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Assessment of Redfish in NAFO Subarea 2 and Division 3K

by

D. Power and D.B. Atkinson

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

Abstract

Canada has been the major prosecutor of this fishery since the implementation of the 200-mile fisheries zone in 1977, frequently taking more than 70% of the total landings. Preliminary information for 1987 indicates a decrease of about 10,000 tons from the 1986 reported landings of 27,000 tons which may be due to incomplete statistics for some countries. Catch rates have generally been declining since 1984 and data from research surveys have not indicated a strong year class since those of the early 1970s. General production models are not appropriate because there are no significant trends in the catch rate series.

Résumé

Le Canada a été le principal éxploitant de cette pêche depuis la mise en application de la zone de pêche de 200 milles en 1977; cette pêche représentait souvent plus de 70 % du total des débarquements. D'après les reseignements préliminaires pour l'année 1987, il y aurait une diminution d'environ 10 000 tonnes par rapport aux 27 000 tonnes débarquées en 1986, comme l'indiquent les relevés. Cette différence est peut-être attribuable à des lacunes dans les statistiques concernant certains pays. Les taux de capture ont généralement baissé depuis 1984 et, selon les données de relevé de recherche effectués, il n'y a pas une classe d'age importante depuis les débuts les années 1970. Les modèles de production généraux n'étaient pas appropriés parce qu'il n'y avait pas de tendances significatives dans les séries des taux de capture.

Introduction

Nominal catches reported from this fishery since 1959 have ranged from a low of 14,519 t in 1980 to a high of 186,837 t in 1959 (Table 1, Figure 1). Catches for Div. 3K have generally been greater than 50% of the total reported landings for this stock and greater than 84% in recent years. Canada has been the major prosecutor of this fishery since the implementation of the 200-mile fisheries zone in 1977, frequently taking more than 70% of the total landings (Table 2). Preliminary data for 1986 and 1987 indicate a drop of about 10,000 tons in 1987 from the 1986 reported catch of 27,047 tons. This may be due to incomplete statistics for some countries at this time. Improved market conditions for redfish were considered responsible for the increase in landings in the 1984-86 period (23,000 tons - 29,000 tons) from a period just prior to this when landings ranged from 14,000 tons to 18,000 tons.

Catches from Div. 2GH have been less than 900 tons since 1977 and have commonly been taken in the July to December period perhaps in part due to ice cover earlier in the year (Table 3a). Catches from Div. 2J have been less than 7000 tons since 1977, except for higher levels in the range of 12,000-16,000 tons in 1978 and 1979, and have been taken throughout the year although mainly in the June to September period (Table 3b). A high parasite load has been noted in Div. 2J. In Div. 3K catches have been greater than 21,000 tons since 1984 and are taken throughout the year (Table 3c).

Sequential population analysis (SPA) of this stock has not been possible to date because of non-convergence in the population matrix.

Methods and Results

A catch and effort database was compiled from ICNAF/NAFO Statistical Bulletins for the 1959-1985 period. In addition, preliminary NAFO data for 1986 (provided by the NAFO Secretariat), preliminary Canadian data for 1986 and 1987 (provided by the Nfld. Region), preliminary Canadian data for 1987 (provided by the Scotia-Fundy Region) and foreign country data for 1987 (provided by the Observer Program, Nfld. Region) were also appended to the database. On the recommendation of CAFSAC at the 1987 meetings, country-gear-tonnage class (CGT) categories were further classified as side or stern trawler which had been combined in previous assessments (cf. Power and Atkinson 1987) for both midwater and bottom trawls. If this information was not readily available, it was gained by reviewing the following: NAFO lists of fishing vessels operating in the convention area, Lloyd's Registry of ships and/or consulting with the Observer Program. Initially selected from this database were observations where redfish comprised more than 50% of the total catch and were therefore considered redfish directed.

A multiplicative model (Gavaris 1980) was again used this year to derive a standardized catch rate series incorporating the previously described database. Within the model all catch and effort observations less than 10 units and any CGT or month category data with less than five samples were deleted. For this assessment the reference categories were Nfld. TC 5 stern trawler, August, Div. 3K and 1959. The CGT reference is different from last year's assessment in which the Poland TC 7 bottom trawler was used.

Residuals from the regression were plotted against predicted values (Figure 3) and expected normal values (Figure 4) and did not reveal any outliers. In order to determine whether the multiplicative model is appropriate for the divisionally aggregated data, yearly residuals for each division were plotted over time (Figs. 5-6). These plots indicate that Div. 2J residuals are more variable both intra- and inter-annually than those for Div. 3K. This is likely an artifact of sample size. However there does not appear to be any violation of the assumption of proportional effect with regard to these two divisions. There are no similar plots for Div. 2G and 2H because after the initial deletions described above there were insufficient data (zero in the case of Div. 2G) for any evaluation of the model assumptions.

The analysis of variance (Table 4) indicates a significant regression that explains only 39% of the variation in the data. All category types were significant but the year effects were only marginally significant. In past assessments when using this multiplicative model, categories with similar parameter estimates derived from the regression were grouped together a posteriori. Since the statistical validity of this practice has been questioned it was decided against doing any groupings within category types. The estimated parameter coefficients for each category are listed in Table 4. The standardized catch rate series (Table 5, Figure 7) shows that over the 1959-1987 period catch rates have generally been in the 1-2 tons/hour range. There was an increase from 1959-1964 followed by a decrease to 1969. Catch rates gradually increased from about 1973 to 1984. They have subsequently declined but are still at relatively high levels. Standardized effort has been in the range of 9000 to 15,000 hours since 1980 (Figure 2). Previously, general production analyses have been carried out on this stock (Power and Atkinson 1987). There must be, however, significant trends in catch rates over time for these analyses to be valid. Since there is little contrast in the standardized catch rates over time from a statistical point of view, it was therefore concluded that general production analyses are not appropriate with these data.

Commercial frequencies available from the 1987 fishery (Figs. 9-13) were combined by the method of Gavaris and Gavaris (1983) as outlined in Fig. 8 and then converted into numbers at age using a single age/length key (Table 6). The weight-length relationships used were:

$$WT(males) = 0.01659FL^{2.9548}$$

$$WT(females) = 0.01372FL^{3.0210}$$

The predominant length range is 25-35 cm. (mode often about 28 cm.), corresponding to the relatively strong year-classes of the early 1970s. The catch-at-age and weight-at-age matrices are shown in Tables 7 and 8.

The Newfoundland Region has carried out stratified random surveys to divisions 2J and 3K since 1978 (Tables 9-12). Since coverage was not complete in all years, a multiplicative model (Gavaris 1980) was used to derive estimates for those strata which

were not covered in certain years. The regression results for each dataset were highly significant ($p<.01$) and the smallest r^2 was 0.80. The historical series of mean numbers and weights per standard tow by STRAP are given in Tables 9-12 as well. The estimates from the model compare favorably with strap estimates using the same strata (Tables 9-12, Fig. 14) because there were not too many missing strata to be accounted for. There appears to be a downward trend both in Div. 2J and Div. 3K in stratified mean per tow for numbers and weights (Fig. 14). The very high values for Div. 2J in 1981 and Div. 3K in 1983 were the result of high catches in one set in stratum 228 and 634 respectively. These strata get weighted heavily when calculating the stratified mean per tow. Mean numbers and weights by stratum for Div. 2GH are given in Tables 13 and 14. The time series is not continuous and, therefore, it is not possible to determine if there are any trends in biomass or abundance. It does appear, however, that the density of redfish in these more northern divisions is lower than in Div. 2J and 3K. The geometric mean biomass from surveys in Div. 2J3K during the 1978-87 period is about 265,000 t.

The length frequencies and numbers at age determined from the surveys (Figures 15-19) indicate that no relatively strong year-class(es) has appeared from 1978 to the present.

As mentioned previously SPA was not attempted because of the relatively short time series of catch-at-age coupled with low fishing mortalities. Because of these, the population matrix does not converge.

Conclusions

The catch rates are declining from the high 1984 level. Although the survey results also suggest a decline over this period, the surveys did not show the dramatic increase in biomass that is suggested by the catch rate series from 1981 to 1984.

No significant trends could be detected in either the catch rate series or the survey series because of large variances associated with each.

The present TAC of 35,000 t implies exploitation at about $F_{0.1} = 0.15$, assuming M=0.1 and a population biomass at the geometric mean biomass from the surveys. It should be pointed out the large variance associated with the survey estimate implies a large variance for the derived $F_{0.1}$ yield.

There is no evidence of good recruitment to the fishery since the early 1970s based on the research length frequencies and so it is anticipated that catch rates will continue to decline.

References

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Table 1: Summary of nominal catches (t) of redfish in SA2 + Div. 3K.

Year	2G	2H	2J	3K	Total	TAC
1959	-	23	52,519	134,065	186,837 a	
1960	-	56	82,800	46,861	129,773 a	
1961	-	542	25,052	29,861	55,455	
1962	-	155	7,576	11,925	19,657 a	
1963	245	16	5,873	17,510	23,644	
1964	120	938	16,001	23,044	50,154 a	
1965	851	1,735	15,367	16,748	40,425 a	
1966	197	4,678	9,135	18,720	32,730	
1967	24	3,327	13,699	9,112	26,162 a	
1968	670	3,156	4,937	10,103	18,881 a	
1969	55	180	5,838	13,785	19,883 a	
1970	85	393	6,482	10,010	16,970	
1971	471	1,079	5,084	12,672	19,306	
1972	22	637	8,879	10,495	20,033	
1973	192	742	10,545	27,486	38,965	30,000
1974	85	429	5,943	23,688	30,145	30,000
1975	67	383	14,096	11,013	25,559	30,000
1976	89	1,606	14,412	9,858	25,965	30,000
1977	99	770	6,509	10,161	17,539	30,000
1978	29	554	11,804	16,759	29,146	30,000
1979	14	256	16,659	13,801	30,730	30,000
1980	2	47	4,423	10,047	14,519	35,000
1981	24	203	4,241	13,174	17,642	35,000
1982	-	583	7,048	10,352	17,983	35,000
1983	-	158	2,166	12,987	15,311	35,000
1984	49	81	2,329	21,230	23,689	35,000
1985	-	133	1,000	28,225	29,358	35,000
1986*	-	68	3,456	23,523	27,047	35,000
1987*					16,715	35,000
1988						35,000

* Provisional.
a Totals include unallocated catch in Subarea 2.

Table 2: Nominal catches (t) of redfish in Subarea 2 + Division 3K by country and year.

Country	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986*	1987*
Canada	3,894	3,498	22,052	26,587	7,785	13,416	11,134	9,297	17,367	21,579	18,826	13,205
Cuba	-	-	-	43	-	-	-	-	-	-	-	-
DDR	1,729	1,305	2,909	543	1,102	720	425	626	485	101	134	380
Iceland	2	-	-	-	-	-	-	-	-	-	-	-
Japan	-	4	255	-	9	4	2,662	-	1,218	3,471	4,178	664
Norway	9	-	-	-	1	-	-	-	-	-	1	-
Poland	3,950	2,269	625	302	870	635	24	1,406	366	66	297	41
Portugal	823	845	378	544	266	393	456	183	437	106	20	-
Romania	-	312	-	-	-	-	-	-	-	-	-	-
Spain	-	134	37	-	44	-	-	-	-	-	-	-
USSR	14,881	8,014	2,685	2,578	4,208	2,474	3,073	3,722	3,690	3,689	3,528	2,351
FRG	647	803	157	68	148	-	180	77	111	204	63	-
France	11	110	22	3	7	-	9	-	2	9	-	-
UK	19	245	26	62	79	-	20	-	13	-	-	-
Others	-	-	-	-	-	-	-	-	-	-	-	74
TOTAL	25,965	17,539	29,146	30,730	14,519	17,642	17,983	15,311	23,689	29,225	27,047	16,715

* Provisional.

Table 3a: Nominal catches (t) of redfish in Divisions 2GH by month and year.

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1976	232	35	94	4	-	30	85	159	175	416	426	39	1,695
1977	48	3	12	8	-	54	38	140	306	194	49	17	869
1978	224	1	-	-	-	-	5	55	33	9	98	158	583
1979	93	-	-	-	11	-	-	35	22	81	23	5	270
1980	9	-	10	-	1	-	1	-	14	12	-	2	49
1981	22	-	-	-	-	2	28	97	19	32	15	12	227
1982	33	-	-	-	-	29	-	1	300	5	106	109	583
1983	-	-	-	-	-	-	37	-	22	7	87	5	158
1984	-	-	-	-	-	-	-	74	6	14	20	16	130
1985	-	-	-	-	-	-	113	20	-	-	-	-	133
1986*	-	-	-	-	-	-	6	59	-	-	3	-	68

* Provisional.

Table 3b: Nominal catches (t) of redfish in Division 2J by month and year.

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1976	2,206	485	-	2	55	73	1,495	7,208	1,827	392	63	606	14,412
1977	217	512	588	54	25	135	914	1,469	1,467	336	619	173	6,509
1978	669	217	418	177	6	1	353	3,994	3,614	1,577	527	251	11,804
1979	137	277	36	-	20	68	2,026	4,452	6,071	3,336	204	32	16,659
1980	43	357	91	59	246	6	13	464	2,784	38	106	216	4,423
1981	206	65	75	12	-	29	1,398	1,886	11	55	114	390	4,241
1982	27	294	191	63	197	410	1,134	2,395	2,188	123	14	12	7,048
1983	37	225	96	93	-	34	403	269	41	18	250	700	2,166
1984	-	-	34	14	2	114	34	1,871	46	80	67	67	2,329
1985	-	-	-	2	-	27	595	316	15	35	-	10	1,000
1986*	67	-	3	-	1	42	34	1,530	1,528	79	152	20	3,456

* Provisional.

Table 3c: Nominal catches (t) of redfish in Division 3K by month and year.

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1976	2,260	1,920	929	561	187	307	1,019	604	357	88	304	1,322	9,858
1977	214	1,624	754	382	245	347	3,699	1,103	1,180	377	163	73	10,161
1978	295	589	4,294	2,565	1,757	412	377	597	1,847	469	1,652	1,905	16,759
1979	134	954	1,874	1,800	1,747	951	450	2,107	1,431	2,073	115	165	13,801
1980	112	209	1,154	1,671	1,087	140	196	1,400	693	509	1,845	1,031	10,047
1981	139	342	501	1,085	630	3,405	3,212	1,998	713	120	416	613	13,174
1982	73	136	112	576	1,187	370	1,010	2,031	424	634	2,214	1,585	10,352
1983	447	1,073	2,558	1,354	972	751	627	3,772	532	548	40	313	12,987
1984	924	1,327	1,761	2,920	2,704	936	1,164	2,764	2,165	2,962	863	740	21,230
1985	1,534	2,378	2,609	2,669	2,061	1,675	1,612	4,961	2,500	1,547	1,717	2,962	28,225
1986*	967	1,933	2,371	1,353	1,942	867	172	2,427	4,049	2,284	3,378	1,780	23,523

* Provisional.

Table 4: ANOVA table and parameter estimates from the multiplicative model.

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.627
MULTIPLE R SQUARED..... 0.393

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	4.926E1	4.926E1	
REGRESSION	67	1.112E2	1.660E0	6.210
TYPE 1	26	4.589E1	1.765E0	6.604
TYPE 2	11	1.403E1	1.275E0	4.772
TYPE 3	2	1.630E0	8.148E-1	3.048
TYPE 4	28	3.070E1	1.096E0	4.102
RESIDUALS	643	1.719E2	2.673E-1	
TOTAL	711	3.323E2		

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
1	3125	INTERCEPT	0.492	0.153	711
2	8				
3	31				
4	59				
1	2125	1	0.085	0.139	20
	2154	2	-0.139	0.226	6
	2155	3	0.184	0.169	12
	3124	4	-0.426	0.105	31
	3155	5	0.269	0.119	28
	11115	6	-0.763	0.207	12
	11116	7	-0.434	0.219	9
	11125	8	-0.082	0.171	11
	11126	9	-0.528	0.166	19
	11127	10	-0.149	0.137	20
	12105	11	-0.236	0.194	12
	12106	12	0.035	0.173	18
	14124	13	0.933	0.246	5
	14125	14	-0.081	0.193	8
	14126	15	0.370	0.130	20
	14127	16	0.053	0.225	6
	16127	17	-0.630	0.101	94
	17116	18	0.270	0.241	8
	17127	19	-0.087	0.213	7
	20114	20	-0.974	0.177	16
	20116	21	-0.620	0.189	17
	20126	22	-0.275	0.242	6
	20127	23	-0.073	0.085	90
	20157	24	0.208	0.178	10
	27124	25	-0.145	0.185	9
	27125	26	0.131	0.077	73
2	1	27	0.276	0.133	19
	2	28	0.346	0.127	22
	3	29	0.186	0.098	43
	4	30	0.258	0.096	52
	5	31	0.049	0.091	56
	6	32	-0.265	0.087	60
	7	33	0.007	0.084	68
	9	34	0.077	0.078	83
	10	35	-0.124	0.082	77
	11	36	-0.133	0.086	70
	12	37	-0.055	0.090	59
3	22	38	-0.132	0.116	24
	23	39	0.092	0.048	211
4	60	40	-0.301	0.184	13
	61	41	0.170	0.268	5
	62	42	0.226	0.251	6
	63	43	0.346	0.197	20
	64	44	0.399	0.193	20
	65	45	0.226	0.196	19
	66	46	0.045	0.221	11
	67	47	0.050	0.189	34
	68	48	-0.224	0.224	12
	69	49	-0.617	0.251	6
	70	50	-0.352	0.259	5
	71	51	0.012	0.221	9
	72	52	-0.124	0.239	9
	73	53	-0.666	0.211	10
	74	54	-0.010	0.260	9
	75	55	-0.435	0.250	8
	76	56	-0.366	0.176	23
	77	57	-0.258	0.161	34
	78	58	-0.338	0.155	61
	79	59	-0.394	0.157	47
	80	60	-0.280	0.154	34
	81	61	-0.403	0.159	34
	82	62	-0.169	0.158	39
	83	63	0.036	0.172	25
	84	64	0.196	0.158	40
	85	65	0.173	0.159	44
	86	66	-0.323	0.159	44
	87	67	0.009	0.151	51

Table 5: The predicted catch rate series for redfish in SA 2 + Division 3K.

STANDARDS USED VARIABLE NUMBERS: 3125 8 31

PREDICTED CATCH RATE

YEAR	LN TRANSFORM MEAN	LN TRANSFORM S.E.	RETRANSFORMED MEAN	RETRANSFORMED S.E.	CATCH	EFFORT
1959	0.4921	0.0235	1.848	0.282	186837	101090
1960	0.1910	0.0351	1.360	0.253	129773	95447
1961	0.6622	0.0752	2.135	0.575	55455	25976
1962	0.7186	0.0596	2.276	0.548	19657	8635
1963	0.8382	0.0288	2.605	0.440	23644	9075
1964	0.8914	0.0280	2.749	0.457	50154	18246
1965	0.7181	0.0289	2.311	0.390	40425	17495
1966	0.5374	0.0395	1.918	0.378	32730	17061
1967	0.5422	0.0266	1.940	0.314	26162	13485
1968	0.2685	0.0393	1.466	0.288	18881	12878
1969	-0.1245	0.0572	0.981	0.231	19883	20270
1970	0.1406	0.0648	1.274	0.319	16970	13322
1971	0.5045	0.0419	1.854	0.376	19306	10413
1972	0.3682	0.0456	1.615	0.341	20033	12406
1973	-0.1736	0.0327	0.945	0.170	38965	41214
1974	0.4825	0.0574	1.800	0.425	30145	16751
1975	0.0570	0.0513	1.180	0.264	25559	21668
1976	0.1260	0.0199	1.284	0.180	25965	20223
1977	0.2338	0.0147	1.434	0.173	17539	12233
1978	0.1541	0.0112	1.326	0.140	29146	21976
1979	0.0981	0.0109	1.254	0.131	30730	24502
1980	0.2124	0.0141	1.404	0.166	14519	10343
1981	0.0893	0.0121	1.242	0.136	17642	14199
1982	0.3236	0.0112	1.571	0.166	17983	11445
1983	0.5280	0.0155	1.923	0.239	15311	7960
1984	0.6879	0.0113	2.262	0.240	23689	10475
1985	0.6648	0.0103	2.211	0.224	29358	13278
1986	0.1693	0.0105	1.347	0.138	27047	20078
1987	0.5016	0.0099	1.878	0.187	16715	8898

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.165

Table 6: Estimated numbers of redfish caught at age (000's) (including their average weight and length) in the commercial fishery in SA 2 and Div. 3K in 1987.

	AVERAGE		CATCH		
AGE	WEIGHT	LENGTH	MEAN	STD. ERR.	C. V.
* 6	0.060	16.000	2	0.00	0.00
7	0.129	20.532	22	10.25	0.47
* 8	0.152	21.785	149	23.23	0.16
9	0.185	23.291	495	43.68	0.09
10	0.214	24.460	658	62.47	0.09
11	0.237	25.351	989	96.55	0.10
12	0.264	26.272	1714	143.90	0.08
13	0.297	27.313	2403	209.45	0.09
14	0.332	28.341	3359	272.00	0.08
15	0.361	29.159	4258	310.61	0.07
16	0.402	30.169	4097	309.71	0.08
17	0.437	31.049	3738	279.93	0.07
18	0.493	32.276	2501	219.34	0.09
19	0.535	33.215	1999	177.07	0.09
20	0.587	34.201	1399	136.55	0.10
21	0.593	34.325	1062	118.63	0.11
22	0.653	35.384	784	96.01	0.12
23	0.691	36.076	738	86.12	0.12
24	0.754	37.138	660	75.53	0.11
25	0.789	37.670	597	68.36	0.11
26	0.801	37.859	435	58.92	0.14
27	0.838	38.484	413	53.34	0.13
28	0.822	38.318	508	57.42	0.11
29	0.886	39.213	422	50.14	0.12
*30	1.166	42.628	1613	61.60	0.04

NOTE

FOR THE AGES FLAGGED BY * THERE WAS AN AGE LENGTH KEY WITH ONLY ONE AGE DETERMINATION FOR SOME LENGTH, SINCE THE VARIANCE FORMULA HAS N-1 IN THE DENOMINATOR IT CANNOT BE EVALUATED FOR THIS LENGTH, CONSEQUENTLY THIS VARIANCE COMPONENT IS NOT INCLUDED IN THE VARIANCE FOR THE FLAGGED AGES. THIS IS GENERALLY NOT A SERIOUS PROBLEM SINCE IT OCCURS WHEN FEW FISH ARE CAUGHT AT THAT LENGTH.

Table 7 : Estimated numbers of redfish caught at age (000's) in SA 2 and Division 3K, 1976-1987.

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
6	7	22	4	240	28	44	1	1	2	0	2	2
7	30	102	400	2159	301	199	224	13	14	48	36	22
8	136	219	1241	5678	1669	607	998	351	60	219	303	149
9	1265	612	3297	8798	996	1398	2252	955	1058	677	599	495
10	2067	843	4071	9251	869	1819	3678	1155	3124	3685	1695	658
11	3866	1569	4495	6700	839	1536	3920	1271	3713	6525	2698	989
12	5580	1930	5806	4011	1031	1047	3967	2051	3982	7682	4484	1714
13	7818	2241	6207	7374	1549	1348	4122	2090	5015	8930	6339	2403
14	8652	3315	6267	6646	1889	1409	3479	2352	4591	7794	8012	3359
15	8615	3162	5265	6571	2050	2138	3765	1855	4472	6429	6576	4258
16	2700	2776	5331	6075	1727	1887	3135	1624	4002	5045	4537	4097
17	1826	2504	3969	5544	1753	2302	3052	1641	2666	4285	4350	3738
18	946	1812	2250	1796	1032	1920	2049	1398	2700	4062	3687	2501
19	757	1778	1488	1241	793	1470	1537	1206	1693	2745	2748	1999
20	1128	1638	1495	1391	10058	1308	1044	912	1851	1488	2108	1399
21	968	895	1084	1412	669	1019	1060	956	1671	1541	1685	1062
22	885	940	950	789	532	1001	627	710	1365	1135	1328	784
23	1100	555	591	573	503	1093	498	613	1044	985	1067	738
24	1005	618	883	599	748	1004	517	823	1183	833	851	660
25	684	598	828	930	521	828	324	771	956	678	695	597
26	678	514	746	569	524	903	369	560	954	820	803	435
27	512	435	509	590	505	540	341	597	758	582	696	413
28	632	418	535	589	389	749	256	565	806	618	654	508
29	284	200	139	283	415	580	226	492	652	531	597	422

Table 8 : Estimated weight at age (kg) of redfish caught in SA 2 and Division 3K, 1976-1987.

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
6	0.10	0.10	0.10	0.10	0.11	0.09	0.10	0.10	0.10	0.08	0.06	0.06
7	0.13	0.13	0.13	0.13	0.17	0.11	0.14	0.14	0.12	0.12	0.11	0.13
8	0.17	0.17	0.17	0.17	0.18	0.16	0.17	0.16	0.17	0.14	0.15	0.15
9	0.21	0.21	0.21	0.21	0.22	0.20	0.21	0.19	0.20	0.19	0.19	0.18
10	0.24	0.24	0.24	0.24	0.24	0.22	0.25	0.22	0.23	0.22	0.22	0.21
11	0.28	0.28	0.28	0.28	0.28	0.24	0.27	0.25	0.25	0.24	0.23	0.24
12	0.32	0.32	0.32	0.32	0.29	0.28	0.30	0.28	0.27	0.26	0.26	0.26
13	0.36	0.36	0.36	0.36	0.31	0.32	0.33	0.30	0.30	0.29	0.29	0.30
14	0.40	0.40	0.40	0.40	0.36	0.35	0.36	0.33	0.35	0.32	0.33	0.33
15	0.44	0.44	0.44	0.44	0.42	0.40	0.41	0.37	0.37	0.36	0.36	0.36
16	0.48	0.48	0.48	0.48	0.46	0.44	0.45	0.41	0.40	0.39	0.40	0.40
17	0.52	0.52	0.52	0.52	0.53	0.49	0.49	0.48	0.44	0.44	0.45	0.44
18	0.56	0.56	0.56	0.56	0.57	0.54	0.56	0.52	0.48	0.47	0.51	0.49
19	0.60	0.60	0.60	0.60	0.60	0.59	0.60	0.57	0.51	0.51	0.51	0.54
20	0.63	0.63	0.63	0.63	0.67	0.63	0.65	0.60	0.57	0.54	0.56	0.59
21	0.67	0.67	0.67	0.67	0.65	0.70	0.70	0.64	0.63	0.60	0.60	0.59
22	0.70	0.70	0.70	0.70	0.75	0.73	0.71	0.67	0.68	0.63	0.62	0.65
23	0.73	0.73	0.73	0.73	0.79	0.76	0.79	0.72	0.70	0.72	0.67	0.69
24	0.76	0.76	0.76	0.76	0.75	0.81	0.79	0.74	0.74	0.76	0.73	0.75
25	0.79	0.79	0.79	0.79	0.77	0.82	0.85	0.80	0.77	0.80	0.79	0.79
26	0.82	0.82	0.82	0.82	0.95	0.84	0.86	0.80	0.83	0.82	0.80	0.80
27	0.84	0.84	0.84	0.84	0.93	0.93	0.87	0.83	0.83	0.85	0.82	0.84
28	0.87	0.87	0.87	0.87	0.92	0.92	0.88	0.82	0.86	0.84	0.83	0.82
29	0.89	0.89	0.89	0.89	1.00	0.89	0.90	0.90	0.87	0.86	0.84	0.89

Table 9 : Mean numbers of redfish caught per standard tow in Division 2J during Canadian research surveys, 1978-1986. Numbers in brackets are number of sucessful sets, ● indicates those strata estimated with the multiplicative model (MA)).

Stratum	1978	1979	1980	1981	1982	1983	1984
203	16.00 (2)	6.00 (2)	17.50 (2)	6.75 (2)	11.33 (3)	10.83 (3)	16.00 (2)
204	23.50 (2)	16.00 (2)	7.00 (1)	16.50 (2)	1.67 (3)	15.67 (3)	23.50 (2)
208	135.50 (2)	2059.00 (2)	29.50 (2)	14.50 (2)	18.67 (3)	11.50 (2)	52.67 (3)
209	3.50 (2)	0.00 (2)	5.50 (2)	0.50 (6)	0.09 (11)	0.43 (7)	0.14 (7)
210	66.00 (3)	9.00 (2)	2.50 (2)	0.00 (3)	17.72 (6)	1.00 (2)	22.25 (4)
211	44.50 (2)	40.50 (2)	66.00 (2)	993.25 (2)	46.00 (2)	0.50 (2)	109.50 (3)
212	5.50 (2)	12.50 (2)	2.00 (2)	4.00 (2)	7.00 (5)	7.50 (3)	18.00 (2)
213	236.67 (3)	249.33 (3)	1.00 (3)	10.17 (6)	12.06 (10)	320.10 (10)	150.80 (5)
214	258.67 (3)	7.50 (2)	0.00 (2)	148.00 (5)	74.75 (8)	77.88 (8)	0.75 (4)
215	24.00 (3)	13.50 (2)	27.50 (2)	2.80 (5)	3.00 (9)	5.25 (8)	5.33 (3)
216	4298.00 (2)	635.50 (2)	1745.50 (2)	187.00 (2)	479.50 (2)	360.00 (3)	539.00 (2)
217	1779.50 (2)	423.00 (2)	890.50 (2)	146.50 (2)	468.50 (2)	487.00 (2)	1127.34 ●
218	982.00 (2)	337.11 ●	520.00 (2)	156.50 (2)	87.50 (2)	168.50 (2)	576.83 ●
219	27.00 (1)	10.49 ●	17.75 ●	14.25 (2)	10.11 ●	2.00 (2)	17.95 ●
222	3286.00 (2)	886.00 (2)	1120.50 (2)	2629.00 (2)	1848.00 (3)	2460.33 (3)	835.00 (3)
223	2499.50 (2)	530.50 (2)	1113.00 (2)	877.00 (2)	652.00 (2)	510.50 (2)	573.00 (2)
224	1176.00 (2)	720.00 (2)	498.50 (2)	342.50 (2)	151.00 (2)	169.50 (2)	220.50 (2)
227	1319.50 (2)	231.50 (2)	223.00 (2)	20.50 (2)	185.20 (5)	135.00 (4)	116.33 (3)
228	177.00 (3)	11.50 (2)	1029.50 (2)	4590.00 (6)	109.10 (10)	226.83 (6)	227.29 (7)
229	175.00 (2)	408.00 (2)	659.00 (2)	1607.00 (2)	1262.50 (4)	1110.75 (4)	293.00 (3)
230	2106.00 (2)	363.25 ●	262.75 (2)	126.50 (2)	210.00 (2)	116.00 (2)	125.50 (2)
231	0.00 (2)	10.83 ●	3.00 (2)	19.00 (1)	4.50 (2)	5.00 (2)	32.50 (2)
235	10.00 (2)	48.00 (2)	41.00 (2)	9.00 (2)	16.67 (3)	28.50 (2)	84.67 (3)
236	45.59 ●	13.45 ●	22.75 ●	8.00 (2)	4.50 (3)	5.00 (2)	8.50 (2)
Mean							
STRAP	517.94	213.87	295.66	659.88	175.80	226.91	127.61
MA	506.86	212.34	282.05	658.88	173.37	226.91	157.06

Table 9 : continued.

Stratum	1985	1986	1987
203	2.00 (3)	1.00 (2)	0.33 (3)
204	0.00 (2)	0.50 (2)	0.00 (2)
208	32.67 (3)	0.50 (2)	2.50 (2)
209	0.11 (9)	0.00 (7)	0.38 (8)
210	0.50 (4)	0.33 (3)	0.75 (4)
211	154.67 (3)	1.50 (2)	9.50 (2)
212	5.50 (4)	6.33 (3)	2.00 (4)
213	1.89 (9)	0.00 (9)	1.22 (9)
214	1.67 (6)	4.83 (6)	3.00 (6)
215	1.17 (6)	5.52 (5)	0.43 (7)
216	197.00 (2)	667.41 (2)	399.50 (2)
217	152.50 (2)	407.50 (2)	203.50 (2)
218	83.00 (2)	64.00 (2)	333.00 (2)
219	0.00 (2)	22.00 (2)	0.50 (2)
222	399.00 (2)	111.00 (2)	130.50 (2)
223	574.00 (2)	950.00 (2)	149.00 (2)
224	37.50 (2)	214.37 (2)	205.50 (2)
227	89.75 (4)	287.33 (3)	60.25 (4)
228	0.14 (7)	47.00 (6)	17.71 (7)
229	280.33 (3)	689.33 (3)	19.33 (3)
230	113.00 (2)	470.00 (2)	221.50 (2)
231	23.50 (2)	9.50 (2)	2.00 (2)
235	12.50 (2)	4.00 (2)	17.00 (2)
236	20.00 (2)	6.80 (2)	3.50 (2)
Mean STRAP	53.12	99.99	43.63
MA	53.12	99.99	43.63

Table 10: Mean numbers of redfish caught per standard tow in Division 3K during Canadian research surveys, 1978-1986. Numbers in brackets are number of sucessful sets, ● indicates those strata estimated with the multiplicative model (MA)).

Stratum	1978	1979	1980	1981	1982	1983	1984
620	43.80 (5)	19.33 (3)	12.00 (3)	7.40 (10)	0.33 (9)	4.70 (10)	0.23 (13)
621	8.60 (5)	3.00 (3)	8.00 (3)	1.36 (11)	1.51 (14)	0.33 (12)	0.50 (14)
622	93.00 (2)	10.33 (3)	18.00 (2)	27.00 (2)	18.33 (3)	20.00 (2)	8.00 (4)
623	51.00 (3)	4.00 (1)	81.50 (2)	7.50 (4)	6.00 (5)	103.67 (6)	13.40 (5)
624	1171.00 (4)	173.00 (2)	11.50 (2)	18.00 (2)	5.25 (4)	3.75 (4)	15.75 (4)
625	121.33 (3)	53.00 (2)	85.50 (2)	387.75 (4)	13.00 (2)	324.33 (3)	21.00 (5)
626	118.33 (3)	31.00 (2)	39.50 (2)	140.40 (5)	96.60 (5)	7.75 (4)	8.00 (6)
627	4.50 (2)	25.67 (3)	45.50 (2)	7.00 (6)	16.00 (7)	23.00 (6)	12.38 (8)
628	67.50 (2)	53.67 (3)	8.50 (2)	32.83 (6)	5.33 (6)	14.50 (6)	8.29 (7)
629	292.00 (3)	160.43 ●	87.50 (2)	49.00 (3)	29.50 (2)	2070.33 (3)	25.00 (4)
630	305.50 (2)	102.00 (2)	46.00 (2)	19.00 (2)	55.41 ●	119.00 (2)	212.00 (3)
631	10.00 (2)	28.00 (3)	50.33 (3)	19.00 (5)	9.00 (2)	47.80 (5)	431.80 (5)
632	424.50 (4)	43.00 (2)	288.00 (2)	45.00 (2)	15.67 (3)	35.33 (3)	15.00 (1)
633	6191.75 (4)	82.25 (4)	413.00 (3)	219.33 (8)	1393.00 (7)	817.73 (12)	155.30 (10)
634	373.25 (4)	28.50 (2)	138.50 (2)	33.19 (7)	112.27 (11)	8899.80 (5)	48.57 (7)
635	776.75 (4)	275.00 (3)	59.50 (2)	2927.20 (5)	6.00 (5)	4.33 (6)	43.63 (8)
636	964.75 (4)	118.50 (2)	3318.00 (2)	41.67 (6)	32.50 (10)	118.00 (6)	16.00 (8)
637	605.50 (5)	759.67 (3)	188.00 (2)	661.50 (6)	41.71 (7)	292.60 (5)	12.50 (6)
638	478.00 (3)	182.00 (2)	857.33 (3)	121.25 (8)	81.64 (10)	151.00 (11)	166.80 (10)
639	798.75 (4)	2118.50 (2)	392.00 (2)	95.83 (6)	553.10 (15)	6536.43 (7)	753.87 (8)
640	1497.00 (2)	1045.15 ●	1190.00 (2)	410.50 (2)	480.50 (2)	968.70 ●	279.50 (2)
641	693.50 (2)	154.00 (2)	399.00 (2)	199.50 (2)	186.25 (4)	55.67 (3)	100.00 (3)
642	1.00 (2)	2.00 (1)	4.50 (2)	1.33 (3)	3.83 (6)	7.59 ●	5.33 (6)
645	1774.50 (2)	1339.43 ●	1280.50 (2)	538.00 (2)	710.33 (3)	1659.50 (2)	141.50 (2)
646	2411.00 (2)	20.50 (2)	115.50 (2)	149.50 (2)	1185.00 (2)	960.00 (2)	471.00 (2)
647	23.00 (2)	0.50 (2)	34.10 (2)	6.50 (2)	0.50 (2)	2.00 (1)	56.00 (1)
Mean							
STRAP	809.39	219.91	349.62	226.98	187.18	1072.28	108.20
MA	809.39	217.71	349.62	226.98	184.65	1021.32	105.97

Table 10: continued.

Stratum	1985	1986	1987
620	0.64 (14)	0.00 (9)	0.43 (14)
621	1.20 (15)	0.50 (14)	0.33 (12)
622	4.00 (4)	6.50 (2)	1.00 (3)
623	5.33 (6)	3.00 (4)	1.20 (5)
624	3.00 (4)	4.50 (2)	2.33 (3)
625	70.60 (5)	0.67 (3)	27.50 (4)
626	31.90 (5)	3.25 (4)	12.20 (5)
627	3.71 (7)	2.60 (5)	2.00 (6)
628	1.75 (6)	0.00 (4)	1.80 (5)
629	20.75 (4)	16.00 (3)	17.67 (3)
630	21.94 (4)	38.90 (2)	1.67 (3)
631	167.14 (7)	13.64 (4)	8.67 (6)
632	12.00 (3)	9.50 (2)	4.50 (2)
633	921.50 (12)	40.72 (8)	24.82 (11)
634	27.56 (9)	45.40 (5)	12.91 (11)
635	13.00 (7)	6.29 (6)	4.00 (6)
636	7.88 (8)	14.25 (4)	5.57 (7)
637	62.00 (7)	11.05 (4)	4.67 (6)
638	105.64 (11)	19.75 (4)	96.50 (10)
639	733.00 (8)	1435.00 (6)	177.14 (7)
640	552.00 (3)	202.00 (2)	268.00 (2)
641	111.25 (4)	53.30 •	52.33 (3)
642	11.40 (5)	1.30 •	1.80 (5)
645	1328.67 (3)	211.95 •	423.00 (2)
646	272.33 (3)	103.06 •	341.50 (2)
647	205.92 (3)	2.81 •	2.64 •
Mean STRAP	154.93	94.26	32.19
MA	154.93	89.97	31.75

Table 11: Mean weight of redfish caught per standard tow in Division 2J during Canadian research surveys, 1978-1986. Numbers in brackets are number of sucessful sets, ● indicates those strata estimated with the multiplicative model (MA)).

Stratum	1978	1979	1980	1981	1982	1983	1984
203	1.34 (2)	0.68 (2)	3.25 (2)	0.75 (2)	2.40 (3)	1.48 (3)	3.75 (2)
204	5.66 (2)	7.03 (2)	1.00 (1)	3.40 (2)	0.43 (3)	2.63 (3)	5.00 (2)
208	42.39 (2)	1540.40 (2)	17.75 (2)	26.00 (2)	7.17 (3)	2.85 (2)	20.00 (3)
209	0.06 (2)	0.00 (2)	3.70 (2)	0.50 (6)	0.00 (11)	0.13 (7)	0.09 (7)
210	1.51 (3)	3.17 (2)	1.00 (2)	0.00 (3)	2.91 (6)	0.75 (2)	2.00 (4)
211	18.82 (2)	19.29 (2)	46.00 (2)	987.00 (2)	13.75 (2)	0.10 (2)	38.25 (3)
212	3.40 (2)	4.77 (2)	0.55 (2)	2.80 (2)	3.40 (5)	2.65 (3)	9.00 (2)
213	55.04 (3)	85.88 (3)	0.43 (3)	2.79 (6)	4.60 (10)	92.82 (10)	42.30 (5)
214	75.15 (3)	4.54 (2)	0.00 (2)	54.14 (5)	28.19 (8)	32.02 (8)	0.38 (4)
215	9.61 (3)	6.01 (2)	7.50 (2)	1.20 (5)	0.41 (9)	1.66 (8)	2.27 (3)
216	2209.48 (2)	267.74 (2)	590.17 (2)	69.50 (2)	195.75 (2)	133.67 (3)	272.50 (2)
217	704.90 (2)	164.29 (2)	470.57 (2)	73.75 (2)	214.00 (2)	239.83 (2)	487.57 ●
218	611.68 (2)	225.85 ●	314.50 (2)	92.00 (2)	55.50 (2)	99.25 (2)	329.45 ●
219	16.33 (1)	6.95 ●	11.61 ●	8.00 (2)	5.53 ●	1.90 (2)	10.14 ●
222	1331.48 (2)	302.99 (2)	402.50 (2)	1033.75 (2)	582.00 (3)	963.48 (3)	303.30 (3)
223	1131.28 (2)	221.87 (2)	538.50 (2)	459.16 (2)	358.16 (2)	271.00 (2)	247.00 (2)
224	836.89 (2)	425.01 (2)	293.25 (2)	204.75 (2)	99.00 (2)	110.75 (2)	114.50 (2)
227	714.01 (2)	148.46 (2)	159.25 (2)	8.00 (2)	99.90 (5)	70.88 (4)	57.33 (3)
228	27.97 (3)	3.34 (2)	437.45 (2)	1548.50 (6)	31.60 (10)	103.54 (6)	88.44 (7)
229	69.61 (2)	181.37 (2)	285.30 (2)	769.25 (2)	432.87 (4)	364.08 (4)	131.83 (3)
230	1160.53 (2)	258.38 ●	196.52 (2)	79.75 (2)	134.15 (2)	74.50 (2)	63.25 (2)
231	0.00 (2)	7.16 ●	3.00 (2)	11.00 (1)	3.50 (2)	2.25 (2)	17.75 (2)
235	2.95 (2)	17.02 (2)	23.50 (2)	4.25 (2)	6.17 (3)	13.25 (2)	38.00 (3)
236	17.37 ●	8.82 ●	14.74 ●	3.75 (2)	2.75 (3)	3.00 (2)	4.75 (2)
Mean							
STRAP	236.46	112.69	131.38	257.79	66.06	88.33	50.80
MA	230.93	113.92	124.86	257.29	64.67	88.33	65.62

Table 11: continued.

Stratum	1985	1986	1987
203	0.08 (3)	0.30 (2)	0.03 (3)
204	0.00 (2)	0.15 (2)	0.00 (2)
208	11.50 (3)	0.15 (2)	0.55 (2)
209	0.11 (9)	0.00 (7)	0.03 (8)
210	0.02 (4)	0.07 (3)	0.22 (4)
211	64.75 (3)	0.88 (2)	3.50 (2)
212	1.64 (4)	2.63 (3)	0.84 (4)
213	0.96 (9)	0.00 (9)	0.45 (9)
214	0.67 (6)	1.62 (6)	1.55 (6)
215	0.17 (6)	1.40 (5)	0.31 (7)
216	70.55 (2)	227.14 (2)	141.50 (2)
217	73.50 (2)	181.63 (2)	92.50 (2)
218	41.25 (2)	44.25 (2)	194.00 (2)
219	0.00 (2)	14.70 (2)	0.20 (2)
222	152.50 (2)	47.10 (2)	63.00 (2)
223	328.75 (2)	606.75 (2)	76.25 (2)
224	26.25 (2)	151.35 (2)	138.00 (2)
227	45.50 (4)	199.22 (3)	38.88 (4)
228	0.01 (7)	17.93 (6)	6.60 (7)
229	50.17 (3)	321.50 (3)	6.67 (3)
230	72.00 (2)	326.50 (2)	151.00 (2)
231	9.75 (2)	6.15 (2)	1.55 (2)
235	5.00 (2)	1.00 (2)	8.50 (2)
236	12.50 (2)	6.30 (2)	2.35 (2)
Mean STRAP	21.19	51.82	22.16
MA	21.19	51.82	22.16

Table 12: Mean weight of redfish caught per standard tow in Division 3K during Canadian research surveys, 1978-1986. Numbers in brackets are number of sucessful sets, ● indicates those strata estimated with the multiplicative model (MA)).

Stratum	1978	1979	1980	1981	1982	1983	1984
620	13.68 (5)	2.34 (3)	2.17 (3)	1.83 (10)	0.05 (9)	2.00 (10)	0.07 (13)
621	0.83 (5)	0.68 (3)	2.90 (3)	0.57 (11)	0.15 (14)	0.00 (12)	0.07 (14)
622	7.26 (2)	3.33 (3)	5.75 (2)	16.25 (2)	14.17 (3)	14.00 (2)	5.50 (4)
623	6.50 (3)	13.60 (1)	32.25 (2)	2.46 (4)	2.80 (5)	84.17 (6)	5.40 (5)
624	82.17 (4)	13.61 (2)	5.00 (2)	1.75 (2)	1.47 (4)	0.63 (4)	5.05 (4)
625	35.90 (3)	16.33 (2)	54.25 (2)	303.50 (4)	4.00 (2)	219.00 (3)	8.30 (5)
626	51.86 (3)	13.15 (2)	27.50 (2)	77.28 (5)	19.36 (5)	2.75 (4)	2.60 (6)
627	2.72 (2)	7.87 (3)	10.75 (2)	2.96 (6)	4.21 (7)	10.57 (6)	4.66 (8)
628	47.17 (2)	57.46 (3)	9.75 (2)	16.82 (6)	3.13 (6)	11.41 (6)	7.67 (7)
629	234.51 (3)	69.54 ●	65.00 (2)	28.33 (3)	12.50 (2)	974.00 (3)	7.69 (4)
630	212.17 (2)	56.69 (2)	20.50 (2)	6.25 (2)	28.30 ●	36.75 (2)	114.03 (3)
631	6.14 (2)	9.31 (3)	16.90 (3)	5.80 (5)	2.50 (2)	23.00 (5)	140.12 (5)
632	59.02 (4)	6.47 (2)	90.75 (2)	9.00 (2)	4.17 (3)	9.83 (3)	5.00 (1)
633	1496.14 (4)	35.16 (4)	137.00 (3)	56.64 (8)	508.52 (7)	295.39 (12)	62.45 (10)
634	84.91 (4)	7.25 (2)	33.50 (2)	7.07 (7)	42.54 (11)	2293.60 (5)	18.61 (7)
635	88.22 (4)	159.42 (3)	12.50 (2)	1192.00 (5)	2.46 (5)	2.30 (6)	18.52 (8)
636	239.67 (4)	24.04 (2)	2362.43 (2)	11.00 (6)	19.05 (10)	72.50 (6)	4.92 (8)
637	82.55 (5)	232.38 (3)	29.50 (2)	336.37 (6)	18.21 (7)	139.22 (5)	5.02 (6)
638	115.88 (3)	102.60 (2)	260.10 (3)	44.31 (8)	33.06 (10)	65.57 (11)	72.85 (10)
639	352.23 (4)	863.46 (2)	280.00 (2)	28.05 (6)	177.42 (15)	1903.69 (7)	329.92 (8)
640	488.50 (2)	370.08 ●	476.25 (2)	181.50 (2)	191.50 (2)	435.82 ●	96.00 (2)
641	370.58 (2)	84.61 (2)	228.00 (2)	98.00 (2)	88.38 (4)	34.50 (3)	54.00 (3)
642	0.57 (2)	1.82 (1)	3.00 (2)	0.67 (3)	1.67 (6)	5.68 ●	2.79 (6)
645	746.60 (2)	486.68 ●	503.70 (2)	204.25 (2)	249.00 (3)	623.50 (2)	51.25 (2)
646	1398.40 (2)	13.16 (2)	77.00 (2)	103.25 (2)	684.00 (2)	512.00 (2)	313.00 (2)
647	16.60 (2)	0.27 (2)	12.35 (2)	2.50 (2)	0.25 (2)	0.80 (1)	28.50 (1)
Mean							
STRAP	215.94	89.01	189.73	96.70	70.89	323.32	46.12
MA	215.94	87.89	189.73	96.70	70.07	309.03	45.22

Table 12: continued.

Stratum	1985	1986	1987
620	0.09 (14)	0.00 (9)	0.10 (14)
621	0.11 (15)	0.04 (14)	0.02 (12)
622	1.04 (4)	1.75 (2)	0.40 (3)
623	2.67 (6)	0.55 (4)	0.22 (5)
624	0.69 (4)	0.85 (2)	0.13 (3)
625	23.12 (5)	0.20 (3)	11.27 (4)
626	14.73 (5)	0.40 (4)	2.58 (5)
627	0.74 (7)	0.54 (5)	0.48 (6)
628	1.34 (6)	0.00 (4)	0.50 (5)
629	7.42 (4)	3.60 (3)	9.35 (3)
630	14.87 (4)	13.90 (2)	1.27 (3)
631	73.09 (7)	4.32 (4)	3.08 (6)
632	2.87 (3)	2.00 (2)	0.60 (2)
633	364.25 (12)	15.05 (8)	7.85 (11)
634	9.74 (9)	17.44 (5)	4.01 (11)
635	4.57 (7)	0.77 (6)	1.35 (6)
636	3.91 (8)	3.35 (4)	1.43 (7)
637	25.94 (7)	3.25 (4)	0.77 (6)
638	47.00 (11)	7.40 (4)	58.70 (10)
639	232.81 (8)	786.50 (6)	75.56 (7)
640	257.41 (3)	57.00 (2)	96.25 (2)
641	47.63 (4)	29.42 •	30.17 (3)
642	4.20 (5)	0.85 •	1.00 (5)
645	468.74 (3)	86.07 •	210.75 (2)
646	153.17 (3)	67.45 •	255.50 (2)
647	145.33 (3)	1.71 •	1.66 •
Mean			
STRAP	60.32	48.70	15.99
MA	60.32	46.51	15.77

Table 13: Mean numbers of redfish caught per standard tow in Divisions 2GH during Canadian research surveys 1979-1987. Numbers in brackets are number of successful sets. * indicates strata not fished.

STRATUM	1979	1981	1986	1987
901	0.57 (7)	0.00 (6)	*	0.25 (4)
902	*	*	*	6.00 (3)
903	185.00 (2)	72.25 (2)	*	22.00 (2)
904	283.67 (3)	52.00 (4)	*	72.83 (3)
906	*	*	*	0.90 (2)
908	112.33 (3)	5.58 (3)	*	4.20 (5)
909	1.08 (12)	0.00 (8)	*	*
910	0.00 (8)	0.00 (8)	*	*
911	27.50 (4)	1.00 (3)	*	0.00 (3)
912	*	*	*	10.00 (2)
913	*	*	*	12.50 (2)
914	*	*	*	67.50 (2)
920	*	*	*	2.42 (4)
921	432.00 (2)	*	*	16.00 (2)
922	*	29.00 (2)	*	*
923	*	99.00 (2)	*	8.50 (2)
924	21.67 (3)	7.00 (2)	*	0.00 (2)
925	0.00 (4)	0.00 (3)	*	*
927	*	*	*	2.20 (5)
928	*	*	*	4.00 (3)
929	41.50 (4)	15.67 (3)	*	16.00 (5)
930	0.17 (6)	0.00 (8)	0.20 (5)	0.00 (9)
931	7.67 (3)	0.33 (3)	2.00 (2)	0.00 (4)
932	*	*	*	11.00 (2)
934	670.73 (2)	*	225.50 (2)	140.00 (2)
935	*	*	*	0.00 (2)
936	*	*	*	5.54 (2)
939	*	*	*	4.15 (2)
940	*	*	*	9.15 (2)
941	*	*	129.00 (2)	50.50 (2)
942	34.00 (2)	156.50 (2)	227.00 (3)	59.33 (3)
943	0.00 (2)	2.00 (2)	0.00 (2)	0.00 (4)
944	66.56 (9)	40.89 (9)	18.14 (2)	6.01 (10)
945	53.67 (3)	4.00 (6)	*	5.00 (5)
946	10.40 (5)	0.14 (7)	*	4.70 (8)
947	1.00 (2)	0.25 (4)	*	2.00 (3)
951	73.50 (2)	5.80 (3)	*	11.00 (2)
952	55.50 (2)	22.00 (2)	*	9.00 (3)
953	61.33 (3)	14.25 (4)	*	1.33 (3)
954	0.00 (5)	0.00 (6)	*	0.00 (11)
955	86.33 (3)	167.33 (3)	*	11.00 (4)
956	0.00 (6)	0.00 (4)	*	0.00 (10)
957	0.00 (6)	0.00 (6)	*	0.00 (11)
958	9.00 (2)	0.00 (2)	*	0.00 (3)
959	553.67 (3)	67.33 (3)	*	4.67 (3)
960	277.00 (2)	59.50 (2)	*	130.67 (3)
961	216.33 (3)	39.00 (3)	*	37.00 (2)
962	*	*	*	0.92 (3)
963	*	*	*	0.00 (2)
Mean	32.08	10.06	21.14	6.69

Table 14: Mean weights of redfish caught per standard tow in Divisions 2GH during Canadian research surveys 1979-1987. Numbers in brackets are number of successful sets. * indicates strata not fished.

STRATUM	1979	1981	1986	1987
901	0.02 (7)	0.00 (6)	*	0.00 (4)
902	*	*	*	1.83 (3)
903	62.65 (2)	24.25 (2)	*	5.38 (2)
904	127.12 (3)	30.25 (4)	*	23.13 (3)
906	*	*	*	0.03 (2)
908	7.57 (3)	0.85 (3)	*	0.10 (5)
909	0.06 (12)	0.00 (8)	*	*
910	0.00 (8)	0.00 (8)	*	*
911	2.95 (4)	0.07 (3)	*	0.00 (3)
912	*	*	*	1.90 (2)
913	*	*	*	3.60 (2)
914	*	*	*	27.00 (2)
920	*	*	*	0.97 (4)
921	151.40 (2)	*	*	8.10 (2)
922	*	12.75 (2)	*	*
923	*	40.25 (2)	*	1.67 (2)
924	5.30 (3)	1.00 (2)	*	0.00 (2)
925	0.00 (4)	0.00 (3)	*	*
927	*	*	*	0.22 (5)
928	*	*	*	1.13 (3)
929	8.28 (4)	5.17 (3)	*	4.34 (5)
930	0.15 (6)	0.00 (8)	0.16 (5)	0.00 (9)
931	4.69 (3)	0.17 (3)	0.65 (2)	0.00 (4)
932	*	*	*	3.75 (2)
934	129.53 (2)	*	125.25 (2)	70.00 (2)
935	*	*	*	0.00 (2)
936	*	*	*	4.15 (2)
939	*	*	*	1.52 (2)
940	*	*	*	3.38 (2)
941	*	*	56.25 (2)	40.75 (2)
942	16.11 (2)	77.50 (2)	102.00 (3)	17.90 (3)
943	0.00 (2)	1.00 (2)	0.00 (2)	0.00 (4)
944	14.62 (9)	21.11 (9)	3.46 (2)	1.16 (10)
945	8.32 (3)	1.42 (6)	*	1.09 (5)
946	2.23 (5)	0.04 (7)	*	1.07 (8)
947	0.14 (2)	0.03 (4)	*	0.40 (3)
951	12.94 (2)	1.28 (3)	*	3.00 (2)
952	5.33 (2)	2.25 (2)	*	1.77 (3)
953	0.91 (3)	0.45 (4)	*	0.00 (3)
954	0.00 (5)	0.00 (6)	*	0.00 (11)
955	10.29 (3)	62.00 (3)	*	0.31 (4)
956	0.00 (6)	0.00 (4)	*	0.00 (10)
957	0.00 (6)	0.00 (6)	*	0.00 (11)
958	3.18 (2)	0.00 (2)	*	0.00 (3)
959	278.75 (3)	31.17 (3)	*	0.47 (3)
960	113.50 (2)	24.00 (2)	*	34.67 (3)
961	106.39 (3)	21.67 (3)	*	14.00 (2)
962	*	*	*	0.28 (3)
963	*	*	*	0.00 (2)
Mean	9.03	4.01	8.65	2.09

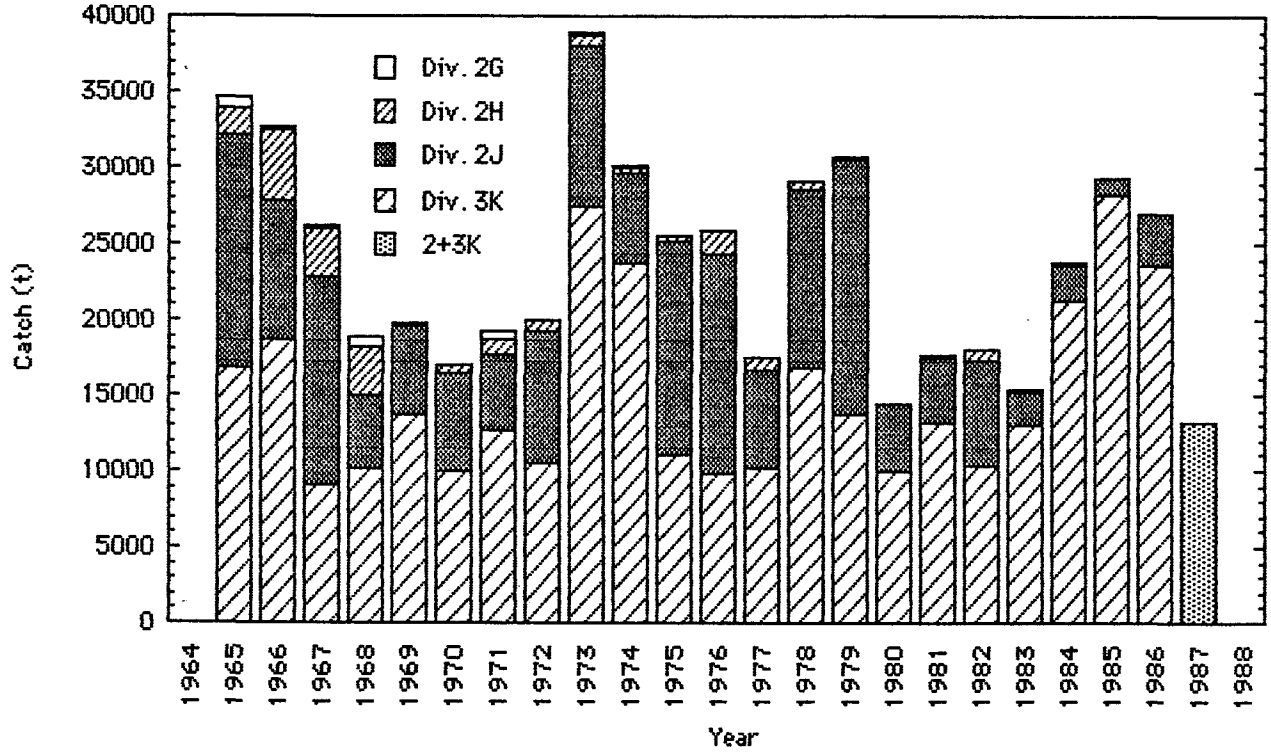

Figure 1 : Nominal catches of redfish in NAFO Subarea 2 + Division3K, 1965-1987 (1986 and 1987 are provisional).

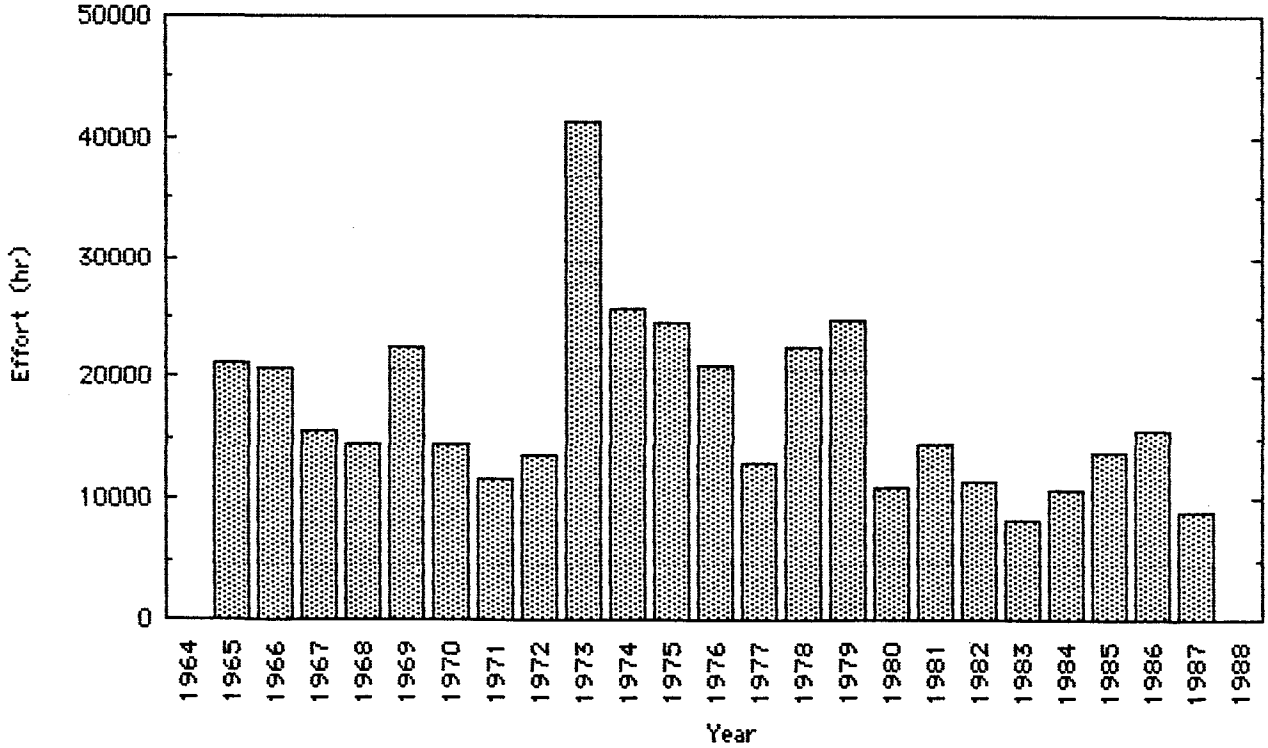

Figure 2: Standardized effort (hr) directed towards redfish in NAFO Subarea 2 + Div. 3K, 1965-1987 (1986 and 19

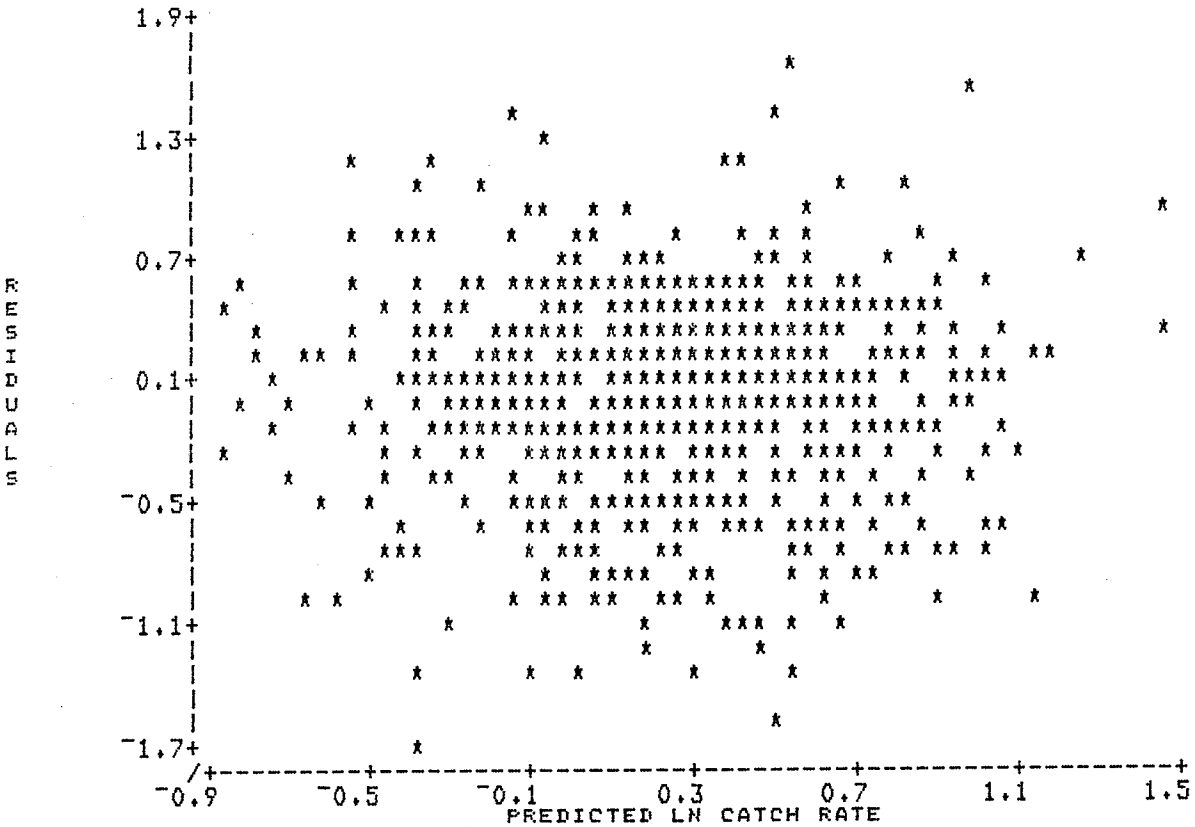

Figure 3: Plot of residuals versus ln(predicted catch rate) from the multiplicative model.

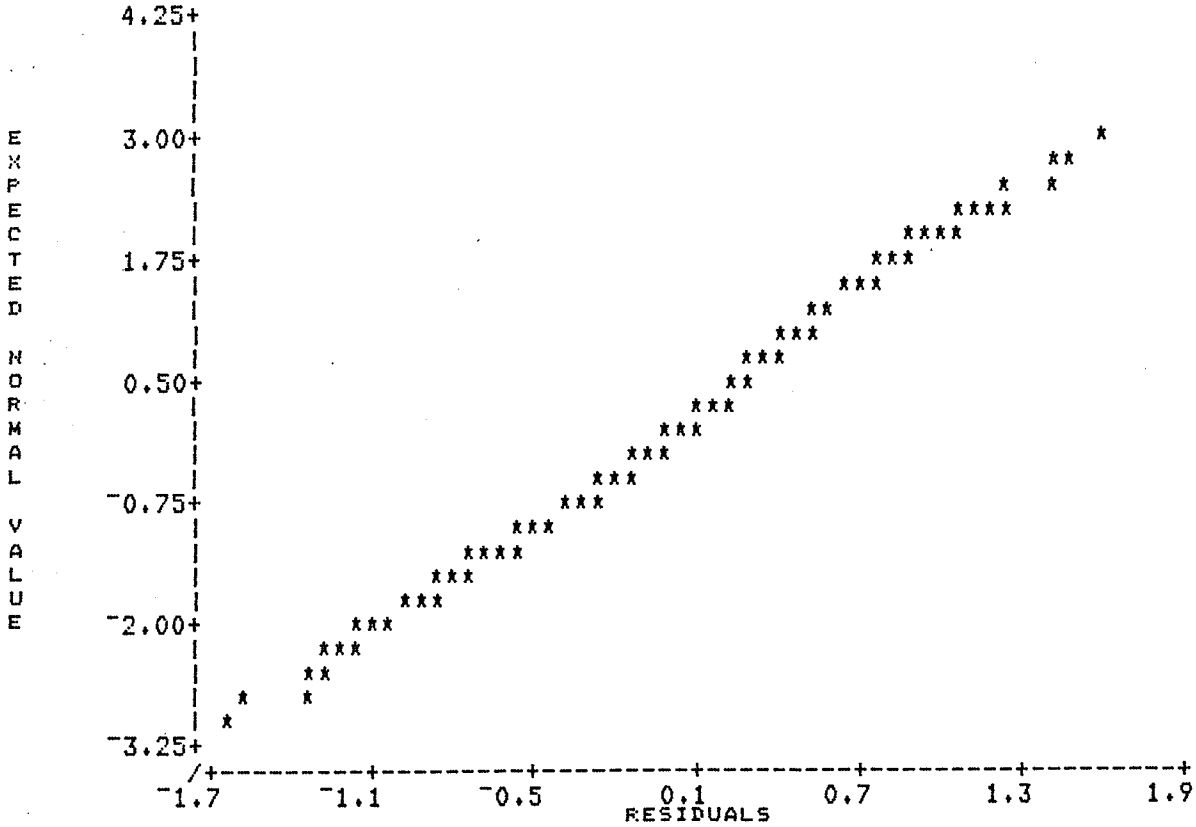

Figure 4: Plot of expected normal versus residuals from the multiplicative model.

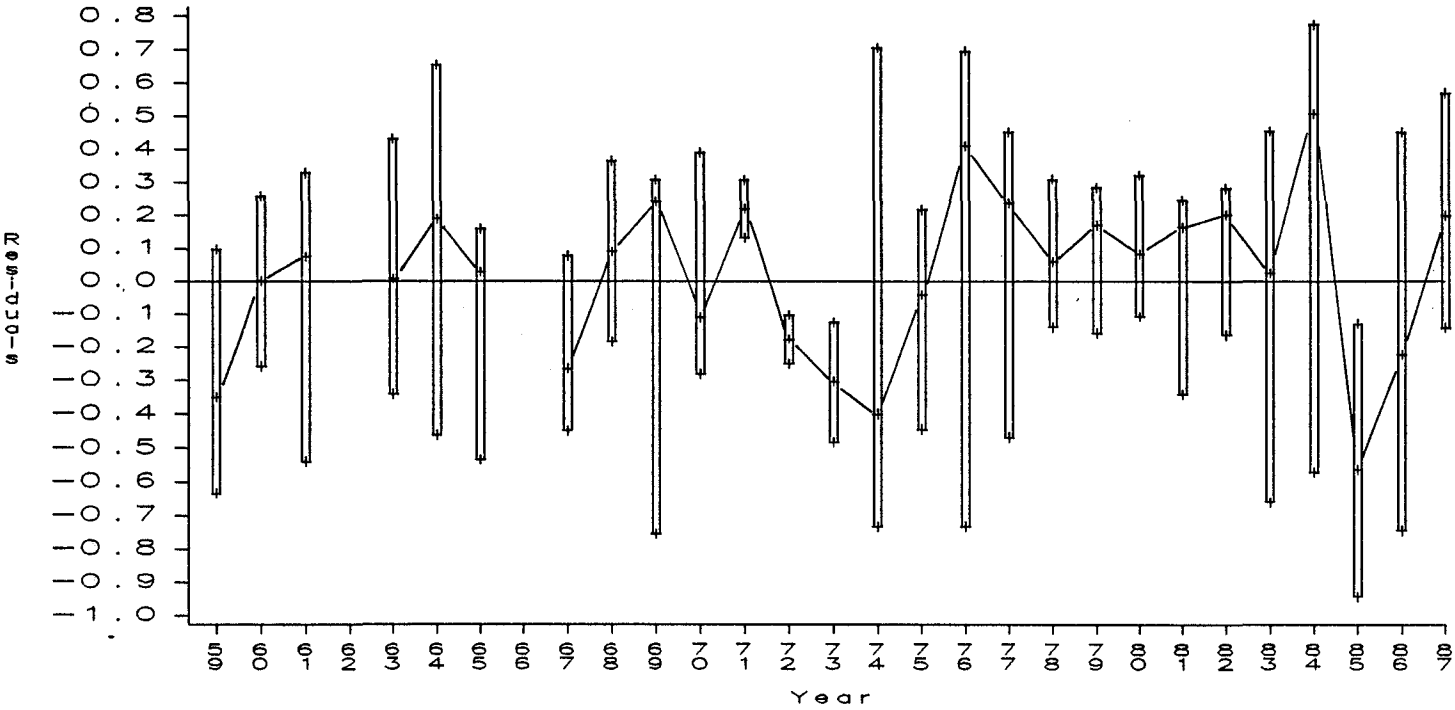

Figure 5: Residuals by year for Div. 2J from the multiplicative model

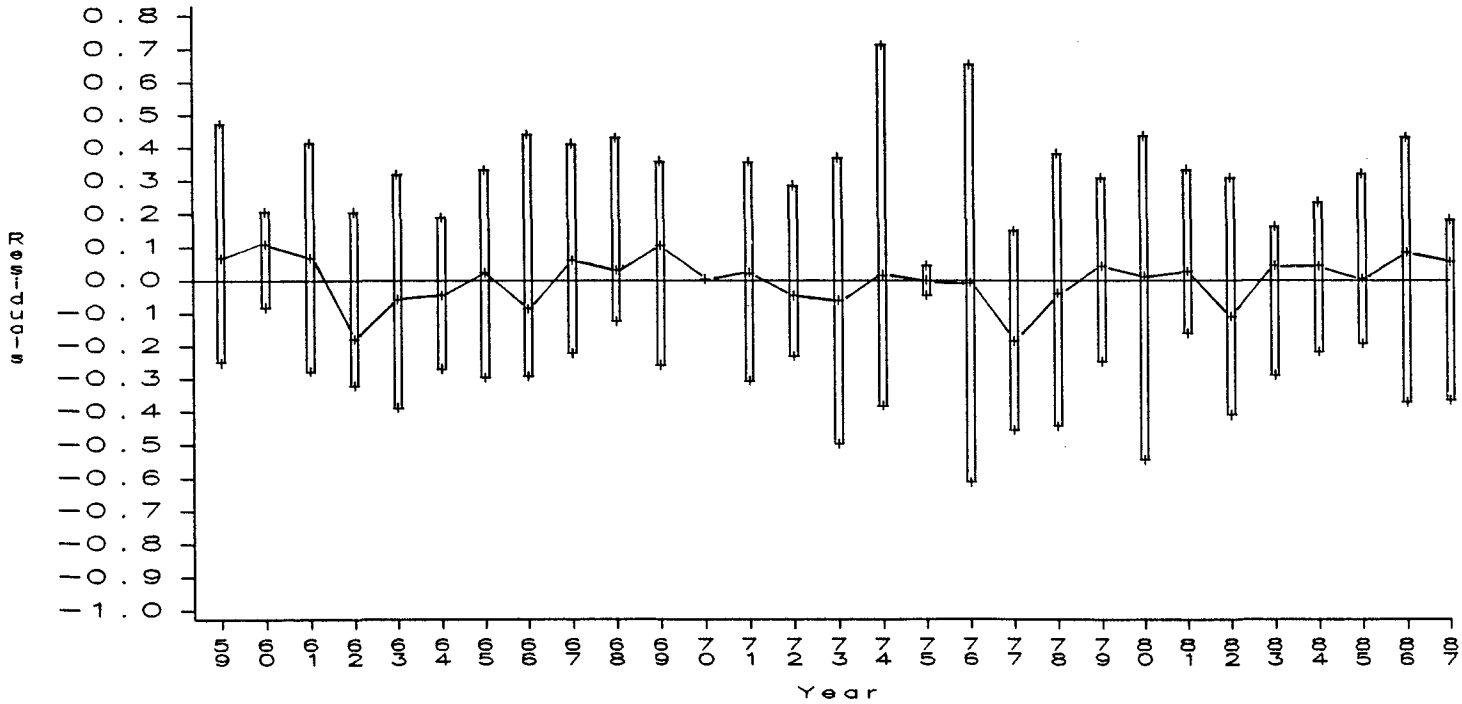

Figure 6: Residuals by year for Div. 3K from the multiplicative model

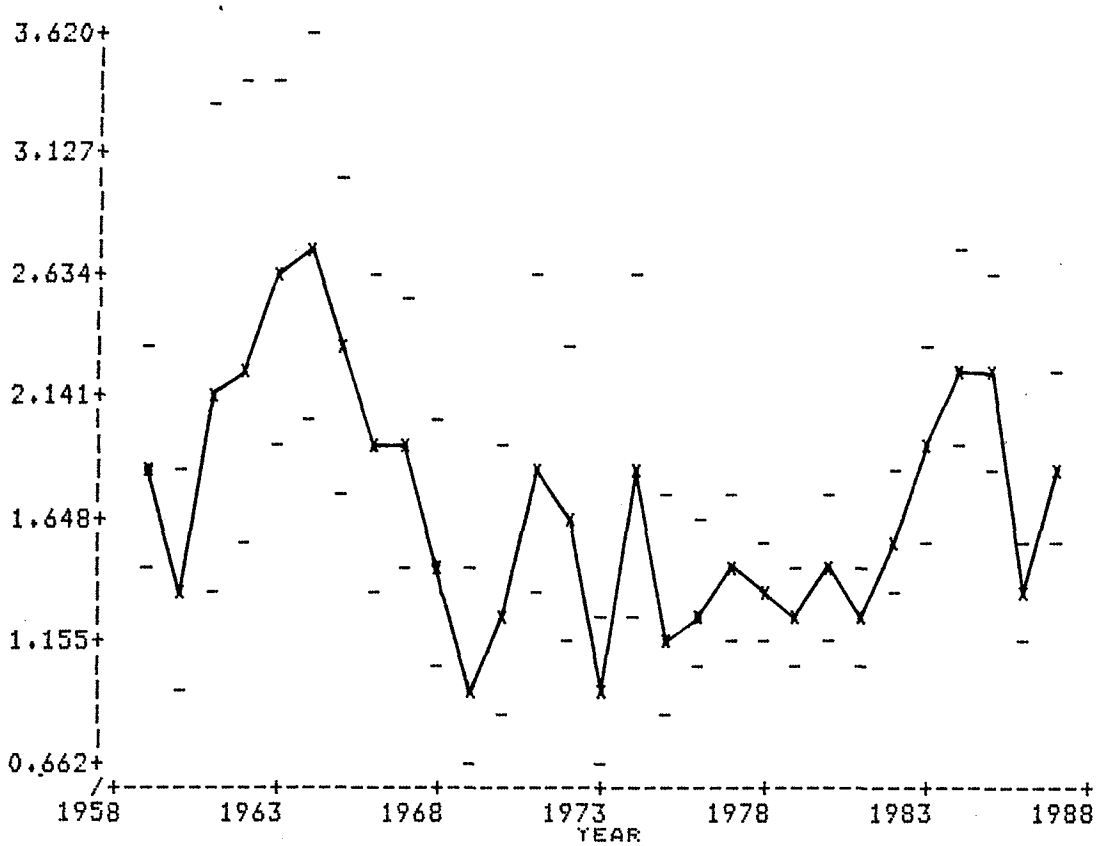

Figure 7: Plot of standardized catch rates for redfish in NAFO Subarea 2 and Division 3K in the period 1959-1987 as derived from the multiplicative model (1986 and 1987 are preliminary).

Frequency	Wt.	Frequency	Wt.	Frequency	Wt.	Frequency	Wt.
Port3KJanCNOT	258	3KJanCanOT	333				
Sea3KJanCNOT	253						
Port3KFebCNOT	187	3KFebCanOT	357				
Sea3KFebCNOT	194						
		Sea3KMarCNOT	521				
Port3KAprCNOT	73	3KAprCanOT	1414				
Sea3KAprCNOT	196						
Port3KMayCNOT	416	3KMayCanOT	701	3KCanOT	10645		
Sea3KMayCNOT	49						
Port3KJunCNOT	139	3KJunCanOT	1146				
Sea3KJunCNOT	72	Port3KJulCNOT	944				
		Sea3KAugCNOT	929				
Port3KSepCNOT	225	3KSepCanOT	1406				
Sea3KSepCNOT	26						
Port3KOctCNOT	87	3KOctCanOT	396				
Sea3KOctCNOT	143						
Port3KNovCNOT	484	3KNovCanOT	689				
Sea3KNovCNOT	946						
Port3KDecCNOT	146	3KDecCanOT	1809				
Sea3KDecCNOT	977						
		Port2JFebCNOT	277				
		Port2JMarCNOT	277				
		Sea2JJunCNOT	82	2JCanOT	2559	2J3KOT	16715
		Sea2JJulCNOT	3				
		Sea2JOctCNOT	29				
		Sea2JNovCNOT	83				
Sea2JAugSUOT	75	2J3KAugSUOT	112				
Sea3KAugSUOT	32						
Sea2JSepSUOT	62	2J3KSepSUOT	676				
Sea3KSepSUOT	572			2J3KSUOT	2351		
Sea2JOctSUOT	554	2J3KOctSUOT	1340				
Sea3KOctSUOT	644	Sea2JNovSUOT	223				
		Sea3KAugJPOT	7				
		Sea3KSepJPOT	112	2J3KJPOT	664		
		Sea3KOctJPOT	7				
		Sea3KDecJPOT	510				
		Sea3KOctDDOT	357	3KDDOT	380		
		Sea3KDecDDOT	4				

Figure 8 : Commercial frequencies used and the process followed to derive the estimated numbers of redfish caught at age in NAFO Subarea 2 and Division 3K in 1987.

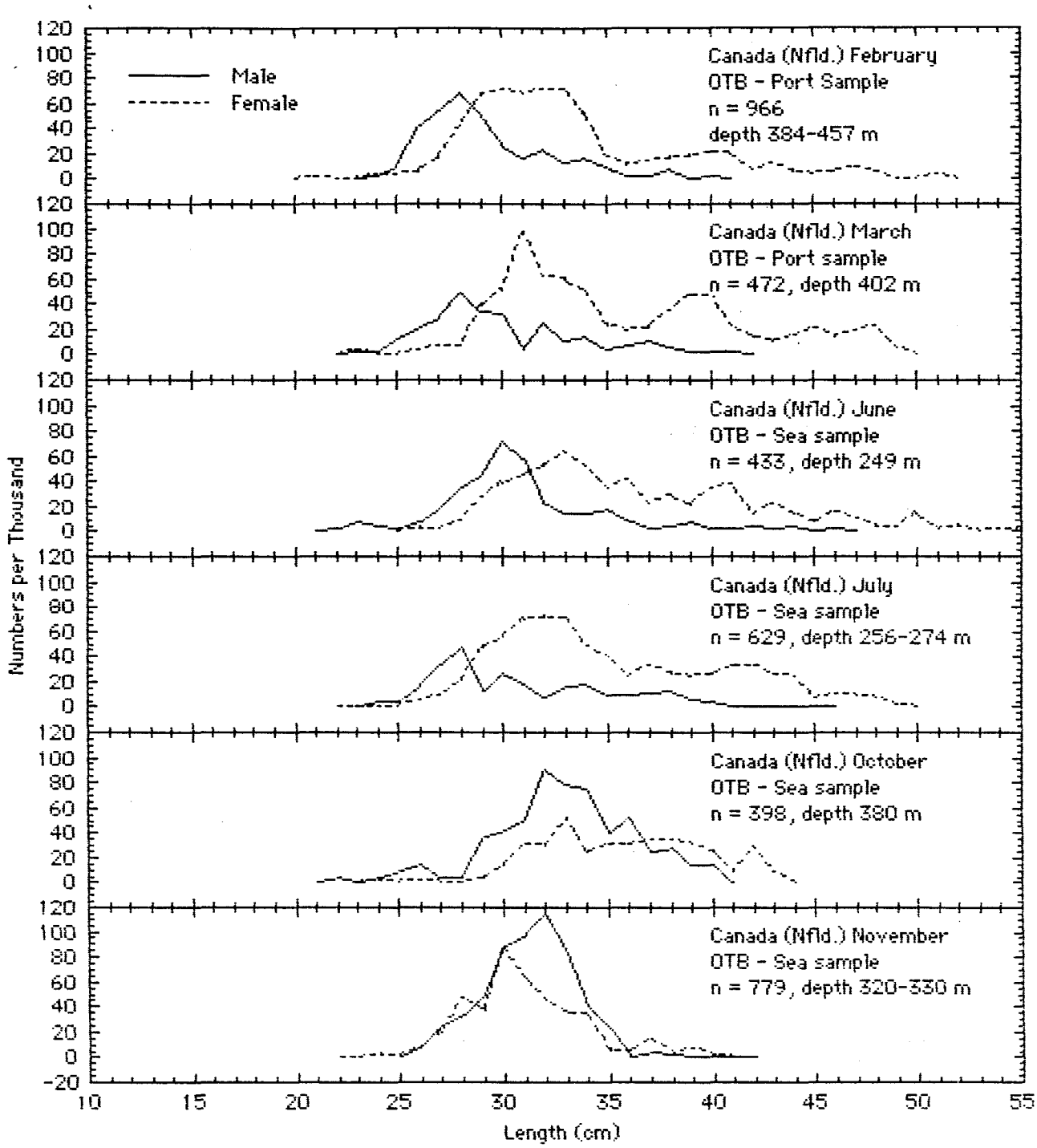

Figure 9 : Length frequencies available from the commercial redfish fishery by Canada (Nfld.) in NAFO Division 2J in 1987.

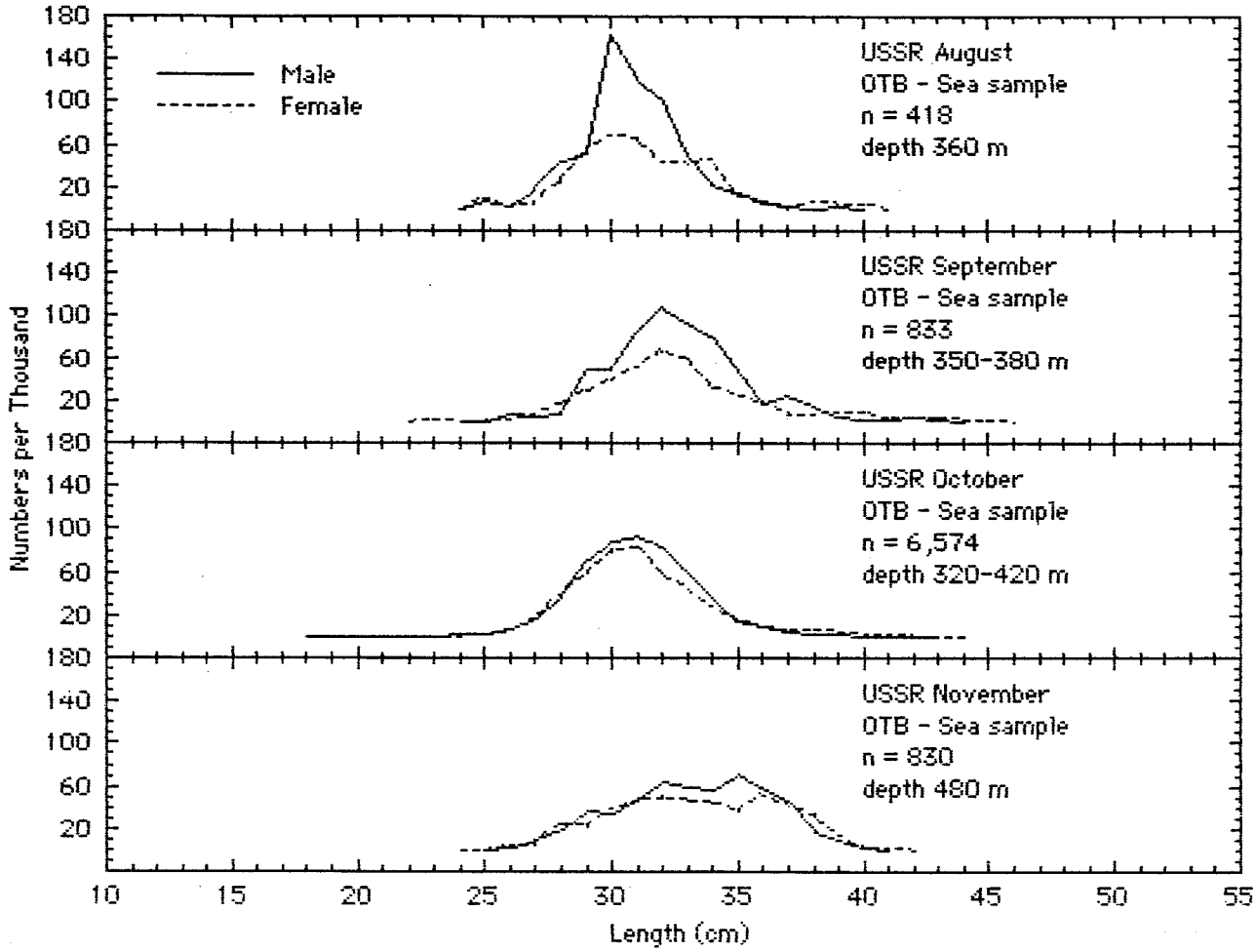

Figure 10: Length frequencies available from the commercial redfish fishery by the USSR in NAFO Division 2J in 1987.

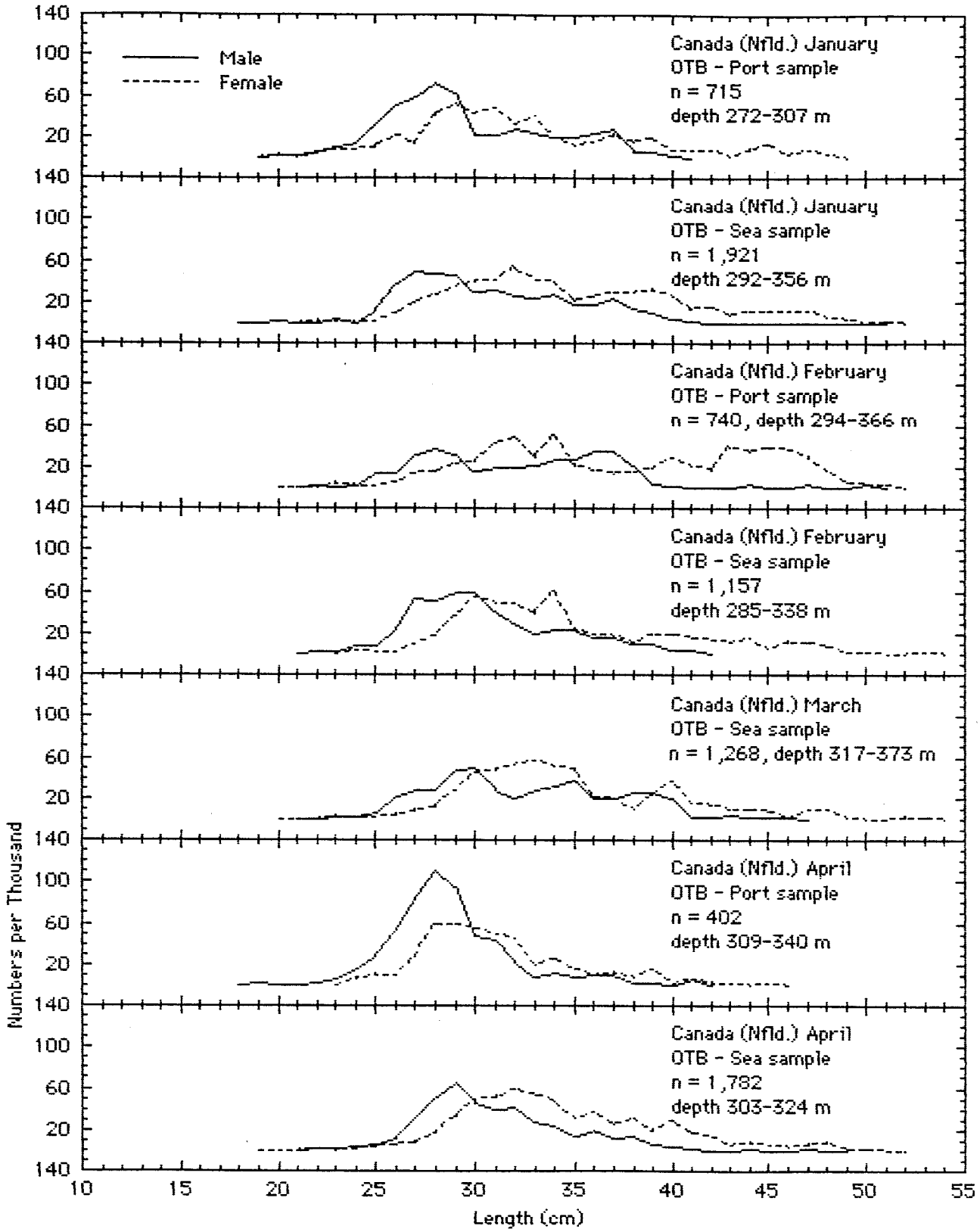

Figure 11: Length frequencies available from the commercial redfish fishery by Canada (Nfld.) in NAFO Division 3K in 1987.

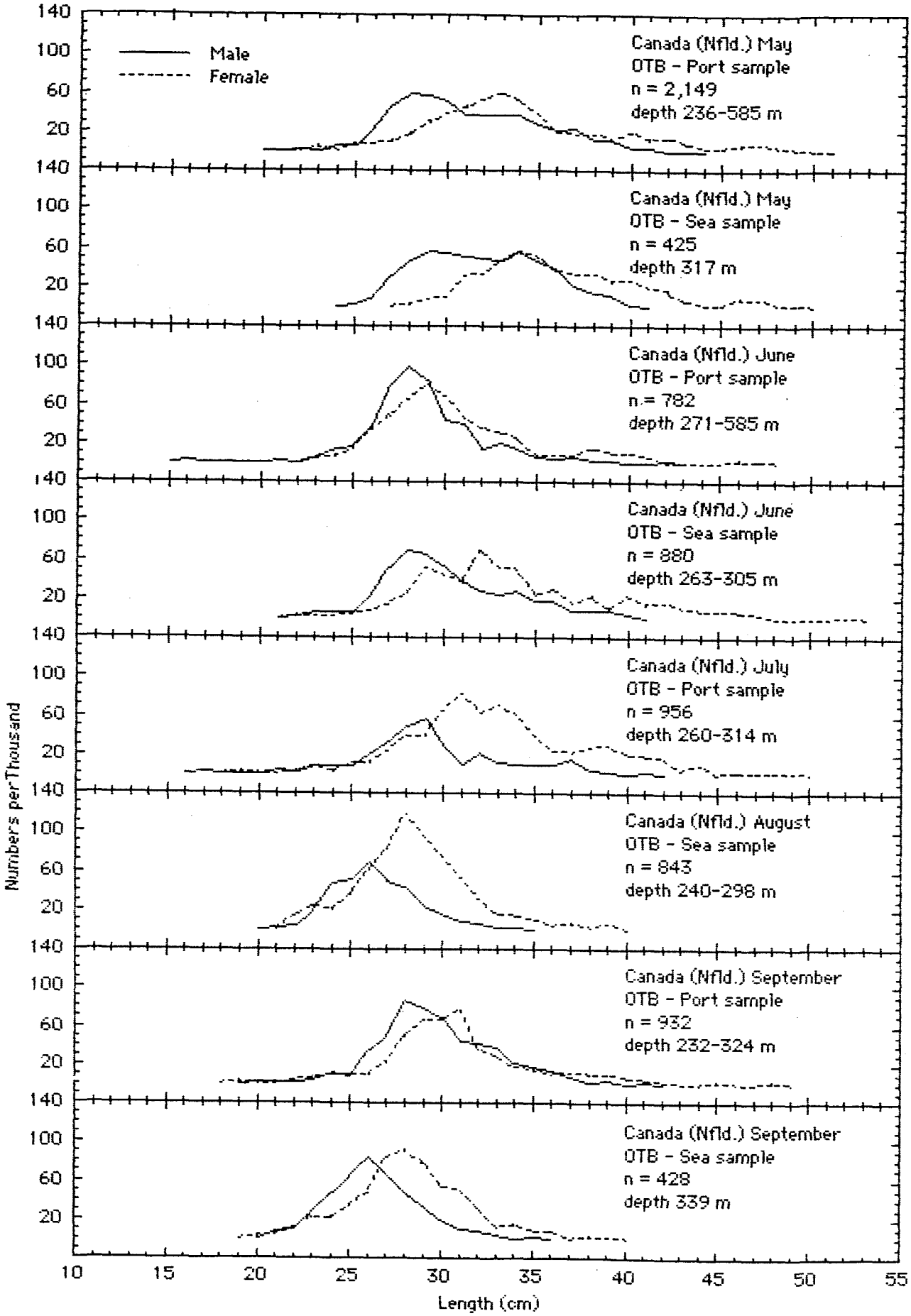

Figure 11: continued.

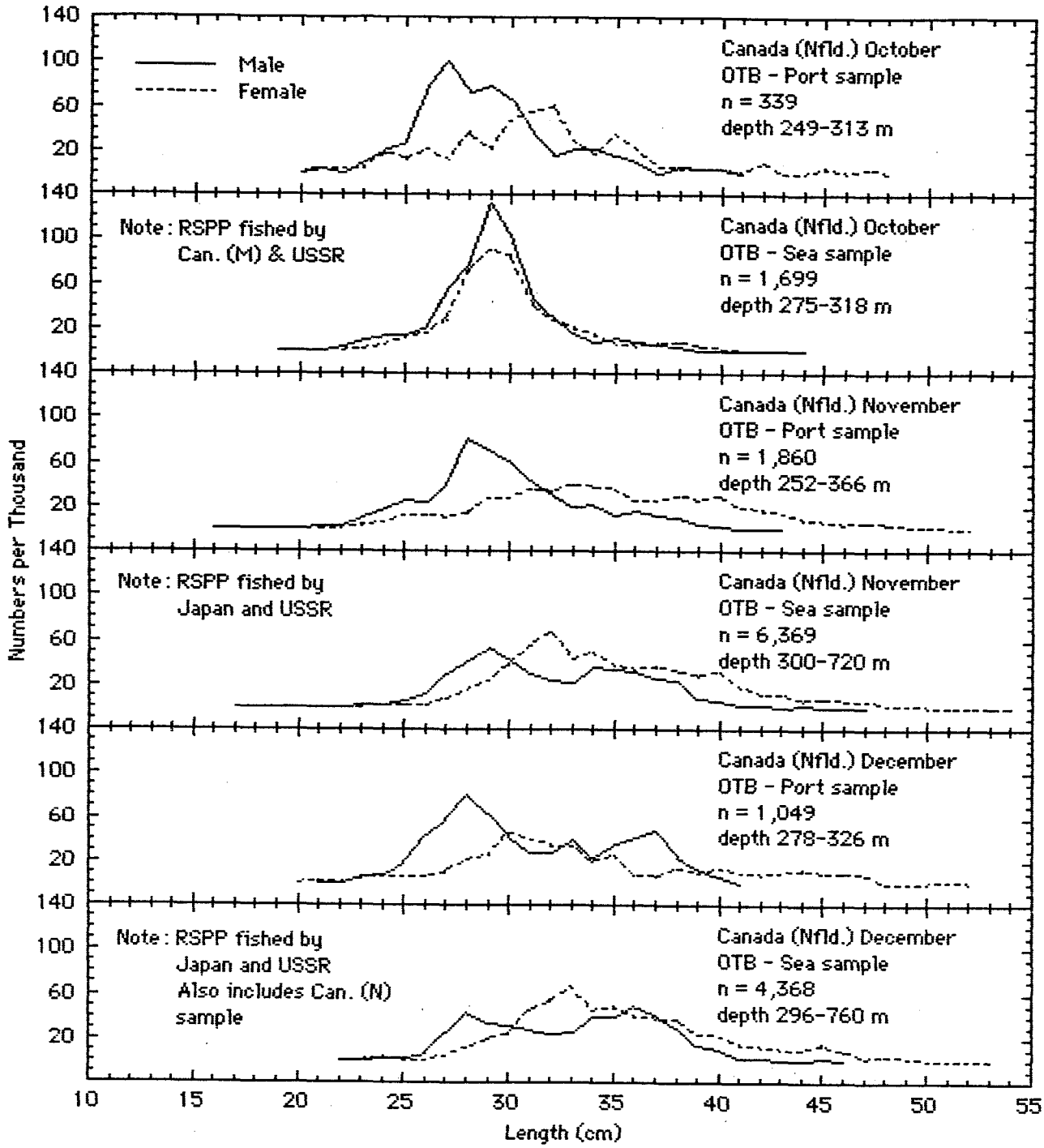

Figure 11: continued.

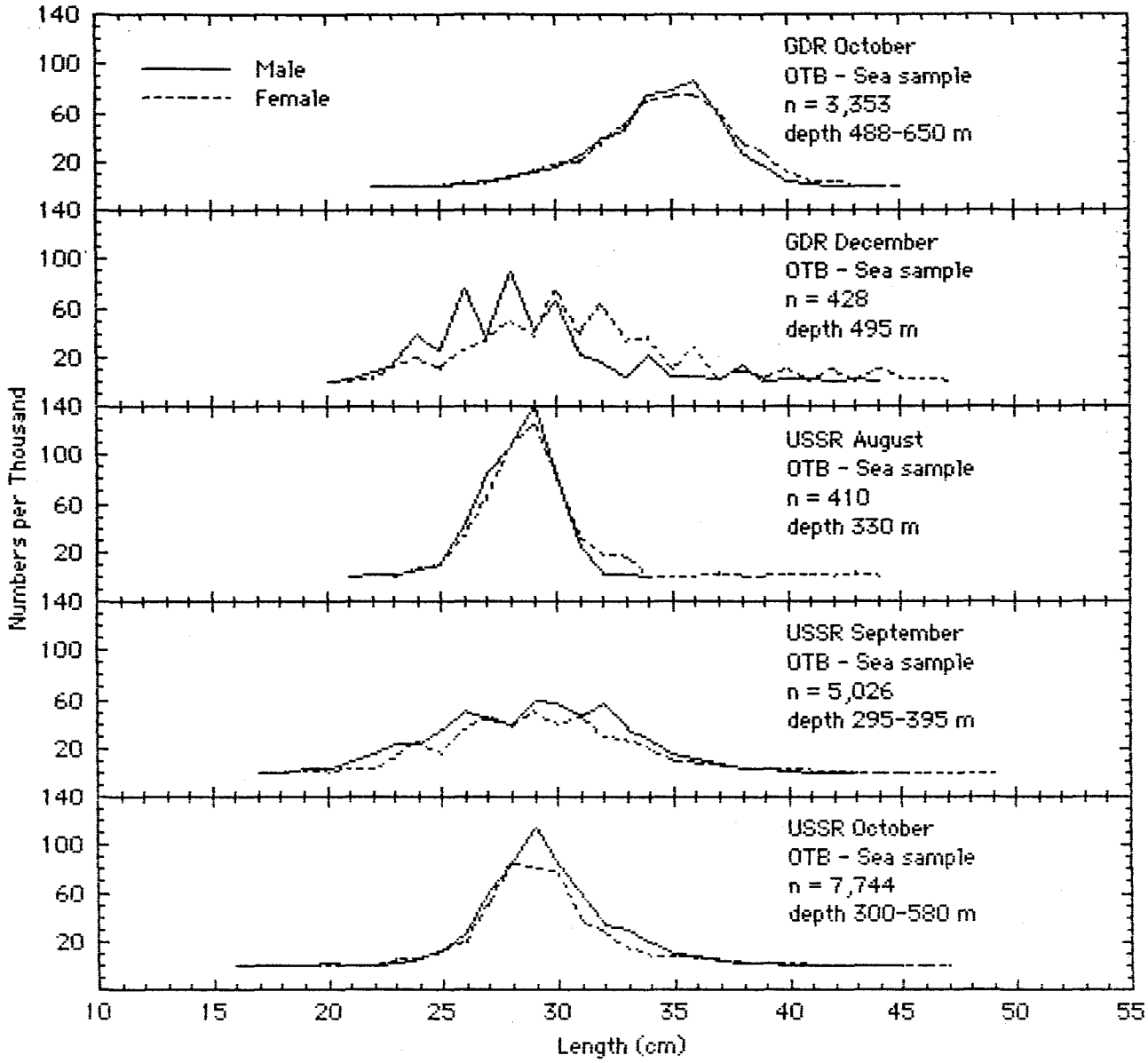

Figure 12: Length frequencies available from the commercial redfish fisheries by the German Democratic Republic and the USSR in NAFO Division 3K in 1987.

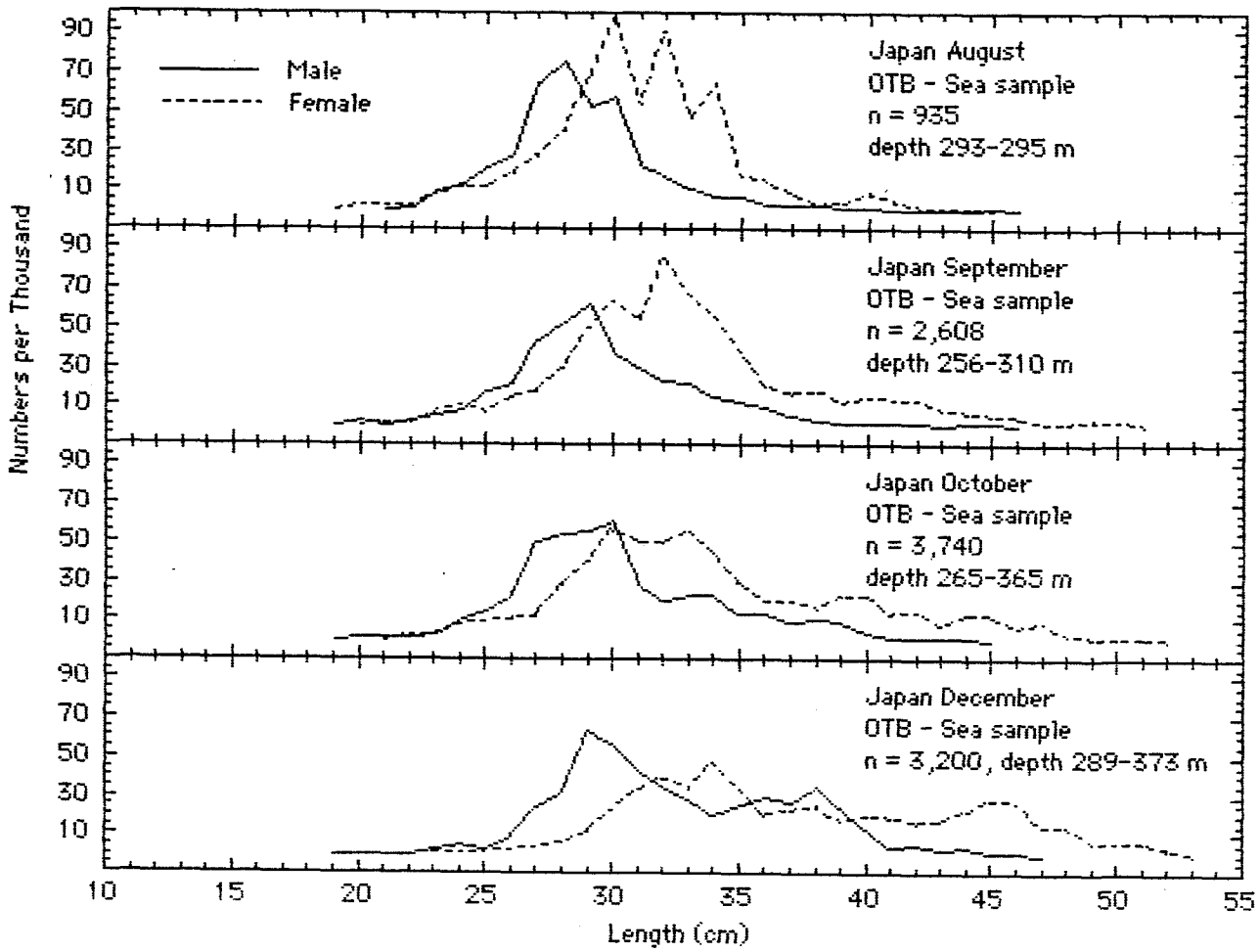

Figure 13: Length frequencies available from the commercial redfish fishery by Japan in NAFO Division 3K in 1987.

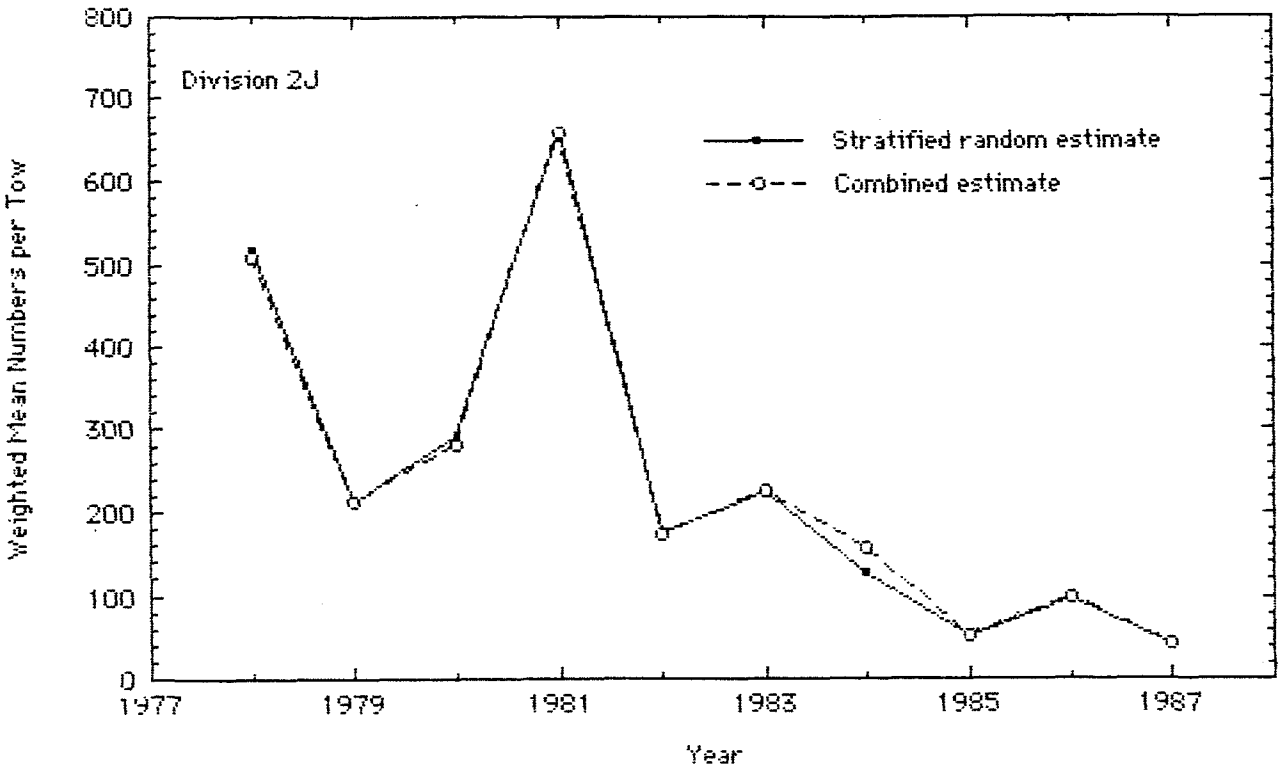

Figure 14: Weighted mean numbers of redfish caught per tow during stratified random surveys in Div. 2J as estimated using stratified random analysis and using a multiplicative analysis to fill in for missing strata.

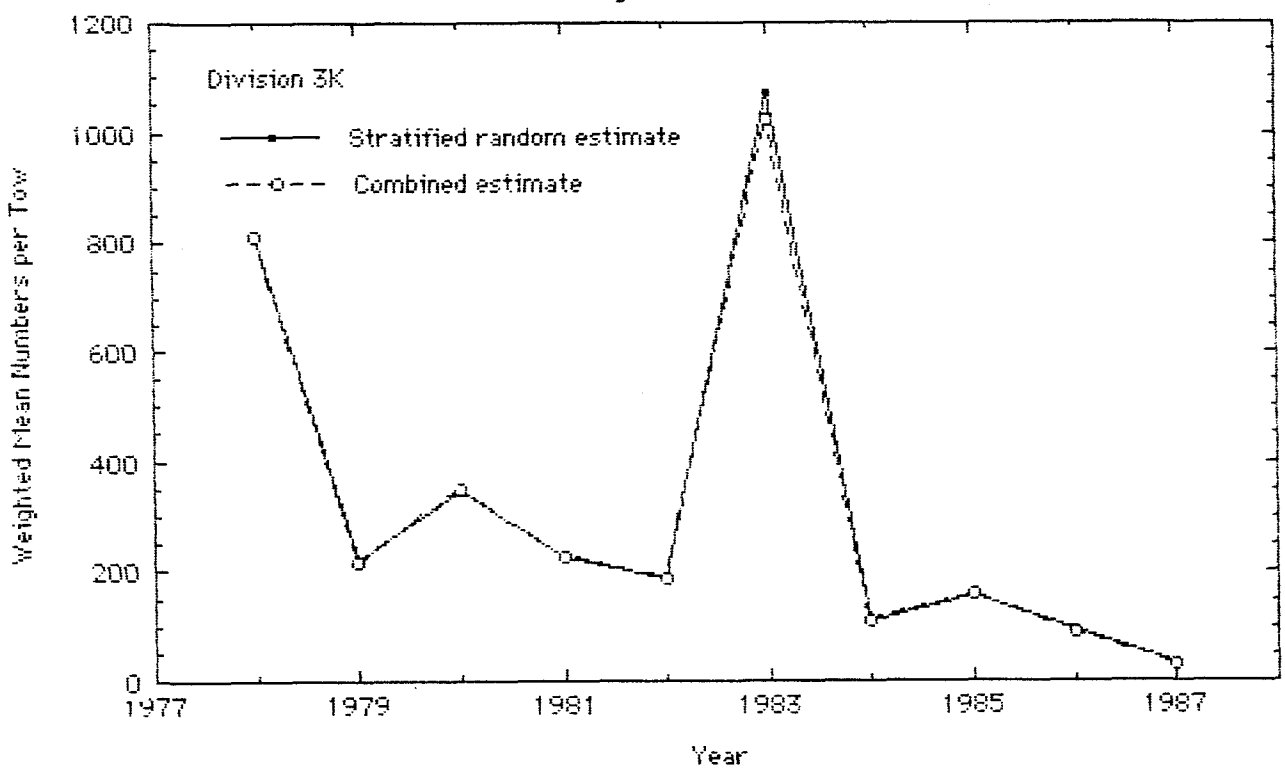

Figure 14: continued, for Div. 3K.

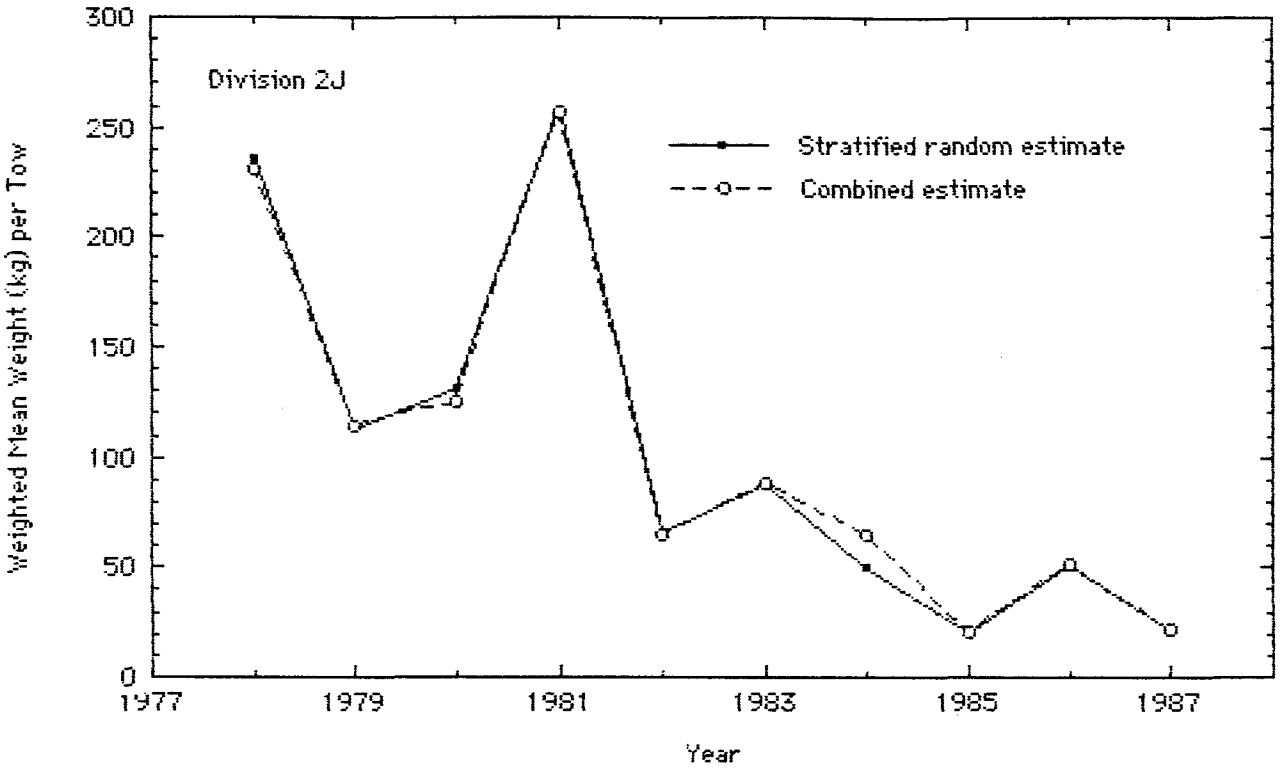

Figure 14: continued, using mean weight (kg.) per tow in Div. 2J.

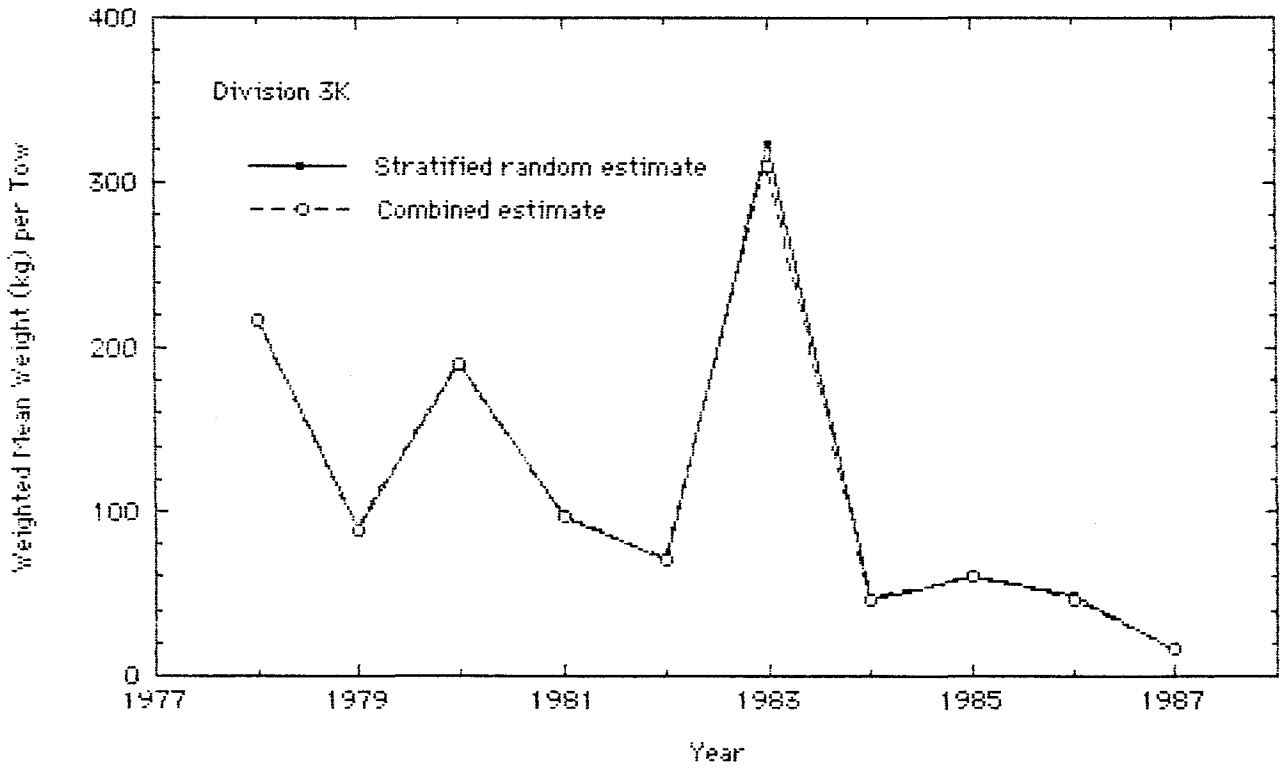

Figure 14: continued, using mean weight (kg.) per tow in Div. 3K.

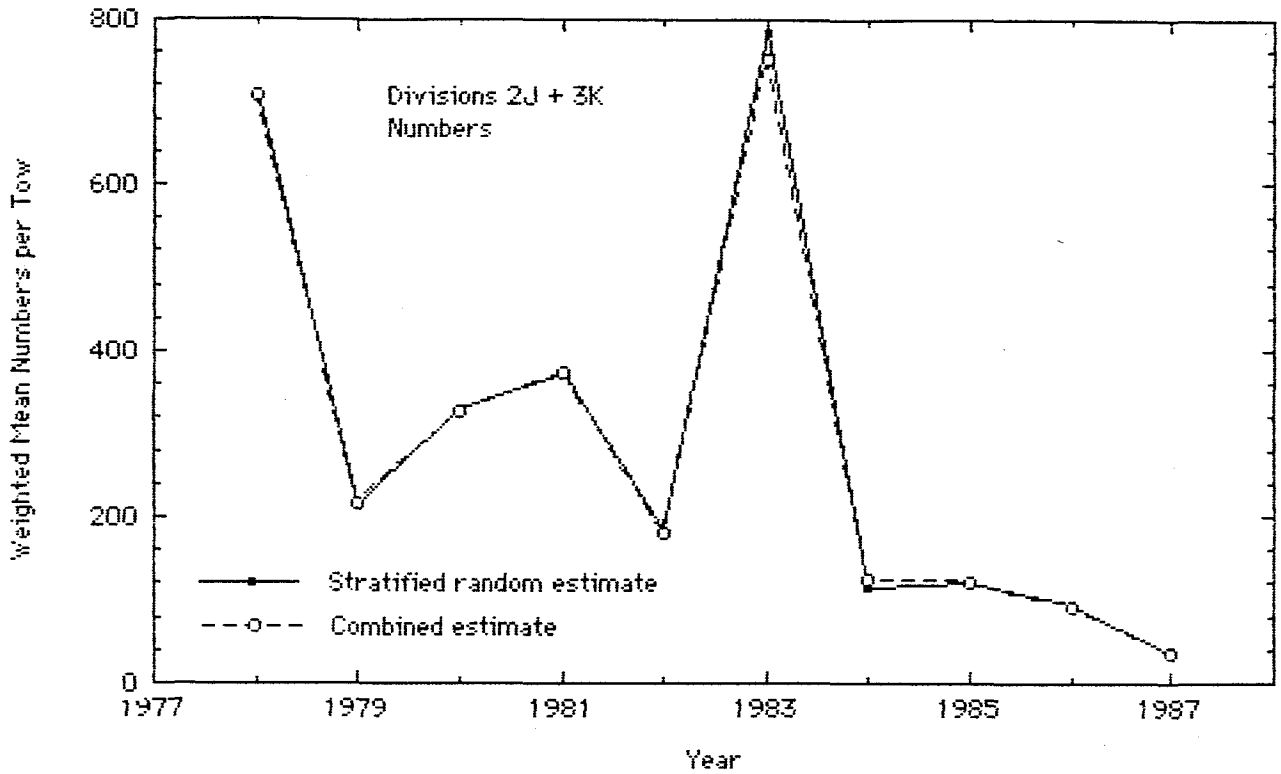

Figure 14: continued, using mean numbers per tow for Div. 2J3K combined.

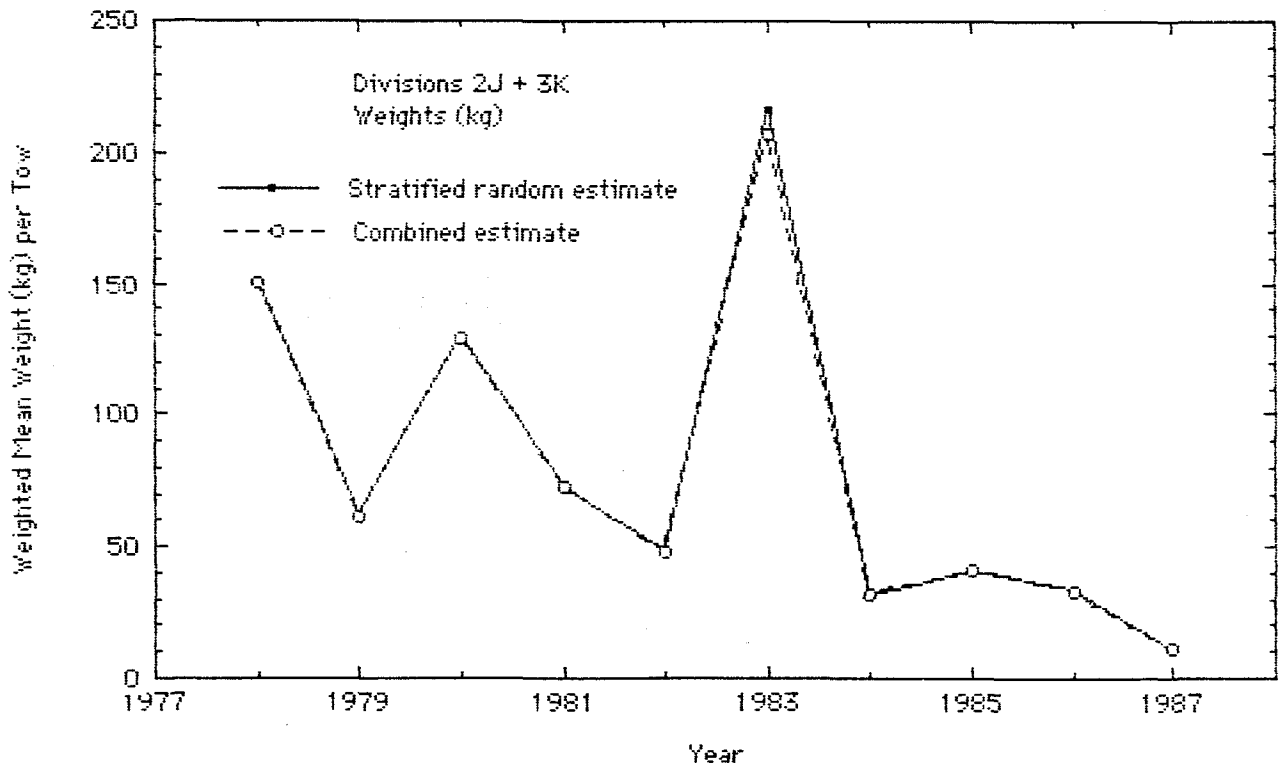

Figure 14: continued, using mean weight per tow for Div. 2J3K combined.

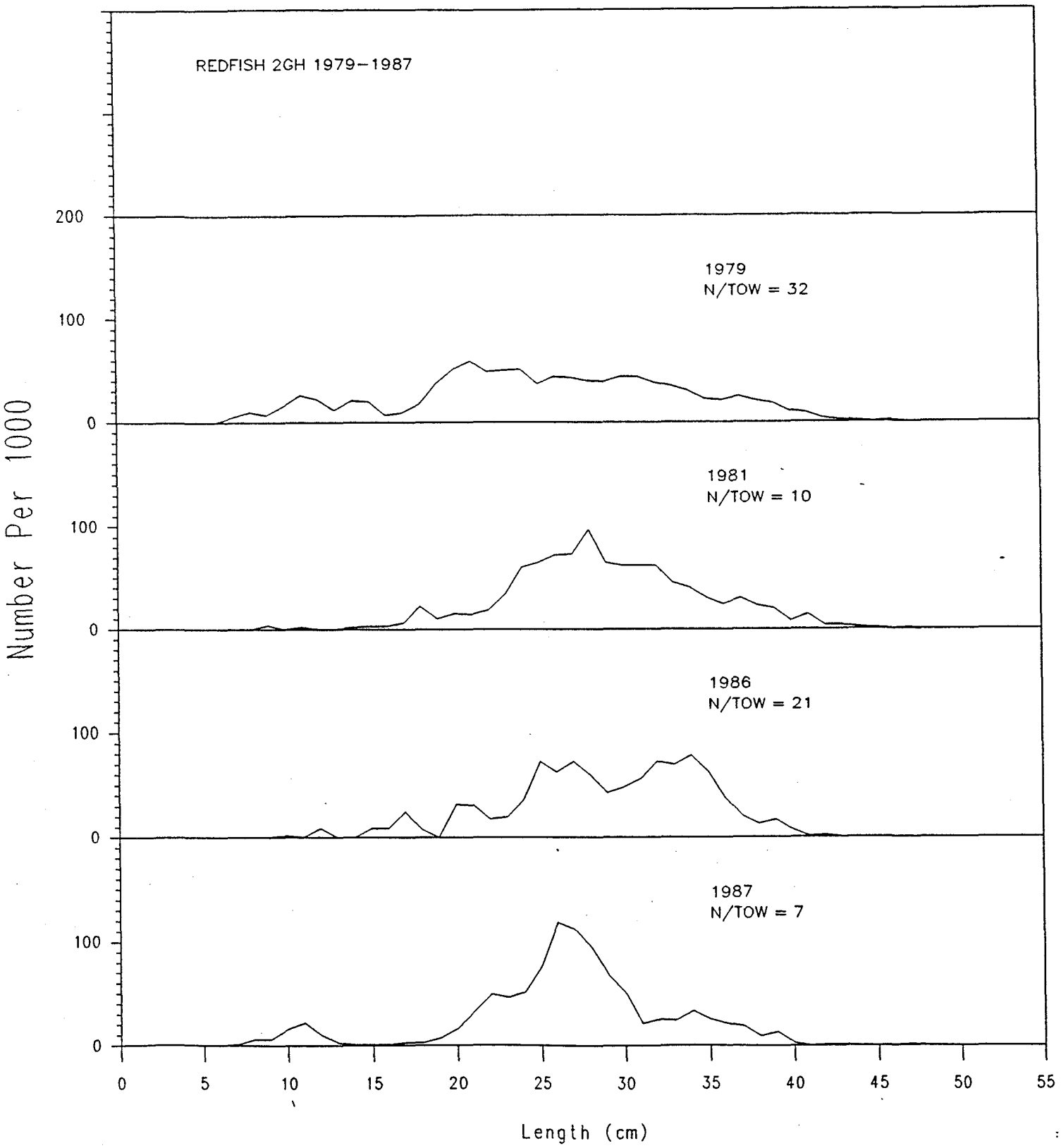

Figure 15: Length frequencies from stratified random research surveys for Div. 2GH for the years 1979-1987.

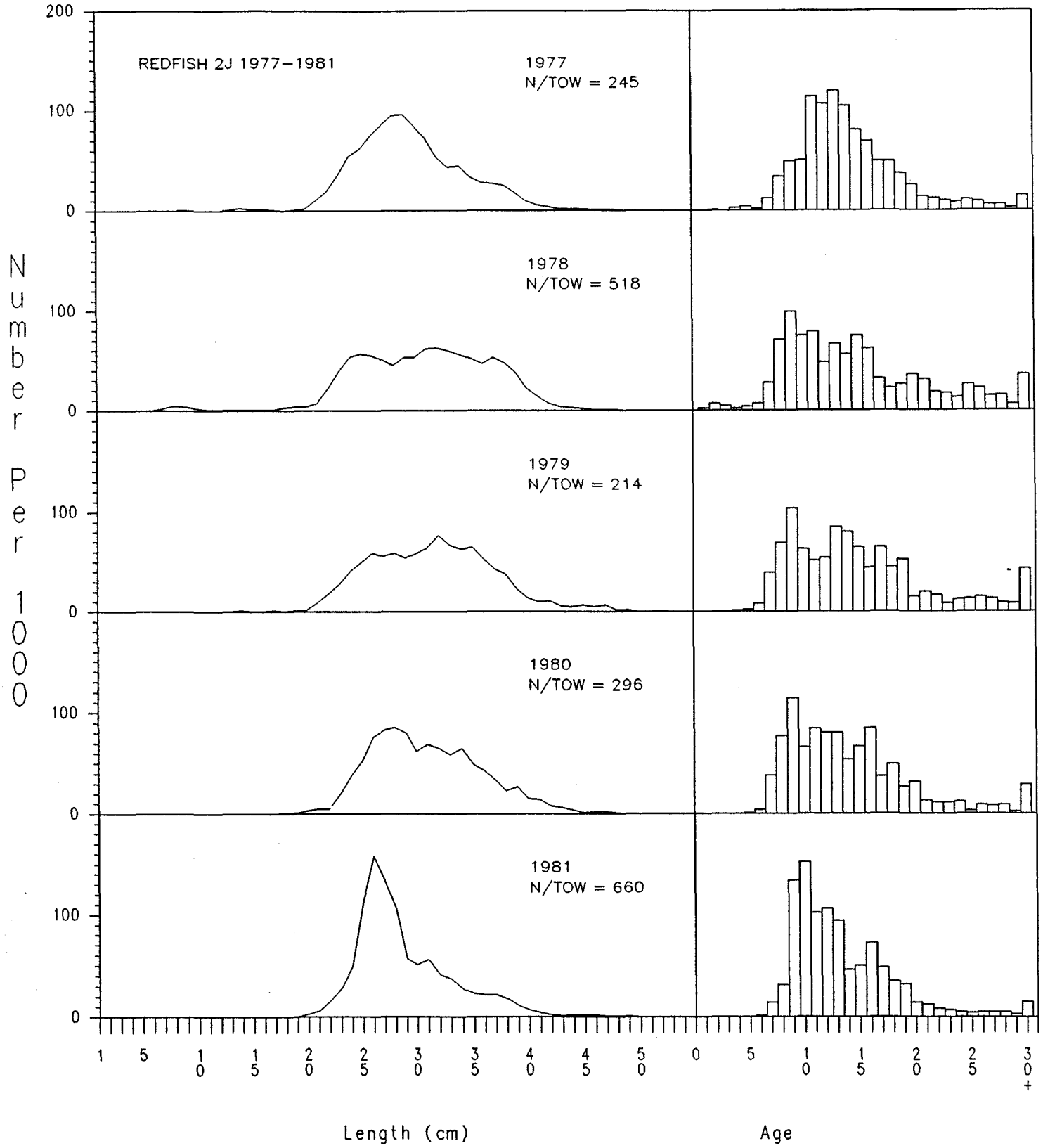

Figure 16: Length frequencies and corresponding age distribution from stratified random research surveys for Div. 2J for the years 1977-1986.

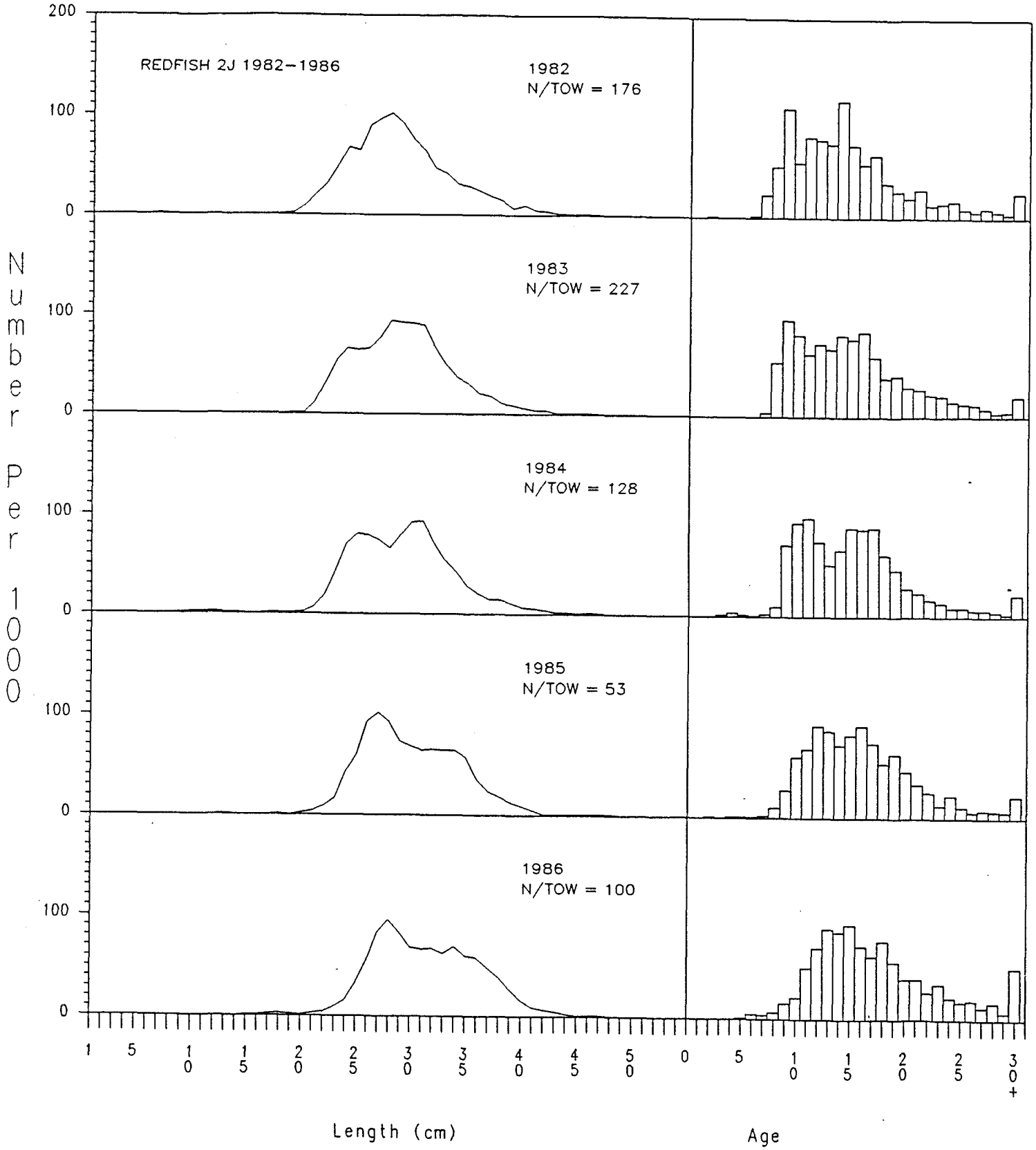

Figure 16: continued.

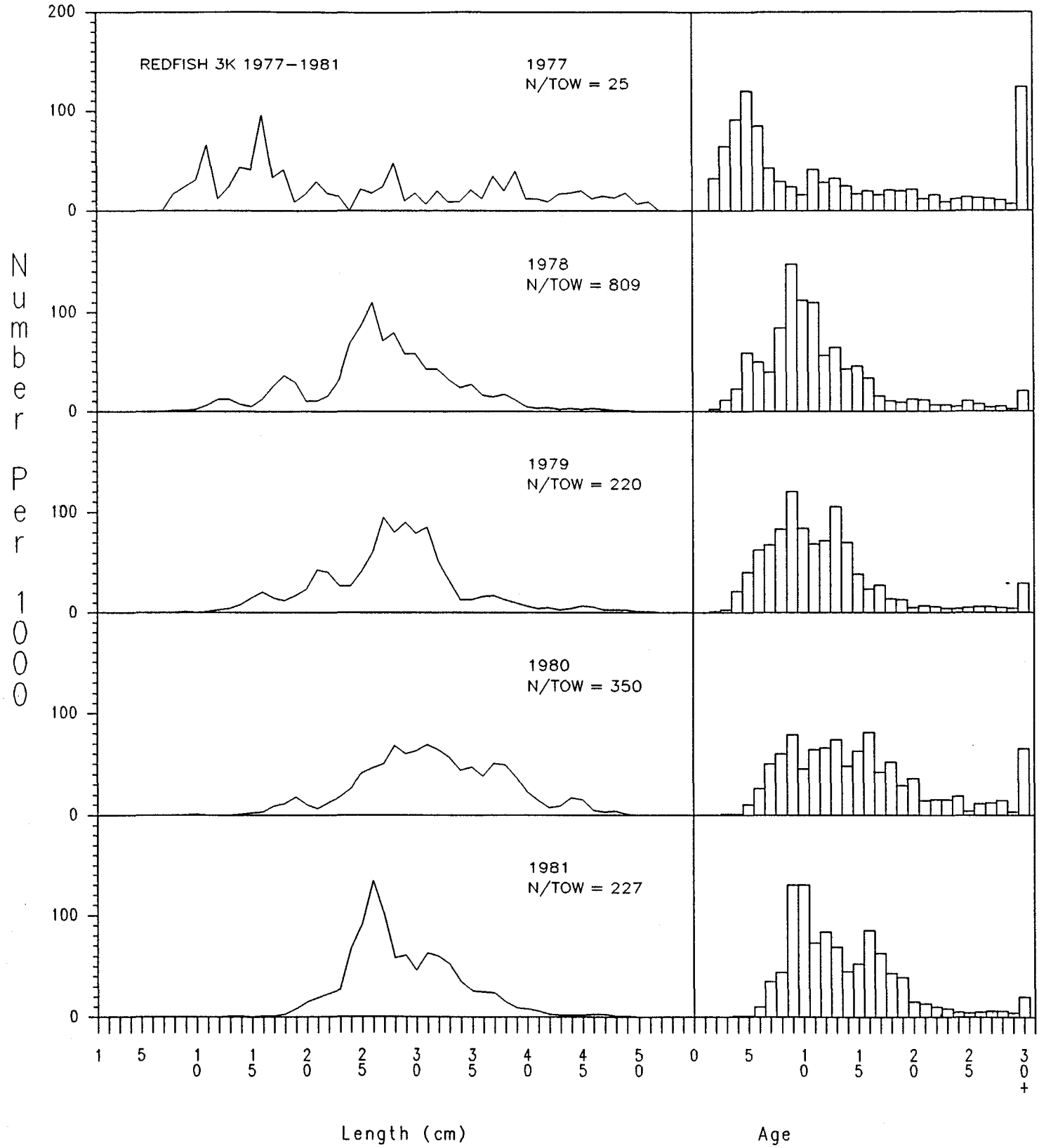

Figure 17: Length frequencies and corresponding age distribution from stratified random research surveys for Div. 3K for the years 1977-1986.

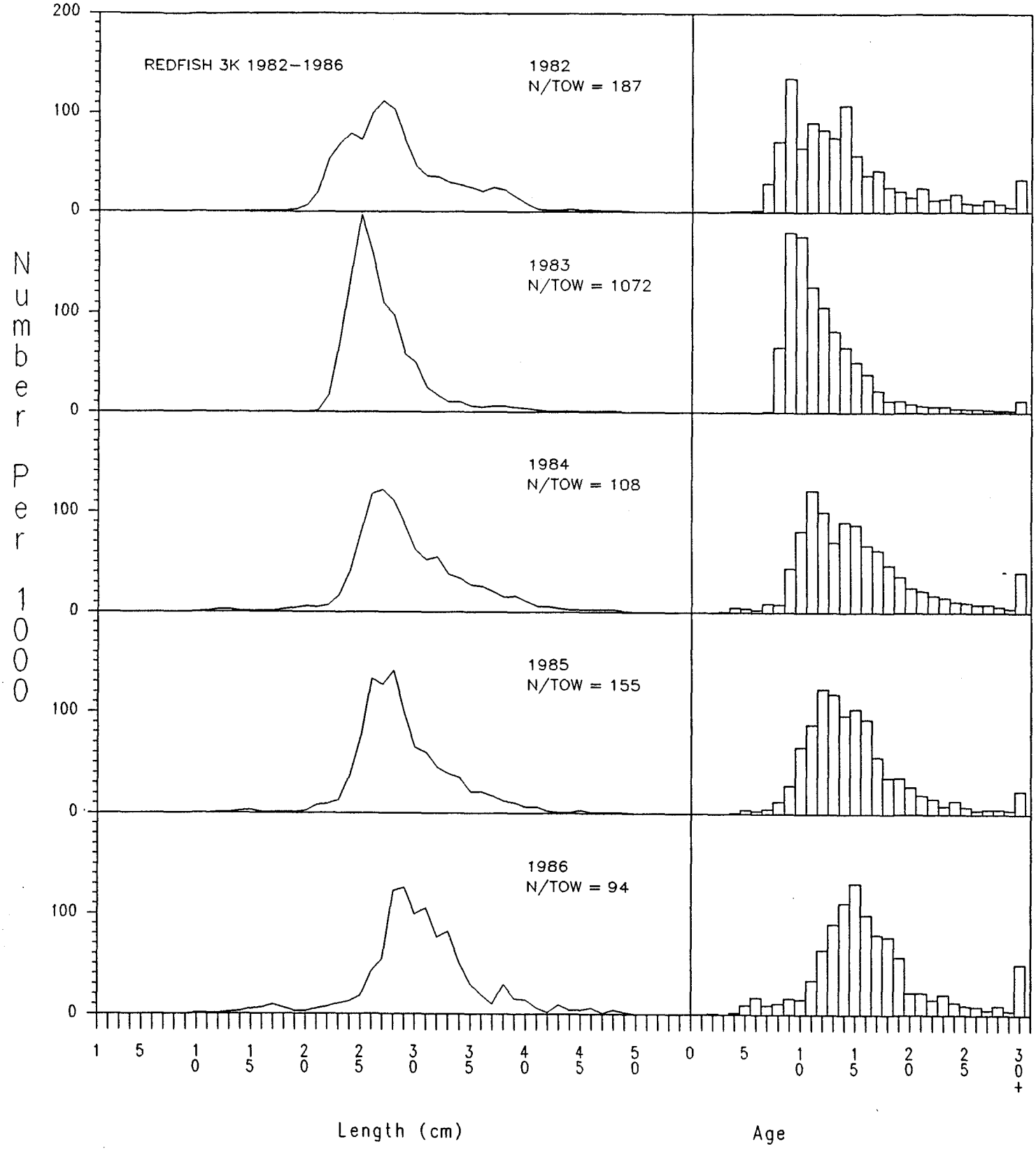

Figure 17: continued.

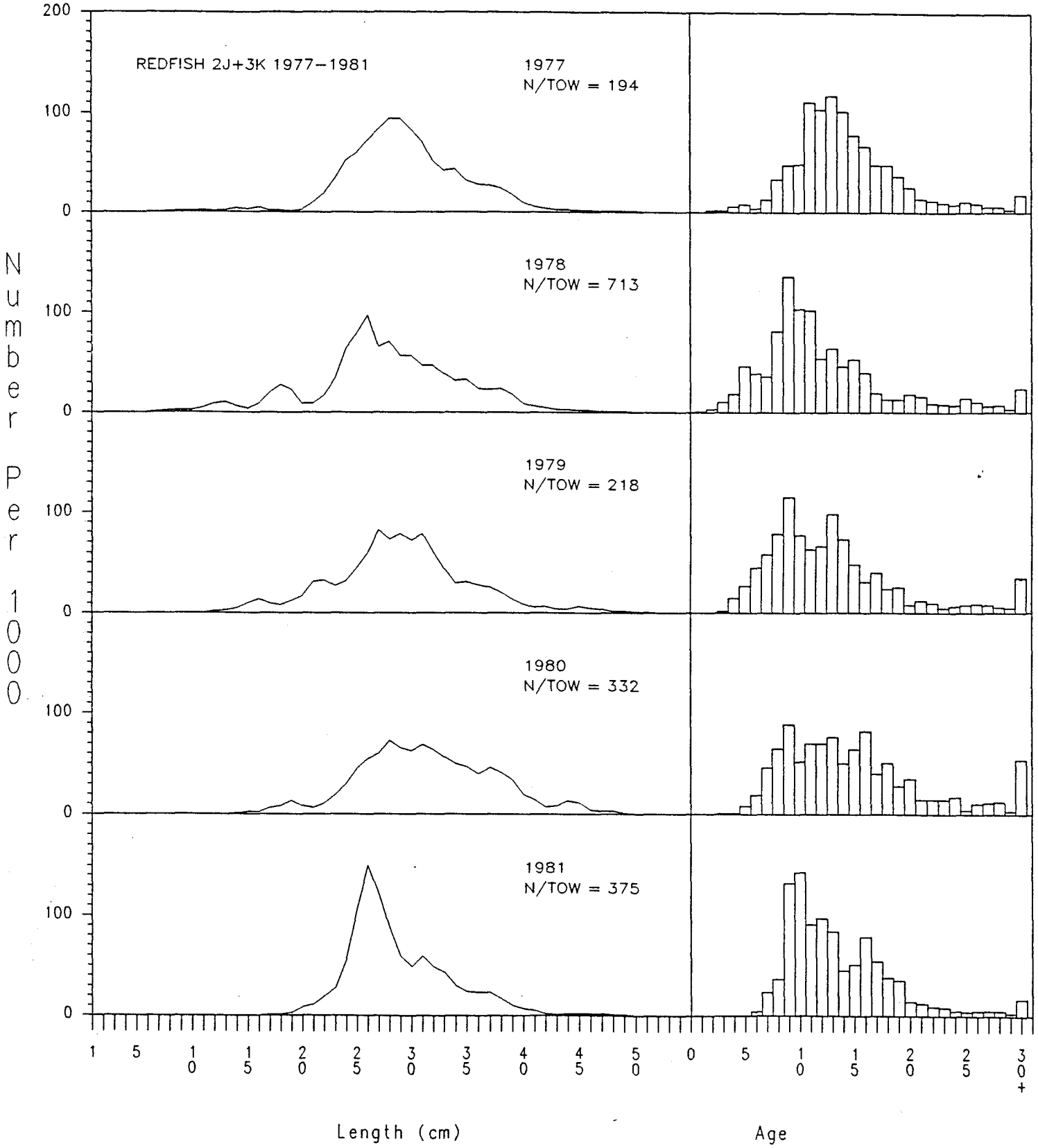

Figure 18: Length frequencies and corresponding age distribution from stratified random research surveys for Div. 2J3K for the years 1977-1986.

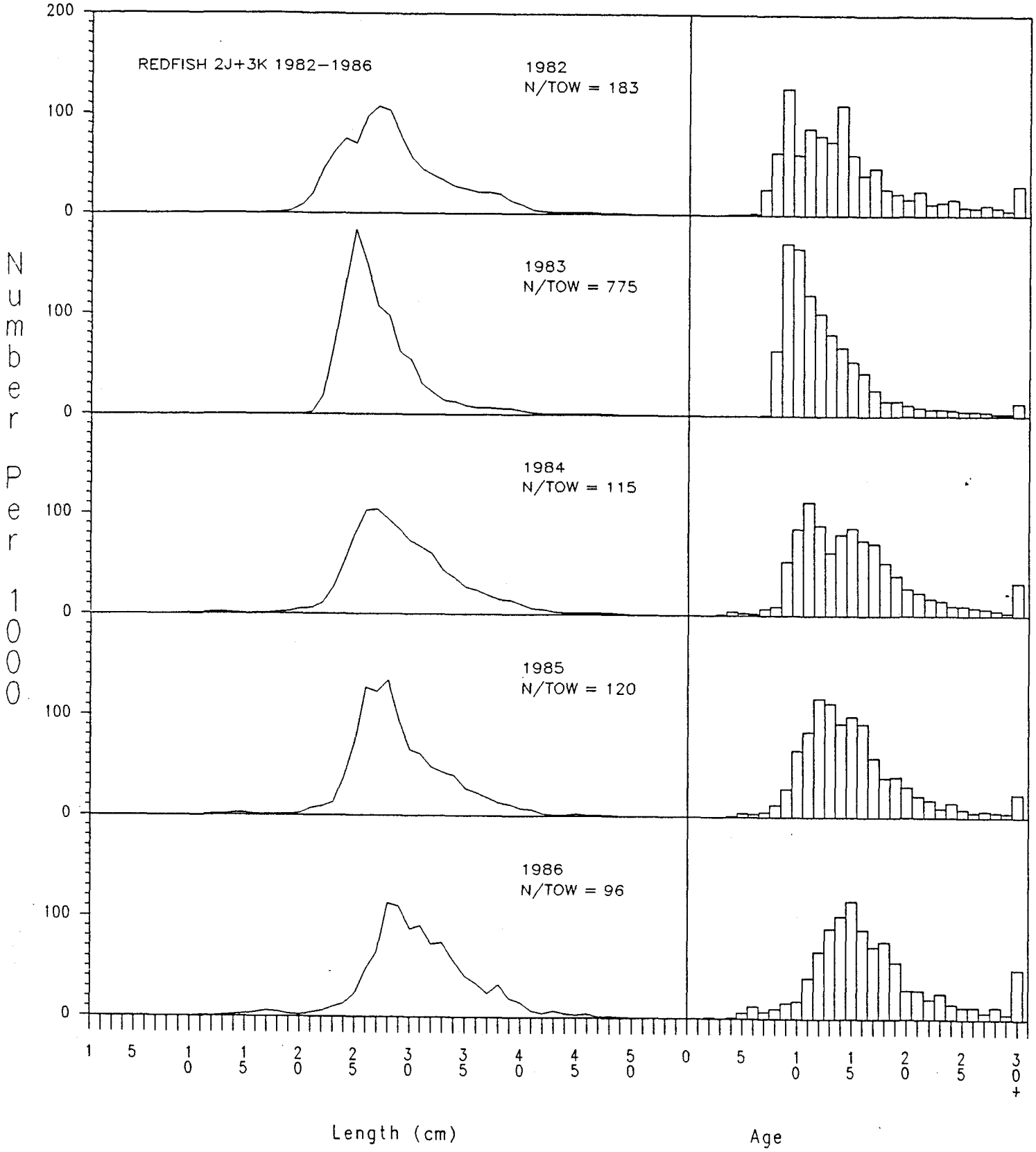

Figure 18: continued.

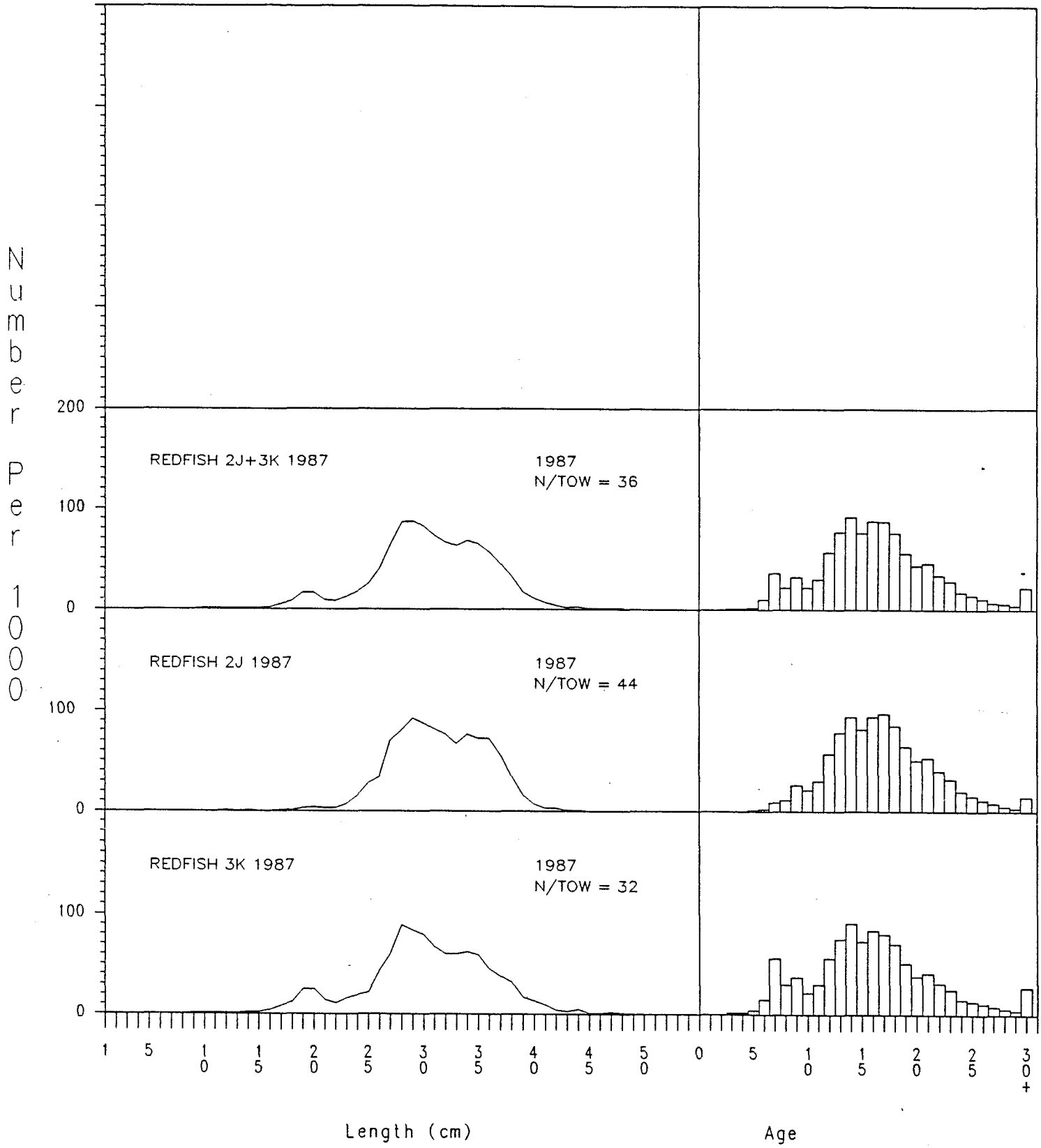

Figure 19: Length frequencies and corresponding age distribution from stratified random research surveys for Div. 2J, Div. 3K and Div 2J3K for the year 1987.