDANCE	4.35520E4	7.19475E3	6.05330E0	0.17
11	ABUNDANCE	2.08333E4	3.62261E3	5.75090E0	0.17
12	ABUNDANCE	1.10686E4	1.9995BE3	5.53546E0	0.18
13	ABUNDANCE	5.34775E3	1.07985E3	4.95232E0	0.20
14	ABUNDANCE	2.78334E3	6.63316E2	4.19610E0	0.24
6	RV SLOPE	4.35695E-4	4.86654E-5	8.95286E0	0.11
7	RV SLOPE	9.77833E-4	1.05440E-4	9.27386E0	0.11
8	RV SLOPE	1.69220E-3	1.79130E-4	9.44676E0	0.11
9	RV SLOPE	2.04998E-3	2.15509E-4	9.51226E0	0.11
10	RV SLOPE	2.17290E-3	2.28088E-4	9.52660E0	0.10
11	RV SLOPE	1.856B5E-3	1.95592E-4	9.49349E0	0.11
12	RV SLOPE	2.15486E-3	2.28425E-4	9.43355E0	0.11
13	RV SLOPE	2.20B77E-3	2.34B0BE-4	9.40670E0	0.11
14	RV SLOPE	2.41071E-3	2.56581E-4	9.39552E0	0.11
9	C/E SLOPE	1.05094E-3	1.07074E-4	9.81506E0	0.10
10	C/E SLOPE	1.56610E-3	1.58334E-4	9.89114E0	0.10
11	C/E SLOPE	1.9B334E-3	1.99871E-4	9.92311E0	0.10
12	C/E SLOPE	2.19266E-3	2.20864E-4	9.92762E0	0.10
13	C/E SLOPE	2.06831E-3	2.08655E-4	9.91257E0	0.10
14	C/E SLOPE	2.10165E-3	2.12704E-4	9.88064E0	0.10

LOG RESIDUALS FOR CANADIAN RV SURVEY INDEX 10/ 6/90

	1975	1976	1977	1978	1979	1980	1981	1982	1984	1985	1986	1987	1988
6	-0.661	-0.631	0.417	0.649	0.460	0.407	0.274	-0.265	-0.423	-0.292	-0.145	0.107	0.102
7	-0.655	-0.546	0.147	0.222	0.272	0.349	0.284	-0.349	-0.109	-0.038	-0.124	0.289	0.030
8	-0.479	-0.234	0.146	-0.006	0.168	0.493	0.656	-0.002	-0.035	-0.149	-0.141	-0.141	-0.173
9	-0.106	-0.076	0.005	-0.155	-0.071	0.246	0.715	0.436	-0.002	-0.311	-0.309	-0.103	-0.045
10	0.281	0.605	0.476	-0.038	-0.112	-0.024	0.348	0.569	-0.159	-0.363	-0.493	-0.343	-0.299
11	0.455	0.952	0.545	-0.231	0.008	-0.188	0.087	0.542	-0.321	-0.224	-0.605	-0.522	-0.178
12	0.385	0.972	0.747	-0.034	-0.189	-0.296	0.284	0.126	-0.226	-0.358	-0.382	-0.222	-0.091
13	0.286	0.780	0.548	-0.074	-0.388	-0.330	-0.516	0.164	-0.311	-0.238	-0.104	-0.024	-0.030
14	0.290	0.403	0.091	0.249	-0.103	-0.505	-0.739	0.173	-0.145	-0.014	-0.257	0.247	0.271

	1989
6	0.000
7	-0.096
8	-0.389
9	-0.375
10	-0.673
11	-0.320
12	-0.147
13	-0.017
14	-0.041

SUM OF RV RESIDUALS : -0.0000000006 MEAN RESIDUAL : -0.0000000000

LOG RESIDUALS FOR CANADIAN C/E INDEX 10/ 6/90

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
9	-0.369	-0.177	-0.139	-0.303	0.048	0.349	-0.198	-0.082	0.219	-0.159	0.159	-0.213	0.422
10	-0.422	-0.387	-0.428	-0.281	-0.324	0.100	0.047	0.136	-0.038	0.134	0.418	-0.109	0.506
11	-0.443	-0.458	-0.650	-0.489	-0.516	-0.162	0.167	0.449	-0.156	0.431	0.283	-0.229	0.138
12	-0.191	-0.418	-0.541	-0.341	-1.010	-0.157	0.184	0.541	0.424	0.336	0.119	0.142	0.080
13	0.043	-0.294	-0.358	-0.245	-0.953	-0.398	0.429	0.380	0.491	0.460	-0.067	0.098	-0.091
14	0.128	-0.101	-0.174	0.059	-1.121	-0.597	0.496	0.426	0.495	0.420	-0.148	-0.095	-0.139

	1988	1989
9	0.164	0.276
10	0.352	0.296
11	0.622	0.244
12	0.471	0.361
13	0.308	0.197
14	0.176	0.175

SUM OF C/E RESIDUALS : 0.0002805242 MEAN RESIDUAL : 0.0000031169

Table 26. Continued.

PARAMETER CORRELATION MATRIX 10/ 6/90

	1	2	3	4	5	6	7	8	9	10	11	12	13
1	1.000	0.058	0.043	0.034	0.027	0.019	0.006	0.009	0.007	0.278	0.024	0.014	0.009
2	0.058	1.000	0.060	0.048	0.038	0.027	0.013	0.009	0.009	0.207	0.211	0.019	0.013
3	0.043	0.060	1.000	0.067	0.053	0.037	0.022	0.015	0.011	0.156	0.156	0.158	0.018
4	0.034	0.048	0.067	1.000	0.066	0.046	0.029	0.019	0.014	0.124	0.127	0.130	0.142
5	0.027	0.038	0.053	0.066	1.000	0.059	0.037	0.024	0.017	0.097	0.099	0.105	0.117
6	0.019	0.027	0.037	0.046	0.059	1.000	0.052	0.032	0.022	0.069	0.069	0.072	0.084
7	0.006	0.013	0.022	0.029	0.037	0.052	1.000	0.030	0.038	0.020	0.050	0.051	0.051
8	0.009	0.009	0.015	0.019	0.024	0.032	0.030	1.000	0.058	0.033	0.013	0.033	0.034
9	0.007	0.009	0.011	0.014	0.017	0.022	0.038	0.058	1.000	0.024	0.024	0.010	0.024
10	0.278	0.207	0.156	0.124	0.097	0.069	0.020	0.033	0.024	1.000	0.085	0.050	0.033
11	0.024	0.211	0.156	0.127	0.099	0.069	0.050	0.013	0.024	0.085	1.000	0.051	0.034
12	0.014	0.019	0.158	0.130	0.105	0.072	0.051	0.033	0.010	0.050	0.051	1.000	0.036
13	0.009	0.013	0.018	0.142	0.117	0.084	0.051	0.034	0.024	0.033	0.034	0.036	1.000
14	0.006	0.009	0.013	0.016	0.144	0.111	0.071	0.043	0.030	0.023	0.024	0.026	0.029
15	0.004	0.006	0.009	0.012	0.015	0.167	0.113	0.065	0.045	0.016	0.018	0.019	0.021
16	0.002	0.004	0.007	0.008	0.011	0.015	0.197	0.115	0.080	0.009	0.013	0.014	0.015
17	0.003	0.003	0.005	0.007	0.008	0.011	0.050	0.205	0.142	0.010	0.008	0.010	0.012
18	0.002	0.004	0.005	0.006	0.008	0.010	0.088	0.052	0.235	0.008	0.010	0.007	0.011
19	0.013	0.018	0.147	0.121	0.097	0.065	0.048	0.032	0.023	0.046	0.047	0.049	0.033
20	0.008	0.011	0.016	0.124	0.104	0.071	0.049	0.032	0.024	0.029	0.030	0.031	0.035
21	0.005	0.007	0.010	0.013	0.118	0.090	0.057	0.036	0.025	0.019	0.020	0.021	0.023
22	0.003	0.005	0.007	0.009	0.011	0.122	0.084	0.048	0.033	0.012	0.013	0.014	0.016
23	0.002	0.003	0.005	0.006	0.007	0.010	0.137	0.079	0.055	0.008	0.009	0.010	0.010
24	0.002	0.003	0.004	0.005	0.006	0.008	0.034	0.153	0.101	0.008	0.005	0.007	0.009

	14	15	16	17	18	19	20	21	22	23	24
1	0.006	0.004	0.002	0.003	0.002	0.013	0.008	0.005	0.003	0.002	0.002
2	0.009	0.006	0.004	0.003	0.004	0.018	0.011	0.007	0.005	0.003	0.003
3	0.013	0.009	0.007	0.005	0.005	0.147	0.016	0.010	0.007	0.005	0.004
4	0.016	0.012	0.008	0.007	0.006	0.121	0.124	0.013	0.009	0.006	0.005
5	0.144	0.015	0.011	0.008	0.008	0.097	0.104	0.118	0.011	0.007	0.006
6	0.111	0.167	0.015	0.011	0.010	0.065	0.071	0.090	0.122	0.010	0.008
7	0.071	0.113	0.197	0.050	0.088	0.048	0.049	0.057	0.084	0.137	0.034
8	0.043	0.065	0.115	0.205	0.052	0.032	0.032	0.036	0.048	0.079	0.153
9	0.030	0.045	0.080	0.142	0.235	0.023	0.024	0.025	0.033	0.055	0.101
10	0.023	0.016	0.009	0.010	0.008	0.046	0.029	0.019	0.012	0.006	0.008
11	0.024	0.018	0.013	0.008	0.010	0.047	0.030	0.020	0.013	0.009	0.005
12	0.026	0.019	0.014	0.010	0.007	0.049	0.031	0.021	0.014	0.010	0.007
13	0.029	0.021	0.015	0.012	0.011	0.033	0.035	0.023	0.016	0.010	0.009
14	1.000	0.028	0.020	0.015	0.014	0.024	0.025	0.030	0.021	0.014	0.011
15	0.028	1.000	0.032	0.023	0.022	0.018	0.019	0.023	0.032	0.022	0.017
16	0.020	0.032	1.000	0.041	0.038	0.014	0.014	0.016	0.023	0.038	0.029
17	0.015	0.023	0.041	1.000	0.044	0.011	0.011	0.013	0.017	0.028	0.045
18	0.014	0.022	0.038	0.044	1.000	0.010	0.010	0.012	0.016	0.026	0.032
19	0.024	0.018	0.014	0.011	0.010	1.000	0.029	0.019	0.013	0.010	0.008
20	0.025	0.019	0.014	0.011	0.010	0.029	1.000	0.021	0.014	0.010	0.008
21	0.030	0.023	0.016	0.013	0.012	0.019	0.021	1.000	0.017	0.011	0.009
22	0.021	0.032	0.023	0.017	0.016	0.013	0.014	0.017	1.000	0.016	0.012
23	0.014	0.022	0.038	0.028	0.026	0.010	0.010	0.011	0.016	1.000	0.020
24	0.011	0.017	0.029	0.045	0.032	0.008	0.008	0.009	0.012	0.020	1.000

POPULATION NUMBERS (000S) 10/ 6/90

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
5	293629	279191	233536	219458	203159	192369	175401	179417	168223	186105	201475	210683	195137	218847	232608
6	229866	239604	227825	190322	178267	165195	157260	143467	146870	137621	152326	164686	168505	157740	176546
7	192404	185368	192636	180444	151781	140025	132556	128253	117177	119350	112316	124001	126051	133489	126240
8	124024	150994	143821	149806	139415	112023	106019	106494	103363	93174	96344	89819	90162	96243	104900
9	75155	93007	106103	107137	113243	97180	80336	82470	82848	79381	73288	73766	62200	63962	72220
10	43691	53176	61130	74601	76186	79164	66796	58606	59426	60281	59696	50327	48295	36568	43208
11	25498	28620	32373	39954	48518	51060	51955	44350	36368	41681	40343	34632	28650	23579	20597
12	17132	15717	15901	20605	23719	31769	31590	30263	22014	22091	22465	19885	15464	13138	10926
13	10692	9745	8203	9167	10697	16004	18692	15122	11667	11222	9376	10038	6892	6339	5291
14	5916	5327	5242	4573	4198	7090	9726	7438	5195	5401	4598	4451	2837	2859	2755
15	3207	2475	2272	2941	1718	2791	4389	2904	2268	2009	2146	1983	1258	1144	1295
16	1691	1304	808	955	1076	1097	1701	935	568	754	658	639	343	335	343
17	743	694	539	352	195	737	658	381	185	128	251	188	33	57	33
18	668	178	346	277	96	102	525	182	125	34	20	61	8	2	12
5+	1024315	1065401	1038736	1000592	952267	896607	837605	800281	756295	759229	775902	785158	745833	754302	796972

FISHING MORTALITY 10/ 6/90

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
5	0.003	0.003	0.005	0.008	0.007	0.002	0.001	0.000	0.001	0.000	0.002	0.023	0.013	0.015	0.062
6	0.015	0.018	0.033	0.026	0.041	0.020	0.004	0.002	0.007	0.003	0.006	0.067	0.033	0.023	0.075
7	0.042	0.054	0.051	0.058	0.104	0.078	0.019	0.016	0.029	0.014	0.024	0.119	0.070	0.041	0.105
8	0.088	0.153	0.094	0.080	0.161	0.132	0.051	0.051	0.064	0.040	0.067	0.167	0.143	0.087	0.107
9	0.146	0.220	0.152	0.141	0.158	0.175	0.115	0.128	0.118	0.085	0.176	0.224	0.331	0.192	0.243
10	0.223	0.296	0.225	0.230	0.200	0.221	0.210	0.277	0.155	0.202	0.344	0.363	0.517	0.374	0.377
11	0.284	0.388	0.252	0.321	0.223	0.280	0.340	0.500	0.299	0.418	0.507	0.606	0.580	0.569	0.590
12	0.364	0.450	0.351	0.456	0.193	0.330	0.537	0.753	0.474	0.595	0.606	0.860	0.692	0.709	0.686
13	0.497	0.420	0.384	0.581	0.211	0.298	0.722	0.869	0.570	0.692	0.607	1.063	0.680	0.633	0.544
14	0.671	0.652	0.378	0.779	0.208	0.280	1.009	0.988	0.750	0.723	0.641	1.064	0.708	0.592	0.524
15	0.700	0.920	0.666	0.806	0.249	0.295	1.347	1.432	0.902	0.915	1.011	1.556	1.124	1.005	0.623
16	0.691	0.683	0.631	1.390	0.178	0.311	1.298	1.418	1.294	0.898	1.051	2.776	1.596	2.118	0.623
17	1.227	0.495	0.467	1.096	0.442	0.140	1.083	0.912	1.493	1.641	1.222	2.965	2.499	1.374	0.623
18	0.484	0.509	0.385	0.549	0.202	0.313	0.716	0.850	0.559	0.655	0.632	0.979	0.711	0.689	0.623

Table 27. Parameters used in projections of biomass and yield.

Age	Jan 1, 1990 population numbers (000)	Average weight (kg)	Partial Recruitment
5	213,000	0.167	0.048
6	162,890	0.244	0.070
7	134,120	0.334	0.115
8	93,048	0.424	0.180
9	77,181	0.491	0.408
10	46,371	0.621	0.675
11	24,256	0.807	1.000
12	9,345	1.068	1.000
13	4,505	1.403	1.000
14	2,515	1.762	1.000
15	1,336	2.235	1.000
16	569	2.923	1.000
17	150	3.625	1.000
18	15	4.319	1.000
19	5	4.500	1.000
20	0	4.600	1.000

Table 28. Results of catch projection assuming catch in 1990 = 24,900 t.

POPULATION NUMBERS 17/ 6/90

	1989	1990	1991	1992
5	213000	213000	213000	213000
6	176546	162890	171793	172144
7	126240	134120	130477	138019
8	104900	93048	105932	103560
9	72220	77181	72014	82616
10	43208	46371	55626	52810
11	20597	24256	30745	37955
12	10926	9345	14529	19216
13	5291	4505	5597	9081
14	2755	2515	2698	3498
15	1295	1336	1507	1686
16	343	569	800	942
17	33	150	341	500
18	12	15	90	213
19	0	5	9	56
20	0	0	3	5
5+	777366	769306	805162	835301
6+	564366	556306	592162	622301
7+	387820	393416	420368	450157
8+	261580	259295	289891	312138

CATCH BIOMASS 17/ 6/90

	1989	1990	1991	1992
5	2128	480	415	415
6	2819	780	712	713
7	3818	1434	1208	1278
8	4092	1958	1933	1889
9	6962	4120	3349	3842
10	7692	4981	5232	4967
11	6783	4786	5345	6598
12	5310	2440	3343	4421
13	2847	1545	1692	2745
14	1810	1084	1024	1328
15	1229	730	725	812
16	427	406	504	593
17	51	133	266	391
18	22	15	84	198
19	0	6	8	55
20	0	0	3	5
5+	45990	24900	25343	30250
6+	43862	24420	25428	29835
7+	41043	23640	24716	29122
8+	37225	22206	23508	27844

POPULATION BIOMASS (AVERAGE) 17/ 6/90

	1989	1990	1991	1992
5	31199.97	32007.03	32038.54	32038.54
6	37664.51	35644.65	37646.89	37723.79
7	36339.65	39903.85	38911.19	41160.36
8	38301.20	34802.85	39767.55	38876.88
9	28647.07	32315.92	30400.96	34876.50
10	20384.42	23613.22	28708.26	27254.86
11	11489.47	15315.96	19796.14	24438.48
12	7740.03	7808.75	12380.53	16374.19
13	5237.12	4944.95	6265.64	10165.00
14	3454.54	3467.94	3793.21	4918.08
15	1972.31	2336.14	2686.83	3007.19
16	682.64	1300.22	1866.15	2196.21
17	81.55	426.28	984.90	1446.46
18	35.56	49.00	310.22	733.41
19	0.00	18.85	31.19	202.01
20	0.00	0.00	11.77	19.92
5+	223230.06	233955.61	255599.98	275431.89
6+	192030.09	201948.58	223561.43	243393.35
7+	154365.58	166303.93	185914.55	205669.56
8+	118025.93	126400.08	147003.36	164509.20

FISHING MORTALITY 17/ 6/90

	1989	1990	1991	1992
5	0.068	0.015	0.013	0.013
6	0.075	0.022	0.019	0.019
7	0.105	0.036	0.031	0.031
8	0.107	0.056	0.049	0.049
9	0.243	0.128	0.110	0.110
10	0.377	0.211	0.182	0.182
11	0.590	0.313	0.270	0.270
12	0.686	0.313	0.270	0.270
13	0.544	0.313	0.270	0.270
14	0.524	0.313	0.270	0.270
15	0.623	0.313	0.270	0.270
16	0.625	0.313	0.270	0.270
17	0.622	0.313	0.270	0.270
18	0.607	0.313	0.270	0.270
19	0.000	0.313	0.270	0.270
20	0.000	0.313	0.270	0.270
5+	0.143	0.065	0.060	0.064

Table 29. Results of catch projection assuming catch in 1990 = 40,000 t.

POPULATION NUMBERS 17/ 6/90

	1989	1990	1991	1992
5	213000	213000	213000	213000
6	176546	162890	169948	172144
7	126240	134120	128439	136537
8	104900	93048	103227	101942
9	72220	77181	69156	80506
10	43208	46371	50748	50714
11	20597	24256	26414	34627
12	10926	9345	11602	16509
13	5291	4505	4470	7251
14	2755	2515	2155	2794
15	1295	1336	1203	1347
16	343	569	639	752
17	33	150	272	399
18	12	15	72	170
19	0	5	7	45
20	0	0	3	4
5+	777366	769306	781353	818740
6+	564366	556306	568353	605740
7+	387820	393416	398405	433596
8+	261580	259295	269967	297059

CATCH BIOMASS 17/ 6/90

	1989	1990	1991	1992
5	2128	821	415	415
6	2819	1331	704	713
7	3818	2436	1189	1264
8	4092	3303	1883	1860
9	6962	6788	3216	3744
10	7692	7989	4773	4770
11	6783	7442	4592	6020
12	5310	3794	2669	3798
13	2847	2403	1351	2192
14	1810	1685	818	1060
15	1229	1135	579	648
16	427	632	402	474
17	51	207	212	312
18	22	24	67	158
19	0	9	7	44
20	0	0	3	4
5+	45990	40000	22881	27476
6+	43862	39179	22466	27061
7+	41043	37848	21762	26348
8+	37225	35412	20573	25084

POPULATION BIOMASS (AVERAGE) 17/ 6/90

	1989	1990	1991	1992
5	31199.97	31841.00	32038.54	32038.54
6	37664.51	35375.75	37242.56	37723.79
7	36339.65	39412.13	38303.25	40718.30
8	38301.20	34137.09	38751.94	38269.47
9	28647.07	30954.46	29194.53	33985.80
10	20384.42	22021.48	26190.61	26173.28
11	11489.47	13846.80	17007.23	22295.28
12	7740.03	7059.71	9886.45	14067.37
13	5237.12	4470.61	5003.41	8117.24
14	3454.54	3135.28	3029.06	3927.32
15	1972.31	2112.05	2145.57	2401.38
16	682.64	1175.50	1490.21	1753.78
17	81.55	385.39	786.49	1155.07
18	35.56	44.30	247.72	585.67
19	0.00	17.04	24.90	161.32
20	0.00	0.00	9.40	15.91
5+	223230.06	225988.60	241351.87	263389.51
6+	192030.09	194147.60	209313.33	231350.97
7+	154365.58	158771.84	172070.77	193627.18
8+	118025.93	119359.71	133767.52	152908.88

FISHING MORTALITY 17/ 6/90

	1989	1990	1991	1992
5	0.068	0.026	0.013	0.013
6	0.075	0.038	0.019	0.019
7	0.105	0.062	0.031	0.031
8	0.107	0.097	0.049	0.049
9	0.243	0.219	0.110	0.110
10	0.377	0.363	0.182	0.182
11	0.590	0.537	0.270	0.270
12	0.686	0.537	0.270	0.270
13	0.544	0.537	0.270	0.270
14	0.524	0.537	0.270	0.270
15	0.623	0.537	0.270	0.270
16	0.625	0.537	0.270	0.270
17	0.622	0.537	0.270	0.270
18	0.607	0.537	0.270	0.270
19	0.000	0.537	0.270	0.270
20	0.000	0.537	0.270	0.270
5+	0.143	0.111	0.057	0.062

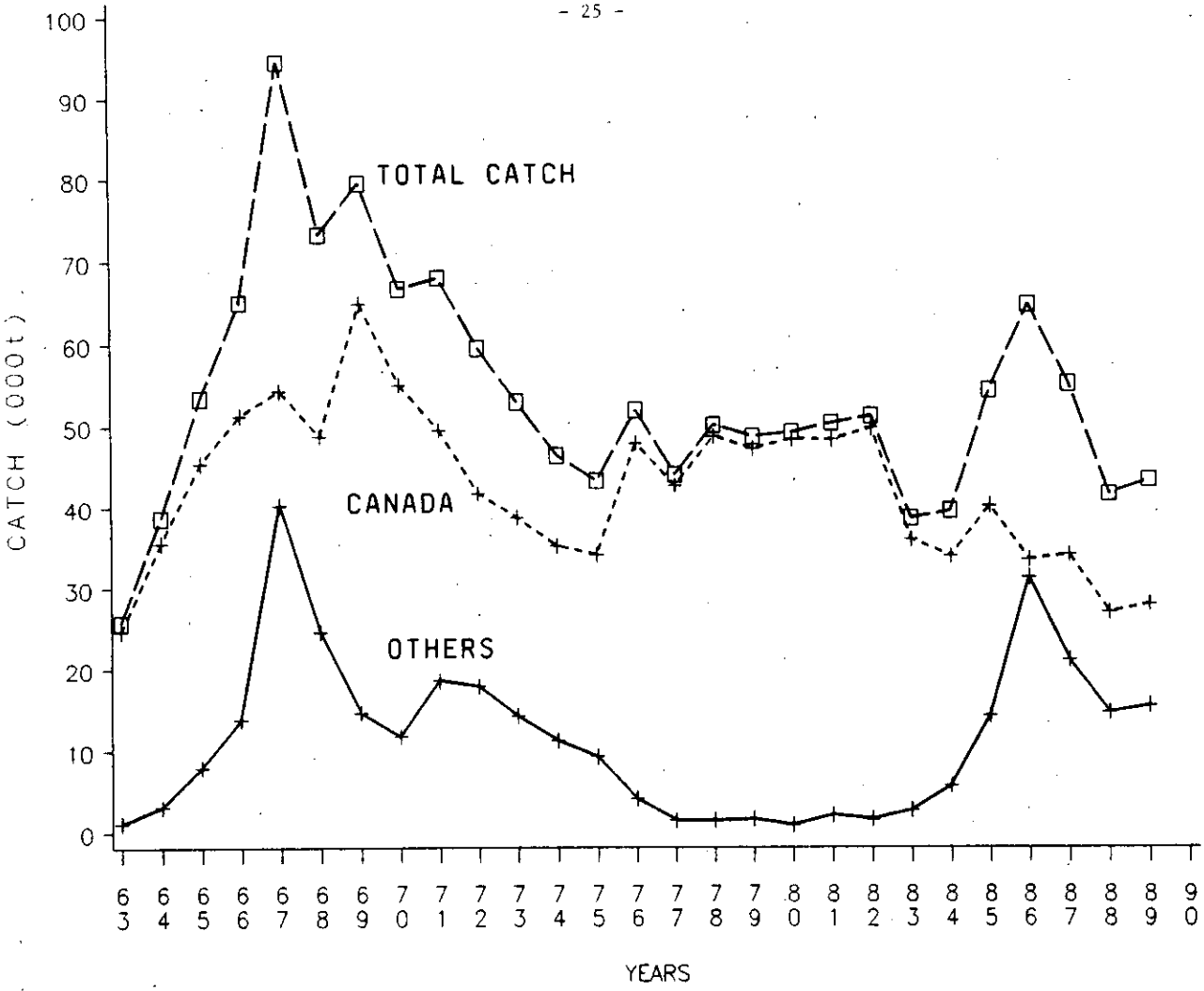


FIG.1. A.PLAICE CATCHES IN DIV.3LNO.

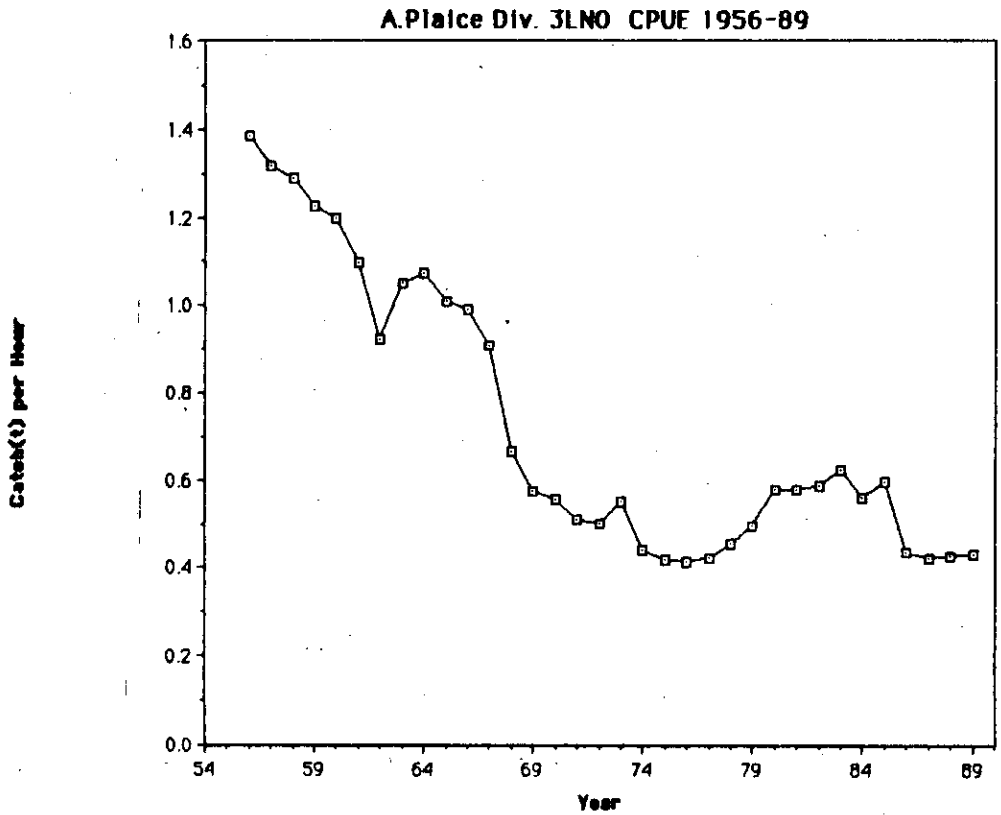


FIG.2. Commercial catch rates of A.plaice in Div. 3LNO from 1956-89.

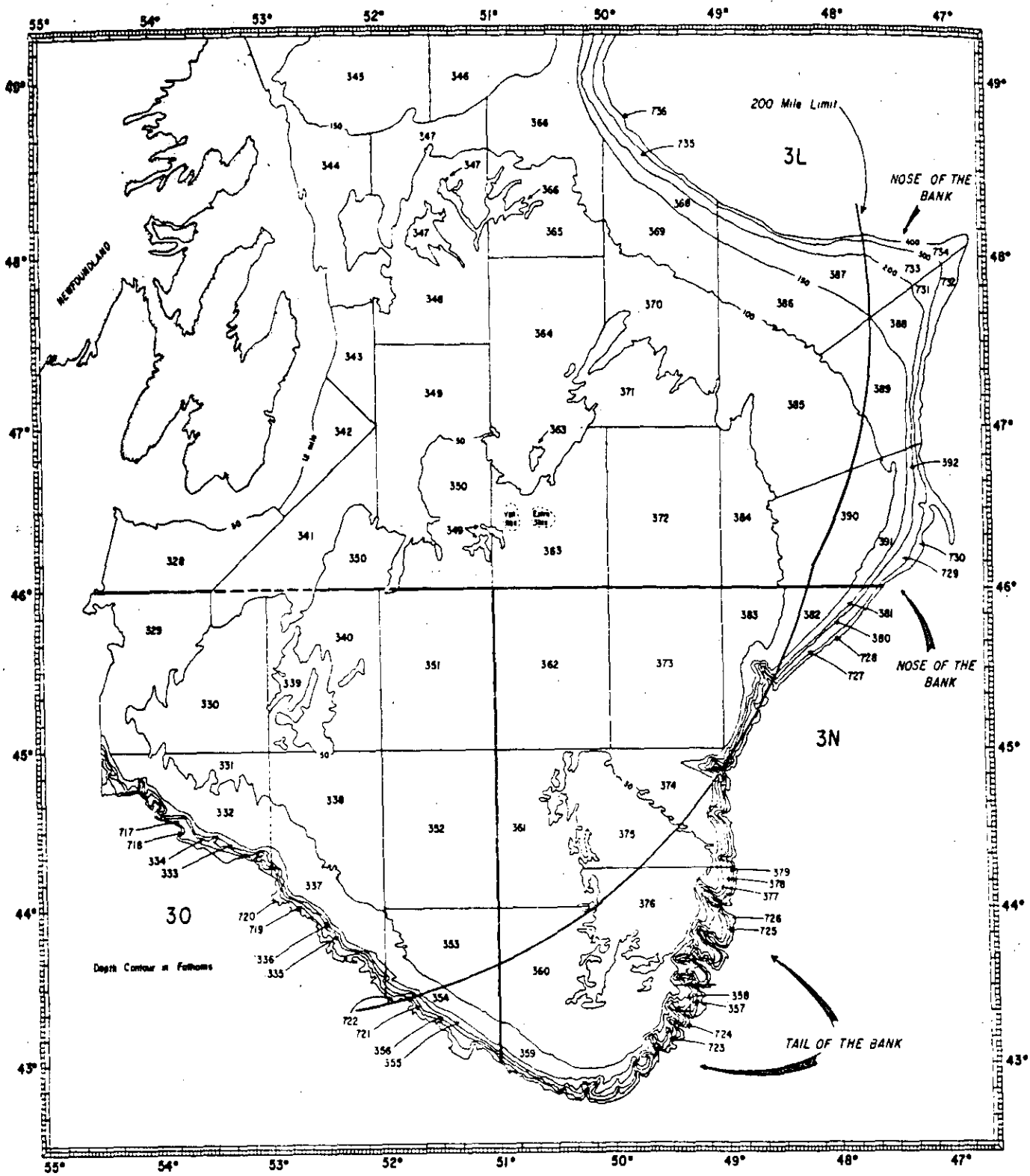


Fig.3. NAFO Div. 3LNO, showing the Canadian 200 mile limit in relation to the Nose and Tail of the Bank, as well as the stratification scheme used in Canadian groundfish surveys.

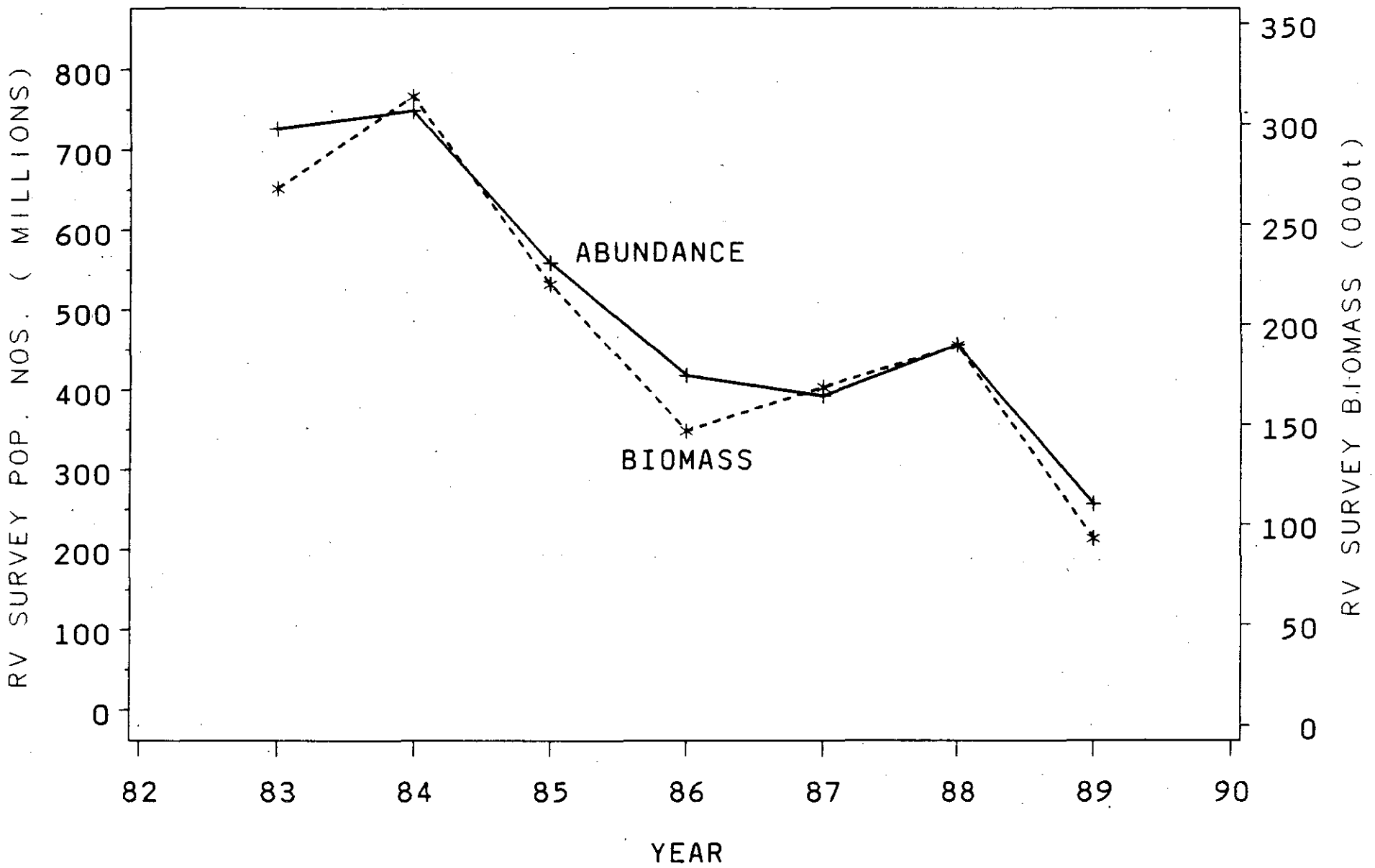


FIG.4. ABUNDANCE AND BIOMASS OF A.PLAICE FROM FALL SURVEYS IN DIV 3L.

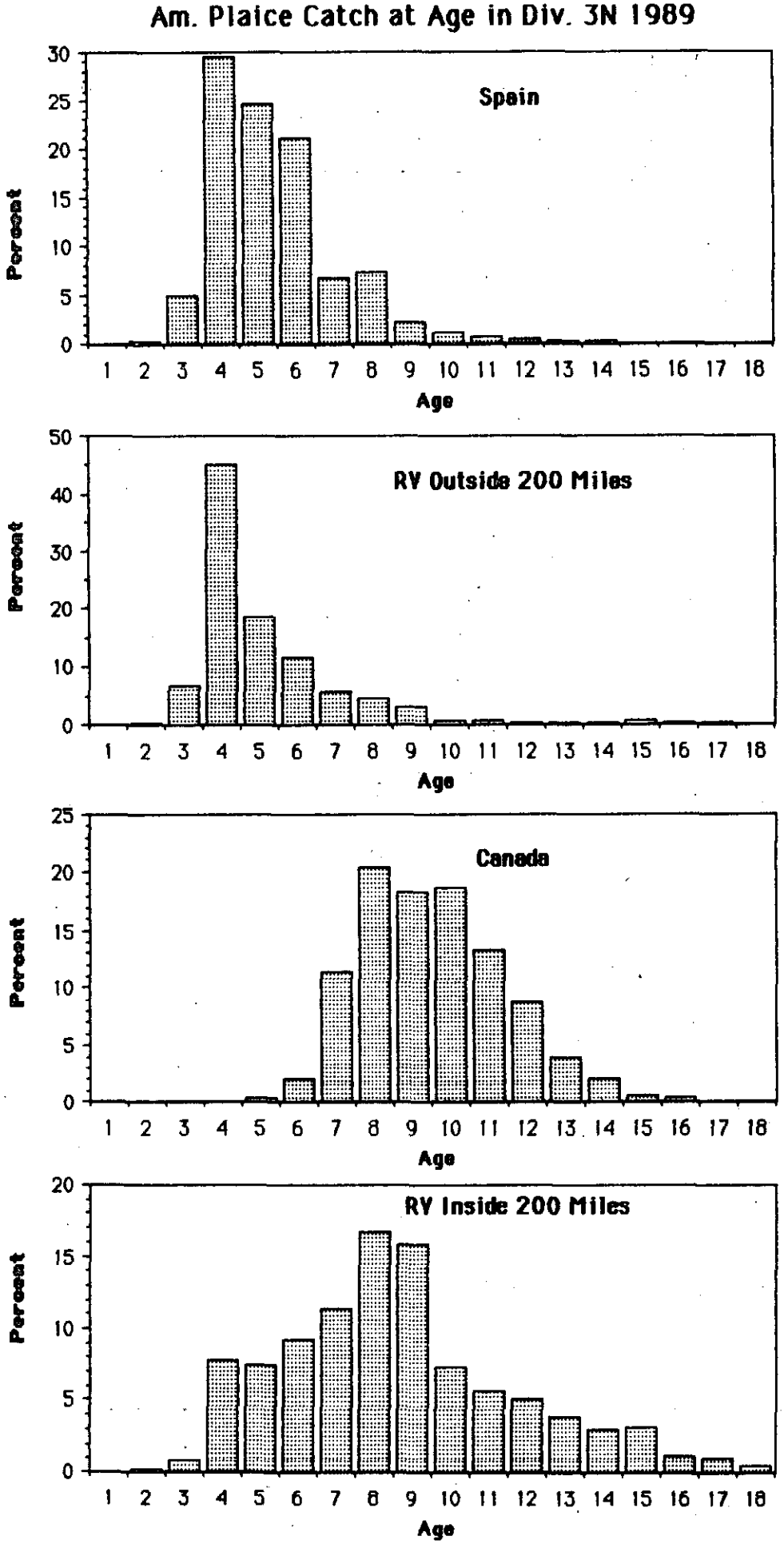
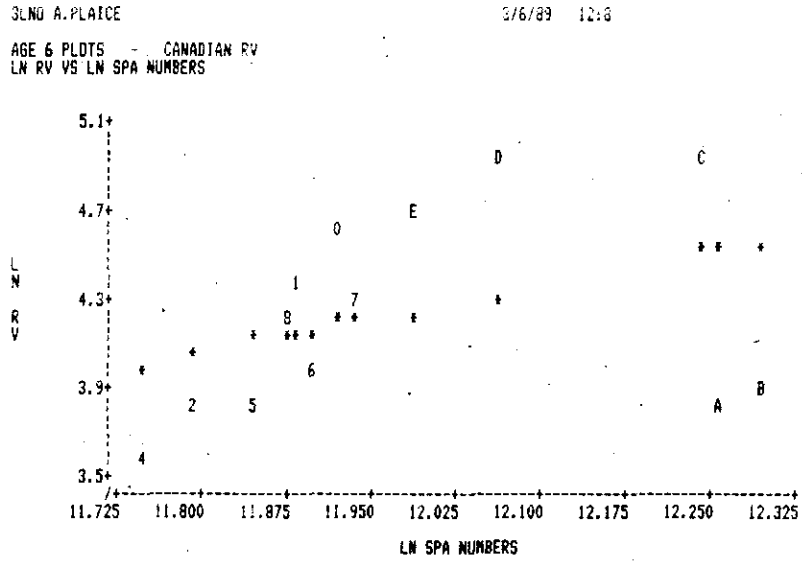
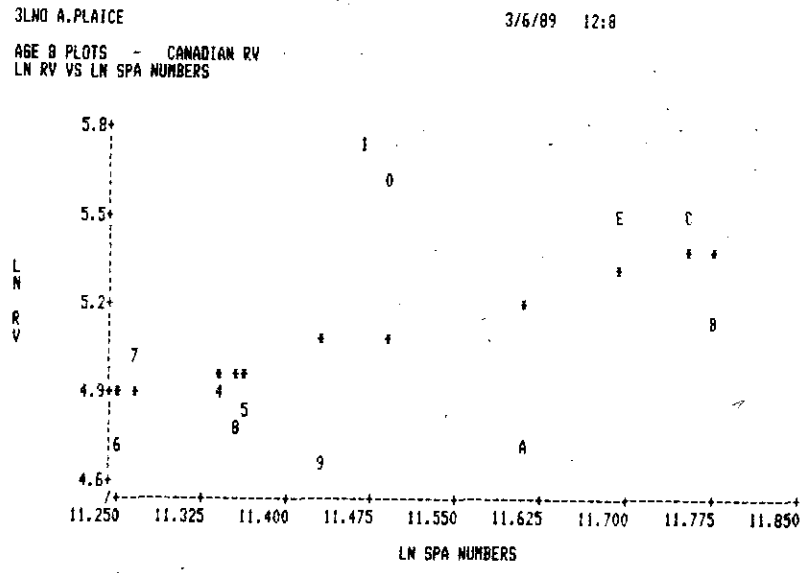
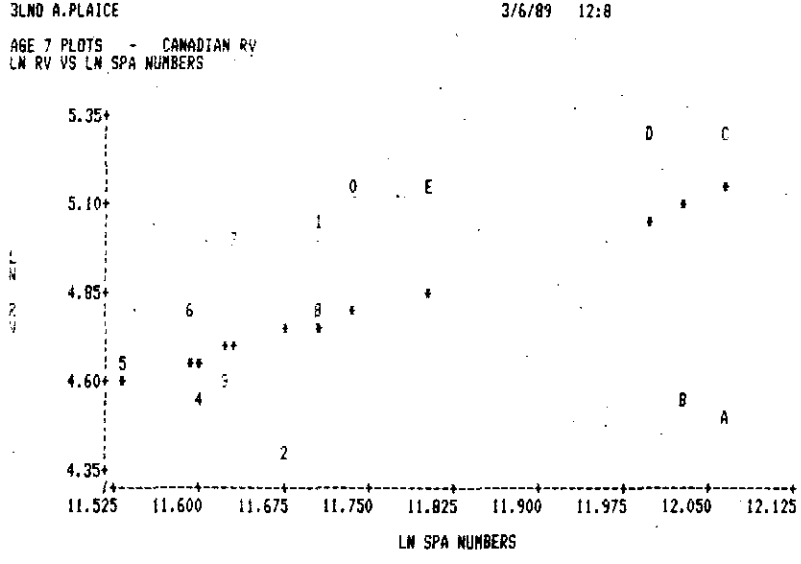


FIG.5. Comparison of age compositions of A.plaice in Div.3N in 1989.







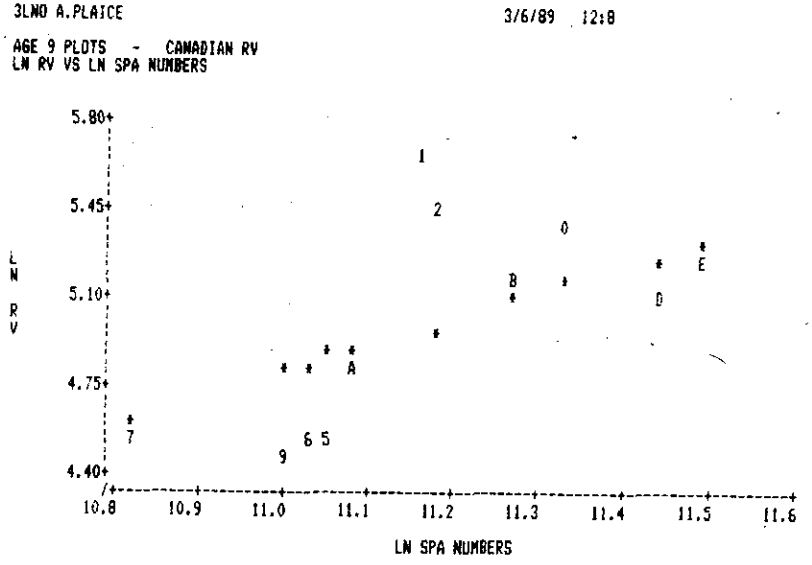
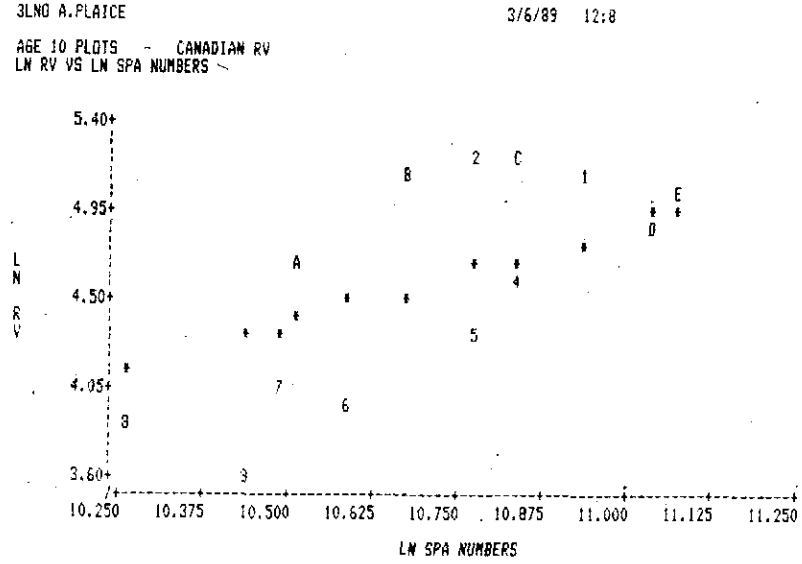


Fig.6. Age by age plots (ln rv survey nos vs ln SPA nos) from ADAPT calibration



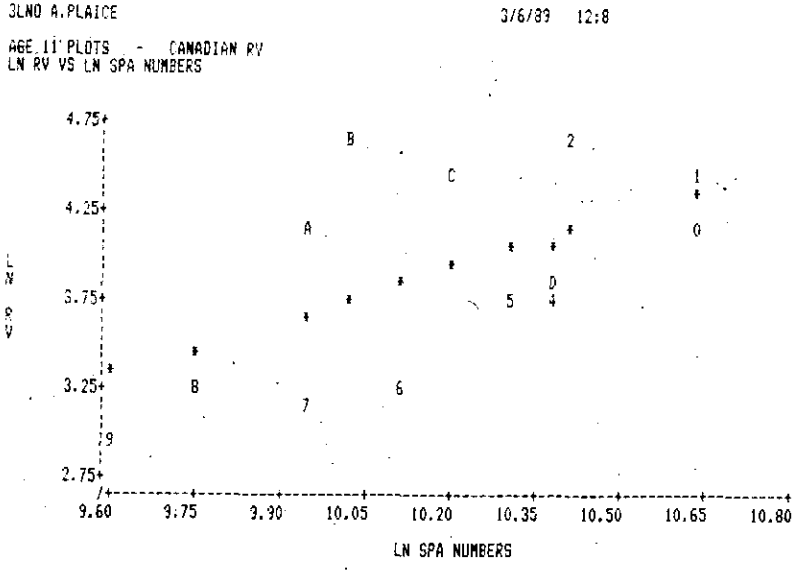
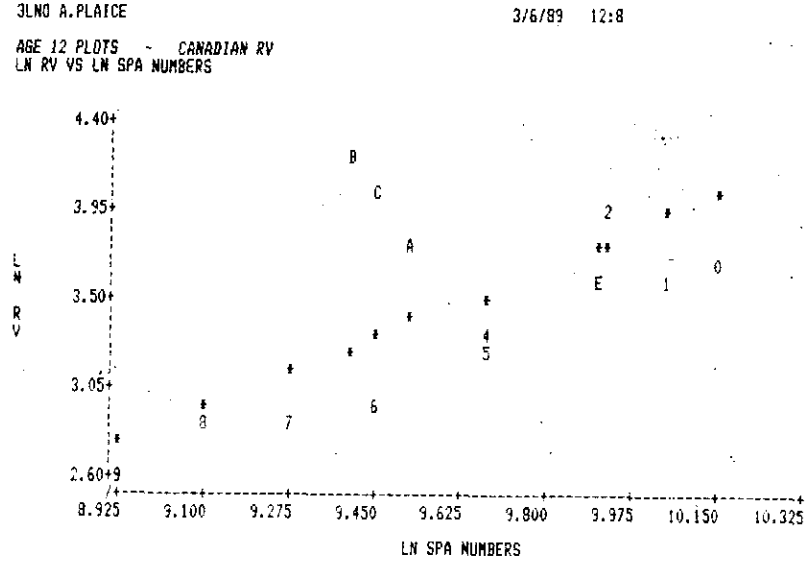


Fig.6. Continued.



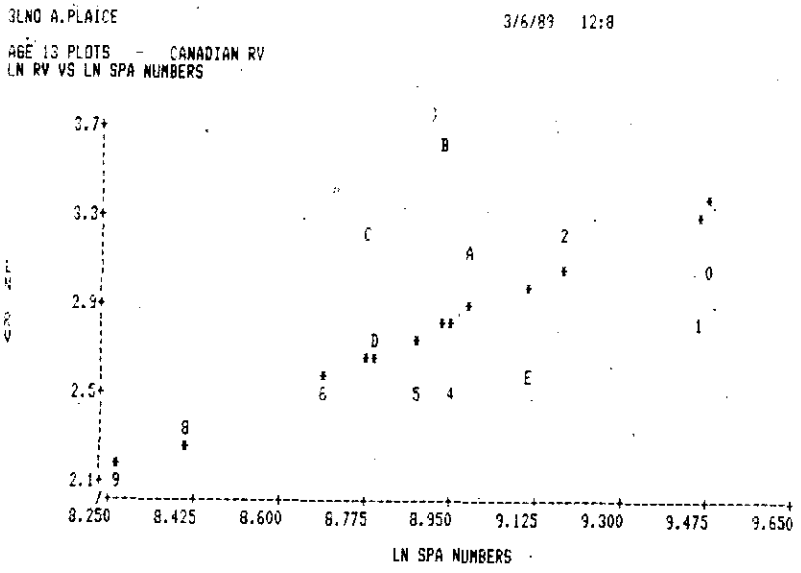


Fig.6. Continued.

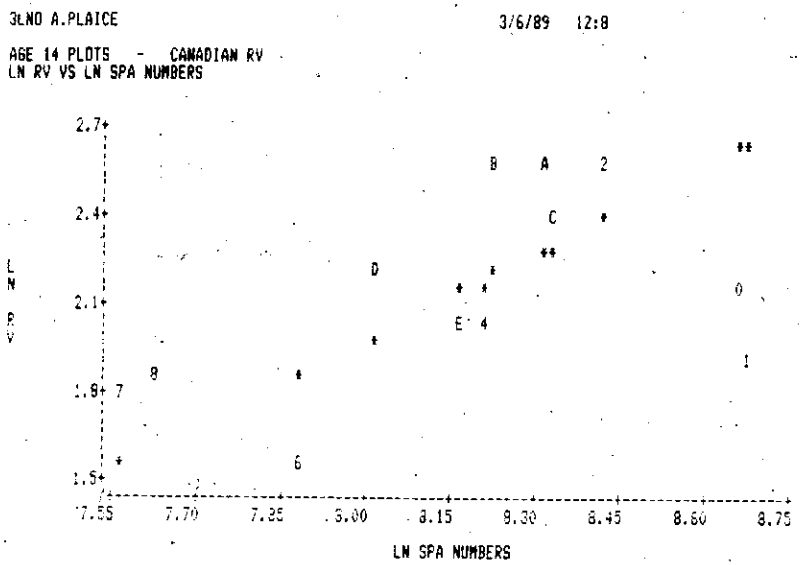
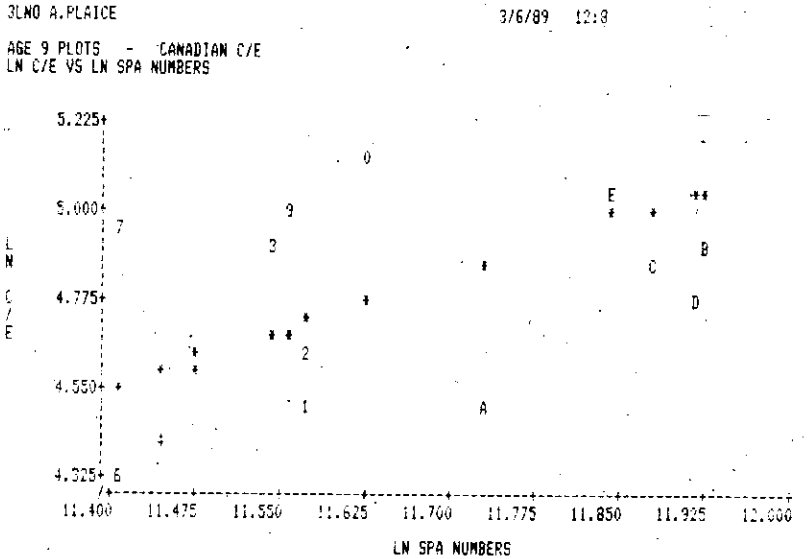


Fig.5. Continued.



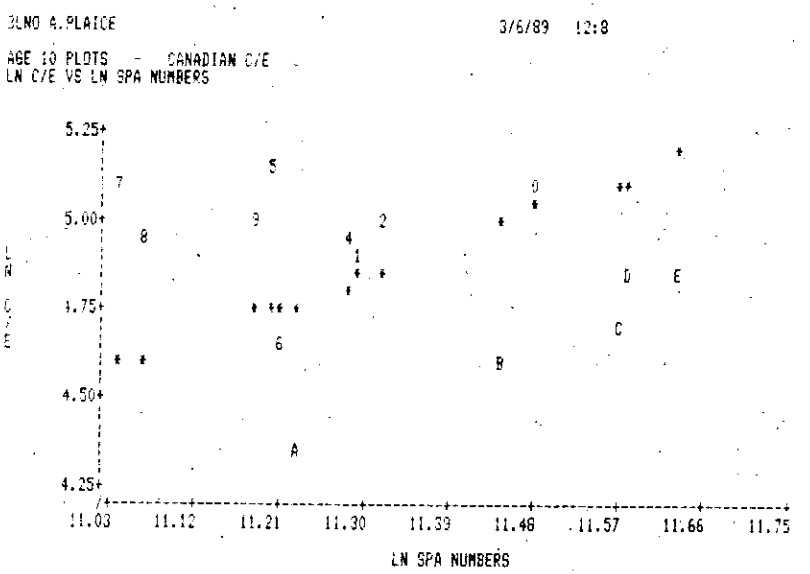
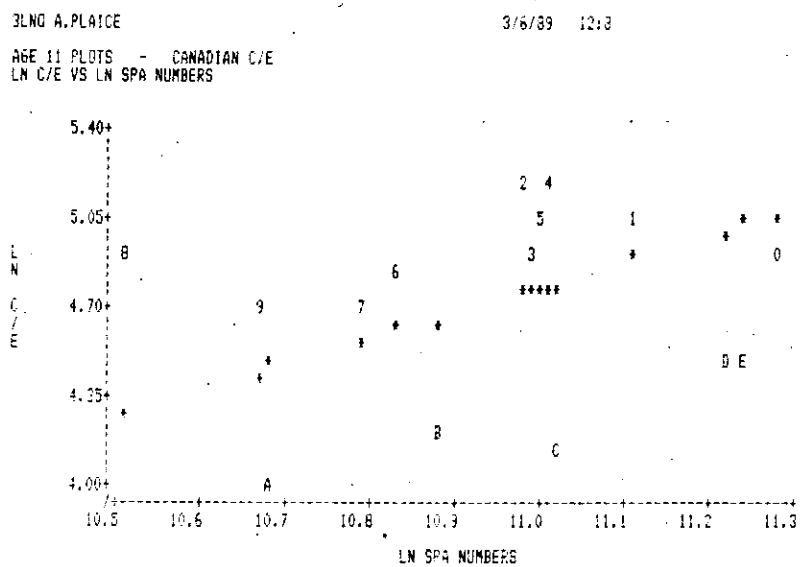


Fig.7. Age by age plots (ln c/e vs ln SPA nos) from ADAPT calibration.



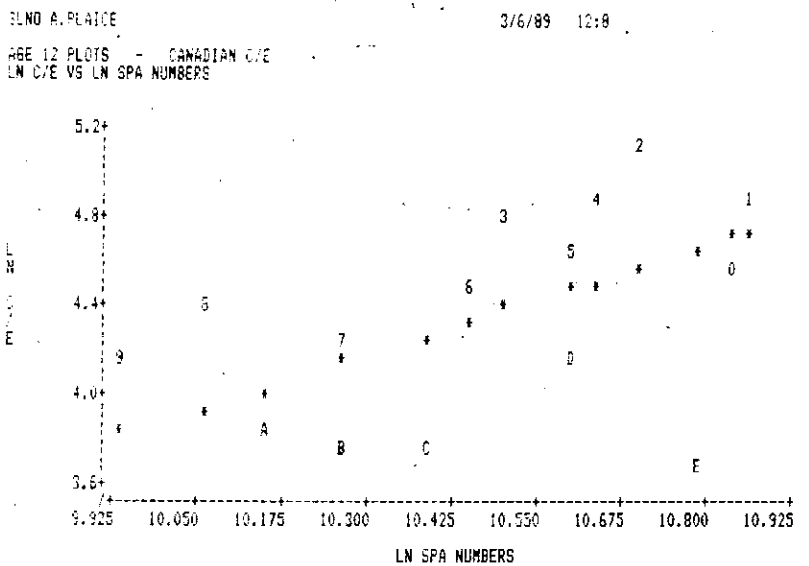
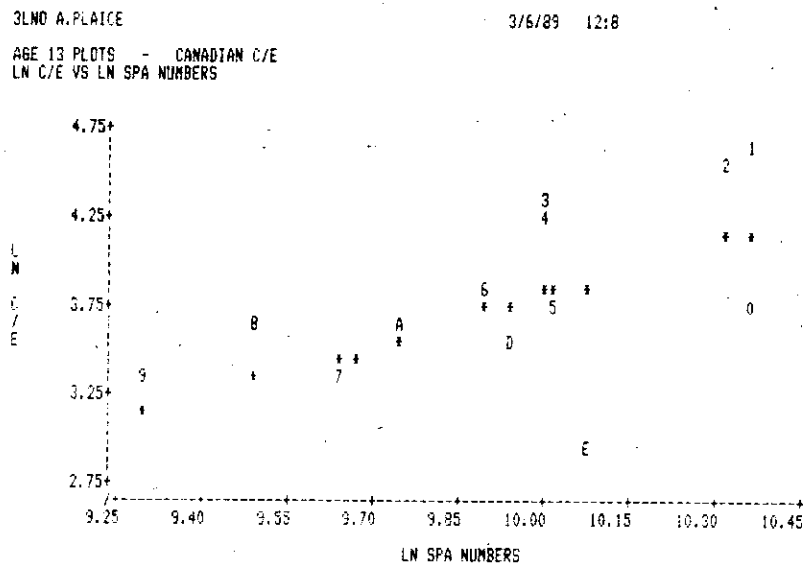


Fig.7. Continued.



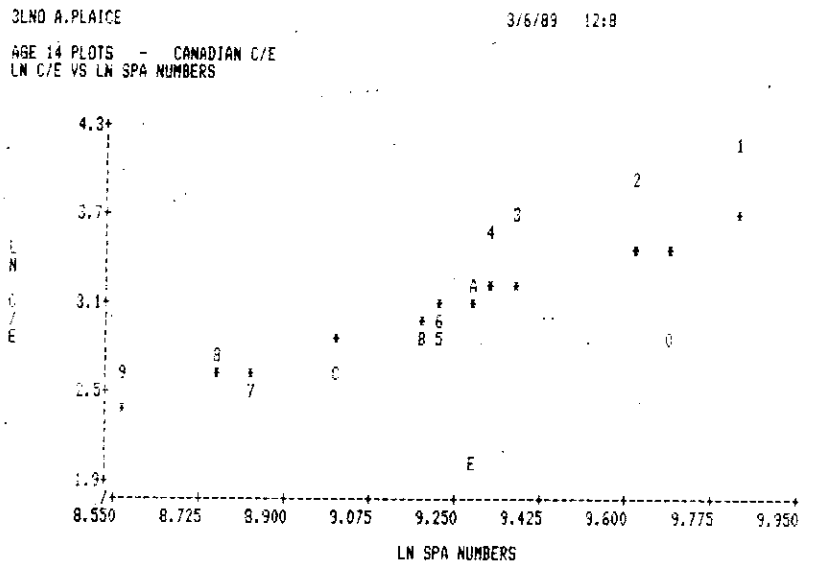


Fig.7. Continued.