Northwest Atlantic Fisheries Organization

Serial No. N1614

NAFO SCR Doc. 89/37

SCIENTIFIC COUNCIL MEETING - JUNE 1989

An Assessment Update for the American Plaice Stock in Divisions 3LNO

by

W. B. Brodie and W. R. Bowering

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

Introduction

TAC regulation

This stock has been under TAC Regulation since 1973 when a TAC of 60,000 t was established. Up to 1987, the TAC has ranged from 47,000 t to 60,000 t annually. An assessment in 1987 suggested that the stock had declined markedly and indicated an $F_{0.1}$ catch in 1988 of 33,000 t. However, the Scientific Council of NAFO was not firmly convinced at that time that the stock had declined to the extent indicated; and an interim TAC of 40,000 t was suggested pending the results of the 1988 assessment. The coastal state, in the meantime, agreed to restrict its catch to 33,000 t should the 1988 assessment confirm the advice given, which indicated an effective TAC in 1988 of 33,585 t. The 1988 assessment did, in fact, confirm the 1987 advice; and the TAC for 1988 was then placed at 33,000 t with a recommended $F_{0.1}$ catch in 1989 of 30,300 t.

Catch trends

The offshore fishery for this stock essentially began in the late 1940s, and the nominal catch reached a maximum of 94,000 t in 1967 (Table 1a, Fig. 1). After a period of considerable foreign involvement in the fishery in the 1960s and early 1970s, catches were almost exclusively Canadian from the late-1970s to early-1980s, after the declaration by Canada of a 200-mile limit. Catches by non-Canadian vessels increased from about 1,400 t in 1982 to over 27,000 t in 1986, as many nations either joined the fishery for the first time or directed fleets at flatfish for the first time (Table 1b). Catches by Spain and Portugal were primarily responsible for this increase, totaling over 21,000 t in 1986. In 1987, the preliminary estimate of non-Canadian catch is considerably lower than 1986 but is still higher than the 1985 value. Catches by Canadian vessels have remained relatively stable between 33,000 t and 40,000 t from 1983 to 1987 but declined to about 27,000 t in 1988, the lowest level since 1963. In most years since 1972, the inshore catch comprised slightly less than 10% of the total Canadian catch from the stock (Table 2), with gillnets being the predominant gear in this sector. Some offshore vessels began using Scottish seines in 1987; and in 1988, the total catch by this gear was about 300 t.

After a long period (1973-82) of relatively stable catches in the 43-53,000 t range, the catch declined to about 39,000 t in 1983 and 1984, then increased to 54,000 and 61,000 t in 1985 and 1986 respectively. The preliminary estimate for 1987 is about 53,000 t. For 1988, the preliminary estimate is 38,000 t. In 1987, the decrease occurred almost exclusively in Div. 3N (Table 3) where a substantial reduction in effort directed at flatfish by foreign vessels was observed by Canadian surveillance personnel. This trend continued in 1988 and, as can be seen in Table 1b, many countries caught much less A. plaice in 1987-88 than 1986. The same magnitude of decline was also observed for yellowtail, which is often caught in the same area in Div. 3N as A. plaice. Canadian surveillance personnel reported that the catch rates of these flounder species by vessels of many nations were much lower in 1987 and that these vessels diverted much of their effort towards redfish and other species in deeper water in the NAFO Regulatory Area in 1987 and 1988. However, there are indications that at least some of this effort is now being redirected towards flounders thus far in 1989. Catches in Div. 3L and 3Ø have been relatively constant in most recent years, although the catch in Div. 3L in 1988 was somewhat lower than recent values.

The fishery in all three divisions is usually carried out on a 12-month basis in most years. In the past 4 years, catches have generally peaked in the 3rd and 4th quarters, although a considerable portion of the catch in Div. 3N in 1985 and 1986 is not available by month.

Stock Assessment

Catch sampling, 1988

CANADA

Length frequencies and otoliths were available from the Canadian fishery in Div. 3LNO in 1988. The level of sampling from the Canadian fishery remains high for this stock, as shown in Table 4, which also indicates how the catch at age from this fishery was derived. The resulting catch at age and average weights at age are shown in Table 5.

USA

Numbers at length were available from the USA catch in Div. 3LNO for all months combined. To determine the age composition (Table 6), an age length-key (sexes combined) from the Canadian fishery in Q3 in Div. 3N was used, as this corresponded to the time and division where the majority of the USA catch occurred.

SPAIN

Numbers at age from the Spanish freezer trawler fishery in Div. 3NO in 1988 were available in SCS Doc. 89/16. From average lengths at age provided for this catch and the standard length weight relationship, average weights at age were derived (Table 6). Approximately 77% (by number) of the Spanish catch consisted of plaice aged 8 and younger, compared to about 10% in the Canadian catch and about 20% in the USA catch.

PORTUGAL

Length frequencies from the Portuguese catch in 1988 were available in SCS Doc. 89/15. However, no age compositions were available; and due to time constraints, no catch at age was derived for these data at this time.

Catch sampling, Div. 3LNO, 1974-88

In 1988, STACFIS recommended that the available sampling information from Div. 3Ø be examined and, if possible, the catch at age for this portion of the stock be incorporated into the assessment, which had been done on the Div. 3LN portion only. This has been done, and the resulting catch at age is now for Div. 3LNO for the period 1974-88 (Tables 7 and 8). Prior to 1974, the sampling was not adequate in Div. 3Ø to allow calculation of the catch at age for the substantial catches in that division (Table 3). Tables 9 and 10 show the corresponding mean weights at age and catch biomass at age respectively for the entire stock (Div. 3LNO). The addition of the data for Div. 3O did not change substantially the pattern of catch at age and average weights at age for the stock.

For the 1988 fishery overall, about 26% of the catch numbers were ages 5-8, compared to about 37% and 30% in 1986 and 1987 respectively. Both in absolute numbers and percentage, the catch of fish aged 12+ remained very low in 1988.

Commercial CPUE data

A multiplicative model was used in the analysis of catch/effort data for this stock, using the data described in Table 11. It should be noted that an error in the effort data was discovered, affecting the years 1984-87. This resulted in underestimates of up to 12-15% for the effort in some years, with 1984 having the largest discrepancy. Figure 2 shows a comparison of the years 1983-87 from the 1988 analysis compared with the results using the corrected data. Tables 12-13 and Figure 3 show the results of the multiplicative analysis using the data for Div. 3LNO combined, as opposed to Div. 3LN only, which has been the index used in previous assessments. As can be seen in Figure 4, the trends are virtually the same for Div. 3LN vs Div. 3LNO. The CPUE for 1986 ØØ remains at a very low level (similar to that observed in the mid-1970s) following a period of relatively good and stable catch rates in the early- to mid-1980s.

Research vessel surveys

a) Biomass estimates, 1984-89 (post-A. T. CAMERON era)

Tables 14-16 show the results (average weight per tow) on a stratified basis, from Canadian spring surveys conducted in Div. 3L, 3N, and 3Ø from 1971-82 and 1984-89.

Figure 5 shows the stratification scheme used in these surveys. In Div. 3L, the biomass has remained relatively stable from 1985-88, ranging from 174,000 t to 193,000 t. However, the estimate for 1989 is somewhat lower at 153,000 t. In Div. 3N, the estimate of biomass declined from about 60,000 t in 1984-85 to 43,000 t in 1989. In Div. 3Ø, the biomass has fluctuated between 44,000 t and 77,000 t in the past six surveys, with the 1989 estimate being the lowest.

In addition to the annual spring surveys in Div. 3LNO, a number of seasonal surveys have been conducted by Canadian vessels in Div. 3L from 1983 to 1988. Coverage in all these surveys was virtually complete to depths of 200 fath (366 m) in all years, and in some years was extended to 400 fath (732 m). In 1983-84, the average biomass was about 290,000 t. In 1985, the average from the four surveys was 209,000 t; and three of the four estimates were between 212,000 and 227,000 t. 1986 produced three widely-different estimates with the winter value clearly being an anomaly at about 49,000 t. In 1987, three surveys indicated a biomass between 168,000 and 202,000 t, with the average (184,000 t) being very close to the 2 estimates (spring and fall) for 1988 of about 190,000 t.

To examine the biomass in the NAFO regulatory area in Div. 3N, all the strata less than 201 fath (368 m) which have all or almost all their area in this zone were selected (Table 17). These strata show a steady decline from 1984 to 1988, totaling 79%. However, in 1989, the biomass increased to slightly above the 1987 level. In 1984-86 these strata in the regulatory area contained about 26% of the total biomass in Div. 3N. This figure declined to about 13% in 1987 and about 11% in 1988 and rose to about 19% in 1989. These figures are not inconsistent with the increase in catch in the regulatory area in Div. 3N up to 1986 and the large decrease observed in 1987 and 1988. The slight increase in 1989 is also consistent with preliminary reports of increased effort on flounders on the Tail of the Bank in 1989 compared to 1988.

b) Population estimates for Div. 3L, 3N, and 3Ø

i) Comparison of surveys from 1971 to 1982 with those from 1983 to 1988, Div. 3LNO.

As has been noted in all recent assessments of this stock, the surveys carried out prior to 1983 were done by the side trawler A. T. CAMERON towing a Yankee 41.5 otter trawl; and those from 1983 onward have been done by either of the identical vessels, the WILFRED TEMPLEMAN and the ALFRED NEEDLER, towing an Engels otter trawl. An analysis of a comparative fishing experiment showed that there were differences in the two vessel-gear types (side vs stern) in their ability to catch A. plaice. Appropriate conversion factors were derived and have been applied to the length frequency data from the A. T. CAMERON catches to make them comparable with catch data from the later period. This methodology has been used in the assessments of this stock since 1984.

To provide an estimate of abundance comparable over the 1971-88 period for Div. 3L, 3N, and 3Ø, a multiplicative model was employed, using year and stratum effects to fill in values for strata not fished in a given year. The data used were the mean number of A. plaice per tow from each stratum less than 201 fath in Div. 3LNO from the series of surveys shown in Tables 14-16. The numbers prior to 1983 were adjusted using the conversion factors noted previously, and all data were increased by 0.5 to allow logarithms of zero catches to be included in the model. Regressions were done separately by divisions, using stratum areas to weight. This procedure was followed for Div. 3LN in the 1988 assessment with Div. 3Ø being included in this assessment.

In Div. 3L, stratum 350 was chosen as the standard; in Div. 3N, stratum 362 was selected; and in Div. 3Ø, stratum 351 was chosen - these being strata with no missing observations. In all analyses, 1985 was chosen as the standard for year, as no strata were missed in that year. Tables 18-20 show, for Div. 3L, 3N, and 3Ø respectively, the estimates of abundance estimated by the model for missed strata, as well as the total estimated abundance for each year, weighted by stratum area.

To obtain age-by-age estimates of abundance from the surveys, age compositions from the same surveys were applied to the abundance estimates from the multiplicative analysis. Results of these analyses are given in Tables 21-23 for Div. 3L, 3N, and 3Ø respectively. In Div. 3L, it is obvious that the abundance in recent years is considerably lower than that observed from 1976 to 1982, when a number of strong year-classes were present in the population. Although the recent surveys indicate that the early 1980s year-classes may be somewhat higher than those of the late 1970s, the estimates of these year-classes in the 1987 and 1988 surveys are still well below the estimates observed for strong year-classes at the same ages in earlier surveys. It should be noted that the biomass estimate from the 1989 survey is about 20% lower than the 1988 survey.

In Div. 3N, the abundance estimates have shown more fluctuation over the series; but it is again clear that the abundance in 1986-88 is substantially lower than average and is probably at the lowest level in the 17-year series. Unlike Div. 3L, there is no evidence of better than average recruitment in the 1987 and 1988 surveys. The 1989 biomass estimate approximated the average value from the 1986-88 surveys in Div. 3N.

In Div. 3Ø, the estimates of abundance show even more variability than Div. 3N; however, 1986, 1988, and 1989 represent the three lowest estimates in the 14-year series.

ii) Fall surveys, Div. 3L

From Tables 24-25, it can be seen that the population estimates from fall surveys in Div. 3L are much lower in 1985-88 than those from 1981 to 1984. Although ages 7 and 8 are dominant in the fall 1988 survey, as they were in the spring 1988 survey, these year-classes do not appear as strong (relative to others at the same age) as indicated in the spring series. The numbers of A. plaice aged 8+ and 12+ were very similar in the 1987 and 1988 fall surveys.

Sequential population analysis

Several formulations of the adaptive framework were attempted to determine the stock size in 1988. For the CPUE fits with fishable biomass (using both annual and average partial recruitment for the years 1975-88), there were trends in the residuals which were not acceptable. These trends were also present in the formulations using 8+ and 10+ population biomass, but were not present to the same extent in the 12+ formulation. Consequently, this formulation was felt to represent the best fit with the CPUE data and showed that the fully-recruited fishing mortality in 1988 was 0.5. However, it was noted that the population sizes at ages 5-9 were in conflict with the survey information, primarily because the partial recruitment values used for these ages were not well estimated.

Using the Canadian survey data (Table 26) for Div. 3LNO for 1975-88 (excluding 1983, when no survey was conducted), and estimating ages 6-15, the adaptive framework showed fully-recruited fishing mortality in 1988 to be about 0.9. However, it was noted that fishing mortality values for ages 10+ were very high compared to most years; and it was felt that these values were not realistic. The estimates at all ages were significant, and this formulation did not require estimates of partial recruitment to determine the population sizes.

These calibations for this stock using the ADAPT method show the same divergence in the indices that was shown in recent assessments. In 1988, the CPUE index showed F to be about 0.5, while the RV survey index showed F to be about 0.7 or higher. Since the divergence was somewhat wider in this assessment (0.5 to 0.9), it was concluded that it would not be appropriate to average the fishing mortalities, as was done in 1988. Therefore, it was decided to use the population estimates at ages 6-9 from the survey formulation and the population at ages 10+ from the CPUE run. Although these were the more optimistic parts of each formulation, these population estimates were more reasonable than those in total from one formulation or the other. That is, the CPUE index was a better indicator of population size at older ages; and the research vessel surveys were a better index of the population of younger fish.

The formulations of ADAPT used are shown in Appendix 1. Results from the CPUE formulation are shown in Table 27 and Figure 6, while the RV survey results are shown in Table 28 and Figures 7-16.

Assessment results

The SPA accepted for this stock is shown in Table 29. This indicates that F increased over the 1983-86 period then declined somewhat in 1987 and 1988. Fully-recruited F in 1988 was 0.5 and was calculated to be 0.6 in 1987, agreeing with the estimate for 1987 in last year's assessment. The population size at ages 8+ was relatively stable from 1983-86 but declined about 12% in 1987 and a further 8% in 1988. The fully-recruited population (ages 12+) sizes in 1987 and 1988 were virtually unchanged and remain at close to the lowest levels in the 15-year series of the SPA. The assessment also indicated that the 1978-80 year-classes were lower than average but that the 1981 and 1982 year-classes were slightly larger, although they are still lower than those of the late-1960s and early-1970s.

Catch projections

The population sizes from the ADAPT formulations described previously were used to project catches for 1990. The population at age 5 in 1989 and 1990 was taken as the geometric mean from 1974-87. The average weights-at-age and the partial recruitment were averages from 1986-88 (Table 30).

The following table contains a summary of the catch projections at (a) $F_{0.1}$ in 1990, (b) catch in 1990 = catch in 1988, and (c) $F_{90} = F_{88} = 0.5$, assuming a catch of 30,300 t in 1989. Results of these catch projections are shown in Table 31, for the $F_{0.1}$ option only.

F in 1990	Catch in 1990 ('000 tons)	9+ Biomass on January 1, 1991 ('000 tons)
(a) 0.26	24.9	152
(b) 0.42	38.1	140
(c) 0.50	44.4	134

The table below shows the summary for the same data, assuming a catch in 1989 of 40,000 t. These latter options represent the situation if an overrun of the 1989 TAC of about 30% occurs.

F in 1990	Catch in 1990 ('000 tons)	9+ Biomass on January 1, 1991 ('000 tons)
(a) 0.26	23.1	145
(b) 0.42	35.6	133
(c) 0.50	41.4	128

These projections are for the entire stock (Div. 3LNO); and no figure for Div. 3Ø is to be added, as has been the case in previous assessments. No projections were done at F_{max} as this is not a meaningful reference point for this stock when the current Y/R analysis is used. The decline in the projected $F_{0.1}$ catch for 1990 was due, in part, to the overrun of the 1988 TAC and, in part, to the fact that the 1989 TAC would generate a fishing mortality above $F_{0.1}$, as based on the current assessment.

At the present time, there is no control over the catch by non-member countries. TACs have been exceeded in recent years; and if this continues, the stock will be difficult if not impossible to manage. This is of particular concern given that a very high proportion of young American plaice is found in the Regulatory Area and, therefore, are particularly susceptible to such uncontrolled fisheries.

Table 1a. Nominal catches (t) of American plaice for NAFO Divisions 3LNO, 1960-88 and TACs from 1973 to 1989.

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	558	72	-	132	25,446	-
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[b]	33,756	140	1	360	1,582	3,581	39,420	55,000
1985[b]	40,024	-	4	81	2,483	11,443	54,035	49,000
1986[b,c]	33,373	-	-	188	505	26,824	60,890	55,000
1987[b,c]	33,923	-	-	28	501	18,241	52,693	48,000
1988[b,c]	26,812	-	-	64	-	11,267	38,143	33,585[d]
1989								30,300

[a]South Korean catches reported to NAFO in 1982-84 as unspecified flounder. The breakdown used for these catches is 60% yellowtail, 40% American plaice.

[b]Catches for S. Korea and/or some others are estimated.

[c]Provisional.

[d]Effective TAC.

Table 1b. Breakdown of catches from Table 1a listed as "other" for 1984-88.

Year	Spain	Portugal	Panama[b]	USA	Cayman Islands[b]	Other	Total
1984	1,622	-	1,775	-	-	184	3,581
1985	5,498	27	3,762	1,310	750	96	11,443
1986[a]	11,882	9,240	3,515	1,605	571	11	26,824
1987[a]	14,476	2,516	-	1,249	-	-[b]	18,241
1988[a]	8,956	850	22	1,384	-	55[b]	11,267

[a]Provisional.

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

Table 2. Catches of American plaice by Canadian vessels using gears other than otter trawl, Div. 3L, 1972-88.

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[a]		3699	49	20	71		3839
1987[a]	240	3683	47	15	78		4063
1988[a]	149	2397	19	10	58		2633

[a]Provisional.

Table 3. Breakdown of plaice nominal catches (t) in Divisions 3LNØ by Division, for the years 1960-88.

Year	Division 3L	Division 3N	Division 3Ø	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	1,469	-	25,446
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	15,125	3,988	-	39,420
1985[a,b]	23,320	25,647	5,068	-	54,035
1986[a,b,c]	25,721	30,431	4,738	-	60,890
1987[a,b,c]	32,269	15,594	4,830	-	52,693
1988[b,c]	18,398	14,105	5,576	64	38,143

[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:3O.

[c]Provisional.

Table 4. Commercial samples and catch used to calculate catch at age and average weights at age for A. plaice in the Canadian catch in Division 3LNO in 1988. *Numbers in parentheses* are the number of observations.

Age-length key	Length frequency	No. samples	Catch (t)	Description
ALKOT2CN3L (667)	LFGNMAYCN3L (2923)	8	407	Canada, inshore, 3L, Jan-May
ALKOT3CN3L (1101)	JUN (3441)	9	453	" " " Jun
+	JUL (1434)	6	807	" " " Jul
ALKOT4CN3L (63)	AUG (971)	4	670	" " " Aug
	SEP (217)	1	147	" " " Sep-Dec
	LFOTFEBCN3L (1567)	4	476	Canada, offshore, 3L, Jan-Feb
ALKSO1CN3L (335)	MAR (1286)	3	714	" " " Mar
	APR (423)	1	101	" " " Apr
ALKSO2CN3L (681)	MAY (3006)	6	1720	" " " May
	JUN (2388)	6	1873	" " " Jun
	JUL (1517)	4	2766	" " " Jul
ALKSO3CN3L (709)	AUG (1144)	3	1442	" " " Aug
	SEP (3164)	8	1248	" " " Sep
	OCT (4142)	9	1385	" " " Oct
ALKSO4CN3L (357)	NOV (840)	2	829	" " " Nov
	DEC (2148)	5	1473	" " " Dec
ALKSO2CN3N (85)	LFOTMAYCN3N (849)	2	752	Canada, offshore, 3N, Jan-Jun
+	JUL (433)	1	793	" " " Jul
ALKSO3CN3N (843)	AUG (2097)	6	1042	" " " Aug
	SEP (1507)	4	891	" " " Sep
	OCT (1535)	4	721	" " " Oct
ALKSO4CN3N (248)	NOV (1975)	5	1035	" " " Nov-Dec
ALKSO1CN3O (214)	LFOTMARCN3O (798)	2	275	Canada, offshore, 3O, Jan-Mar
	MAY (1293)	3	809	" " " Apr-May
ALKSO2CN3O (722)	JUN (2868)	7	1442	" " " Jun
ALKSO3CN3O (235)	JUL (1279)	3	1235	" " " Jul-Sep
	LFOTDECCN3O (470)	1	681	Canada, offshore otter trawl, 3Ø, Oct-Dec
ALKSO4CN3O (187)	LFSCNOVCN3O (208)	4	48	" " Scottish seine, 3Ø, Oct-Dec

Table 5. Average lengths and weights at age, and catch numbers at age of A.plaice in the Canadian fishery in Div 3LNO in 1988.

	AVERAGE		CATCH		
AGE	WEIGHT	LENGTH	MEAN	STD. ERR.	C. V.
* 5	0.116	24.500	1	0.00	0.01
* 6	0.222	29.362	31	8.61	0.27
* 7	0.289	32.061	615	48.38	0.08
8	0.355	34.099	2977	125.15	0.04
* 9	0.436	36.254	7433	205.68	0.03
10	0.554	38.898	8883	238.86	0.03
11	0.732	42.307	8426	222.73	0.03
*12	0.979	46.239	5162	162.75	0.03
*13	1.319	50.639	2306	94.18	0.04
*14	1.721	54.905	991	44.47	0.04
15	2.211	59.187	516	25.81	0.05
*16	2.855	63.985	185	14.33	0.08
*17	3.628	68.771	34	5.30	0.16
18	4.692	74.500	1	0.96	0.76

Table 6. Catch at age and average weights at age from the fisheries for A.plaice in Div 3LNO in 1988. The column for total numbers has been adjusted to the total nominal catch for 1988.

	CANADA		SPAIN		USA		TOTAL	
AGE	NO.	WGT.	NO.	WGT.	NO.	WGT.	NO.	WGT.
3			180	.053			191	.053
4			712	.127			756	.127
5			1972	.170			2094	.170
6	31	.222	2150	.255	7	.210	2323	.254
7	615	.289	2819	.351	55	.319	3705	.339
8	2977	.355	2641	.521	269	.395	6252	.431
9	7433	.436	1369	.680	455	.503	9831	.475
10	8883	.554	659	.984	319	.691	10472	.587
11	8426	.732	373	1.322	193	.946	9549	.761
12	5162	.979	457	1.399	138	1.210	6114	1.018
13	2306	1.319	167	1.761	94	1.505	2727	1.355
14	991	1.721	47	1.926	65	1.858	1171	1.738
15	516	2.211	44	2.206	51	2.349	649	2.222
16	185	2.855	34	2.630	21	2.961	255	2.832
17	34	3.628			3	3.772	39	3.640
18	1	4.692					1	4.692
Total	37560		13624		1670		56129	
S.O.P.	27169		6630		1380		37360	
Catch	26812		7724		1384		38143	

TABLE 7. CATCH AT AGE FOR A.PLAICE IN DIV. 3LNO FROM 1974-88.

AGE	1974	1975	1976	1977	1978	1979	1980	1981
5	354	883	837	974	1558	1257	263	154
6	5955	3128	3907	6723	4467	6551	2977	554
7	10475	7220	8781	8743	9195	13532	9531	2248
8	10069	9433	19363	11730	10397	18747	12578	4786
9	7768	9234	16597	13559	12743	14977	14111	7921
10	9004	7903	12338	11157	13881	12506	14212	11425
11	7086	5701	8323	6520	9938	8791	11288	13565
12	4596	4732	5156	4257	6823	3775	8088	11872
13	3809	3788	3024	2369	3655	1843	3732	8693
14	2278	2617	2309	1493	2239	714	1565	5591
15	1141	1461	1347	1000	1472	342	645	2938
16	651	763	584	342	649	159	265	1119
17	267	475	245	182	212	63	87	394
18	80	234	65	101	107	16	25	246
19	20	100	20	41	44	5	2	103

AGE	1982	1983	1984	1985	1986	1987	1988
5	27	119	48	296	3811	2099	2094
6	314	991	397	788	8461	4632	2324
7	1814	3053	1516	2362	11162	7247	3705
8	4799	5797	3311	5652	11497	10550	6252
9	8946	8343	5853	10694	12614	15638	9831
10	12836	7707	9958	15741	13359	17344	10472
11	15801	8493	12887	14528	13931	11230	9549
12	14489	7517	8964	9233	10065	6861	6114
13	7942	4588	5072	4108	5709	3010	2727
14	4224	2480	2515	1969	2533	1268	1171
15	2000	1219	1090	1235	1339	739	649
16	641	373	404	388	516	231	255
17	206	130	93	160	152	27	39
18	96	49	15	9	35	4	1
19	9	13	1	5	2	1	0

TABLE 8. CATCH AT AGE IN PERCENTAGES.

AGE	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
5	0.6	1.5	1.0	1.4	2.0	1.5	0.3	0.2	0.0	0.2
6	9.4	5.4	4.7	9.7	5.8	7.9	3.8	0.8	0.4	1.9
7	16.5	12.5	10.6	12.6	11.9	16.2	12.0	3.1	2.4	6.0
8	15.8	16.4	23.4	17.0	13.4	22.5	15.8	6.7	6.5	11.4
9	12.2	16.0	20.0	19.6	16.5	18.0	17.8	11.1	12.1	16.4
10	14.2	13.7	14.9	16.1	17.9	15.0	17.9	16.0	17.3	15.1
11	11.1	9.9	10.0	9.4	12.8	10.6	14.2	18.9	21.3	16.7
12	7.2	8.2	6.2	6.2	8.8	4.5	10.2	16.6	19.5	14.8
13	6.0	6.6	3.6	3.4	4.7	2.2	4.7	12.1	10.7	9.0
14	3.6	4.5	2.8	2.2	2.9	0.9	2.0	7.8	5.7	4.9
15	1.8	2.5	1.6	1.4	1.9	0.4	0.8	4.1	2.7	2.4
16	1.0	1.3	0.7	0.5	0.8	0.2	0.3	1.6	0.9	0.7
17	0.4	0.8	0.3	0.3	0.3	0.1	0.1	0.6	0.3	0.3
18	0.1	0.4	0.1	0.1	0.1	0.0	0.0	0.3	0.1	0.1
19	0.0	0.2	0.0	0.1	0.1	0.0	0.0	0.1	0.0	0.0

AGE	1984	1985	1986	1987	1988
5	0.1	0.4	4.0	2.6	3.8
6	0.8	1.2	8.9	5.7	4.2
7	2.9	3.5	11.7	9.0	6.7
8	6.4	8.4	12.1	13.0	11.3
9	11.2	15.9	13.3	19.3	17.8
10	19.1	23.4	14.0	21.4	19.0
11	24.7	21.6	14.6	13.9	17.3
12	17.2	13.7	10.6	8.5	11.1
13	9.7	6.1	6.0	3.7	4.9
14	4.8	2.9	2.7	1.6	2.1
15	2.1	1.8	1.4	0.9	1.2
16	0.8	0.6	0.5	0.3	0.5
17	0.2	0.2	0.2	0.0	0.1
18	0.0	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0

TABLE 9. MEAN WEIGHTS (KG) AT AGE.

AGE	1974	1975	1976	1977	1978	1979	1980	1981
5	0.210	0.213	0.207	0.209	0.195	0.209	0.209	0.209
6	0.256	0.254	0.261	0.264	0.260	0.322	0.328	0.379
7	0.339	0.348	0.346	0.357	0.353	0.374	0.408	0.406
8	0.424	0.417	0.414	0.430	0.412	0.453	0.482	0.453
9	0.578	0.564	0.557	0.614	0.512	0.551	0.541	0.487
10	0.706	0.692	0.660	0.672	0.614	0.609	0.570	0.536
11	0.912	0.896	0.829	0.878	0.768	0.702	0.650	0.551
12	1.125	1.077	1.017	1.018	0.917	0.934	0.739	0.676
13	1.372	1.318	1.142	1.231	1.184	1.228	0.982	0.792
14	1.579	1.523	1.347	1.415	1.380	1.688	1.355	1.005
15	1.975	1.777	1.661	1.782	1.694	1.910	1.758	1.305
16	2.411	2.254	2.050	2.191	2.066	2.117	1.793	1.772
17	2.647	2.538	2.263	2.323	2.276	2.336	2.224	2.116
18	2.944	2.821	2.718	2.541	2.274	3.194	2.689	2.431
19	2.989	2.907	2.850	3.109	2.156	3.179	2.857	2.584

AGE	1982	1983	1984	1985	1986	1987	1988
5	0.256	0.298	0.270	0.212	0.121	0.230	0.170
6	0.298	0.382	0.314	0.329	0.193	0.293	0.254
7	0.360	0.473	0.382	0.430	0.277	0.397	0.339
8	0.427	0.555	0.460	0.473	0.411	0.435	0.431
9	0.485	0.658	0.551	0.549	0.545	0.493	0.475
10	0.533	0.698	0.563	0.655	0.660	0.650	0.587
11	0.596	0.697	0.654	0.820	0.769	0.838	0.761
12	0.739	0.756	0.852	1.102	0.981	1.097	1.018
13	0.976	0.959	1.128	1.472	1.285	1.387	1.355
14	1.275	1.220	1.444	1.898	1.665	1.726	1.738
15	1.594	1.551	1.987	2.341	2.061	2.211	2.222
16	2.028	2.132	2.561	2.904	2.523	2.939	2.832
17	2.322	2.370	2.851	3.270	3.044	3.386	3.640
18	2.705	2.809	3.713	4.056	4.048	4.227	4.692
19	3.338	3.012	2.684	5.366	4.596	4.000	4.500

TABLE 10. CALCULATED CATCH BIOMASS AT AGE.

AGE	1974	1975	1976	1977	1978	1979	1980	1981
5	74	189	173	203	304	263	55	32
6	1526	794	1019	1777	1160	2107	975	210
7	3551	2510	3035	3117	3248	5067	3890	913
8	4265	3929	8017	5039	4280	8489	6060	2166
9	4491	5208	9241	8329	6526	8256	7634	3859
10	6354	5467	8139	7500	8518	7612	8106	6121
11	6461	5109	6898	5726	7636	6173	7341	7481
12	5170	5097	5245	4333	6255	3528	5979	8028
13	5227	4993	3452	2916	4327	2263	3665	6885
14	3598	3986	3110	2112	3089	1205	2121	5617
15	2254	2596	2238	1782	2494	653	1134	3835
16	1570	1720	1197	749	1341	337	475	1983
17	707	1206	554	423	482	147	193	834
18	236	660	177	257	243	51	67	598
19	60	291	57	127	95	16	6	266
5+	45543	43755	52553	44391	49998	46166	47700	48828

AGE	1982	1983	1984	1985	1986	1987	1988
5	7	35	13	63	461	482	355
6	94	379	125	259	1637	1355	590
7	653	1445	579	1016	3092	2874	1258
8	2047	3217	1523	2673	4727	4585	2696
9	4343	5493	3237	5872	6870	7709	4673
10	6837	5376	5609	10315	8816	11266	6149
11	9412	5919	8436	11908	10711	9407	7267
12	10701	5683	7639	10175	9869	7526	6224
13	7749	4402	5720	6046	7335	4176	3694
14	5387	3025	3632	3736	4217	2188	2035
15	3187	1891	2166	2893	2759	1634	1442
16	1300	795	1034	1126	1303	678	723
17	478	308	265	525	464	90	143
18	260	138	56	35	140	17	5
19	30	39	3	27	9	4	0
5+	52485	38145	40016	56667	62410	53993	37255

Table 11. Summary of Canadian catch (t) and effort (hrs) data used in the multiplicative model, Divisions 3LNØ A. plaice CPUE calculations. Values for 1984-87 revised from 1988.

Year	Division 3L		Division 3N		Division 3Ø	
	Catch	Effort	Catch	Effort	Catch	Effort
1956	3863	3824	2115	2493	8	30
1957	3020	3385	2288	2668	20	36
1958	5096	5154	3099	4435	-	-
1959	5758	6780	3645	4738	31	59
1960	9792	11004	2584	3700	45	124
1961	6930	8790	2329	3615	51	70
1962	8278	12524	3419	6280	4	18
1963	11452	15543	6051	8410	222	509
1964	10279	14401	9081	10737	571	981
1965	11219	14487	18082	23677	962	1806
1966	8544	11560	20947	27769	2995	5220
1967	22104	30236	12261	15830	2193	3071
1968	24582	40128	6743	11389	357	790
1969	32196	59051	7053	14310	1244	2778
1970	19979	39158	3932	8147	3137	5273
1971	19998	41637	4441	9926	1625	3106
1972	17259	35232	5878	13452	875	2250
1973	12548	24730	7477	14354	6363	13137
1974	11276	26785	9609	21436	6721	16568
1975	10267	25395	11769	28294	2586	7929
1976	20133	45254	15569	38003	5152	17091
1977	18027	42580	14084	35295	2559	7738
1978	23685	48906	9961	24719	5067	13477
1979	20518	40603	10096	21629	3595	8536
1980	22638	37118	11929	22841	1446	3398
1981	28056	48719	6066	11741	1332	2917
1982	23502	40865	9541	18585	2930	6420
1983	12169	20677	6036	8662	2797	5990
1984	10299	17145	6308	11478	2185	4895
1985	14929	22654	10591	17784	1989	4749
1986	12665	27463	4968	12213	2162	5820
1987	14355	33204	1834	4894	1895	5550
1988	8391	20669	3554	8423	2855	8480

TABLE 12. RESULTS OF CATCH RATE STANDARDIZATION FOR A.PLAICE IN DIV. 3LNO.

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.770
MULTIPLE R SQUARED..... 0.593

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	8.103E2	8.103E2	
REGRESSION	48	1.480E2	3.084E0	47.545
TYPE 1	3	2.553E1	8.511E0	131.216
TYPE 2	2	6.542E0	3.271E0	50.432
TYPE 3	11	4.525E0	4.114E-1	6.343
TYPE 4	32	1.197E2	3.741E0	57.676
RESIDUALS	1567	1.016E2	6.486E-2	
TOTAL	1616	1.060E3		

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
1	3125	INTERCEPT	0.338	0.071	1616
2	32				
3	7				
4	56				
1	3114	1	-0.374	0.019	485
	3115	2	-0.573	0.139	7
	3124	3	-0.118	0.019	368
2	34	4	-0.088	0.015	587
	35	5	-0.170	0.017	419
3	1	6	0.085	0.036	77
	2	7	0.091	0.034	91
	3	8	-0.013	0.034	94
	4	9	-0.122	0.032	118
	5	10	-0.108	0.028	150
	6	11	-0.016	0.027	165
	8	12	0.003	0.028	159
	9	13	-0.032	0.028	166
	10	14	-0.064	0.028	146
	11	15	-0.015	0.028	152
	12	16	0.005	0.030	124
4	57	17	-0.054	0.097	13
	58	18	-0.095	0.089	16
	59	19	-0.105	0.086	17
	60	20	-0.160	0.085	18
	61	21	-0.249	0.087	16
	62	22	-0.411	0.084	19
	63	23	-0.294	0.081	22
	64	24	-0.271	0.079	33
	65	25	-0.315	0.074	55
	66	26	-0.337	0.072	68
	67	27	-0.422	0.072	73
	68	28	-0.728	0.074	61
	69	29	-0.870	0.073	71
	70	30	-0.901	0.074	60
	71	31	-0.990	0.075	60
	72	32	-1.017	0.074	65
	73	33	-0.922	0.074	70
	74	34	-1.149	0.074	64
	75	35	-1.194	0.075	59
	76	36	-1.229	0.073	73
	77	37	-1.177	0.074	61
	78	38	-1.131	0.073	76
	79	39	-1.037	0.074	62
	80	40	-0.875	0.074	60
	81	41	-0.881	0.074	65
	82	42	-0.862	0.075	60
	83	43	-0.798	0.076	54
	84	44	-0.926	0.078	45
	85	45	-0.846	0.076	51
	86	46	-1.145	0.077	49
	87	47	-1.195	0.079	43
	88	48	-1.185	0.078	43

TABLE 13. CPUE SERIES FOR A.PLAICE IN DIV 3LNO.

STANDARDS USED VARIABLE NUMBERS: 3125 32 7

PREDICTED CATCH RATE

YEAR	LN TRANSFORM MEAN	LN TRANSFORM S.E.	RETRANSFORMED MEAN	RETRANSFORMED S.E.	CATCH	EFFORT
1956	0.3384	0.0050	1.445	0.102	10000	6918
1957	0.2842	0.0060	1.368	0.106	10000	7308
1958	0.2432	0.0045	1.314	0.088	10000	7608
1959	0.2332	0.0040	1.302	0.082	10000	7682
1960	0.1782	0.0038	1.232	0.076	24047	19516
1961	0.0892	0.0042	1.127	0.073	17913	15895
1962	-0.0730	0.0036	0.959	0.058	18206	18994
1963	0.0441	0.0031	1.078	0.060	25446	23608
1964	0.0675	0.0028	1.104	0.058	38567	34946
1965	0.0238	0.0017	1.057	0.044	53261	50392
1966	0.0015	0.0015	1.034	0.040	65011	62886
1967	-0.0837	0.0014	0.949	0.035	94413	99447
1968	-0.3897	0.0015	0.699	0.027	73167	104666
1969	-0.5312	0.0014	0.607	0.022	79437	130893
1970	-0.5627	0.0015	0.588	0.023	66645	113339
1971	-0.6520	0.0016	0.538	0.021	67888	126240
1972	-0.6781	0.0015	0.524	0.020	59361	113295
1973	-0.5838	0.0014	0.576	0.022	52843	91782
1974	-0.8103	0.0014	0.459	0.017	46297	100853
1975	-0.8554	0.0016	0.439	0.017	43221	98503
1976	-0.8910	0.0013	0.423	0.015	51825	122375
1977	-0.8388	0.0015	0.446	0.017	43981	98577
1978	-0.7930	0.0013	0.467	0.017	50028	107106
1979	-0.6985	0.0014	0.513	0.019	48569	94607
1980	-0.5365	0.0015	0.604	0.023	49086	81319
1981	-0.5427	0.0015	0.600	0.023	50158	83610
1982	-0.5238	0.0015	0.611	0.024	51052	83512
1983	-0.4599	0.0017	0.652	0.027	38535	59136
1984	-0.5871	0.0019	0.574	0.025	39420	68712
1985	-0.5073	0.0017	0.621	0.026	54035	86947
1986	-0.8064	0.0018	0.461	0.019	60890	132143
1987	-0.8571	0.0020	0.438	0.020	52693	120313
1988	-0.8464	0.0019	0.443	0.019	38143	86162

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.046

Table 14. 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 ($t \times 10^{-3}$), 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	118,151	-	-	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

(cont'd next page)

Table 14. (Cont'd.)

Stratum	Year - Trip 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[a] WT 82, 83
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)	39.7(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)	145.7(7)
345	10.1(5)	32.5(4)	7.6(4)	-	23.3(5)	16.3(7)	11.0(4)	12.9(8)	7.5(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)	79.3(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)	102.1(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)	9.5(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(181)	69.9(154)	-(205)
Biomass	252.1	221.0	222.0	97.9	175.1	174.1	180.9	193.0	153.0

[a]Preliminary analysis

Table 15. 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 ($t \times 10^{-3}$) 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)
$\leq$ 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
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)
Biomass	47.4	75.3	40.7	68.4	59.9	43.8	52.8	32.4	42.8

Table 16. 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.

Depth (fm)	Stratum	No. of trawlable units	Year - Trip 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

Table (Cont'd.)

Stratum	Year - Trip 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
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)
Biomass	79.2	42.4	64.5	76.6	48.2	71.7	50.7	43.8

Table 17. Comparison of American plaice biomass from different strata in Div. 3N from surveys in 1984-89.

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

TABLE 18. RESULTS FROM ANALYSIS OF RV SURVEY DATA FOR A.PLAICE IN DIV. 3L.

PREDICTED TOTALS FOR MISSING STRATA

YEAR	STRATUM	TOTAL
71	328	18745
71	341	30103
71	342	9958
71	343	11915
71	344	26613
71	345	5964
71	346	2593
71	391	1737
71	392	179
72	328	15313
72	341	24597
72	342	8136
72	343	9736
72	344	21743
72	345	4865
72	346	2114
72	347	13077
72	366	8345
72	368	173
72	369	5096
72	386	3971
72	387	212
72	388	150
72	392	145
73	328	12383
73	342	6581
73	343	7877
73	344	17588
73	345	3923
73	346	1705
73	347	10577
73	348	52159
73	349	28430
73	364	79347
73	365	22503
73	366	6744
73	368	138
73	369	4117
73	370	23406
73	371	15494
73	386	3207
73	387	166
74	328	10339
74	341	16619
74	342	5496
74	343	6580
74	344	14690
74	345	3274
74	346	1419
75	328	15239
75	341	24478
75	342	8097
75	343	9689
75	344	21639
75	345	4842
75	371	19061
75	384	10525
76	328	26380
76	341	42351
76	342	14010
76	343	16762
76	371	32974
76	384	18222
76	390	18175
76	391	2447
76	392	254
78	328	23524
78	346	3260
78	366	12831
78	368	273
80	328	22607
81	342	12174
84	343	8804
84	344	19660
84	345	4395
84	346	1909
84	347	11823
84	348	58289
84	365	25149
84	366	7542
84	368	156
84	369	4605
84	370	26158
84	371	17317
84	384	9561
84	385	43634
84	386	3588
84	387	189
84	388	135
84	389	2976
84	390	9530
84	391	1282
84	392	131

OVERALL TOTALS

YEAR	WEIGHTED AVERAGE
71	650622
72	474399
73	424727
74	331757
75	500422
76	724583
77	914804
78	774042
79	774802
80	830985
81	699554
82	739247
84	457575
85	378126
86	390221
87	444230
88	461172

TABLE 19. RESULTS FROM ANALYSIS OF RV SURVEY DATA FOR A.PLAICE IN DIV. 3N.

PREDICTED TOTALS FOR MISSING STRATA

YEAR	STRATUM	TOTAL
71	357	22
71	358	172
71	359	4083
71	360	29027
71	376	6018
71	377	1320
71	379	37
71	380	35
72	357	16
72	379	29
73	360	21178
74	357	17
74	358	139
74	359	3325
74	360	23638
74	376	4894
75	357	17
75	358	140
75	359	3857
75	373	13645
75	378	306
75	379	30
75	380	28
75	382	2962
75	383	3083
76	357	26
76	358	198
76	374	6320
76	375	5163
76	377	1512
76	378	427
76	379	43
76	380	41
76	381	597
78	357	56
78	358	395
78	359	9150
78	380	84
81	361	10371
82	380	35
87	357	19

OVERALL TOTALS

YEAR	WEIGHTED AVERAGE
71	103749
72	80306
73	76577
74	75653
75	76660
76	100709
77	153259
78	286959
79	140700
80	111267
81	189132
82	94589
84	101538
85	90910
86	67495
87	77725
88	51580

TABLE 20. RESULTS FROM ANALYSIS OF RV SURVEY DATA FOR A.PLAICE IN DIV. 3O.

PREDICTED TOTALS FOR MISSING STRATA

YEAR	STRATUM	TOTAL
73	332	4152
73	333	34
73	334	4
73	340	16089
75	329	18490
75	334	5
75	335	13
75	354	2798
75	356	21
76	339	14725
76	356	32
77	331	3610
77	335	18
77	339	13400
77	355	130
77	356	29
78	354	1638
78	355	54
78	356	11
80	339	13363
81	331	7108
81	332	12306
81	333	110
81	334	18
81	335	38
81	336	180
81	337	7183
81	338	27672
81	352	35630
81	353	36683

OVERALL TOTALS

YEAR	WEIGHTED AVERAGE
73	134859
75	133602
76	200120
77	191659
78	85281
79	198544
80	186842
81	400246
82	122962
84	107551
85	105907
86	71880
87	114332
88	65737

TABLE 21. ABUNDANCE (MILLIONS) OF A.PLAICE AT AGE FROM CANADIAN SPRING SURVEYS IN DIV. 3L. RESULTS ARE FROM A MODEL WHICH ACCOUNTS FOR MISSED STRATA.

AGE	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1
2	0.0	0.1	0.0	0.0	0.6	0.5	0.3	0.5	0.4	1.3
3	1.6	0.3	1.2	0.2	2.4	7.8	2.4	10.8	0.9	4.1
4	9.7	11.1	9.6	3.7	3.8	14.7	10.6	16.0	12.9	7.3
5	39.8	23.1	45.7	5.7	10.2	15.7	34.5	61.3	42.0	39.9
6	60.0	52.4	52.9	21.7	28.1	17.2	70.8	71.2	71.0	77.5
7	120.4	77.4	72.3	35.7	51.7	54.5	131.4	112.3	105.3	100.8
8	64.0	80.9	44.5	51.0	95.4	121.5	207.0	171.5	167.9	200.7
9	119.2	51.9	35.1	56.7	103.3	143.3	151.1	138.3	139.7	173.0
10	54.1	56.0	46.7	59.3	90.5	150.8	155.7	106.2	123.7	113.2
11	49.1	33.7	40.1	33.4	46.3	96.2	68.0	36.5	62.6	50.2
12	45.9	35.6	34.6	29.5	33.9	56.5	45.8	25.4	27.0	32.1
13	34.5	16.6	18.8	17.5	16.4	26.8	19.0	11.3	9.9	16.6
14	24.0	13.3	13.1	9.5	9.2	7.7	7.2	7.3	5.3	6.3
15	12.0	11.0	4.9	5.6	4.1	5.9	5.4	3.0	3.3	3.7
16	8.3	7.6	2.3	2.0	3.5	2.8	3.1	1.5	1.6	2.9
17	4.7	2.5	0.6	0.3	0.9	2.0	1.4	0.8	0.7	0.8
18	2.7	0.7	1.6	0.0	0.3	0.6	0.9	0.2	0.2	0.4
19	0.5	0.3	0.0	0.1	0.0	0.2	0.2	0.0	0.1	0.1
1+	650.6	474.3	424.7	331.8	500.4	724.6	914.8	774.0	774.8	831.0

AGE	1981	1982	1984	1985	1986	1987	1988
1	0.2	0.0	0.0	0.0	0.0	0.1	0.0
2	0.4	0.1	0.0	0.0	0.1	0.3	0.2
3	4.1	2.6	0.0	0.5	0.2	0.6	1.0
4	4.4	9.6	0.5	1.7	1.5	2.7	4.7
5	15.8	10.6	1.7	9.2	6.5	13.2	19.2
6	45.8	30.1	18.5	29.5	40.0	50.6	58.7
7	66.5	56.5	72.6	83.2	101.2	119.5	108.9
8	179.4	120.5	109.7	97.3	94.2	124.8	104.8
9	173.3	186.8	121.1	66.5	74.5	65.0	90.8
10	107.3	152.9	67.9	42.0	35.9	35.9	32.6
11	58.0	90.5	31.1	22.9	14.7	12.1	17.8
12	23.2	39.8	19.4	11.6	9.9	10.5	10.9
13	10.6	21.5	7.3	6.7	6.4	5.0	5.5
14	3.7	10.4	4.4	3.3	2.4	2.1	3.2
15	2.3	3.3	1.8	1.8	1.4	1.1	1.8
16	2.0	2.5	0.9	1.3	0.9	0.4	0.8
17	1.1	1.3	0.4	0.3	0.3	0.1	0.2
18	0.2	0.1	0.2	0.1	0.1	0.1	0.0
19	0.1	0.0	0.1	0.1	0.0	0.0	0.0
1+	699.6	739.2	457.6	378.1	390.3	444.2	461.2

TABLE 22. ABUNDANCE (MILLIONS) OF A.PLAICE AT AGE FROM CANADIAN SPRING SURVEYS IN DIV. 3N. RESULTS ARE FROM A MODEL WHICH ACCOUNTS FOR MISSED STRATA.

AGE	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
1	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.1
2	0.0	0.2	0.1	0.0	1.0	0.2	0.1	0.4	0.4	0.1	1.0
3	3.0	0.4	0.4	1.0	5.3	3.2	1.6	5.2	1.2	0.7	5.0
4	3.1	2.3	1.0	2.8	10.5	5.8	9.5	14.0	2.8	2.1	7.6
5	5.2	5.6	5.6	5.8	9.0	12.4	14.4	43.2	11.0	6.1	5.3
6	3.4	8.6	9.9	11.0	8.2	12.4	28.7	61.5	18.5	13.0	12.3
7	12.5	5.0	11.5	12.2	14.7	12.3	25.3	70.1	29.4	26.4	41.6
8	8.6	8.4	8.5	11.5	10.1	15.4	22.3	38.5	33.2	22.2	42.3
9	14.7	10.2	5.6	7.6	5.7	10.0	18.3	17.6	18.0	17.1	31.1
10	14.7	13.7	8.2	7.9	3.2	9.2	11.8	18.0	13.7	9.5	20.5
11	13.4	8.9	9.5	5.5	2.9	4.9	9.1	7.8	5.7	4.8	9.0
12	10.0	6.5	6.6	3.5	1.6	5.2	5.2	5.2	3.0	3.4	5.4
13	4.8	4.3	4.7	3.4	2.0	3.5	2.9	2.5	1.2	1.7	3.0
14	3.2	3.2	1.4	1.3	0.9	1.8	2.1	1.3	1.0	1.2	1.0
15	2.1	1.2	1.2	1.4	0.8	2.3	1.0	1.1	0.9	0.9	1.9
16	2.1	0.9	1.0	0.5	0.5	1.3	0.7	0.8	0.4	0.7	0.9
17	0.8	0.2	1.0	0.2	0.1	0.7	0.2	0.2	0.1	0.8	0.5
18	1.7	0.2	0.3	0.1	0.1	0.1	0.1	0.1	0.0	0.2	0.4
19	0.7	0.2	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.0
1+	103.7	80.3	76.7	75.7	76.7	100.7	153.3	287.0	140.7	111.3	189.1

AGE	1982	1984	1985	1986	1987	1988
1	0.3	0.0	0.1	0.0	0.0	0.0
2	0.6	0.1	0.1	0.1	0.9	0.2
3	1.8	1.0	1.8	0.7	3.9	2.4
4	6.6	2.5	8.2	2.9	7.2	5.5
5	7.5	5.8	8.6	7.8	7.0	6.0
6	7.9	11.3	11.3	10.3	10.5	5.4
7	8.8	13.9	9.6	9.7	10.4	5.7
8	15.8	13.2	10.7	7.6	8.7	6.2
9	17.7	14.8	10.3	7.6	8.6	5.9
10	11.4	16.7	11.0	7.2	6.2	4.7
11	6.4	7.9	8.4	4.0	3.8	2.7
12	3.7	5.2	5.0	3.3	2.9	1.9
13	1.2	3.2	2.6	2.3	2.4	1.6
14	1.7	1.8	1.6	1.2	1.8	1.1
15	0.9	1.5	1.3	1.2	1.6	1.1
16	0.9	1.4	0.4	0.7	0.9	0.5
17	0.8	0.7	0.1	0.5	0.4	0.4
18	0.4	0.3	0.0	0.1	0.2	0.2
19	0.1	0.1	0.0	0.1	0.1	0.1
1+	94.5	101.5	90.9	67.5	77.7	51.6

TABLE 23. ABUNDANCE (MILLIONS) OF A.PLAICE AT AGE FROM CANADIAN SPRING SURVEYS IN DIV. 3O. RESULTS ARE FROM A MODEL WHICH ACCOUNTS FOR MISSED STRATA.

AGE	1973	1975	1976	1977	1978	1979	1980	1981	1982	1984	1985
1	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.4	0.1	0.0	0.0
2	1.3	0.1	0.2	0.4	0.3	0.9	0.8	2.6	0.7	0.1	0.0
3	9.3	2.3	2.4	1.9	1.5	4.6	2.2	12.6	1.9	0.1	0.4
4	5.5	5.6	3.3	9.9	4.3	9.8	5.4	8.3	3.9	0.4	1.3
5	13.2	8.1	12.4	28.6	8.1	18.1	4.7	19.5	4.2	2.6	4.3
6	17.2	12.4	22.1	37.7	12.4	21.8	8.7	26.4	6.1	7.7	4.7
7	22.2	24.6	30.4	40.3	16.6	36.9	46.6	52.4	15.6	15.2	11.1
8	13.5	13.7	43.6	20.0	16.1	39.0	48.8	95.9	26.3	23.7	17.7
9	11.9	15.2	26.1	19.7	8.7	28.5	29.1	96.4	23.6	18.4	17.3
10	11.7	15.5	19.0	11.8	7.4	19.3	19.0	48.8	20.1	15.6	18.9
11	8.2	13.9	11.0	8.9	3.5	7.8	9.7	18.3	8.8	7.0	13.3
12	7.4	8.9	9.2	6.6	2.3	5.9	5.5	9.7	6.2	4.3	7.6
13	4.2	5.9	7.2	2.7	2.1	2.4	2.5	3.4	2.5	2.6	3.1
14	3.2	3.6	4.4	1.6	0.9	1.4	1.0	2.2	0.9	1.8	2.8
15	2.2	2.9	3.8	1.1	0.5	0.9	1.2	1.3	0.9	2.2	2.2
16	1.3	0.6	2.1	0.4	0.4	0.8	1.0	1.0	0.7	1.3	0.9
17	1.1	0.2	1.6	0.1	0.0	0.3	0.4	0.7	0.4	0.7	0.2
18	0.7	0.0	0.3	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.1
19	0.2	0.0	0.4	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0
1+	105.0	117.4	181.2	151.0	71.1	165.2	173.8	356.6	112.3	100.7	99.9

AGE	1986	1987	1988
1	0.0	0.1	0.0
2	0.1	0.3	0.1
3	0.7	0.9	0.8
4	2.4	3.1	1.4
5	3.2	8.3	2.2
6	5.3	13.1	5.3
7	9.4	17.2	7.1
8	11.4	18.3	10.6
9	10.9	18.6	9.8
10	9.7	13.2	9.1
11	6.4	6.9	6.1
12	5.6	5.0	4.9
13	3.1	3.4	3.1
14	1.3	2.1	2.2
15	1.3	1.7	1.3
16	0.5	1.0	1.3
17	0.4	0.5	0.3
18	0.1	0.3	0.3
19	0.1	0.1	0.1
1+	65.5	101.9	61.5

Table 24. Mean weight (kg) of American plaice per tow, by stratum, from R. V. surveys (fall) 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 ($t \times 10^{-3}$) are given at the bottom of the table. Strata marked with a plus sign were omitted from the selected strata calculations at the bottom of this table.

Stratum	1981 ATC 323 324, 325	1982 ATC 333, 334	1983 WT 7, 8, 9	1984 WT 16, 17, 18	1985 WT 37, 38, 39	1986 AN 72	1987 WT 65	1988 WT 78
328+	-	-	-	50.1(4)	99.5(8)	90.1(6)	15.5(4)	153.0(7)
341	8.2(3)	18.2(4)	121.3(4)	110.8(5)	21.6(7)	16.7(7)	262.4(9)	127.2(8)
342	109.7(3)	44.8(3)	19.5(4)	162.5(2)	84.7(3)	4.4(3)	30.6(3)	19.2(3)
343+	50.9(4)	-	483.2(3)	53.3(4)	932.5(3)	17.2(3)	15.7(3)	28.5(3)
344	227.3(4)	106.2(3)	70.7(6)	193.0(6)	93.8(9)	28.2(7)	46.3(4)	23.6(7)
345	10.5(4)	17.4(6)	13.6(8)	48.4(7)	24.4(9)	12.5(4)	14.8(2)	24.1(7)
346	13.0(3)	4.3(4)	10.8(5)	11.5(6)	6.5(5)	20.9(3)	4.3(4)	8.7(5)
347	324.3(3)	235.9(4)	134.7(6)	216.5(6)	52.1(4)	30.7(4)	40.3(2)	191.5(5)
348	114.1(6)	126.8(5)	112.3(11)	201.4(11)	43.4(14)	64.1(5)	46.7(9)	101.2(10)
349	20.1(7)	27.5(5)	113.1(9)	81.7(14)	21.3(10)	16.8(9)	45.8(10)	77.1(9)
350	8.3(6)	4.3(2)	72.1(8)	128.9(12)	57.7(9)	11.5(11)	15.0(9)	56.4(10)
363	65.5(4)	34.3(3)	253.7(3)	54.9(8)	48.0(10)	44.3(7)	45.0(9)	37.0(10)
364	254.2(9)	114.7(11)	95.2(11)	254.6(10)	114.4(18)	86.0(5)	104.1(14)	87.5(14)
365	242.8(4)	284.0(4)	198.7(5)	67.9(4)	136.6(8)	123.5(5)	98.2(6)	91.6(5)
366	318.3(3)	19.3(6)	50.8(4)	39.7(11)	62.4(9)	205.5(4)	10.1(7)	67.8(7)
368	0.0(2)	1.5(2)	-	0.0(2)	1.4(2)	5.9(2)	2.8(2)	0.4(2)
369	218.5(2)	27.9(4)	129.4(6)	76.4(7)	67.3(6)	19.4(3)	35.5(4)	121.1(5)
370	121.0(4)	88.2(6)	121.0(6)	145.8(7)	34.3(9)	145.3(2)	61.4(6)	23.6(7)
371	149.9(4)	97.3(5)	180.4(5)	110.7(7)	156.9(7)	26.3(3)	61.4(5)	53.6(6)
372	20.3(5)	79.9(7)	102.5(4)	74.0(13)	68.3(17)	37.5(9)	58.4(13)	43.0(13)
384	63.2(3)	176.9(4)	105.0(3)	210.8(6)	92.6(8)	100.0(5)	111.8(6)	48.9(6)
385	78.5(8)	128.4(8)	107.1(5)	96.5(12)	30.0(12)	86.1(8)	127.9(9)	61.7(13)
386	121.8(3)	123.0(4)	-	99.0(8)	123.6(5)	31.4(4)	41.3(4)	209.5(5)
387	2.3(2)	0.3(3)	-	0.7(3)	0.7(4)	0.9(2)	0.7(3)	4.0(4)
388+	-	0.0(3)	-	0.0(2)	14.0(2)	-	2.0(2)	10.0(2)
389+	-	25.1(4)	-	103.1(6)	183.0(5)	3.9(4)	82.0(4)	49.6(4)
390	38.5(3)	87.8(4)	72.7(3)	89.5(3)	97.2(7)	26.8(6)	42.0(8)	18.6(8)
391+	-	37.0(2)	25.0(2)	233.8(2)	105.8(2)	37.3(2)	24.5(2)	27.5(2)
392+	-	5.1(2)	4.7(2)	10.5(2)	6.8(2)	0.9(2)	11.0(2)	9.0(2)
729+	-	-	-	3.3(2)	4.5(2)	0.0(2)	-	-
730+	-	-	-	0.0(2)	0.0(2)	-	-	-
731+	-	-	-	0.0(2)	1.0(2)	-	-	-
732+	-	-	-	0.0(2)	0.0(2)	-	-	-
733+	-	-	-	0.0(4)	0.7(3)	-	-	-
734+	-	-	-	0.0(3)	0.0(2)	-	-	-
735+	-	2.3(2)	-	0.0(3)	0.2(2)	20.6(2)	-	-
736+	-	-	0.0(2)	-	6.8(2)	2.1(2)	-	-
Mean (#sets)	108.2(99)	78.6(120)	110.8(125)	108.4(208)	75.7(231)	52.7(141)	61.1(165)	68.6(189)
Biomass (Total)	273.3	206.4	268.0	313.8	220.2	146.7	168.7	189.5
Biomass (selected strata)	271.3	204.0	248.4	294.5	157.9	134.2	160.0	166.9

Table 25. American plaice population numbers (x 10^{-5}) estimated from research vessel surveys (fall) in NAFO Division 3L. Estimates in each year are for the same strata. Values for the trips by the A. T. CAMERON were adjusted by the appropriate conversion factors to make these estimates comparable with those from the W. TEMPLEMAN surveys.

	Survey - Year							
	ATC	ATC	WT	WT	WT	AN	WT	WT
	323, 324, 325	333, 334	7, 8, 9	16, 17, 18	37, 38, 39	72	65	78
	Sep-Nov	Oct-Dec	Oct-Nov	Jul-Sep	Oct-Nov	Nov	Oct	Oct-Nov
Age	1981	1982	1983[a]	1984	1985	1986	1987	1988
1	8.3	1.3	0.0	0.0	0.0	1.7	0.2	0.0
2	11.0	16.8	2.0	0.0	1.3	8.5	13.1	3.0
3	80.0	53.1	22.8	2.4	1.9	18.4	18.5	28.1
4	119.9	187.1	89.2	27.7	13.8	102.6	49.3	74.7
5	214.2	343.0	474.7	175.7	108.4	327.4	233.7	279.1
6	431.1	771.0	1,024.5	617.6	480.2	888.0	630.0	740.3
7	1,682.7	1,370.6	1,732.6	1,683.8	921.9	864.9	958.1	982.1
8	1,567.7	1,826.6	1,535.7	1,943.7	807.0	838.9	834.9	945.6
9	1,333.3	1,067.9	784.2	1,155.5	683.8	474.8	594.6	566.2
10	1,303.1	588.5	436.2	772.3	305.3	200.7	192.6	221.0
11	557.8	297.2	187.2	306.6	139.1	84.6	106.1	89.0
12	404.5	130.6	140.2	178.0	99.0	46.0	53.4	52.9
13	155.1	47.3	83.2	84.6	51.3	23.2	29.4	27.5
14	42.7	17.5	12.8	40.4	9.2	10.1	13.4	15.0
15	11.9	19.1	14.9	26.4	4.5	4.0	8.7	8.7
16	2.8	7.6	6.9	10.6	0.8	1.1	1.6	2.7
17	-	3.2	2.0	2.9	0.3	0.8	1.7	1.2
18	-	0.4	-	-	0.3	0.6	-	0.4
UNK	-	-	-	-	0.2	0.2	-	-
Totals								
2+	7,917.8	6,747.5	6,549.1	7,028.2	3,643.1	3,894.6	3,739.1	4,037.5
4+	7,826.8	6,677.6	6,524.3	7,025.8	3,639.9	3,867.7	3,707.5	4,006.4
6+	7,492.7	6,147.5	5,960.4	6,822.4	3,517.7	3,347.7	3,424.5	3,652.6
8+	5,378.9	4,005.9	3,203.3	4,521.0	2,115.6	1,684.8	1,836.4	1,930.2
12+	617.0	225.7	260.0	342.9	180.4	85.8	108.2	108.4

[a] 3 out of 23 strata not surveyed in 1983.

TABLE 26. ABUNDANCE (MILLIONS) OF A.PLAICE AGED 6-19 IN DIV. 3LNO COMBINED, AS USED IN ADAPTIVE FRAMEWORK. VALUES ARE FROM TABLES 21-23.

AGE	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
6	79.6	0.0	48.7	51.8	137.2	145.4	111.3	99.3	84.4	44.1
7	105.5	0.0	91.0	97.5	197.0	199.4	171.6	174.0	160.4	80.9
8	66.2	0.0	119.2	181.2	249.3	226.7	240.1	272.1	317.3	162.6
9	52.3	0.0	124.2	180.2	189.1	165.0	186.2	219.5	301.2	228.1
10	66.3	0.0	109.2	179.9	179.3	131.9	156.7	141.9	176.4	184.4
11	57.5	0.0	63.1	112.7	86.0	47.9	76.1	64.8	85.2	105.7
12	48.3	0.0	44.4	71.2	57.6	33.0	35.9	41.1	38.3	49.7
13	27.6	0.0	24.3	37.7	24.6	15.9	13.5	20.8	17.0	25.2
14	17.6	0.0	13.7	13.9	10.9	9.5	7.7	8.5	6.9	13.0
15	8.3	0.0	7.8	12.0	7.5	4.6	5.1	5.8	6.1	5.1
16	5.2	0.0	4.6	6.2	4.2	2.2	2.8	4.6	3.9	4.1
17	2.7	0.0	1.2	4.3	1.7	1.0	1.1	2.0	2.3	2.5
18	2.6	0.0	0.4	1.0	1.1	0.4	0.3	0.8	0.7	0.7
19	0.5	0.0	0.1	0.6	0.2	0.1	0.2	0.3	0.1	0.1
6+	540.2	0.0	651.9	950.2	1145.7	983.0	1008.6	1055.5	1200.2	906.2

AGE	1983	1984	1985	1986	1987	1988
6	0.0	37.5	45.5	55.5	74.1	69.3
7	0.0	101.8	103.9	120.1	146.9	121.6
8	0.0	146.9	125.7	113.2	152.0	121.5
9	0.0	154.6	94.1	93.0	92.1	106.4
10	0.0	100.2	71.9	52.8	55.2	46.4
11	0.0	46.0	44.6	25.1	22.8	26.6
12	0.0	28.9	24.2	18.8	18.4	17.7
13	0.0	13.1	12.4	11.8	10.8	10.2
14	0.0	8.0	7.7	4.9	6.0	6.5
15	0.0	5.5	5.3	3.9	4.4	4.2
16	0.0	3.6	2.6	2.1	2.3	2.6
17	0.0	1.8	0.6	1.1	1.0	0.9
18	0.0	0.7	0.2	0.3	0.6	0.3
19	0.0	0.2	0.1	0.2	0.2	0.2
6+	0.0	648.8	538.8	502.8	586.8	534.6

TABLE 27. RESULTS OF ADAPTIVE FRAMEWORK USING CPUE AND 12+ POPULATION BIOMASS.

ESTIMATED PARAMETERS AND STANDARD ERRORS
APPROXIMATE STATISTICS ASSUMING LINEARITY NEAR SOLUTION

ORTHOGONALITY OFFSET..... 0.000144
MEAN SQUARE RESIDUALS 0.025250

AGE	PARAMETER	ESTIMATE	STD. ERR.	T-STATISTIC	C.V.
12	ABUNDANCE	1.72681E4	2.59120E3	6.66412E0	0.15
12	C/E SLOPE	1.09057E-5	5.15544E-7	2.11537E1	0.05

PARAMETER CORRELATION MATRIX

	1	2
1	1.000	-0.439
2	-0.439	1.000

RESIDUALS FROM CPUE INDEX

1975	76	77	78	79	80	81	82	83	84	85	86	87	88
-.29	-.09	.003	-.02	-.02	-.03	-.04	.04	.42	.14	-.009	-.12	.005	.02

SUM OF RESIDUALS : -0.0000012859 MEAN RESIDUAL : -0.0000000099

POPULATION NUMBERS (000S)

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
5	293376	278984	236021	222875	203923	197020	189276	210203	199147	184177	139957	115807	161539	466507
6	229737	239397	227655	192356	181065	165821	161068	154827	172076	162940	150748	114319	91367	130357
7	192231	185263	192466	180305	153446	142316	133069	131370	126478	139987	133045	122709	85941	70613
8	123978	150853	143735	149667	139301	113387	107894	106913	105916	100789	113240	106791	90365	63805
9	75136	92970	105987	107066	113130	97087	81452	84006	83191	81471	79523	87599	77030	64439
10	43354	53161	61100	74506	76128	79071	66720	59520	60684	60562	61407	55431	60307	48917
11	25350	28345	32361	39929	48441	51013	51878	44288	37116	42710	40574	36033	33295	33682
12	16361	15596	15676	20595	23699	31705	31552	30200	21963	22704	23307	20073	16896	17098
13	11201	9114	8104	8982	10688	15987	18640	15090	11616	11180	10477	10728	7327	7625
14	5764	5743	4725	4491	4047	7083	9712	7395	5169	5359	4564	4861	3617	3275
15	2986	2351	2613	2518	1651	2667	4383	2893	2233	1988	2112	1955	1688	1815
16	1537	1123	706	1234	730	1042	1600	930	559	725	641	611	389	714
17	815	568	391	269	423	453	614	298	182	120	228	174	33	110
18	324	238	244	155	28	290	292	146	57	31	14	42	5	3
19	273	54	136	108	30	9	214	17	33	3	12	4	3	0
5+	1022425	1063758	1031919	1005058	956730	904951	858366	848097	826417	814743	759847	677137	629803	908961

FISHING MORTALITY

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
5	0.003	0.003	0.005	0.008	0.007	0.001	0.001	0.000	0.001	0.000	0.002	0.037	0.014	0.005
6	0.015	0.018	0.033	0.026	0.041	0.020	0.004	0.002	0.006	0.003	0.006	0.085	0.058	0.020
7	0.042	0.054	0.052	0.058	0.103	0.077	0.019	0.015	0.027	0.012	0.020	0.106	0.098	0.060
8	0.088	0.153	0.095	0.080	0.161	0.131	0.050	0.051	0.062	0.037	0.057	0.127	0.138	0.114
9	0.146	0.220	0.152	0.141	0.158	0.175	0.114	0.125	0.117	0.083	0.161	0.173	0.254	0.184
10	0.225	0.296	0.225	0.231	0.200	0.221	0.210	0.272	0.151	0.201	0.333	0.310	0.382	0.268
11	0.286	0.392	0.252	0.322	0.224	0.280	0.341	0.501	0.292	0.406	0.504	0.557	0.466	0.372
12	0.385	0.455	0.357	0.456	0.194	0.331	0.538	0.755	0.475	0.573	0.576	0.808	0.596	0.496
13	0.468	0.457	0.390	0.597	0.211	0.298	0.724	0.871	0.574	0.696	0.568	0.887	0.605	0.496
14	0.697	0.588	0.430	0.801	0.217	0.280	1.011	0.998	0.756	0.731	0.648	0.858	0.490	0.496
15	0.778	1.003	0.550	1.039	0.260	0.311	1.350	1.444	0.925	0.932	1.040	1.414	0.661	0.496
16	0.795	0.855	0.766	0.870	0.276	0.330	1.492	1.434	1.339	0.957	1.103	2.718	1.065	0.496
17	1.033	0.647	0.722	2.057	0.180	0.238	1.236	1.449	1.567	1.945	1.503	3.411	2.209	0.496
18	1.598	0.360	0.613	1.431	0.991	0.101	2.652	1.298	2.929	0.764	1.150	2.521	2.623	0.496
19	0.513	0.527	0.402	0.589	0.204	0.314	0.741	0.867	0.577	0.653	0.619	0.909	0.597	0.496

TABLE 28. RESULTS OF ADAPTIVE FRAMEWORK USING RV SURVEY DATA.

ESTIMATED ABUNDANCE FOR AGE 6-15 ALONG WITH CORRESPONDING SLOPES FOR AMERICAN PLAICE IN DIV. 3LNO DERIVED FROM ADAPT USING CANADIAN RV DATA.

ESTIMATED PARAMETERS AND STANDARD ERRORS
APPROXIMATE STATISTICS ASSUMING LINEARITY NEAR SOLUTION

ORTHOGONALITY OFFSET..... 0.000130
MEAN SQUARE RESIDUALS 0.140795

AGE	PARAMETER	ESTIMATE	STD. ERR.	T-STATISTIC	C.V.
6	ABUNDANCE	1.67131E5	6.51211E4	2.56646E0	0.39
7	ABUNDANCE	1.35735E5	3.78101E4	3.58992E0	0.28
8	ABUNDANCE	8.92625E4	2.09744E4	4.25579E0	0.23
9	ABUNDANCE	5.87711E4	1.27391E4	4.61342E0	0.22
10	ABUNDANCE	2.66097E4	5.71817E3	4.65354E0	0.21
11	ABUNDANCE	1.75168E4	3.51492E3	4.98354E0	0.20
12	ABUNDANCE	1.00078E4	1.80228E3	5.55288E0	0.18
13	ABUNDANCE	5.36676E3	1.18375E3	4.53370E0	0.22
14	ABUNDANCE	3.10899E3	7.77082E2	4.00085E0	0.25
15	ABUNDANCE	1.49833E3	3.57259E2	4.19397E0	0.24
6	RV SLOPE	4.54471E-4	5.19885E-5	8.74177E0	0.11
7	RV SLOPE	1.03855E-3	1.14331E-4	9.08371E0	0.11
8	RV SLOPE	1.85392E-3	2.00431E-4	9.24969E0	0.11
9	RV SLOPE	2.25609E-3	2.41847E-4	9.32860E0	0.11
10	RV SLOPE	2.47695E-3	2.66179E-4	9.30558E0	0.11
11	RV SLOPE	2.04714E-3	2.21189E-4	9.25517E0	0.11
12	RV SLOPE	2.32336E-3	2.52382E-4	9.20575E0	0.11
13	RV SLOPE	2.27834E-3	2.48273E-4	9.17672E0	0.11
14	RV SLOPE	2.40572E-3	2.60849E-4	9.22264E0	0.11
15	RV SLOPE	3.96219E-3	4.27162E-4	9.27563E0	0.11

TABLE 28. CONT.

RESIDUALS BETWEEN LN OBS. AND PRED. RV FOR AMERICAN PLAICE IN DIV. 3LNO DERIVED FROM ADAPT USING CANADIAN RV DATA.

LOG RESIDUALS FOR CANADIAN RV SURVEY INDEX

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1984	1985
6	-0.673	-0.651	0.381	0.613	0.414	0.374	0.288	-0.213	-0.226	-0.249
7	-0.685	-0.574	0.090	0.172	0.210	0.291	0.246	-0.372	0.037	0.181
8	-0.537	-0.287	0.056	-0.085	0.079	0.408	0.579	-0.087	0.037	-0.089
9	-0.167	0.023	-0.088	-0.239	-0.166	0.161	0.638	0.335	0.013	-0.297
10	0.194	0.519	0.347	-0.156	-0.018	-0.147	0.239	0.437	-0.229	-0.443
11	0.398	0.911	0.449	-0.317	-0.088	-0.277	0.005	0.449	-0.369	-0.317
12	0.399	0.948	0.690	-0.098	-0.264	-0.362	-0.342	0.053	-0.246	-0.447
13	0.229	0.870	0.533	0.080	-0.418	-0.353	-0.530	0.136	-0.281	-0.275
14	0.362	0.334	0.220	0.288	-0.061	-0.495	-0.715	0.185	-0.088	0.020
15	-0.009	0.754	-0.010	-0.258	-0.057	-0.387	-0.400	-0.124	0.113	0.062

AGE	1986	1987	1988
6	-0.108	0.051	0.000
7	0.147	0.305	-0.050
8	-0.017	0.133	-0.189
9	-0.238	0.071	-0.047
10	-0.486	-0.237	-0.019
11	-0.626	-0.404	0.186
12	-0.466	-0.166	0.299
13	-0.197	-0.054	0.261
14	-0.299	0.071	0.178
15	0.057	0.238	0.021

SUM OF RV 1 RESIDUALS : -0.0000012859 MEAN RESIDUAL : -0.0000000099

CORRELATIONS BETWEEN ESTIMATED PARAMETERS FOR AMERICAN PLAICE IN DIV. 3LNO DERIVED FROM ADAPT USING CANADIAN RV DATA.

PARAMETER CORRELATION MATRIX

	1	2	3	4	5	6	7	8	9	10
1	1.000	0.065	0.054	0.044	0.032	0.005	0.014	0.010	0.008	0.005
2	0.065	1.000	0.075	0.062	0.044	0.018	0.013	0.014	0.011	0.006
3	0.054	0.075	1.000	0.076	0.054	0.026	0.018	0.013	0.013	0.008
4	0.044	0.062	0.076	1.000	0.066	0.034	0.023	0.016	0.012	0.009
5	0.032	0.044	0.054	0.066	1.000	0.047	0.029	0.019	0.014	0.007
6	0.005	0.018	0.026	0.034	0.047	1.000	0.039	0.024	0.016	0.009
7	0.014	0.013	0.018	0.023	0.029	0.039	1.000	0.024	0.024	0.028
8	0.010	0.014	0.013	0.016	0.019	0.024	0.024	1.000	0.048	0.033
9	0.008	0.011	0.013	0.012	0.014	0.016	0.024	0.048	1.000	0.051
10	0.005	0.006	0.008	0.009	0.007	0.009	0.028	0.033	0.051	1.000
11	-0.292	-0.223	-0.184	-0.152	-0.109	-0.018	-0.047	-0.034	-0.027	-0.016
12	-0.030	-0.222	-0.188	-0.155	-0.109	-0.070	-0.016	-0.034	-0.026	-0.016
13	-0.019	-0.028	-0.192	-0.164	-0.113	-0.073	-0.049	-0.011	-0.026	-0.016
14	-0.013	-0.018	-0.023	-0.183	-0.141	-0.081	-0.053	-0.035	-0.008	-0.016
15	-0.008	-0.012	-0.016	-0.019	-0.213	-0.119	-0.067	-0.042	-0.031	-0.007
16	-0.003	-0.007	-0.009	-0.012	-0.016	-0.242	-0.105	-0.064	-0.042	-0.025
17	-0.005	-0.006	-0.007	-0.009	-0.011	-0.014	-0.252	-0.122	-0.078	-0.042
18	-0.004	-0.005	-0.005	-0.006	-0.007	-0.009	-0.022	-0.256	-0.148	-0.078
19	-0.003	-0.004	-0.005	-0.005	-0.005	-0.006	-0.034	-0.028	-0.246	-0.144
20	-0.002	-0.003	-0.004	-0.004	-0.005	-0.006	-0.074	-0.042	-0.032	-0.250

	11	12	13	14	15	16	17	18	19	20
1	-0.292	-0.030	-0.019	-0.013	-0.008	-0.003	-0.005	-0.004	-0.003	-0.002
2	-0.223	-0.222	-0.028	-0.018	-0.012	-0.007	-0.006	-0.005	-0.004	-0.003
3	-0.184	-0.188	-0.192	-0.023	-0.016	-0.009	-0.007	-0.005	-0.005	-0.004
4	-0.152	-0.155	-0.164	-0.183	-0.019	-0.012	-0.009	-0.006	-0.005	-0.004
5	-0.109	-0.109	-0.113	-0.141	-0.213	-0.016	-0.011	-0.007	-0.005	-0.005
6	-0.018	-0.070	-0.073	-0.081	-0.119	-0.242	-0.014	-0.009	-0.006	-0.006
7	-0.047	-0.016	-0.049	-0.053	-0.067	-0.105	-0.252	-0.022	-0.034	-0.074
8	-0.034	-0.034	-0.011	-0.035	-0.042	-0.064	-0.122	-0.256	-0.028	-0.042
9	-0.027	-0.026	-0.026	-0.008	-0.031	-0.042	-0.078	-0.148	-0.246	-0.032
10	-0.016	-0.016	-0.016	-0.016	-0.007	-0.025	-0.042	-0.078	-0.144	-0.250
11	1.000	0.103	0.067	0.044	0.029	0.012	0.018	0.014	0.010	0.009
12	0.103	1.000	0.070	0.046	0.032	0.021	0.010	0.013	0.009	0.006
13	0.067	0.070	1.000	0.050	0.035	0.023	0.015	0.008	0.010	0.008
14	0.044	0.046	0.050	1.000	0.042	0.027	0.018	0.011	0.006	0.009
15	0.029	0.032	0.035	0.042	1.000	0.038	0.024	0.016	0.010	0.008
16	0.012	0.021	0.023	0.027	0.038	1.000	0.037	0.024	0.017	0.016
17	0.018	0.010	0.015	0.018	0.024	0.037	1.000	0.046	0.032	0.032
18	0.014	0.013	0.008	0.011	0.016	0.024	0.046	1.000	0.049	0.031
19	0.010	0.009	0.010	0.006	0.010	0.017	0.032	0.049	1.000	0.043
20	0.009	0.006	0.008	0.009	0.008	0.016	0.032	0.031	0.043	1.000

TABLE 28. CONT.

POPULATION NUMBERS (000S)

AGE	1975	1976	1977	1978	1979	1980	1981	1982
5	293362	278557	233749	220401	202719	185434	159723	155568
6	229736	239385	227306	190496	179040	164834	151583	130631
7	192227	185262	192457	180019	151923	140658	132261	123604
8	123977	150849	143734	149659	139067	112140	106537	106252
9	75134	92969	105985	107066	113123	96896	80431	82894
10	43354	53159	61099	74304	76128	79066	66563	58685
11	25349	28344	32359	39928	48439	51012	51874	44160
12	16361	15596	15675	20594	23698	31704	31551	30197
13	11201	9114	8104	8982	10687	15987	18639	15090
14	5764	5743	4725	4491	4047	7082	9712	7394
15	2986	2351	2613	2518	1651	2667	4382	2892
16	1536	1123	706	1234	729	1042	1600	930
17	814	567	391	269	423	453	614	297
18	324	237	243	155	28	290	292	146
19	271	53	135	107	30	9	214	17
5+	1022397	1063309	1029280	1000425	951733	889273	815977	758757

AGE	1983	1984	1985	1986	1987	1988
5	137712	170901	185855	212518	206061	253007
6	127344	114641	139879	151897	170546	166809
7	106667	103364	91864	113810	116707	135440
8	99557	84569	83255	73074	83080	88994
9	82650	76265	66244	63050	49425	58474
10	59773	60119	57145	44559	40208	26316
11	36432	41965	40211	32543	24394	17226
12	21857	22143	22697	19776	14039	9811
13	11613	11094	10019	10228	7084	5286
14	5168	5356	4493	4486	3208	3076
15	2232	1987	2110	1898	1381	1480
16	559	724	641	609	342	462
17	181	120	227	174	32	71
18	57	31	14	41	5	2
19	33	2	12	4	2	0
5+	691836	691383	704664	728667	716516	766455

TABLE 28. CONT.

FISHING MORTALITY

AGE	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
5	0.003	0.003	0.005	0.008	0.007	0.002	0.001	0.000	0.001	0.000	0.002
6	0.015	0.018	0.033	0.026	0.041	0.020	0.004	0.003	0.009	0.004	0.006
7	0.042	0.054	0.052	0.058	0.104	0.078	0.019	0.016	0.032	0.016	0.029
8	0.088	0.153	0.095	0.080	0.161	0.132	0.051	0.051	0.067	0.044	0.078
9	0.146	0.220	0.152	0.141	0.158	0.175	0.115	0.127	0.118	0.089	0.197
10	0.225	0.296	0.225	0.231	0.200	0.221	0.210	0.277	0.154	0.202	0.363
11	0.286	0.392	0.252	0.322	0.224	0.280	0.341	0.503	0.298	0.415	0.510
12	0.385	0.455	0.357	0.456	0.194	0.331	0.538	0.756	0.478	0.593	0.597
13	0.468	0.457	0.390	0.597	0.211	0.298	0.725	0.871	0.574	0.704	0.604
14	0.697	0.588	0.430	0.801	0.217	0.280	1.011	0.998	0.756	0.732	0.662
15	0.778	1.003	0.550	1.039	0.260	0.311	1.351	1.445	0.925	0.932	1.042
16	0.796	0.855	0.766	0.870	0.276	0.330	1.482	1.486	1.340	0.958	1.104
17	1.035	0.649	0.723	2.057	0.180	0.238	1.237	1.449	1.577	1.954	1.511
18	1.603	0.362	0.616	1.433	0.991	0.101	2.653	1.300	2.944	0.779	1.173
19	0.516	0.531	0.405	0.593	0.205	0.314	0.742	0.868	0.580	0.667	0.643

AGE	1986	1987	1988
5	0.020	0.011	0.009
6	0.064	0.030	0.015
7	0.115	0.071	0.031
8	0.191	0.151	0.081
9	0.250	0.430	0.204
10	0.402	0.648	0.571
11	0.641	0.711	0.922
12	0.827	0.777	1.125
13	0.959	0.634	0.824
14	0.978	0.574	0.538
15	1.513	0.895	0.651
16	2.755	1.370	0.917
17	3.436	2.604	0.917
18	2.654	3.032	0.917
19	0.960	0.729	0.917

TABLE 29. FINAL SPA RUN, USING THE POPULATION NUMBERS IN 1988 DERIVED FROM THE ANALYSES WITH THE ADAPTIVE FRAMEWORK.

POPULATION NUMBERS

AGE	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
5	280993	293376	278985	236025	222885	203937	197047	189326	210289	199185	171129	185023	210153	212614	257836
6	241373	229737	239397	227656	192360	181073	165832	161091	154868	172146	162971	140065	151216	168610	172174
7	163004	192231	185263	192466	180306	153449	142322	133078	131389	126511	140044	133070	113963	116150	133855
8	102900	123978	150853	143735	149667	139302	113389	107900	106921	105930	100816	113287	106811	83205	88538
9	61538	75136	92970	105987	107066	113130	97088	81454	84010	83197	81483	79545	87637	77047	58577
10	40914	43354	53161	61100	74506	76128	79071	66721	59522	60687	60567	61417	55449	60338	48931
11	27815	25350	28345	32361	39929	48441	51013	51878	44288	37118	42713	40578	36041	33310	33707
12	18761	16361	15596	15676	20595	23699	31705	31552	30200	21963	22705	23310	20077	16903	17111
13	11250	11201	9114	8104	8982	10688	15987	18640	15090	11616	11180	10478	10730	7330	7630
14	6165	5764	5743	4725	4491	4047	7083	9712	7395	5169	5359	4564	4862	3619	3278
15	3139	2986	2351	2613	2518	1651	2667	4383	2893	2233	1988	2112	1956	1689	1816
16	1715	1537	1123	706	1235	730	1042	1600	930	559	725	641	611	389	714
17	691	815	568	391	269	424	453	614	298	182	120	228	174	33	110
18	421	324	238	244	155	28	290	292	146	57	31	14	42	5	3
19	56	273	54	136	108	30	9	215	17	33	3	12	4	3	0
5+	960734	1022425	1063760	1031925	1005072	956756	904999	858456	848256	826584	801833	794343	799726	781246	824280
6+	679741	729049	784775	795899	782188	752819	707952	669129	637967	627399	630704	609320	589573	568632	566445
7+	438367	499312	545378	568243	589828	571746	542120	508039	483099	455254	467733	469255	438356	400021	394270
8+	275363	307081	360115	375777	409522	418297	399798	374961	351711	328743	327689	336185	324394	283871	260415

MEAN POPULATION BIOMASS

AGE	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
5	53445	56674	52151	44577	39266	38569	37271	35800	48789	53826	41871	35581	22836	44056	39441
6	55329	52496	56108	53681	44724	51755	48771	55260	41820	59431	46346	41634	25711	44051	39364
7	48342	59335	56553	60669	56137	49579	50740	48553	42519	53549	48170	51381	27088	40339	40574
8	37395	44872	52629	53488	53741	52945	46510	43197	40345	51707	41283	47252	37463	30499	33278
9	30015	35826	42274	54867	46456	52413	43796	34060	34814	46935	39127	36663	39834	30530	22908
10	22943	24434	27642	33455	37151	38186	36802	29326	25270	35695	28108	31196	28670	29709	22945
11	19680	17996	17726	22867	23904	27723	26341	22096	18962	20437	20948	23881	19435	20369	19536
12	16489	13342	11643	12233	13846	18306	18182	15093	14365	12073	13475	17868	12405	12788	12548
13	11258	10770	7626	7533	7328	10761	12364	9634	9035	7759	8328	10765	8406	6985	7447
14	6925	5797	5354	4961	3916	5586	7623	5656	5497	4061	5036	5841	4996	4513	4104
15	4432	3383	2272	3276	2446	2529	3670	2908	2262	2079	2365	2833	2000	2504	2907
16	2917	2194	1422	992	1567	1229	1451	1372	929	608	1100	1040	500	649	1457
17	1283	1189	867	593	243	823	816	689	338	202	141	358	143	42	288
18	1006	424	495	424	174	53	673	235	205	49	74	31	58	7	10
19	120	567	109	317	161	79	19	359	35	68	5	43	10	8	1
5+	311579	329300	334870	353934	331058	350536	335029	304237	285184	348480	296377	306369	229554	267049	246809
6+	258135	272626	282719	309357	291792	311966	297758	268437	236395	294653	254506	270788	206718	222993	207368
7+	202805	220130	226611	255675	247069	260211	248987	213177	194576	235222	208160	229154	181007	178942	168004
8+	154463	160795	170058	195006	190932	210633	198247	164624	152057	181673	159989	177773	153919	138603	127430

FISHING MORTALITY

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
5	0.001	0.003	0.003	0.005	0.008	0.007	0.001	0.001	0.000	0.001	0.000	0.002	0.020	0.011	0.009
6	0.028	0.015	0.018	0.033	0.026	0.041	0.020	0.004	0.002	0.006	0.003	0.006	0.064	0.031	0.015
7	0.074	0.042	0.054	0.052	0.058	0.103	0.077	0.019	0.015	0.027	0.012	0.020	0.115	0.071	0.031
8	0.114	0.088	0.153	0.095	0.080	0.161	0.131	0.050	0.051	0.062	0.037	0.057	0.127	0.151	0.081
9	0.150	0.146	0.220	0.152	0.141	0.158	0.175	0.114	0.125	0.117	0.083	0.161	0.173	0.254	0.204
10	0.279	0.225	0.296	0.225	0.231	0.200	0.221	0.210	0.272	0.151	0.201	0.333	0.310	0.382	0.268
11	0.331	0.286	0.392	0.252	0.322	0.224	0.280	0.341	0.501	0.292	0.406	0.504	0.557	0.466	0.372
12	0.316	0.385	0.455	0.357	0.456	0.194	0.331	0.538	0.755	0.475	0.573	0.576	0.808	0.595	0.496
13	0.469	0.468	0.457	0.390	0.597	0.211	0.298	0.724	0.871	0.574	0.696	0.568	0.887	0.605	0.496
14	0.525	0.697	0.588	0.430	0.801	0.217	0.280	1.011	0.998	0.756	0.731	0.648	0.857	0.490	0.496
15	0.514	0.778	1.003	0.550	1.039	0.260	0.311	1.350	1.444	0.925	0.932	1.040	1.414	0.661	0.496
16	0.544	0.795	0.855	0.766	0.870	0.276	0.330	1.482	1.434	1.339	0.957	1.103	2.718	1.065	0.496
17	0.557	1.033	0.647	0.723	2.057	0.180	0.238	1.236	1.449	1.567	1.945	1.503	3.411	2.208	0.496
18	0.235	1.598	0.360	0.613	1.432	0.991	0.101	2.652	1.297	2.929	0.764	1.150	2.521	2.622	0.496
19	0.500	0.513	0.527	0.402	0.589	0.204	0.314	0.741	0.867	0.577	0.653	0.619	0.909	0.597	0.496
12+	0.414	0.525	0.530	0.407	0.597	0.205	0.313	0.750	0.869	0.581	0.654	0.619	0.911	0.597	0.496

TABLE 30. American plaice in Div. 3LNO: parameters used in projections of biomass and yield.

Age	Jan 1, 1989 Stock Size	Avg. wt.	PR
5	218,000	.173	.020
6	176,592	.247	.058
7	138,866	.338	.113
8	106,246	.426	.189
9	66,849	.504	.331
10	39,108	.632	.504
11	30,643	.789	.733
12	19,024	1.032	1.000
13	8,531	1.342	1.000
14	3,804	1.710	1.000
15	1,634	2.165	1.000
16	905	2.765	1.000
17	356	3.356	1.000
18	55	4.322	1.000
19	1	4.365	1.000

TABLE 31. RESULTS OF CATCH PROJECTION ASSUMING A CATCH OF 30,300t in 1989 AND F0.1 IN 1990.

CATCH NUMBERS

AGE	1989	1990
5	1425	1025
6	3326	2404
7	5048	3717
8	6375	4747
9	6855	6080
10	5929	5416
11	6501	4209
12	5268	4010
13	2362	2260
14	1053	1014
15	452	452
16	251	194
17	99	108
18	15	42
19	0	7
5+	44961	35685
6+	43536	34660
7+	40209	32256
8+	35162	28539

CATCH BIOMASS

AGE	1989	1990
5	247	178
6	821	593
7	1705	1255
8	2713	2021
9	3457	3066
10	3748	3424
11	5131	3322
12	5436	4137
13	3171	3034
14	1801	1733
15	979	978
16	693	537
17	331	361
18	66	183
19	1	29
5+	30300	24850
6+	30053	24672
7+	29232	24079
8+	27527	22824

POPULATION NUMBERS

AGE	1989	1990
5	218000	218000
6	176592	177196
7	138866	141577
8	106246	109137
9	66849	81235
10	39108	48551
11	30643	26679
12	19024	19241
13	8531	10845
14	3804	4863
15	1634	2169
16	905	932
17	356	516
18	55	203
19	1	31
5+	810614	841176
6+	592614	623176
7+	416022	445980
8+	277156	304403

POPULATION BIOMASS (AVERAGE)

AGE	1989	1990
5	34155.62	34189.27
6	39087.18	39332.77
7	41673.29	42722.86
8	39661.41	41118.13
9	28854.22	35630.05
10	20546.38	26131.78
11	19336.58	17430.14
12	15015.94	15913.19
13	8759.97	11668.24
14	4974.88	6664.13
15	2705.90	3762.71
16	1914.10	2064.28
17	914.07	1387.97
18	181.86	703.10
19	3.34	109.71
5+	257784.73	278828.35
6+	223629.11	244639.08
7+	184541.93	205306.31
8+	142868.65	162583.44

FISHING MORTALITY

AGE	1989	1990
5	0.007	0.005
6	0.021	0.015
7	0.041	0.029
8	0.068	0.049
9	0.120	0.086
10	0.182	0.131
11	0.265	0.191
12	0.362	0.260
13	0.362	0.260
14	0.362	0.260
15	0.362	0.260
16	0.362	0.260
17	0.362	0.260
18	0.362	0.260
19	0.362	0.260
5+	0.067	0.050

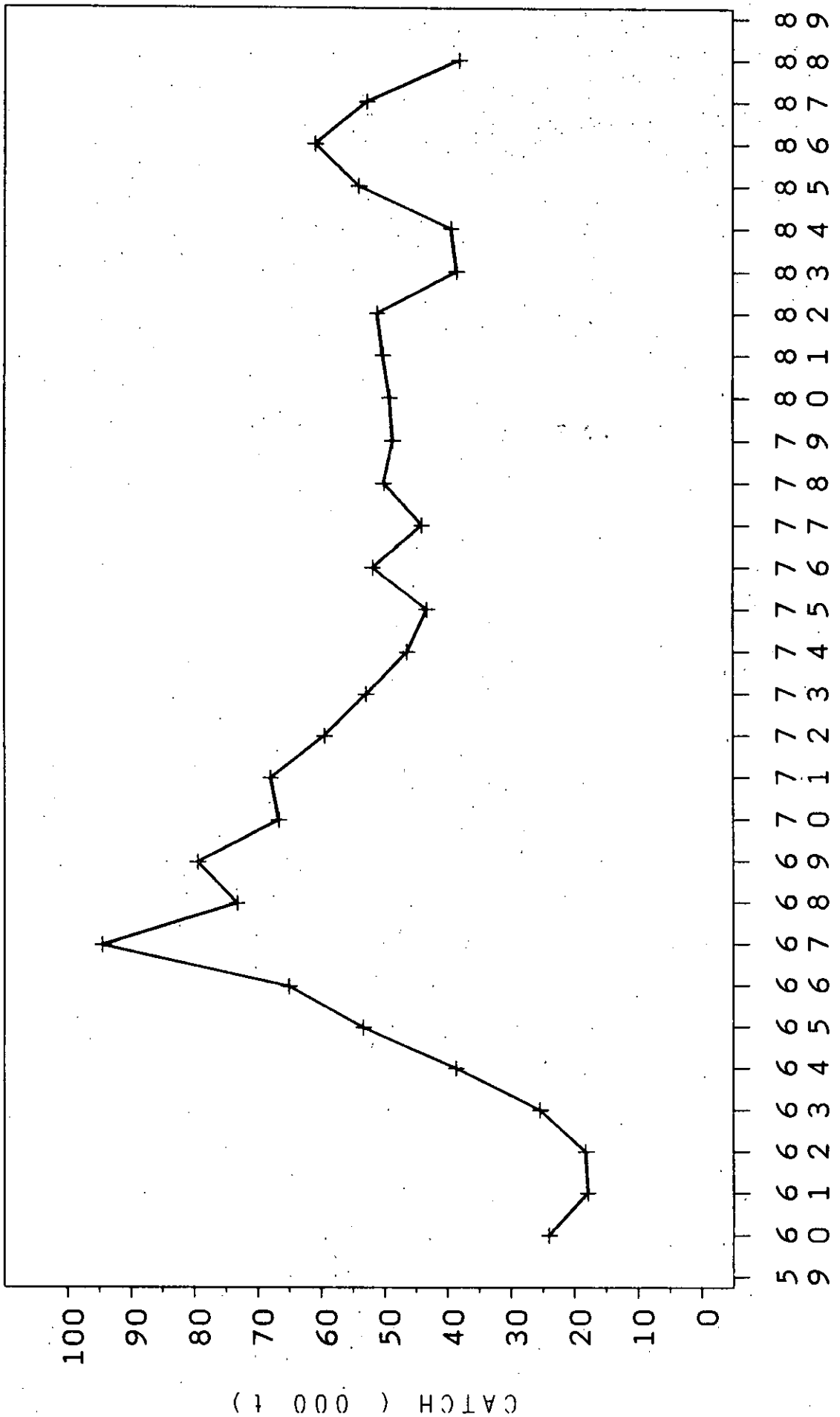


FIG.1. CATCHES OF A.PLAICE IN DIV. 3LNO FROM 1960-88.

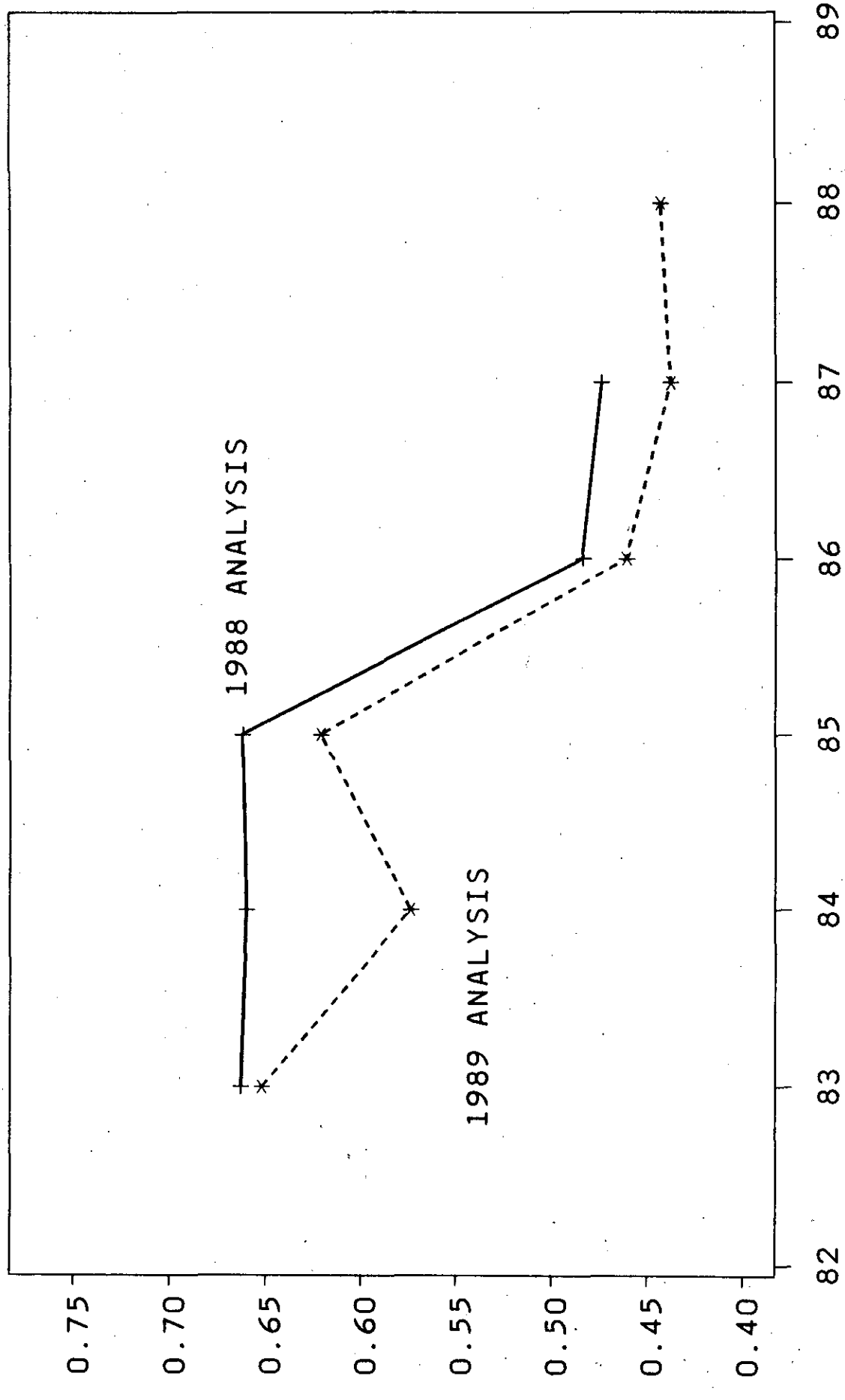


FIG.2. COMPARISON OF CPUE FOR 1983-87 FROM 1988 AND 1989 ANALYSES.

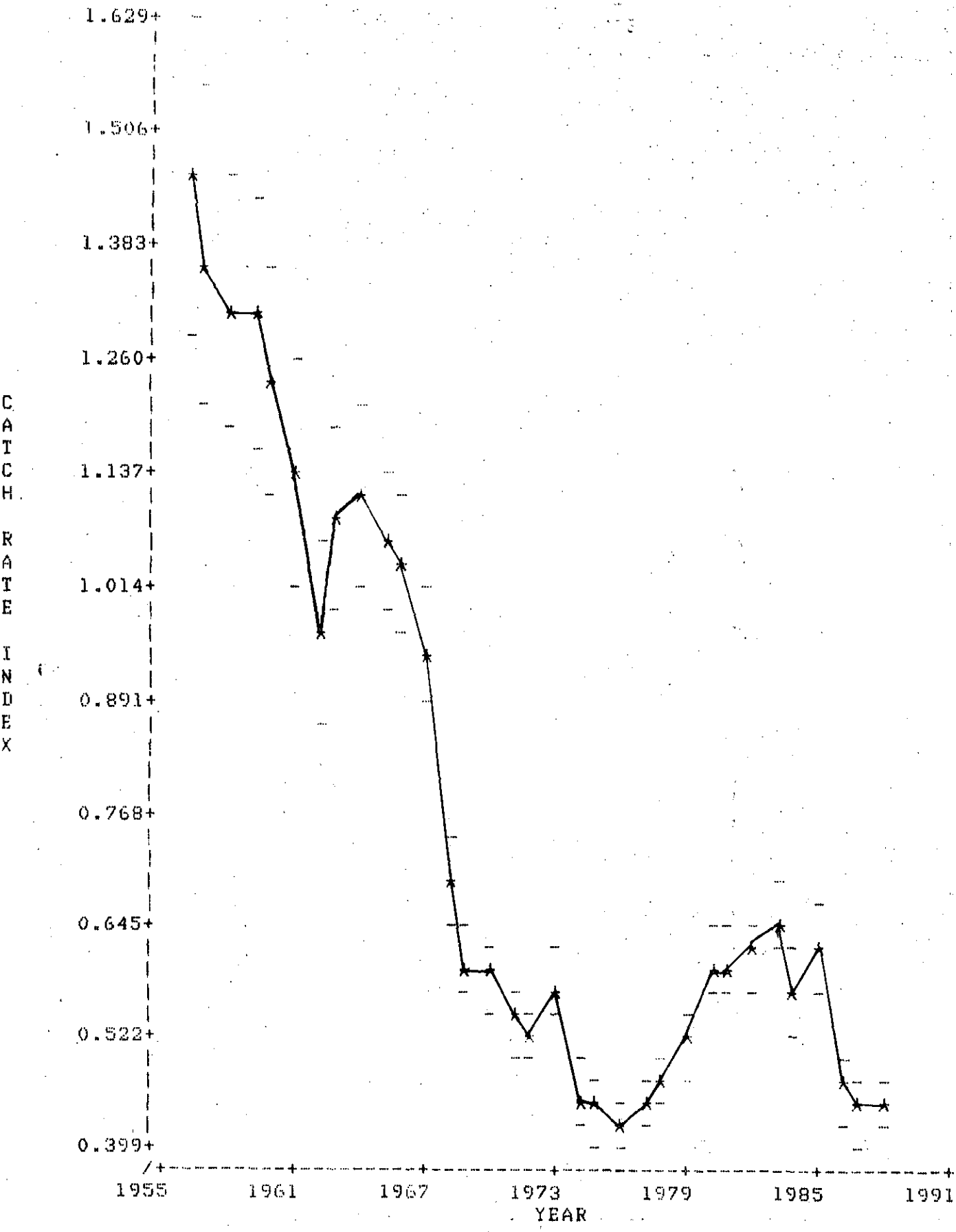


FIG.3. PLOT OF CPUE FOR DIV 3LNO.

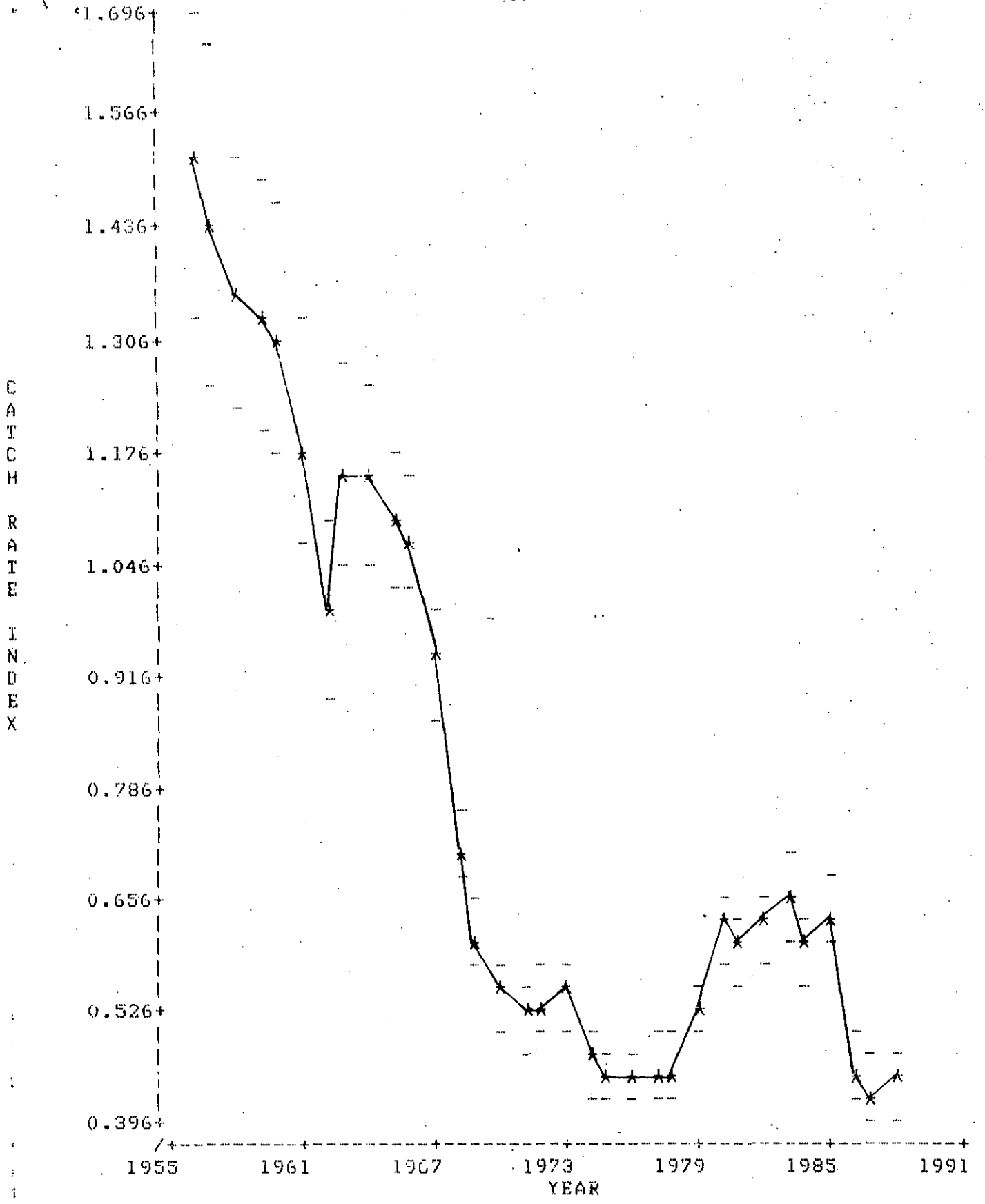


FIG.4. PLOT OF CPUE FOR DIV 3LN ONLY.

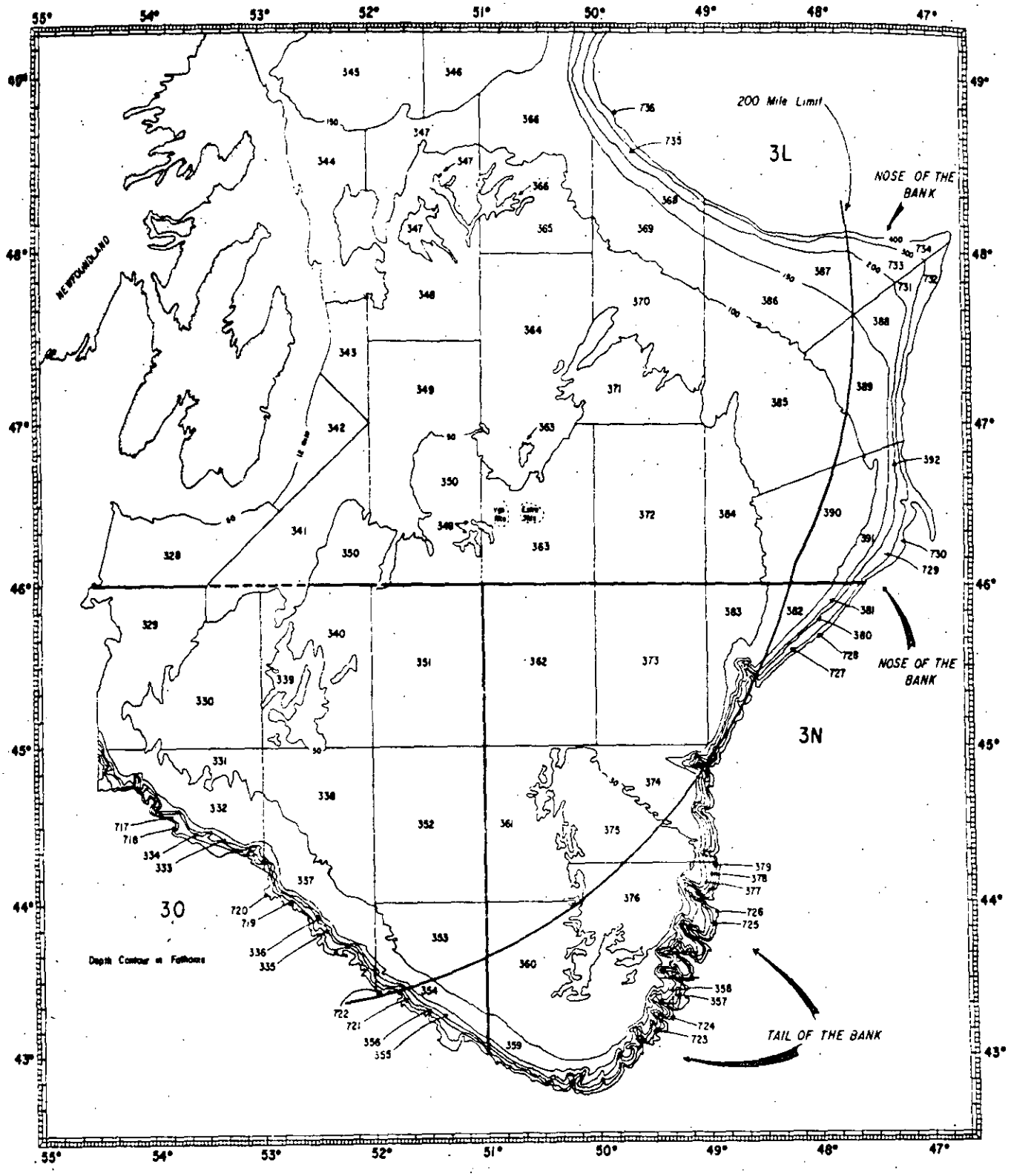


Fig. 5 NAFO Div. 3LNO, showing the Canadian 200 mile limit in relation to the Nose and Tail of the Bank, as well as the stratification scheme used in Canadian groundfish surveys.

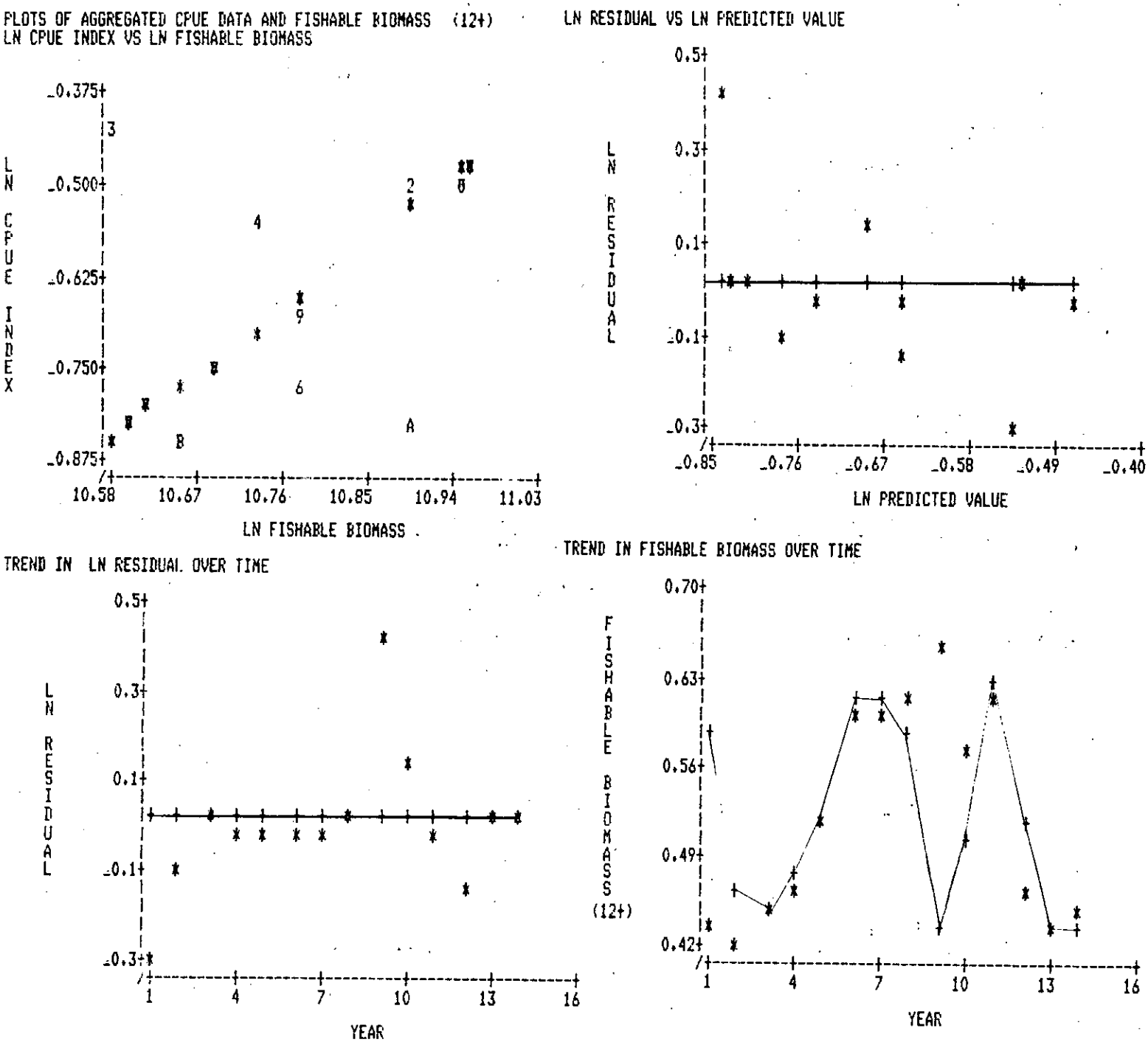
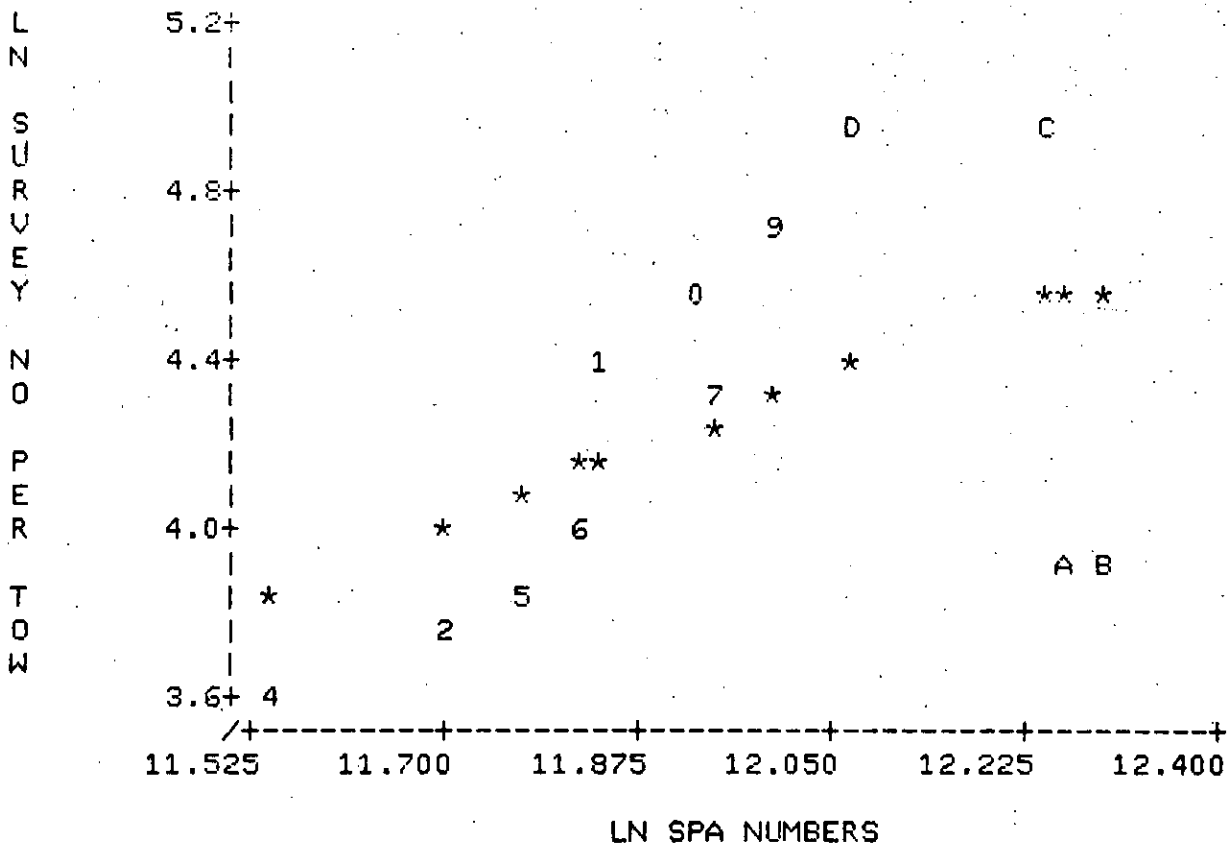


FIG.6. PLOTS FROM ADAPTIVE FRAMEWORK USING CPUE AND 12+ POP. BIOMASS.

AGE 6 PLOTS
LN SURVEY NO. PER TOW VS LN SPA NUMBERS



TREND IN LN RESIDUAL OVER TIME

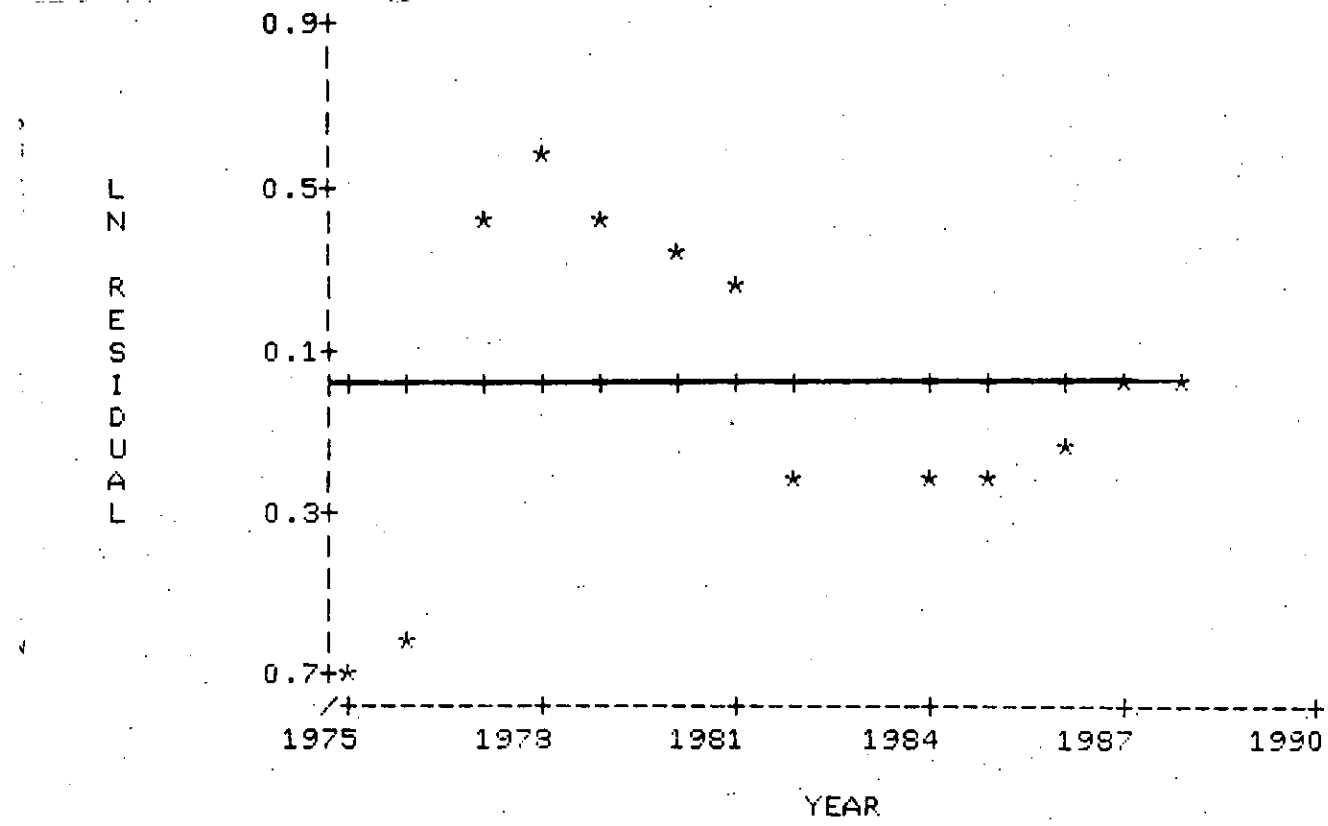
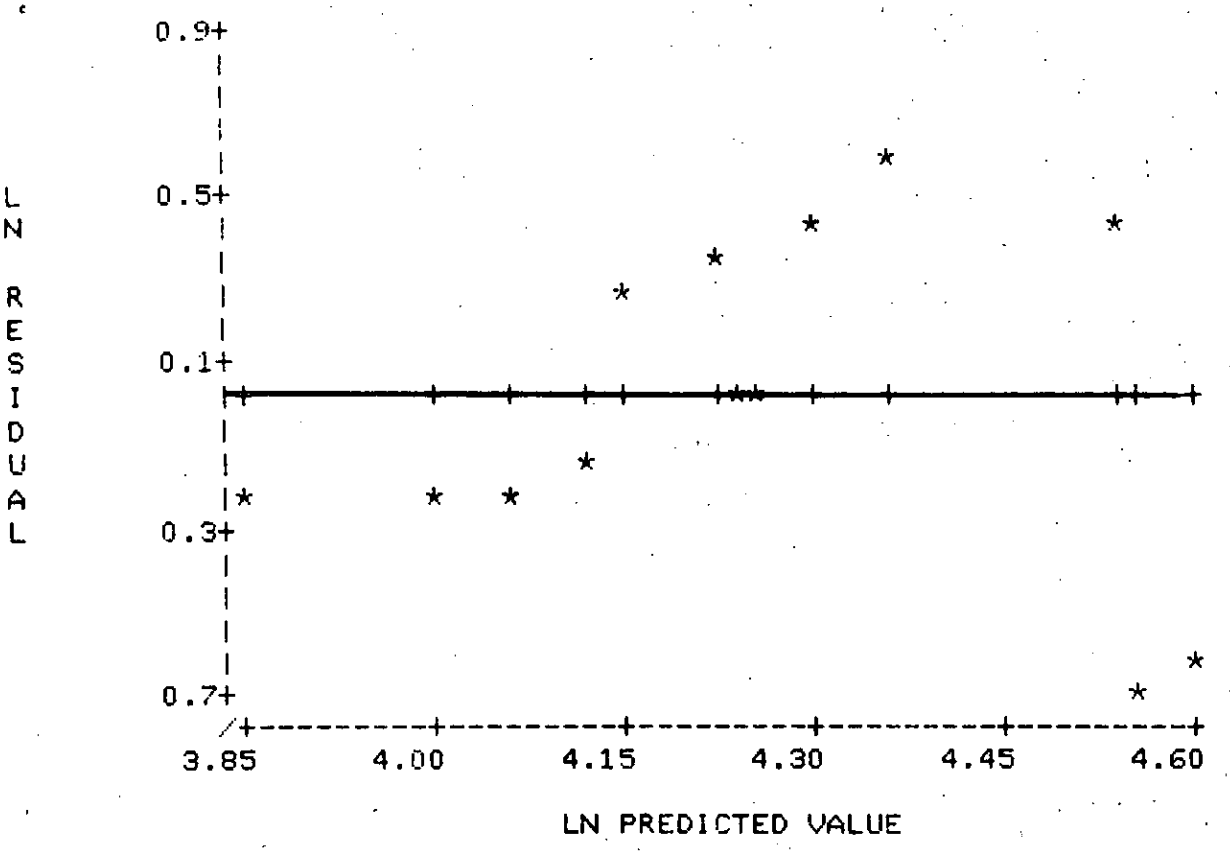


FIG.7. PLOTS FROM ADAPTIVE FRAMEWORK USING RV SURVEY DATA (AGE 6).

LN RESIDUAL VS LN PREDICTED VALUE



TREND IN POPULATION ABUNDANCE OVER TIME

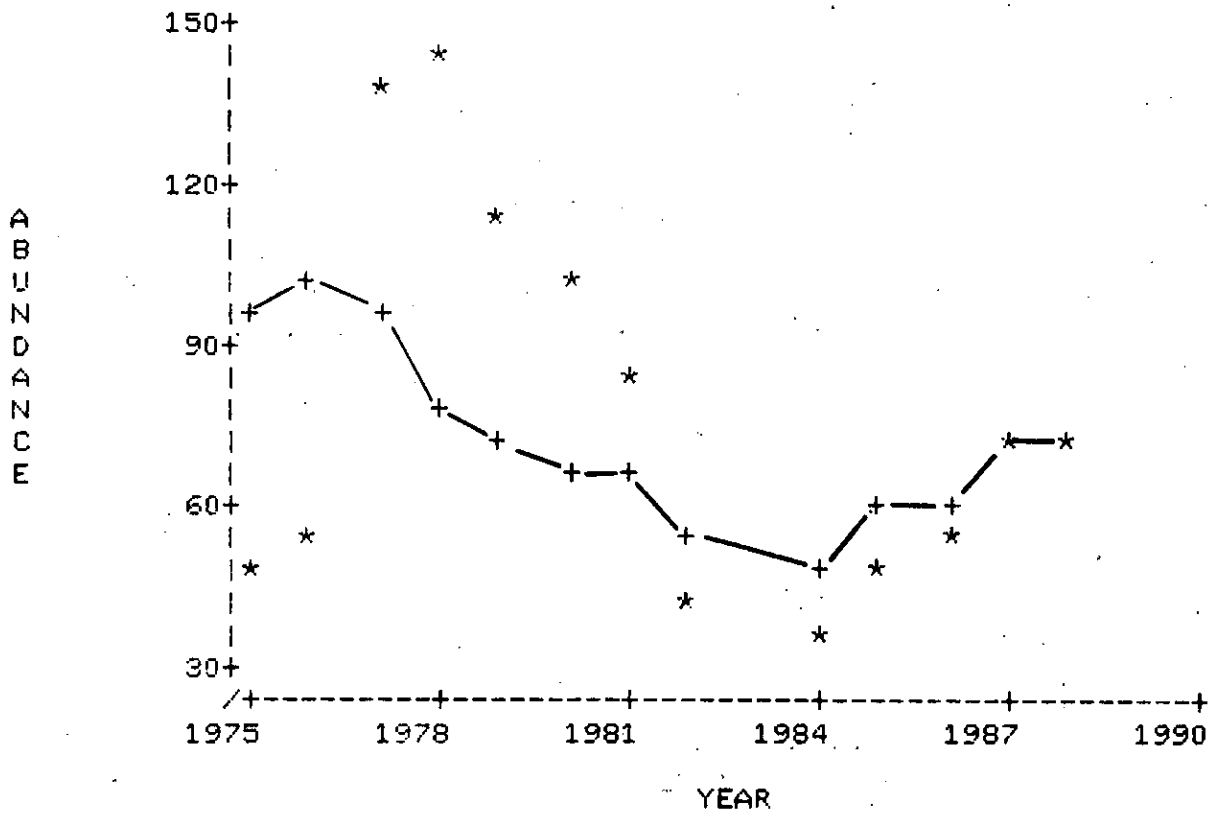
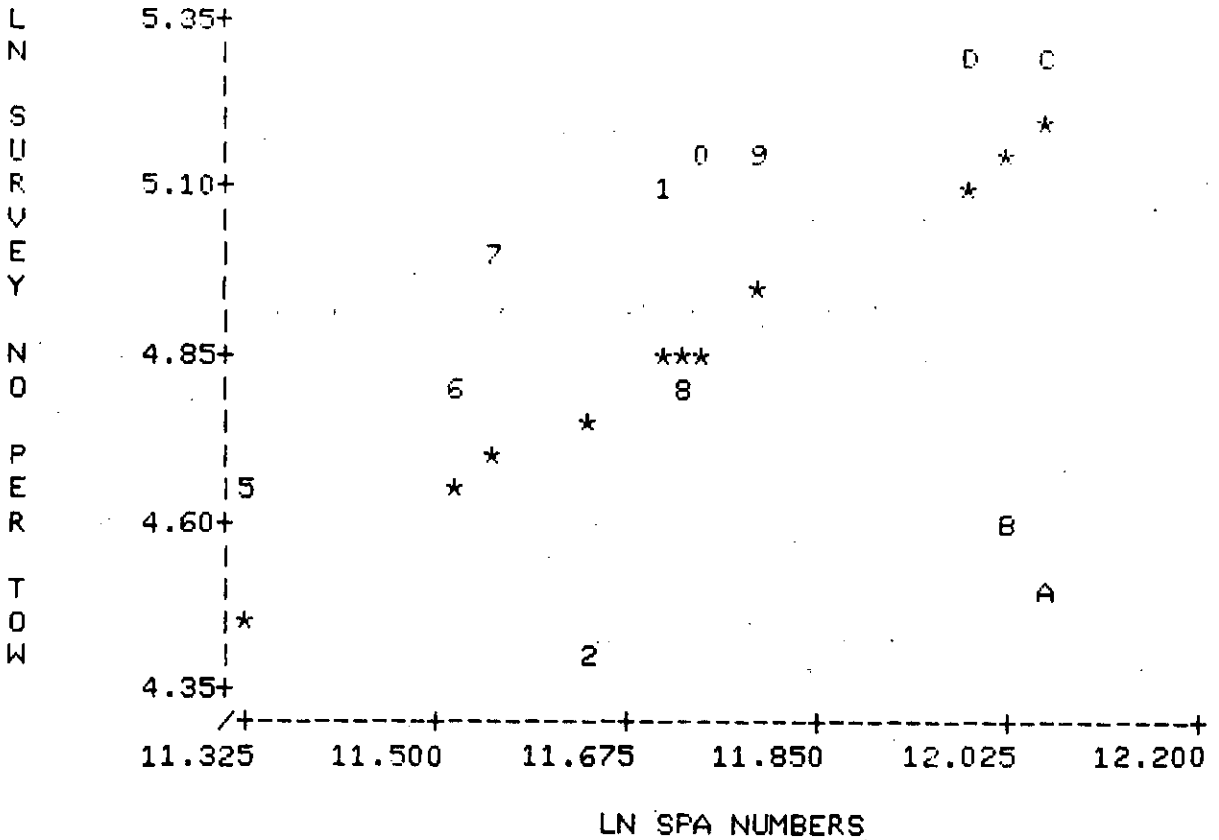


FIG.7. CONTINUED.

AGE 7 PLOTS
LN SURVEY NO. PER TOW VS LN SPA NUMBERS



TREND IN LN RESIDUAL OVER TIME

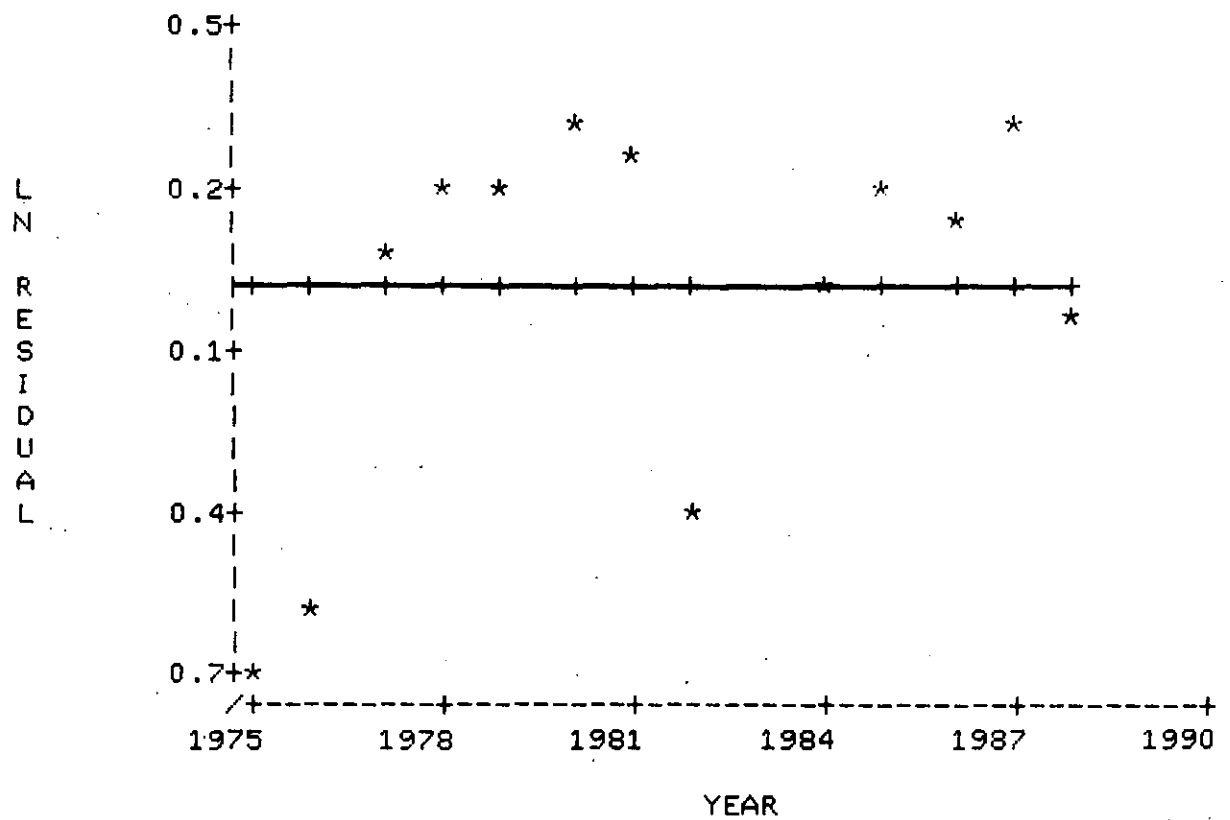
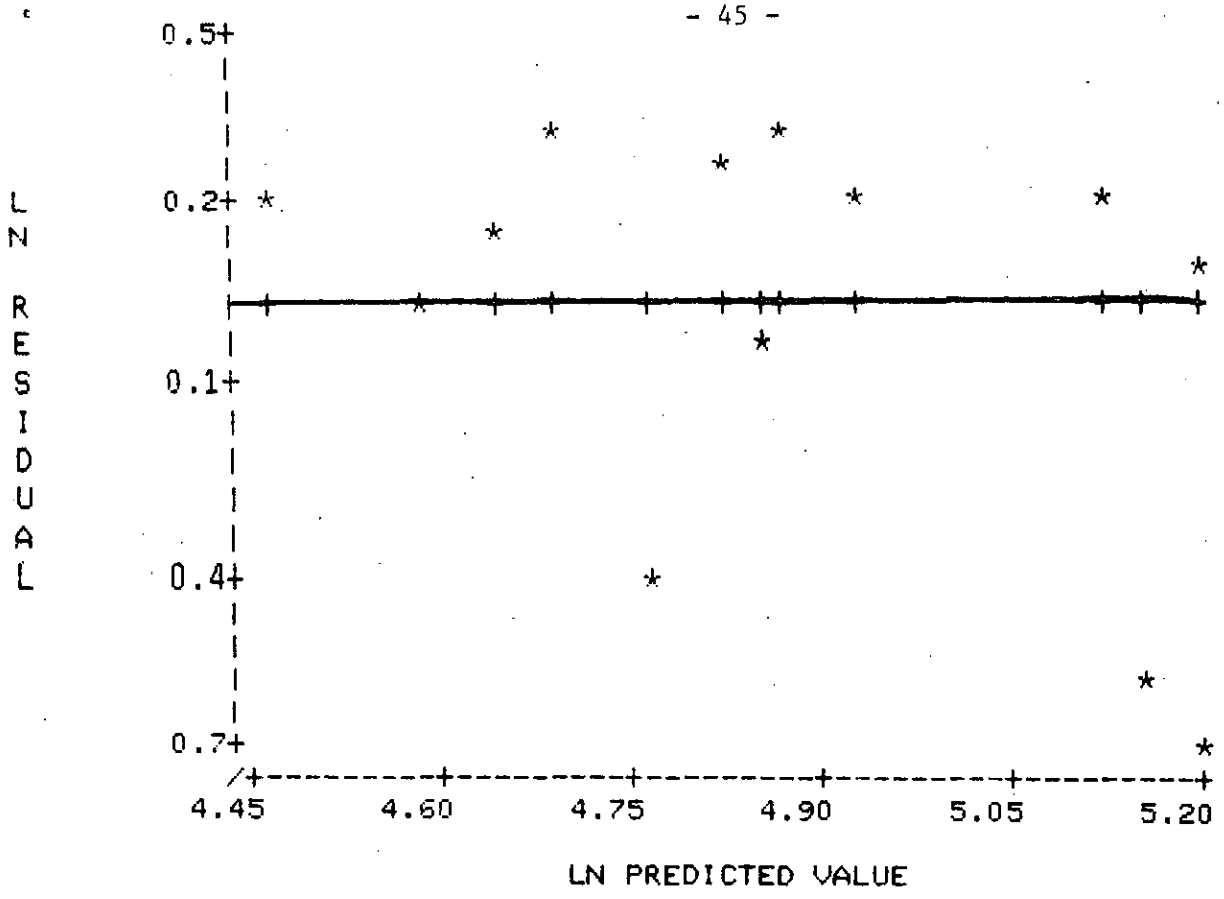


FIG.8. PLOTS FROM ADAPTIVE FRAMEWORK USING RV SURVEY DATA (AGE 7).

LN RESIDUAL VS LN PREDICTED VALUE



TREND IN POPULATION ABUNDANCE OVER TIME

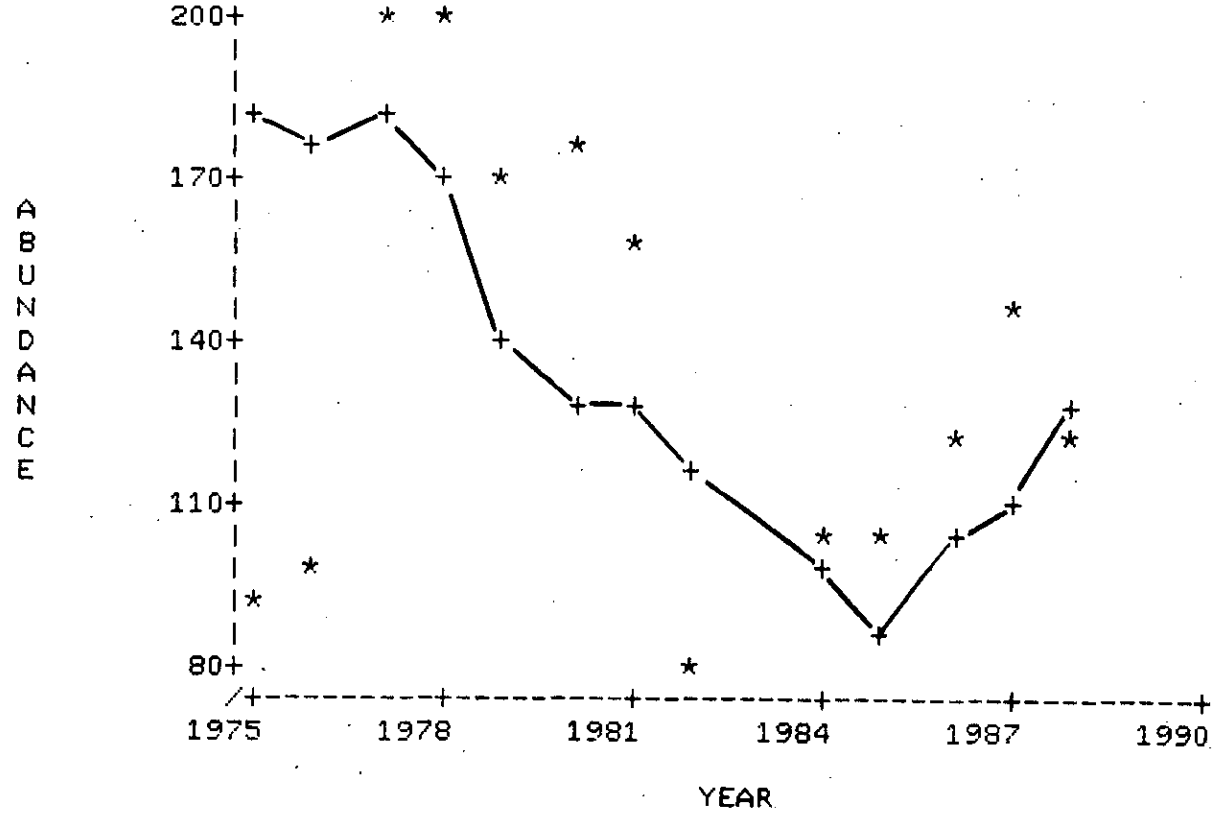
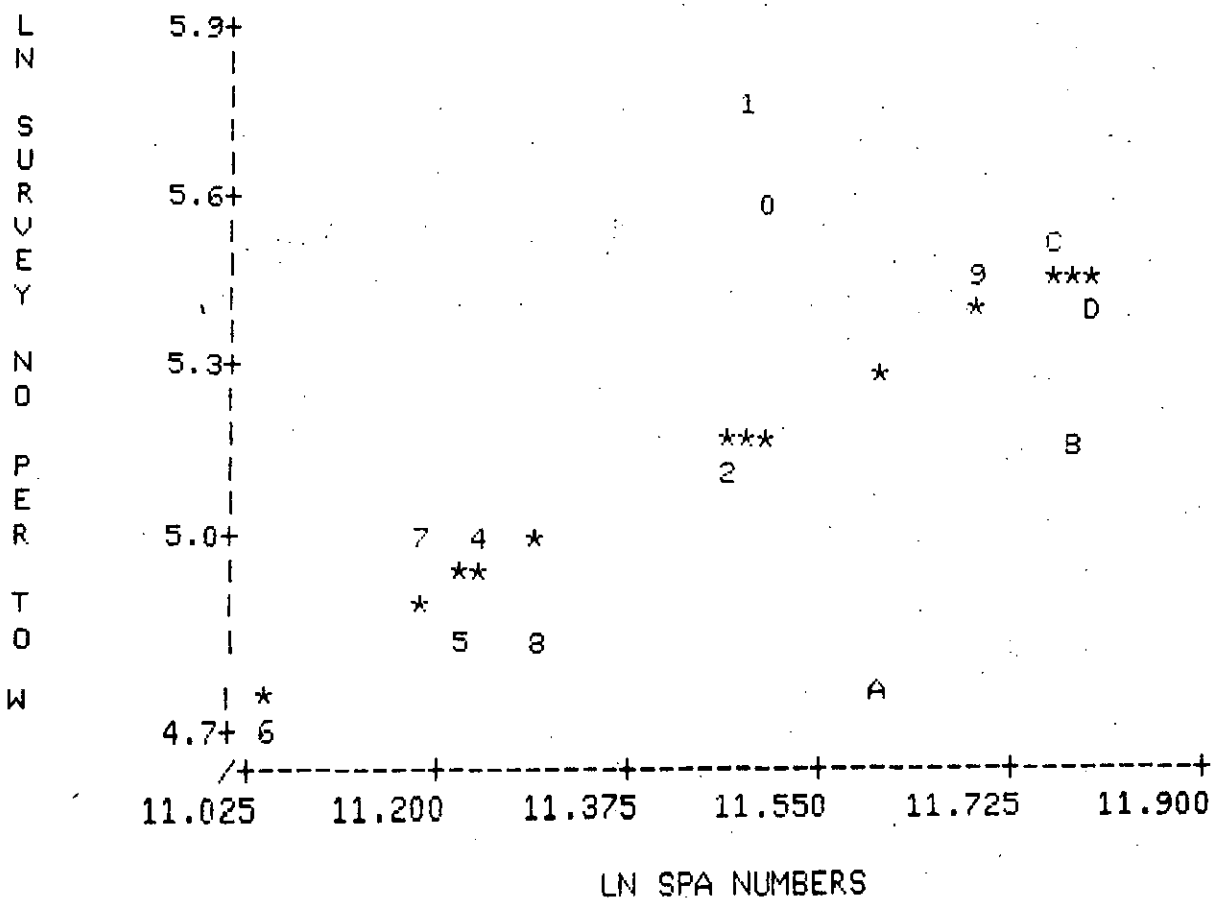


FIG.8. CONTINUED.



TREND IN LN RESIDUAL OVER TIME

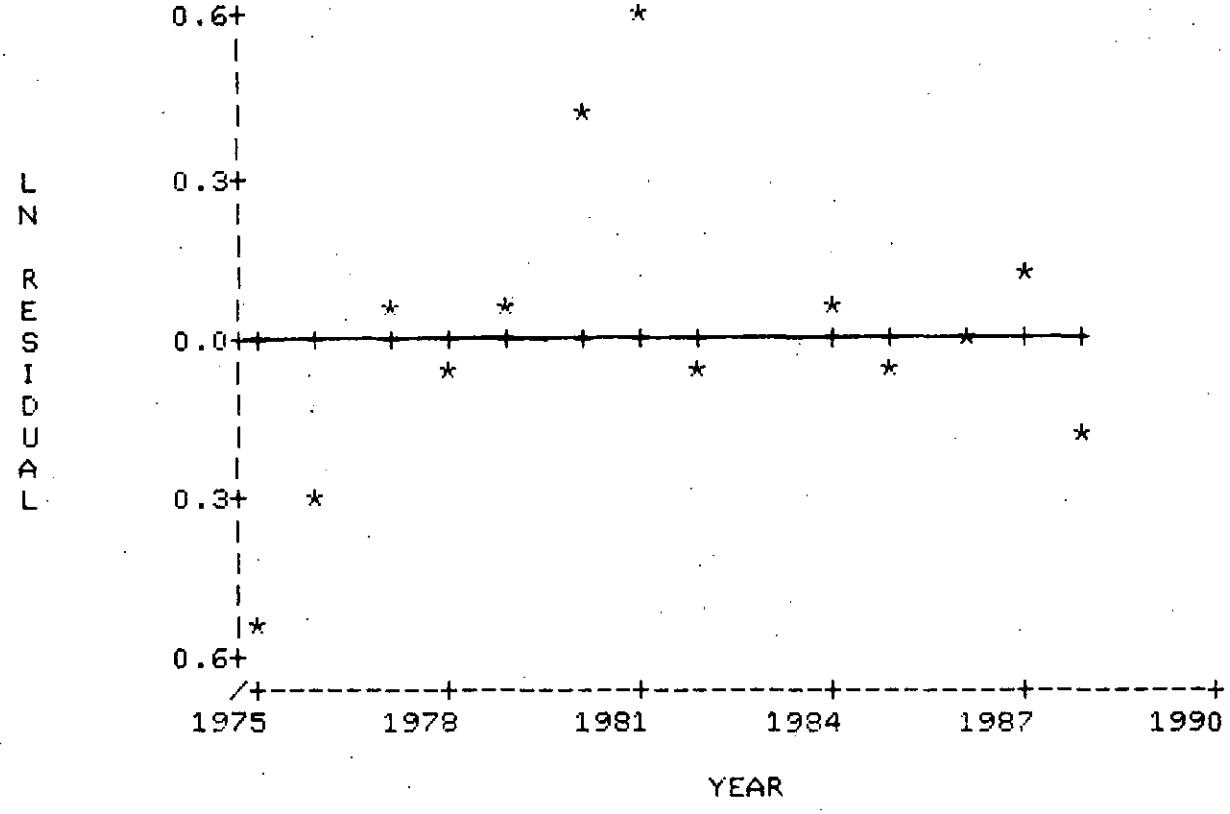
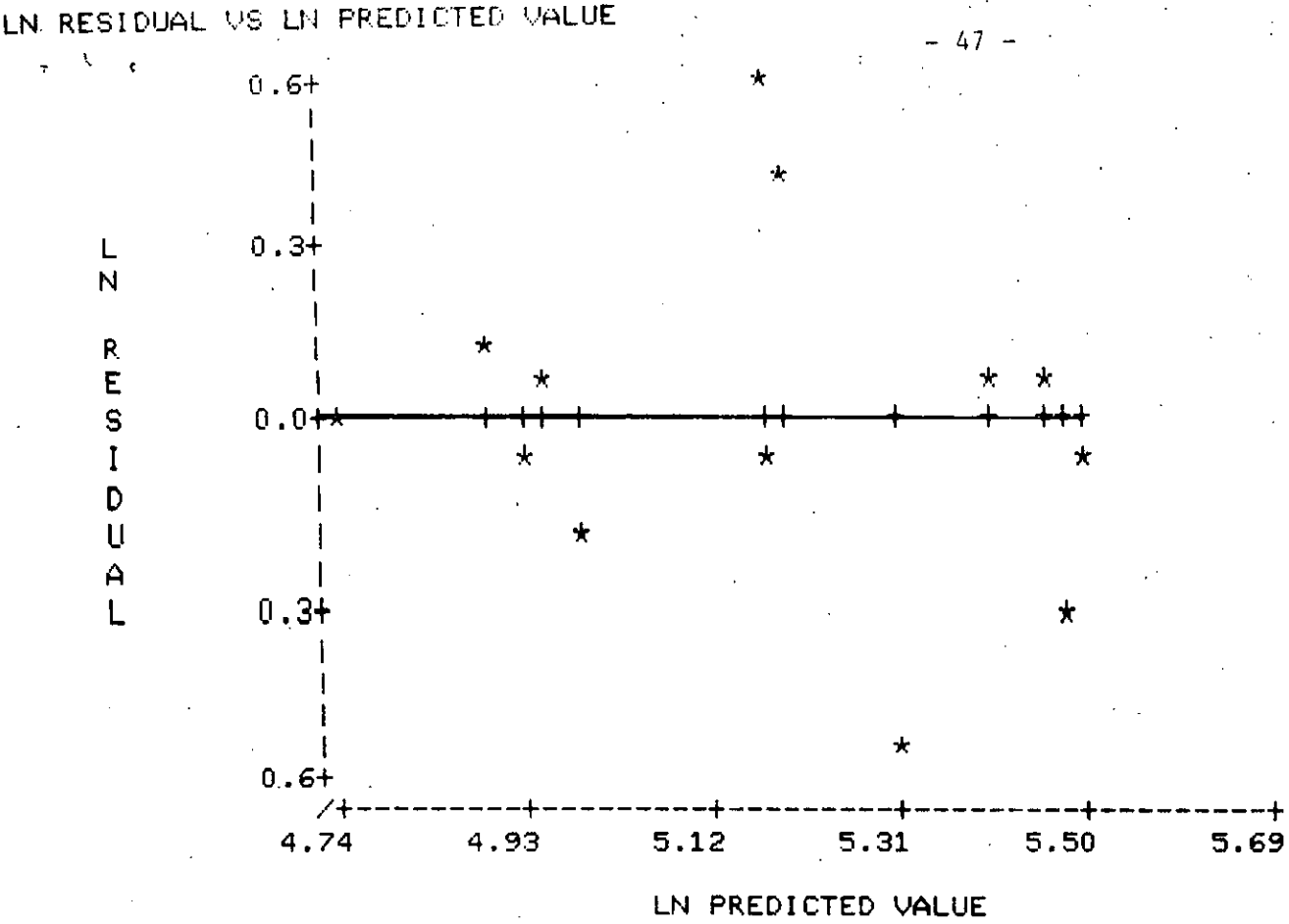


FIG.9. PLOTS FROM ADAPTIVE FRAMEWORK USING RV SURVEY DATA (AGE 8).



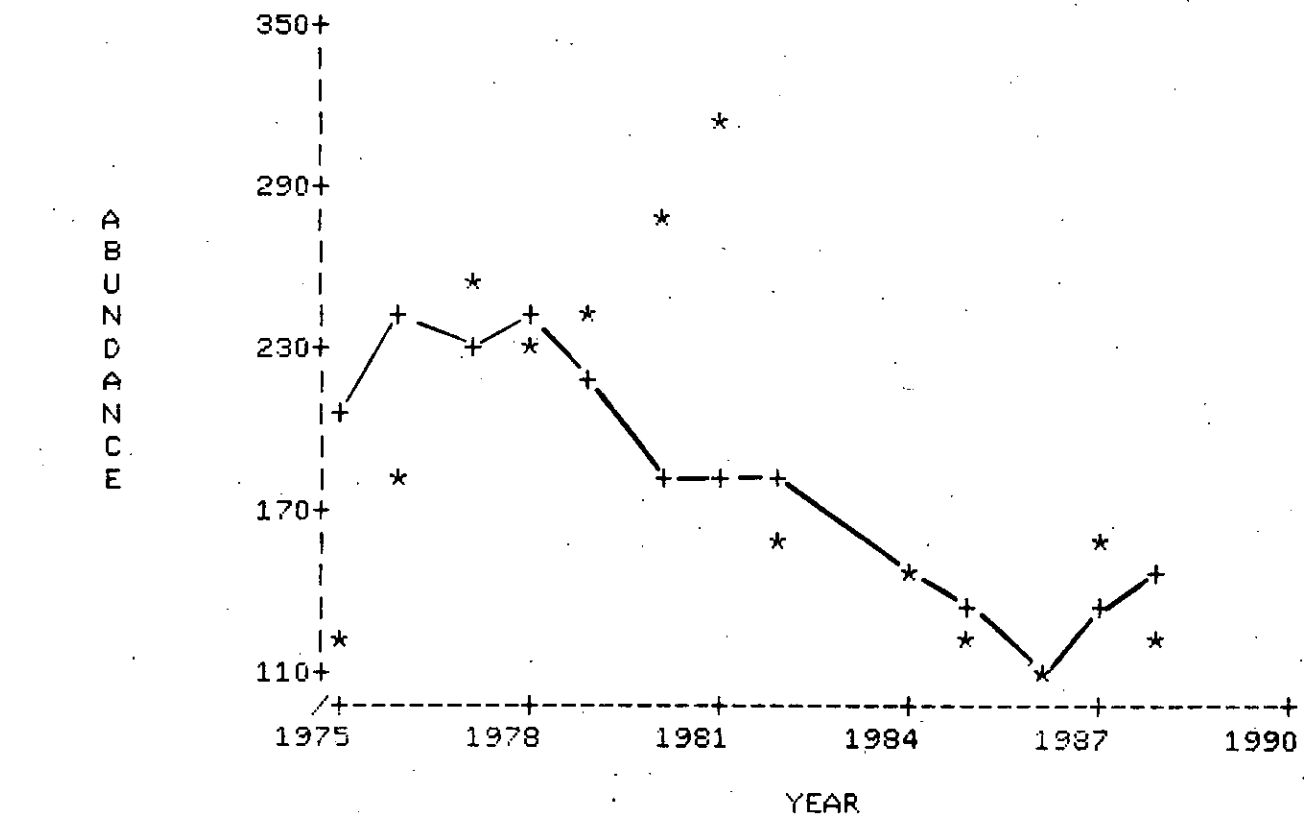
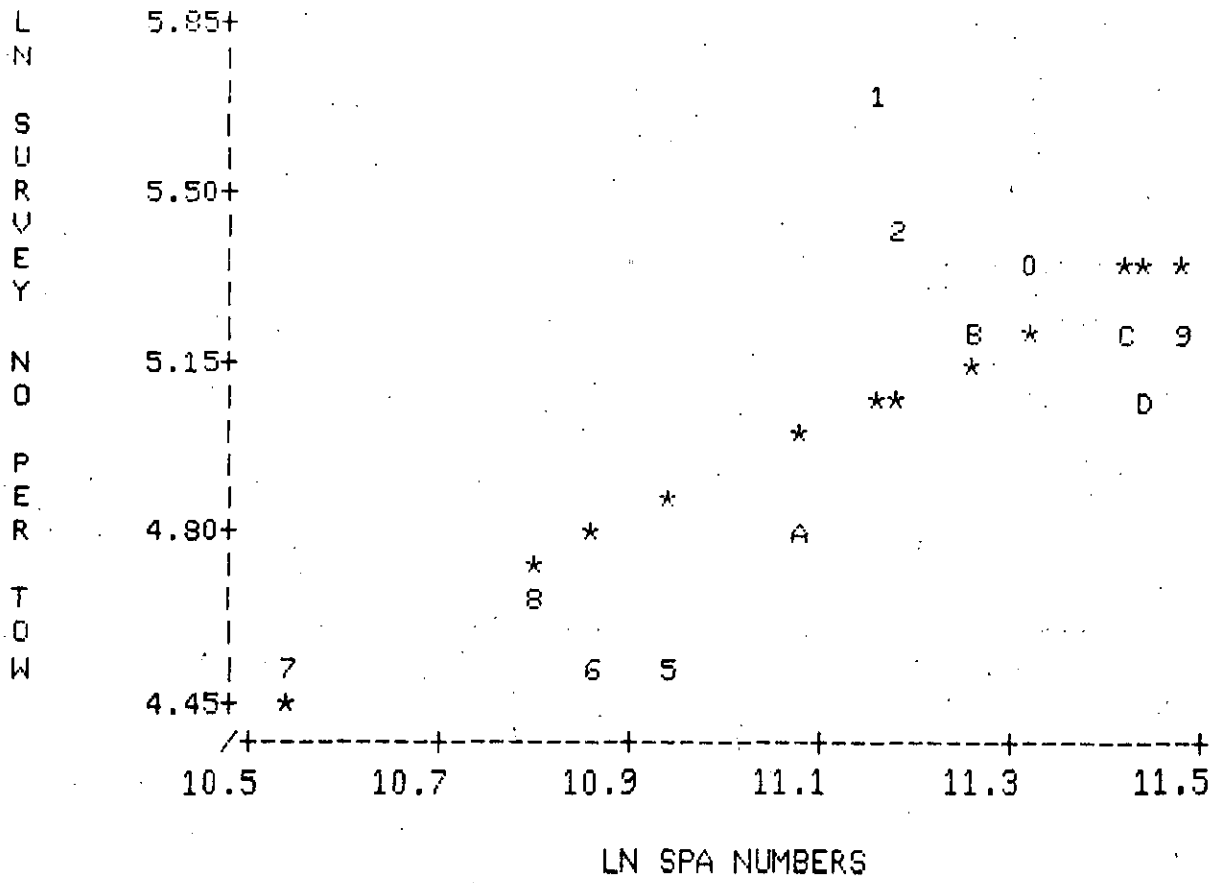


FIG.9. CONTINUED.



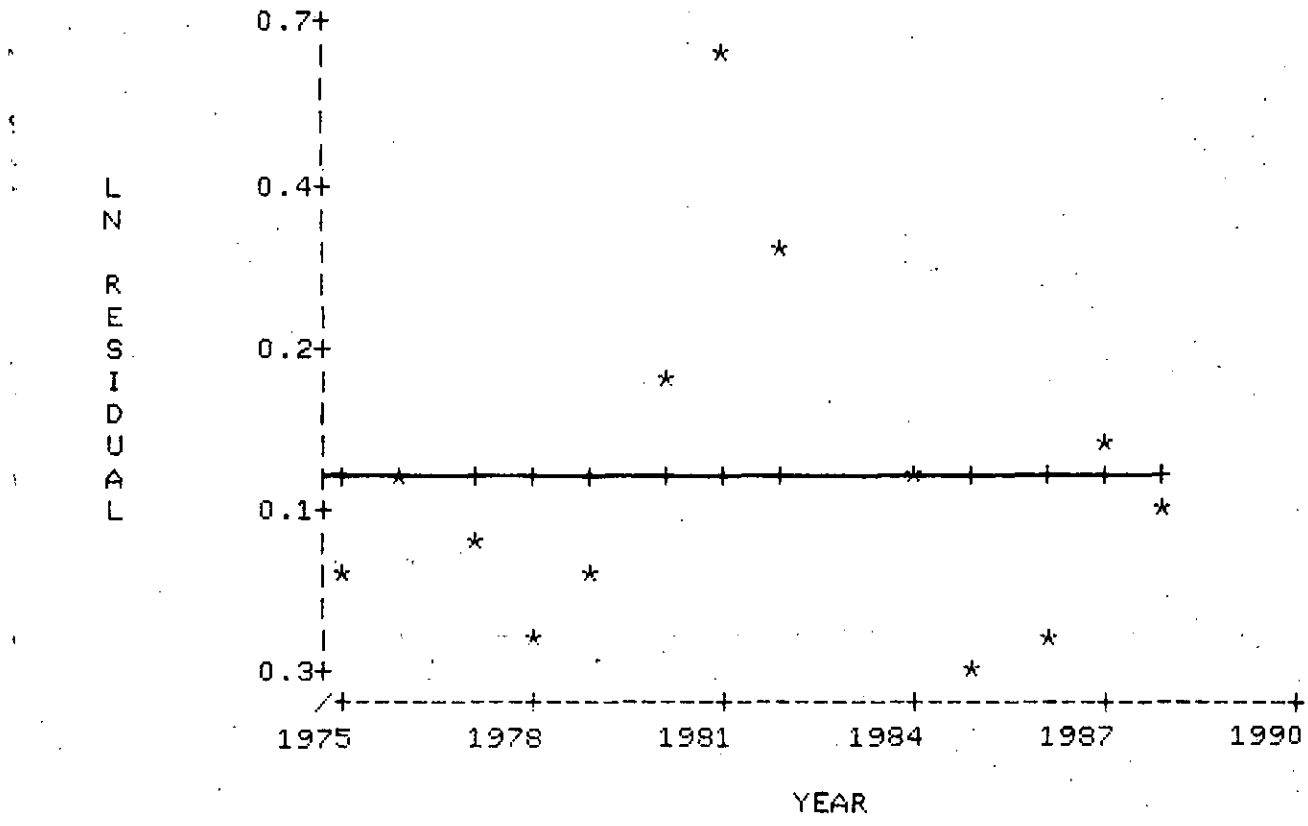
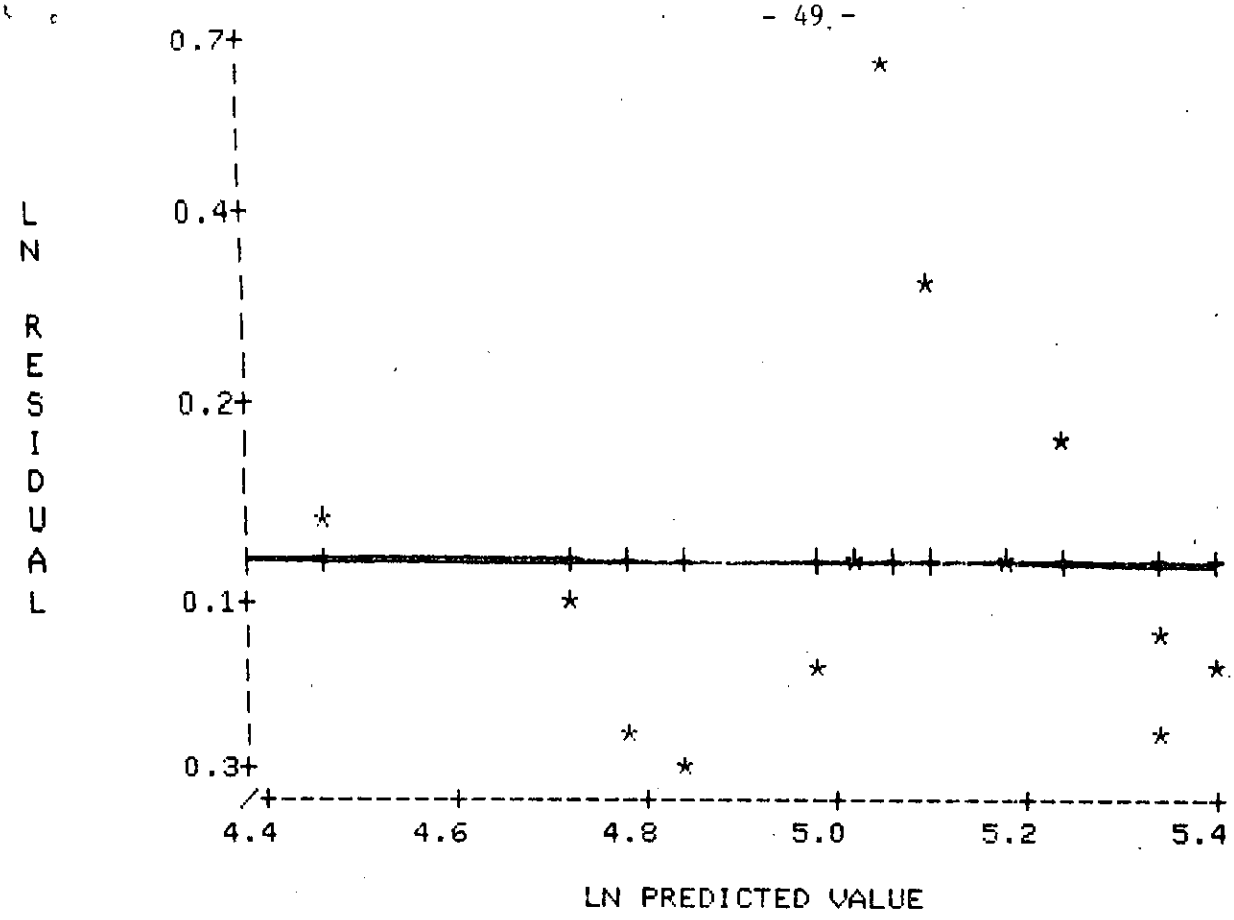


FIG.10. PLOTS FROM ADAPTIVE FRAMEWORK USING RV SURVEY DATA (AGE 9).

LN RESIDUAL VS LN PREDICTED VALUE



TREND IN POPULATION ABUNDANCE OVER TIME

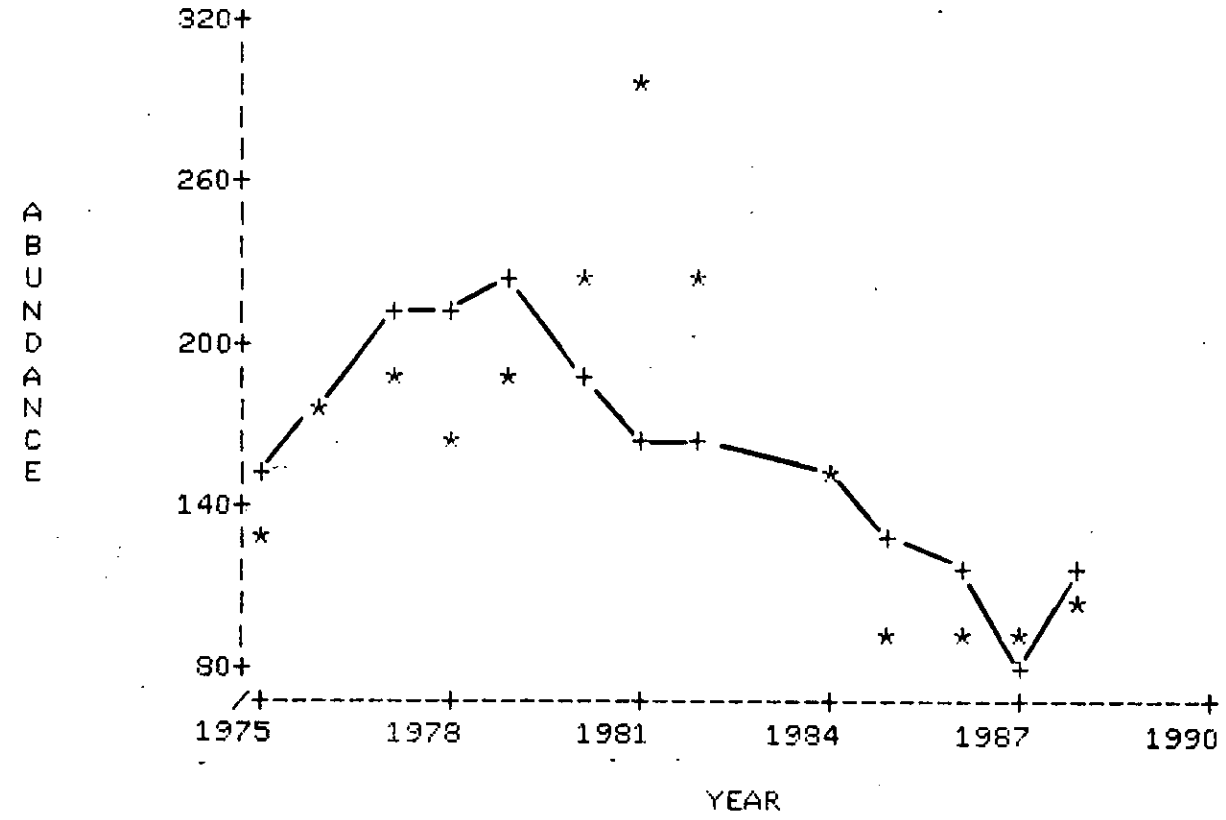
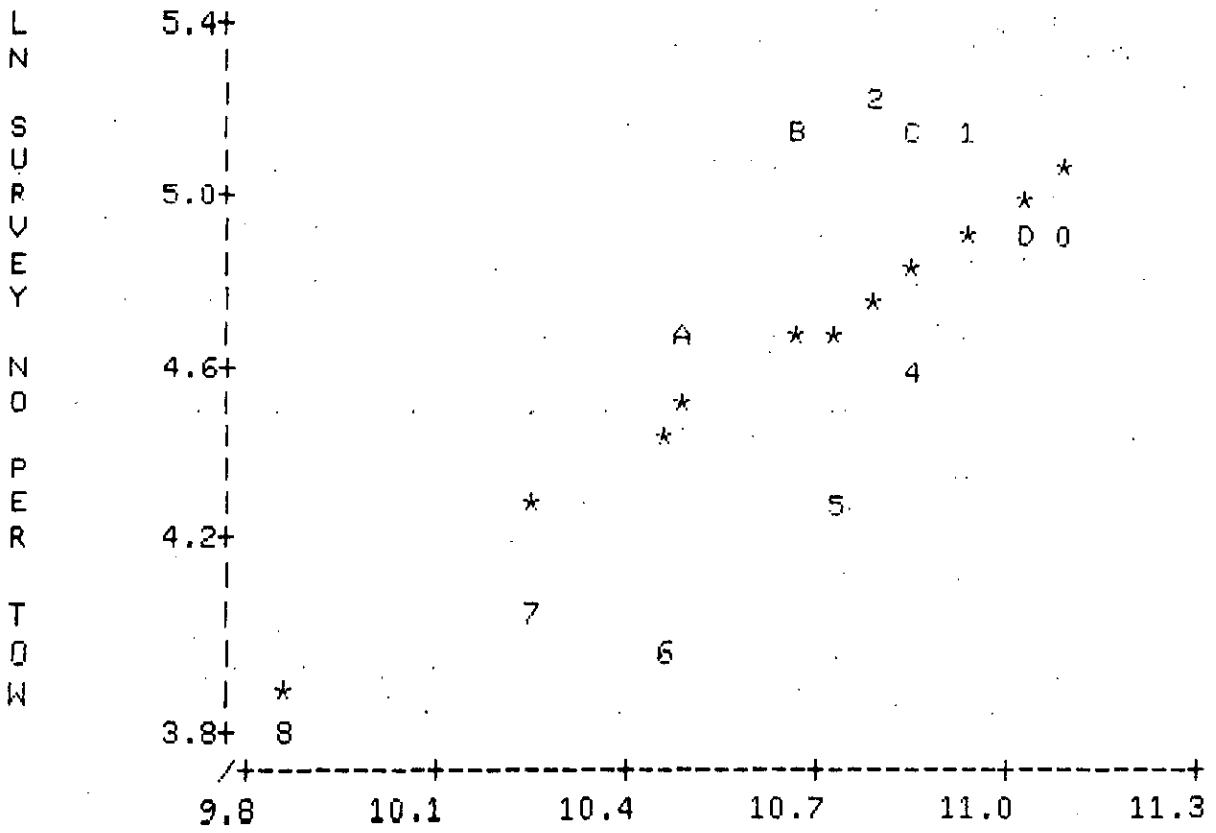


FIG.10. CONTINUED.

AGE 10 PLOTS
LN SURVEY NO. PER TOW VS LN SPA NUMBERS



TREND IN LN RESIDUAL OVER TIME

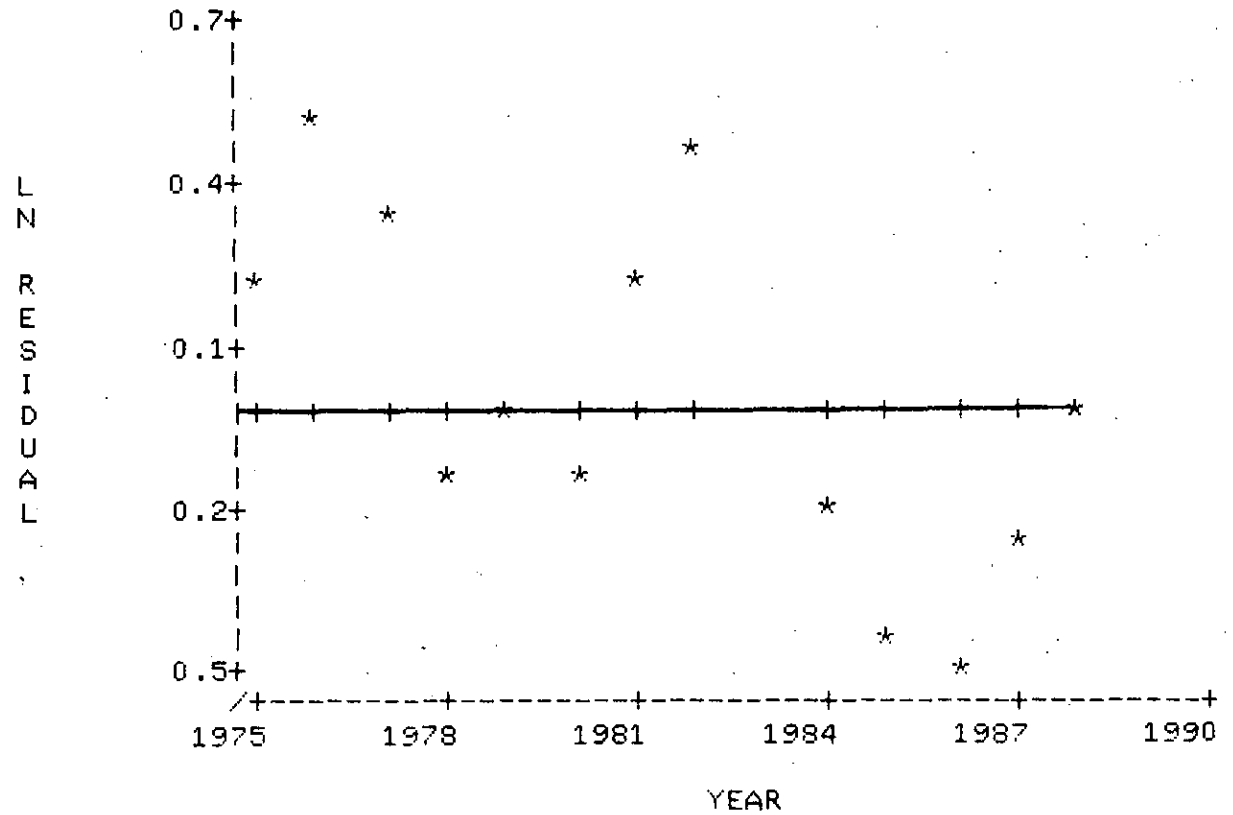
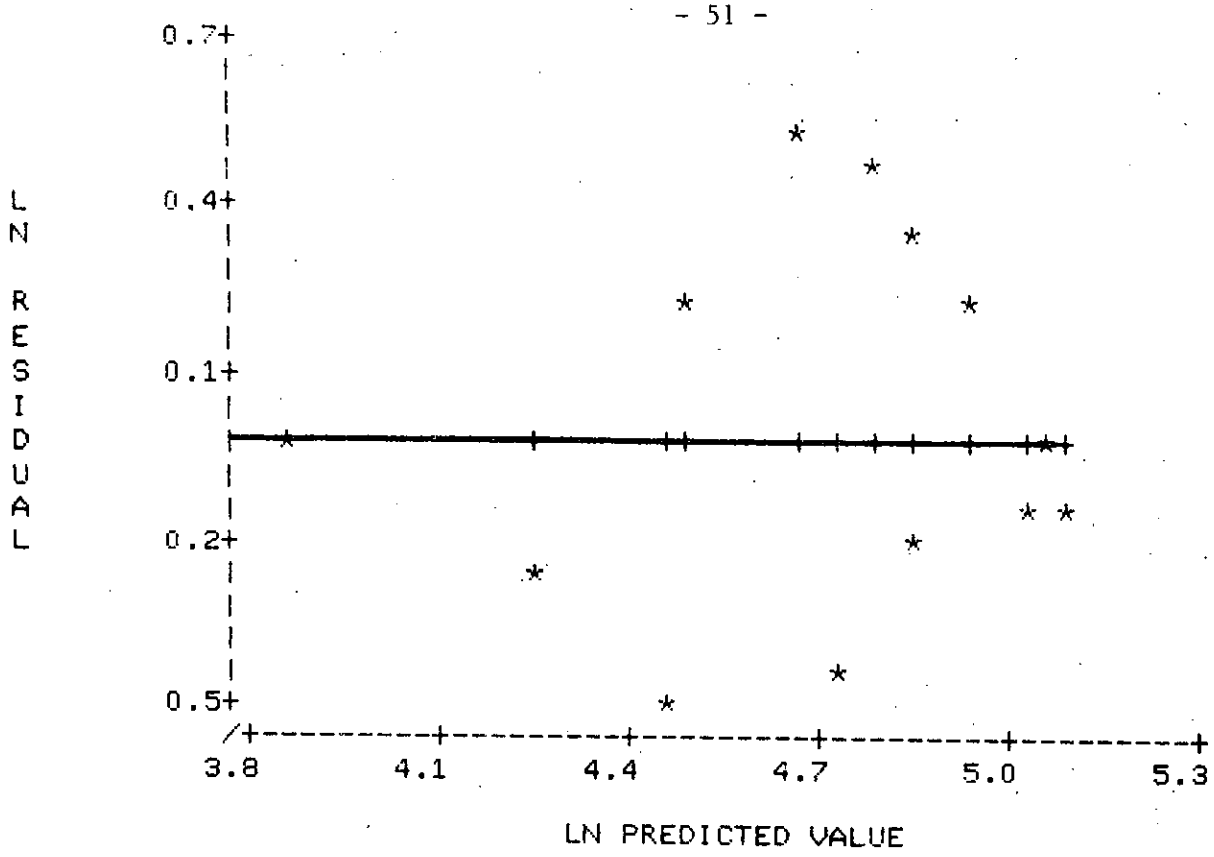


FIG.11. PLOTS FROM ADAPTIVE FRAMEWORK USING RV SURVEY DATA (AGE 10).

LN RESIDUAL VS LN PREDICTED VALUE



TREND IN POPULATION ABUNDANCE OVER TIME

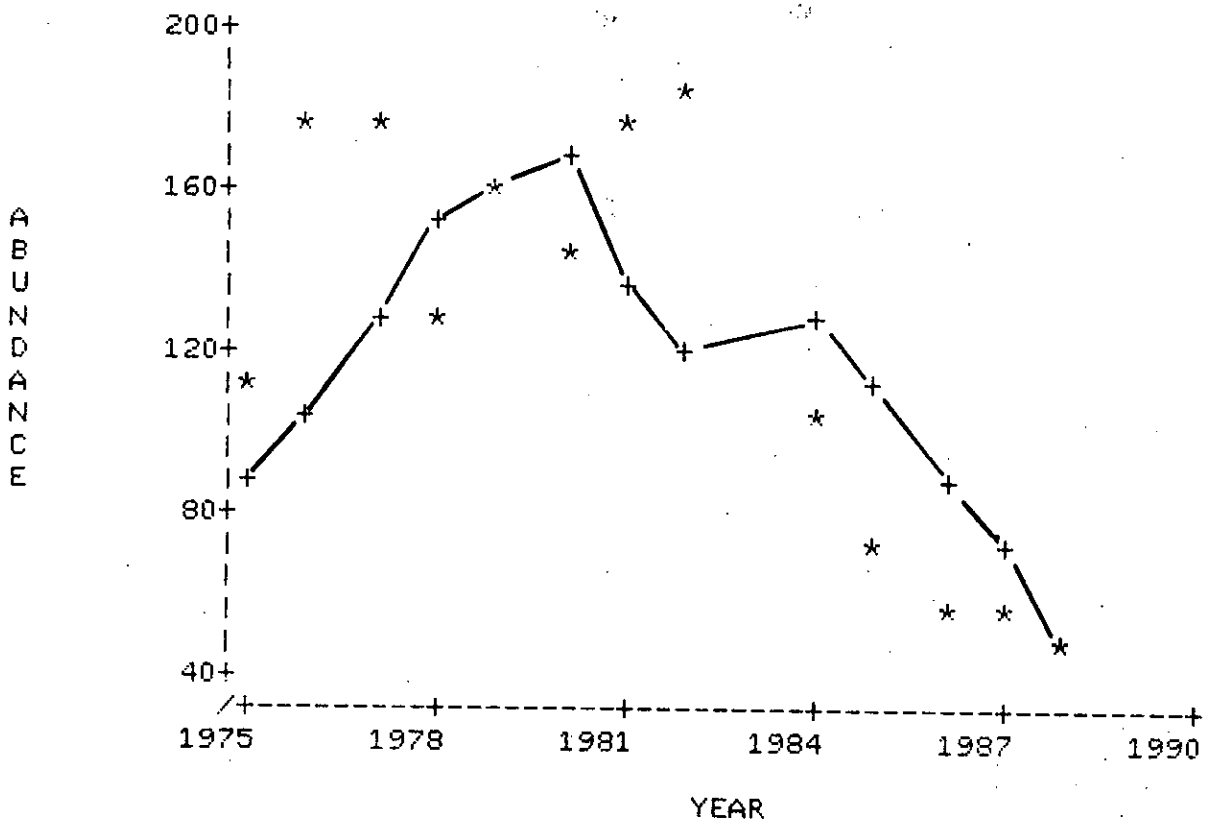
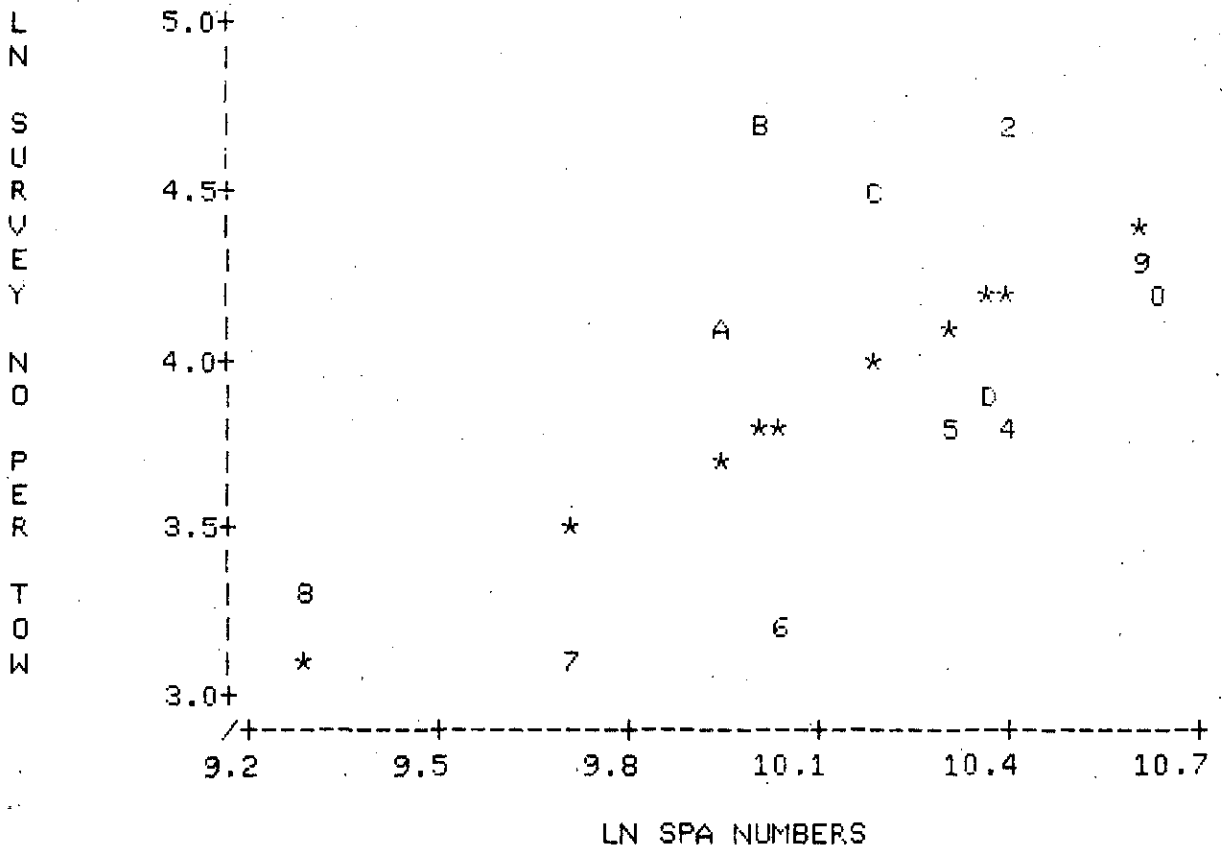


FIG.11. CONTINUED.



TREND IN LN RESIDUAL OVER TIME

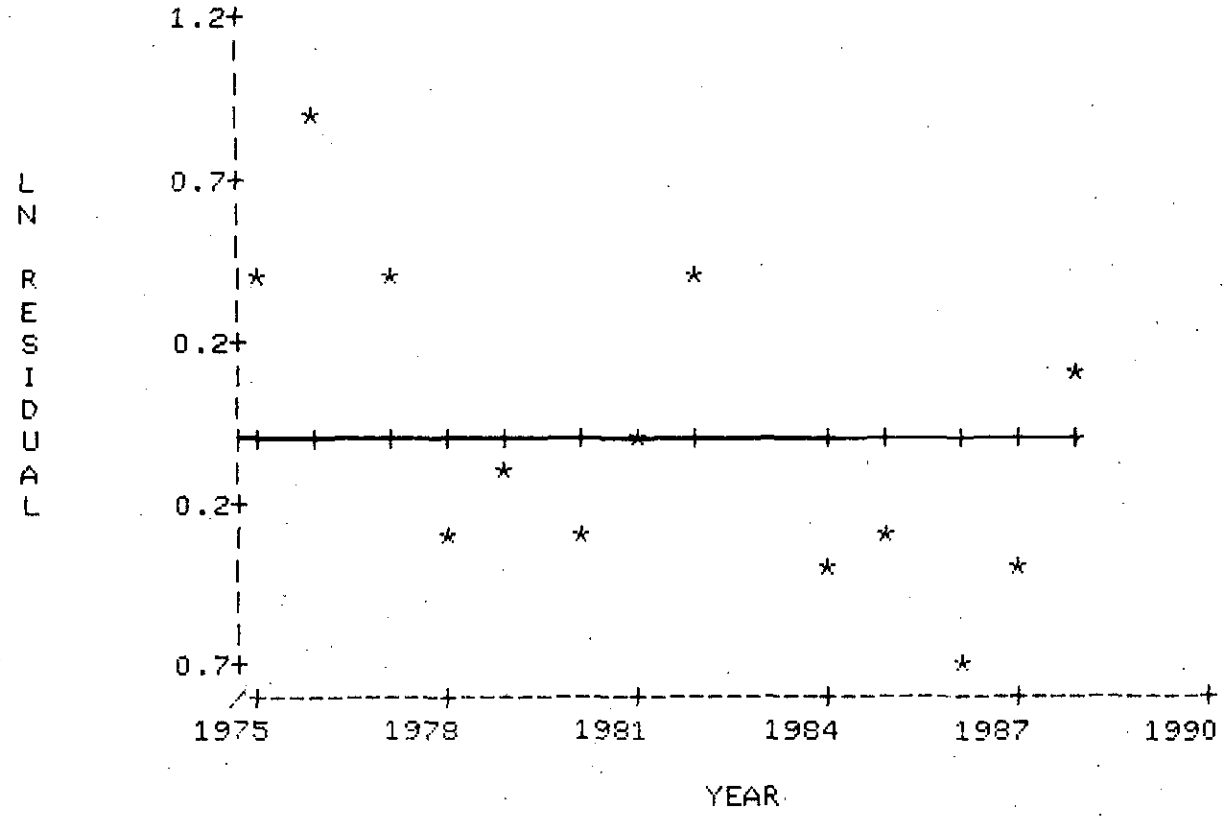
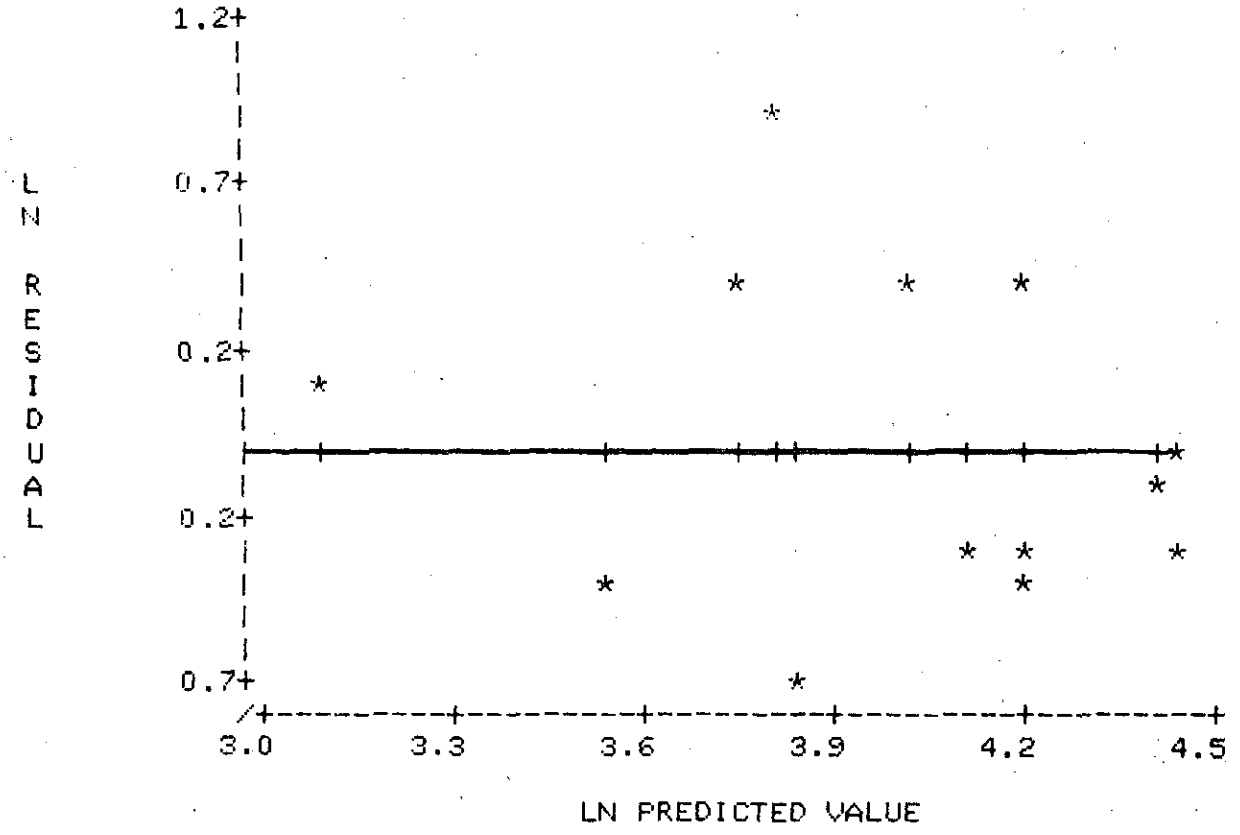


FIG.12. PLOTS FROM ADAPTIVE FRAMEWORK USING RV SURVEY DATA (AGE 11).

LN RESIDUAL VS LN PREDICTED VALUE



TREND IN POPULATION ABUNDANCE OVER TIME

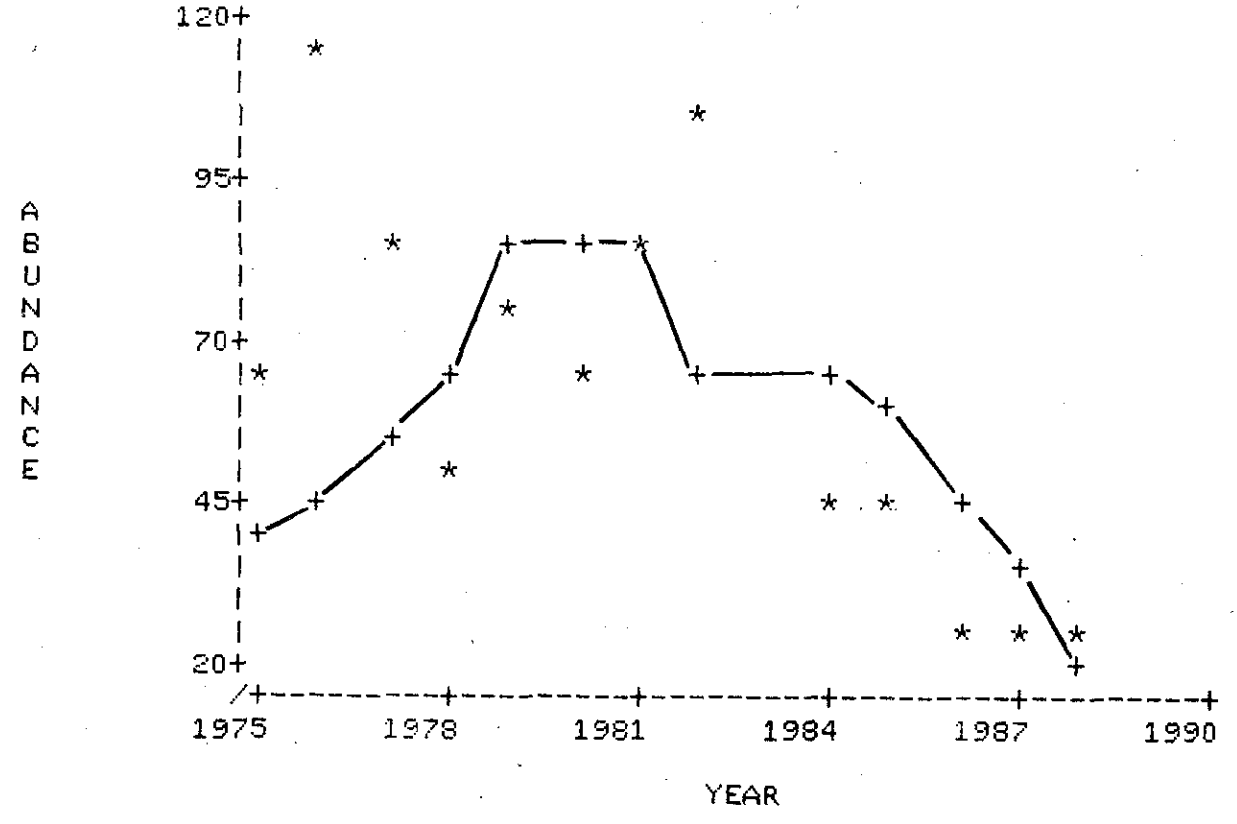
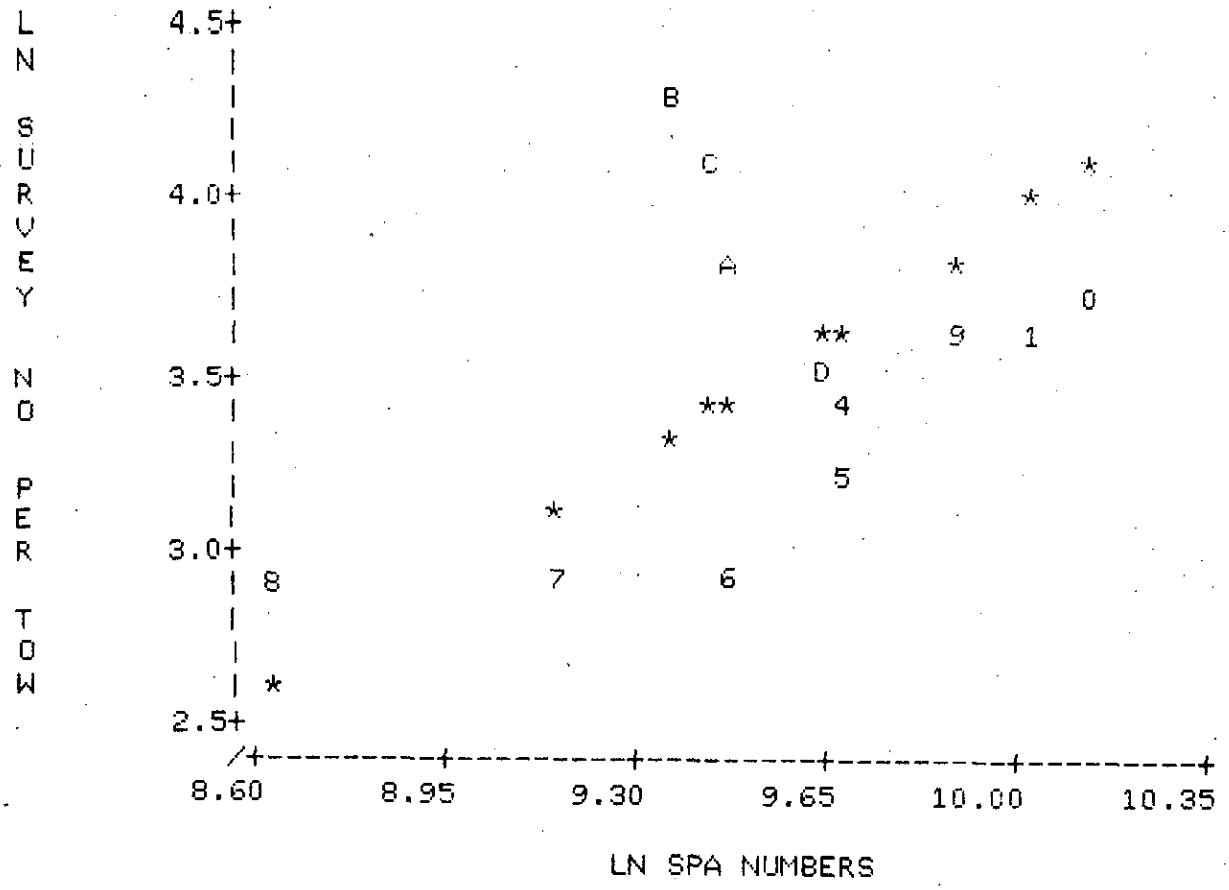


FIG.12. CONTINUED.

AGE 12 PLOTS
LN SURVEY NO. PER TOW VS LN SPA NUMBERS



TREND IN LN RESIDUAL OVER TIME

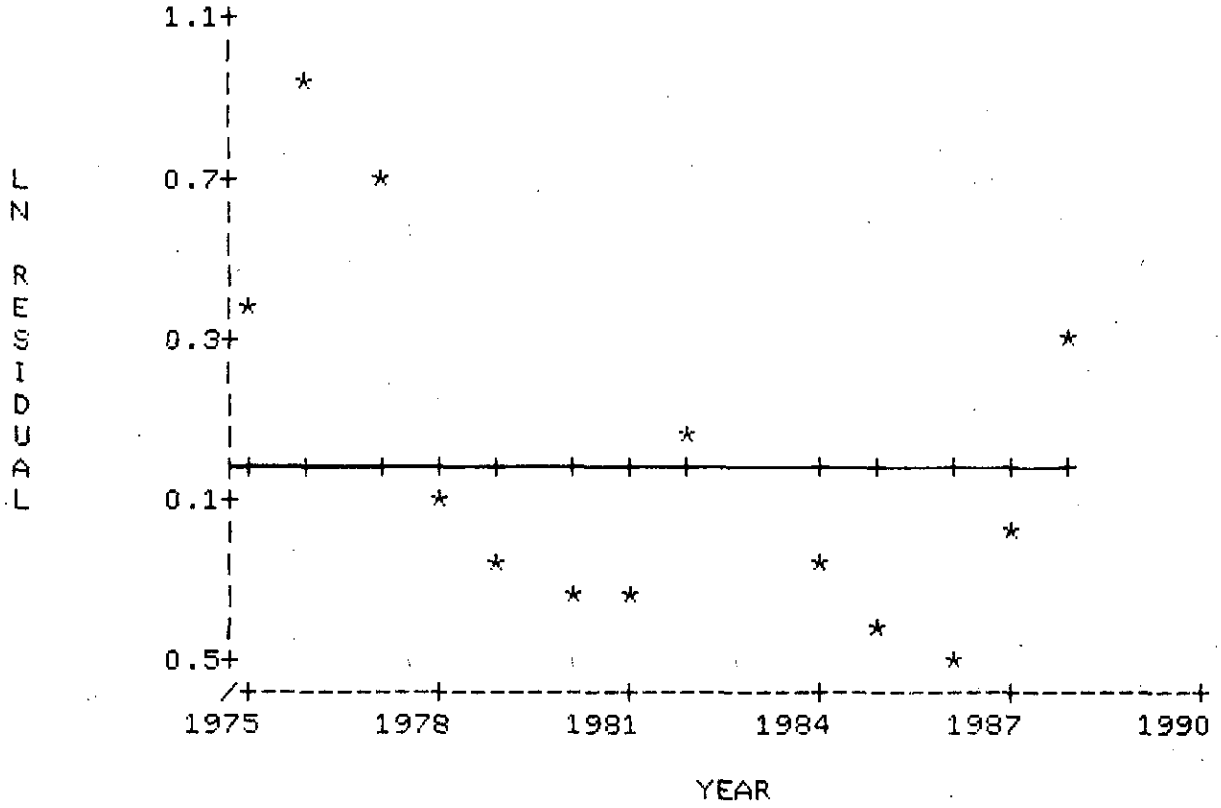
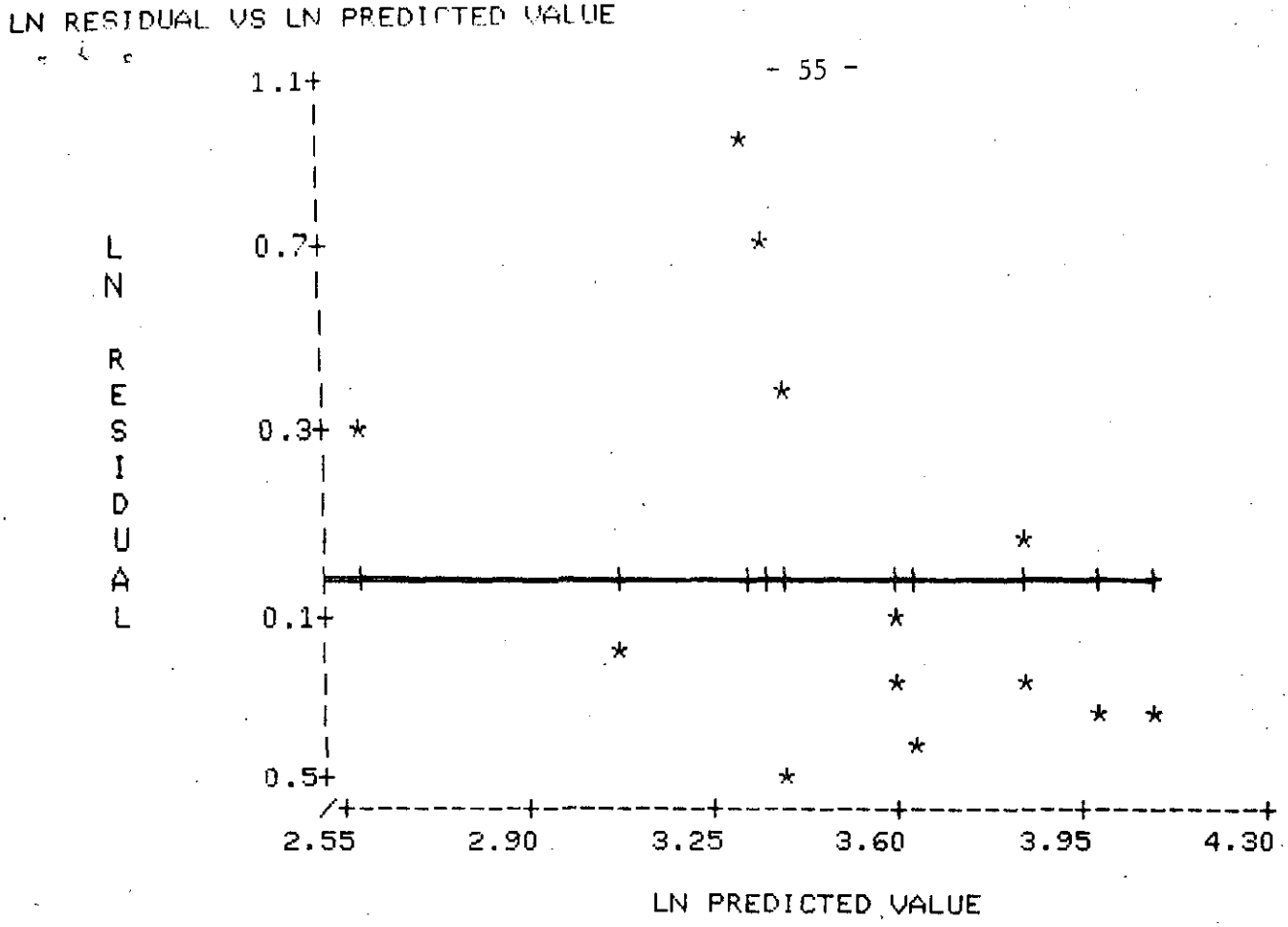


FIG.13. PLOTS FROM ADAPTIVE FRAMEWORK USING RV SURVEY DATA (AGE 12).



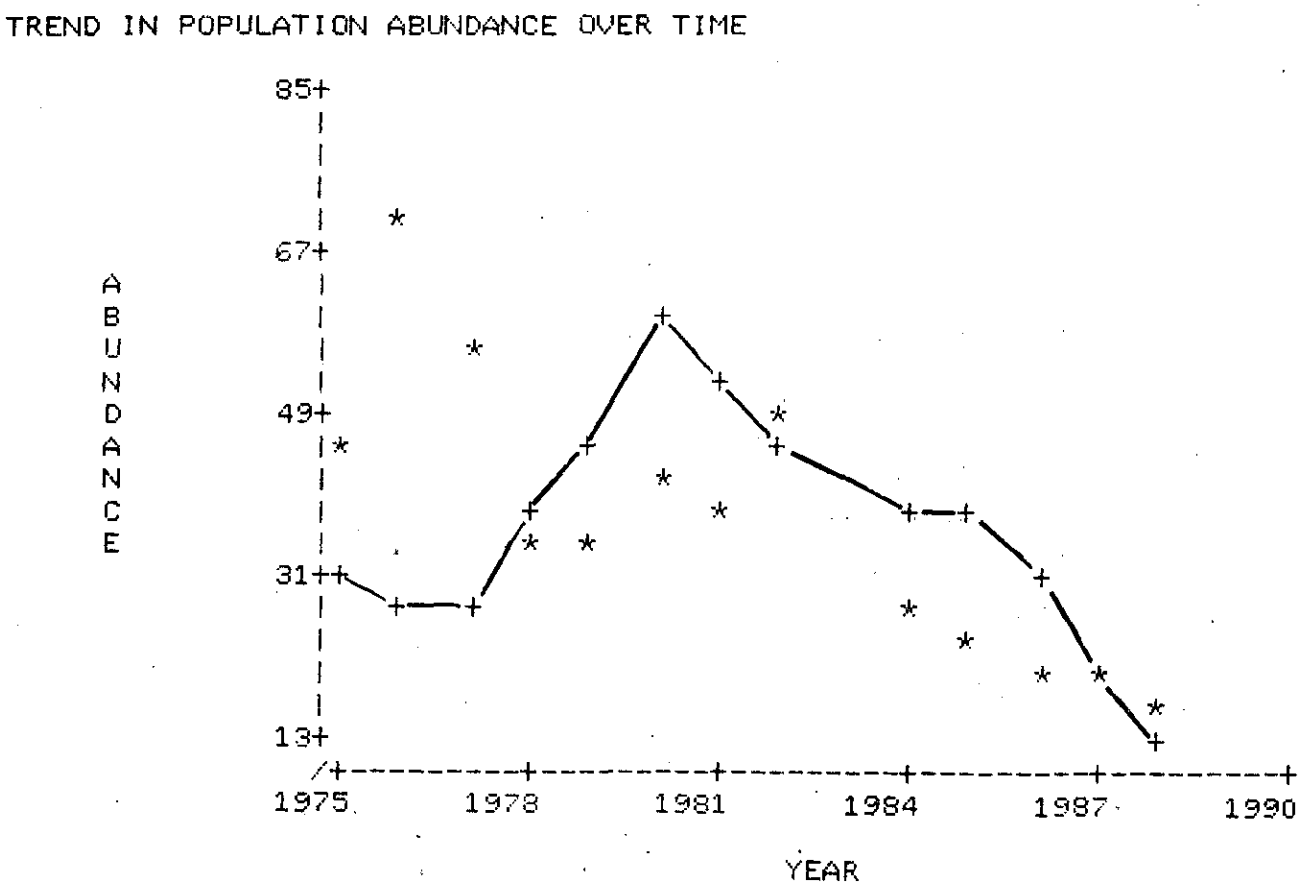
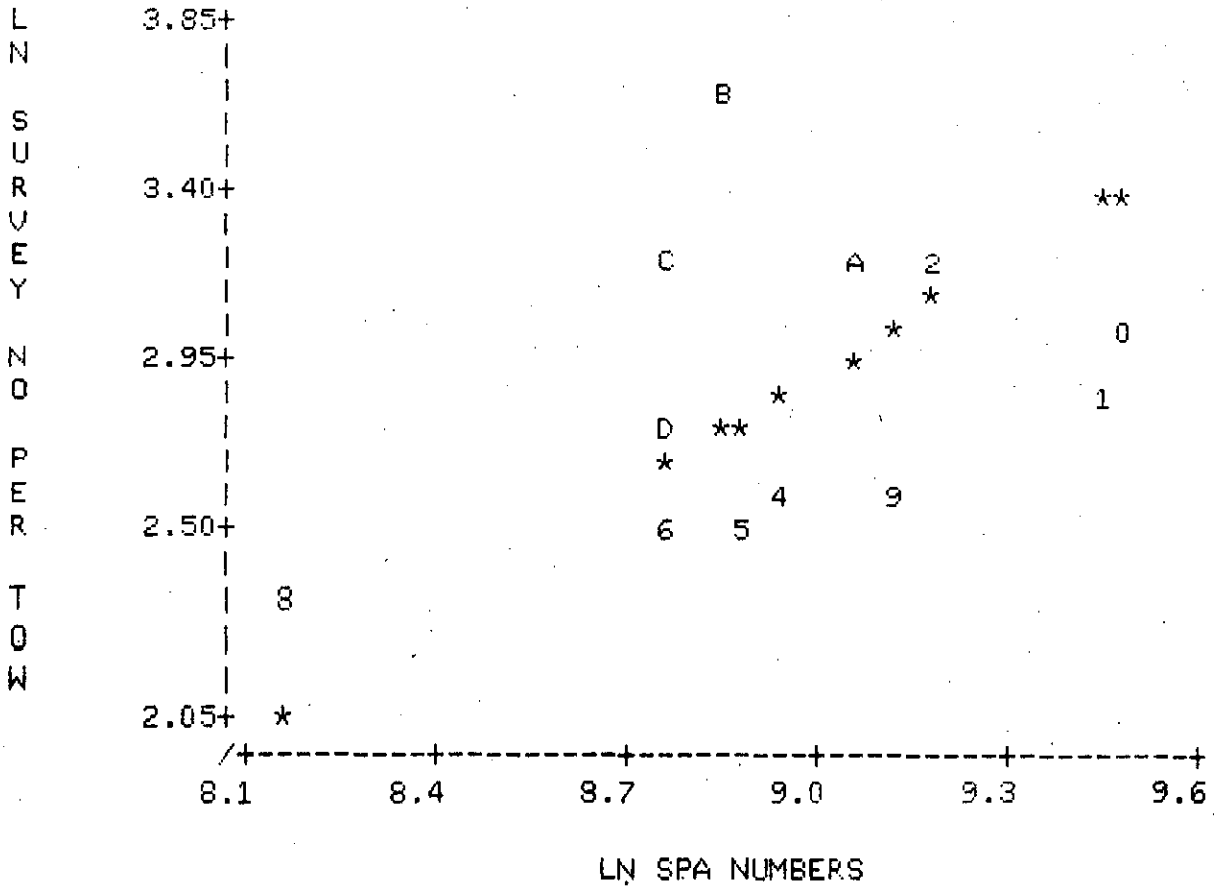


FIG.13. CONTINUED.



TREND IN LN RESIDUAL OVER TIME

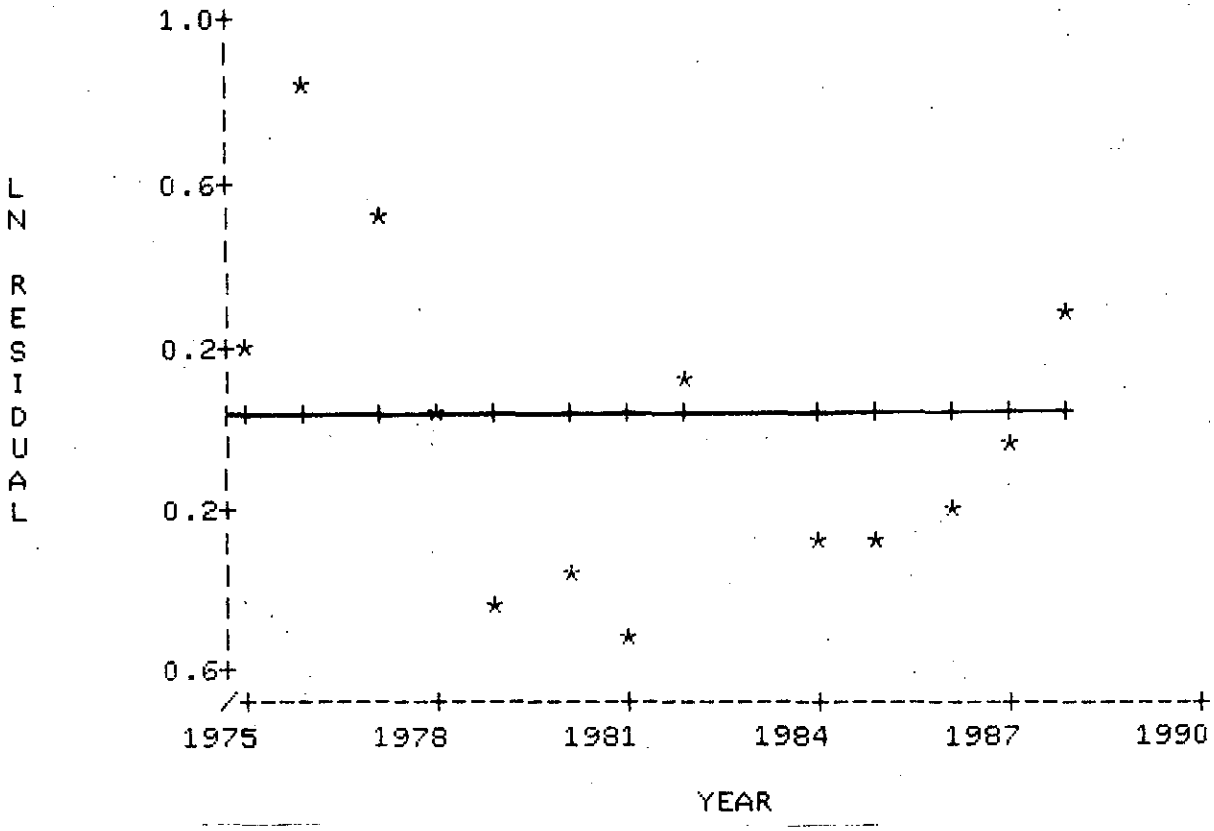
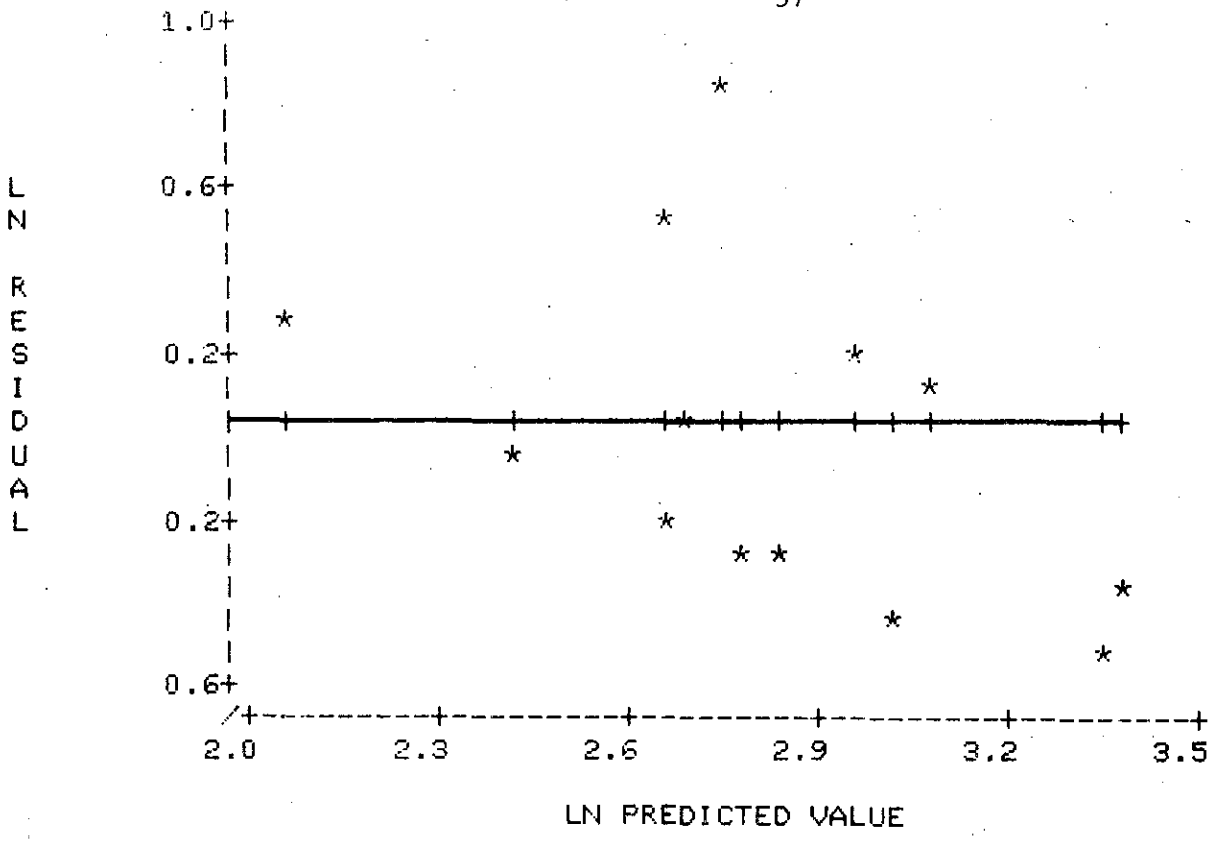


FIG.14. PLOTS FROM ADAPTIVE FRAMEWORK USING RV SURVEY DATA (AGE 13).

LN RESIDUAL VS LN PREDICTED VALUE



TREND IN POPULATION ABUNDANCE OVER TIME

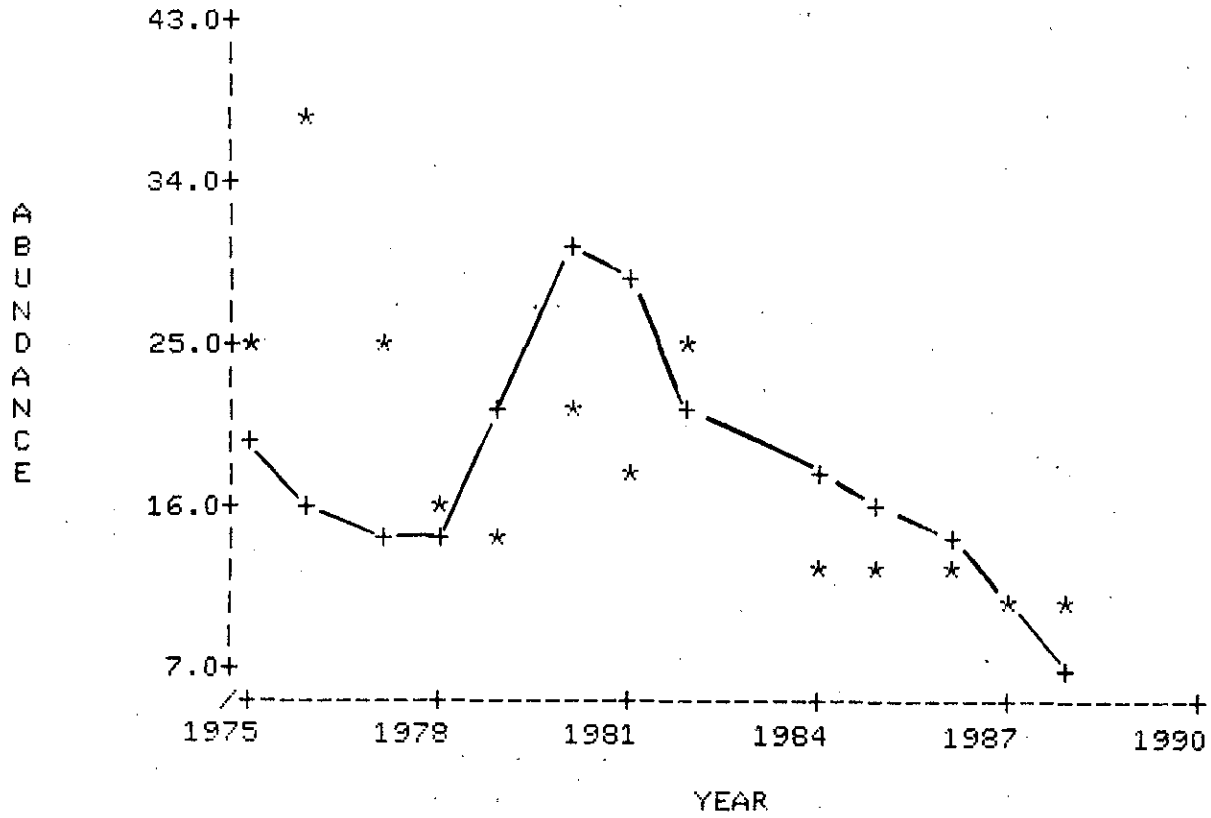
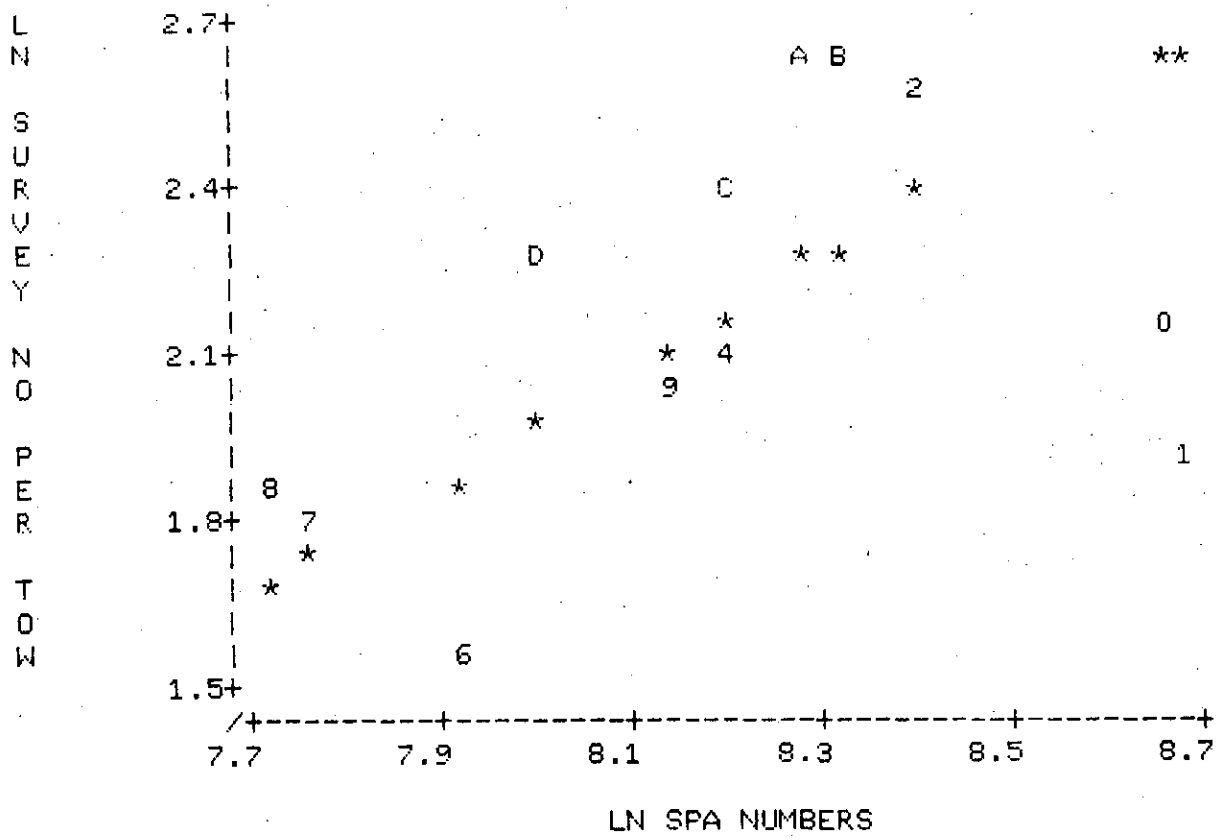


FIG.14. CONTINUED.

AGE 14 PLOTS
LN SURVEY NO. PER TOW VS LN SPA NUMBERS



TREND IN LN RESIDUAL OVER TIME

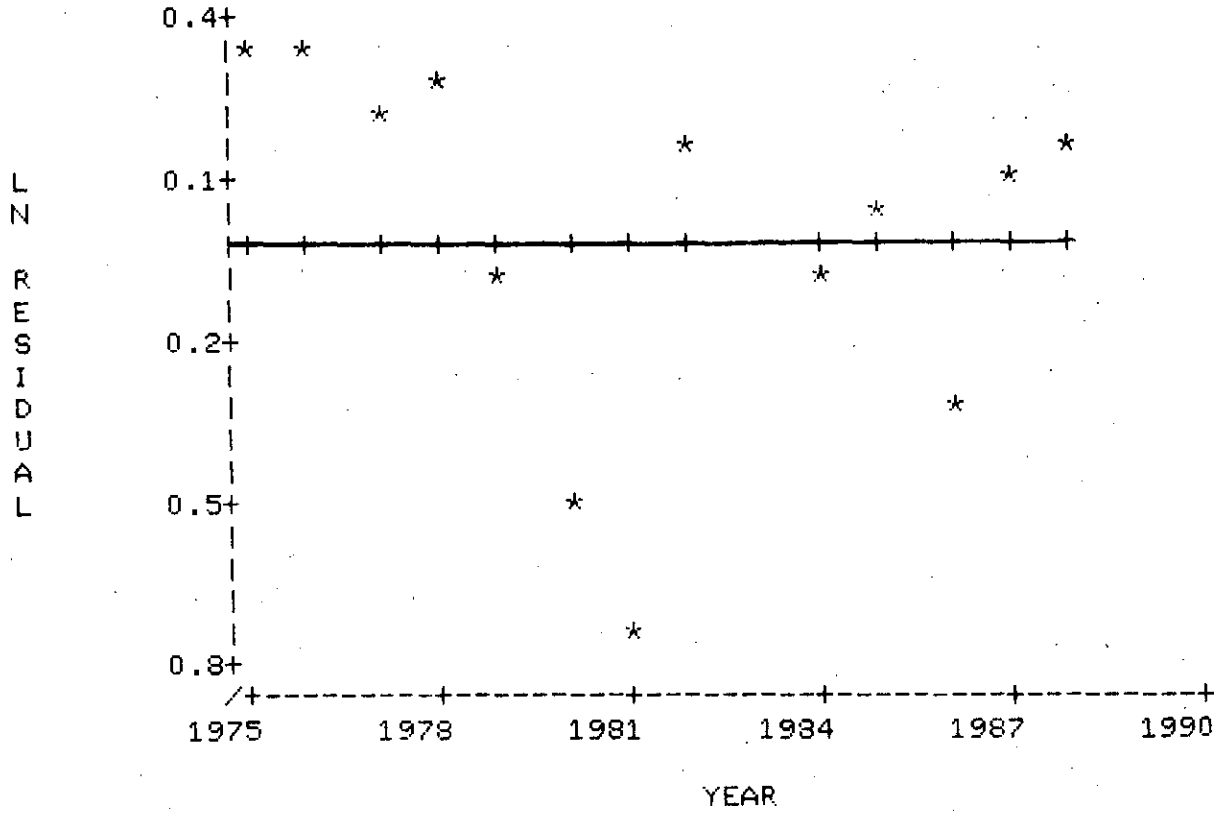
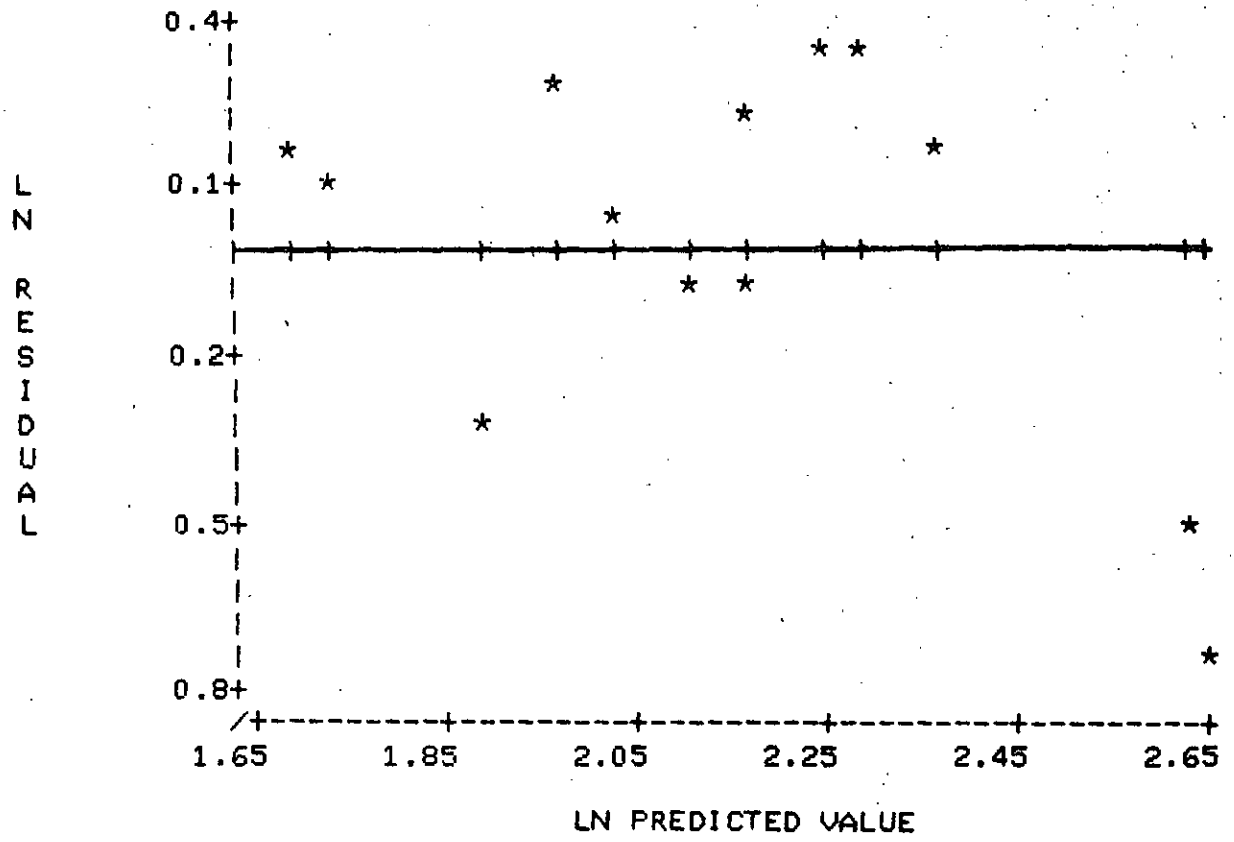


FIG.15. PLOTS FROM ADAPTIVE FRAMEWORK USING RV SURVEY DATA (AGE 14).

LN RESIDUAL VS LN PREDICTED VALUE



TREND IN POPULATION ABUNDANCE OVER TIME

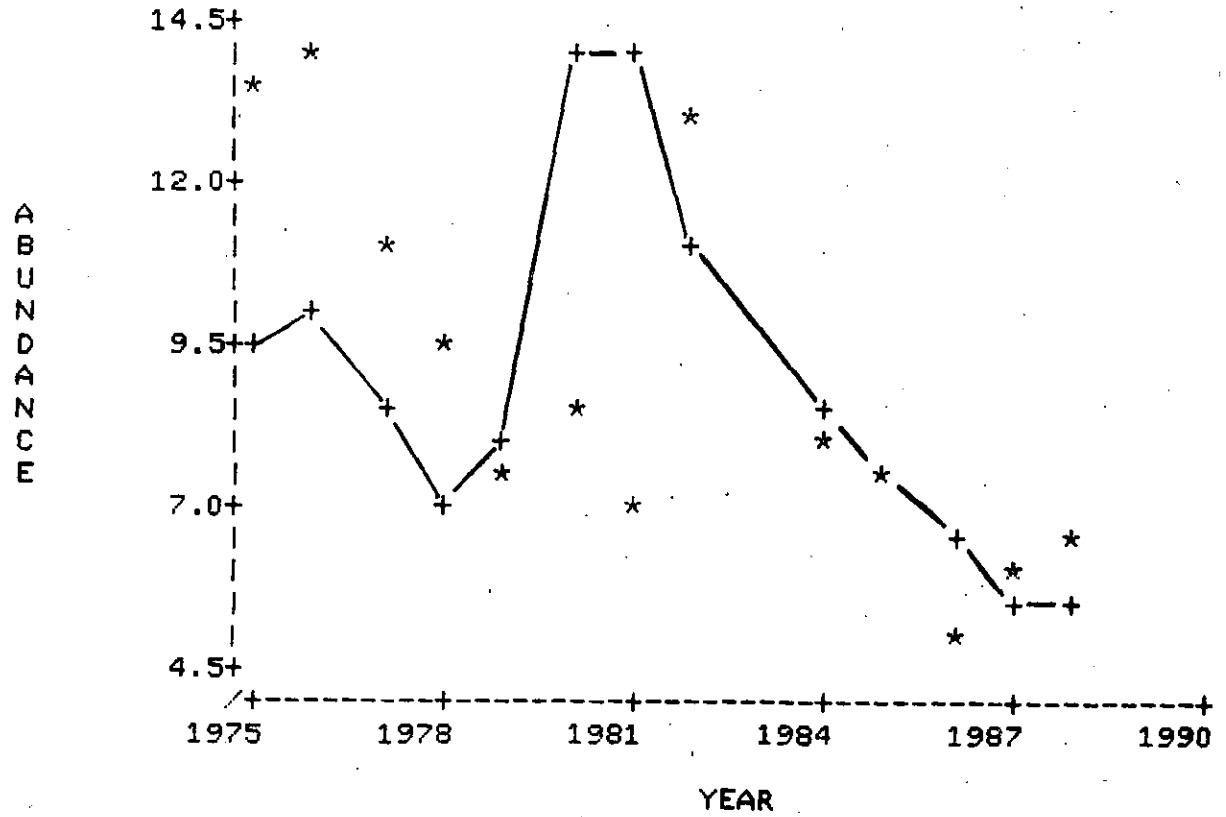
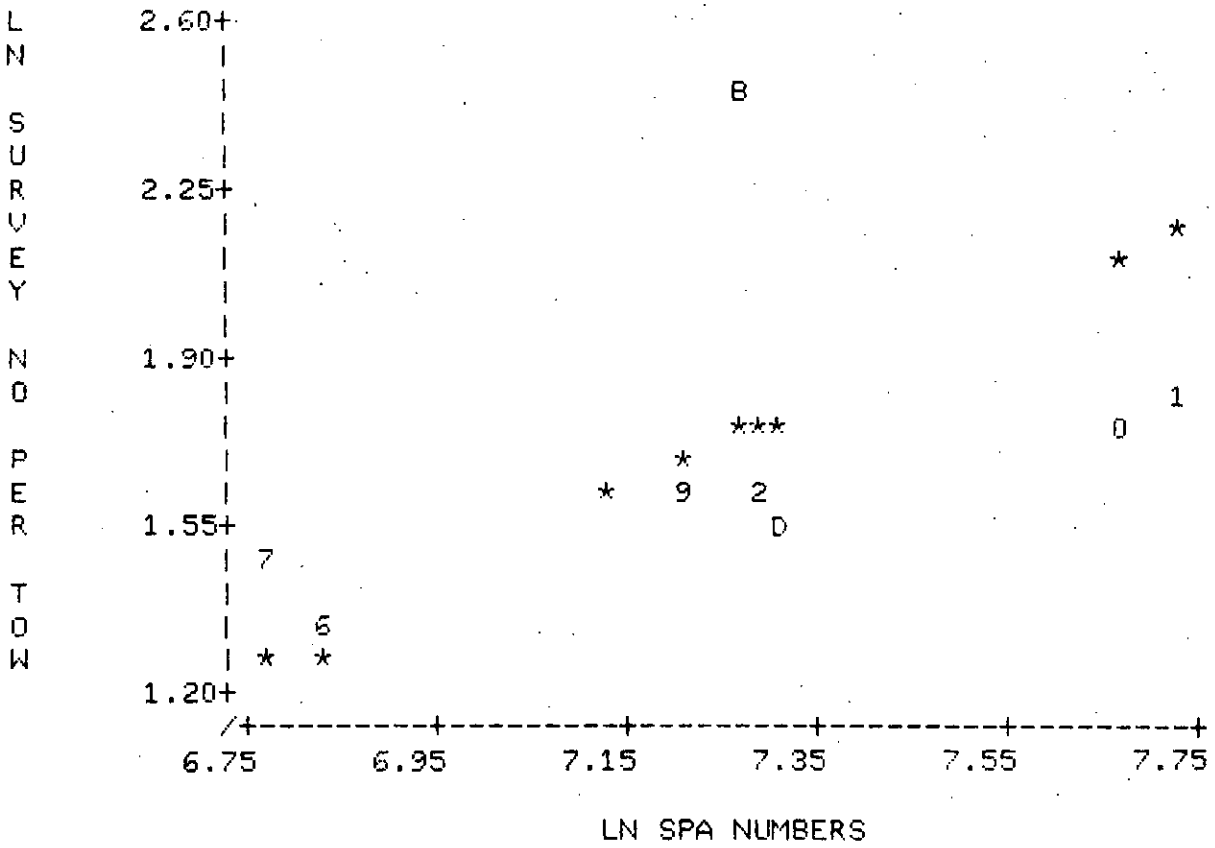


FIG.15. CONTINUED.

AGE 15 PLOTS
LN SURVEY NO. PER TOW VS LN SPA NUMBERS



TREND IN LN RESIDUAL OVER TIME

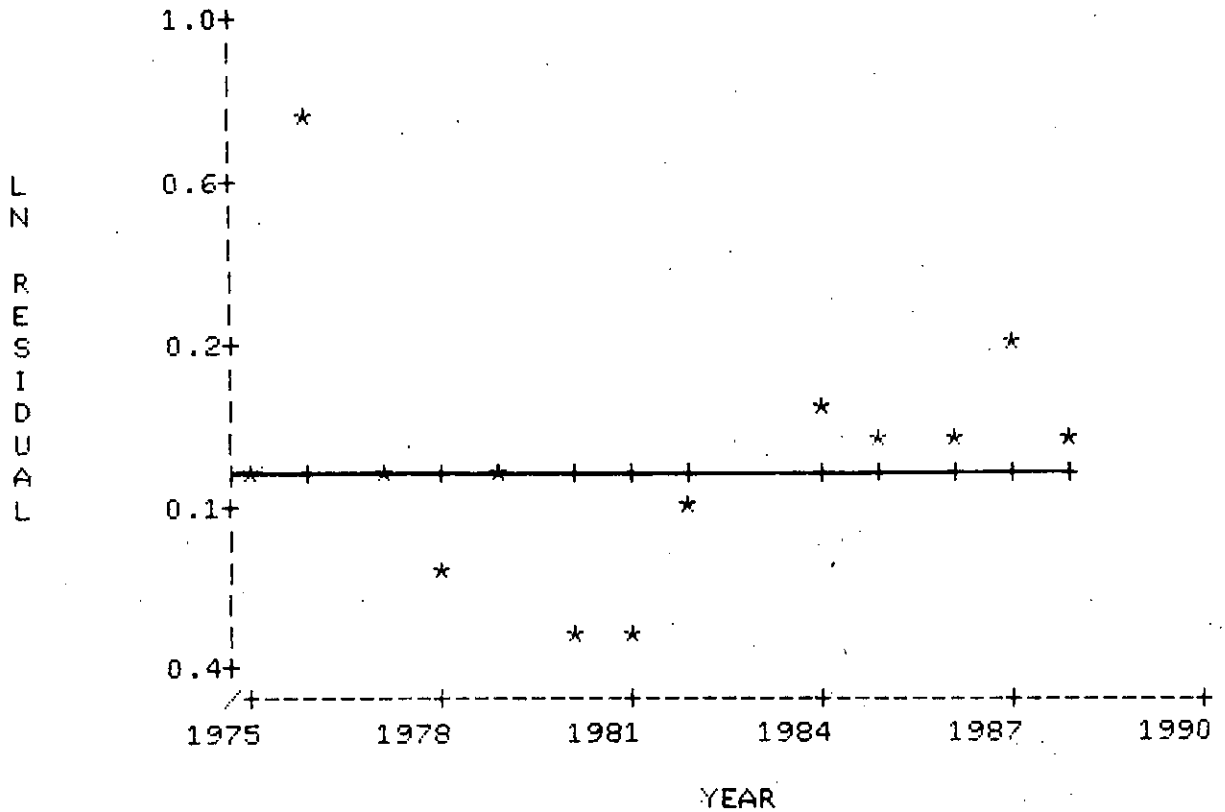
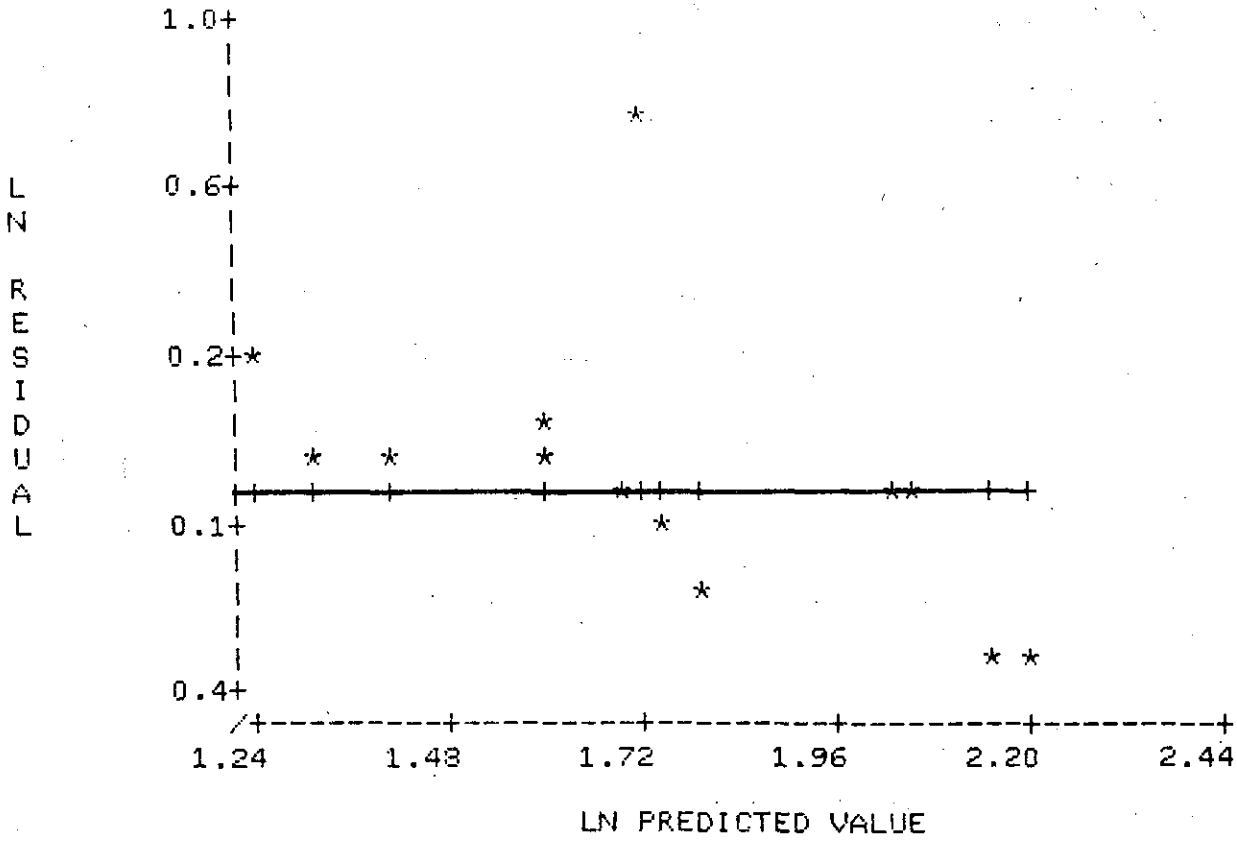


FIG.16. PLOTS FROM ADAPTIVE FRAMEWORK USING RV SURVEY DATA (AGE 15).

LN-RESIDUAL VS LN PREDICTED VALUE



TREND IN POPULATION ABUNDANCE OVER TIME

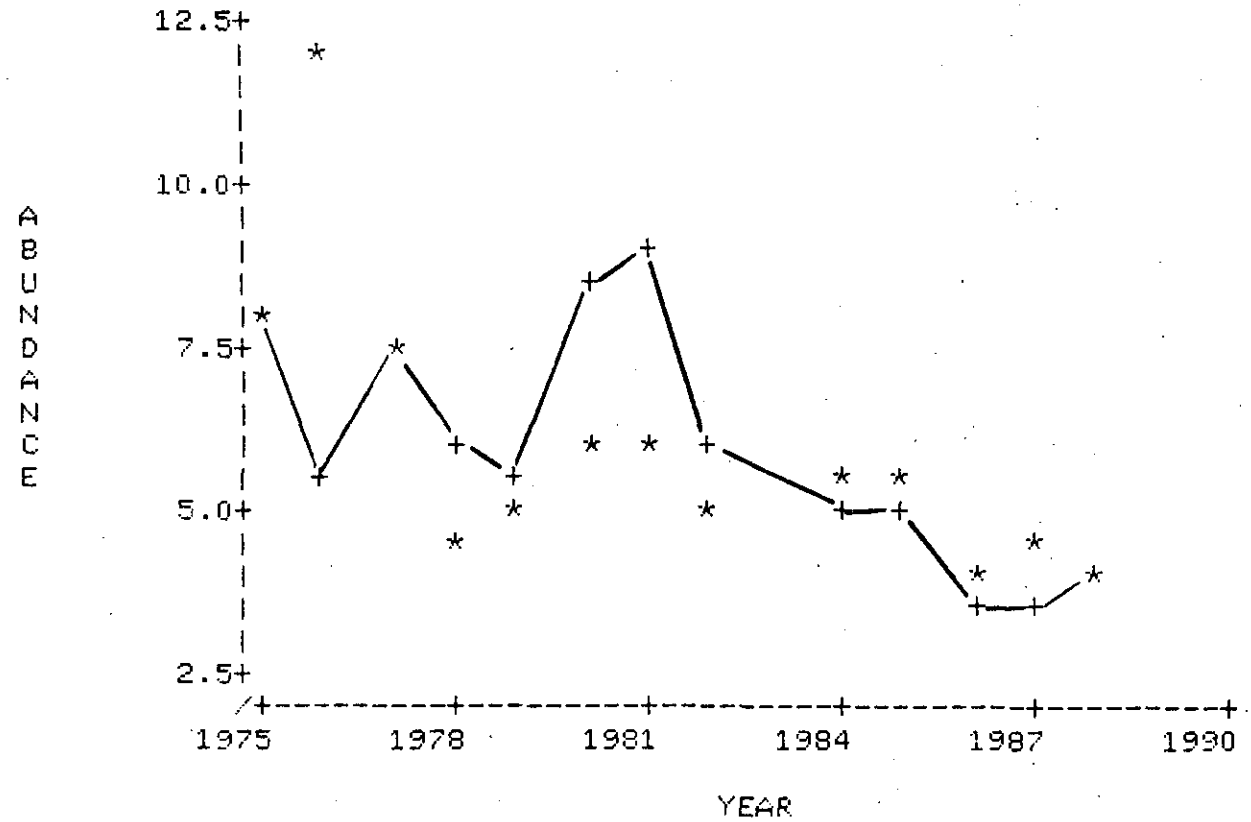


FIG.16. CONTINUED.

Appendix 1

Formulations of Adaptive Framework Used

i) RV surveys

Parameters:

- Year-class estimates
  N_i, 1988 $i = 6,15$
- Calibration coefficients for RV numbers
  K_i $i = 6,15$

Structure:

- Natural mortality = 0.2
- Error in catch-at-age assumed negligible
- F on oldest age (19) calculated as Weighted F for ages 12-16
- F on ages 16-19 in 1988 was set equal to the F for ages 12-15 in 1988
- Intercepts not fitted

Input:

- $C_{i,t}$ $i = 6,15$ $t = 1975-88$
- $RV_{i,t}$ $i = 6,15$ $t = 1975-82, 1984-88$

Objective function:

- Minimize
  $\Sigma\Sigma_{it}[obs(lnRV_{it})-pred(lnRV_{it})]^2$

Summary:

- Number of observations = 126
- Number of parameters = 20

ii) CPUE

Parameters:

- Year-class estimates (N_i, 1988 $i = 12$)
- Calibration constant for CPUE (q)

Structure:

- For oldest age (19) set equal to weighted F on ages 12-16
- Intercept not fitted
- Error in catch-at-age assumed negligible
- Natural mortality = 0.2
- The following PR was assumed for 1988 (from 1988 assessment)

Age	5	6	7	8	9	10	11	12-19
PR	.01	.04	.12	.23	.37	.54	.75	1.00

Input:

- $C_{i,t}$ $i = 5-19$ $t = 1975-88$
- C/E_t related to 12+ population biomass

Objective function:

- Minimize
  $\Sigma_t[obs(lnC/E_t)-pred(lnC/E_t)]^2$

Summary:

- Number of observations = 14
- Number of parameters = 2