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CSCPCA Document de recherche 84/31

Division 3P Redfish

by

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### Abstract

The continued low effort directed toward redfish in Div. 3P resulted in less than 50% of the TAC of 18,000 t being taken again in 1983. Catch rates have been increasing since about 1978 and the extensive 1983 research survey indicates both a wide range of ages present in the stock and good recruitment to the fishery by the late 1980's.

### Résumé

Un effort de pêche toujours faible dirigé sur le sébaste de la div. 3P a résulté, de nouveau en 1983, en des prises de moins de 50 % du TPA de 18 000 t. Les taux de capture augmentent depuis 1978, et le relevé intensif de 1983 par navire de recherche indique la présence d'une gamme d'âges étendue dans le stock et laisse entrevoir un bon recrutement pour la pêche de la fin des années 1980.

## Introduction

Catches of redfish in Div. 3P have declined from about 37,000 t in 1970 to about 7,000 t in 1983. From 1979 to the present the TAC's have not been achieved due to a decrease in effort. This decrease is reflective of poor market conditions coupled with fish plant closures in some years.

## Methods and Results

### Catch and Effort

Tables 1a and 1b indicate that since 1971 Newfoundland has taken the largest portion of redfish from both 3Ps and 3Pn. Although this fishery is prosecuted throughout the year (Tables 2a, 2b) the trend in more recent years is towards fishing in the second half of the year in both Divisions. Historically the largest catches have been taken in 3Ps (Table 3) but in more recent years they have been more evenly divided. While not decreasing in 3Pn, catches have dropped in 3Ps, indicating that the decrease in effort has largely occurred here. The catches from 3P are summarized in Fig. 1.

Again this year the effort data from catches comprising >50% redfish were standardized using the multiplicative model (Gavaris 1980). Corrections to the Maritimes data were received too late to be included and thus were not used again this year. The categories of vessel type-gear, month, and year were weighted step-wise by  $\log_{10}$  effort. The regression results (Table 4) indicate significance and the standardized (to 1959) effort and catch rates (Table 5 and Fig. 2 and 3) indicate reduced effort and an increase in catch rates since about 1978. As noted in last year's assessment (Atkinson MS 1983), the high catch rates of the mid-to-late 1960's probably reflect recruitment of the strong year-classes of the late 1950's and are not indicative of an historic average.

### Numbers and Weight at Age

The commercial length frequencies available (Fig. 4, 5, and 6) were combined (Fig. 7) then converted to numbers at age by the method of Gavaris and Gavaris (1983) using the 1983 commercial age-length data. The weights at age were determined from the following relationships:

$$Wt_{\text{males}}(\text{gm}) = 0.01659FL^{2.9548}$$

$$Wt_{\text{females}}(\text{gm}) = 0.01372FL^{3.0210}$$

The results (Table 6) indicate that fish aged 14-18 dominated in the landings. These correspond to fish lengths modal at about 30 cm seen in the frequencies. The catches and weights at age from 1973-1983 are shown in Tables 7 and 8. The weight at age has been calculated annually only for 1981-83.

## Research Cruise Data

The time series is not considered to be a reliable index of abundance (Atkinson, MS 1983) and is not shown. In 1983, the research cruise resulted in excellent coverage of the area. The results (Fig. 8) indicate very good future recruitment to the fishery with fish aged 2-5 being present in relatively high numbers. Unlike previous surveys which consistently showed fish aged 7-10 to be relatively abundant (Atkinson MS 1983), the 1983 results indicate a wide range of ages present. If this survey, because of the coverage, can be considered more reliable, then the presence of the wide range of ages would suggest that the stock is in a healthy condition.

## Discussion

In recent years it has not been possible to tune any cohort analysis because of the low effort and resultant low fishing mortality. With only 7,280 t caught in 1983, this trend continues and attempts made to determine terminal F were unsuccessful.

The catch rates have shown a gradual increase in recent years and results of the successful research cruise in 1983 indicated the presence of a wide range of ages in the population along with relatively strong year-classes that will recruit to the fishery by the late 1980's. These indicators all suggest that this stock is in a healthy condition. Because of the low effort and F no change in the present TAC of 18,000 t can be suggested although it is felt that this level may be conservative.

## References

- Atkinson, D.B. MS 1983. An Assessment of the 3P Redfish Stock. CAFSAC Res. Doc. 83/26.
- 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.
- Gavaris, S. and C.A. Gavaris. 1983. Estimation of catch at age and its variance for groundfish stocks in the Newfoundland region. In Sampling Commercial Catches of Marine Fish and Invertebrates. W.G. Doubleday and D. Rivard. ed. Can. Spec. Pub. Fish. Aquat. Sci. 66 pp 178-182.

Table 1a. 3Pn redfish catches (t) by country and gear

Country	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983 <sup>a</sup>
Can(MQ)(M) <sup>C</sup>	-	353	1,520	3,941	2,735	932	743	37	30	108	311	539
Can(N)	455	3,115	2,559	3,505	2,925	1,283	2,266	2,676	2,154	3,749	3,508	2,328
Can(Q)	-	-	-	-	-	-	-	384	165	387	-	1,369 <sup>b</sup>
Fr(M)	-	-	53	27	8	-	1	1	-	11	-	-
Fr(Sp)	2	-	24	571	236	270	32	62	23	1	1	68 <sup>b</sup>
FRG	29	-	-	-	-	-	-	-	-	-	-	-
Japan	-	-	-	6	-	-	-	-	-	-	-	-
Portugal	153	186	105	50	-	-	-	-	-	-	-	-
U.K.	-	-	3	-	-	-	-	-	-	-	-	-
Ireland	-	-	-	-	28	-	-	-	-	-	-	-
Total	639	3,654	4,264	8,100	5,932	2,485	3,042	3,160	2,372	4,256	3,820	

<sup>a</sup>Provisional<sup>b</sup>Includes 3Pn+3Ps<sup>c</sup>Maritime and Quebec catches were combined prior to 1979.

Table 1b. 3Ps redfish catches (t) by country and gear.

Country	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983 <sup>a</sup>
Can(MQ)(M) <sup>C</sup>	654	1,131	513	2,549	3,242	3,730	2,592	970	360	391	515	670
Can(N)	4,758	9,978	4,999	8,744	7,948	9,489	9,282	5,119	4,609	4,123	1,553	2,306
Can(Q)	-	-	-	-	-	-	-	248	-	-	-	1,369 <sup>b</sup>
Fr(M)	-	-	147	60	6	8	14	21	112	124	5	-
Fr(Sp)	558	155	200	571	1,071	1,437	315	101	111	47	17	68 <sup>b</sup>
FRG	7	-	-	-	-	-	-	-	-	-	-	-
GDR	13	-	-	-	-	-	-	-	-	-	-	-
Japan	1,038	444	601	-	8	-	-	-	-	-	-	-
Portugal	-	-	90	101	10	-	-	-	-	-	-	-
Spain	-	-	-	10	13	-	-	-	-	-	-	-
U.K.	-	7	-	3	-	-	-	-	-	-	-	-
USSR	18,370	2,999	11,344	8,112	911	14	-	-	-	-	-	-
Ireland	-	-	-	-	26	-	-	-	-	-	-	-
Total	25,398	14,714	17,894	20,150	13,235	14,678	12,203	6,459	5,192	4,685	2,090	

<sup>a</sup>Provisional<sup>b</sup>Includes 3Pn + 3Ps<sup>c</sup>Maritime and Quebec catches were combined prior to 1979

Table 2a. 3Pn redfish catches (t) by month and year.

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Unknown	Total
1972	35	29	-	52	12	35	70	113	22	86	2	30	153	639
1973	53	192	892	381	3	298	102	230	664	303	234	302	-	3,654
1974	660	643	149	21	32	142	133	55	108	203	1,508	610	-	4,264
1975	1,944	445	224	744	21	61	273	1,146	2,764	340	104	34	-	8,100
1976	281	511	1,370	1,892	469	281	509	371	130	91	19	8	-	5,932
1977	146	108	373	74	71	291	102	459	613	89	71	88	-	2,485
1978	6	339	674	38	10	77	160	549	392	55	491	251	-	3,042
1979	17	142	598	354	74	92	210	168	167	372	570	396	-	3,160
1980	5	38	279	193	12	155	388	196	173	192	360	381	-	2,372
1981	9	432	100	315	117	160	969	540	498	753	272	91	-	4,256
1982	-	1	39	13	10	153	502	288	923	652	959	280	-	3,820
1983 <sup>a</sup>	21	59	30	207	1	218	251	590	807	144	356	183	-	2,867

<sup>a</sup>Provisional Canada (N+M) only

Table 2b. 3Ps redfish catches (t) by month and year.

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1972	416	295	1,005	204	337	1,291	3,762	6,721	4,677	3,292	2,815	583	25,398
1973	445	331	2,451	425	239	1,720	2,514	2,552	1,381	836	630	1,190	14,714
1974	1,077	1,317	3,378	3,328	487	2,463	2,162	1,029	689	838	667	459	17,894
1975	911	357	657	847	2,546	1,846	3,072	3,527	2,589	1,731	1,104	963	20,150
1976	363	371	1,729	1,272	714	2,414	2,970	2,282	822	211	66	21	13,235
1977	80	388	1,348	694	506	2,408	1,848	1,782	1,846	2,010	1,307	461	14,678
1978	31	301	899	396	148	903	1,625	2,029	1,892	2,178	1,066	735	12,203
1979	30	53	459	881	140	886	951	1,005	690	587	618	159	6,459
1980	6	72	347	469	174	257	978	1,130	706	335	339	379	5,192
1981	21	537	763	157	217	897	465	937	134	150	224	183	4,685
1982	4	5	27	127	154	133	220	580	193	398	205	44	2,090
1983 <sup>a</sup>	8	9	28	27	73	59	133	460	666	953	166	394	2,976

<sup>a</sup>Provisional Canada (N+M) Only

Table 3. Summary of redfish catches (t) in 3P.

Year	3Pn	3Ps	Total
1959	9	3,774	3,783
1960	14	9,211	9,225
1961	1,060	8,340	9,400
1962	2,132	11,306	13,438
1963	2,597	11,150	13,747
1964	4,688	9,119	13,807
1965	8,802	9,931	18,733
1966	4,325	16,543	20,868
1967	4,526	28,465	32,991
1968	2,642	11,242	13,884
1969	3,324	28,727	32,051
1970	3,689	33,581	37,270
1971	966	26,534	27,500
1972	639	25,398	26,037
1973	3,654	14,714	18,368
1974	4,264	17,894	22,158
1975	8,100	20,150	28,250
1976	5,932	13,235	19,167
1977	2,485	14,678	17,163
1978	3,042	12,203	15,245
1979	3,160	6,459	9,619
1980	2,372	5,192	7,564
1981	4,256	4,685	8,941
1982	3,820	2,090	5,910
1983 <sup>a</sup>			7,280

<sup>a</sup>Provisional

Table 4. Regression of multiplicative model for Div. 3P redfish.

MULTIPLE R.....0.686  
 MULTIPLE R SQUARED.....0.470

ANALYSIS OF VARIANCE				
SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
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INTERCEPT	1	3.293E2	3.293E2	
REGRESSION	33	1.085E2	3.287E0	24.934
TYPE 1	3	3.240E1	1.080E1	81.914
TYPE 2	6	9.872E0	1.645E0	12.481
TYPE 3	24	7.985E1	3.327E0	25.239
RESIDUALS	928	1.223E2	1.318E-1	
TOTAL	962	5.601E2		

Table 5. Predicted relative power for Div. 3P redfish.

YEAR	TOTAL CATCH	PROP.	RELATIVE POWER		EFFORT
			MEAN	S.E.	
-----	-----	-----	-----	-----	-----
1959	3783	0.364	1.000	0.000	3783
1960	9225	0.349	0.924	0.145	9985
1961	9400	0.728	0.903	0.134	10414
1962	13438	0.582	0.824	0.115	16301
1963	13747	0.777	1.203	0.161	11423
1964	13807	0.803	1.221	0.175	11310
1965	18733	0.766	1.484	0.205	12621
1966	20868	0.618	1.703	0.238	12255
1967	32991	0.333	1.501	0.209	21978
1968	13884	0.391	1.318	0.185	10534
1969	32051	0.219	1.393	0.194	23001
1970	37270	0.252	1.219	0.166	30571
1971	27500	0.143	1.048	0.148	26230
1972	26037	0.150	0.908	0.129	28681
1973	18368	0.634	0.996	0.134	18446
1974	22158	0.270	0.830	0.114	26688
1975	28250	0.375	0.768	0.105	36799
1976	19167	0.504	0.741	0.101	25874
1977	17163	0.567	0.616	0.083	27844
1978	15245	0.692	0.646	0.087	23583
1979	9619	0.701	0.661	0.088	14563
1980	7564	0.758	0.752	0.101	10056
1981	8941	0.616	0.676	0.092	13224
1982	5910	0.629	0.871	0.123	6786
1983	7280	0.396	1.081	0.161	6733

AVERAGE C.V. FOR THE MEAN:0.134



Table 6. Estimated commercial catch at age for redfish in 3P, 1983.

AGE	AVERAGE		CATCH		
	WEIGHT	LENGTH	MEAN	STD. ERR.	C. V.
6	0.076	16.997	10	2.73	0.28
7	0.114	19.452	12	3.25	0.26
8	0.164	22.350	10	3.79	0.36
9	0.214	24.449	72	13.23	0.18
10	0.258	25.960	231	31.43	0.14
11	0.269	26.419	286	35.21	0.12
12	0.318	27.919	498	74.80	0.15
13	0.347	28.778	741	105.05	0.14
14	0.376	29.582	1178	146.80	0.12
15	0.394	30.059	1310	159.00	0.12
16	0.412	30.467	1392	164.32	0.12
17	0.454	31.408	1156	152.93	0.13
18	0.464	31.649	1451	165.50	0.11
19	0.490	32.144	754	122.60	0.16
20	0.495	32.289	698	117.07	0.17
21	0.533	33.132	595	91.67	0.15
22	0.579	33.966	421	77.75	0.18
23	0.606	34.535	333	64.35	0.19
24	0.673	35.753	334	55.91	0.17
25	0.684	36.029	332	48.61	0.15
26	0.740	36.973	268	45.39	0.17
27	0.711	36.510	529	62.70	0.12
28	0.820	38.205	309	48.63	0.16
29	0.845	38.512	328	51.32	0.16
30	0.939	39.833	1313	75.79	0.06

Table 7. Commercial catch at age of redfish in 3P, 1973-1983.

AGE	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
6	13	105	401	41	257	1339	440	191	8	3	10
7	11	895	694	56	491	4146	1510	976	204	11	12
8	16	1876	1868	263	499	7359	2703	1776	1550	76	10
9	8	1647	883	581	790	7382	2859	2377	1923	234	72
10	20	1528	486	386	835	5203	1606	1929	1686	250	231
11	536	1830	1112	434	777	2358	896	1532	1344	606	286
12	1004	1399	623	506	971	2049	1020	1219	1236	856	498
13	3076	3602	1016	990	849	857	714	629	1327	943	741
14	6099	3058	1123	1119	1022	1085	710	802	635	1315	1178
15	9314	3173	2206	1072	1438	1162	496	579	518	1042	1310
16	5866	7661	3613	1796	793	927	449	313	384	940	1392
17	7300	2597	8428	1124	1298	791	603	366	348	458	1156
18	1842	3930	6040	4154	1005	1067	548	308	304	322	1451
19	978	1063	12060	1897	2659	852	531	315	399	233	754
20	1149	1326	3015	6345	1490	1883	655	319	374	151	698
21	589	701	2323	1463	4659	520	1021	428	286	188	595
22	385	1555	2080	2387	2281	1534	676	809	510	207	421
23	404	2821	1758	1957	2398	1040	1263	484	876	194	333
24	484	1410	790	1310	2031	1080	731	796	521	302	334
25	168	2147	1205	2269	1083	1053	1053	482	1021	393	332
26	2	1887	995	1613	619	674	691	490	688	575	268
27	2	2	687	868	396	532	454	239	649	386	529
28	2	2	2	575	307	339	345	287	450	411	309
29	2	2	2	2	289	187	207	171	371	342	328

Table 8. Weights at age of redfish in 3P, 1973-1983.

AGE	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
6	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.06	0.08
7	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.10	0.11
8	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.16
9	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.22	0.22	0.21
10	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.27	0.27	0.26
11	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.33	0.27
12	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.34	0.36	0.32
13	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.36	0.37	0.35
14	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.42	0.40	0.38
15	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.43	0.42	0.39
16	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.47	0.44	0.41
17	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.51	0.45
18	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.54	0.52	0.46
19	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.62	0.57	0.49
20	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.63	0.60	0.50
21	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.60	0.66	0.53
22	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.65	0.67	0.58
23	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.65	0.70	0.61
24	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.71	0.68	0.67
25	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.73	0.71	0.68
26	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.78	0.75	0.74
27	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.81	0.85	0.71
28	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.87	0.82	0.82
29	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.88	0.93	0.86

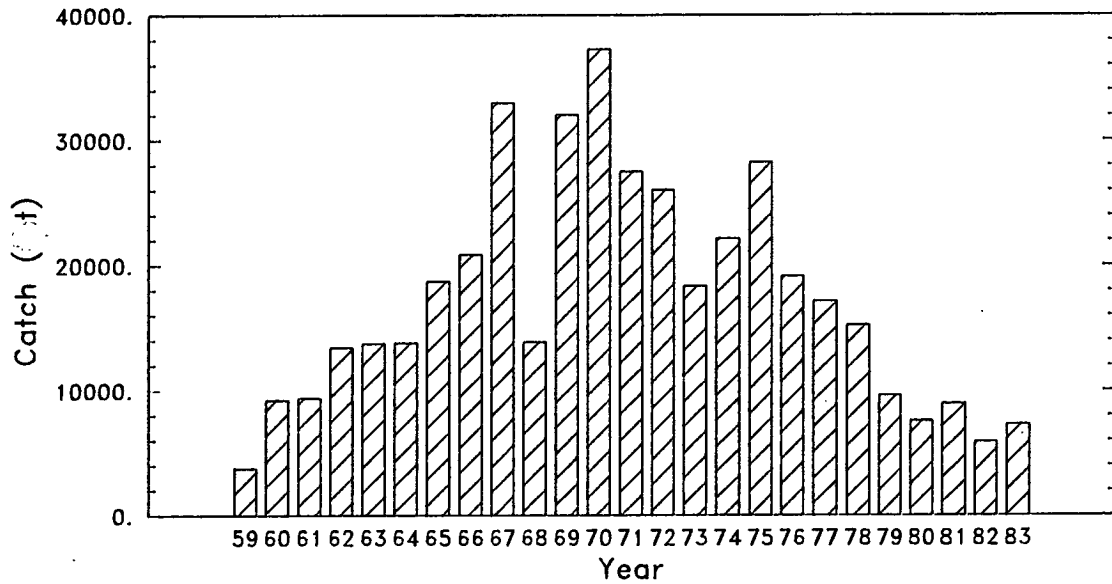


Fig.1: Nominal catches of redfish from 3P, 1959–1983. (1983 Provisional)

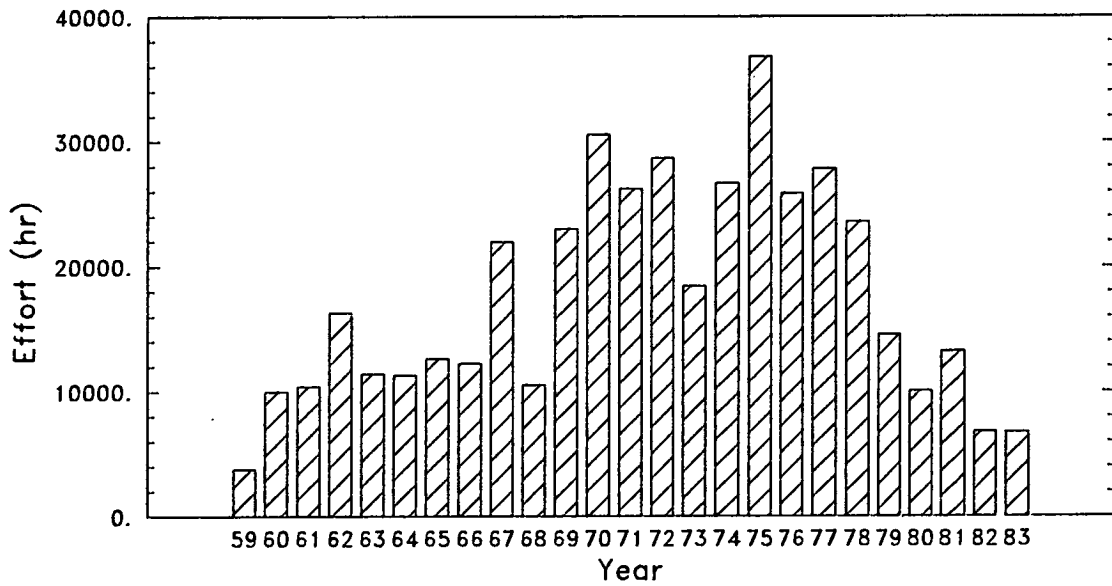


Fig.2: Standardized directed effort for redfish, 3P, 1959–1983. (1983 Provisional)

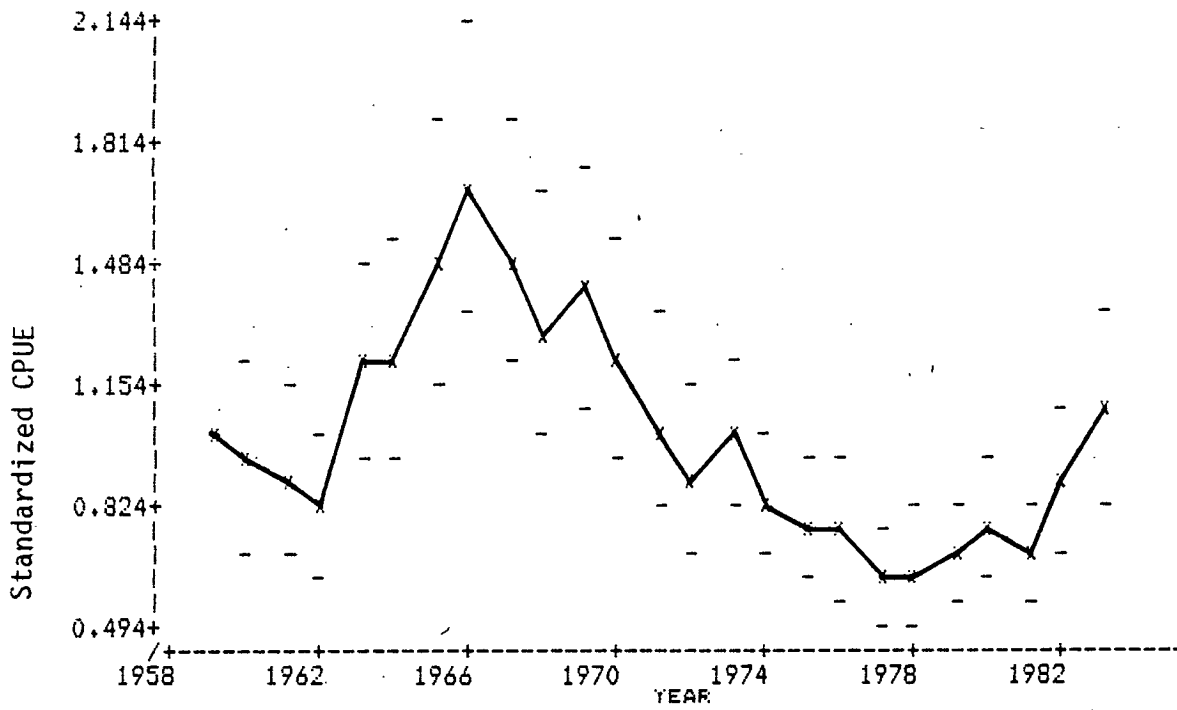


Fig. 3. Standardized catch rates for redfish in 3P.

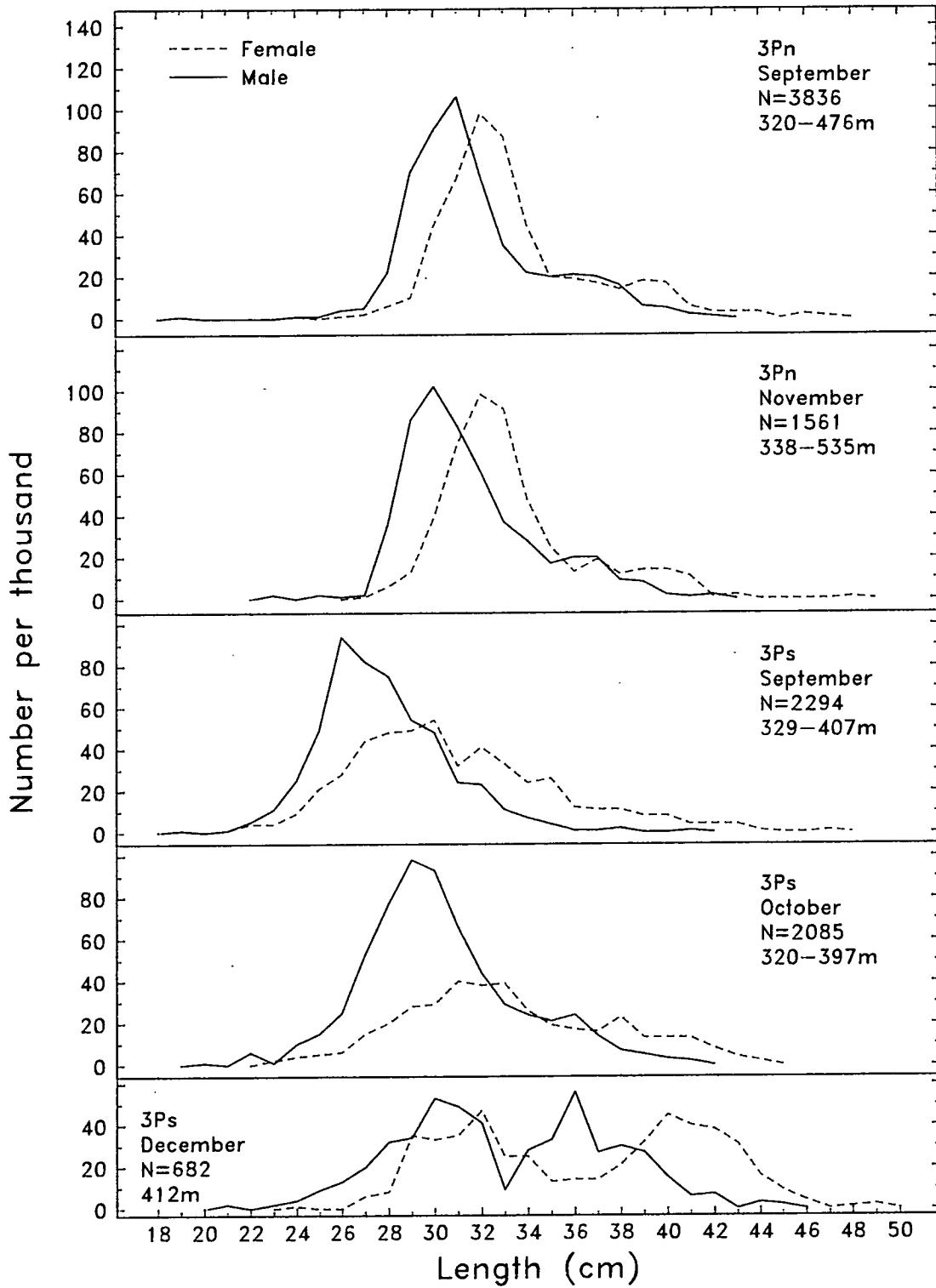


Fig.4: Commercial frequencies from Canadian (Nfld.) otter trawl redfish fishery in 3P in 1983 (port sampling).

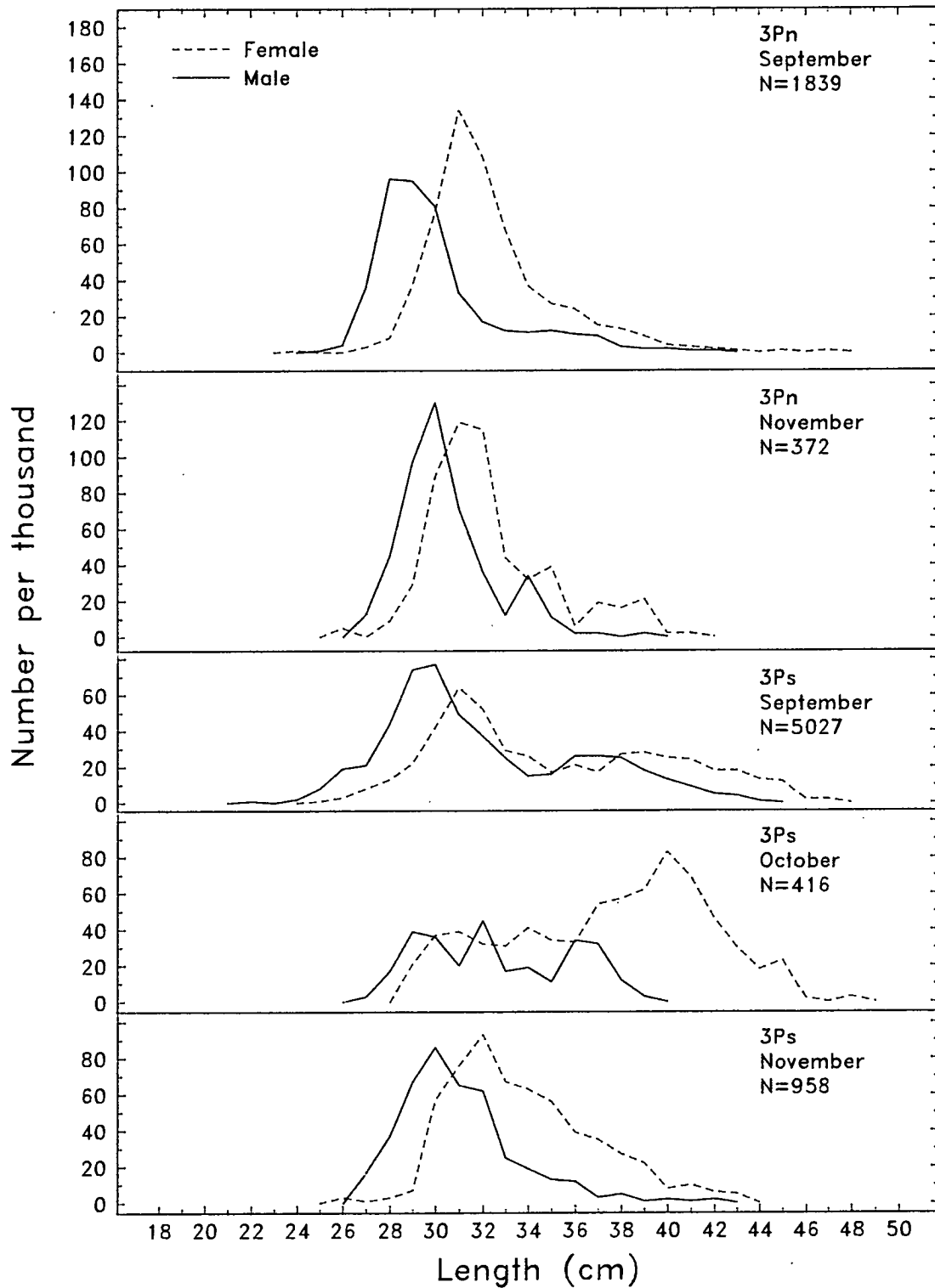


Fig. 5: Commercial frequencies from Canadian (Nfld.) otter trawl redfish fishery in 3P in 1983 (Foreign Cooperative Research (FCR) sampling).

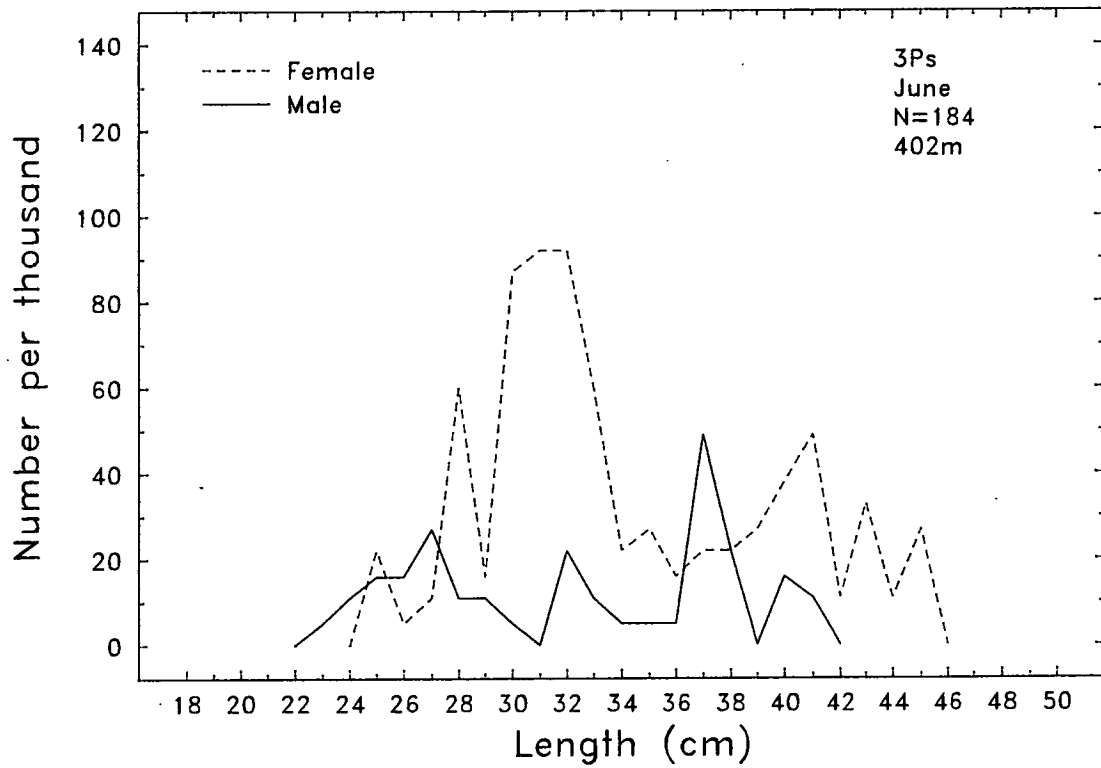


Fig.6: Commercial frequencies from Canadian (Maritime) otter trawl redfish fishery in 3P in 1983 (port sampling).

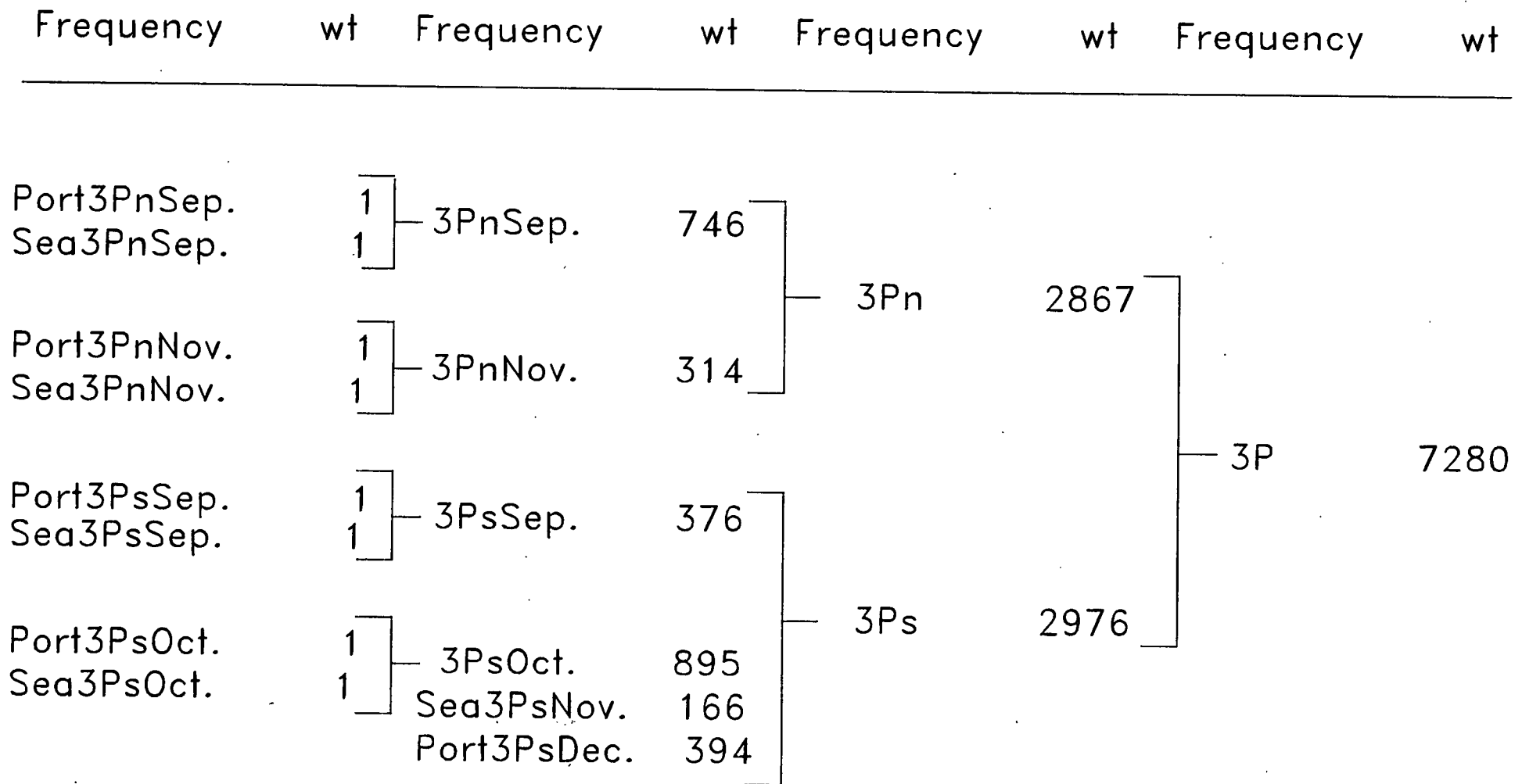


Fig.7: Commercial frequencies used and the combination process used to derive the final commercial redfish frequency for 3P, 1983 (Maritimes frequency not used because of low sample size).



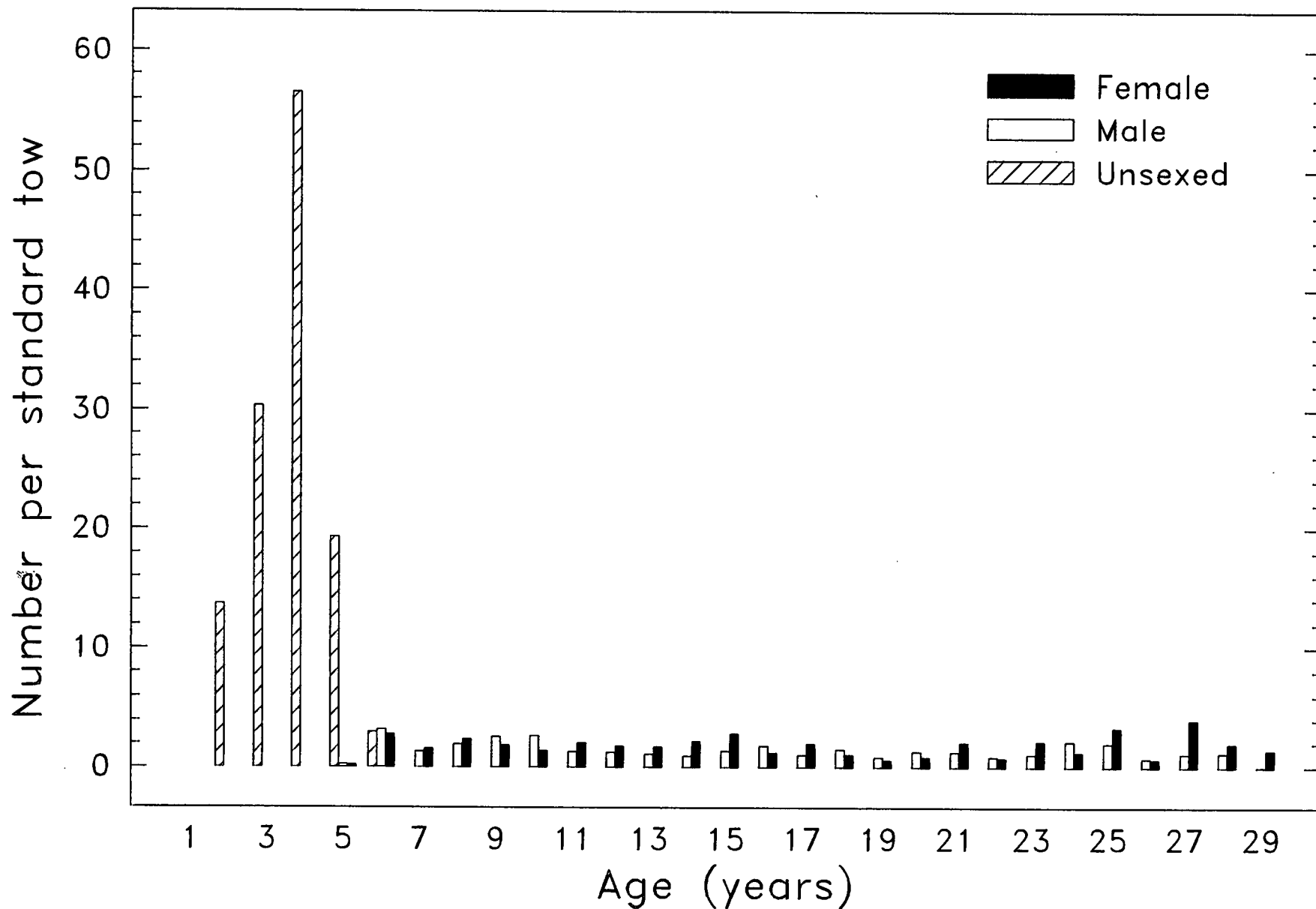


Fig.8: Number of redfish caught at age per standard tow during research cruise to 3P, June, 1983.