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Redfish Assessment Division 3Ø

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INTRODUCTION

The status of Division 3Ø redfish stock has been evaluated in previous years by the simple Shaefer general production model using catch and effort data. In 1978 the total allowable catch was set at 20,000 m tons, the same level as the previous year. This paper re-evaluates the stock using the same general production model but compares the old effort standard to a different standardizing method suggested by Robson (1966).

METHODS

As in previous assessments difficulties arising from the large catches of redfish being reported as other than redfish directed effort has resulted in the decision to use all catches in which redfish comprise greater than 50% of the catch in calculating CPUE. Landings and CPUE were tabulated from ICNAF Statistical Bulletins for the years 1955 to 1977.

In the past the catch per hour was determined by using Canada(Nfld.) tonnage class 4 for the years 1955-69 but since then the standard was adjusted to USSR tonnage class 7 from regression by a factor of 0.81.

Additionally, with changes in effort by differing countries and vessel categories a different method of standardizing fishing effort was also used. Namely, multilinear linear regression procedures which greatly increased the available effort data in the Division 3Ø fishery used to calculate CPUE (Gavaris, 1979)

Seasonal commercial length frequencies sampled by otter trawl for Canada(Nfld.) for 1978 are shown. Additionally, catch per tow at length from 1977 research and ageing data are presented.

RESULTS AND DISCUSSION

Stepwise multiple linear regression applied to the CPUE model produced a multiple R value of 0.68. The resulting vessel power coefficients for the fishing vessel types are listed in Table 1. Canada(Nfld.) was arbitrarily chosen as the standard and set equal to one. Several vessel types ranked higher than the standard but there was no trend of increasing or decreasing fishing power with an increase in vessel size. Trends in the nominal catch for the years 1955 to 1977 are listed in Table 2. Total nominal catches declined from 19,000 m tons in 1971 to 9,000 tons in 1973 and increased to 15,000 tons in 1975 and in 1976 but declined in 1977 to 11,000 tons. For the three years previous to 1977 the TAC was set at 16,000 tons but since due to the apparent good condition of the stock the TAC was raised to 20,000 tons.

All catches by the vessels which comprised the standard were used to calculate percent caught by the standard, CPUE and effort from the multiple regression technique are listed in Table 2. Additionally, trends in CPUE and effort for the years 1961 to 1977 in standardized trawler units following the method of Parsons and Parsons 1975 are shown in Fig. 1. CPUE for both standards follow a similar general pattern of increasing over the last seven years but the catch rate is lower for the standard based on the stepwise regression procedure. For example, in 1977 the catch rate is 0.79 using the new method and 1.4 using the Parsons and Parsons method. It is encouraging, however, that both standards follow similar patterns and that the CPUE apparently has been increasing since the late 60's. Perhaps the catch rate associated with the new standard better reflects the fishery, because it accounted for 69 percent of the catch in 1977 while the other method accounted for less that 5% of the catch.

The regression of CPUE on effort was significant ($P<0.01$) and $r=-0.753$ for the unlagged catch rate data (Fig. 2).

The unlagged yield curves based on the two differing effort standards are illustrated in Fig. 3 and 4. The estimated yield at MSY is 18,500 tons and the equilibrium at 2/3 effort MSY is 16,500 tons for the yield curve based on the multiple regression model (Fig. 3). For the effort standard suggested by Parsons and Parsons the yield at MSY is estimated to be 19,000 and the equilibrium yield at 2/3 MSY is 17,000 tons (Fig. 4). Throughout the 70's the yield points are on the ascending limb of the parabolas and in most cases clustered near the equilibrium line or above it. Thus some increase in effort could be implemented to increase the yield from this redfish stock without any detrimental effect.

Catch per tow for all depth combined from the 1977 research cruise indicate that the most common length classes are from 20-27 cm for both males and females (Table 3). Another peak, however, occurs from 34-43 cm for both sexes. A definite shift in increased length at depth occurs for both sexes from 100 to 400 fms. The smaller redfish are mainly found in 100-200 fms and the larger in 200-400 fms.

The catch rate from the research tows of larger redfish remain relatively high in the deeper waters (Table 3). Comparison of catch rate of small redfish (22-27 cm) for both sexes, with that for large redfish (36-41 for males and 38-45 for females) indicates catch rates of similar magnitude. Apparently the larger size classes were either relatively large year-classes or under exploited during their formative years. The latter case may occur as the area is not fishable to any degree below depths of 200 fms (McKone 1978).

Canadian(Nfld.) commercial length frequencies for 1978 bottom trawl indicate a number of length sizes are caught in the commercial fishery. By far the major contributions are in the range 22-28 cm for both sexes which when compared to research data indicates the fishery is in shallow water as indicated (Fig. 5).

Examination of ageing data indicates that the bulk of the commercial catch is comprised of redfish in the 8-12 year-old age groups for both sexes.

In summary, there are indications that the Division 3Ø redfish stock remains in good condition. The TAC is generally not caught and in 1977 was particularly low relative to the year previous, apparently because the commercial fleet will fish other more accessible areas first. Catch rates continue to remain high, slightly down from the previous year and effort also declined. Catches continue to remain slightly higher than expected from the yield parabola at the effort expended. Length frequencies indicate the commercial fleet mainly catch the younger year-classes but in those areas where tows can be made at greater depth, research data indicate a high abundance of large redfish.

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Table 1. Power coefficients of fishing vessel types for those countries who have been the major contributors.

COUNTRY	T.C.	GEAR	RELATIVE POWERS
Canada (N)	4	OT	1
USA	4	OT	1.82
USSR	7	OT	2.08
USSR	6	OT	0.57
USSR	4	OT	0.57
Poland	7	OT	1.80

Table 2. The total catch by those vessels which make up the standard, the nominal catch for all vessels, the percent caught by the standard, the catch per hour and total effort.

YEAR	CATCH BY STANDARD	TOTAL CATCH	PERCENT	STANDARD c/hr	TOTAL EFFORT
1955	7,918	8,422	94	0.29	29,041
1956	5,549	6,015	92	0.68	8,845
1957	2,020	2,347	86	1.01	2,323
1958	4,486	6,071	74	0.98	6,194
1959	8,213	9,268	89	0.84	11,033
1960	4,688	5,030	93	0.77	6,532
1961	7,971	11,394	70	0.73	15,608
1962	4,841	7,557	64	0.54	13,994
1963	4,128	9,194	45	0.60	15,323
1964	8,153	20,232	40	0.62	32,632
1965	7,391	22,438	33	0.38	59,047
1966	366	15,305	2		
1967	330	19,037	2		
1968	2	6,445			
1969	7,218	15,878	45	0.60	26,463
1970	10,170	13,192	77	0.52	25,369
1971	9,547	19,792	48	0.58	34,124
1972	4,664	16,117	29	0.50	32,234
1973	7,476	8,797	85	0.77	11,424
1974	7,561	13,124	58	0.70	18,748
1975	5,115	15,110	34	0.66	22,893
1976	8,900	15,348	58	0.90	17,053
1977	7,500	10,850	69	0.79	13,734

Table 3. Research (1977). Average catch per tow by depth and for all depths combined for male and female redfish from Division 3Ø.

Length	Male Depth 101-150 fms	Male Depth 151-200 fms	Male Depth 201-300 fms	Male Depth 301-400 fms	Male Combined Depths	Female Depth 101-150 fms	Female Depth 151-200 fms	Female Depth 201-300 fms	Female Depth 301-400 fms	Female Combined Depths
13	1	1			1					
14	1	1			1		1			
15	8	1	1		3	1	1			1
16	8	3	1		3	3	2			1
17	21	5	1		7	5	1			2
18	30	4			9	11	2			3
19	27	6	2		9	16	3	1		5
20	26	11	7		11	15	6	1		6
21	41	22	14	5	21	22	12	4		10
22	59	32	17		27	35	13	6	5	15
23	107	40	20	3	43	40	22	8	2	18
24	122	61	19		51	74	23	9		27
25	122	58	23	1	51	90	38	5	5	35
26	69	51	18	5	36	80	42	5	2	32
27	29	33	14	1	19	71	53	6	1	33
28	13	18	7		10	58	46	7	2	28
29	6	13	8	1	7	26	38	5	1	18
30	1	8	6		4	14	27	6		12
31	4	5	9	1	5	8	17	8	6	10
32	1	4	13	12	8	8	13	13	1	9
33		2	15	20	9	3	15	15	5	10
34		1	14	13	7	2	13	25	8	12
35			8	31	10	1	12	19	7	10
36			5	49	14	1	7	16	7	8
37			6	68	19		3	9	10	6
38		1	6	83	23		2	6	33	10
39		1	6	95	26			3	39	11
40			6	53	15		2	3	57	16
41			4	31	9		1	8	82	23
42				5	1		1	10	96	27
43				7	2		1	7	61	17
44				2	1			4	45	12
45				2	1		1	1	3	1
46								1		

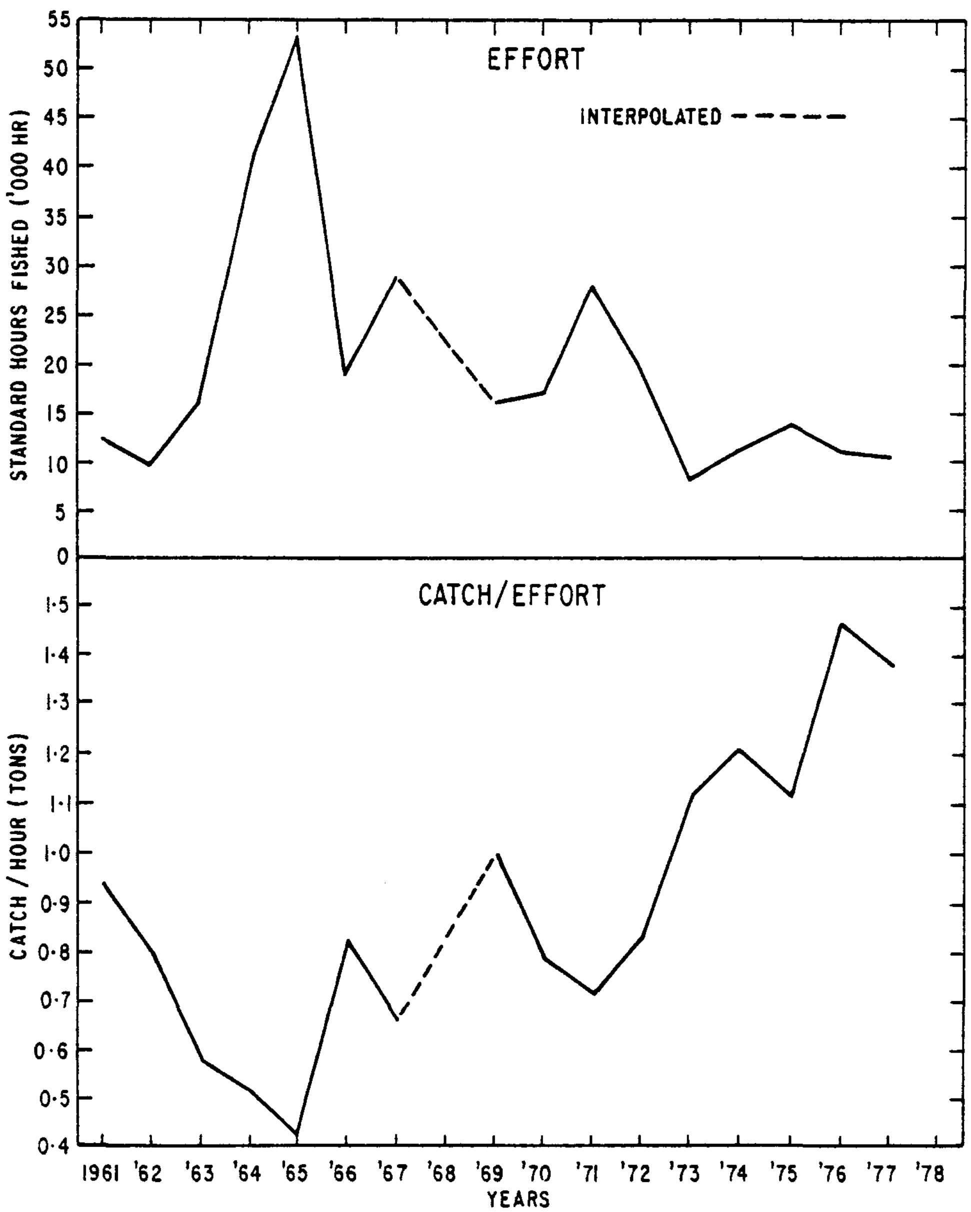

Fig. 1. Trends in effort and catch per unit effort in standardized trawler units following the method of Parsons and Parsons 1975 with 1972-1977 added for Division 3Ø.

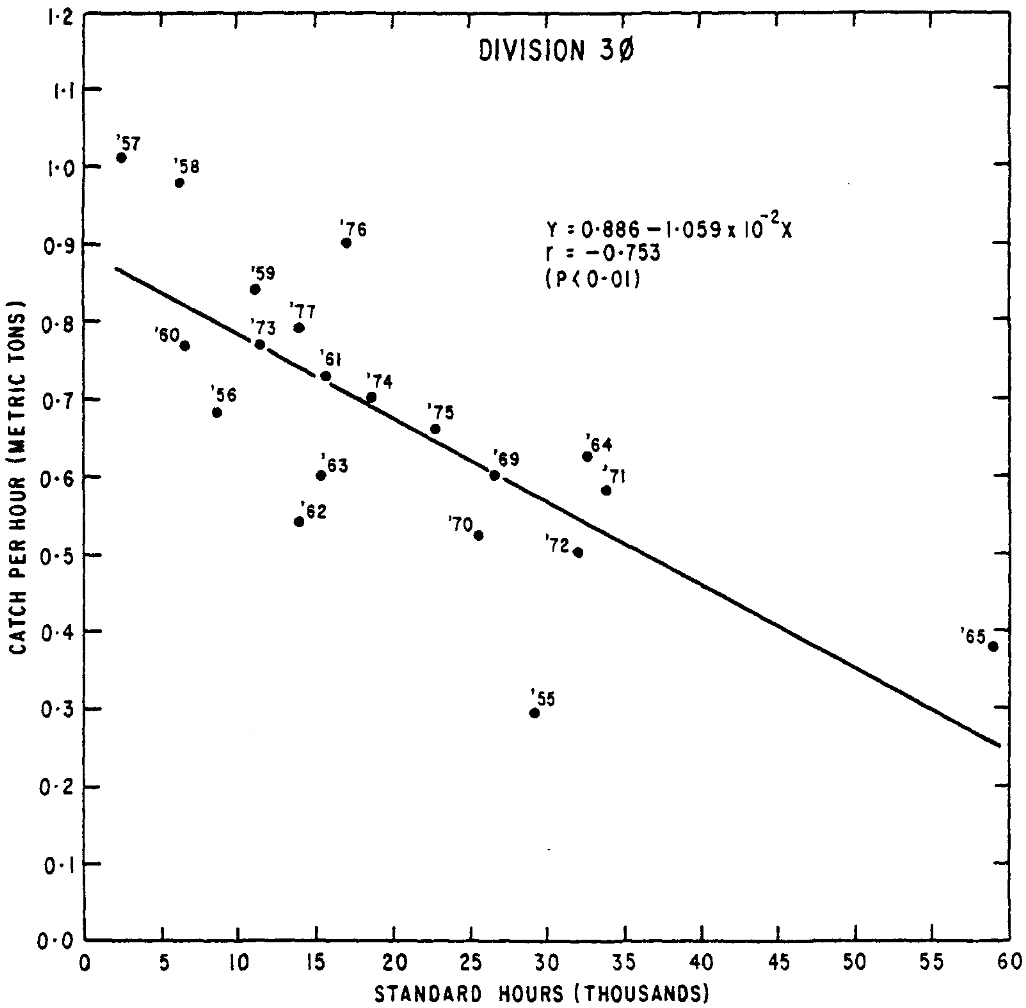

Fig. 2. Linear regression of catch per standard hour fished and the standard hours fished for the standard derived from using multiple linear regression techniques.

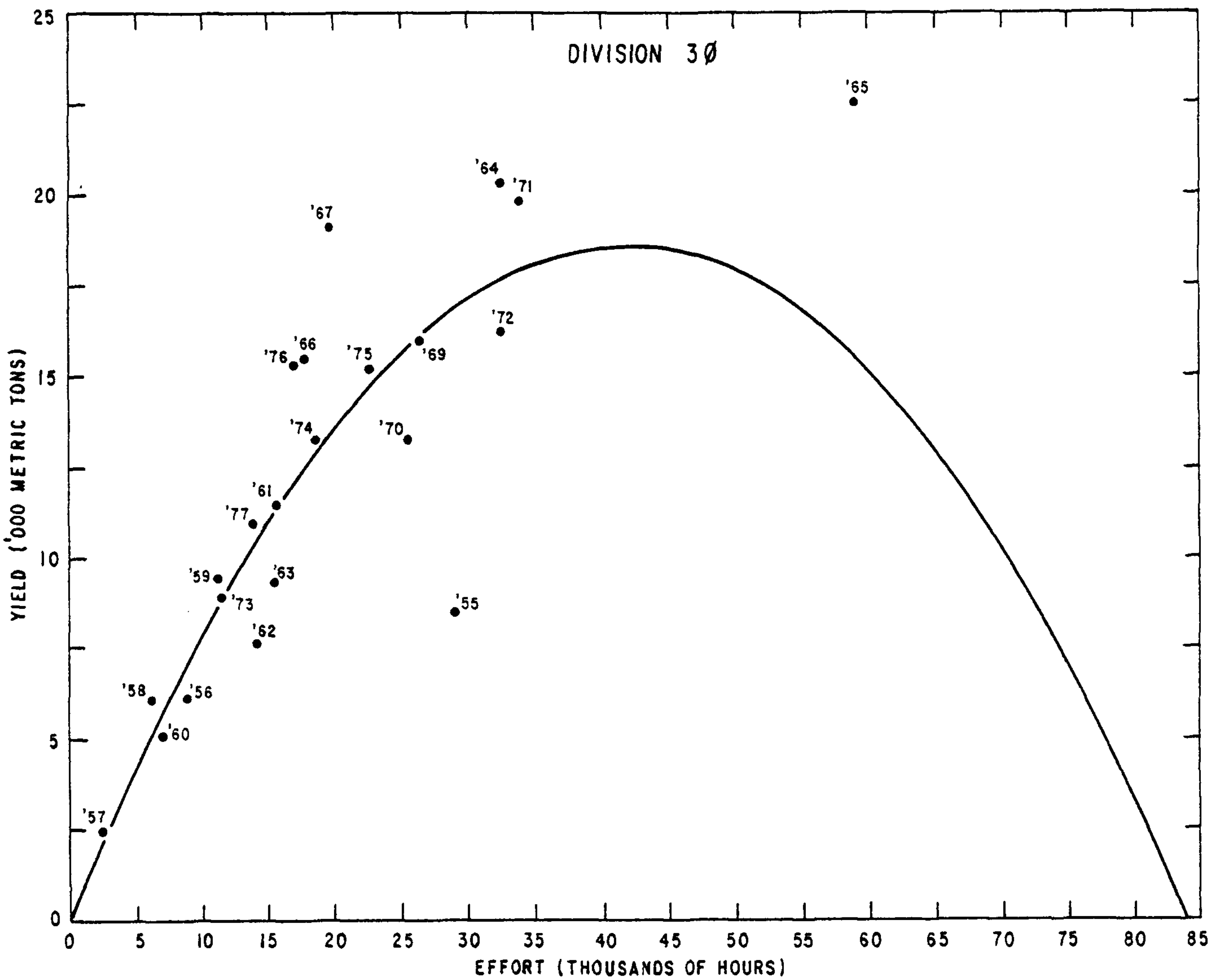

Fig. 3. Simple yield curve for Division 3Ø redfish derived from catch per unit effort for the standard hours fished from multiple linear regression.

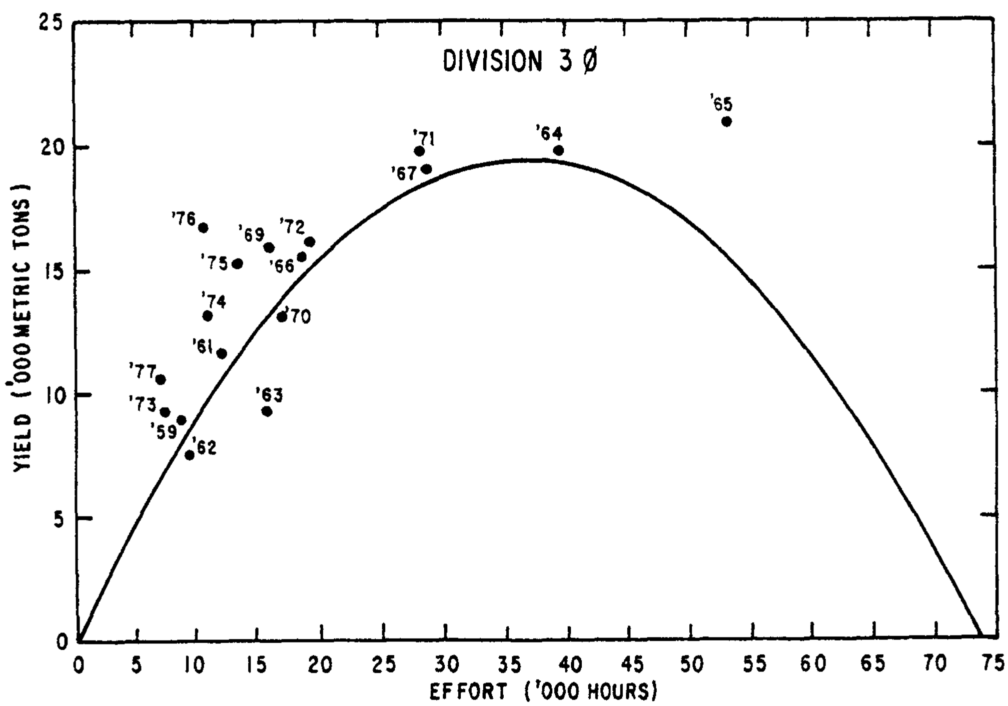

Fig. 4. Yield curves for redfish Div. 3Ø derived from catch per unit effort for standard hours fished from Parsons and Parsons 1975 extended to include 1972-1977.

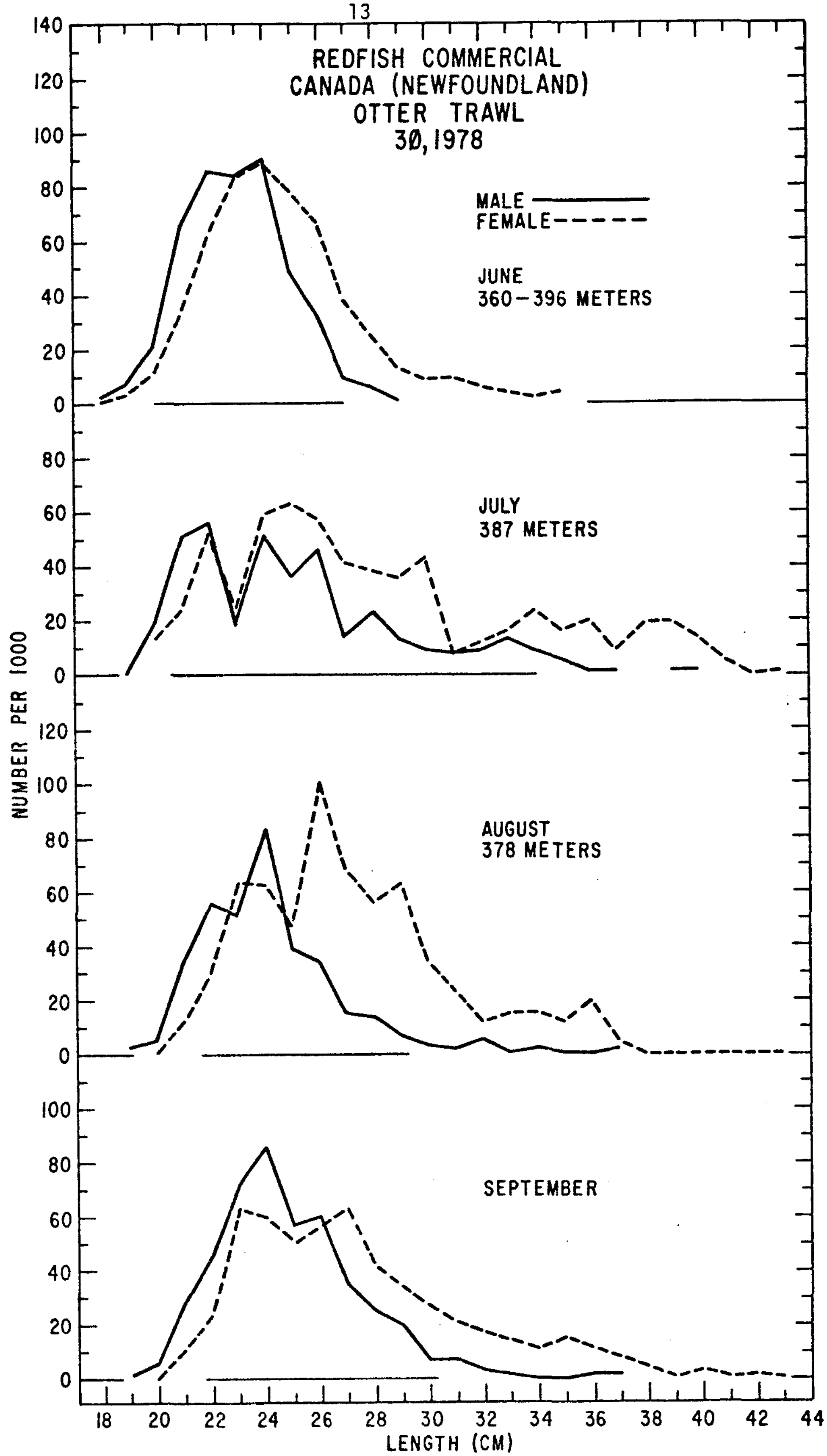

Fig. 5. Length frequencies of Canadian commercial catches for bottom trawl in 1978.

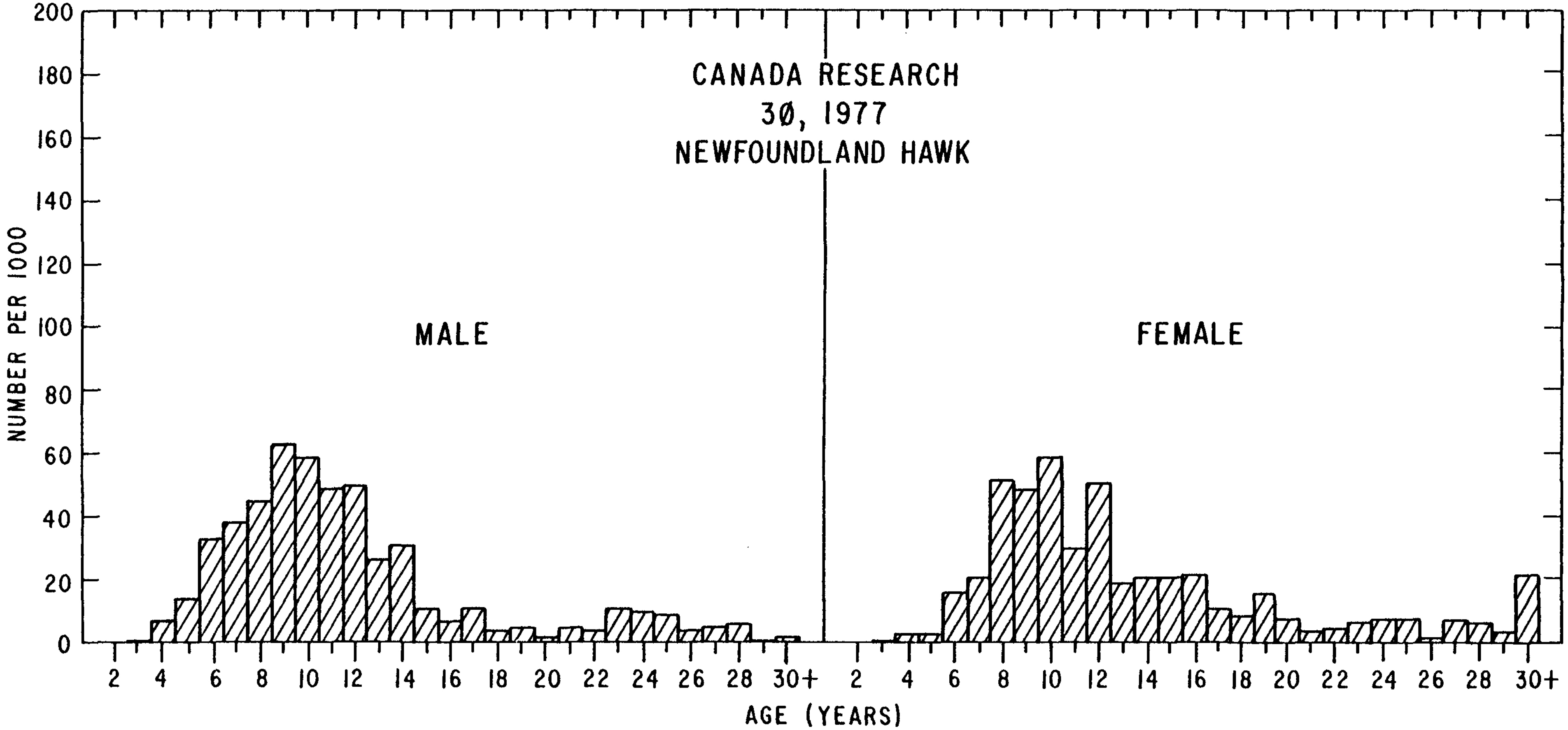

Fig. 6. Age frequencies of 1977 Canadian research sampling.