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An Assessment of Divisions 3LN Redfish

by

D. Power

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

Introduction

The average reported catch from Div. 3LN from 1959 to 1985 was about 21,000 t ranging between 8,000 t and 45,000 t (Table 1, Fig. 1). In 1986 the catch of 43,000 t was double that taken in 1985. The catch increased again in 1987 to the highest recorded historically at 78,000 t. Since 1987 catches have declined substantially. The 1992 catch of 24,000 t is about the same amount taken in 1991.

From 1980 to 1985 the former USSR, Cuba and Canada were the primary fleets in essentially a trawler fishery. Canada accounted for most of the Div. 3L catch while the USSR was the dominant fleet in Div. 3N (Table 2). Over this period catches averaged 19,000 t and between 60%-80% was taken from Div. 3N. The rapid expansion of the fishery in 1986 was due primarily to the entry of EEC-Portugal, taking 13,000 t in Div. 3L and 8,000 t in Div. 3N. The USSR, which had taken the majority of its catch from Div. 3N since 1980, also diverted the major portion of its fishery to Div. 3L in 1986. In 1987 various countries who are not contracting parties of NAFO, most notably South Korea, Panama and Caymen Islands began to fish in the regulatory area accounting for a catch of about 24,000 t. Since then these countries have taken between 7,000 t and 12,000 t annually.

From 1980 to 1990 the TAC each year for this stock has been 25,000 t. The TAC was reduced to 14,000 for 1991 and has been maintained at that level to 1993. Since 1986 the TAC has been exceeded each year, and in some years catches have been double (1988) and even triple (1987).

The monthly pattern of the catches in recent years (Table 3) reveals the fishery is conducted year round in Div. 3L but mostly in the second half of the year in Div. 3N. A tabulation of the of the catches for each division by gear type since 1980 (Table 4) shows the bottom trawl is the predominant gear in the fishery.

Since 1986 the shifts in the proportion of midwater trawls in Div. 3L is probably reflective of movements of the Russian fleet as it accounts for most of the catches by this gear.

Commercial Fishery Data

Catch and Effort

Catch and effort data were obtained from 1959 to 1989 from ICNAF/NAFO Statistical Bulletins and were combined with provisional 1990-1991 NAFO data and preliminary Canadian data for 1991-1992. In addition, catch rate data available in Portuguese research reports from NAFO SCS Document series for 1989-1992 from the annual Portuguese sampling program were also incorporated into this database. Only those data where redfish comprised more than 50% of the total catch were selected for further analysis except those data that met this criteria for Portugal prior to 1989 because they were considered confounded with cod directed effort.

The catch/effort data were analyzed with a multiplicative model (Gavaris 1980) to derive a standardized catch rate series in tons per hour and additional series utilizing effort in days fished. 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, consistent with last years assessment (eg. see Power and Atkinson, MS 1989).

In the usual practise, catch or effort data of less than 10 units were eliminated prior to analysis as were most category types where there was less than five samples in the database except the year category type. However, for the analysis utilizing the effort in terms of days fished catch less than 10 tons or effort less than an arbitrarily chosen 5 days were eliminated prior to analysis. For all analyses an unweighted regression was run because of unknown percentages of prorating prior to 1984. The data were analyzed for each division separately because of different trends in the catch rate series in recent years, which violates a basic assumption of the model if the data are combined.

The regression for Div. 3L using effort in hours was significant ($p < .05$), explaining 57% of the variation in catch rates (Table 5). All category types were significant. Although the year category type is significant, none of the estimated coefficients are different from 1959 (within 2 s.e.). The standardized catch rate series (Table 9, Fig. 2a) shows much within year variability especially prior to 1974. There is a slight trend of increase from 1974 to 1986 followed by a decline to 1991 except for an intermittent increase in 1989. The 1992 rate suggests a large increase but it must be noted that the catch rate data utilized account for a relatively small proportion of the catch.

The regression for Div. 3N using effort in hours fished is significant ($p < .05$), explaining 61% of the variability in the CPUE data (Table 6). All category types were significant, except the month category. For the year category type only six of the estimated coefficients are different from 1959 (within 2 s.e.). The standardized catch rate series (Table 10, Fig. 2b) shows much within year variability over time, especially for the period prior to 1976. There is a general trend of increase from 1976 to one of the highest rates in the series in 1980 followed by a decline to 1986. Catch rate increased sharply in 1987 and has since declined successively to 1992, the lowest rate in the series. The estimate of the 1992 rate is based on only one observation.

Analyses incorporating effort measured in days fished were conducted on the premise that such a unit of effort may reflect time searching for concentrations of redfish.

The regression for Div. 3L using effort in days fished was significant ($p < .05$), explaining 64% of the variation in the CPUE data (Table 7). All category types were significant. For the year category type only three of the estimated coefficients are different from 1959 (within 2 s.e.). The standardized catch rate series (Table 11, Fig. 3a) shows much interannual variability throughout the series especially prior to 1978. There is a trend of successive increases from 1978 to 1982 followed by a decrease to 1985. Catch rate increased again in 1986 to the level of the 1983 rate and except for an intermittent large increase in 1989 have decreased systematically to 1990. Since 1990 the rate has been stable but at a relatively low level.

The regression utilizing effort as days fished for Div. 3N was significant ($p < .05$), explaining 70% of the variability in CPUE (Table 8). Only the month category type was not significant. The catch rate series has much interannual variability associated with the mean (Table 12, Fig. 3b) particularly prior to 1980 but there is an indication of stability. From 1980 to 1985 there is a trend of decline followed by successive increases to 1987. Since then except for an intermittent increase in 1991 the series shows a systematic decline to 1992. Again caution is warranted about the 1992 rate which is based on only one observation.

Since the multiplicative analyses on Div. 3L and Div. 3N CPUE data indicated there was generally no contrast in the estimated catch rate series over time, general production analyses were not considered appropriate. The results of previous attempts for Div.

3L (NAFO Sci. Coun. Rep., 1987) and for Div. 3N (NAFO Sci. Coun. Rep., 1988) have been viewed with little confidence.

Commercial fishery sampling

Length compositions from the Portuguese fishery in Div. 3L (Avila de Melo *et al.*, MS 1993) indicate the dominant size in the catch was between 21-30 cm for males and females in the first quarter and 24-29 cm for both in the second quarter (Fig. 4). Sampling in Div. 3N suggest the dominant size range was 20-32 cm in the first quarter and 29-38 cm in the second quarter. In both Div. 3L and Div. 3N there was a higher proportion of fish <24 cm sampled in the first quarter compared to the second quarter. Length frequencies available from limited Canadian sampling from Div. 3L indicate the majority of the catch was composed of 24-29 cm for males and 24-32 cm for females in the first quarter.

Research Survey Data

A number of stratified-random surveys have been conducted by Canada in Div. 3L in various years and seasons from 1978 to 1992 in which strata up to a maximum of 732 m (400 fathoms) were sampled. Although these surveys were conducted at various times of the year throughout the period, they provide an indication of relative abundance and dynamics of the population. The design of the surveys was based on the stratification scheme down to 400 fathoms for Div. 3LN (Fig. 5).

Estimates of density in terms of mean number and mean weight (kg) per standard tow show large fluctuations between some adjacent years (Table 13-14, Fig. 6). There are also rather large changes in stratum by stratum density estimates in adjacent years where seasons can be compared. In spite of these cautions it appears that both abundance and biomass are at there lowest levels in 1992 relative to time period the surveys cover.

Stratified-random surveys have also been conducted by Canada in Div 3N in 1991 and 1992 that cover to the extent of the stratification (732 m). Estimates of density in terms of mean number and weight per standard tow (Table 15-16) are considerably higher than in Div 3L but it is evident that there is much more variability in these estimates as well.

Russian stratified-random bottom trawl surveys in Div. 3L (Power and Vaskov, MS 1992) indicate that from 1984 to 1990 there has been a steady decline in density in terms of mean number and mean weight per standard tow. The 1991 estimates indicate a three fold increase but still substantially lower than the level of the mid 1980s (Fig. 7). In Div. 3N, although there are still some rather dynamic changes over this period, there is also an indication of a decline. This is evident in both the mean number and weight per standard tow (Fig. 8). A comparison of Canadian and Russian bottom trawl surveys in Div. 3L indicate a decline in density estimates in terms of stratified mean weight from 1984 to 1990 (Fig. 9). There was no survey conducted by Russia in 1992. Canadian surveys conducted in 1992 indicate a further decline in density from 1991.

Length frequencies and corresponding age distributions from the Canadian surveys in Div. 3L expressed as number per thousand indicate there has been relatively poor recruitment observed over the time period covered by the surveys (Fig. 10-11). For the 1992 spring and fall surveys the catch was dominated by 25-30 cm fish corresponding to the year-classes of the early-1980s.

Length frequencies and age distributions from the Div. 3N Canadian surveys in 1991 and 1992 (Fig. 12) show different distributions compared with Div. 3L for each corresponding seasonal survey, consistently being composed of size groups that are much smaller. There was a relatively good pulse of recruitment picked up in the 1991 fall survey in the range of 12-14 cm (1986-1987 year-classes) that was again detected in the 1992 spring survey. The 1992 fall survey was largely incomplete (only 16 sets completed in strata greater than 93 m) and dominated by a few large catches so the estimated distribution may not be representative.

Prognosis

The catch rate indices derived for Div. 3L and Div. 3N show much within year variability, particularly prior to 1975. Although

some of the changes in mean catch rate between some years are too dramatic to be solely the result changes in population abundance, there are indications of decline since the mid-1980s in all the derived indices. This corresponds to a period when some of the largest catches historically have been taken, which have probably generated high fishing mortalities. Although the 1992 data from these indices are provisional and do not cover catches of the entire fishery, they suggest the situation has not improved and may have even deteriorated.

Russian bottom trawl surveys indicate a decline in density to historically low values in recent years for Div. 3L and Div. 3N. The situation in Div. 3L is confirmed in the surveys conducted by Canada that cover the deep strata sufficiently. Although a cautious approach should be taken in drawing conclusions about stock status given the inherent variability in bottom trawl surveys, the 1992 Canadian surveys indicate that densities are at an all time low over the time period.

There is no information to evaluate where the current TAC stands in relation to an appropriate reference catch. With the prospect of continuing poor recruitment in Div. 3L and given that the unknown strength of the recruitment detected in Div. 3N would not be available to the fishery until the late-1990s, a cautious approach is warranted in establishing a TAC. In light of this there continues to be a substantial fishery by non-Contracting parties in the Regulatory area.

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Table 1. Summary of nominal catches (t) of redfish in Divisions 3LN.

Year	3L	3N	Total	TAC
1959	34,107	10,478	44,585	
1960	11,463	16,547	28,010	
1961	8,349	14,826	23,175	
1962	3,425	18,009	21,434	
1963	8,191	12,906	21,097	
1964	3,898	4,206	8,104	
1965	9,451	4,042	13,493	
1966	6,927	10,047	16,974	
1967	7,684	19,504	27,188	
1968	2,348	15,265	17,613	
1969	927	22,142	23,069	
1970	1,029	13,359	14,388	
1971	10,043	24,310	34,353	
1972	3,095	25,838	28,933	
1973	4,709	28,588	33,297	
1974	11,419	10,867	22,286	28,000
1975	3,838	14,033	17,871	20,000
1976	15,971	4,541	20,512	20,000
1977	13,452	3,064	16,516	16,000
1978	6,318	5,725	12,043	16,000
1979	5,584	8,483	14,067	18,000
1980	4,367	11,663	16,030	25,000
1981	9,407	14,873	24,280	25,000
1982	7,870	13,677	21,547	25,000
1983	8,657	11,090	19,747	25,000
1984	2,696	12,065	14,761	25,000
1985	3,677	16,880	20,557	25,000
1986	27,833	14,972	42,805	25,000
1987	30,342	40,949	78,441[a]	25,000
1988	22,317	23,049	53,266[a]	25,000
1989	18,947	12,902	33,649[a]	25,000
1990[b]	15,535	9,217	29,102[a]	25,000
1991[b]	8,891	12,724	25,815[a]	14,000
1992[b]	4,803	10,153	24,281[a]	14,000
1993				14,000

[a]Includes estimates of unreported catch.
[b]Provisional.

Table 2a. Nominal catches (t) of redfish in Div. 3L by country and year since 1980.

Country	1980	1981	1982	1983	1984	1985	1986	1987[b]	1988[b]	1989[b]	1990[b,c]	1991[b,c]	1992[b,c]
Canada (M)	554	1,696	1,003	2,663	52	342	2,597	2,352	5,042	1,095	73	37	86
Canada (N)	2,412	5,925	5,910	3,800	1,229	1,716	2,235	2,159	1,444	489	947	362	655
EEC/Germany	375	509	12	586	938	981	540	696	694	742	643	1151	1,455
Japan	26	128	159	-	105	129	135	114	152	114	151	83	138
EEC/Portugal	639	275	125	91	48	4	13,469	19,858	9,867	5,408	4,820	5,099	767
EEC/Spain	-	137	25	347	91	192	199	335	94	109	837	681	625
Russia	345	737	607	1,168	232	309	8,658	4,459	5,004	10,037	7,003	1,032	571
Kor-S	-	-	29	-	-	-	-	364	20	952	1,061	420	370
Others[a]	16	-	-	2	1	4	-	5	-	1	-	26	31
TOTAL	4,367	9,407	7,870	8,657	2,696	3,677	27,833	30,342	22,317	18,947	15,535	8,891	4,803

[a]Others include France (M), France (SP), Poland, EEC-UK.
[b]Does not include estimates of unreported catches.
[c]Provisional.

Table 2b. Nominal catches (t) of redfish in Div. 3N by country and year.

Country	1980	1981	1982	1983	1984	1985	1986	1987[b]	1988[b]	1989[b]	1990[b,c]	1991[b,c]	1992[b,c]
Canada (M)	683	442	-	-	13	311	-	-	1	22	-	-	-
Canada (N)	367	63	337	1	2	82	17	21	4	4	11	-	2
EEC/Portugal	-	-	1	-	365	890	8,273	7,854	2,147	600	1,235	3,275	1,148
Japan	-	-	-	-	81	-	12	51	-	39	4	5	1
EEC/Spain	14	239	278	875	239	2,881	1,393	132	581	224	416	956	119
Russia	8,944	12,762	10,414	7,844	9,045	10,576	2,227	14,397	6,735	941	359	4,821	3,009
Cuba	1,644	1,309	2,621	2,370	2,320	2,055	2,429	2,433	2,483	2,869	2,456	1,378	1,308
Kor-S	-	-	26	-	-	-	617	16,053	11,098	8,203	4,640	2,276	4,560
Others[a]	11	58	-	-	-	85	4	8	-	-	96	13	6
TOTAL	11,663	14,873	13,677	11,090	12,065	16,880	14,972	40,949	23,049	12,902	9,217	12,724	10,153

[a]Others include France (M), USA, EEC-Germany, DEN(G).
[b]Does not include estimates of unreported catches.
[c]Provisional.

Table 3a. Nominal catches (t) of redfish in Division 3L by month and year since 1980.

Year	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Total
1980	271	112	396	119	373	261	80	10	718	311	22	1,694	4,367
1981	280	61	137	1,120	2,286	532	73	90	404	161	1,980	2,283	9,407
1982	1,126	672	1,232	1,225	295	289	459	37	643	1,367	173	352	7,870
1983	1,304	496	672	1,080	934	708	274	642	562	1,070	799	116	8,657
1984	243	135	168	360	76	161	49	57	1,002	318	46	81	2,696
1985	481	120	177	331	215	165	41	78	354	866	441	408	3,677
1986	423	845	3,470	7,266	3,662	503	975	2,196	544	3,964	2,166	1,819	27,833
1987[a]	2,439	1,631	5,306	1,423	1,765	75	1,233	3,877	3,285	4,215	3,712	1,381	30,342
1988[a]	2,856	1,623	865	1,466	471	1,213	2,776	4,800	1,628	1,869	682	2,068	22,317
1989[a]	786	4,497	4,301	1,140	1,628	501	1,730	1,311	832	1,151	1,002	68	18,947
1990[a,b]	269	331	294	831	578	1,717	3,061	3,683	1,911	1,611	1,056	193	15,535
1991[a,b]	182	915	562	762	545	369	230	163	213	653	2,098	1,058	7,750[c]

[a]Does not include estimates of unreported catches.
[b]Provisional.
[c]Does not include 1,141 t that could not be disaggregated by month.

Table 3b. Nominal catches (t) of redfish in Division 3N by month and year since 1980.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1980	3,561	2,798	2,269	121	368	833	81	422	1,085	122	2	1	11,663
1981	6,293	3,657	877	78	77	145	1,035	1,577	413	273	208	240	14,873
1982	3,042	1,970	2,919	1,141	243	100	581	3,156	485	21	12	7	13,677
1983	869	609	2,029	2,186	1,226	675	1,121	1,266	303	376	208	222	11,090
1984	4,562	1,763	1,821	676	67	74	1,694	1,014	156	93	131	14	12,065
1985	1,110	2,169	2,181	4,213	1,668	420	1,665	676	784	541	230	1,223	16,880
1986	392	665	406	534	454	915	4,392	81	1,196	110	4,131	1,696	14,972
1987[a]	3,787	3,118	1,885	2,203	2,698	2,383	4,339	6,280	7,287	2,431	1,004	3,534	40,949
1988[a]	662	648	815	841	952	1,295	2,327	4,505	3,390	1,419	3,453	2,742	23,049
1989[a]	576	151	274	380	278	1,183	928	4,109	2,085	1,515	1,164	259	12,902
1990[a,b]	220	366	537	9	1,003	1,679	1,236	1,716	619	754	858	220	9,217
1991[a,b]	371	91	15	122	296	664	1,165	359	857	2,013	1,085	860	7,898[c]

[a]Does not include estimates of unreported catches.
[b]Provisional.
[c]Does not include 4,826 t that could not disaggregated by month.

Table 4. Nominal catches by gear type for redfish in Divisions 3L and 3N.

	3L					3N				
Year	Bottom trawl	MW trawl	Gillnets	Misc.	Total	Bottom trawl	MW trawl	Gillnets	Misc.	Total
1980	3,920	314	133	-	4,367	9,197	2,463	-	3	11,663
1981	8,397	650	223	137	9,407	8,858	5,774	2	239	14,873
1982	7,234	466	145	25	7,870	7,400	6,001	1	275	13,677
1983	7,760	308	238	351	8,657	7,050	3,165	-	875	11,090
1984	2,151	237	218	90	2,696	3,287	8,767	-	11	12,065
1985	3,092	307	128	150	3,677	10,232	6,453	-	195	16,880
1986	18,964	8,624	122	123	27,833	10,423	3,405	-	1,144	14,972
1987[a]	25,294	4,441	276	331	30,342	32,391	8,527	-	31	40,949
1988[a]	15,435	6,722	105	55	22,317	16,740	6,269	17	23	23,049
1989[a]	7,542	10,922	449	34	18,947	9,131	3,746	-	25	12,902
1990[a,b]	7,848	7,537	136	14	15,535	6,511	2,675	10	21	9,217
1991[a,b,c]	6,978	625	69	78	7,750[c]	6,453	1,378	-	67	7,898[c]

[a]Does not include estimates of unreported catches.

[b]Provisional.

[c]Does not include 1,141 t catch in Div. 3L and 4,826 t catch in Div. 3N that could not disaggregated by gear.

Table 5. ANOVA results and regression coefficients from a multiplicative model utilized to derive a standardized catch rate series for redfish in Div. 3L. Effort is measured in hours fished. (1990-1992 based on provisional data)

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.756
MULTIPLE R SQUARED..... 0.572

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	P-VALUE
INTERCEPT	1	3.175E1	3.175E1	
REGRESSION	77	1.387E2	1.801E0	8.117
Country¦Gear¦TC (1)	29	6.040E1	2.083E0	9.385
Month (2)	11	9.809E0	8.918E-1	4.019
Bycatch PCT (3)	4	1.830E1	4.576E0	20.619
Year (4)	33	1.396E1	4.230E-1	1.906
RESIDUALS	468	1.039E2	2.219E-1	
TOTAL	546	2.743E2		

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
CGT	3125	INTERCEPT	0.081	0.173	546
Month	6				
Bycatch PCT	95				
Year	59				
(1)	2114	1	-0.654	0.201	9
	2125	2	-0.129	0.191	8
	2155	3	-0.096	0.216	6
	3114	4	-0.481	0.179	15
	3124	5	-0.004	0.171	9
	3154	6	-0.536	0.235	5
	3155	7	0.208	0.121	27
	10127	8	-0.606	0.231	5
	11115	9	-0.479	0.208	10
	11116	10	-0.362	0.216	8
	11125	11	0.047	0.116	22
	11126	12	-0.042	0.204	11
	11127	13	-0.056	0.135	20
	11155	14	-0.501	0.225	5
	14126	15	-0.349	0.183	8
	14127	16	0.449	0.197	13
	16127	17	-0.049	0.177	27
	17116	18	-0.114	0.238	5
	17126	19	-0.645	0.182	9
	20114	20	-1.273	0.194	11
	20116	21	-0.227	0.215	11
	20127	22	0.316	0.092	60
	20145	23	1.170	0.338	12
	20157	24	0.463	0.089	49
	25126	25	-0.230	0.187	8
	25127	26	0.550	0.182	10
	27125	27	0.101	0.093	37
	27126	28	0.254	0.209	6
	27157	29	1.066	0.200	7
(2)	1	30	0.092	0.113	37
	2	31	0.219	0.109	39
	3	32	0.390	0.100	51
	4	33	0.486	0.099	52
	5	34	0.203	0.104	40
	7	35	0.141	0.093	59
	8	36	0.013	0.098	53
	9	37	0.180	0.101	46
	10	38	0.060	0.100	50
	11	39	0.098	0.103	43
	12	40	0.181	0.126	23
(3)	55	41	-0.649	0.107	29
	65	42	-0.618	0.086	44
	75	43	-0.367	0.075	66
	85	44	-0.103	0.062	102
(4)	60	45	0.198	0.199	13
	61	46	0.467	0.256	7
	62	47	0.128	0.234	10
	63	48	0.363	0.243	9
	64	49	0.611	0.331	3
	65	50	0.508	0.282	5
	66	51	0.063	0.218	13
	67	52	0.342	0.215	19
	68	53	0.168	0.259	7
	69	54	0.209	0.235	7
	70	55	0.336	0.243	8
	71	56	0.290	0.235	12
	72	57	0.100	0.249	6
	73	58	0.469	0.315	3
	74	59	-0.317	0.329	15
	75	60	-0.084	0.289	4
	76	61	-0.019	0.168	31
	77	62	-0.082	0.175	32
	78	63	-0.176	0.181	22
	79	64	0.114	0.195	18
	80	65	-0.017	0.197	16
	81	66	0.133	0.191	18
	82	67	0.145	0.182	25
	83	68	0.201	0.183	21
	84	69	0.062	0.199	15
	85	70	0.238	0.192	19
	86	71	0.296	0.179	31
	87	72	0.097	0.189	21
	88	73	-0.039	0.175	36
	89	74	0.339	0.193	23
	90	75	-0.223	0.177	38
	91	76	-0.120	0.235	10
	92	77	0.517	0.273	5

Table 6. ANOVA results and regression coefficients from a multiplicative model utilized to derive a standardized catch rate series for redfish in Div. 3N. Effort is measured in hours fished. (1990-1992 based on provisional data)

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.783
MULTIPLE R SQUARED..... 0.612

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	3.980E1	3.980E1	
REGRESSION	65	1.091E2	1.678E0	8.361
Country¦Gear¦TC (1)	17	2.501E1	1.471E0	7.329
Month (2)	11	2.529E0	2.299E-1	1.145 (NS)
Bycatch PCT (3)	4	1.668E1	4.170E0	20.777
Year (4)	33	1.863E1	5.647E-1	2.813
RESIDUALS	344	6.905E1	2.007E-1	
TOTAL	410	2.179E2		

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
CGT	3125	INTERCEPT	0.134	0.163	410
Month	6				
Bycatch PCT	95				
Year	59				
(1)	2114	1	-0.286	0.165	17
	3114	2	-0.035	0.135	59
	3124	3	0.049	0.214	6
	4127	4	0.402	0.157	18
	4157	5	0.594	0.147	28
	11115	6	-0.475	0.265	5
	14127	7	0.483	0.252	5
	16127	8	-0.164	0.234	5
	17116	9	-0.261	0.273	5
	17126	10	-0.109	0.279	6
	20114	11	-0.933	0.215	8
	20116	12	-0.009	0.210	8
	20127	13	0.584	0.116	85
	20157	14	0.690	0.126	64
	25126	15	0.322	0.178	16
	25127	16	0.744	0.148	40
	27125	17	0.382	0.222	6
(2)	1	18	-0.148	0.121	32
	2	19	-0.079	0.128	27
	3	20	-0.118	0.123	31
	4	21	0.040	0.134	23
	5	22	-0.041	0.125	25
	7	23	-0.016	0.107	51
	8	24	-0.008	0.106	52
	9	25	-0.090	0.108	52
	10	26	-0.225	0.119	34
	11	27	-0.116	0.125	28
	12	28	-0.302	0.133	23
(3)	55	29	-0.673	0.099	41
	65	30	-0.647	0.086	45
	75	31	-0.365	0.080	54
	85	32	-0.244	0.073	63
(4)	60	33	0.241	0.242	5
	61	34	0.203	0.190	11
	62	35	0.292	0.171	16
	63	36	0.181	0.210	8
	64	37	0.207	0.221	8
	65	38	0.420	0.228	7
	66	39	0.550	0.169	17
	67	40	0.477	0.262	6
	68	41	-0.303	0.272	4
	69	42	0.172	0.206	8
	70	43	0.144	0.204	8
	71	44	0.064	0.291	3
	72	45	0.126	0.189	10
	73	46	0.259	0.220	8
	74	47	0.594	0.222	7
	75	48	0.441	0.230	6
	76	49	-0.235	0.205	8
	77	50	0.001	0.230	6
	78	51	0.057	0.207	8
	79	52	0.152	0.166	17
	80	53	0.452	0.167	16
	81	54	0.320	0.174	17
	82	55	0.389	0.165	17
	83	56	0.224	0.172	15
	84	57	-0.033	0.184	13
	85	58	-0.109	0.180	15
	86	59	-0.092	0.189	12
	87	60	0.334	0.151	38
	88	61	0.025	0.165	24
	89	62	-0.094	0.174	21
	90	63	-0.461	0.176	16
	91	64	-0.120	0.237	10
	92	65	-0.531	0.537	1

Table 7. ANOVA results and regression coefficients from a multiplicative model utilized to derive a standardized catch rate series for redfish in Div. 3L. Effort is measured in days fished. (1990-1992 based on provisional data)

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.803
MULTIPLE R SQUARED..... 0.644

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	2.637E3	2.637E3	
REGRESSION	73	9.631E1	1.319E0	7.910
Country¦Gear¦TC (1)	25	4.684E1	1.874E0	11.234
Month (2)	11	3.348E0	3.044E-1	1.825
Bycatch PCT (3)	4	9.411E0	2.353E0	14.106
Year (4)	33	1.104E1	3.345E-1	2.005
RESIDUALS	319	5.321E1	1.668E-1	
TOTAL	393	2.787E3		

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
CGT	3125	INTERCEPT	2.670	0.170	393
Month	6				
Bycatch PCT	95				
Year	59				
(1)	2114	1	-0.588	0.204	7
	2125	2	-0.206	0.185	7
	2155	3	-0.200	0.211	5
	3114	4	-0.567	0.186	11
	3124	5	0.352	0.170	7
	3155	6	0.318	0.123	24
	10125	7	0.146	0.199	8
	10126	8	0.038	0.192	11
	11115	9	-0.541	0.206	9
	11125	10	-0.179	0.114	18
	11126	11	-0.170	0.233	10
	11127	12	-0.354	0.139	15
	11155	13	-0.948	0.201	5
	14126	14	-0.476	0.176	7
	16127	15	-0.147	0.164	24
	17116	16	-0.164	0.241	4
	17126	17	-0.245	0.188	7
	20114	18	-1.488	0.209	8
	20116	19	-0.751	0.212	8
	20127	20	0.381	0.114	39
	20145	21	0.464	0.488	11
	20157	22	0.574	0.100	32
	25127	23	0.517	0.210	5
	27125	24	0.143	0.097	27
	27157	25	0.464	0.211	5
(2)	1	26	-0.108	0.122	26
	2	27	-0.022	0.125	21
	3	28	0.224	0.108	35
	4	29	0.216	0.109	34
	5	30	0.082	0.123	20
	7	31	0.222	0.097	44
	8	32	0.163	0.102	41
	9	33	0.188	0.103	38
	10	34	0.106	0.102	44
	11	35	0.032	0.111	31
	12	36	0.088	0.122	22
(3)	55	37	-0.631	0.113	20
	65	38	-0.520	0.093	34
	75	39	-0.336	0.075	58
	85	40	-0.112	0.065	83
(4)	60	41	0.117	0.177	13
	61	42	0.177	0.185	15
	62	43	0.106	0.201	10
	63	44	0.364	0.231	6
	64	45	0.552	0.290	3
	65	46	0.032	0.266	4
	66	47	-0.096	0.201	12
	67	48	0.222	0.223	12
	68	49	0.055	0.240	6
	69	50	-0.005	0.232	5
	70	51	-0.613	0.289	3
	71	52	0.182	0.347	3
	72	53	-0.596	0.249	4
	73	54	-0.022	0.315	2
	74	55	-0.507	0.469	12
	75	56	-0.287	0.285	3
	76	57	-0.028	0.153	24
	77	58	-0.084	0.159	27
	78	59	-0.389	0.168	16
	79	60	-0.160	0.196	11
	80	61	-0.107	0.205	9
	81	62	0.091	0.192	13
	82	63	0.198	0.187	15
	83	64	0.183	0.184	13
	84	65	-0.083	0.217	8
	85	66	-0.158	0.196	12
	86	67	0.139	0.179	22
	87	68	-0.015	0.184	17
	88	69	-0.113	0.177	24
	89	70	0.154	0.201	12
	90	71	-0.310	0.186	25
	91	72	-0.259	0.237	6
	92	73	-0.322	0.293	3

Table 8. ANOVA results and regression coefficients from a multiplicative model utilized to derive a standardized catch rate series for redfish in Div. 3N. Effort is measured in days fished. (1990-1992 based on provisional data)

REGRESSION OF MULTIPLICATIVE MODEL

MULTIPLE R..... 0.836
MULTIPLE R SQUARED..... 0.699

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	P-VALUE
INTERCEPT	1	2.726E3	2.726E3	
REGRESSION	58	1.054E2	1.817E0	11.342
Country¦Gear¦TC (1)	11	5.439E1	4.945E0	30.869
Month (2)	11	1.615E0	1.469E-1	0.917 (NS)
Bycatch PCT (3)	4	6.544E0	1.636E0	10.212
Year (4)	32	1.754E1	5.482E-1	3.422
RESIDUALS	283	4.534E1	1.602E-1	
TOTAL	342	2.876E3		

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
CGT	3125	INTERCEPT	2.303	0.219	342
Month	6				
Bycatch PCT	95				
Year	59				
(1)	2114	1	-0.239	0.201	13
	3114	2	-0.036	0.177	46
	4127	3	0.027	0.204	15
	4157	4	0.483	0.203	24
	17126	5	0.078	0.300	5
	20114	6	-1.501	0.264	6
	20127	7	0.517	0.175	72
	20157	8	0.709	0.185	49
	22114	9	1.170	0.191	50
	25126	10	0.126	0.220	16
	25127	11	0.651	0.201	36
(2)	1	12	-0.164	0.125	29
	2	13	-0.062	0.123	28
	3	14	-0.062	0.125	27
	4	15	-0.012	0.130	22
	5	16	-0.145	0.129	20
	7	17	0.114	0.110	37
	8	18	-0.027	0.107	44
	9	19	-0.033	0.113	39
	10	20	-0.007	0.123	27
	11	21	-0.012	0.125	24
	12	22	-0.154	0.130	21
(3)	55	23	-0.508	0.097	35
	65	24	-0.481	0.095	31
	75	25	-0.184	0.084	41
	85	26	-0.144	0.080	40
(4)	60	27	0.853	0.153	12
	61	28	0.180	0.132	22
	62	29	0.228	0.169	12
	63	30	0.015	0.136	19
	64	31	0.087	0.156	12
	65	32	0.223	0.218	5
	66	33	0.359	0.205	6
	68	34	0.273	0.288	3
	69	35	0.483	0.217	7
	70	36	0.524	0.216	7
	71	37	0.368	0.268	3
	72	38	0.460	0.193	9
	73	39	0.287	0.326	2
	74	40	-1.426	0.437	1
	75	41	0.678	0.239	5
	76	42	-0.025	0.197	7
	77	43	0.444	0.263	4
	78	44	0.153	0.242	5
	79	45	0.492	0.194	9
	80	46	0.580	0.192	10
	81	47	0.387	0.197	11
	82	48	0.370	0.181	15
	83	49	0.338	0.188	13
	84	50	0.208	0.211	8
	85	51	-0.060	0.189	13
	86	52	0.166	0.204	10
	87	53	0.402	0.171	36
	88	54	0.141	0.181	23
	89	55	0.117	0.193	17
	90	56	-0.314	0.209	10
	91	57	0.011	0.236	7
	92	58	-0.538	0.498	1

Table 9. Standardized catch rate series for Div. 3L from a multiplicative model utilizing hours fished as a measure of effort.

	PREDICTED CATCH RATE					
	LN TRANSFORM		RETRANSFORMED			
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT
1959	0.0814	0.0300	1.194	0.206	34107	28558
1960	0.2796	0.0355	1.452	0.271	11463	7894
1961	0.5481	0.0625	1.874	0.462	8349	4455
1962	0.2095	0.0501	1.344	0.297	3425	2549
1963	0.4447	0.0550	1.696	0.393	8191	4829
1964	0.6928	0.1038	2.121	0.667	3898	1838
1965	0.5897	0.0749	1.941	0.522	9451	4868
1966	0.1448	0.0391	1.267	0.248	6927	5469
1967	0.4230	0.0346	1.677	0.310	7684	4583
1968	0.2492	0.0525	1.397	0.316	2348	1681
1969	0.2908	0.0435	1.463	0.302	927	634
1970	0.4177	0.0535	1.652	0.377	1029	623
1971	0.3709	0.0445	1.584	0.331	10043	6341
1972	0.1817	0.0543	1.304	0.300	3095	2373
1973	0.5507	0.0902	1.853	0.545	4709	2542
1974	-0.2360	0.0974	0.841	0.256	11419	13584
1975	-0.0027	0.0660	1.078	0.273	3838	3559
1976	0.0628	0.0161	1.180	0.149	15971	13530
1977	-0.0010	0.0162	1.107	0.141	13452	12147
1978	-0.0944	0.0176	1.008	0.133	6318	6268
1979	0.1952	0.0228	1.343	0.202	5584	4157
1980	0.0647	0.0205	1.180	0.168	4367	3700
1981	0.2149	0.0189	1.372	0.188	9407	6854
1982	0.2264	0.0148	1.391	0.169	7870	5657
1983	0.2828	0.0170	1.470	0.191	8657	5888
1984	0.1436	0.0213	1.277	0.185	2696	2112
1985	0.3189	0.0185	1.523	0.206	3677	2414
1986	0.3771	0.0145	1.618	0.195	27833	17205
1987	0.1785	0.0186	1.324	0.180	33917	25624
1988	0.0428	0.0150	1.158	0.141	26267	22687
1989	0.4206	0.0193	1.686	0.233	19847	11775
1990	-0.1418	0.0146	0.963	0.116	17710	18394
1991	-0.0390	0.0366	1.055	0.200	10991	10415
1992	0.5988	0.0582	1.975	0.470	9466	4792

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.188

Table 10. Standardized catch rate series for Div. 3N from a multiplicative model utilizing hours fished as a measure of effort.

	PREDICTED CATCH RATE					
	LN TRANSFORM		RETRANSFORMED			
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT
1959	0.1344	0.0266	1.248	0.203	10478	8395
1960	0.3756	0.0644	1.559	0.390	16547	10615
1961	0.3375	0.0424	1.517	0.309	14826	9771
1962	0.4262	0.0344	1.665	0.306	18009	10819
1963	0.3154	0.0521	1.477	0.333	12906	8739
1964	0.3418	0.0566	1.513	0.356	4206	2780
1965	0.5546	0.0600	1.869	0.452	4042	2163
1966	0.6848	0.0246	2.166	0.339	10047	4637
1967	0.6116	0.0668	1.972	0.502	19504	9893
1968	-0.1688	0.0680	0.903	0.232	15265	16909
1969	0.3069	0.0428	1.471	0.302	22142	15051
1970	0.2781	0.0448	1.428	0.299	13359	9355
1971	0.1984	0.0915	1.288	0.381	24310	18873
1972	0.2607	0.0373	1.409	0.270	25838	18343
1973	0.3933	0.0459	1.602	0.340	28588	17850
1974	0.7282	0.0512	2.233	0.499	10867	4867
1975	0.5752	0.0547	1.913	0.442	14033	7337
1976	-0.1005	0.0454	0.978	0.206	4541	4645
1977	0.1356	0.0518	1.234	0.278	3064	2483
1978	0.1916	0.0425	1.311	0.268	5725	4366
1979	0.2868	0.0271	1.453	0.238	8483	5837
1980	0.5863	0.0280	1.960	0.326	11663	5951
1981	0.4547	0.0290	1.717	0.291	14873	8661
1982	0.5230	0.0266	1.841	0.299	13677	7429
1983	0.3584	0.0311	1.558	0.273	11090	7118
1984	0.1012	0.0353	1.202	0.224	12065	10036
1985	0.0256	0.0338	1.115	0.204	16880	15133
1986	0.0425	0.0369	1.133	0.216	14972	13217
1987	0.4688	0.0240	1.746	0.269	44524	25499
1988	0.1591	0.0298	1.277	0.219	26999	21136
1989	0.0403	0.0311	1.134	0.199	13802	12175
1990	-0.3267	0.0324	0.785	0.140	11392	14516
1991	0.0140	0.0575	1.090	0.258	14824	13605
1992	-0.3967	0.2885	0.644	0.323	14815	23021

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.212

Table 11. Standardized catch rate series for Div. 3L from a multiplicative model utilizing days fished as a measure of effort.

PREDICTED CATCH RATE

YEAR	LN TRANSFORM MEAN	LN TRANSFORM S.E.	RETRANSFORMED MEAN	RETRANSFORMED S.E.	CATCH	EFFORT
1959	2.6700	0.0288	15.475	2.610	34107	2204
1960	2.7875	0.0368	17.334	3.302	11463	661
1961	2.8471	0.0397	18.373	3.629	8349	454
1962	2.7764	0.0436	17.084	3.536	3425	200
1963	3.0343	0.0571	21.963	5.180	8191	373
1964	3.2222	0.0841	26.144	7.436	3898	149
1965	2.7024	0.0726	15.637	4.144	9451	604
1966	2.5740	0.0377	13.996	2.695	6927	495
1967	2.8916	0.0461	19.147	4.070	7684	401
1968	2.7253	0.0479	16.199	3.509	2348	145
1969	2.6652	0.0464	15.266	3.255	927	61
1970	2.0569	0.0869	8.141	2.353	1029	126
1971	2.8524	0.1169	17.769	5.911	10043	565
1972	2.0742	0.0651	8.374	2.106	3095	370
1973	2.6478	0.1049	14.568	4.605	4709	323
1974	2.1628	0.2154	8.486	3.741	11419	1346
1975	2.3829	0.0701	11.374	2.964	3838	337
1976	2.6415	0.0184	15.119	2.045	15971	1056
1977	2.5863	0.0179	14.310	1.911	13452	940
1978	2.2807	0.0208	10.527	1.512	6318	600
1979	2.5098	0.0277	13.192	2.182	5584	423
1980	2.5633	0.0271	13.920	2.282	4367	314
1981	2.7609	0.0203	17.020	2.416	9407	553
1982	2.8683	0.0176	18.976	2.507	7870	415
1983	2.8531	0.0189	18.678	2.558	8657	463
1984	2.5872	0.0308	14.231	2.484	2696	189
1985	2.5118	0.0211	13.261	1.919	3677	277
1986	2.8093	0.0160	17.902	2.256	27833	1555
1987	2.6551	0.0188	15.322	2.094	33917	2214
1988	2.5571	0.0181	13.898	1.865	26267	1890
1989	2.8245	0.0251	18.093	2.855	19847	1097
1990	2.3603	0.0181	11.414	1.532	17710	1552
1991	2.4109	0.0424	11.862	2.421	10991	927
1992	2.3482	0.0719	10.978	2.895	9466	862

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.203

Table 12. Standardized catch rate series for Div. 3N from a multiplicative model utilizing days fished as a measure of effort.

PREDICTED CATCH RATE

YEAR	LN TRANSFORM MEAN	LN TRANSFORM S.E.	RETRANSFORMED MEAN	RETRANSFORMED S.E.	CATCH	EFFORT
1959	2.3030	0.0479	10.584	2.292	10478	990
1960	3.1556	0.0543	24.748	5.697	16547	669
1961	2.4825	0.0476	12.668	2.736	14826	1170
1962	2.5314	0.0527	13.268	3.010	18009	1357
1963	2.3180	0.0500	10.733	2.373	12906	1202
1964	2.3903	0.0571	11.496	2.713	4206	366
1965	2.5255	0.0795	13.014	3.604	4042	311
1966	2.6621	0.0455	15.175	3.207	10047	662
1968	2.5764	0.0730	13.738	3.651	15265	1111
1969	2.7865	0.0655	17.013	4.292	22142	1301
1970	2.8268	0.0666	17.703	4.503	13359	755
1971	2.6714	0.0960	14.934	4.526	24310	1628
1972	2.7627	0.0500	16.743	3.704	25838	1543
1973	2.5903	0.1233	13.584	4.634	28588	2105
1974	0.8767	0.2056	2.349	1.014	10867	4626
1975	2.9814	0.0768	20.558	5.599	14033	683
1976	2.2776	0.0562	10.276	2.405	4541	442
1977	2.7468	0.0816	16.221	4.548	3064	189
1978	2.4560	0.0689	12.205	3.154	5725	469
1979	2.7950	0.0394	17.385	3.425	8483	488
1980	2.8834	0.0511	18.880	4.220	11663	618
1981	2.6904	0.0548	15.537	3.595	14873	957
1982	2.6731	0.0462	15.338	3.266	13677	892
1983	2.6410	0.0491	14.831	3.251	11090	748
1984	2.5113	0.0616	12.946	3.169	12065	932
1985	2.2431	0.0530	9.944	2.263	16880	1698
1986	2.4688	0.0577	12.431	2.949	14972	1204
1987	2.7051	0.0443	15.852	3.304	44524	2809
1988	2.4442	0.0496	12.179	2.684	26999	2217
1989	2.4199	0.0507	11.880	2.646	13802	1162
1990	1.9891	0.0582	7.693	1.832	11392	1481
1991	2.3138	0.0709	10.576	2.772	14824	1402
1992	1.7646	0.2606	5.552	2.664	14815	2668

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.254

Table 13. Mean number per standard tow from various Canadian surveys in Div. 3L where strata greater than 366 m (200 fathoms) were sampled. Dashes (-) represent unsampled strata. Number of successful sets in brackets. G.A. = GADUS ATLANTICA, W.T. = WILFRED TEMPLEMAN, A.N. = ALFRED NEEDLER.

Stratum	Depth range (m)	Area (sq.n.mi)	Aug 16-Aug 29 1978 (G.A. 12)	Sep 4-Sep 10 1979 (G.A. 25)	May 8-May 13 1980 (G.A. 36)	Sep 18-Sep 26 1981 (G.A. 55)	Jul 26-Sep 3 1984 (W.T. 16-18)	Jan 10-Feb 11 1985-Q1 (W.T. 22-24)	Apr 17-May 26 1985-Q2 (W.T. 28-30)	Jul 27-Aug 25 1985-Q3 (W.T. 32-34)	Oct 9-Nov 18 1985-Q4 (W.T. 37-39)
347	184-274	983	131.67(3)	0.00(2)	0.00(4)	3.96(4)	0.00(6)	0.00(5)	0.40(5)	0.00(3)	0.00(5)
366	184-274	1394	197.00(3)	13.50(2)	9.83(6)	47.67(6)	13.91(11)	0.00(5)	1.33(6)	17.40(5)	17.22(9)
369	184-274	961	0.00(3)	1.00(2)	0.25(4)	13.75(4)	0.43(7)	0.00(5)	0.20(5)	0.17(6)	0.00(6)
386	184-274	983	115.67(3)	11.50(2)	2.00(4)	11.00(4)	23.13(8)	0.00(5)	0.40(5)	19.60(5)	0.60(5)
389	184-274	821	0.33(3)	0.00(1)	29.50(2)	4.00(3)	21.67(6)	4.00(4)	0.20(5)	1.75(4)	7.40(5)
391	184-274	282	0.00(2)	19.00(2)	4.00(2)	1.50(2)	0.50(2)	0.00(2)	0.00(2)	0.00(2)	12.50(2)
345	275-366	1432	68.50(2)	96.75(4)	12.00(4)	46.60(5)	37.80(7)	3.33(3)	3.20(5)	62.29(7)	5.11(9)
346	275-366	865	206.00(2)	126.75(4)	27.00(2)	70.33(3)	263.33(6)	10.00(4)	20.00(2)	91.33(3)	84.40(5)
368	275-366	334	2709.00(2)	140.00(3)	24.00(2)	526.50(2)	4379.50(2)	4.50(2)	14.50(2)	320.50(2)	351.50(2)
387	275-366	718	532.00(2)	595.40(5)	23.67(3)	1748.67(3)	4678.00(3)	102.00(4)	11.33(6)	1807.33(3)	628.00(4)
388	275-366	361	1240.50(2)	2326.33(3)	4.50(2)	464.50(2)	195.00(2)	16.00(3)	20.00(2)	397.00(2)	78.00(2)
392	275-366	145	-	818.00(3)	27.33(3)	536.50(2)	2811.00(2)	4.00(2)	10.00(2)	131.50(2)	1398.50(2)
735	367-549	272	810.50(2)	452.67(3)	39.00(2)	768.00(2)	723.33(3)	10.50(2)	52.50(2)	282.00(2)	232.00(2)
733	367-549	468	817.00(2)	1300.67(3)	43.67(3)	1420.50(2)	480.00(4)	1921.67(3)	1147.53(3)	1699.50(2)	727.00(3)
731	367-549	216	486.00(2)	457.00(3)	325.50(2)	176.00(2)	257.00(2)	80.67(3)	63.00(2)	257.00(2)	502.00(2)
729	367-549	186	-	488.00(3)	77.00(1)	1050.00(2)	448.00(2)	3406.00(2)	24.50(2)	1231.00(2)	2720.50(2)
736	550-731	175	163.50(2)	270.33(3)	119.00(1)	84.00(2)	17.00(1)	-	532.50(2)	26.50(2)	222.00(2)
734	550-731	228	1435.50(2)	535.67(3)	1756.00(2)	760.50(2)	557.00(3)	195.50(2)	366.00(2)	912.00(2)	540.00(2)
732	550-731	231	85.50(2)	54.00(2)	104.00(2)	53.00(2)	90.00(2)	416.00(2)	141.50(2)	48.00(2)	39.00(2)
730	550-731	170	1135.00(2)	399.33(3)	295.00(2)	496.50(2)	100.50(2)	816.00(2)	8926.00(2)	347.00(2)	37.50(2)
Upper (95% CI)*			653.4	544.2	266.4	680.1	1078.5	302.2	1909.1	465.2	290.3
Weighted mean (by area) (incl. strata with 1 set)			349.3	257.3	64.5	293.5	567.5	174.7	208.7	286.8	187.9
Lower (95% CI)*			45.2	11.03	-139.6	-93.2	73.94	47.2	-1491.7	108.5	85.5
Abundance of surveyed area ($\times 10^{-6}$)			285.6	216.8	54.3	247.3	478.2	144.9	175.9	241.7	158.3

*Confidence interval of mean for those strata with at least two sets.

Table 13. (Cont'd.)

Stratum	Depth range (m)	Area (sq.n.mi)	Jan 22-Feb 27 1986-Q1 (W.T. 42-44)	Nov 13-Nov 30 1986-Q4 (A.N. 72)	Jan 17-Jan 25 1990-Q1 (W.T. 90)	Aug 7-Aug 19 1990-Q3 (W.T. 98)	Oct 18-Nov 18 1990-Q4 (W.T. 101)	May 11-May 29 1991-Q2 (W.T. 106-7)	Aug 4-Aug 11 1991-Q3 (W.T. 109)	Nov 10-Dec 2 1991-Q4 (W.T. 114-115)
347	184-274	983	1.50(4)	0.00(4)	0.50(4)	1.93(4)	0.00(2)	0.25(2)	0.00(3)	0.00(4)
366	184-274	1394	1.50(2)	5.50(4)	1.00(5)	9.00(4)	0.00(6)	-	0.33(3)	0.19(21)
369	184-274	961	0.00(3)	4.24(3)	0.00(4)	2.50(4)	0.00(4)	0.00(2)	6.50(4)	0.56(9)
386	184-274	983	0.86(7)	4.10(4)	5.50(4)	1.29(7)	2.00(4)	0.67(3)	1.00(3)	0.00(3)
389	184-274	821	1.50(4)	2.25(4)	0.00(3)	5.33(3)	1.00(3)	1.67(3)	0.33(3)	0.00(3)
391	184-274	282	0.00(3)	18.00(2)	0.50(2)	1.00(5)	0.00(2)	0.00(3)	5.67(3)	0.00(3)
345	275-366	1432	1.33(3)	6.68(4)	0.40(5)	16.33(6)	1.00(5)	0.67(3)	4.50(4)	0.25(4)
346	275-366	865	4.25(4)	22.13(3)	14.67(3)	247.66(7)	67.00(3)	-	30.00(4)	6.80(15)
368	275-366	334	7.00(1)	24.90(2)	21.00(2)	1728.57(7)	57.50(2)	-	409.75(4)	31.17(6)
387	275-366	718	12.00(4)	6.00(2)	135.00(3)	297.70(10)	89.67(3)	45.00(3)	189.40(5)	13.00(5)
388	275-366	361	15.67(3)	-	13.00(2)	183.86(7)	16.00(2)	13.53(3)	50.33(3)	12.33(3)
392	275-366	145	9.67(3)	359.50(2)	4.00(2)	146.56(9)	9.00(2)	2.50(2)	350.67(3)	4.67(3)
735	367-549	272	-	153.50(2)	223.00(2)	603.51(6)	195.00(1)	-	106.82(3)	125.67(3)
733	367-549	468	452.07(2)	-	72.00(2)	490.87(9)	216.00(2)	16.00(2)	611.00(4)	340.00(3)
731	367-549	216	153.00(1)	220.80(1)	68.00(2)	166.83(6)	275.50(2)	27.50(2)	244.00(3)	41.00(3)
729	367-549	186	2690.00(2)	1491.22(2)	206.50(2)	328.43(7)	206.50(2)	19.00(2)	190.00(2)	142.00(3)
736	550-731	175	-	24.74(2)	208.50(2)	93.50(6)	281.00(2)	-	12.67(3)	51.00(2)
734	550-731	228	451.00(2)	-	142.93(2)	271.60(5)	42.00(2)	231.60(2)	59.67(3)	16.00(2)
732	550-731	231	1694.00(1)	-	68.00(2)	59.44(9)	193.00(2)	300.00(2)	96.67(3)	39.00(2)
730	550-731	170	1822.50(1)	-	109.50(2)	183.52(4)	42.00(1)	178.00(2)	222.33(3)	348.50(2)
Upper (95% CI)*			466.0	66.3	62.5	263.8	63.1	123.2	94.9	58.3
Weighted mean (by area) (incl. strata with 1 set)			146.4	49.9	33.9	156.2	45.9	25.7	76.9	30.4
Lower (95% CI)*			-294.7	25.8	5.3	48.6	21.3	-71.9	58.8	2.5
Abundance of surveyed area ($\times 10^{-6}$)			118.5	36.6	28.6	131.6	38.7	15.8	64.8	25.6

*Confidence interval of mean for those strata with at least two sets.

Table 13. (Cont'd.)

Stratum	Depth range (m)	Area (sq.n.mi)	May 13-Jun 7 1992-Q2 (W.T. 120-122)	Nov 5-Nov 29 1992-Q4 (W.T. 129-130)
347	184-274	983	0.00(4)	0.00(2)
366	184-274	1394	0.33(6)	1.00(24)
369	184-274	961	0.00(4)	0.00(8)
386	184-274	983	0.00(4)	0.00(3)
389	184-274	821	0.00(3)	0.67(3)
391	184-274	282	2.50(2)	0.00(3)
345	275-366	1432	0.00(6)	0.25(4)
346	275-366	865	1.75(4)	2.64(14)
368	275-366	334	12.00(2)	18.20(10)
387	275-366	718	8.00(3)	10.00(3)
388	275-366	361	2.00(2)	20.00(3)
392	275-366	145	3.50(2)	3.33(3)
735	367-549	272	76.50(2)	222.33(3)
733	367-549	468	53.00(2)	210.00(3)
731	367-549	216	26.00(2)	205.00(3)
729	367-549	186	59.50(2)	296.50(2)
736	550-731	175	60.50(2)	45.50(2)
734	550-731	228	140.00(2)	108.00(2)
732	550-731	231	214.50(2)	198.50(2)
730	550-731	170	113.50(2)	69.50(2)
Upper (95% CI)[a]			38.6	49.8
Weighted mean (by area) (incl. strata with 1 set)			16.7	33.3
Lower (95% CI)[a]			-5.2	16.8
Abundance of surveyed area ($\times 10^{-6}$)			14.1	28.1

[a]Confidence interval of mean for those strata with at least two sets.

Table 14. Mean weight (kg) per standard tow from various Canadian surveys in Div. 3L where strata greater than 366 m (200 fathoms) were sampled. Dashes (-) represent unsampled strata. Number of successful sets in brackets. G.A. = GADUS ATLANTICA, W.T. = WILFRED TEMPLEMAN, A.N. = ALFRED NEEDLER.

Stratum	Depth range (m)	Area (sq. n. mi)	Aug 16-Aug 29 1978 (G.A. 12)	Sep 4-Sep 10 1979 (G.A. 25)	May 8-May 13 1980 (G.A. 36)	Sep 18-Sep 26 1981 (G.A. 55)	Jul 26-Sep 3 1984 (W.T. 16-18)	Jan 10-Feb 11 1985-Q1 (W.T. 22-24)	Apr 17-May 26 1985-Q2 (W.T. 28-30)	Jul 27-Aug 25 1985-Q3 (W.T. 32-34)	Oct 9-Nov 18 1985-Q4 (W.T. 37-39)
347	184-274	983	42.52(3)	0.00(2)	0.00(4)	1.32(4)	0.00(6)	0.00(5)	0.00(5)	0.00(3)	0.00(5)
366	184-274	1394	35.42(3)	1.82(2)	2.00(6)	25.01(6)	1.14(11)	0.00(5)	0.05(6)	4.00(5)	5.33(9)
369	184-274	961	0.00(3)	0.80(2)	0.25(4)	2.40(4)	0.00(7)	0.00(5)	0.20(5)	0.17(6)	0.00(6)
386	184-274	983	62.99(3)	11.34(2)	1.25(4)	8.50(4)	14.18(8)	0.00(5)	0.21(5)	15.30(5)	0.44(5)
389	184-274	821	0.03(3)	0.00(1)	9.25(2)	2.33(3)	8.83(6)	0.50(4)	0.01(5)	0.63(4)	1.46(5)
391	184-274	282	0.00(2)	6.39(2)	0.75(2)	0.08(2)	0.03(2)	0.00(2)	0.00(2)	0.00(2)	4.00(2)
345	275-366	1432	51.08(2)	78.92(4)	8.50(4)	35.80(5)	31.10(7)	0.83(3)	3.14(5)	44.41(7)	3.32(9)
346	275-366	865	151.18(2)	80.88(4)	14.75(2)	64.83(3)	163.33(6)	5.80(4)	18.25(2)	67.50(3)	61.50(5)
368	275-366	334	1154.53(2)	61.72(3)	7.25(2)	176.75(2)	1915.75(2)	2.00(2)	5.35(2)	181.75(2)	151.50(2)
387	275-366	718	203.16(2)	286.77(5)	6.83(3)	572.00(3)	1972.33(3)	71.50(4)	4.68(6)	633.03(3)	279.17(4)
388	275-366	361	262.18(2)	562.10(3)	1.10(2)	145.50(2)	63.00(2)	14.17(3)	7.65(2)	130.50(2)	30.75(2)
392	275-366	145	-	304.24(3)	7.50(3)	146.75(2)	1118.44(2)	1.40(2)	1.50(2)	45.75(2)	451.50(2)
735	367-549	272	603.98(2)	252.05(3)	14.50(2)	348.00(2)	442.00(3)	4.50(2)	20.50(2)	186.00(2)	127.75(2)
733	367-549	468	460.96(2)	647.34(3)	18.83(3)	754.00(2)	280.63(4)	895.28(3)	623.43(3)	1023.50(2)	353.76(3)
731	367-549	216	289.42(2)	255.57(3)	112.25(2)	69.00(2)	120.00(2)	29.17(3)	16.00(2)	121.50(2)	275.50(2)
729	367-549	186	-	199.53(3)	24.00(1)	413.50(2)	203.43(2)	1249.00(2)	7.25(2)	560.00(2)	1213.50(2)
736	550-731	175	61.59(2)	116.73(3)	28.00(1)	42.25(2)	11.00(1)	-	152.00(2)	17.25(2)	107.75(2)
734	550-731	228	1084.93(2)	357.43(3)	1187.45(2)	430.64(2)	350.00(3)	119.75(2)	146.75(2)	598.50(2)	387.13(2)
732	550-731	231	47.44(2)	29.94(2)	30.25(2)	30.50(2)	49.25(2)	217.50(2)	56.00(2)	33.00(2)	22.00(2)
730	550-731	170	509.74(2)	238.85(3)	96.75(2)	263.25(2)	57.25(2)	408.00(2)	4710.00(2)	195.50(2)	19.75(2)
Upper (95% CI)*			252.9	164.5	185.3	245.6	536.8	111.3	1008.1	264.9	278.7
Weighted mean (by area) (incl. strata with 1 set)			163.5	114.6	34.4	124.4	255.5	78.7	107.3	138.3	88.8
Lower (95% CI)*			74.13	82.8	-115.9	3.2	-18.1	46.1	-793.4	11.7	-101.1
Trawlable biomass (t) of surveyed area			133724	96536	29001	104817	215259	65282	90432	116543	74828

*Confidence interval of mean for those strata with at least two sets.

Table 14. (Cont'd.)

Stratum	Depth range (m)	Area (sq.n.mi)	Jan 22-Feb 27 1986-Q1 (W.T. 42-44)	Nov 13-Nov 30 1986-Q4 (A.N. 72)	Jan 17-Jan 25 1990-Q1 (W.T. 90)	Aug 7-Aug 19 1990-Q3 (W.T. 98)	Oct 18-Nov 18 1990-Q4 (W.T. 101)	May 11-May 29 1991-Q2 (W.T. 106-7)	Aug 4-Aug 11 1991-Q3 (W.T. 109)	Nov 10-Dec 24 1991-Q4 (W.T. 114-115)
347	184-274	983	0.08(4)	0.00(4)	0.06(4)	0.63(4)	0.00(2)	0.00(4)	0.00(3)	0.00(4)
366	184-274	1394	0.01(2)	2.13(4)	0.04(5)	2.56(4)	0.00(6)	-	0.10(3)	0.03(21)
369	184-274	961	0.00(3)	0.71(3)	0.00(4)	0.79(4)	0.00(4)	0.00(2)	3.27(4)	0.12(9)
386	184-274	983	0.45(7)	0.34(4)	3.21(4)	0.09(7)	0.05(4)	0.02(3)	0.20(3)	0.00(3)
389	184-274	821	0.15(4)	0.84(4)	0.00(3)	0.85(3)	0.54(3)	0.07(3)	0.22(3)	0.00(3)
391	184-274	282	0.00(3)	3.50(2)	0.01(2)	0.26(5)	0.00(2)	0.00(2)	1.40(3)	0.00(3)
345	275-366	1432	0.04(3)	5.21(4)	0.02(5)	8.66(6)	0.53(5)	0.07(3)	2.13(4)	0.12(4)
346	275-366	865	1.08(4)	16.80(3)	3.22(3)	172.19(7)	38.98(3)	-	11.46(4)	2.59(15)
368	275-366	334	1.70(1)	7.25(2)	5.10(2)	737.95(7)	14.25(2)	-	153.78(4)	6.80(6)
387	275-366	718	8.00(4)	3.10(2)	75.92(3)	115.68(10)	35.05(3)	12.73(3)	61.37(5)	6.08(5)
388	275-366	361	5.33(3)	-	2.85(2)	47.46(7)	3.30(2)	1.56(3)	8.13(3)	1.67(3)
392	275-366	145	4.10(3)	113.25(2)	2.08(2)	35.49(9)	2.32(2)	0.48(2)	133.63(3)	0.56(3)
735	367-549	272	-	63.50(2)	51.22(2)	417.61(6)	70.45(1)	-	47.01(3)	30.17(3)
733	367-549	468	238.22(2)	-	30.00(2)	314.42(9)	59.60(2)	5.83(2)	282.51(5)	100.25(3)
731	367-549	216	69.00(1)	105.60(1)	18.38(2)	66.18(6)	116.86(2)	5.47(2)	78.32(3)	9.65(3)
729	367-549	186	1118.30(2)	480.88(2)	121.20(2)	175.09(7)	94.00(2)	4.45(2)	86.38(2)	40.88(3)
736	550-731	175	-	14.38(2)	65.63(2)	51.32(6)	156.25(2)	-	6.43(3)	22.02(2)
734	550-731	228	296.90(2)	-	80.68(2)	164.97(5)	23.00(2)	43.29(2)	37.08(3)	11.00(2)
732	550-731	231	850.50(1)	-	37.75(2)	31.32(9)	118.85(2)	56.35(2)	44.95(3)	19.08(2)
730	550-731	170	767.81(1)	-	59.68(2)	107.15(4)	25.90(1)	45.30(2)	120.32(3)	247.68(2)
Upper (95% CI)*			202.7	24.8	31.9	130.0	29.9	11.7	40.8	19.8
Weighted mean (by area) (incl. strata with 1 set)			68.6	18.5	14.9	80.1	19.7	5.53	31.5	11.4
Lower (95% CI)*			-121.9	8.3	-2.1	30.1	6.6	-0.6	22.1	2.9
Trawlable biomass (t) of surveyed area			55514	13568	12525	67453	16563	3399	26510	9576

*Confidence interval of mean for those strata with at least two sets.

Table 14. (Cont'd.)

Stratum	Depth range (m)	Area (sq.n.mi)	May 13-Jun 7 1992-Q2 (W.T. 120-122)	Nov 5-Nov 29 1992-Q4 (W.T. 129-130)
347	184-274	983	0.00(4)	0.00(2)
366	184-274	1394	0.08(6)	0.28(24)
369	184-274	961	0.00(4)	0.00(8)
386	184-274	983	0.00(4)	0.00(3)
389	184-274	821	0.00(3)	0.03(3)
391	184-274	282	0.40(2)	0.00(3)
345	275-366	1432	0.00(6)	0.19(4)
346	275-366	865	0.50(4)	0.83(14)
368	275-366	334	4.70(2)	4.60(10)
387	275-366	718	2.47(3)	2.43(3)
388	275-366	361	0.30(2)	3.27(3)
392	275-366	145	1.63(2)	0.55(3)
735	367-549	272	20.88(2)	79.35(3)
733	367-549	468	16.83(2)	68.35(3)
731	367-549	216	6.75(2)	46.25(3)
729	367-549	186	13.70(2)	89.72(2)
736	550-731	175	17.38(2)	13.60(2)
734	550-731	228	51.63(2)	43.58(2)
732	550-731	231	71.70(2)	67.80(2)
730	550-731	170	41.40(2)	36.53(2)
Upper (95% CI)*			12.5	16.2
Weighted mean (by area) (incl. strata with 1 set)			5.4	10.7
Lower (95% CI)*			-1.7	5.3
Trawlable biomass (t) of surveyed area			4528	9037

*Confidence interval of mean for those strata with at least two sets.

Table 15 Mean number per standard tow from various Canadian surveys in Div. 3N where strata greater than 366 m (200 fathoms) were sampled. Dashes (-) represent unsampled strata. Number of successful sets in brackets. W.T. = Wilfred Templeman.

Stratum	Depth range (m)	Area (sq. n. mi.)	May 3-11 1991-Q2 (W.T. 106)	Aug 11-18 1991-Q3 (W.T. 109)	Oct 27-Nov 10 1991-Q4 (W.T. 113-114)	May 2-May 13 1992-Q2 (W.T. 119-120)	Oct 26-Nov 5 1992-Q4 (W.T. 128-129)
382	93-183	647	0.50(2)	0.00(3)	0.00(3)	0.00(3)	0.00(2)
377	93-183	100	0.00(2)	0.00(2)	0.00(1)	0.00(2)	0.00(2)
359	93-183	421	0.50(2)	26.25(4)	0.00(2)	0.00(2)	0.00(2)
381	185-274	182	0.50(2)	5.00(3)	1.00(2)	1.00(2)	-
378	185-274	139	5.33(3)	13.00(3)	177.00(2)	7.50(2)	1.50(2)
358	185-274	225	9.00(2)	677.00(3)	1867.50(2)	6.00(2)	18258.00(2)
380	275-366	116	1.00(2)	3856.00(2)	197.00(2)	0.00(2)	-
379	275-366	106	30.00(2)	6305.20(2)	57.00(1)	6.50(2)	94.50(2)
357	275-366	164	101.50(2)	2649.00(2)	2380.00(2)	105.00(2)	4188.00(2)
727	367-549	160	15.50(2)	121.44(4)	-	9.00(2)	-
725	367-549	105	148.00(2)	502.67(3)	378.33(1)	219.00(1)	2083.70(2)
723	367-549	155	158.00(2)	328.00(1)	170.00(2)	236.50(2)	-
728	550-731	156	72.50(2)	66.50(4)	-	85.00(2)	-
726	550-731	72	402.00(2)	91.00(2)	74.00(1)	89.50(2)	-
724	550-731	124	446.85(2)	61.00(1)	34.76(2)	80.50(2)	-
Upper (95% CI)[a]			134.6	2964.8	850.2	55.1	23024.8
Weighted mean (by area) (Incl. strata with 1 set)			56.2	648.9	367.7	38.5	2634.5
Lower (95% CI)[a]			-22.2	-1572.3	-32.2	8.7	-17755.9
Abundance of surveyed area ($X 10^{-6}$)			12.1	139.9	70.6	6.6	377.1

[a]Confidence interval of mean for those strata with at least 2 sets.

Table 16. Mean weight (kg) per standard tow from various Canadian surveys in Div. 3N where strata greater than 366 m (200 fathoms) were sampled. Dashes (-) represent unsampled strata. Number of successful sets in brackets. W.T. = Wilfred Templeman.

Stratum	Depth range (m)	Area (sq. n. mi.)	May 3-11 1991-Q2 (W.T. 106)	Aug 11-18 1991-Q3 (W.T. 109)	Oct 27-Nov 10 1991-Q4 (W.T. 113-114)	May 2-May 13 1992-Q2 (W.T. 119-120)	Oct 26 - Nov 5 1992-Q4 (W.T. 128-129)
382	93-183	647	0.16(2)	0.00(3)	0.00(3)	0.00(3)	0.00(2)
377	93-183	100	0.00(2)	0.00(2)	0.00(1)	0.00(2)	0.00(2)
359	93-183	421	0.00(2)	0.60(4)	0.00(2)	0.00(2)	0.00(2)
381	185-274	182	0.13(2)	0.97(3)	0.09(2)	0.17(2)	-
378	185-274	139	0.88(3)	3.68(3)	57.39(2)	1.10(2)	0.38(2)
358	185-274	225	0.18(2)	106.19(3)	132.02(2)	0.30(2)	2176.10(2)
380	275-366	116	0.03(2)	1041.38(2)	53.54(2)	0.00(2)	-
379	275-366	106	3.14(2)	949.58(2)	7.25(1)	0.73(2)	13.28(2)
357	275-366	164	11.13(2)	576.92(2)	324.18(2)	5.95(2)	674.36(2)
727	367-549	160	2.85(2)	40.73(4)	-	1.20(2)	-
725	367-549	105	18.78(2)	177.22(3)	127.50(1)	27.05(1)	589.09(2)
723	367-549	155	19.05(2)	188.85(1)	46.42(2)	31.20(2)	-
728	550-731	156	22.20(2)	30.75(4)	-	23.95(2)	-
726	550-731	72	97.75(2)	41.17(2)	40.05(1)	26.80(2)	-
724	550-731	124	76.18(2)	36.10(1)	26.17(2)	18.33(2)	-
Upper (95% CI)			24.4	729.9	160.7	10.3	2769.5
Weighted mean (by area)			9.7	141.7	48.7	6.0	348.0
Lower (95% CI)			-5.1	-442.0	-61.7	0.0	-2073.6
Trawlable biomass (t) of surveyed area			2085	30552	9350	1071	49807

*Confidence interval of mean for those strata with at least 2 sets.

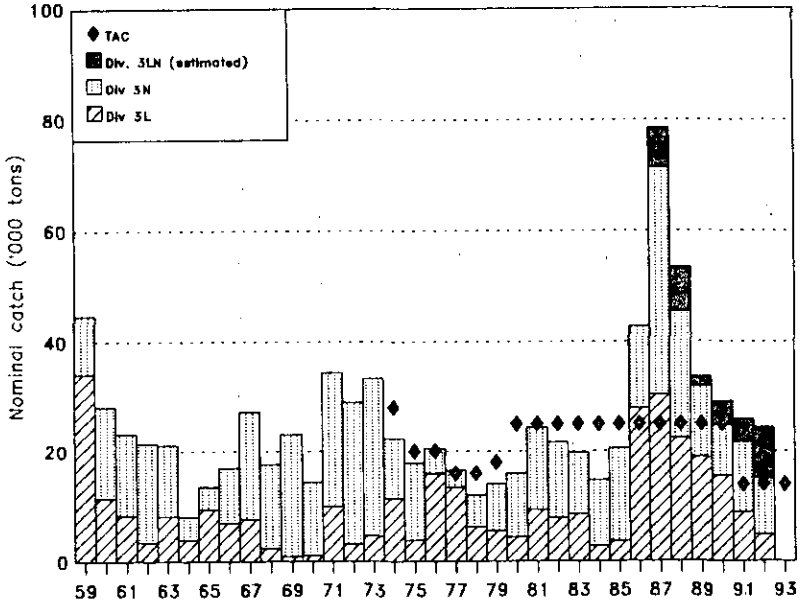

Fig. 1. Nominal catches and TACs of redfish in Div. 3LN (1990–92 are provisional).

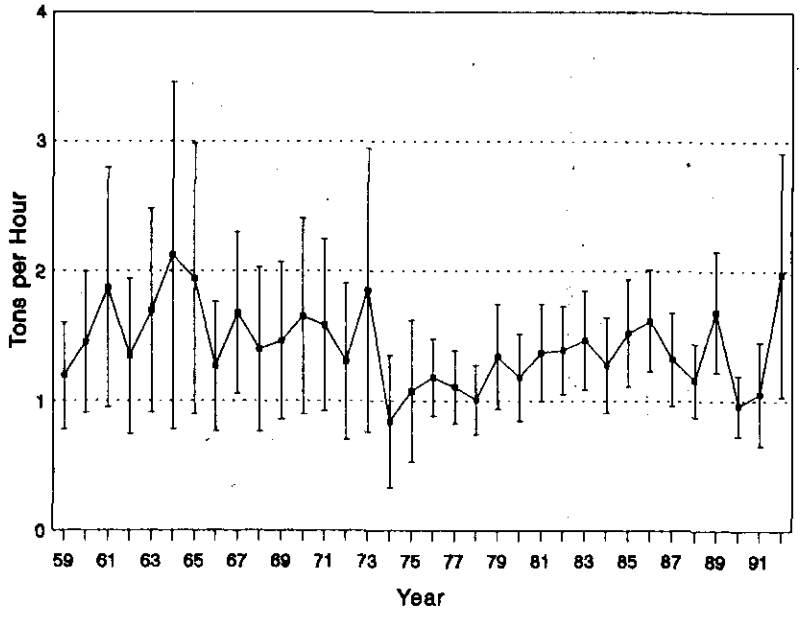

Fig. 2a. Standardized CPUE (tons per hour fished) with approximate 95% confidence intervals for Div. 3L redfish from 1959-1992.

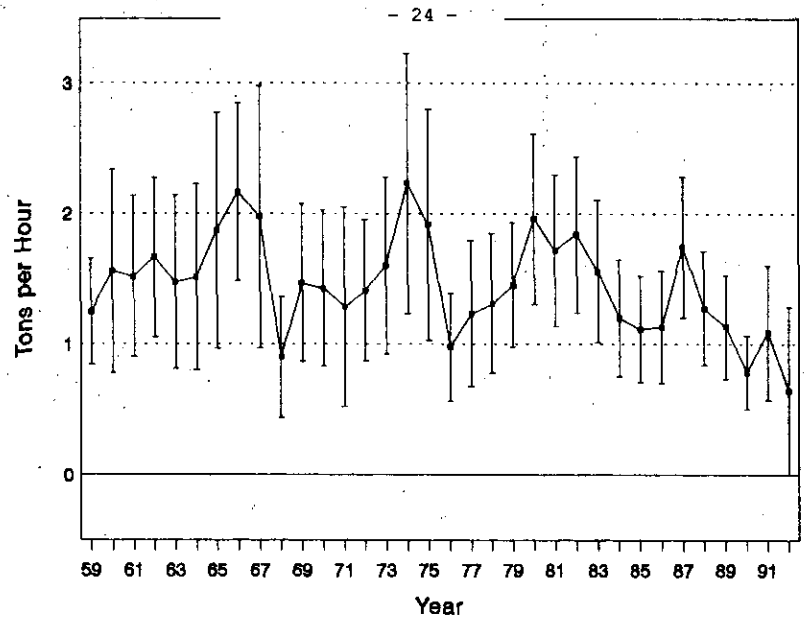

Fig. 2b. Standardized CPUE (tons per hour fished) with approximate 95% confidence intervals for Div. 3N redfish from 1959-1992.

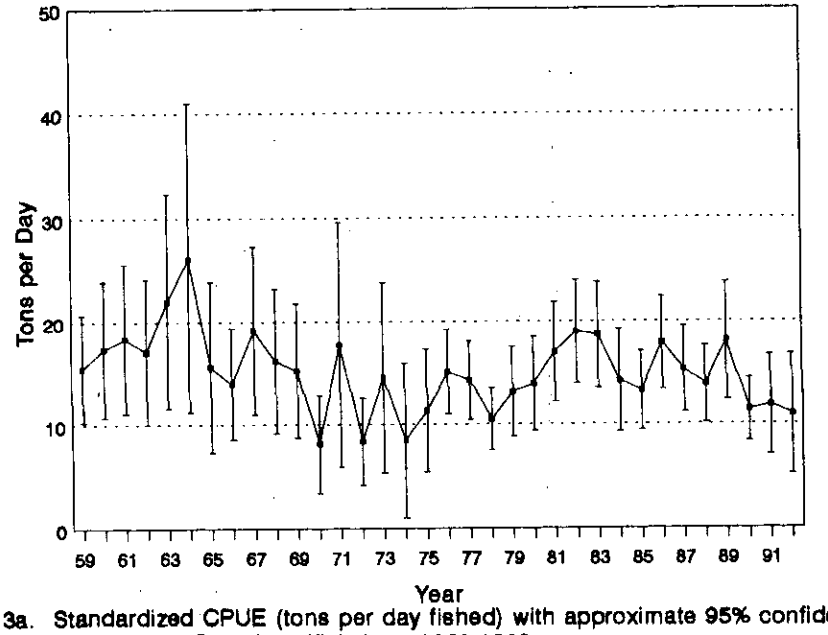

Fig. 3a. Standardized CPUE (tons per day fished) with approximate 95% confidence intervals for Div. 3L redfish from 1959-1992.

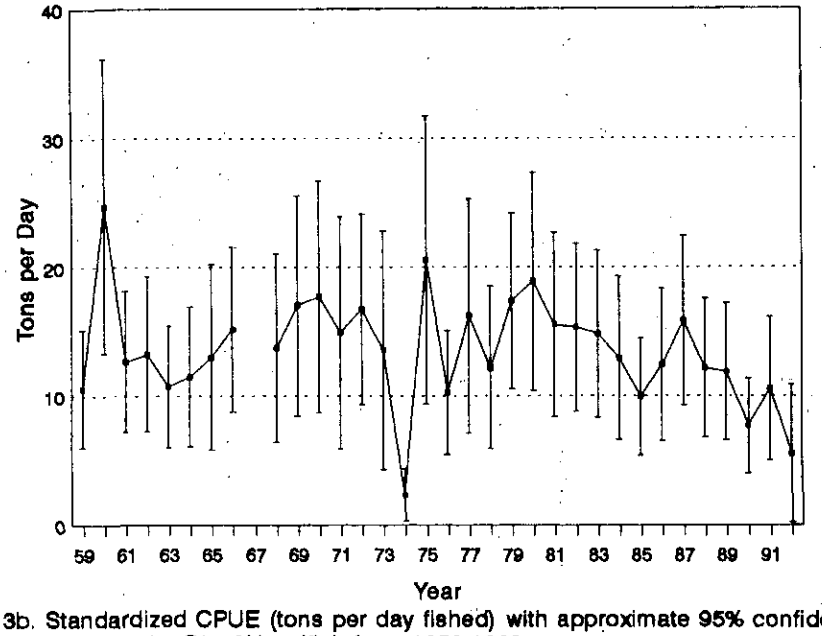

Fig. 3b. Standardized CPUE (tons per day fished) with approximate 95% confidence intervals for Div. 3N redfish from 1959-1992.

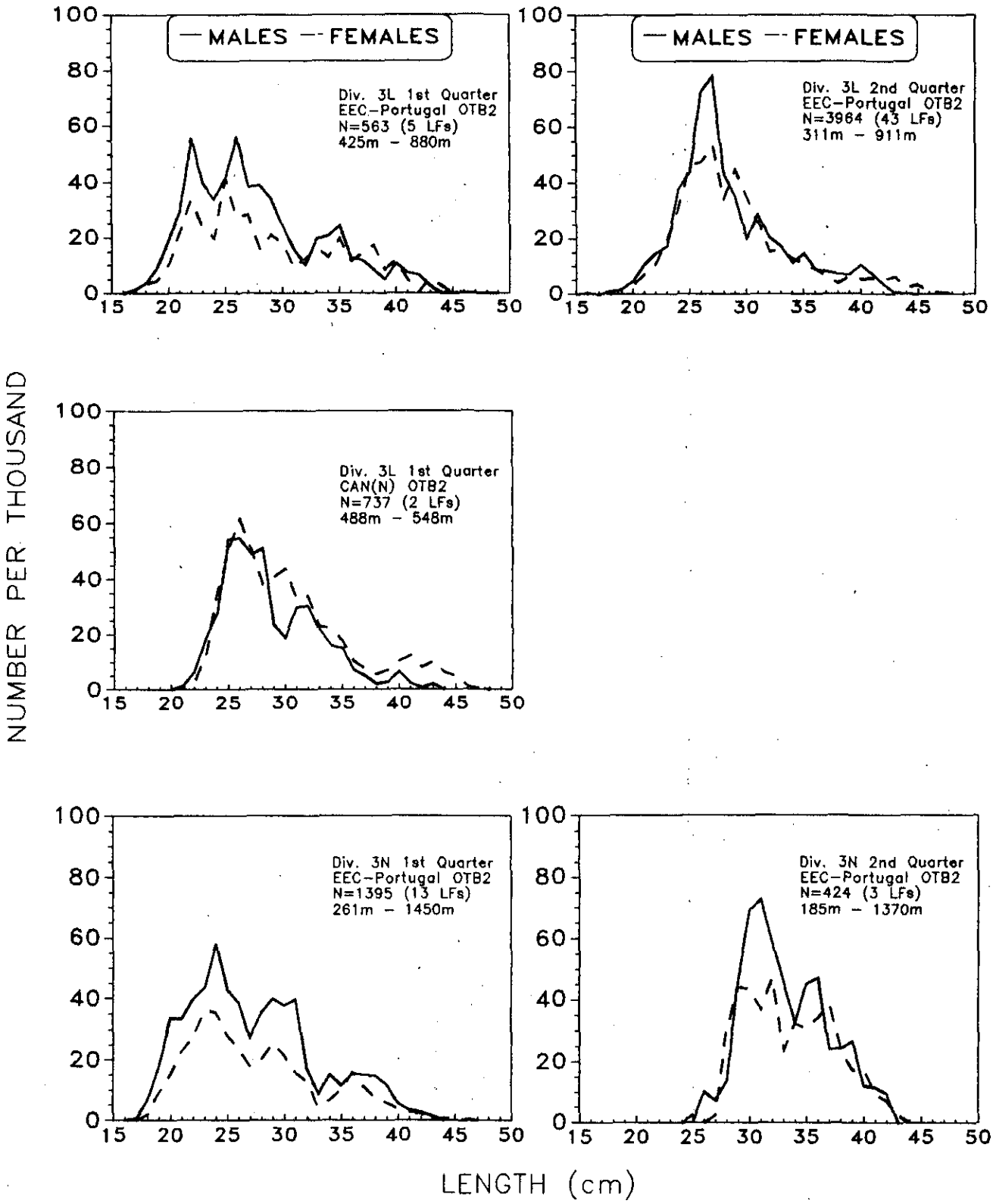

Fig. 4. Length frequencies from sampling of commercial fisheries in Div. 3L and 3N in 1992.

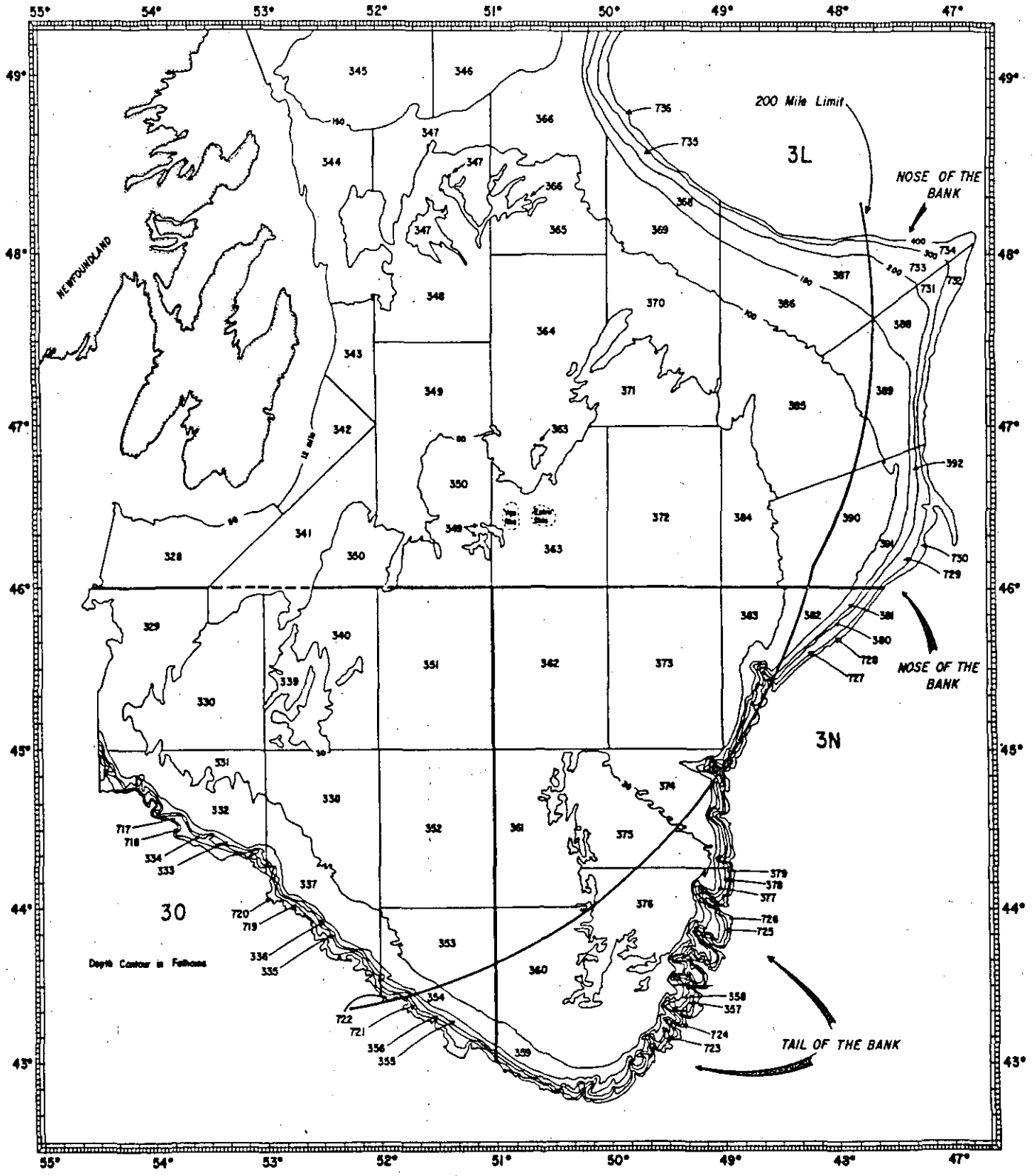

Fig. 5. Stratification scheme for NAFO Divisions 3LNO showing the boundary line between the Canadian economic zone and the Regulatory area.

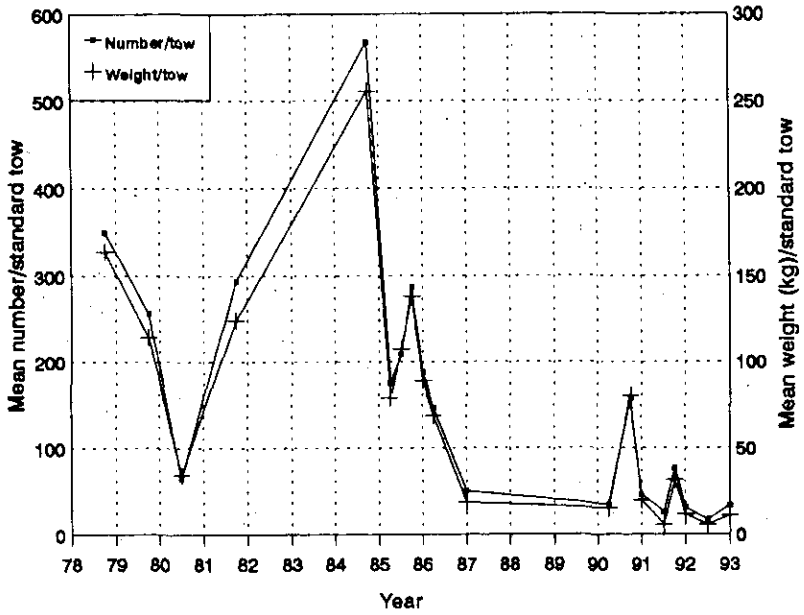

Fig 6. Stratified mean number and weight per standard tow in Div. 3L from various Canadian surveys where strata greater than 366 m were surveyed.

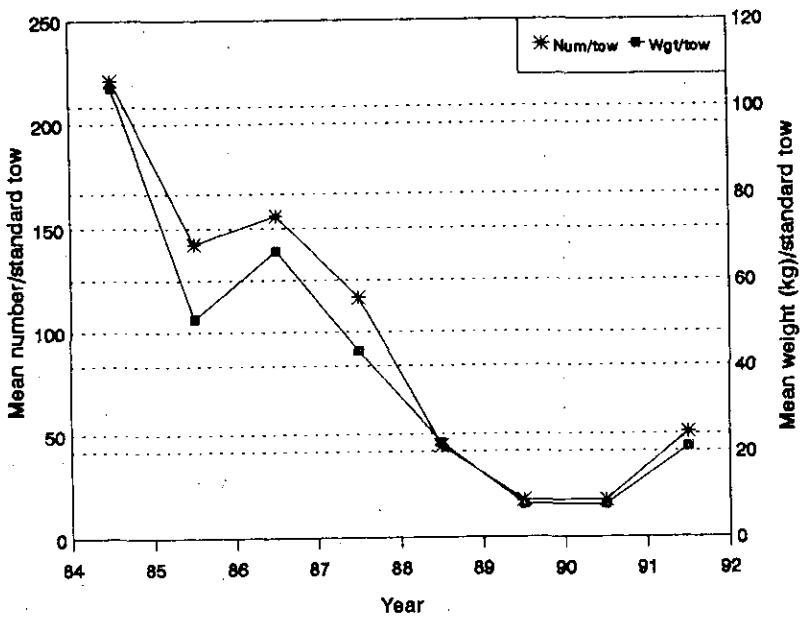

Fig 7. Stratified mean number and weight per standard tow from Russian surveys in Div. 3L.

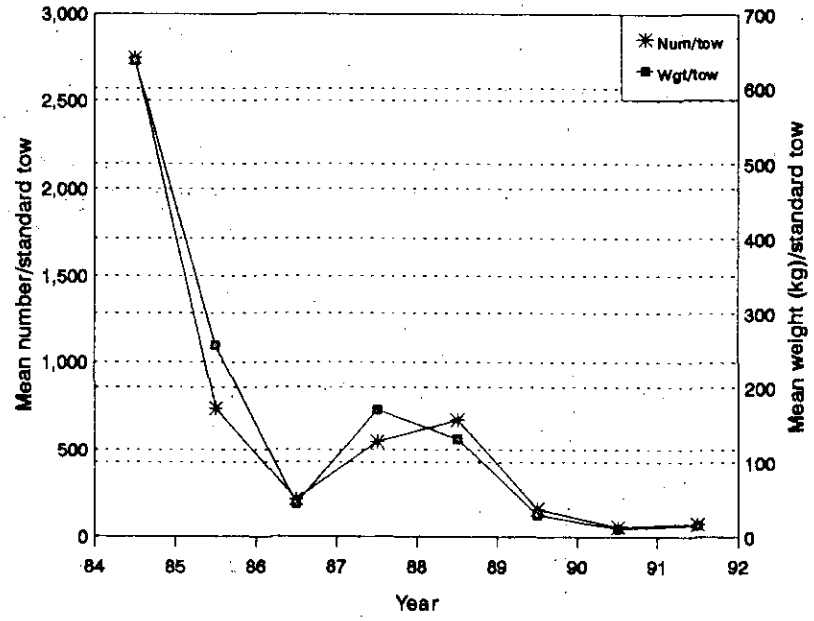

Fig 8. Stratified mean number and weight per standard tow from Russian surveys in Div. 3N.

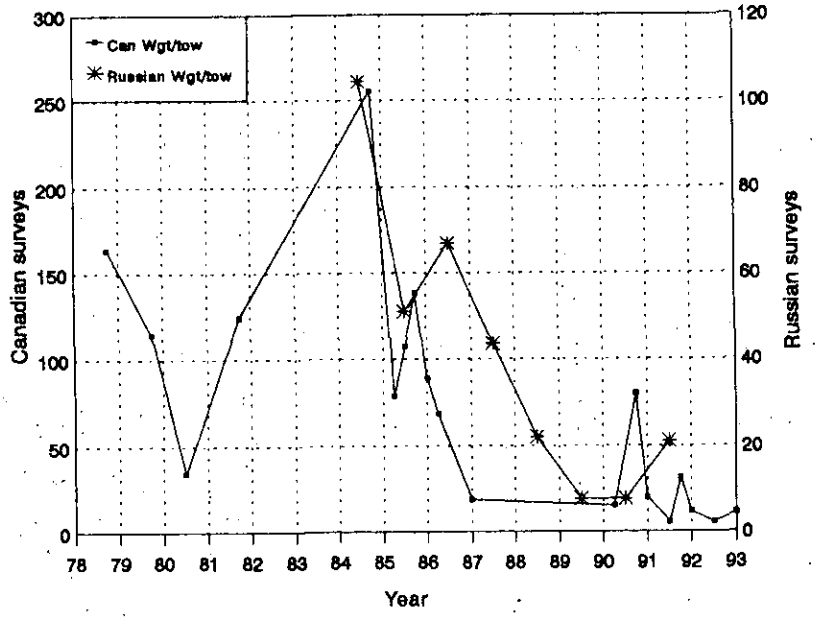

Fig 9. Stratified mean weight (kg) per standard tow in Div. 3L from Canadian and Russian surveys where strata greater than 366 m were surveyed.

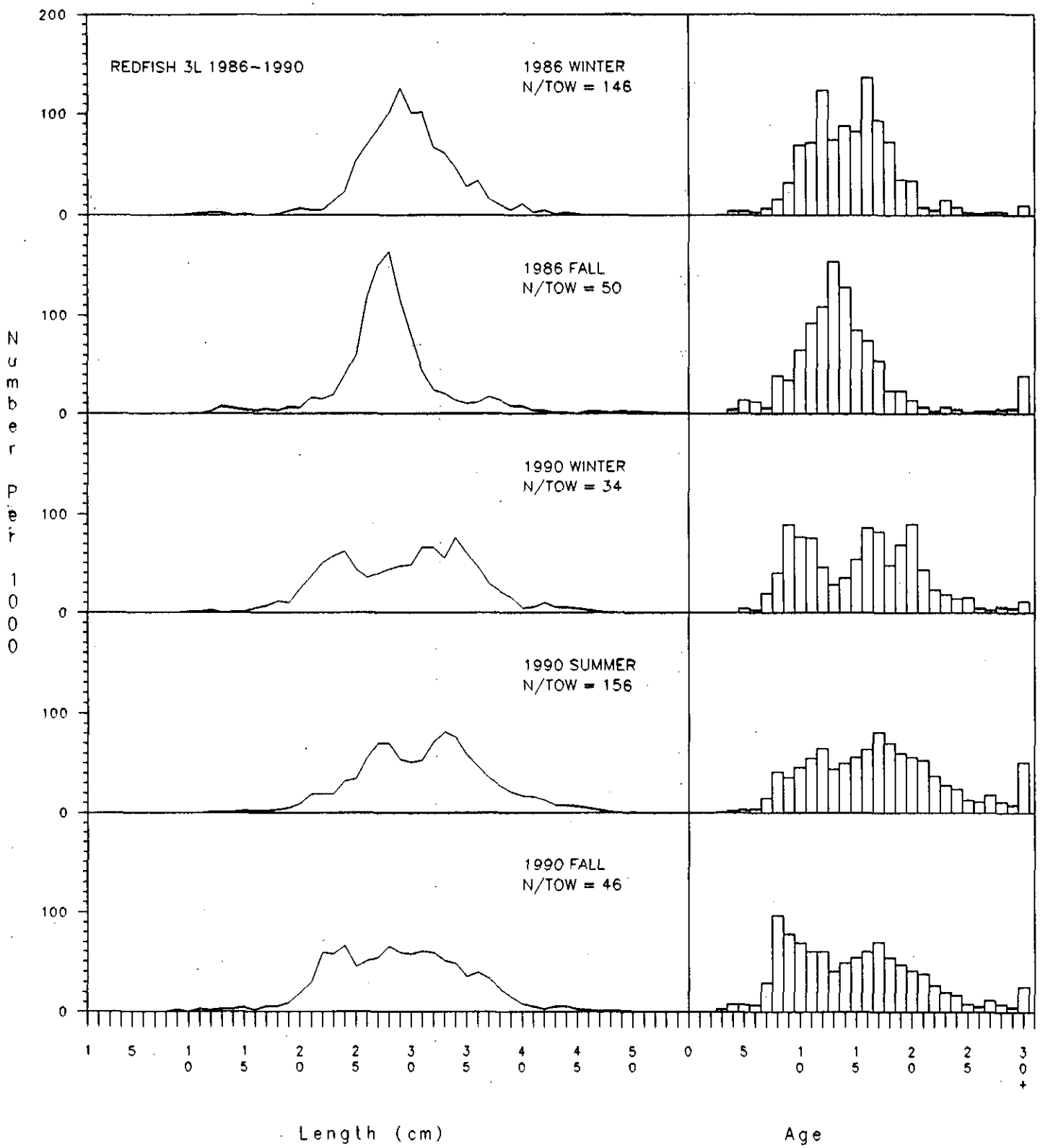

Figure 10. Length frequencies and corresponding age distribution from various stratified random research surveys where strata greater than 366 m (200 fathoms) were sampled in Div. 3L from 1986-1990.

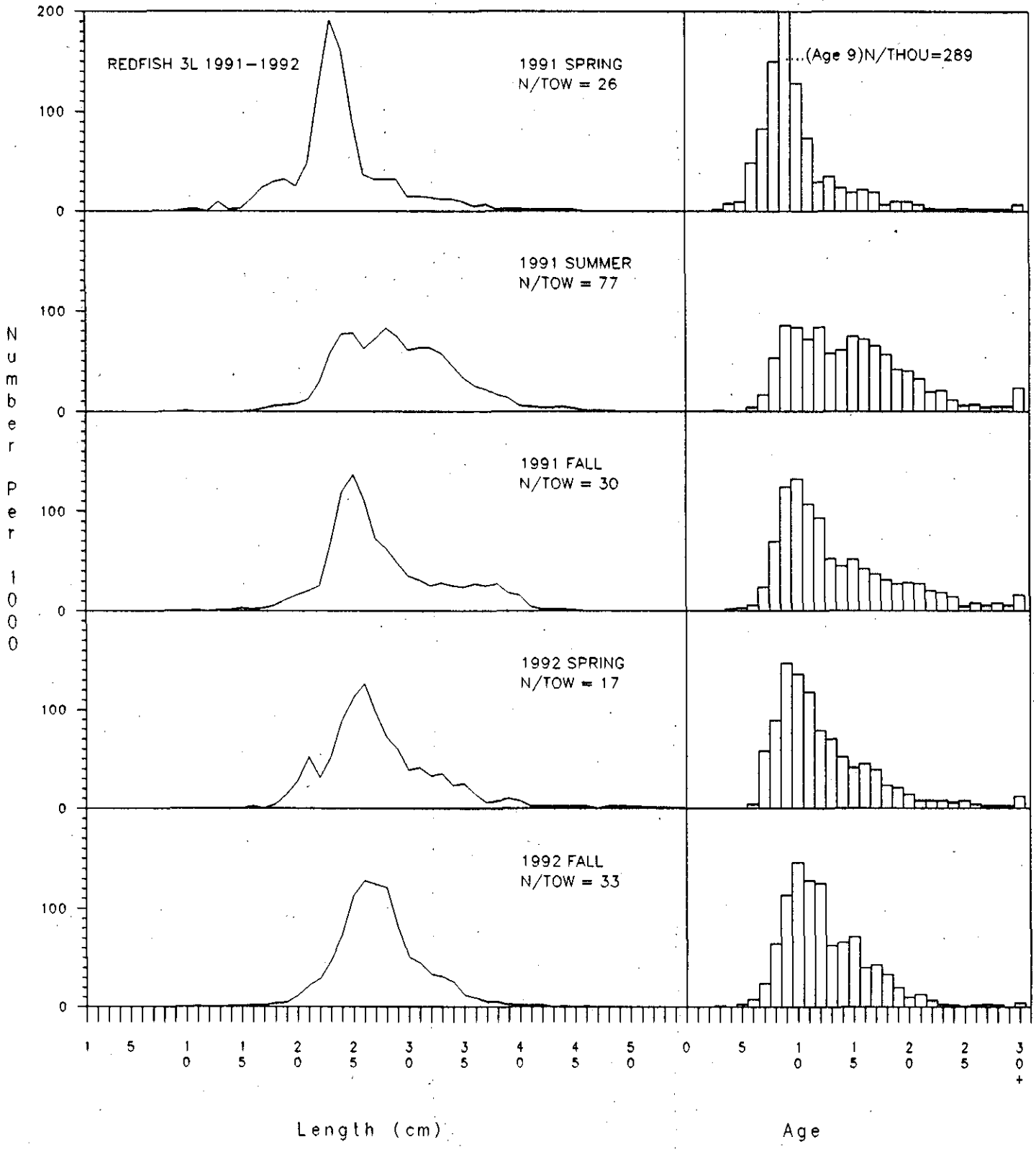

Figure 11 Length frequencies and corresponding age distribution from various stratified random research surveys where strata greater than 366 m (200 fathoms) were sampled in Div. 3L from 1991-1992.

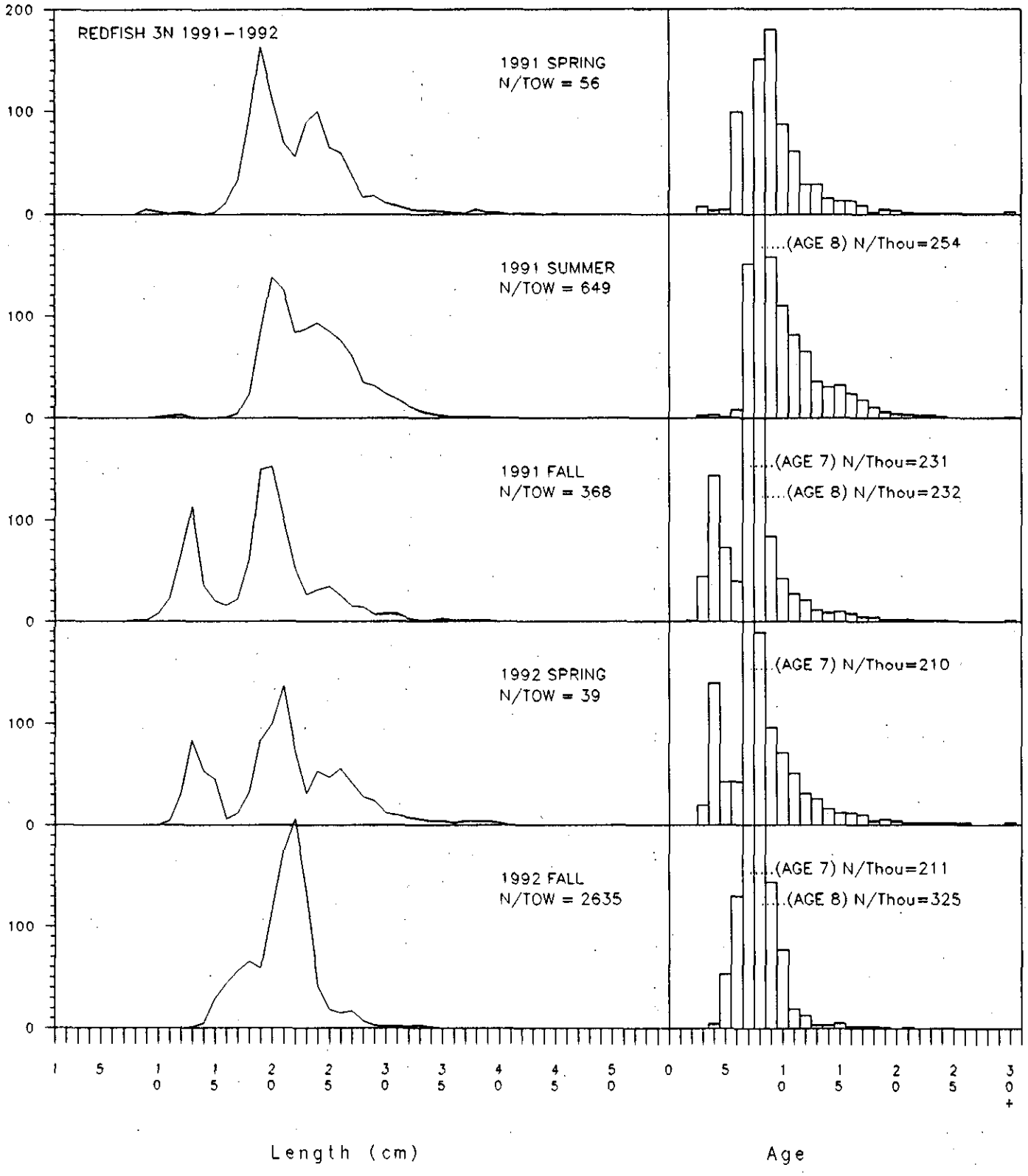

Figure **12**. Length frequencies and corresponding age distribution from seasonal stratified random research surveys where strata greater than 366 m (200 fathoms) were sampled in Div. 3N from 1991-1992.