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NAFO Subarea 2 and Division 3K Redfish

by

D. Power and D.B. Atkinson
Fisheries Research Branch
Department of Fisheries and Oceans
P.O. Box 5667
St. John's, Newfoundland A1C 5X1

Abstract

Canada has dominated this fishery from 1977 to the present, the period corresponding to extended jurisdiction. Canadian landings in 1985 doubled over those of 1983, primarily due to improved markets. Catch rates declined only slightly from 1984 to 1985 but remain high relative to rates over the entire time series. The results of the general production analysis were viewed with caution because of the strong influence of the 1983, 1984 and 1985 data points in the regression of catch rate on effort.

Résumé

Le Canada a dominé dans cette pêche de 1977 jusqu'à maintenant, soit depuis l'établissement des zones économiques de 200 milles. Les prises canadiennes en 1985 ont doublé par rapport à celles de 1983, surtout à cause des marchés améliorés. Les taux de capture n'ont diminué que légèrement de 1984 à 1985, mais ils sont demeurés élevés comparativement à ceux de l'ensemble des séries chronologiques. Les résultats de l'analyse de la production générale ont été évalués avec circonspection à cause de l'effet considérable des données de 1983, 1984 et 1985 dans la régression du taux de prise sur l'effort de pêche.

Introduction

Historical catches of redfish from SA 2 and Division 3K have fluctuated between 15,000 t and 55,000 t since the 1959 and 1960 catches of over 100,000 t (Table 1, Fig.1). The present TAC of 35,000 t was set based on the results of an equilibrium general production model (Gavaris MS 1979) but has not been achieved since its inception. In 1985, preliminary data indicate a doubling of the landings over that of 1983 primarily due to an increase in the Canadian landings in response to improved market conditions (Table 2). The increase in the Japanese landings in 1985 over 1984 is due to landings of just over 2000 t associated with the Resource Short Plant Program (RSPP).

Canada has dominated this fishery since 1977 (Table 2). This corresponds to the period of extended jurisdiction. In 1985 Canada landed 84% of their allocation. The USSR and Japan both achieved their allocations.

Catches in Divisions 2GH are generally taken in the second half of the year (reflective of ice cover in the first half) (Table 3a). Catches from Division 2J are spread more evenly throughout the year (Table 3b) although the majority has been taken during the summer months in recent years. In Division 3K, catches are spread fairly uniformly throughout the year (Table 3c).

Analytical assessments of this stock have not been successful to date due to the relatively short time series of data available coupled with low effort and hence low fishing mortalities.

Methods and Results

As in previous assessments, a multiplicative model (Gavaris 1980) was used to derive a standardized catch rate series using catch and effort data where redfish comprised >50% of the total catch. These data were obtained from ICNAF/NAFO Statistical Bulletins for the period 1959-1983, preliminary NAFO data for 1984 and preliminary Canadian data for 1985. Those country-gear-TC and month category types with <5 data points were deleted from the model as well as all catches and effort <10 units because of potential biases. Parameter estimates and within category groupings are shown in Table 4.

The results (Table 5) indicate that the regression is significant. Type 1 represents country-gear-TC combinations while type 2 represents month groupings. Effort in 1985 has doubled from that in 1983 (Table 6, Fig. 2) after declining from 1979 through 1983. The catch rate in 1984 was the highest on record (Table 6, Fig. 3) while that of 1985 is only slightly less. The 1985 data only include information from Canada.

An equilibrium general production model was run on the standardized catch rate and effort data from 1961 on. The model was also employed using effort data lagged 6, 8 and 10 years (Gulland 1961). The regression results for each run were checked for serial correlation by determining if a significant correlation existed between each standardized residual and its corresponding (lag-1) residual (Draper and Smith 1982, p 153-169). This approach was taken instead of using the Durbin-Watson statistic for serial correlation because this test is sometimes inconclusive. It was anticipated that any relationship using unlagged data would show serial correlation which would then diminish or disappear using lagged data. The results confirmed the hypothesis:

LAG	df	r	p-value	
nil	24	0.684	<0.001	Highly significant
6	18	0.271	>0.10	N.S.
8	16	0.325	>0.10	N.S.
10	14	0.352	>0.10	N.S.

It was therefore considered most reasonable to use the results of the runs using lagged data although it could not be determined which lag period is most appropriate. It was also noted that a regression of catch rate on unlagged effort with the 1973 point removed was not significant. The regressions of catch rate on effort using lagged data were all significant but the general production model results obtained were considerably different from those obtained previously (Atkinson MS 1985) particularly for a lag of 10 years. This is thought to be due to the position of the 1983, 1984 and 1985 data points in the regression ie. at the extreme left. In last year's assessment, the preliminary 1984 catch rate was higher (2.067) but was lowered when data other than those from only Canada were incorporated in the model. In addition, the preliminary 1985 catch rate is of about the same order as the 1984 level. These all worked together to lower the slope and intercept of the regression and hence, resulted in a lower estimated MSY etc. Because of the strong influence of these 3 most recent years, the model was not considered to be appropriate.

A non-equilibrium analysis was also attempted but the results were not satisfactory due to a lack of convergence in the parameter estimates.

The commercial length frequencies available from the 1985 fishery (Fig. 4-11) were combined (Fig. 12) to derive the estimated numbers caught at age (Gavaris and Gavaris 1983) (Table 7). Ages 10-18 dominated the fishery, reflective of the relatively strong year-classes of the early to mid 1970's.

The weight-length relationships used were:

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

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

The catch-and weight-at-age matricies available for this stock are shown in Tables 8 and 9.

SPA was last attempted on this stock in 1985 (Atkinson MS 1985). It was concluded that the SPA could not be tuned satisfactorily because of the short time series of data available and low recent levels of effort. Because the time series is still short relative to the number of cohorts in the fishery (10 vs.24 years) and because effort continues to be low, SPA was not attempted for this assessment.

The research survey results (Table 10) indicate that the numbers and weights per tow are at the same level as in 1984. Numbers caught per tow at age (Fig. 13) indicate that ages 10-16 are well represented in the population. These represent the relatively strong year-classes of the early to mid 1970's . Poor recruitment is indicated from the late 1970's onwards.

Conclusions

The catch rate series shows a general increase from 1979 to 1984 with only a slight decline in 1985. This increase is believed to be due to the growth and recruitment to the fishery of the relatively strong year-classes of the early to mid 1970's and the 1985 survey results indicate that these year-classes are still well represented in the population. A drop in the numbers and weights per tow between the 1983 and 1984 surveys was noted last year (Atkinson MS 1985). The 1985 survey point is consistent with that of 1984 although it is not known how to interpret this as the apparent decline in abundance and biomass is not reflected in the catch rates. Neither the equilibrium nor non-equilibrium production models yielded satisfactory results.

Based on these, there does not appear to be any evidence to indicate a change in the TAC in 1987 from the present level of 35,000 t. Although this level was first established based on the MSY value from an unlagged equilibrium model, attempts to reproduce the analysis indicated that it was strongly influenced by the 1973 point and its exclusion resulted in a non-significant regression. The average annual catch from 1961-1985 is only 26,500 t. The apparent poor recruitment since the mid 1970's will result in a drop in the catch rates as the relatively strong year classes currently contributing to the fishery pass through it.

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

Year	2G	2H	2J	3K	Total	TAC
1959	-	23	52,519	134,065	186,837	a
1960	-	56	82,800	46,861	129,773	a
1961	-	542	25,052	29,861	55,455	
1962	-	155	7,576	11,925	19,657	a
1963	245	16	5,873	17,510	23,644	
1964	120	938	16,001	23,044	50,154	a
1965	851	1,735	15,367	16,748	40,425	a
1966	197	4,678	9,135	18,720	32,730	
1967	24	3,327	13,699	9,112	26,162	a
1968	670	3,156	4,937	10,103	18,881	a
1969	55	180	5,838	13,785	19,883	a
1970	85	393	6,482	10,010	16,970	
1971	471	1,079	5,084	12,672	19,306	
1972	22	637	8,879	10,495	20,033	
1973	192	742	10,545	27,486	38,965	30,000
1974	85	429	5,943	23,688	30,145	30,000
1975	67	383	14,096	11,013	25,559	30,000
1976	89	1,606	14,412	9,858	25,965	30,000
1977	99	770	6,509	10,161	17,539	30,000
1978	29	554	11,804	16,759	29,146	30,000
1979	14	256	16,659	13,801	30,730	30,000
1980	2	47	4,423	10,047	14,519	35,000
1981	24	203	4,241	13,174	17,642	35,000
1982	-	583	7,048	10,352	17,983	35,000
1983	-	158	2,166	12,987	15,311	35,000
1984*	49	81	2,311	21,203	23,644	35,000
1985*					29,011	35,000
1986						35,000

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

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

Country	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984*	1985*
Canada	153	445	3,894	3,498	22,052	26,587	7,785	13,416	11,134	9,297	17,368	21,537
Cuba	-	-	-	-	-	43	-	-	-	-	-	-
GDR	2,465	2,447	1,729	1,305	2,909	543	1,102	720	425	626	485	4
Iceland	-	-	2	-	-	-	-	-	-	-	-	-
Japan	-	-	-	4	255	-	9	4	2,662	-	1,218	3,459
Norway	13	-	9	-	-	-	1	-	-	-	-	-
Poland	3,646	4,219	3,950	2,269	625	302	870	635	24	1,406	366	70
Portugal	4,820	2,971	823	845	378	544	266	393	456	183	397	76
Romania	-	-	-	312	-	-	-	-	-	-	-	-
Spain	-	26	-	134	37	-	44	-	-	-	-	-
USSR	11,898	13,575	14,881	8,014	2,685	2,578	4,208	2,474	3,073	3,722	3,684	3,688
Denmark	9	-	-	-	-	-	-	-	-	-	-	-
FRG	6,593	1,837	647	803	157	68	148	-	180	77	111	-
France	48	4	11	110	22	3	7	-	9	-	2	-
UK	500	35	19	245	26	62	79	-	20	-	13	-
Others	-	-	-	-	-	-	-	-	-	-	-	177
TOTAL	30,145	25,559	25,965	17,539	29,146	30,730	14,519	17,642	17,983	15,311	23,644	29,011

* Provisional.

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

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1974	40	-	12	-	-	2	112	91	22	111	24	100	514
1975	33	42	145	24	11	7	126	36	4	17	1	4	450
1976	232	35	94	4	-	30	85	159	175	416	426	39	1,695
1977	48	3	12	8	-	54	38	140	306	194	49	17	869
1978	224	1	-	-	-	-	5	55	33	9	98	158	583
1979	93	-	-	-	11	-	-	35	22	81	23	5	270
1980	9	-	10	-	1	-	1	-	14	12	-	2	49
1981	22	-	-	-	-	2	28	97	19	32	15	12	227
1982	33	-	-	-	-	29	-	1	300	5	106	109	583
1983	-	-	-	-	-	-	37	-	22	7	87	5	158
1984*	-	-	-	-	-	-	-	48	32	14	20	16	130

* Provisional.

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

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1974	1,237	1,545	294	318	208	444	786	667	25	9	32	378	5,943
1975	3,736	1,586	2,155	1,636	810	651	1,345	1,538	210	109	158	162	14,096
1976	2,206	485	-	2	55	73	1,495	7,208	1,827	392	63	606	14,412
1977	217	512	588	54	25	135	914	1,469	1,467	336	619	173	6,509
1978	669	217	418	177	6	1	353	3,994	3,614	1,577	527	251	11,804
1979	137	277	36	-	20	68	2,026	4,452	6,071	3,336	204	32	16,659
1980	43	357	91	59	246	6	13	464	2,784	38	106	216	4,423
1981	206	65	75	12	-	29	1,398	1,886	11	55	114	390	4,241
1982	27	294	191	63	197	410	1,134	2,395	2,188	123	14	12	7,048
1983	37	225	96	93	-	34	403	269	41	18	250	700	2,166
1984*	-	-	34	14	2	114	34	1,862	45	77	67	62	2,311

* Provisional.

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

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1974	261	1,633	7,983	1,388	2,222	831	1,260	2,028	1,354	400	1,961	2,367	23,688
1975	1,142	2,570	2,588	1,633	212	259	617	932	433	151	341	135	11,013
1976	2,260	1,920	929	561	187	307	1,019	604	357	88	304	1,322	9,858
1977	214	1,624	754	382	245	347	3,699	1,103	1,180	377	163	73	10,161
1978	295	589	4,294	2,565	1,757	412	377	597	1,847	469	1,652	1,905	16,759
1979	134	954	1,874	1,800	1,747	951	450	2,107	1,431	2,073	115	165	13,801
1980	112	209	1,154	1,671	1,087	140	196	1,400	693	509	1,845	1,031	10,047
1981	139	342	501	1,085	630	3,405	3,212	1,998	713	120	416	613	13,174
1982	73	136	112	576	1,187	370	1,010	2,031	424	634	2,214	1,585	10,352
1983	447	1,073	2,558	1,354	972	751	627	3,772	532	548	40	313	12,987
1984*	924	1,327	1,761	2,920	2,704	937	1,164	2,764	2,165	2,962	863	712	21,203

* Provisional.

Table 4: Parameter estimates from the analysis of catch/effort for redfish in SA 2 + Div. 3K using a multiplicative model.

Country-Gear-TC	Estimate	Month	Estimate
USSR OTB 4	-0.497	Jun.	-0.379
CAN(N) OTB 4	-0.117	Oct.	
		Nov.	-0.232
POL OTB 4		Dec.	
GDR OTB 5	0.000		
GDR OTB 6		May	-0.129
		Jul.	
CAN(M) OTB 4	0.145		
		Jan.	
CAN(MQ) OTM 4		Mar.	
CAN(N) OTB 5		Apr.	0.000
GDR OTB 7	0.341	Aug.	
POR OTB 7		Sep.	
USSR OTB 7			
		Feb.	0.151
CAN(M) OTB 5			
CAN(MQ) OTB 5		____	
CAN(MQ) OTM 5		Div.	
CAN(N) OTM 5	0.542	____	
ICE OTB 5			
JPN OTB 6		2H	-0.256
USSR OTM 7			
		2J	0.000
POR OTB 6	0.797	3K	

Table 5: Regression of multiplicative model for redfish in SA 2 + Div. 3K.

multiple r.....0.618
multiple r squared.....0.382

analysis of variance

source of variation	df	sums of squares	mean squares	f-value
intercept	1	3.477e1	3.477e1	
regression	37	8.376e1	2.264e0	9.412
type 1	6	3.080e1	5.134e0	21.344
type 2	4	9.748e0	2.437e0	10.131
type 3	1	1.253e0	1.253e0	5.208
type 4	26	2.903e1	1.116e0	4.641
residuals	563	1.354e2	2.405e-1	
total	601	2.540e2		

Table 6: The predicted catch rate for redfish in SA 2 + Div. 3K.

year	total catch	catch rate mean	s.e.	effort
1959	186837	1.456	0.177	128324
1960	129773	1.115	0.162	116374
1961	55455	1.717	0.394	32307
1962	19657	1.452	0.281	13535
1963	23644	1.568	0.173	15077
1964	50154	1.737	0.192	28871
1965	40425	1.513	0.165	26717
1966	32730	1.203	0.169	27212
1967	26162	1.244	0.116	21034
1968	18881	1.004	0.138	18803
1969	19883	0.739	0.134	26910
1970	16970	0.930	0.221	18244
1971	19306	1.187	0.183	16265
1972	20033	1.213	0.198	16519
1973	38965	0.721	0.122	54011
1974	30145	1.210	0.252	24918
1975	25559	0.704	0.165	36303
1976	25965	1.064	0.133	24399
1977	17539	1.064	0.112	16485
1978	29146	1.058	0.097	27548
1979	30730	1.013	0.102	30341
1980	14519	1.069	0.113	13587
1981	17642	0.956	0.104	18456
1982	17983	1.242	0.134	14480
1983	15311	1.550	0.189	9877
1984	23644	1.738	0.181	13602
1985	29011	1.706	0.178	17005

average c.v. for the mean:0.141
(1984 and 1985 are provisional)

Table 7: Estimated numbers of redfish caught at age (000's) (including their average weight and length) in the commercial fishery in SA 2 + Div.3K in 1985.

	average		catch		
age	weight	length	mean	std. err.	c. v.
* 7	0.118	20.037	48	11.26	0.24
8	0.138	21.130	218	27.21	0.12
9	0.191	23.587	672	124.77	0.19
10	0.217	24.603	3658	340.02	0.09
11	0.238	25.377	6477	497.52	0.08
12	0.264	26.274	7626	614.91	0.08
13	0.293	27.198	8865	668.22	0.08
14	0.317	27.937	7737	632.43	0.08
15	0.358	29.047	6381	538.84	0.08
16	0.395	29.958	5008	467.10	0.09
17	0.439	31.030	4254	387.45	0.09
18	0.471	31.772	4032	339.67	0.08
19	0.505	32.548	2725	259.08	0.10
20	0.536	33.292	1477	160.31	0.11
21	0.605	34.518	1530	150.18	0.10
22	0.629	34.978	1127	128.06	0.11
23	0.719	36.497	978	107.97	0.11
24	0.761	37.191	827	95.75	0.12
25	0.799	37.838	673	84.61	0.13
26	0.822	38.164	814	89.91	0.11
27	0.851	38.657	557	72.02	0.13
*28	0.840	38.553	614	72.82	0.12
29	0.862	38.863	527	66.31	0.13
*30	1.158	42.532	2358	86.52	0.04

* for the ages flagged by * there was an age length key with only one age determination for some length. Since the variance formula has n-1 in the denominator it cannot be evaluated for this length. Consequently this variance component is not included in the variance for the flagged ages. This is generally not a serious problem since it occurs when few fish are caught at that length.

Table 8. Estimated numbers of redfish caught at age (000's) in SA 2 and Division 3K, 1976-1985.

age	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
6	7	22	4	240	28	44	1	1	2	0
7	30	102	400	2159	301	199	224	13	14	48
8	136	219	1241	5678	1669	607	998	351	60	218
9	1265	612	3297	8798	996	1398	2252	955	1056	672
10	2067	843	4071	9251	869	1819	3678	1155	3118	3658
11	3866	1569	4495	6700	839	1536	3920	1271	3706	6477
12	5580	1930	5806	4011	1031	1047	3967	2051	3974	7626
13	7818	2241	6207	7374	1549	1348	4122	2090	5005	8865
14	8652	3315	6267	6646	1889	1409	3479	2352	4582	7737
15	8615	3162	5265	6571	2050	2138	3765	1855	4464	6381
16	2700	2776	5331	6075	1727	1887	3135	1624	3995	5008
17	1826	2504	3969	5544	1753	2302	3052	1641	2661	4254
18	946	1812	2250	1796	1032	1920	2049	1398	2695	4032
19	757	1778	1488	1241	793	1470	1537	1206	1689	2725
20	1128	1638	1495	1391	10058	1308	1044	912	1847	1477
21	968	895	1084	1412	669	1019	1060	956	1668	1530
22	885	940	950	789	532	1001	627	710	1363	1127
23	1100	555	591	573	503	1093	498	613	1042	978
24	1005	618	883	599	748	1004	517	823	1181	827
25	684	598	828	930	521	828	324	771	955	673
26	678	514	746	569	524	903	369	560	953	814
27	512	435	509	590	505	540	341	597	756	577
28	632	418	535	589	389	749	256	565	804	614
29	284	200	139	283	415	580	226	492	650	527

Table 9: Estimated weight at age (kg) of redfish caught in SA 2 and Division 3K, 1976-1985.

age	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
6	0.10	0.10	0.10	0.10	0.11	0.09	0.10	0.10	0.10	0.08
7	0.14	0.14	0.14	0.14	0.17	0.11	0.14	0.14	0.12	0.12
8	0.17	0.17	0.17	0.17	0.18	0.16	0.17	0.16	0.17	0.14
9	0.20	0.20	0.20	0.20	0.22	0.20	0.21	0.19	0.20	0.19
10	0.24	0.24	0.24	0.24	0.24	0.22	0.25	0.22	0.23	0.22
11	0.28	0.28	0.28	0.28	0.28	0.24	0.27	0.25	0.25	0.24
12	0.32	0.32	0.32	0.32	0.29	0.28	0.30	0.28	0.27	0.26
13	0.36	0.36	0.36	0.36	0.31	0.32	0.33	0.30	0.31	0.29
14	0.40	0.40	0.40	0.40	0.36	0.35	0.36	0.33	0.35	0.32
15	0.44	0.44	0.44	0.44	0.42	0.40	0.41	0.37	0.37	0.36
16	0.48	0.48	0.48	0.48	0.46	0.44	0.45	0.41	0.40	0.40
17	0.52	0.52	0.52	0.52	0.53	0.49	0.49	0.48	0.44	0.44
18	0.56	0.56	0.56	0.56	0.57	0.54	0.56	0.52	0.48	0.47
19	0.60	0.60	0.60	0.60	0.60	0.59	0.60	0.57	0.51	0.51
20	0.63	0.63	0.63	0.63	0.67	0.63	0.65	0.60	0.57	0.54
21	0.67	0.67	0.67	0.67	0.65	0.70	0.69	0.64	0.63	0.61
22	0.70	0.70	0.70	0.70	0.75	0.73	0.71	0.67	0.68	0.63
23	0.73	0.73	0.73	0.73	0.79	0.76	0.80	0.72	0.70	0.72
24	0.76	0.76	0.76	0.76	0.75	0.81	0.79	0.74	0.74	0.76
25	0.79	0.79	0.79	0.79	0.77	0.82	0.85	0.80	0.77	0.80
26	0.81	0.81	0.81	0.81	0.95	0.84	0.86	0.80	0.83	0.82
27	0.84	0.84	0.84	0.84	0.93	0.93	0.87	0.83	0.83	0.85
28	0.87	0.87	0.87	0.87	0.92	0.92	0.88	0.82	0.86	0.84
29	0.89	0.89	0.89	0.89	1.00	0.89	0.90	0.90	0.87	0.86

Table 10: Numbers and weights of redfish caught per standard tow and total estimated biomass from Canadian research cruises in Divisions 2J and 3K (coefficients of variation shown in brackets).

Year	No. sets	No. per tow	Wt. per tow (kg)	Total Biomass (t)
1978	118	707.5 (0.39)	215.4 (0.27)	657,320 (0.27)
1979	197	163.5 (0.24)	69.0 (0.26)	210,513 (0.26)
1980	203	163.4 (0.24)	77.2 (0.33)	235,532 (0.33)
1981	171	388.7 (0.48)	156.9 (0.43)	478,660 (0.43)
1981a	169	136.3 (0.20)	65.4 (0.22)	199,364 (0.22)
1982	230	182.8 (0.33)	68.6 (0.33)	209,166 (0.33)
1983	199	615.7 (0.45)	199.0 (0.38)	601,135 (0.38)
1983a	197	232.2 (0.18)	94.6 (0.16)	285,618 (0.16)
1984	201	113.7 (0.20)	47.0 (0.21)	139,381 (0.21)
1985	230	116.1 (0.28)	45.1 (0.27)	137,468 (0.27)

a Excluding 2 large catches.

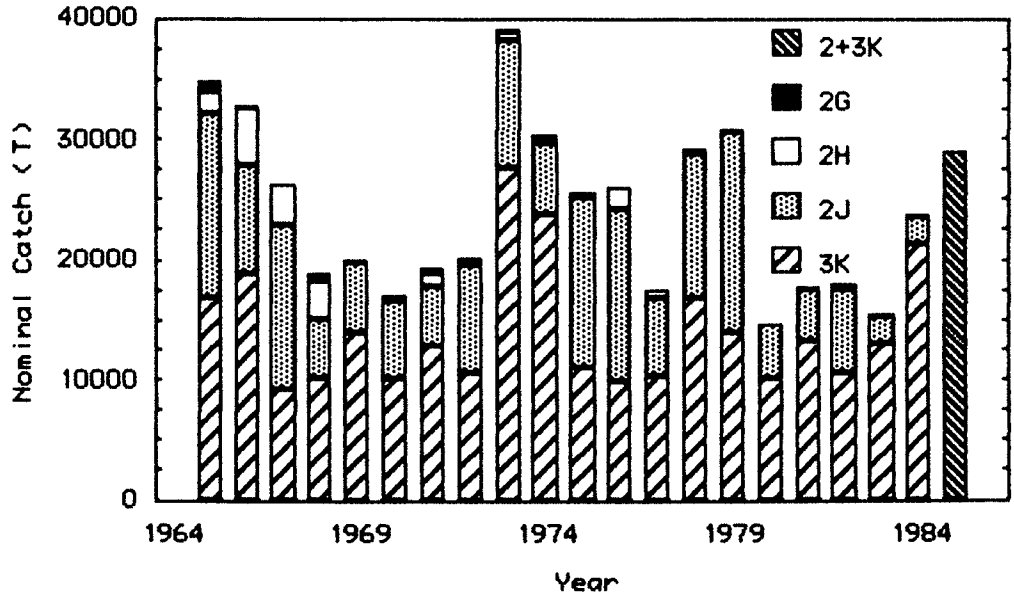

Fig. 1: Nominal catches of redfish from SA 2+ Div. 3K, 1965-1985 (1984 and 1985 are provisional, 1965 does not include an unallocated catch of 5724 t from SA 2).

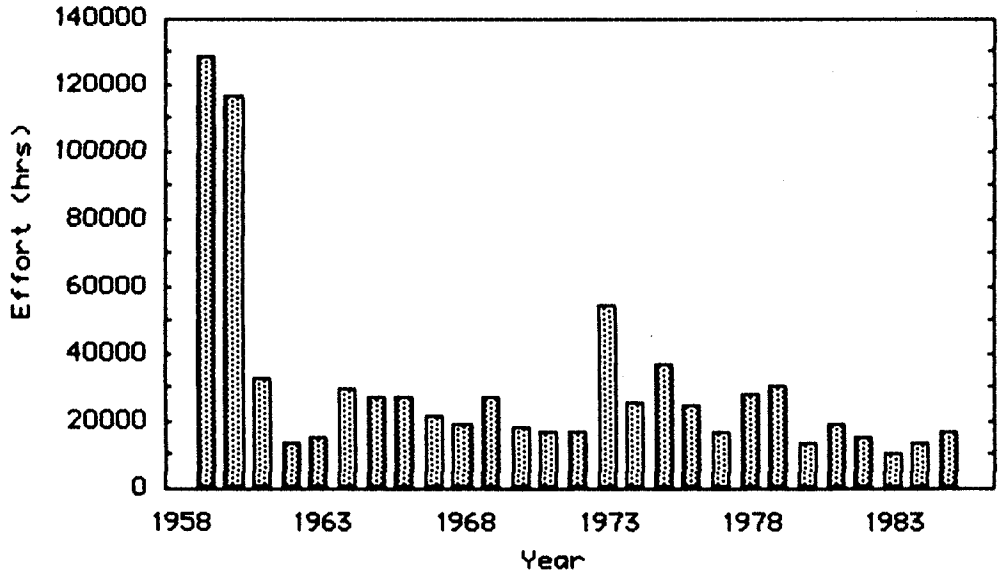

Fig. 2: Standardized effort for redfish in SA 2 + Div. 3K, 1959-1985. (1984 and 1985 are provisional)

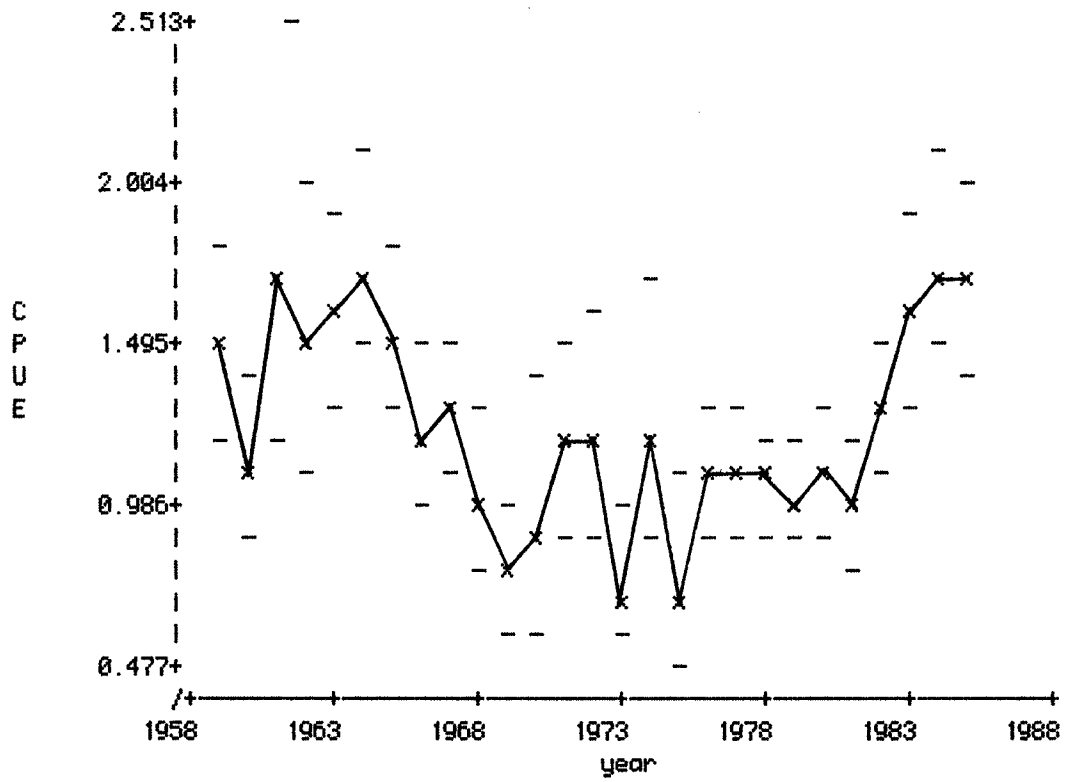

Fig. 3: Standardized CPUE (t/hr) for redfish in SA 2 + Div. 3K, 1959-1985. (1984 and 1985 Provisional)

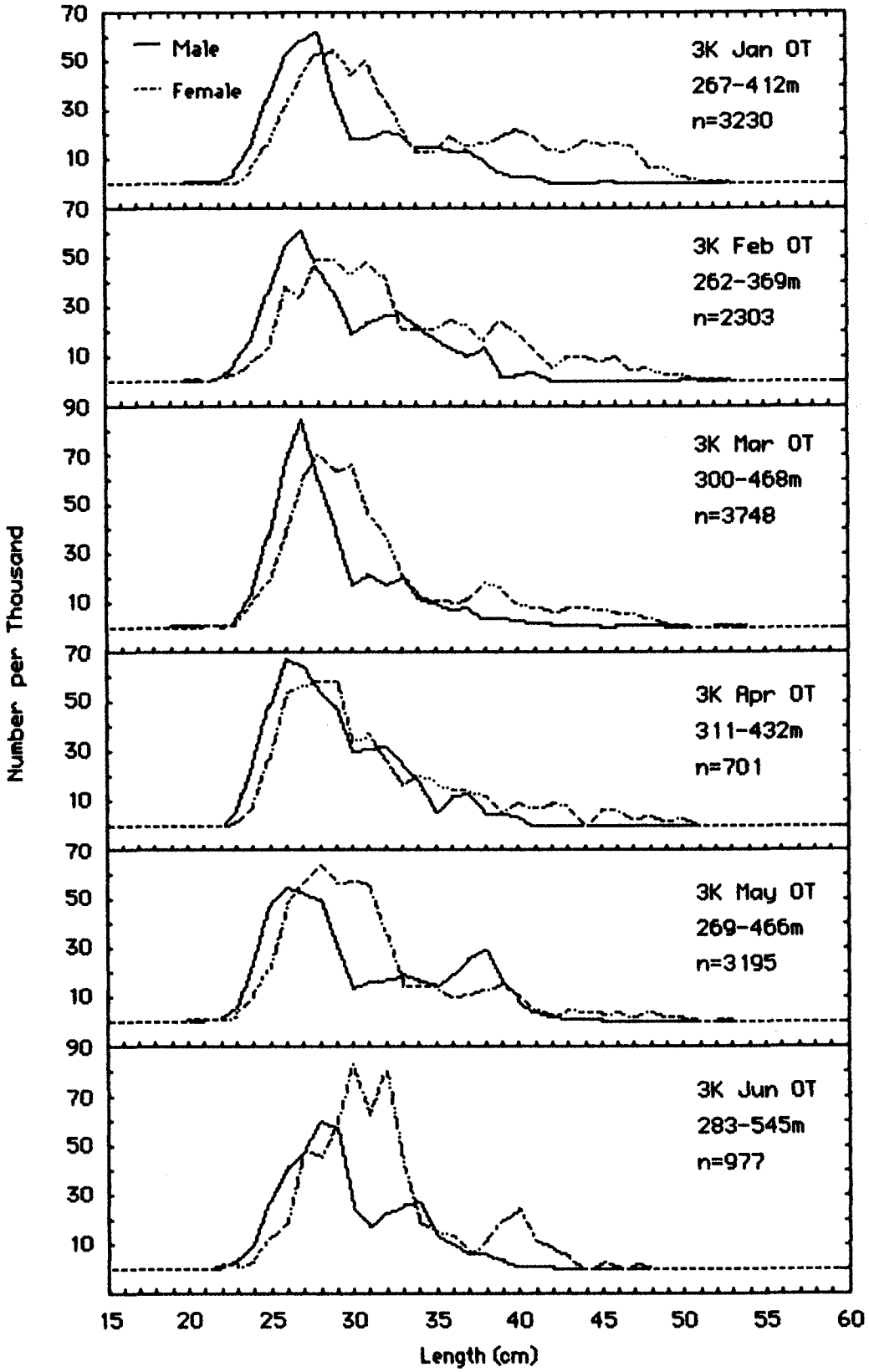

Fig. 4: Commercial frequencies from the Canadian (Nfld.) otter trawl fishery for redfish in SA 2 + Division 3K, 1985 (port sampling).

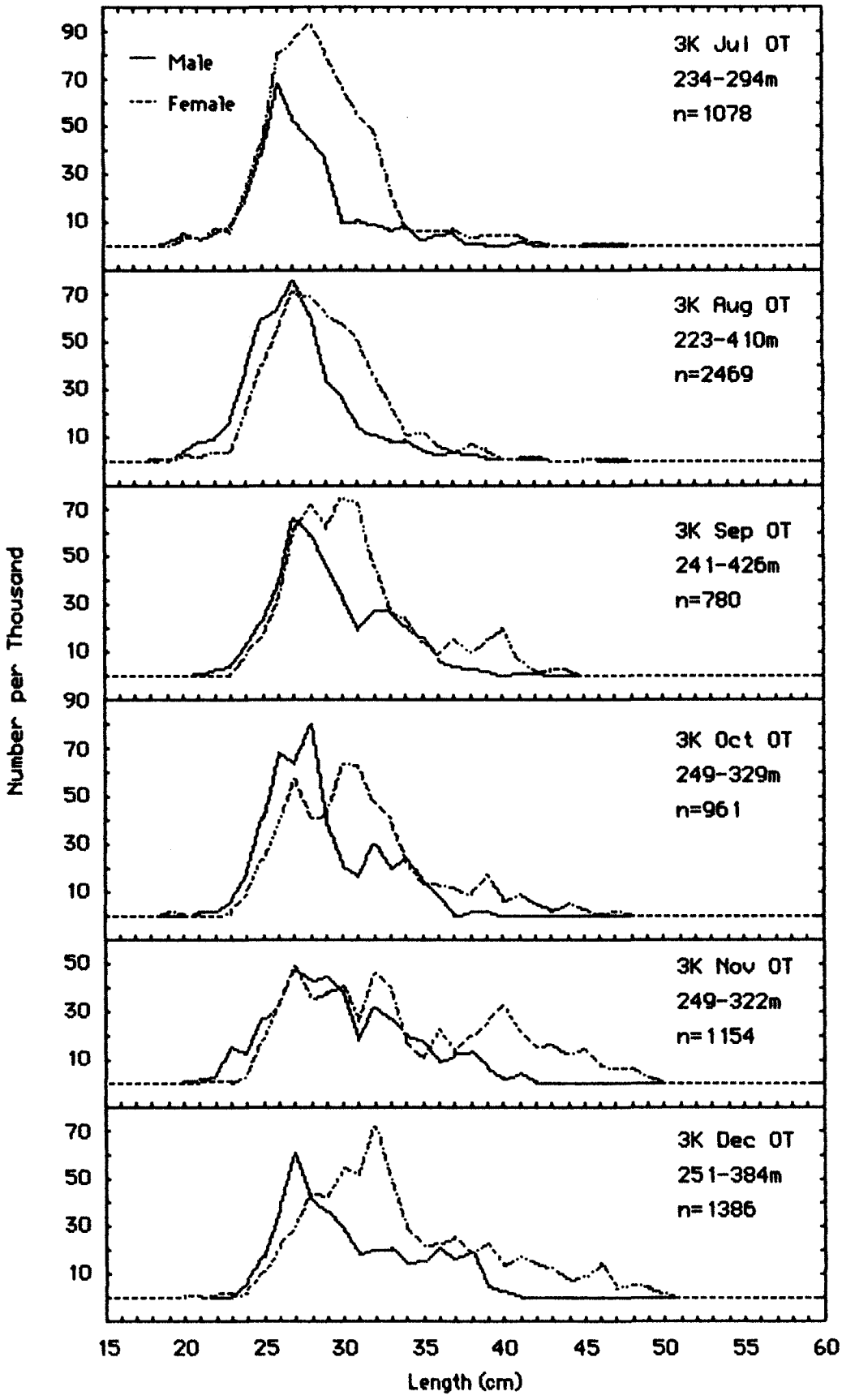

Fig. 5: Commercial frequencies from the Canadian (Nfld.) otter trawl fishery for redfish in SA 2 + Division 3K, 1985 (port sampling).

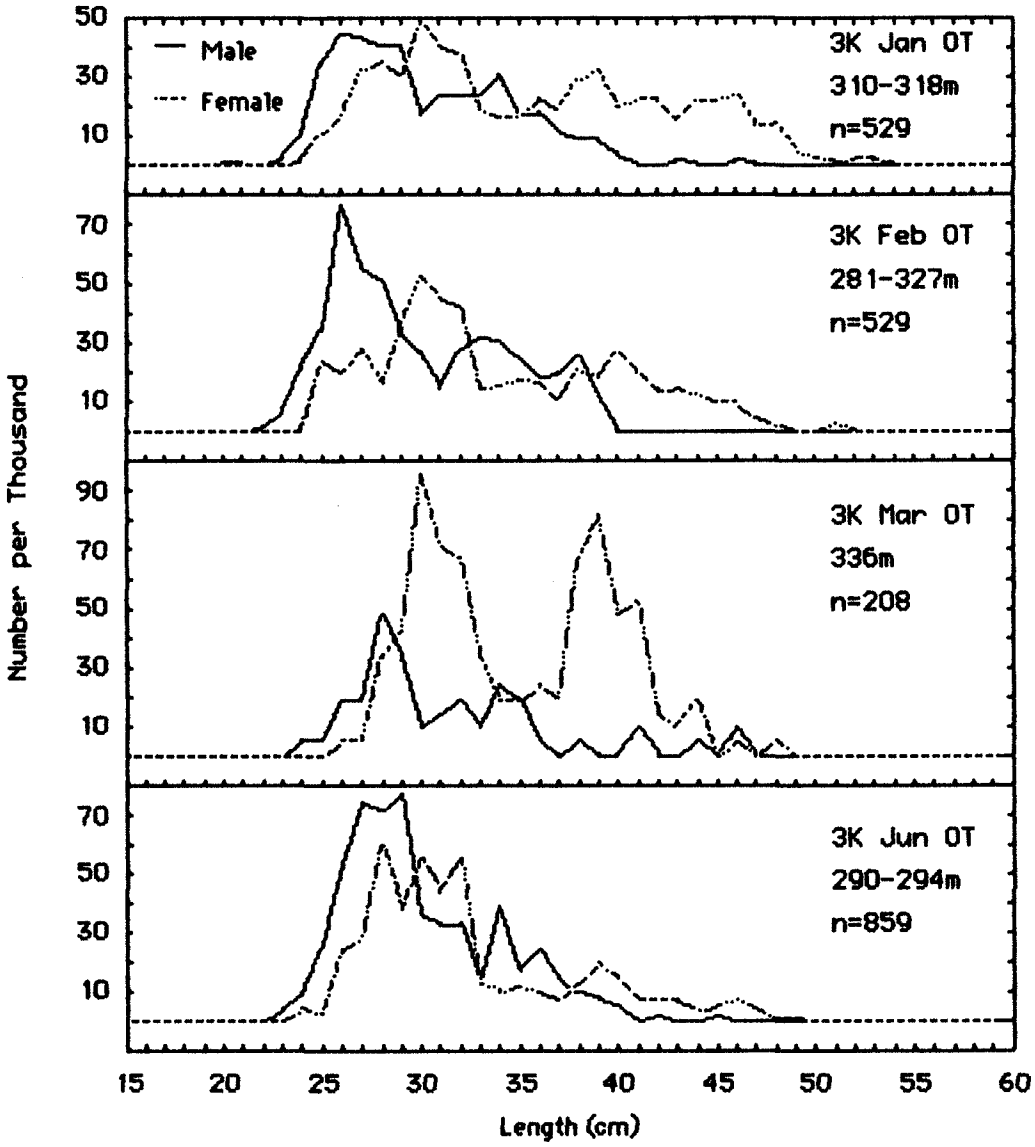

Fig. 6: Commercial frequencies from the Canadian (Nfld.) otter trawl fishery for redfish in SA 2 + Division 3K, 1985 (sea sampling).

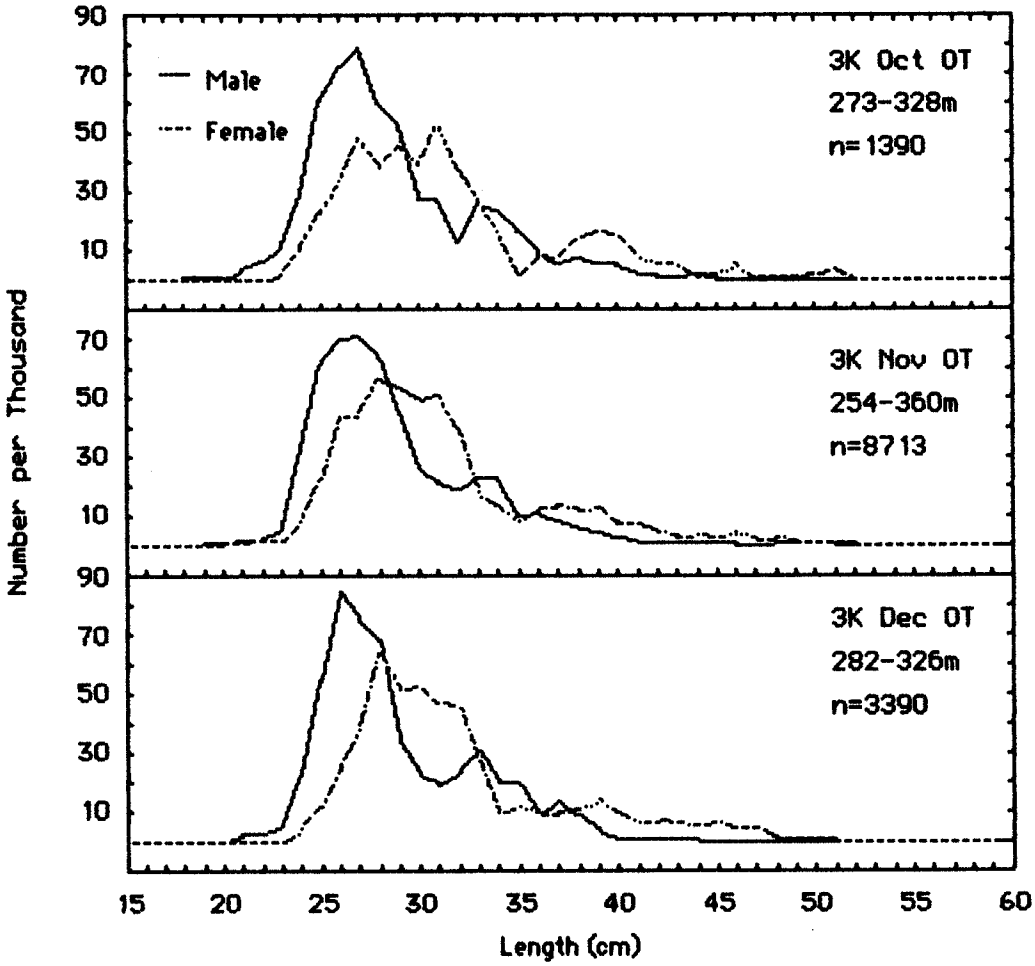

Fig. 7: Commercial frequencies from the Canadian (Nfld.) otter trawl fishery for redfish in SA 2 + Division 3K, 1985 (sea sampling).

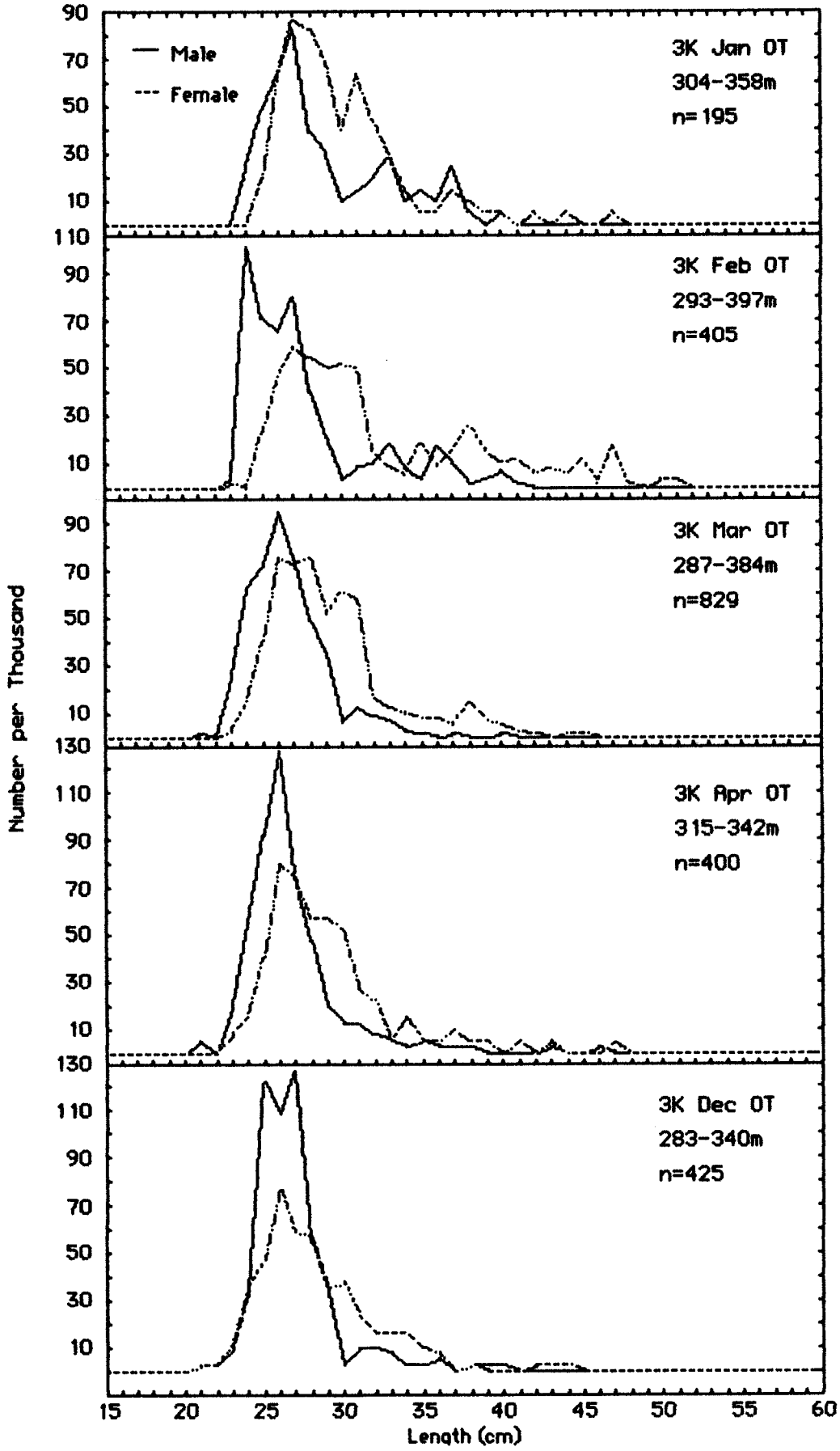

Fig. 8 : Commercial frequencies from the Canadian (Maritimes) otter trawl fishery for redfish in SA 2 + Division 3K, 1985 (port sampling).

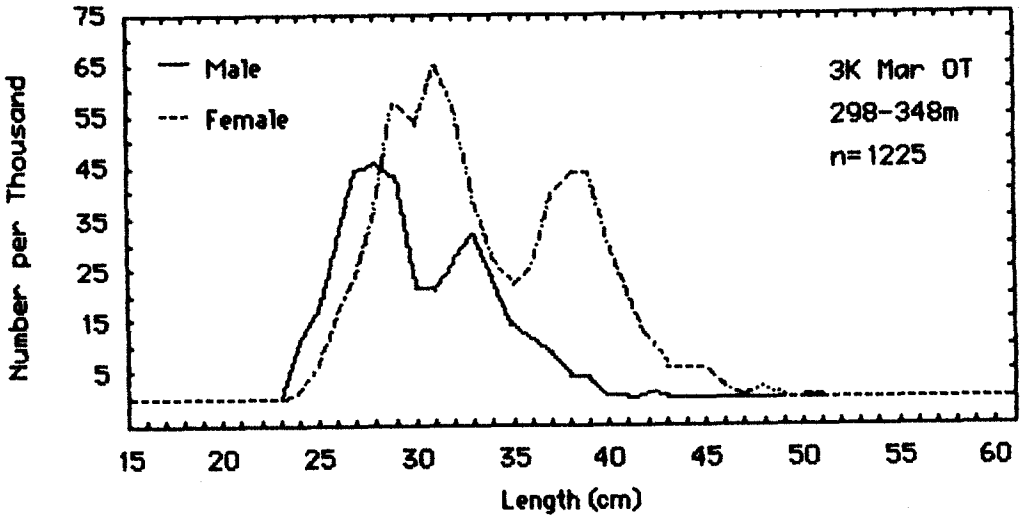

Fig. 9 : Commercial frequencies from the Canadian (Maritimes) otter trawl fishery for redfish in SA 2 + Division 3K, 1985 (sea sampling).

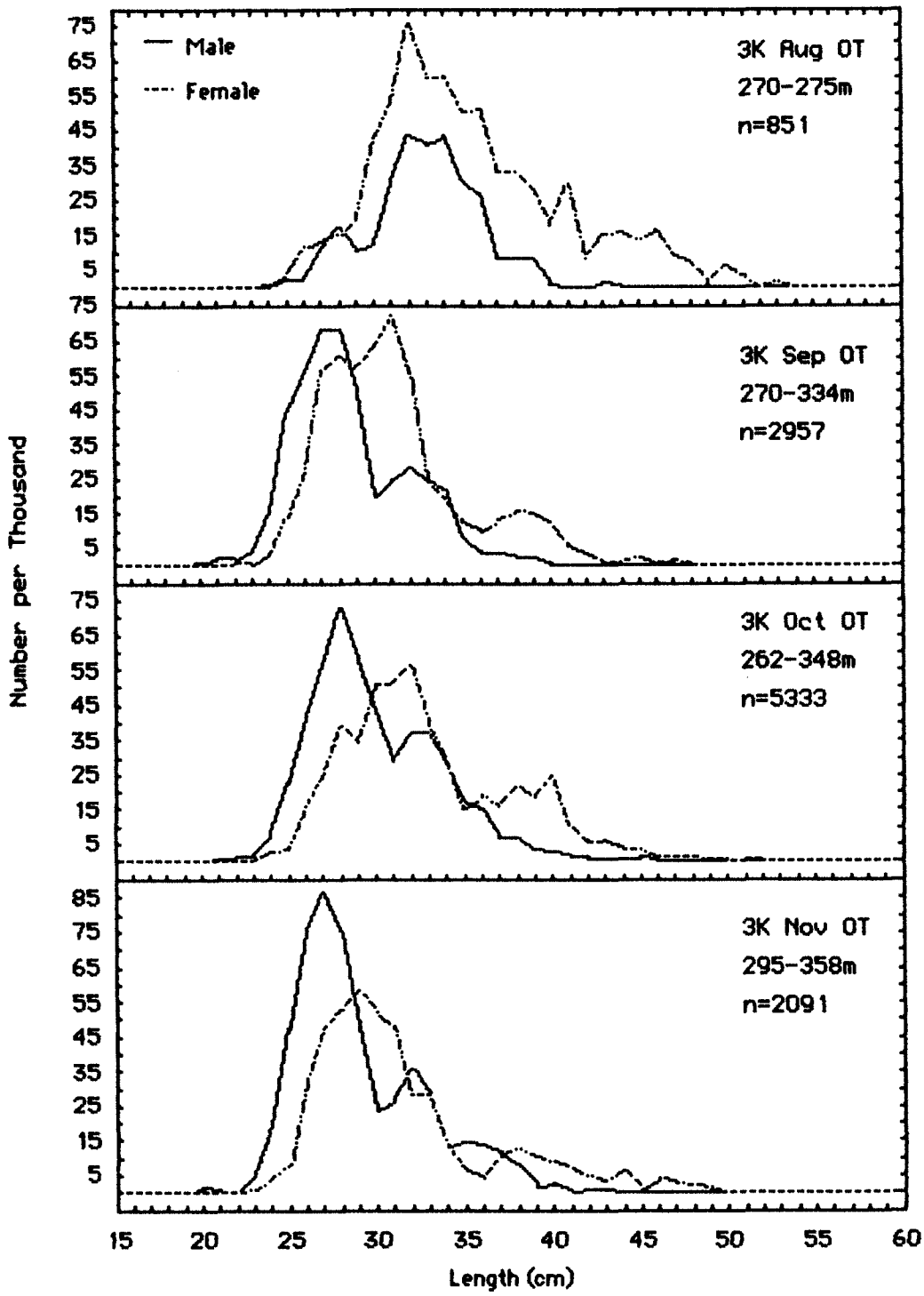

Fig. 10: Commercial frequencies from the Japanese otter trawl fishery for redfish in SA 2 + Division 3K, 1985 (sea sampling).

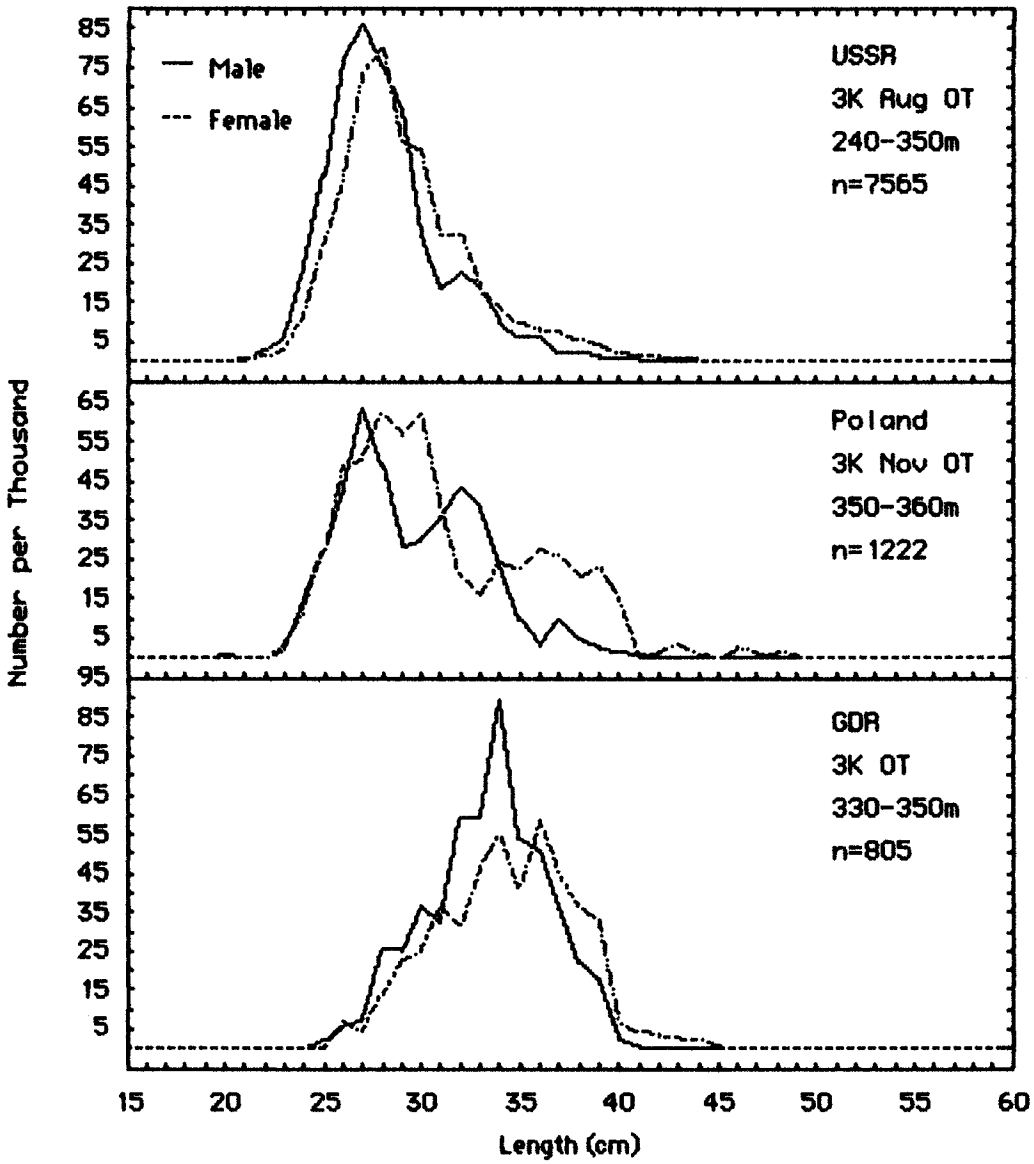

Fig. 11: Commercial frequencies from various foreign otter trawl fisheries for redfish in SA 2 + Division 3K, 1985 (sea sampling).

Frequency	Wt.	Frequency	Wt.	Frequency	Wt.	Frequency	Wt.
Sea3KJanCNOT	3-	3KJanCNOT	1076-				
Port3KJanCNOT	8-						
Sea3KFebCNOT	2-	3KFebCNOT	1271				
Port3KFebCNOT	6-						
				3KSROT	3688-		
Sea3KMarCNOT	1-	3KMarCNOT	1417	3KPLOT	70		
Port3KMarCNOT	8-	Port3KAprCNOT	1284	3KCNOT	14118		
		Port3KMayCNOT	1254				
Sea3KJunCNOT	3-	3KJunCNOT	1180				
Port3KJunCNOT	2-	Port3KJulCNOT	1184				
		Port3KAugCNOT	1838				
Sea3KOctCNOT	3-	Port3KSepCNOT	1347				
Port3KOctCNOT	2-	3KOctCNOT	805				
						2+3K	29011
Sea3KNovCNOT	21-	3KNovCNOT	803				
Port3KNovCNOT	3-						
Sea3KDecCNOT	8-	3KDecCNOT	659-				
Port3KDecCNOT	4-						
		Port3KJanCMOT	253-				
		Port3KFebCMOT	1109				
Sea3KMarCMOT	5-	3KMarCMOT	1184	3KCMOT	6486		
Port3KMarCMOT	4-	Port3KAprCMOT	1343				
		Port3KDecCMOT	467-				
Sea3KAugJPOT	188-						
Sea3KSepJPOT	381	----------	-----	3KJPOT	3459-		
Sea3KOctJPOT	625						
Sea3KNovJPOT	1585-						

Fig. 12: Commercial Frequencies used and the combination process followed to derive the estimate of number of redfish caught at age in SA 2 + Div. 3K in 1985.

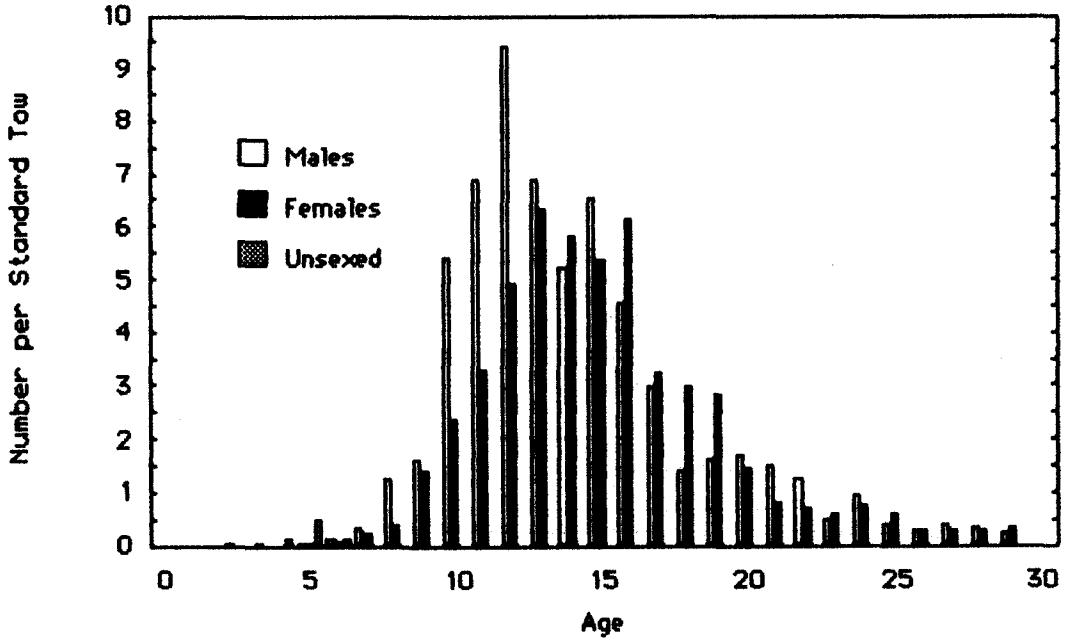

Fig. 13: Numbers of redfish caught at age per standard tow during Canadian research surveys in Divisions 2J and 3K in 1985.