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Canadian Atlantic Fisheries
Scientific Advisory Committee

CAFSAC Research Document 91/61

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Comité scientifique consultatif des pêches
canadiennes dans l'Atlantique

CSCPCA Document de recherche 91/61

Redfish in SA2 and Div. 3K

by

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Abstract

Canada has accounted for most of the reported landings since the implementation of the 200-mile fisheries zone in 1977. Landings have dropped substantially since the mid-1980s, from an average of about 27,000 tons to the lowest reported at 2,300 tons in 1990. This decline was the result of a major redirection of effort to other fisheries for the principal Canadian sector because of cost-ineffective catch rates as well as a marketability problem due to external parasites. Research survey data indicate recruitment has been poor since the year-classes of the early 1970s. There is no analysis applicable at present to determine where the current TAC (20,000 tons, 1991-1993) stands in relation to an appropriate target.

Résumé

Depuis l'entrée en vigueur de la zone de pêche des 200 milles, en 1977, la plupart des débarquements déclarés sont imputables au Canada. Les prises ont sensiblement diminué depuis le milieu des années 1980, passant d'une moyenne d'environ 27 000 tonnes à un seuil de 2 300 tonnes en 1990. Cette chute est le résultat d'une ré-orientation massive de l'effort de pêche de la principale composante de la flotte canadienne vers d'autres espèces, en raison des taux de prises insuffisants et de difficultés de commercialisation découlant de la présence de parasites. Les campagnes d'évaluation révèlent que le recrutement a été faible depuis l'apparition des classes annuelles du début des années 1970. Aucune analyse ne permet pour le moment de déterminer si le TPA actuel (20 000 t pour 1991-1993) correspond à un objectif adéquat.

DESCRIPTION OF THE FISHERY

The nominal landing for 1990 of 2,298 t (Table 1) was the lowest on record from this stock which has experienced as much as 187,000 t taken in 1959. Preliminary statistics indicate this amount is a continuation of a steady reduction in catches in recent years from the 1984-1986 period when catches averaged about 25,000 t. The reduction is primarily due to reduced effort by Canada, whose quota has been at least 85% of a Total Allowable Catch (TAC) of 35,000 t in each year from 1980-1990.

A number of reasons have been cited for this substantial decline according to Canadian sectors which have a directed fishery for this stock. Firstly there is the persistent complaint of parasite infestation (Sphyrion lumpi, an external copepod which attaches itself to the flesh), particularly in Div. 2J. Secondly, the principal Canadian harvester has diverted effort to other fisheries because catch rates do not allow cost effective operations. In addition, there have been no Resource Short Plant Program effort by foreign countries since 1987 which is indicated by the drop in the landings for Japan and USSR (Table 2).

Since the early 1980s the fishery has concentrated in Div. 3K (Tables 3a, b and c) which may be due to a variety of factors such as ice cover early in the year in Div. 2G and 2H and the parasite problem mentioned above in Div. 2J. Landings are spread throughout the year and the bottom otter trawl is the prominent gear (Table 4).

DATA

Catch and weight at age

Commercial length frequencies (Figs. 1a and b) available from the 1990 fishery were combined by the method of Gavaris and Gavaris (1983), as outlined in Fig. 2, and then converted into numbers at age using a single age/length key for the year (Table 5).

The length-weight relationships used were:

$$WT \text{ (males)} = 0.01659 \text{ (Forklength)}^{2.9548}$$

$$WT \text{ (females)} = 0.013272 \text{ (Forklength)}^{3.0210}$$

Additional information recorded with the length frequencies indicate fishing occurred generally in the 300-500m depth range, and modal lengths of 28-30 cm were common. The catch at age (Tables 6-7) indicates the relatively strong year classes of the early 1970s were again dominant in the 1990 catch.

Commercial catch rates

Catch and effort data were available from 1959 to 1988 from ICNAF/NAFO Statistical Bulletins and were combined with provisional 1989 NAFO data and 1990 Atlantic region data compiled by various DFO regional statistics branches. In addition to this, observer data from the Nfld. region were utilized, but only the data where the onboard observer monitored the information. This latter information was aggregated on a trip by trip basis. Initially selected from this database were observations where redfish comprised more than 50% of the total catch and were therefore considered to be redfish directed.

These data were analysed with a multiplicative model (Gavaris 1980) to derive a standardized catch rate series. Effects included in the model were a combination country-gear-tonnage class category type (CGT), NAFO division, month, and a category type representing the amount of bycatch associated with each observation. For this effect five groups were arbitrarily established : (>50% <=60%), (>60% <=70%), (>70% <=80%), (>80% <=90%) and (>90%) where each group corresponds to the percentage of redfish relative to the total catch associated with each observation. In the usual practise, catch or effort data of less than 10 units were eliminated prior to analysis as were data where there was less than five samples from any one category type except year.

The model utilizing effort measured in hours fished explained 52% of the variability in the catch rates (Table 8). All category types are highly significant with the exception of division which is marginally non-significant ($.05 < p < .10$). Estimated coefficients from the regression show catch rates are generally higher during the first half of the year. Residual plots (Fig. 3) did not signal that the model was inappropriate. The standardized catch rate series (Table 9, Fig. 4) shows an increase from 1959 to 1964 followed by a decrease to the lowest rate on record in 1973. A period of stability occurred up until 1981. From 1981 to 1984 there was a steady increase followed by a comparable decrease to 1988. Preliminary data indicate two successive increases since 1988. The increase in recent years may not be indicative of an increase in stock biomass but may be attributed to recent limited fishing effort.

Research vessel surveys

Stratified random groundfish surveys have been conducted in the fall in Div. 2J and 3K since 1977. These surveys generally cover strata down to depths of 1000m. Since coverage was not complete in all years, a multiplicative model was used to obtain estimates of mean number and weight for strata which were missed in various surveys. The historical series of mean numbers and weights per standard tow suggest a downward trend in both measures of

density for both Div. 2J and Div. 3K (Tables 10-13, Fig 5). The 1990 survey indicated a two-fold increase in both number and weight in each division.

Length frequencies and numbers at age represented as numbers per thousand indicate that there has been relatively poor recruitment since the year classes of the early 1970s (Figs. 6-11). There was no indication from the 1990 survey that this situation has changed.

ESTIMATION OF STOCK PARAMETERS

In the 1990 assessment of this stock, estimates of maximum exploitable yield (MEY) from a non-equilibrium version of the Schaefer general production model (Rivard and Bledsoe, 1978) utilizing catch and standardized effort data were not significantly different from zero. It was considered that this situation would not change with the addition of the 1990 data point as it near the range of data from recent years. It remains that there is not enough contrast in the catch rate indices for general production analysis to be appropriate.

PROGNOSIS

There is no analysis applicable at present to determine where the current TAC stands in relation to an appropriate target level.

The index of stock size based on standardized commercial catch per hour fished suggests a decline from 1984 to 1988. The increase in recent years may not be indicative of an increase in stock biomass but may be attributed to recent limited fishing effort.

While the timing and coverage the surveys may not be optimum to fully understand the dynamics of the stock, there is a stronger concern about poor recruitment since the year classes of the early 1970s given the results of the 1990 survey. If the stock were to experience good recruitment in the near future, it would still take about 10 years for this to start recruiting to the fishery because of the relatively slow growth rate of redbfish.

The reduction of the TAC from 35,000 t in 1990 to 20,000 t in 1991-93 (based on average catches of the 1980s) was implemented as a more prudent approach given the indication of poor recruitment. There is no new information to suggest a change from the current 1991-1993 management plan.

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Rivard, D., and L. J. Bledsoe. 1978. Parameter estimation for the Pella-Tomlinson stock production model under non-equilibrium conditions. Fish. Bull. 76(3):523-534.

Table 1. Summary of nominal catches (t) of redbfish 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	867	28,225	29,225	35,000
1986	-	69	3,456	23,360	27,019	35,000
1987	-	16	3,212	15,283	18,511	35,000
1988 ^b	8	28	994	5,912	6,942	35,000
1989 ^b	1	3	79	3,084	3,167	35,000
1990 ^b			192	1,856	2,298 ^c	35,000
1991						20,000

^aTotals include unallocated catch in Subarea 2.

^bProvisional.

^cTotal includes 250 t that could not be separated by division.

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

Country	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989 ^a	1990 ^a
Can (N)	10,938	11,095	3,768	10,298	7,350	5,413	12,298	14,863	10,933	8,719	4,437	1,594	1,805
Can (M)	11,114	15,492	4,017	3,118	3,784	3,384	5,069	6,716	7,860	3,429	923	585	243
Cuba	-	43	-	-	-	-	-	-	-	-	-	-	-
DDR	2,909	543	1,102	720	425	626	485	101	134	378	-	-	-
Faroes	-	-	-	-	-	-	-	-	-	16	-	-	-
France (Metro)	22	3	7	-	9	-	2	9	5	3	-	-	-
FRG	157	68	148	-	180	77	111	204	63	65	-	-	-
Japan	255	-	9	4	2,662	-	1,218	3,471	4,178	2,127	698	489	239
Norway	-	-	1	-	-	-	-	-	1	-	-	-	-
Poland	625	302	870	635	24	1,406	366	66	297	41	36	8	-
Portugal	378	544	266	393	456	183	437	106	20	-	-	-	-
Spain	37	-	44	-	-	-	-	-	-	-	-	-	-
UK	26	62	79	-	20	-	13	-	-	-	-	-	-
USSR	2,685	2,578	4,208	2,474	3,073	3,722	3,690	3,689	3,528	3,733	848	491	8
EEC	-	-	-	-	-	-	-	-	-	-	-	-	3
Total	29,146	30,730	14,519	17,642	17,983	15,311	23,689	29,225	27,019	18,511	6,942	3,167	2,298

^aProvisional.

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
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	1	-	3	-	69
1987	-	-	-	-	-	-	10	-	4	-	2	-	16
1988	-	-	-	-	-	-	15	2	-	4	15	-	36
1989 ^a	-	-	-	-	-	1	-	-	2	1	-	-	4
1990 ^a	-	-	-	-	-	-	-	-	-	-	-	-	-

^aProvisional.

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
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	482	296	15	35	-	10	867
1986	68	-	3	-	1	42	34	1,529	1,528	79	152	20	3,456
1987	154	277	276	184	8	82	3	1,380	153	458	118	119	3,212
1988	27	12	99	44	50	1	-	25	368	256	112	-	994
1989 ^a	27	-	-	1	1	3	-	5	15	5	8	14	79
1990 ^a	-	-	-	1	-	-	-	7	7	41	56	80	192 ^b

^aProvisional.^bCanadian data only.

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
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	966	1,932	2,371	1,353	1,924	860	172	2,426	4,049	2,283	3,378	1,780	23,494
1987	369	357	522	1,413	732	1,150	945	1,001	2,323	2,134	1,202	3,135	15,283
1988	496	390	414	254	394	393	249	449	727	1,425	549	172	5,912
1989 ^a	55	75	250	28	232	166	166	412	804	648	207	41	3,084 ^b
1990 ^a	21	34	167	370	392	192	75	19	192	245	21	128	1,856 ^b

^aProvisional.^bCanadian data only.

Table 4. Breakdown of catches by gear type for redfish in SA2 + 3K.

Year	2GH			2J			3K			Totals	
	Bottom MW		Misc.	Bottom MW		Misc.	Bottom MW		Misc.		
	trawl	Gillnets		trawl	Gillnets		trawl	Gillnets			
1976	1,535	160	-	11,857	2,555	-	8,706	901	247	4	25,965
1977	869	-	-	5,894	615	-	9,345	658	158	-	17,539
1978	582	1	-	10,028	1,776	-	14,695	1,901	163	-	29,146
1979	255	15	-	14,360	2,299	-	9,316	4,103	382	-	30,730
1980	49	-	-	4,350	5	68	9,804	-	243	-	14,519
1981	227	-	-	4,236	-	5	12,630	250	294	-	17,642
1982	583	-	-	7,036	-	12	7,366	2,876	110	-	17,983
1983	158	-	-	2,166	-	-	12,872	114	1	-	15,311
1984	130	-	-	2,316	-	13	20,751	352	127	-	23,689
1985	133	-	-	856	-	11	27,818	306	101	-	29,225
1986	69	-	-	3,209	227	-	22,073	1,319	102	-	27,019
1987	16	-	-	3,190	7	15	14,810	423	50	-	18,511
1988	30	6	-	993	-	1	5,830	1	81	-	6,942
1989 ^a	4	-	-	77	-	2	2,944	42	98	-	3,167 ^b
1990 ^a	-	-	-	165	-	27	1,813	-	36	7	2,048 ^b

^aProvisional.^bCanadian data only.

Table 5. Estimated numbers of redfish caught at age ('000) (including their average weight and length) from the commercial fishery in Subarea 2 and Division 3K in 1990.

AGE	AVERAGE		CATCH		
	WEIGHT	LENGTH	MEAN	STD. ERR.	C. V.
7	0.100	19.000	1	0.01	0.01
8	0.153	21.877	6	2.29	0.40
9	0.181	23.143	42	6.07	0.14
10	0.227	24.873	42	7.13	0.17
11	0.239	25.401	58	9.01	0.16
12	0.270	26.472	105	15.38	0.15
13	0.292	27.215	109	18.47	0.17
14	0.345	28.756	268	37.66	0.14
15	0.378	29.622	454	49.96	0.11
16	0.434	30.966	561	57.88	0.10
17	0.478	31.916	477	55.49	0.12
18	0.550	33.421	481	52.59	0.11
19	0.563	33.678	393	47.96	0.12
20	0.616	34.759	244	33.79	0.14
21	0.678	35.822	206	30.87	0.15
22	0.734	36.823	97	17.71	0.18
23	0.744	36.974	83	15.69	0.19
24	0.860	38.697	68	13.85	0.20
25	0.838	38.366	69	13.79	0.20
26	0.874	39.012	82	13.75	0.17
27	0.874	38.959	72	12.96	0.18
28	0.947	40.068	72	11.84	0.17
29	1.035	41.329	49	8.84	0.18
30	1.283	44.018	137	12.54	0.09

Table 8. Anova table and regression coefficients from a multiplicative analysis of catch rate data with effort measured in hours fished.

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R,..... 0.722
 MULTIPLE R SQUARED,.... 0.521

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	4.594E1	4.594E1	
REGRESSION	74	1.557E2	2.105E0	10.452
CGT TYPE 1	25	3.524E1	1.409E0	6.999
MONTH TYPE 2	11	2.679E1	2.436E0	12.095
DIV TYPE 3	3	1.736E0	5.786E-1	2.873
PCT TYPE 4	4	4.634E1	1.159E1	57.532
YEAR TYPE 5	31	2.570E1	8.289E-1	4.116
RESIDUALS	712	1.434E2	2.014E-1	
TOTAL	787	3.451E2		

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
1	3125	INTERCEPT	0.642	0.131	787
2	8				
3	31				
4	95				
5	59				
1	2125	1	0.145	0.120	20
	2154	2	-0.108	0.197	6
	2155	3	-0.286	0.147	12
	3124	4	-0.359	0.092	30
	3155	5	-0.116	0.103	28
	11115	6	-0.708	0.128	33
	11116	7	-0.608	0.184	9
	11125	8	-0.213	0.137	14
	11126	9	-0.390	0.137	21
	11127	10	-0.164	0.109	30
	14124	11	-0.421	0.153	10
	14125	12	-0.244	0.157	9
	14126	13	-0.244	0.107	22
	14127	14	-0.021	0.153	10
	16127	15	-0.425	0.086	94
	17116	16	-0.202	0.233	7
	17127	17	-0.053	0.184	7
	20114	18	-1.214	0.154	16
	20116	19	-0.744	0.159	18
	20126	20	-0.314	0.236	5
	20127	21	0.013	0.072	91
	20157	22	-0.089	0.148	11
	27124	23	-0.152	0.160	9
	27125	24	0.112	0.060	93
	27126	25	0.288	0.193	6

Table 8. (continued)

REGRESSION COEFFICIENTS					
CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
2	1	26	0.450	0.105	24
	2	27	0.585	0.101	28
	3	28	0.350	0.083	48
	4	29	0.404	0.084	50
	5	30	0.169	0.079	54
	6	31	-0.251	0.073	64
	7	32	-0.020	0.069	78
	9	33	-0.031	0.064	101
	10	34	-0.154	0.067	90
	11	35	-0.049	0.073	72
	12	36	0.031	0.075	65
3	21	37	-0.241	0.275	3
	22	38	0.052	0.090	31
	23	39	0.110	0.040	226
4	55	40	-0.880	0.065	80
	65	41	-0.700	0.061	92
	75	42	-0.407	0.055	118
	85	43	-0.243	0.044	193
5	60	44	0.024	0.165	12
	61	45	0.140	0.229	5
	62	46	0.217	0.217	6
	63	47	0.454	0.178	14
	64	48	0.457	0.183	13
	65	49	0.210	0.155	32
	66	50	0.219	0.162	27
	67	51	0.267	0.168	24
	68	52	-0.008	0.203	9
	69	53	-0.129	0.212	7
	70	54	-0.043	0.226	5
	71	55	0.017	0.191	9
	72	56	-0.165	0.205	9
	73	57	-0.351	0.184	10
	74	58	0.276	0.232	9
	75	59	-0.323	0.220	8
	76	60	-0.281	0.152	23
	77	61	-0.185	0.139	34
	78	62	-0.328	0.133	61
	79	63	-0.294	0.135	47
	80	64	-0.252	0.133	34
	81	65	-0.259	0.138	34
	82	66	-0.075	0.136	39
	83	67	0.018	0.148	25
	84	68	0.240	0.134	41
	85	69	-0.189	0.135	45
	86	70	-0.248	0.131	60
	87	71	-0.048	0.133	45
	88	72	-0.267	0.143	28
	89	73	-0.163	0.161	18
	90	74	-0.032	0.170	15

Table 9. Standardized catch rate series from a multiplicative analysis of catch rate data using effort measured in hours fished.

YEAR	LN TRANSFORM		RETRANSFORMED		CATCH	EFFORT
	MEAN	S.E.	MEAN	S.E.		
1959	0.6422	0.0171	2.084	0.271	186837	89637
1960	0.6662	0.0281	2.123	0.353	129773	61118
1961	0.7826	0.0583	2.350	0.560	55455	23601
1962	0.8589	0.0443	2.554	0.532	19657	7697
1963	1.0964	0.0243	3.271	0.507	23644	7228
1964	1.0988	0.0262	3.275	0.527	50154	15312
1965	0.8525	0.0163	2.573	0.327	40425	15709
1966	0.8608	0.0193	2.591	0.359	32730	12634
1967	0.9094	0.0212	2.717	0.394	26162	9628
1968	0.6342	0.0340	2.050	0.375	18881	9208
1969	0.5131	0.0408	1.810	0.362	19883	10982
1970	0.5994	0.0488	1.966	0.429	16970	8633
1971	0.6592	0.0313	2.105	0.370	19306	9171
1972	0.4776	0.0336	1.753	0.319	20033	11425
1973	0.2910	0.0253	1.461	0.231	38965	26668
1974	0.9182	0.0462	2.707	0.576	30145	11136
1975	0.3188	0.0400	1.491	0.296	25559	17140
1976	0.3616	0.0148	1.576	0.191	25965	16472
1977	0.4571	0.0113	1.737	0.184	17539	10096
1978	0.3143	0.0084	1.508	0.138	29146	19324
1979	0.3486	0.0086	1.561	0.144	30730	19689
1980	0.3903	0.0105	1.626	0.167	14519	8932
1981	0.3828	0.0094	1.614	0.156	17642	10928
1982	0.5670	0.0086	1.942	0.179	17983	9262
1983	0.6606	0.0118	2.129	0.231	15311	7193
1984	0.8817	0.0085	2.660	0.245	23689	8906
1985	0.8315	0.0075	2.531	0.219	29225	11547
1986	0.3940	0.0066	1.635	0.133	27019	16528
1987	0.5944	0.0077	1.997	0.175	18511	9272
1988	0.3753	0.0104	1.602	0.163	6942	4335
1989	0.4792	0.0153	1.772	0.219	3167	1787
1990	0.6101	0.0179	2.018	0.269	2298	1139

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.141

Table 10. Mean numbers of redfish caught per standard tow in Division 2J during Canadian research surveys, 1978-1989. Numbers in brackets are number of successful sets, "(*)" indicates those strata estimated with the multiplicative model (MA).

Stratum	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	Stratum	1990
203	16.00(2)	6.00(2)	17.50(2)	6.75(2)	11.33(3)	10.83(3)	16.00(2)	2.00(3)	1.00(2)	0.33(3)	0.00(2)	1.33(3)	203	0.00(2)
204	23.50(2)	16.00(2)	7.00(1)	16.50(2)	1.67(3)	15.67(3)	23.50(2)	0.00(2)	0.50(2)	0.50(2)	0.50(2)	1.50(2)	204	6.50(2)
208	135.50(2)	2059.00(2)	29.50(2)	14.50(2)	18.67(3)	11.50(2)	52.67(3)	32.67(3)	0.50(2)	2.00(2)	1.50(2)	3.50(2)	208	0.00(2)
209	3.50(2)	0.00(2)	5.50(2)	0.50(6)	0.09(11)	0.43(7)	0.14(7)	0.11(9)	0.00(7)	0.38(8)	0.00(5)	0.00(8)	209	0.00(6)
210	66.00(3)	9.00(2)	2.50(2)	0.00(3)	17.72(6)	1.00(2)	22.25(4)	0.50(4)	0.33(3)	0.75(4)	6.00(3)	0.00(4)	210	0.00(3)
211	44.50(2)	40.50(2)	66.00(2)	993.25(2)	46.00(2)	0.50(2)	109.50(3)	154.67(3)	1.50(2)	9.50(2)	2.00(2)	11.00(2)	211	2.50(2)
212	5.50(2)	12.50(2)	2.00(2)	4.00(2)	7.00(5)	7.50(3)	18.00(2)	5.50(4)	6.33(3)	2.00(4)	0.00(2)	0.75(4)	212	3.00(3)
213	236.67(3)	249.33(3)	1.00(3)	10.17(6)	12.06(10)	320.10(10)	150.80(5)	1.89(9)	0.00(9)	1.22(9)	1.13(8)	0.00(9)	213	0.50(8)
214	258.67(3)	7.50(2)	0.00(2)	148.00(5)	74.75(8)	77.88(8)	0.75(4)	1.67(6)	4.83(6)	3.00(6)	6.17(6)	0.50(6)	214	0.80(5)
215	24.00(3)	13.50(2)	27.50(2)	2.80(5)	3.00(9)	5.25(8)	5.33(3)	1.17(6)	5.52(5)	0.43(7)	0.43(7)	0.67(6)	215	1.33(6)
216	4298.00(2)	635.50(2)	1745.50(2)	187.00(2)	479.50(2)	360.00(3)	539.00(2)	197.00(2)	667.41(2)	399.50(2)	123.00(2)	44.00(2)	216	7.00(2)
217	1779.50(2)	423.00(2)	890.50(2)	146.50(2)	468.50(2)	487.00(2)	633.41(*)	152.50(2)	407.50(2)	203.50(2)	560.50(2)	46.50(2)	217	124.00(2)
218	982.00(2)	407.01(*)	520.00(2)	156.50(2)	87.50(2)	168.50(2)	401.14(*)	83.00(2)	64.00(2)	333.00(2)	324.00(2)	110.50(2)	218	54.50(2)
219	27.00(1)	7.96(*)	6.00(*)	14.25(2)	5.71(*)	2.00(2)	7.84(*)	0.00(2)	22.00(2)	0.50(2)	2.50(2)	0.00(2)	219	6.19(2)
222	3286.00(2)	886.00(2)	1120.50(2)	2629.00(2)	1848.00(3)	2460.33(3)	835.00(3)	399.00(2)	111.00(2)	130.50(2)	2383.00(2)	21.00(2)	222	7.00(2)
223	2499.50(2)	530.50(2)	1113.00(2)	877.00(2)	652.00(2)	510.50(2)	573.00(2)	574.00(2)	950.00(2)	149.00(2)	733.00(2)	75.00(2)	223	29.50(2)
224	1176.00(2)	720.00(2)	498.50(2)	342.50(2)	151.00(2)	169.50(2)	220.50(2)	37.50(2)	214.37(2)	205.50(2)	442.00(2)	21.00(2)	224	14.50(2)
227	1319.50(2)	231.50(2)	223.00(2)	20.50(2)	185.20(5)	135.00(4)	116.33(3)	89.75(4)	287.33(3)	60.25(4)	9.00(3)	12.75(4)	227	214.00(3)
228	177.00(3)	11.50(2)	1029.50(2)	4590.00(6)	109.10(10)	226.83(6)	227.29(7)	0.14(7)	47.00(6)	17.71(7)	14.40(5)	5.88(8)	228	5.83(6)
229	175.00(2)	408.00(2)	659.00(2)	1607.00(2)	1262.50(4)	1110.75(4)	293.00(3)	280.33(3)	689.33(3)	19.33(3)	5.67(3)	67.33(3)	229	10.50(2)
230	2106.00(2)	403.44(*)	262.75(2)	126.50(2)	210.00(2)	116.00(2)	125.50(2)	113.00(2)	470.00(2)	221.50(2)	54.50(2)	118.50(2)	230	274.50(2)
231	0.00(2)	8.35(*)	3.00(2)	19.00(1)	4.50(2)	5.00(2)	32.50(2)	23.50(2)	9.50(2)	2.00(2)	8.00(2)	1.00(1)	231	0.00(2)
235	10.00(2)	48.00(2)	41.00(2)	9.00(2)	16.67(3)	28.50(2)	84.67(3)	12.50(2)	4.00(2)	17.00(2)	35.00(2)	3.00(2)	235	85.50(2)
236	19.28(*)	6.67(*)	5.02(*)	8.00(2)	4.50(3)	5.00(2)	8.50(2)	20.00(2)	6.80(2)	3.50(2)	0.00(2)	0.09(*)	236	0.50(2)
Mean	506.65	215.20	282.05	658.98	173.32	226.91	142.98	53.12	99.99	43.63	116.87	13.48	Mean	23.44
Total (x 10 ⁻⁶)	556.85	236.52	309.99	724.27	190.50	249.40	157.14	58.39	109.90	47.96	128.45	14.82	Total (x 10 ⁻⁶)	25.76

(Cont'd.)

Table 11. Mean numbers of redfish caught per standard tow in Division 3K during Canadian research surveys, 1978-1989. Numbers in brackets are number of successful sets, "(*)" indicates those strata estimated with the multiplicative model (MA).

Stratum	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	Stratum	1990
620	43.80(5)	19.33(3)	12.00(3)	7.40(10)	0.33(9)	4.70(10)	0.23(13)	0.64(14)	0.00(9)	0.43(14)	0.33(12)	0.93(15)	620	0.00(9)
621	8.60(5)	3.00(3)	8.00(3)	1.36(11)	1.51(14)	0.33(12)	0.50(14)	1.20(15)	0.50(14)	0.33(12)	0.10(10)	0.06(17)	621	0.19(11)
622	93.00(2)	10.33(3)	18.00(2)	27.00(2)	18.33(3)	20.00(2)	8.00(4)	4.00(4)	6.50(2)	1.00(3)	0.67(3)	8.00(3)	622	2.00(2)
623	51.00(3)	4.00(1)	81.50(2)	7.50(4)	6.00(5)	103.67(6)	13.40(5)	5.33(6)	3.00(4)	1.20(5)	7.00(5)	3.83(6)	623	0.60(5)
624	1171.00(4)	173.00(2)	11.50(2)	18.00(2)	5.25(4)	3.75(4)	15.75(4)	3.00(4)	4.50(2)	2.33(3)	2.33(3)	1.33(3)	624	3.00(4)
625	121.33(3)	53.00(2)	85.50(2)	387.75(4)	13.00(2)	324.33(3)	21.00(5)	70.60(5)	0.67(3)	27.50(4)	2.25(4)	9.50(4)	625	0.75(4)
626	118.33(3)	31.00(2)	39.50(2)	140.40(5)	96.60(5)	7.75(4)	8.00(6)	31.90(5)	3.25(4)	12.20(5)	0.40(5)	351.40(5)	626	0.00(4)
627	4.50(2)	25.67(3)	45.50(2)	7.00(6)	16.00(7)	23.00(6)	12.38(8)	3.71(7)	2.60(5)	2.00(6)	1.00(5)	31.17(6)	627	12.40(5)
628	67.50(2)	53.67(3)	8.50(2)	32.83(6)	5.33(6)	14.50(6)	8.29(7)	1.75(6)	0.00(4)	1.80(5)	1.80(5)	0.75(4)	628	0.00(5)
629	292.00(3)	120.97(*)	87.50(2)	49.00(3)	29.50(2)	2070.33(3)	25.00(4)	20.75(4)	16.00(3)	17.67(3)	10.50(2)	3.33(3)	629	2311.50(2)
630	305.50(2)	102.00(2)	46.00(2)	19.00(2)	18.88(*)	119.00(2)	212.00(3)	21.94(4)	38.90(2)	1.67(3)	0.67(3)	2.00(3)	630	2.00(2)
631	10.00(2)	28.00(3)	50.33(3)	19.00(5)	9.00(2)	47.80(5)	431.80(5)	167.14(7)	13.64(4)	8.67(6)	14.50(6)	18.71(7)	631	3.67(6)
632	424.50(4)	43.00(2)	288.00(2)	45.00(2)	15.67(3)	35.33(3)	15.00(1)	12.00(3)	9.50(2)	4.50(2)	10.00(2)	5.00(2)	632	4.00(2)
633	6191.75(4)	82.25(4)	413.00(3)	219.33(8)	1393.00(7)	817.73(12)	155.30(10)	921.50(12)	40.72(8)	24.82(11)	30.88(8)	15.70(10)	633	44.73(11)
634	373.25(4)	28.50(2)	138.50(2)	33.19(7)	112.27(11)	8899.80(5)	48.57(7)	27.56(9)	45.40(5)	12.91(11)	10.50(6)	13.63(7)	634	2.71(7)
635	776.75(4)	275.00(3)	59.50(2)	2927.20(5)	6.00(5)	4.33(6)	43.63(8)	13.00(7)	6.29(6)	4.00(6)	3.20(5)	30.14(7)	635	2.00(6)
636	964.75(4)	118.50(2)	3318.00(2)	41.67(6)	32.50(10)	118.00(6)	16.00(8)	7.88(8)	14.25(4)	5.57(7)	7.00(6)	3.60(5)	636	0.57(7)
637	605.50(5)	759.67(3)	188.00(2)	661.50(6)	41.71(7)	292.60(5)	12.50(6)	62.00(7)	11.05(4)	4.67(6)	8.50(8)	3.80(5)	637	0.80(5)
638	478.00(3)	182.00(2)	857.33(3)	121.25(8)	81.64(10)	151.00(11)	166.80(10)	105.64(11)	19.75(4)	96.50(10)	840.88(8)	33.09(11)	638	206.67(9)
639	798.75(4)	2118.50(2)	392.00(2)	95.83(6)	553.10(15)	6536.43(7)	753.87(8)	733.00(8)	1435.00(6)	177.14(7)	204.67(6)	22.25(8)	639	359.00(7)
640	1497.00(2)	588.88(*)	1190.00(2)	410.50(2)	480.50(2)	715.42(*)	279.50(2)	552.00(3)	202.00(2)	268.00(2)	388.50(2)	51.50(2)	640	105.00(2)
641	693.50(2)	154.00(2)	399.00(2)	199.50(2)	186.25(4)	55.67(3)	100.00(3)	111.25(4)	27.47(*)	52.33(3)	24.98(*)	26.05(*)	641	25.00(2)
642	1.00(2)	2.00(1)	4.50(2)	1.33(3)	3.83(6)	6.00(*)	5.33(6)	11.40(5)	0.35(*)	1.80(5)	0.27(*)	0.30(*)	642	2.67(3)
645	1774.50(2)	1059.87(*)	1280.50(2)	538.00(2)	710.33(3)	1659.50(2)	141.50(2)	1328.67(3)	167.00(*)	423.00(2)	589.00(2)	1948.00(2)	645	206.20(2)
646	2411.00(2)	20.50(2)	115.50(2)	149.50(2)	1185.00(2)	960.00(2)	471.00(2)	272.33(3)	46.12(*)	341.50(2)	41.98(*)	43.76(*)	646	14.50(2)
647	23.00(2)	0.50(2)	34.10(2)	6.50(2)	0.50(2)	2.00(1)	56.00(1)	205.92(3)	1.38(*)	2.00(1)	1.21(*)	1.28(*)	647	10.75(2)
Mean	811.10	211.86	349.62	226.99	183.97	1019.55	105.99	154.93	88.44	31.75	84.60	36.96	Mean	81.40
Total (x 10 ⁻⁶)	1733.39	452.76	747.17	485.08	393.15	2178.87	226.50	331.09	189.00	67.86	180.80	78.98	Total (x 10 ⁻⁶)	173.95

(Cont'd.)

Table 12. Mean weight of redfish caught per standard tow in Division 2J during Canadian research surveys, 1978-1989. Numbers in brackets are number of successful sets, "(*)" indicates those strata estimated with the multiplicative model (MA).

Stratum	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	Stratum	1990
203	1.34(2)	0.68(2)	3.25(2)	0.75(2)	2.40(3)	1.48(3)	3.75(2)	0.08(3)	0.30(2)	0.03(3)	0.00(2)	0.54(3)	203	0.00(2)
204	5.66(2)	7.03(2)	1.00(1)	3.40(2)	0.43(3)	2.63(3)	5.00(2)	0.00(2)	0.15(2)	0.00(2)	0.25(2)	0.59(2)	204	2.22(2)
208	42.39(2)	1540.40(2)	17.75(2)	26.00(2)	7.17(3)	2.85(2)	20.00(3)	11.50(3)	0.15(2)	0.55(2)	1.20(2)	1.65(2)	208	0.00(2)
209	0.06(2)	0.00(2)	3.70(2)	0.50(6)	0.00(11)	0.13(7)	0.09(7)	0.11(9)	0.00(7)	0.03(8)	0.00(5)	0.00(8)	209	0.00(6)
210	1.51(3)	3.17(2)	1.00(2)	0.00(3)	2.91(6)	0.75(2)	2.00(4)	0.02(4)	0.07(3)	0.22(4)	0.50(3)	0.00(4)	210	0.00(3)
211	18.82(2)	19.29(2)	46.00(2)	987.00(2)	13.75(2)	0.10(2)	38.25(3)	64.75(3)	0.88(2)	3.50(2)	1.10(2)	2.41(2)	211	0.68(2)
212	3.40(2)	4.77(2)	0.55(2)	2.80(2)	3.40(5)	2.65(3)	9.00(2)	1.64(4)	2.63(3)	0.84(4)	0.00(2)	0.21(4)	212	0.74(3)
213	55.04(3)	85.88(3)	0.43(3)	2.79(6)	4.60(10)	92.82(10)	42.30(5)	0.96(9)	0.00(9)	0.45(9)	0.41(8)	0.00(9)	213	0.12(8)
214	75.15(3)	4.54(2)	0.00(2)	54.14(5)	28.19(8)	32.02(8)	0.38(4)	0.67(6)	1.62(6)	1.55(6)	2.70(6)	0.16(6)	214	0.22(5)
215	9.61(3)	6.01(2)	7.50(2)	1.20(5)	0.41(9)	1.66(8)	2.27(3)	0.17(6)	1.40(5)	0.31(7)	0.10(7)	0.11(6)	215	0.21(6)
216	2209.48(2)	267.74(2)	590.17(2)	69.50(2)	195.75(2)	133.67(3)	272.50(2)	70.55(2)	227.14(2)	141.50(2)	50.00(2)	8.43(2)	216	3.05(2)
217	704.90(2)	164.29(2)	470.57(2)	73.75(2)	214.00(2)	239.83(2)	246.72(*)	73.50(2)	181.63(2)	92.50(2)	272.75(2)	20.17(2)	217	22.63(2)
218	611.68(2)	240.28(*)	314.50(2)	92.00(2)	55.50(2)	99.25(2)	213.21(*)	41.25(2)	44.25(2)	194.00(2)	245.75(2)	53.95(2)	218	24.80(2)
219	16.33(1)	5.67(*)	4.66(*)	8.00(2)	3.37(*)	1.90(2)	4.98(*)	0.00(2)	14.70(2)	0.20(2)	1.50(2)	0.00(2)	219	2.60(2)
222	1331.48(2)	302.99(2)	402.50(2)	1033.75(2)	582.00(3)	963.48(3)	303.30(3)	152.50(2)	47.10(2)	63.00(2)	1064.29(2)	6.18(2)	222	1.85(2)
223	1131.28(2)	221.87(2)	538.50(2)	459.16(2)	358.16(2)	271.00(2)	247.00(2)	328.75(2)	606.75(2)	76.25(2)	449.25(2)	28.70(2)	223	7.38(2)
224	836.89(2)	425.01(2)	293.25(2)	204.75(2)	99.00(2)	110.75(2)	114.50(2)	26.25(2)	151.35(2)	138.00(2)	326.25(2)	9.83(2)	224	5.63(2)
227	714.01(2)	148.46(2)	159.25(2)	8.00(2)	99.90(5)	70.88(4)	57.33(3)	45.50(4)	199.22(3)	38.88(4)	4.97(3)	5.18(4)	227	105.45(3)
228	27.97(3)	3.34(2)	437.45(2)	1548.50(6)	31.60(10)	103.54(6)	88.44(7)	0.01(7)	17.93(6)	6.60(7)	5.80(5)	1.57(8)	228	1.10(6)
229	69.61(2)	181.37(2)	285.30(2)	769.25(2)	432.87(4)	364.08(4)	131.83(3)	50.17(3)	321.50(3)	6.67(3)	2.13(3)	26.08(3)	229	3.30(2)
230	1160.53(2)	267.72(*)	196.52(2)	79.75(2)	134.15(2)	74.50(2)	63.25(2)	72.00(2)	326.50(2)	151.00(2)	50.25(2)	80.28(2)	230	140.98(2)
231	0.00(2)	6.08(*)	3.00(2)	11.00(1)	3.50(2)	2.25(2)	17.75(2)	9.75(2)	6.15(2)	1.55(2)	5.30(2)	0.83(1)	231	0.00(2)
235	2.95(2)	17.02(2)	23.50(2)	4.25(2)	6.17(3)	13.25(2)	38.00(3)	5.00(2)	1.00(2)	8.50(2)	15.32(2)	1.37(2)	235	52.38(2)
236	7.73(*)	4.81(*)	3.94(*)	3.75(2)	2.75(3)	3.00(2)	4.75(2)	12.50(2)	6.30(2)	2.35(2)	0.00(2)	0.03(*)	236	0.43(2)
Mean	231.35	115.08	125.32	257.34	65.15	88.34	58.38	21.19	51.82	22.16	59.54	5.78	Mean	10.61
Total (WT)	254278	126484	137742	282841	71603	97088	64161	23290	56954	24351	65435	6355	Total (WT)	11661

(Cont'd.)

Table 13. Mean weight of redfish caught per standard tow in Division 3K during Canadian research surveys, 1978-1989. Numbers in brackets are number of successful sets, "(*)" indicates those strata estimated with the multiplicative model (MA).

Stratum	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	Stratum	1990
620	13.68(5)	2.34(3)	2.17(3)	1.83(10)	0.05(9)	2.00(10)	0.07(13)	0.09(14)	0.00(9)	0.10(14)	0.01(12)	0.09(15)	620	0.00(9)
621	0.83(5)	0.68(3)	2.90(3)	0.57(11)	0.15(14)	0.00(12)	0.07(14)	0.11(15)	0.00(14)	0.02(12)	0.02(10)	0.00(17)	621	0.02(11)
622	7.26(2)	3.33(3)	5.25(2)	16.25(2)	14.17(3)	14.00(2)	5.50(4)	1.04(4)	1.75(2)	0.40(3)	0.07(3)	1.02(3)	622	0.68(2)
623	6.50(3)	13.60(1)	32.25(2)	2.46(4)	2.80(5)	84.17(6)	5.40(5)	2.67(6)	0.55(4)	0.22(5)	0.76(5)	0.37(6)	623	0.23(5)
624	82.17(4)	13.61(2)	5.00(2)	1.75(2)	1.47(4)	0.63(4)	5.05(4)	0.69(4)	0.85(2)	0.13(3)	0.17(3)	0.03(3)	624	0.21(4)
625	35.90(3)	16.33(2)	54.25(2)	303.50(4)	4.00(2)	219.00(3)	8.30(5)	23.12(5)	0.20(3)	11.27(4)	0.25(4)	1.08(4)	625	0.12(4)
626	51.86(3)	13.15(2)	27.50(2)	77.28(5)	19.36(5)	2.75(4)	2.60(6)	14.73(5)	0.40(4)	2.58(5)	0.06(5)	196.36(5)	626	0.00(4)
627	2.72(2)	7.87(3)	10.75(2)	2.96(6)	4.21(7)	10.57(6)	4.66(8)	0.74(7)	0.54(5)	0.48(6)	0.22(5)	11.74(6)	627	3.05(5)
628	47.17(2)	54.46(3)	9.75(2)	16.82(6)	3.13(6)	11.41(6)	7.67(7)	1.34(6)	0.00(4)	0.50(5)	0.27(5)	0.18(4)	628	0.00(5)
629	234.51(3)	53.49(*)	65.00(2)	28.33(3)	12.50(2)	974.00(3)	7.69(4)	7.42(4)	3.60(3)	9.35(3)	4.50(2)	1.33(3)	629	1352.63(2)
630	212.17(2)	56.69(2)	20.50(2)	6.25(2)	8.76(*)	36.75(2)	114.03(3)	14.87(4)	13.90(2)	1.27(3)	0.03(3)	0.54(3)	630	0.27(2)
631	6.14(2)	9.31(3)	16.90(3)	5.80(5)	2.50(2)	23.00(5)	140.12(5)	73.09(7)	4.32(4)	3.08(6)	3.58(6)	5.67(7)	631	0.41(6)
632	59.02(4)	6.47(2)	90.75(2)	9.00(2)	4.17(3)	9.83(3)	5.00(1)	2.87(3)	2.00(2)	0.60(2)	3.05(2)	0.60(2)	632	0.40(2)
633	1496.14(4)	35.16(4)	137.00(3)	56.64(8)	508.52(7)	295.39(12)	62.45(10)	364.25(12)	15.05(8)	7.85(11)	8.95(8)	4.21(10)	633	13.99(11)
634	84.91(4)	7.25(2)	33.50(2)	7.07(7)	42.54(11)	2293.60(5)	18.61(7)	9.74(9)	17.44(5)	4.01(11)	3.45(6)	4.00(7)	634	0.68(7)
635	88.22(4)	159.42(3)	12.50(2)	1192.00(5)	2.46(5)	2.30(6)	18.52(8)	4.57(7)	0.77(6)	1.35(6)	0.26(5)	19.51(7)	635	1.07(6)
636	239.67(4)	24.04(2)	2362.43(2)	11.00(6)	19.05(10)	72.50(6)	4.92(8)	3.91(8)	3.25(4)	1.43(7)	1.66(6)	0.68(5)	636	0.15(7)
637	82.55(5)	232.38(3)	29.50(2)	336.37(6)	18.21(7)	139.22(5)	5.02(6)	25.94(7)	3.25(4)	0.77(6)	2.42(8)	0.88(5)	637	0.20(5)
638	115.88(3)	102.60(2)	260.10(3)	44.31(8)	33.06(10)	65.57(11)	72.85(10)	47.00(11)	7.40(4)	58.70(10)	553.31(8)	15.43(11)	638	119.55(9)
639	352.23(4)	863.46(2)	280.00(2)	28.05(6)	177.42(15)	1903.69(7)	329.92(8)	232.81(8)	786.50(6)	75.56(7)	57.70(6)	11.94(8)	639	131.22(7)
640	488.50(2)	190.36(*)	476.25(2)	181.50(2)	191.50(2)	287.59(*)	96.00(2)	257.41(3)	57.00(2)	96.25(2)	131.00(2)	14.28(2)	640	25.02(2)
641	370.58(2)	84.61(2)	228.00(2)	98.00(2)	88.38(4)	34.50(3)	54.00(3)	47.63(4)	14.91(*)	30.17(3)	13.07(*)	13.51(*)	641	13.13(2)
642	0.57(2)	1.82(1)	3.00(2)	0.67(3)	1.67(6)	4.24(*)	2.79(6)	4.20(5)	0.05(*)	1.00(5)	0.00(*)	0.00(*)	642	1.52(3)
645	746.60(2)	360.51(*)	503.70(2)	204.25(2)	249.00(3)	623.50(2)	51.25(2)	468.74(3)	63.16(*)	210.75(2)	210.50(2)	619.98(2)	645	57.55(2)
646	1398.40(2)	13.16(2)	77.00(2)	103.25(2)	684.00(2)	512.00(2)	313.00(2)	153.17(3)	28.72(*)	255.50(2)	25.24(*)	26.07(*)	646	5.95(2)
647	16.60(2)	0.27(2)	12.35(2)	2.50(2)	0.25(2)	0.80(1)	28.50(1)	145.33(3)	0.66(*)	1.20(1)	0.52(*)	0.56(*)	647	6.94(2)
Mean	220.26	85.47	189.73	96.70	69.71	308.00	45.22	60.32	45.60	15.77	47.39	15.55	Mean	41.35
Total (WT)	470721	182658	405461	206661	148970	658226	96637	128909	97445	33711	101272	33234	Total (WT)	88358

(Cont'd.)

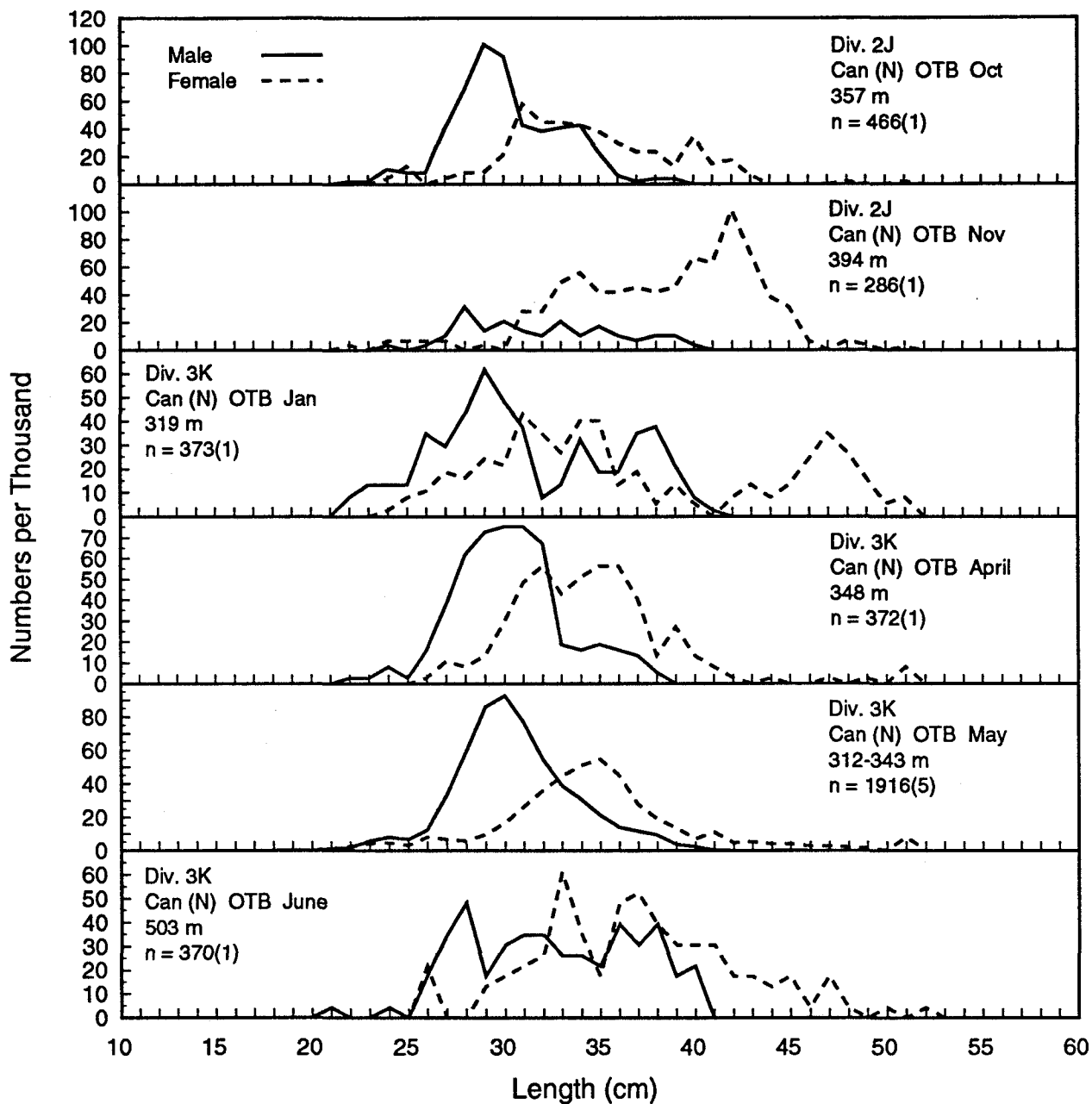


Figure 1q: Commercial length frequencies from Div. 2J3K in 1990 (port sampling).

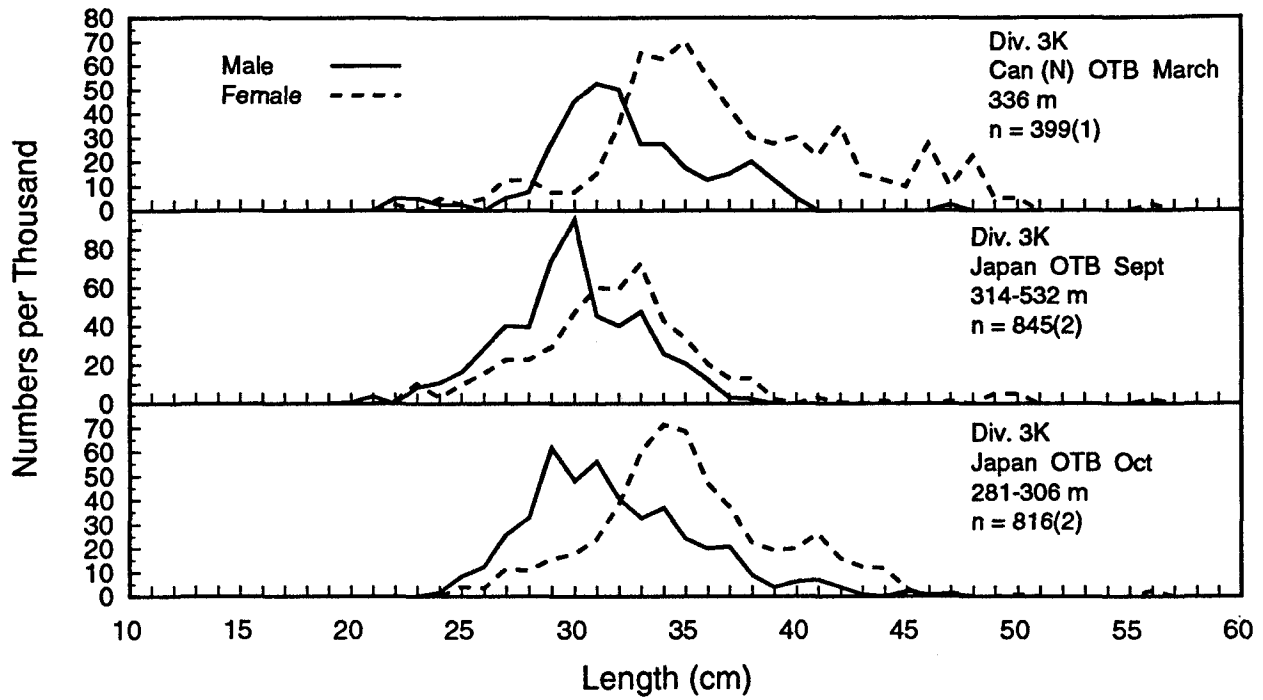


Figure 1b: Commercial length frequencies from Div. 2J3K in 1990 (observer sampling).

<u>2J</u>			
OTB/Q1/CAN(N)/OCT - 26		OTB/Q4 - 157	LF2J - 194
NOV - 48			
<u>3K</u>			
OTB/Q1/CAN(N)/JAN - 8		OTB/Q1 - 218	LF2J3K - 2298
MAR - 160			
OTB/Q2/CAN(N)/APR - 271		OTB/Q2 - 956	LF3K - 2104
MAY - 392			
OTB/Q3/CAN(N)/JUL - 61		OTB/Q3 - 362	
OTB/Q3/JPN /SEP - 106			
OTB/Q4/JPN /OCT - 129		OTB/Q4 - 524	

Legend: OTB = bottom otter trawl
 Q = quarter of year
 JPN = Japan
 Can(N) = Newfoundland

Fig. 2. Commercial frequencies available and the process of combining these with appropriate weightings to derive the estimated numbers of redfish caught at age in NAFO Subarea 2 and Div. 3K in 1990.

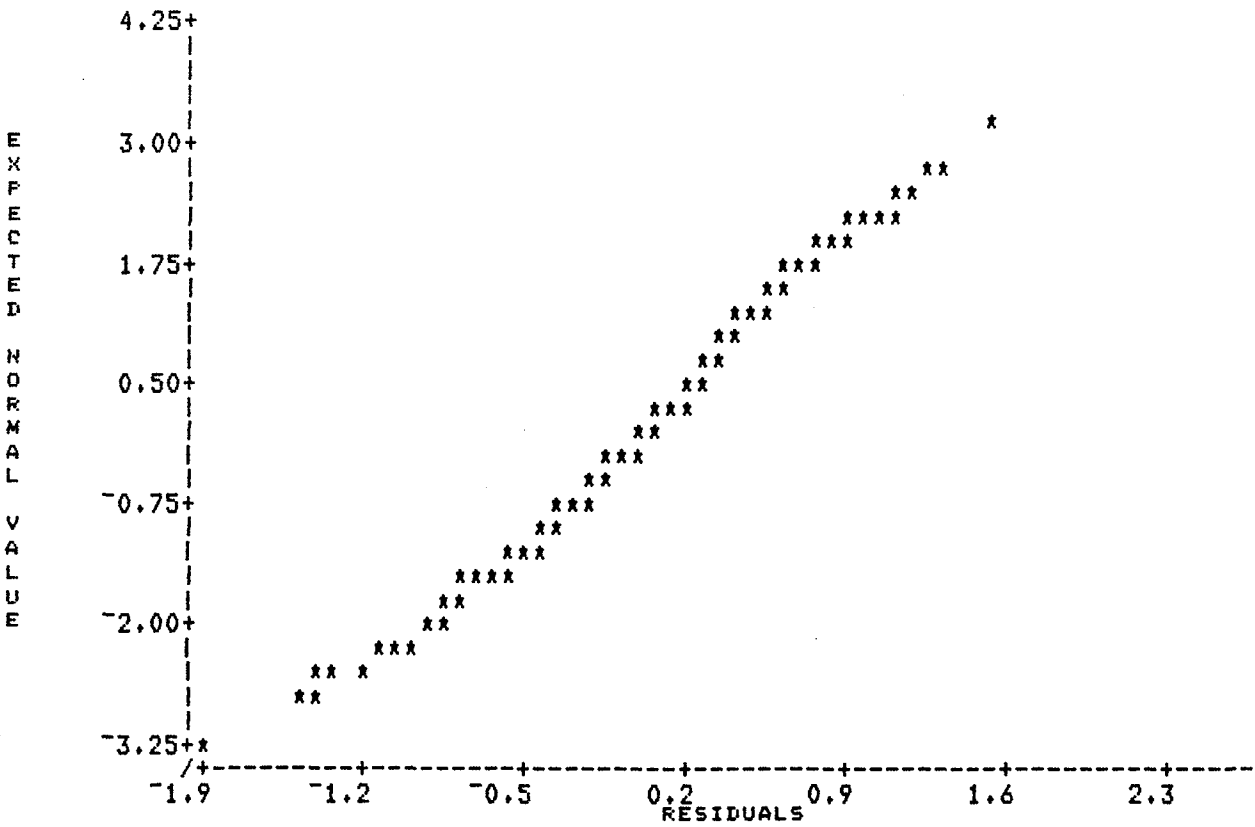
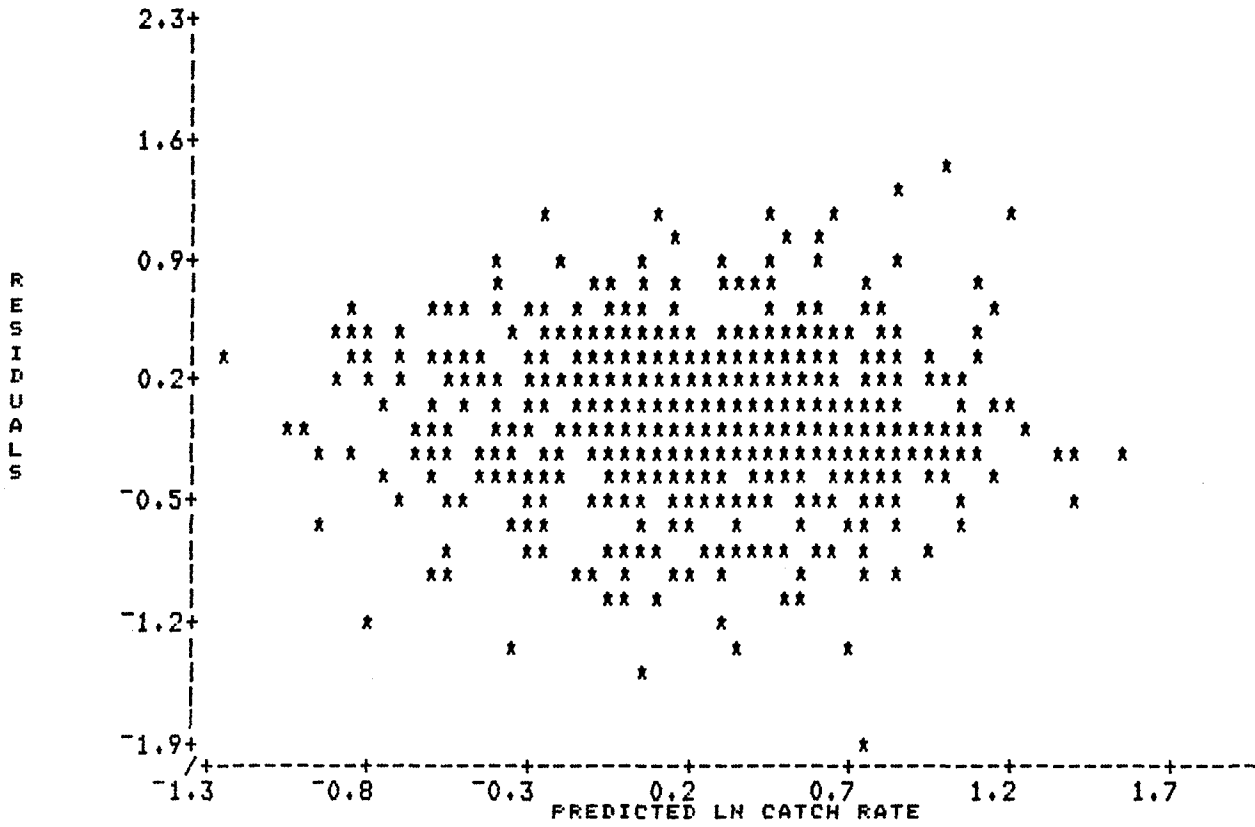


Fig. 3. Residual plots from a multiplicative analysis of catch rate data with effort measured in hours fished.

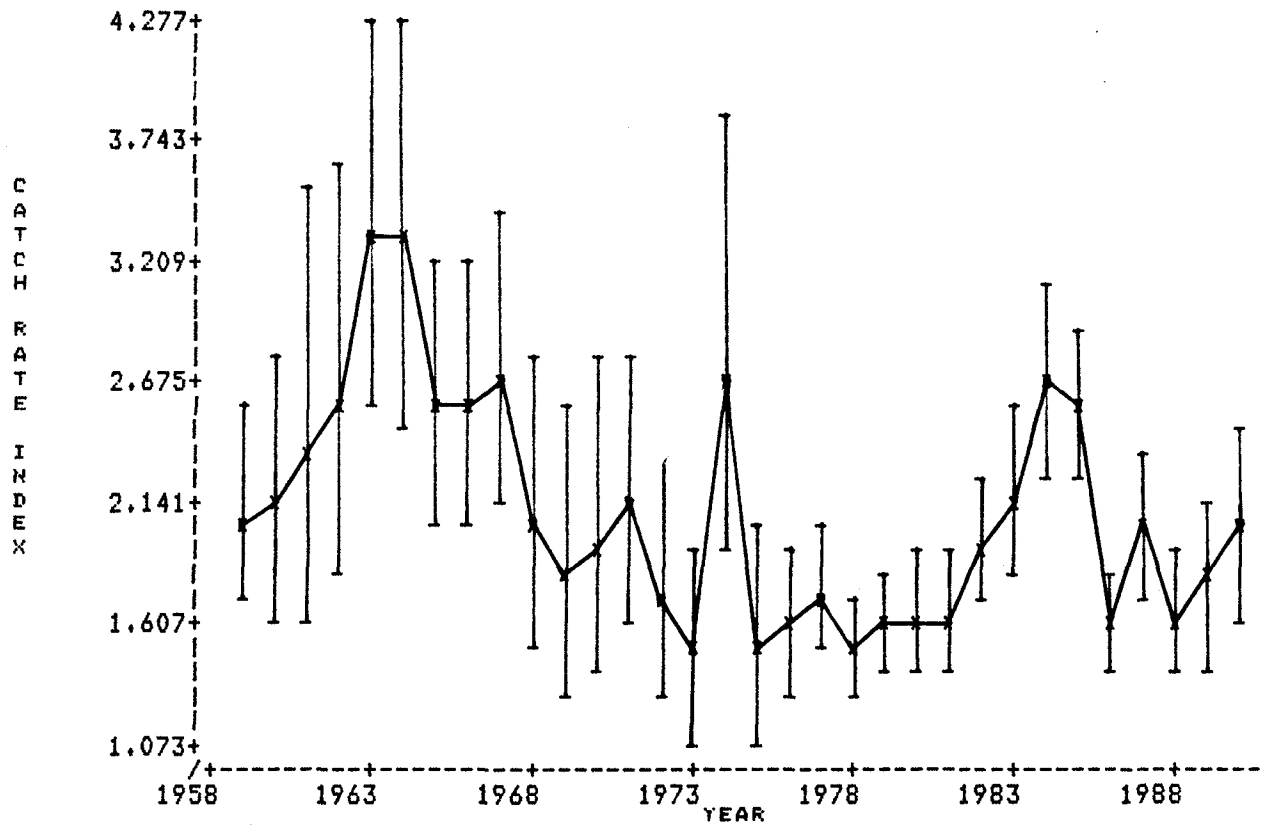


Fig. 4. Standardized catch rate series from a multiplicative analysis of catch rate data with effort measured in hours fished.

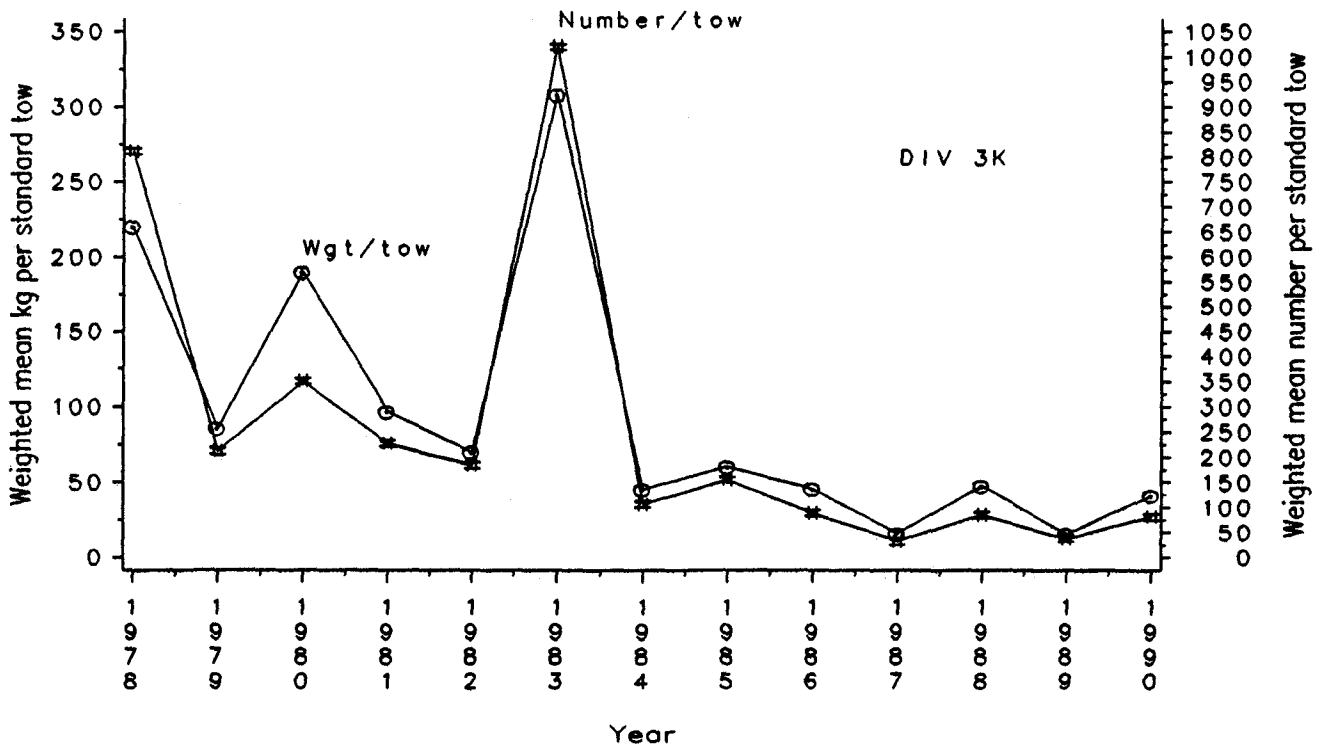
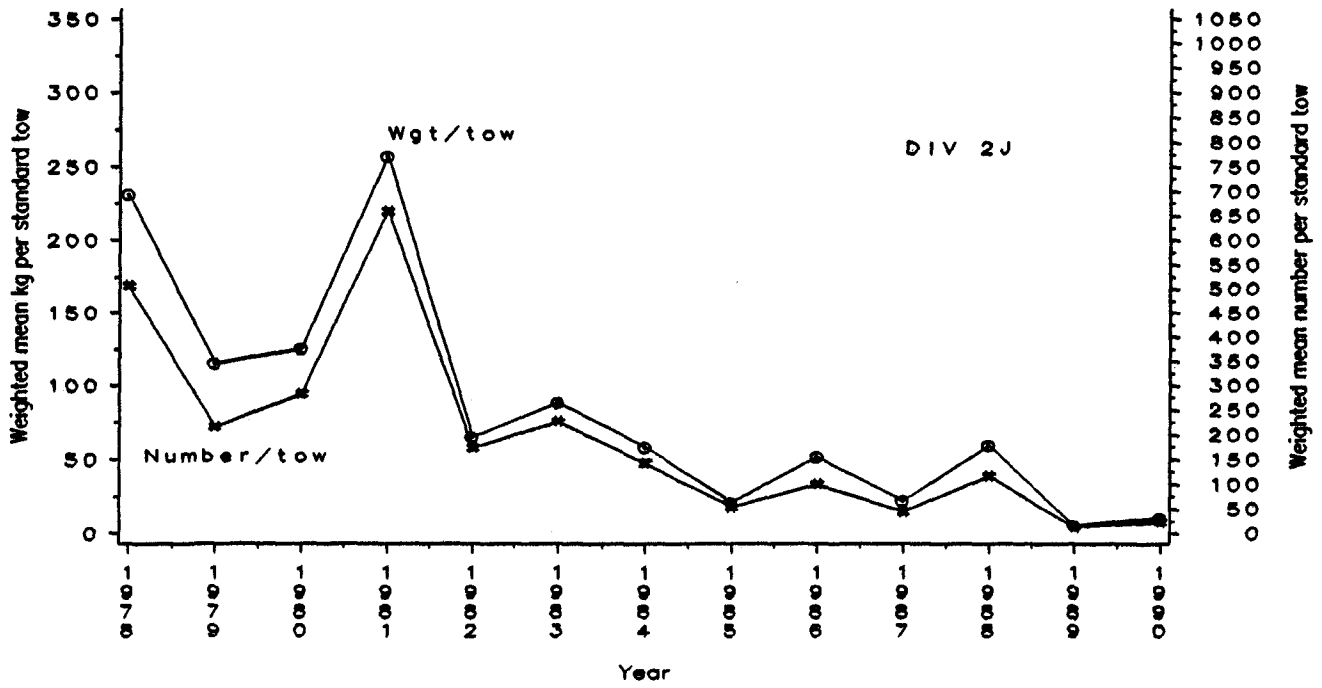


Fig. 5 : Stratified mean numbers and weight per standard tow in Div. 2J and 3K derived from using a multiplicative analysis to fill in mean values in certain years in which various strata were not covered by the survey

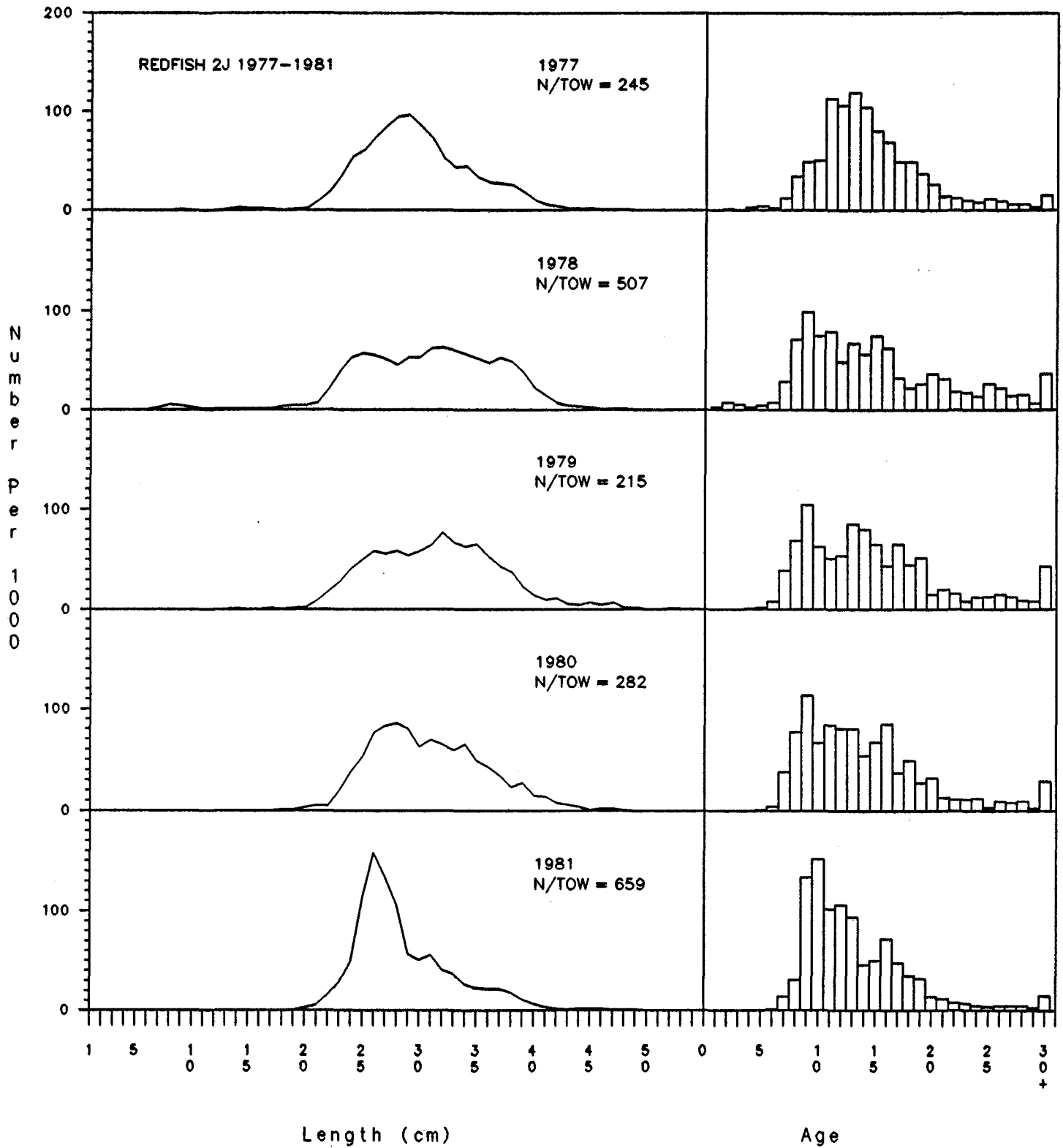


Figure 6. Redfish length frequencies and corresponding age distribution from stratified random research surveys in Div. 2J3K for the years 1977-1981.

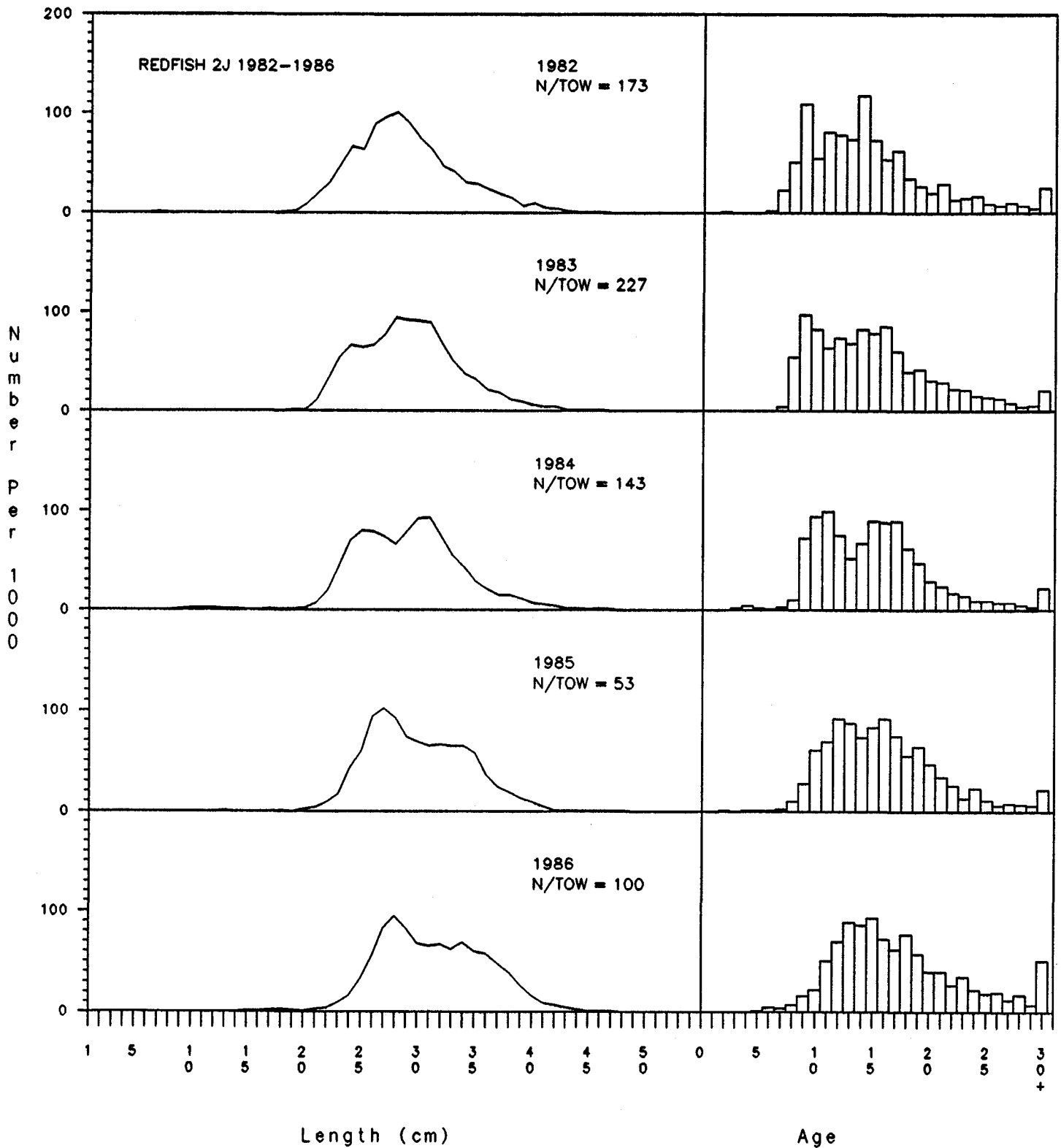


Figure 7. Redfish length frequencies and corresponding age distribution from stratified random research surveys in Div. 2J3K for the years 1982-1986.

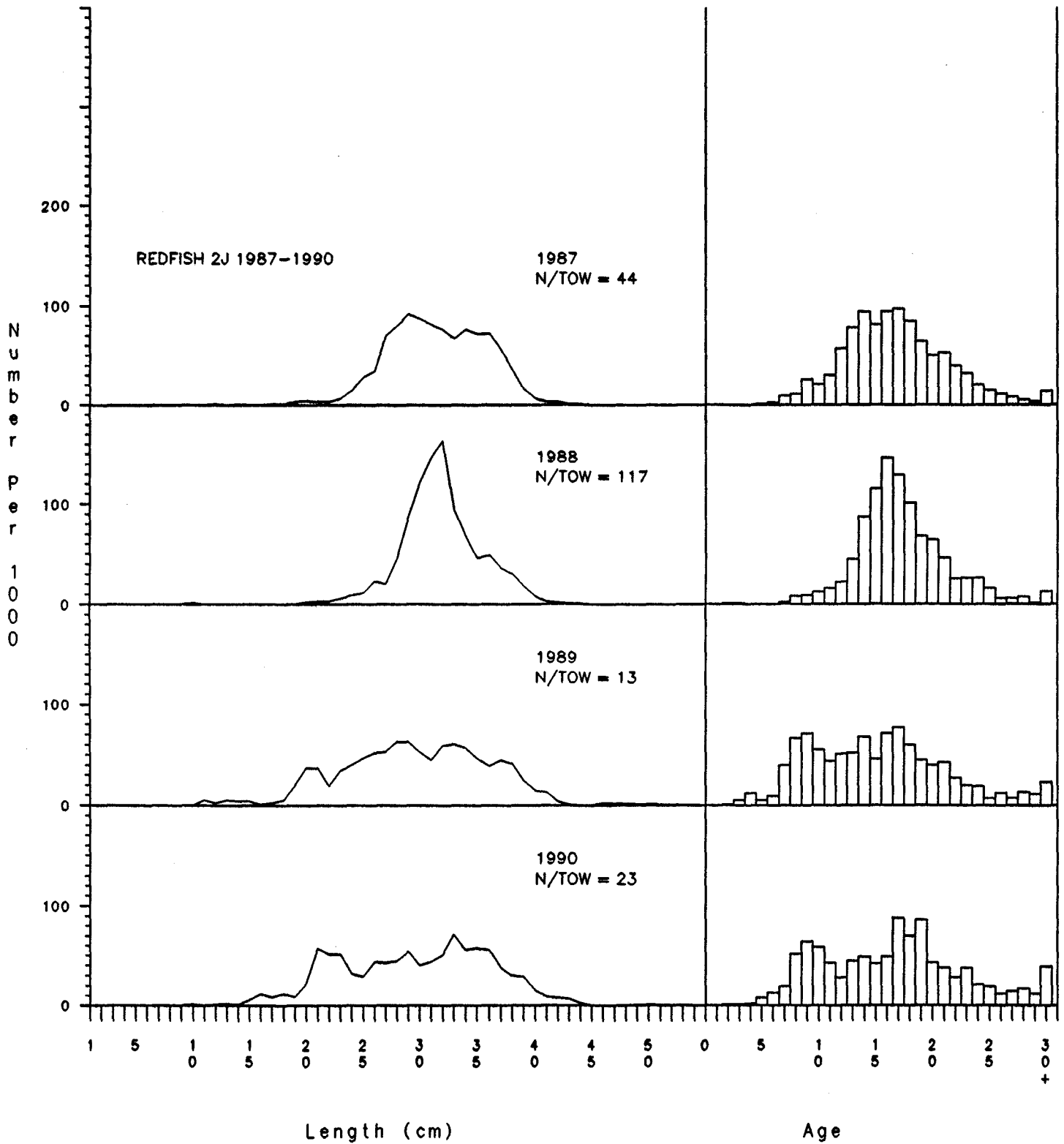


Figure 8. Redfish length frequencies and corresponding age distribution from stratified random research surveys in Div. 2J3K for the years 1987-1990.

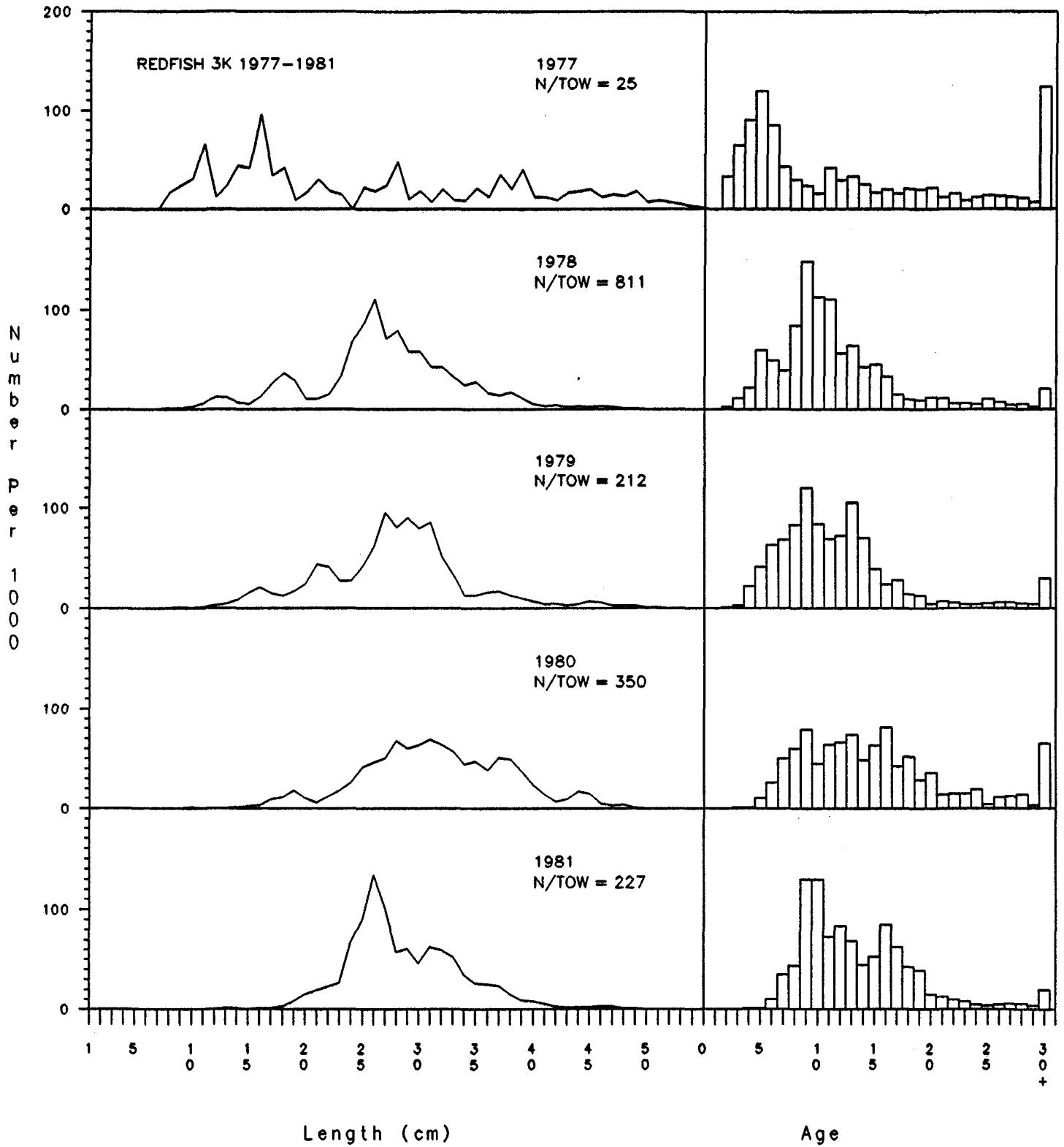


Figure 9. Redfish length frequencies and corresponding age distribution from stratified random research surveys in Div. 2J3K for the years 1977-1981.

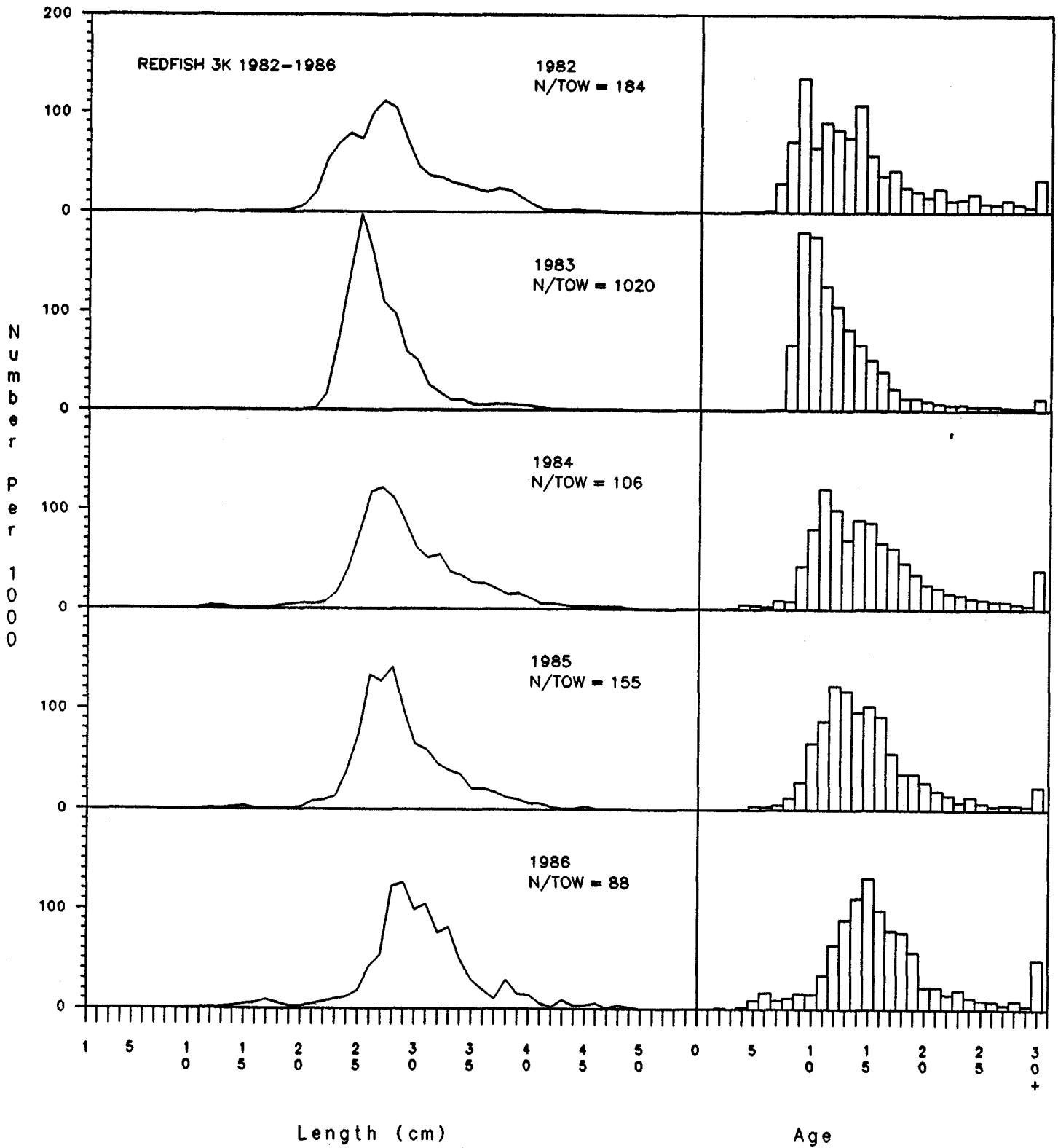


Figure 10. Redfish length frequencies and corresponding age distribution from stratified random research surveys in Div. 2J3K for the years 1982-1986.

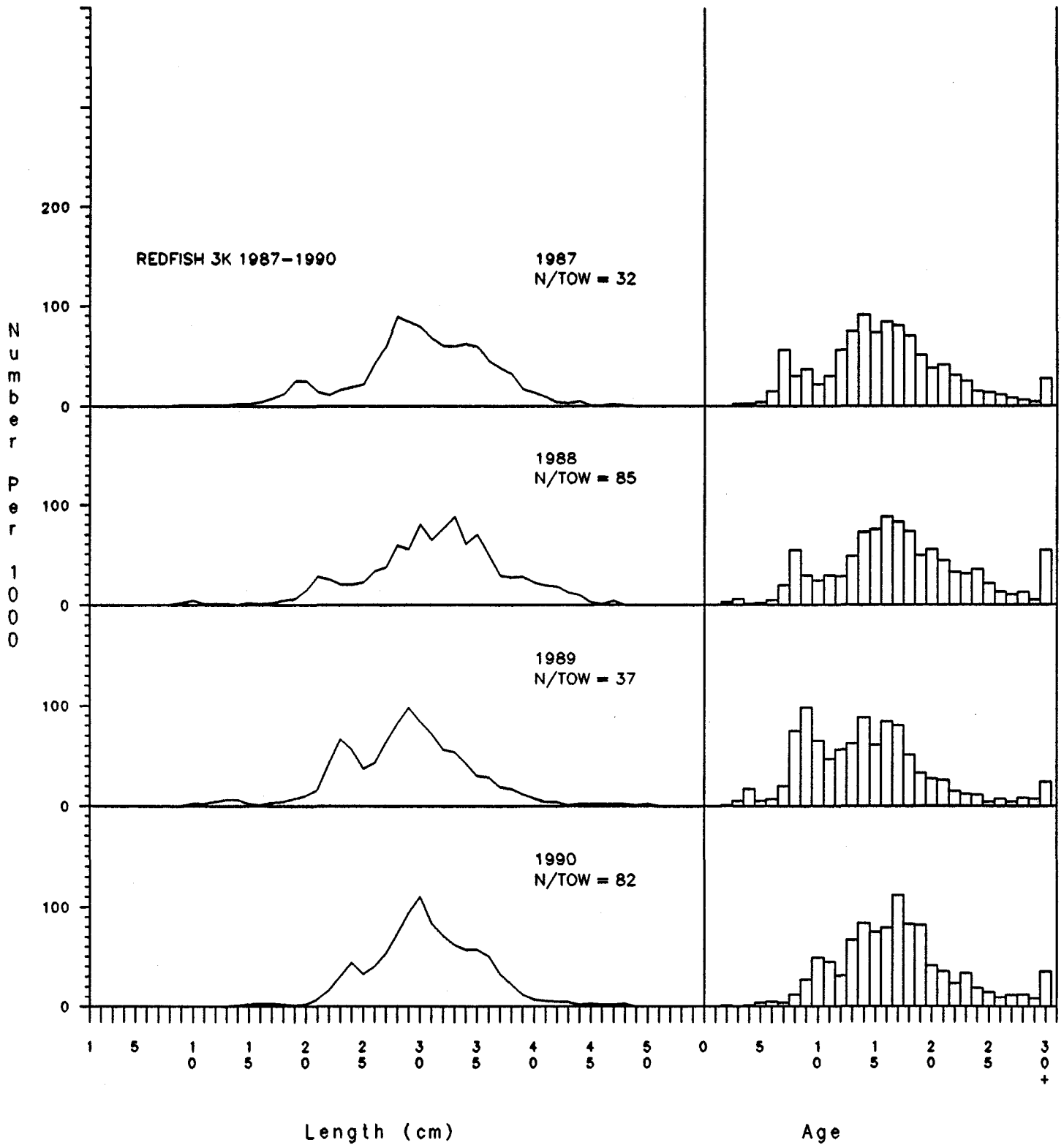


Figure 11. Redfish length frequencies and corresponding age distribution from stratified random research surveys in Div. 2J3K for the years 1987-1990.