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Redfish in NAFO Division 3O

by

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Abstract

Canadian catches of redfish from Div. 3O continued to be low in 1986 with only 139 t reported. This represented only 1% of the TAC and about 1.5 % of the country's allocation. Catch rates show a considerable amount of inter-annual fluctuation with no apparent overall trend except for an inexplicable increase to a higher level between 1978 and 1979. The TAC's have never been achieved for this stock. Over the history of the fishery, the average annual catch is about 13,000 t.

Résumé

Les prises canadiennes de sébaste de la division 30 sont restées faibles en 1986 et les prises signalées n'atteignaient que 139 t. Cela ne représente que 1 % du TPA et environ 1,5 % du contingent pour le pays. Les taux de prise présentent des fluctuations considérables d'une année à l'autre et aucune tendance générale n'est apparente à l'exception d'un accroissement inexplicable entre 1978 et 1979. Les TPA n'ont jamais été atteints dans le cas de ce stock. Les prises annuelles moyennes s'établissent à environ 13 000 t depuis les débuts de la pêche à cette espèce.

Introduction

Over the past 11 years, nominal catches have been between about 7000 t and 18,000 t (Table 1). Historically, they have been as high as about 22,500 t (Figure 1). In 1986, provisional statistics indicate a catch of about 7500 t. Of this, Canada accounted for only 139 t, or about 2%. The Soviet Union usually takes the majority of the reported catches from this stock. Although there was some fishing in most months of the year (Table 2), the majority of the landings were taken in July and August. The present TAC is 20,000 t and the 1986 catch is only about 38% of this. TAC's have never been achieved on this stock since their first imposition in 1974.

Methods and Results

Catch and effort data from ICNAF/NAFO Statistical bulletins for the period 1959-1984 were combined with preliminary NAFO data for 1985 and preliminary Canadian data for 1986. Only data where redfish comprised >50% of the total catch were used. These were input into a multiplicative model (Gavaris 1980) to derive a standardized catch rate series (using STANDAR V1, Anon. MS 1986). Those country-gear-TC and months with less than 5 data points were deleted as were all catches and effort of less than 10 units in order to eliminate potential biases. Because questions have been raised concerning the validity of grouping similar category types *a posteriori*, the same groupings as were used in the 1986 assessment (Atkinson and Power MS 1986) were incorporated. Because problems have been encountered with pro-rating of effort data, and this is an unknown quantity in the data prior to 1984, no weighting was done in this year's analysis. The parameter estimates and groupings used are shown in Table 3 while the regression results are in Tables 4 and 5. The catch rates, although showing a high amount of inter-annual fluctuation, indicate no overall trend with time for the period 1959 to about 1978 (Figure 3). After that, there is an apparent shift to a somewhat higher overall rate but again no trend is indicated in the 1979-1986 period. The reasons for this increase is unknown. Effort has been fairly stable in the recent period (Figure 2). There are no effort data available for 1968.

It had been pointed out last year (Atkinson and Power MS 1986) that no serial correlation existed in the regressions of CPUE on effort, even when unlagged effort was used. This was interpreted to mean that the effort exerted on this stock was having little to no effect on it and the relationships seen between CPUE and effort were only fortuitous. Further discussion of this lead to the conclusion that the observed lack of serial correlation could possibly be attributed to other factors such as fairly stable recruitment over time. Since there were insufficient data to examine this possibility, it was concluded that the general production analyses could not be rejected on this basis.

Least squares regressions of standardized CPUE on effort (unlagged and lagged 6, 8 and 10 years) were carried out. All were significant (eg. Fig. 4) and general production curves were derived (eg. Fig. 5). The results can be summarized as follows:

	LAG (years)			
	None	6	8	10
f_{MEY}	30,820 hr	20,299 hr	19,395 hr	17,902 hr
MEY yield	20,070 t	16,193 t	16,440 t	15,986 t
2/3 f_{MEY}	20,547 hr	13,532 hr	12,930 hr	11,935 hr
2/3 f_{MEY} yield	17,840 t	14,393 t	14,613 t	14,209 t

The data were also input into a non-equilibrium version of the Schaefer model (Rivard and Bledsoe 1978) and analysed (SURPROD V1, Anon. MS 1986) in an attempt to determine the virgin stock biomass (B_∞), the maximum exploitable yield (MEY), the catchability coefficient (q) and the transient stock biomass. With input of B_∞=220,000 t and MEY=20,000 t, the model converged (based on change in RSS<0.00001) with input q-values of 0.000003, 0.000005, 0.000007, and 0.000009 (only ones tried) yielding a range of results for B_{∞}, MEY and transient biomass. These in turn, resulted in a range of non-equilibrium yields in 1987 and 1988 at ⅔ MEY effort. The model would not converge when allowed to estimate q, however, and was therefore not considered to be appropriate with the available range of data.

The one commercial frequency available (Fig. 6) indicates fish 20-30 cm predominating. The predominance of females in this frequency is interesting, and given the fact that the sample was taken in April, may indicate fishing on a spawning (hatching) concentration.

There are no research data available for this stock.

Conclusions

The catch rates fluctuate considerably from one year to the next and made an inexplicable increase in 1979 to a new, still fluctuating level for the more recent period. The untrawlable bottom in the area insures a reserve of mature fish.

Previous reasoning for rejection of the equilibrium production analyses has been overturned. These analyses suggest a yield at 2/3 f MEY ranging from about 18,000 t to 14,000 t depending on whether the effort data are lagged or not. It is considered that lagging the effort data is most appropriate and this process indicates an equilibrium yield at 2/3 f MEY of about 14,000 t.

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Gavaris, S. 1980. Use of a multiplicative model to estimate catch rate and effort from commercial data. Can. J. Fish. Aquat. Sci. 37: 2272-2275.

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Table 1: Nominal catches (t) of redfish in Division 30 by country and year.

Country	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985*	1986*
Canada (M)+	-	610	655	381	1,557	565	417	47	4	29	48	5
Canada (N)	103	3,054	2,317	1,460	4,847	976	2,160	444	3	138	56	134
France (M)	-	1	-	-	-	-	-	-	-	-	-	-
France (SP)	-	15	2	-	-	-	-	-	-	-	-	-
France	-	-	-	-	-	-	-	-	2	-	-	-
Japan	7	4	-	3	2	-	-	496	1	1,258	661	1,162
Portugal	-	1	-	-	134	59	-	5	-	-	-	-
Romania	-	-	-	-	664	-	-	-	-	-	-	-
Spain	-	-	-	1	8	-	-	-	-	25	630	-
UK	-	-	-	-	-	-	-	-	-	-	-	-
USSR	15,000	11,663	7,376	4,647	8,008	14,219	8,659	8,717	5,670	7,262	5,905	5,960
Cuba	-	-	500	368	2,517	1,487	1,368	1,651	1,460	1,316	806	374
USA	-	-	-	-	-	-	-	-	-	-	104	2
TOTAL	15,110	15,348	10,850	6,860	17,737	17,306	12,604	11,360	7,140	10,028	8,210	7,637

* Provisional.

+ Maritimes and Quebec were combined prior to 1979.

Table 2: Nominal catches (t) of redfish in Division 30 by month and year.

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1975	-	2	1,926	1,313	2,186	3,680	723	897	3,123	1,159	-	101	15,110
1976	352	452	399	857	1,477	1,497	3,119	1,440	2,221	2,540	40	954	15,348
1977	553	36	1,047	1,736	987	1,865	1,580	1,113	1,032	828	63	10	10,850
1978	48	102	1,478	1,326	1,216	930	656	353	433	155	158	5	6,860
1979	35	844	2,464	2,072	87	1,997	739	692	1,235	1,320	3,594	2,658	17,737
1980	612	1,250	856	3,698	1,145	858	143	2,395	1,860	149	986	3,354	17,306
1981	991	3,735	1,444	1,601	621	1,467	773	584	510	873	5	-	12,604
1982	-	1	1,121	1,258	545	652	4,555	2,245	661	233	89	-	11,360
1983	254	355	2,904	1,227	71	156	576	938	319	1	73	266	7,140
1984	219	155	2	32	85	257	446	3,210	2,799	1,882	435	506	10,028
1985*	1,522	-	-	44	567	363	212	1,710	1,486	350	35	1,817	8,200 a
1986*	77	1	309	567	56	5	2,994	2,209	50	-	406	963	7,637

a includes 104 t caught by USA in unknown month

* Provisional.

Table 3: Parameter estimates from the analysis of catch/effort for redfish in Division 30 using a multiplicative model.

Country-Gear-TC	Estimate	Month	Estimate
FR(SP) OTB 4	-0.853	Apr.	-0.583
USSR OTB 4	-0.710	Jan.	
		Feb.	-0.288
CAN(M) OTB 4	-0.398	Oct.	
		Nov.	
CAN(N) OTB 4			
CAN(MQ) OTB 4	0.000	Mar.	
CAN(MQ) OTB 5		May	-0.159
CAN(M) OTB 5		Jul.	
		Dec.	
CAN(N) OTB 5	0.075		
		Jun.	
JPN OTB 6	0.238	Aug.	0.000
		Sep.	
POL OTB 7	0.436		
JPN OTB 7			
CUBA OTM 7	0.718		
USSR OTB 7			
CUBA OTB 7	0.904		
USSR OTM 7			

Table 4: Regression of multiplicative model for redfish in Division 30.

multiple r............ 0.793
multiple r squared..... 0.629

analysis of variance

source of variation	df	sums of squares	mean squares	f-value
intercept	1	8.192e0	8.192e0	
regression	37	1.170e2	3.163e0	15.842
type 1	8	5.683e1	7.104e0	35.584
type 2	3	7.833e0	2.611e0	13.079
type 3	26	1.538e1	5.917e¯1	2.964
residuals	345	6.888e1	1.996e¯1	
total	383	1.941e2		

Table 5: The predicted catch rate for redfish in Division 30.

	ln transform		retransformed			
year	mean	s.e.	mean	s.e.	catch	effort
1959	¯0.1218	0.0171	0.970	0.127	9268	9553
1960	¯0.0813	0.0683	0.985	0.253	5030	5108
1961	0.0391	0.0294	1.133	0.193	11394	10060
1962	¯0.1060	0.0196	0.984	0.137	7557	7677
1963	¯0.1009	0.0191	0.990	0.136	9194	9290
1964	¯0.2474	0.0356	0.848	0.159	20232	23865
1965	¯0.4800	0.0465	0.668	0.143	22438	33580
1966	¯0.1732	0.1109	0.879	0.285	15305	17406
1967	0.2038	0.0304	1.335	0.231	19037	14263
1969	¯0.4637	0.0275	0.686	0.113	15878	23158
1970	¯0.3210	0.0249	0.792	0.124	13192	16660
1971	¯0.0204	0.0198	1.072	0.151	19792	18459
1972	¯0.3622	0.0147	0.764	0.092	16117	21101
1973	0.0247	0.0256	1.118	0.178	8797	7865
1974	¯0.4777	0.0254	0.677	0.107	13124	19389
1975	¯0.5088	0.0346	0.653	0.121	15110	23137
1976	¯0.0401	0.0115	1.056	0.113	15348	14538
1977	¯0.1648	0.0102	0.933	0.094	10850	11634
1978	¯0.2166	0.0102	0.885	0.089	6860	7747
1979	0.2434	0.0094	1.403	0.136	17737	12640
1980	0.0343	0.0104	1.138	0.116	17306	15208
1981	0.2193	0.0113	1.369	0.145	12604	9210
1982	0.2909	0.0123	1.469	0.163	11360	7731
1983	0.1170	0.0167	1.232	0.159	7140	5795
1984	0.1116	0.0123	1.228	0.136	10028	8165
1985	¯0.0620	0.0145	1.031	0.124	8210	7961
1986	0.2422	0.2136	1.265	0.556	7637	6037

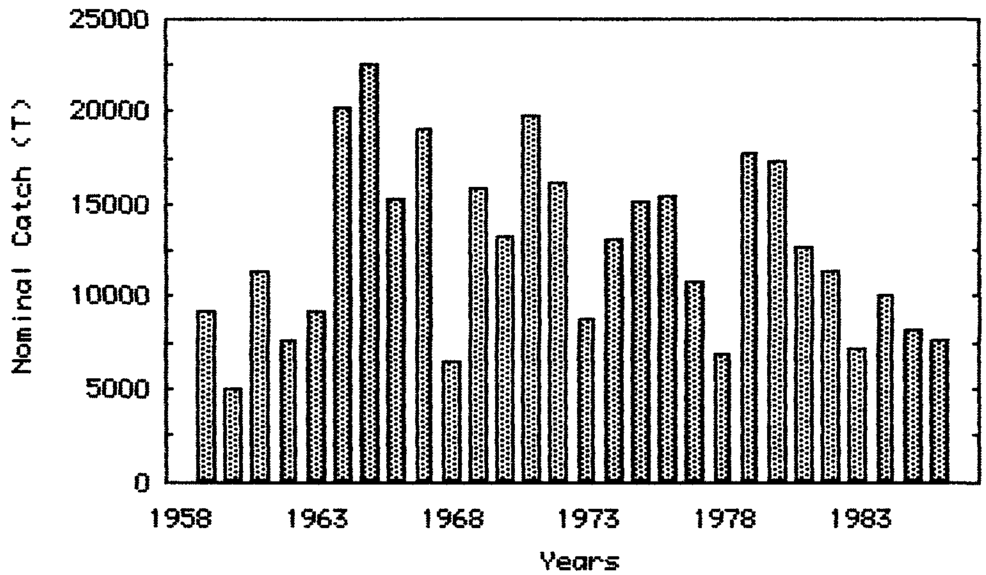

Fig. 1: Nominal catches of redfish from Division 30, 1959-1986
(1985 and 1986 are provisional)

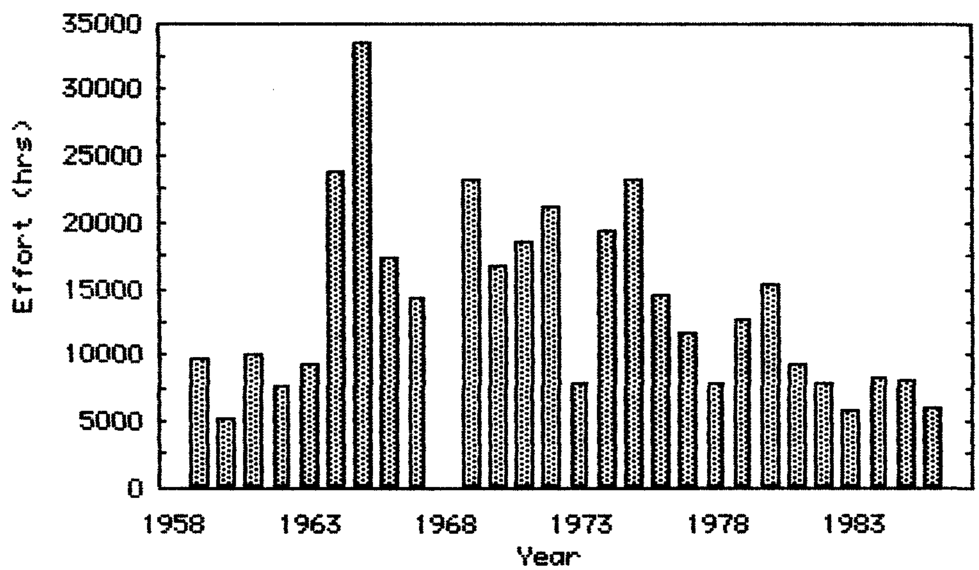

Fig. 2: Standardized effort for redfish in Division 30, 1959-1986
(1985 and 1986 are provisional)

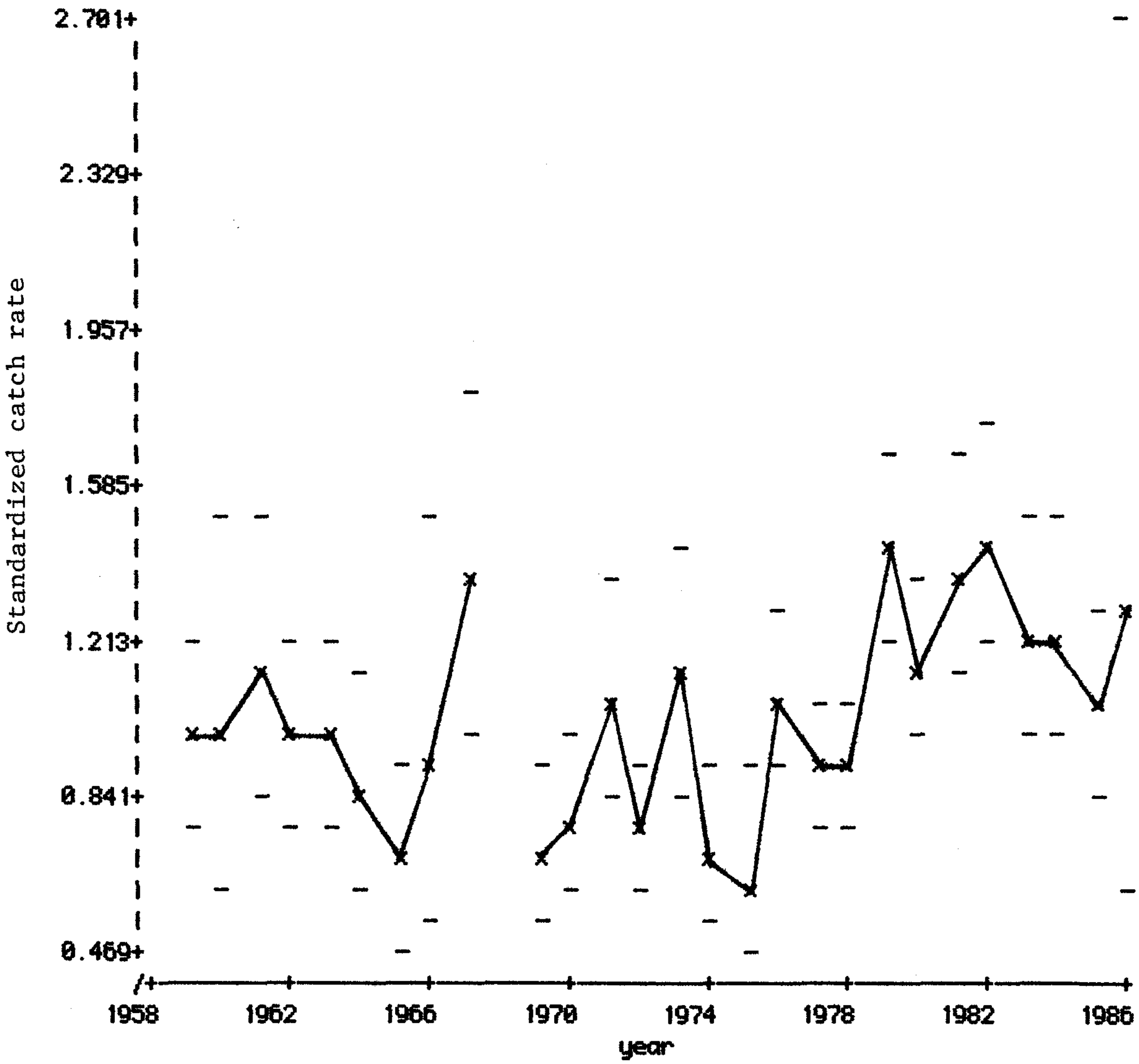

Figure 3: Plot of catch rates for redfish in NAFO Division 30 in the period 1959-1986 as derived using a multiplicative model (1985 and 1986 are preliminary).

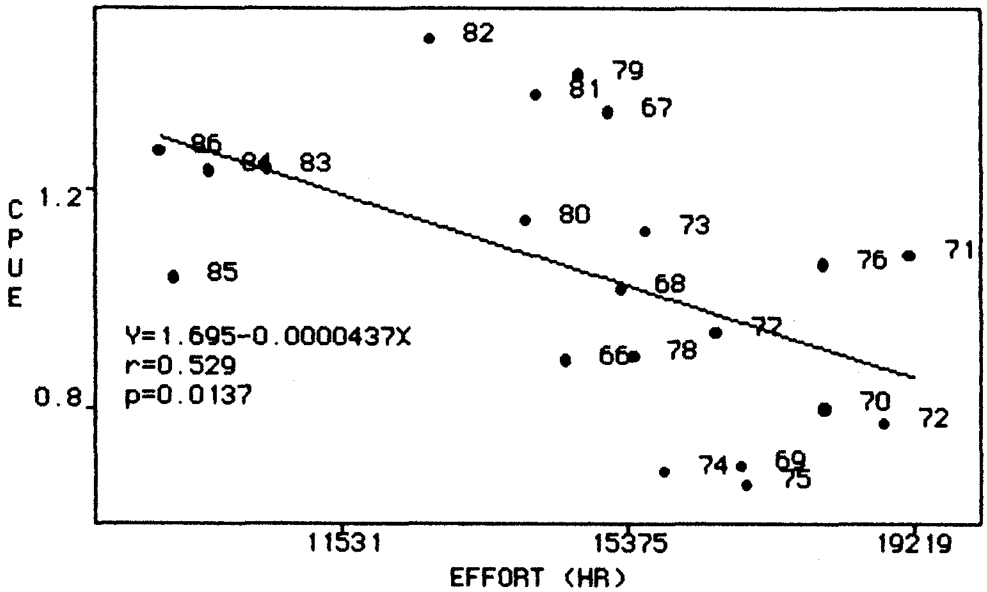

Fig. 4: Regression of standardized CPUE on standardized effort lagged 8 years for redfish in NAFO Division 30 (1985 and 1986 are preliminary).

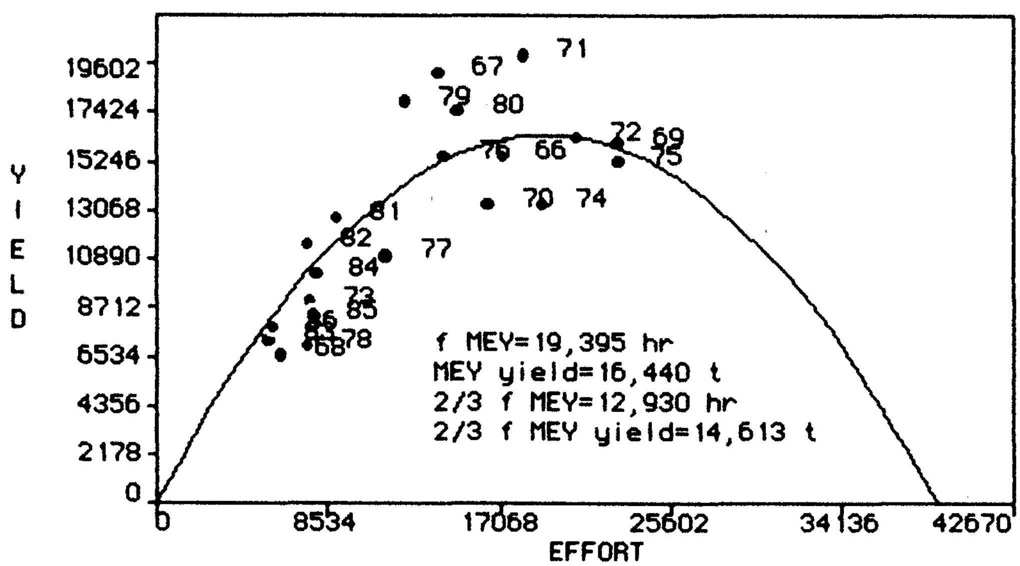

Fig. 5: General production curve derived from regression in Figure 4 above with the actual annual unlagged yield and effort shown for 1966-1986.

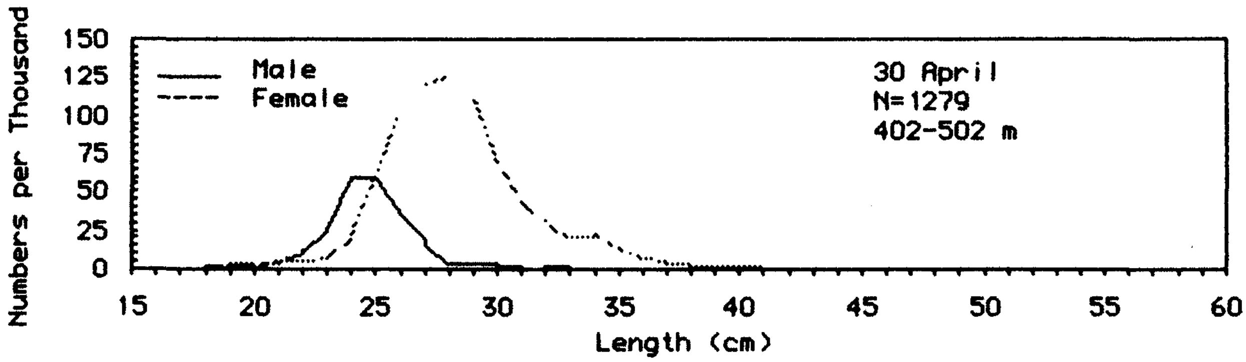

Fig.6: Commercial length frequencies of redfish caught by Japan in NAFO Division 3O in 1986 (sea sampling).