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Redfish in NAFO Division 3P

by

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Abstract

The nominal catch increased from about 6000 t in 1987 to just over 9000 t in 1988. This increase was due to increased landings by Newfoundland vessels, primarily from Subdiv. 3Pn in the Feb. to April period. Catches by midwater trawl increased between 1987 and 1988, particularly in Subdiv. 3Pn. Contouring analyses of research survey data from 1980-1989 revealed that there is considerable and variable overlap in the distribution of redfish between Div. 3P, 4R and 4V at the time of the surveys (Feb. - March). Because of this, Div. 3P redfish are not considered a biological stock and the catch rates are not considered to be indicative of 'stock' dynamics in this area. This conclusion invalidates the use of general production analyses conducted in the past. Arithmetic mean biomass from research surveys from 1980-1989 suggest a biomass of about 68,000 t and exploitation of 15% (approximating $F_{0.1}$) gives a catch of about 10,000 t.

Résumé

Les prises nominales sont passées d'environ 6 000 t en 1987 à un peu plus de 9 000 t en 1988. Cette augmentation est due à une hausse des débarquements des bateaux de Terre-Neuve, particulièrement ceux de la sous-division 3Pn de février à avril. Les prises des chalutiers pélagiques ont aussi augmenté de 1987 à 1988, surtout dans la sous-division 3Pn également. L'analyse de contour appliqué aux données des relevés de recherche des années 1980 à 1989 révèle l'existence d'un chevauchement considérable et variable dans la distribution du sébaste entre les divisions 3P, 4R et 4V au moment de ces relevés (février-mars). Pour cette raison, le sébaste de la division 3P n'est pas considéré comme un stock biologique; aussi, les taux de prises dans cette division ne sont-ils pas jugés révélateurs de la dynamique des stocks dans le secteur. Cela rend inopérantes les analyses de production générales effectuées jusqu'ici. La moyenne arithmétique de la biomasse établie d'après les relevés de recherche des années 1980 à 1989 permet de chiffrer à environ 68 000 t la biomasse. Un taux d'exploitation de 15 % (soit approximativement $F_{0.1}$) correspond à des prises de 10 000 t.

Introduction

Nominal catches peaked at about 37,000 t in 1970 but have been as low as 3,500 t (1985). Catches in 1986 and 1987 were just over 6,000 t then increased in 1988 to about 9,100 t (Table 1, Figure 1). During the late 60's and early 70's when catches were greatest, the majority was taken in Subdiv. 3Ps. Landings from Subdiv. 3Pn have generally ranged between 2,000-4,000 t over the history of the fishery but the increase in catch in 1988 was the result of increased landings from this subdivision.

The 1988 catch from Subdiv. 3Pn is the third highest on record. This increase was the result of increased effort by Newfoundland vessels (Table 2) in the area. As has been the case over the past few years, Maritime vessels take most of their catch in Subdiv. 3Pn.

Catches in both subdivisions are spread throughout the year but in 1988, the largest catches from Subdiv. 3Pn were taken in the February-April period (Table 3). Use of midwater trawls in Subdiv. 3Pn has increased in recent years (Table 4).

Methods and Results

Catch and effort data for the 1959-1986 period were extracted from ICNAF/NAFO Statistical Bulletins in the usual manner. They were combined with preliminary data from NAFO for 1987 and preliminary data from Canada for 1988. Newfoundland vessels were not included for the period 1986-1988 because of coding problems. As in the past, only catches where redfish comprised >50% of the total were used. An additional category type, redfish catch as percent total catch (still using only catches where redfish was >50% of the total), was included this year but it did not affect the overall trend in rates over time.

The resultant dataset was analysed using a multiplicative model (Gavaris 1980) in order to derive standardized catch rate and effort series. Before analysis, all country-gear-TC and months with <5 data points were deleted as were all catches and effort of <10 units. Grouping of categories with similar coefficients was not done. Again, because of unknown amounts of pro-rating possibly existing in the data, the model was run without weighting.

The analysis of variance from the regression (Tables 5a and 5b) indicate that the model explains only about 59% of the variation in the data. Each of the category types is significant. The residual plots (Figures 2a and 2b) do not reveal any drastic outliers.

Catch rates (Table 6, Figure 3) declined from 1959 to 1960 then rose steadily until 1966 with recruitment of the very strong year-classes of 1956 and 1958. After 1966, catch rates declined gradually until about 1975. Since then the rates have been fairly stable but showed small peaks in 1980, 1983 and 1987. The decline from 1987 to 1988 may be the result of catching more of the younger fish (ages 9-10) as these year-classes are reaching commercial size. It must be remembered however, that Newfoundland data are not included for these years. Effort increased between 1987 and 1988 (Figure 4).

There are 7 commercial frequencies (Figure 5) available from the Canadian fishery in 1988. A serious hindrance in obtaining commercial length frequencies from the Div. 3P fishery is that during any one trip, fishing is often conducted in subdivisions 3Ps, 3Pn and 4V. Because of this, it is not possible for port samplers to separate length frequencies by subdivision. The available length frequencies were combined (Table 7) then applied to a commercial age-length key (Gavaris and Gavaris 1983) to derive an estimate of the numbers of redfish caught at age in the 1986 fishery as well as their mean length- and weight-at-age. The weight/length relationships used to calculate the mean weight-at-age are:

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

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

The resultant vector (Table 8) was bimodal, with peaks at ages 9-10 and ages 17-19. The younger year-classes should contribute more significantly to the fishery in upcoming years. The catch- and weight-at-age matrices for 1973-1988 are shown in Table 9.

The stratified random survey data for 1973-1989 were again input into a multiplicative model to estimate mean values per tow for missing strata. The data were analysed separately for numbers and weight. Because data are available for Subdiv. 3Pn for relatively few years, the results changed somewhat with the inclusion of the 1989 data (Tables 10, 11 and 12). Trends in mean catch per tow do not follow trends in catch rates and it was considered that trends in the survey data may not reflect trends in stock abundance.

Contour maps (Figure 6) illustrate the variable densities of redfish encountered during the surveys. These figures also suggest that in some years, the redfish may be outside the survey area, often in Subdiv. 4Vn, and in some years there may be an influx of redfish from divisions 4RST.

The mean numbers caught at length per tow in 1989 (Figure 7) reveals two modes approximately corresponding to those seen in the commercial fishery. The majority of fish in the smallest mode are still under 25 cm, and will not recruit to the fishery for another year or two.

Discussion

The contouring analyses of the research survey data suggest that there is considerable overlap in the distribution of redfish between Div. 3P, 4R and 4V. It is probable that redfish in the Div. 3P area probably do not constitute a biological stock, and therefore catch rates are not a good reflection of stock dynamics but are confounded by movements of redfish between areas. This conclusion invalidates the general production analyses used in previous years.

Biomass estimates from the research surveys are quite variable over time, but were taken as an approximation of long term redfish abundance in Div. 3P. No trends in biomass are apparent from these data and the arithmetic mean of the 1980-1989 biomass was considered an appropriate estimate because survey coverage was consistent and adequate during this period. This indicates an average biomass of about 68,000 t in Div. 3P. Exploitation at 15% (approximately $F_{0.1}$) results in a catch of about 10,000 t.

References

- 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.* 66pp 178-182.

Table 1: Summary of nominal catches (t) of redfish in Division 3P.

Year	3Pn	3Ps	Total	TAC
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	25,000
1975	8,100	20,150	28,250	25,000
1976	5,932	13,235	19,167	18,000
1977	2,485	14,678	17,163	18,000
1978	3,042	12,203	15,245	18,000
1979	3,160	6,459	9,619	16,000
1980	2,372	5,192	7,564	18,000
1981	4,256	4,685	8,941	18,000
1982	3,820	2,090	5,910	18,000
1983	2,929	2,996	5,925	18,000
1984	2,396	2,005	4,401	18,000
1985	1,788	1,854	3,642	18,000
1986*	3,426	3,560	6,986	18,000
1987*	4,257	2,026	6,283	18,000
1988*	6,963	2,186	9,149	15,000
1989				15,000

* Provisional.

Table 2a: Nominal catches (t) of redfish in Division 3Pn by country and year.

Country	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986*	1987*	1988*
Canada (M)+	932	743	37	30	108	311	540	860	391	2,063	3,031	3,689
Canada (N)	1,283	2,266	2,676	2,154	3,749	3,508	2,385	1,536	1,187	1,288	1,178	3,218
Canada (Q)	-	-	384	165	387	-	-	-	-	75	48	56
France (M)	-	1	1	-	11	-	-	-	-	-	-	-
France (SP)	270	32	62	23	1	1	-	-	-	-	-	-
France	-	-	-	-	-	-	4	-	-	-	-	-
TOTAL	2,485	3,042	3,160	2,372	4,256	3,820	2,929	2,396	1,578	3,426	4,257	6,963

* Provisional.

+ Maritimes and Quebec were combined prior to 1979.

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

Country	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986*	1987*	1988*
Canada (M)+	3,730	2,592	970	360	391	515	670	396	313	606	421	770
Canada (N)	9,489	9,282	5,119	4,609	4,123	1,553	2,316	1,608	1,429	2,876	1,605	1,416
Canada (Q)	-	-	248	-	-	-	-	-	-	88	-	-
France (M)	8	14	21	112	124	5	-	-	12	-	-	-
France (SP)	1,437	315	101	111	47	17	-	-	-	-	-	-
France	-	-	-	-	-	-	10	1	-	-	-	-
USSR	14	-	-	-	-	-	-	-	-	-	-	-
TOTAL	14,678	12,203	6,459	5,192	4,685	2,090	2,996	2,005	1,754	3,570	2,026	2,186

* Provisional.

+ Maritimes and Quebec were combined prior to 1979.

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

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
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	21	63	30	207	1	217	294	622	791	144	356	183	2,929
1984	3	534	223	119	57	87	305	258	173	435	130	72	2,396
1985	66	18	13	101	3	131	272	527	206	135	122	194	1,788
1986*	-	78	217	1,336	861	68	169	94	84	167	281	72	3,427
1987*	162	83	221	128	49	43	71	166	47	2	7	247	4,257
1988*	48	1,052	2,428	2,132	809	132	40	123	73	36	71	19	6,963

* Provisional a includes catch of 3,031 t by Canada (M) in unknown months

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

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
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	8	11	25	28	82	61	133	462	667	957	168	394	2,996
1984	9	126	179	39	114	470	804	141	40	37	22	24	2,005
1985	32	27	102	50	126	127	361	413	367	150	63	36	1,854
1986*	12	30	683	280	480	426	736	210	324	105	179	95	3,560
1987*	26	25	81	124	166	193	409	240	185	57	41	58	2,026
1988*	52	468	160	123	133	172	110	178	200	95	124	371	2,186

* Provisional a includes catch of 421 t by Canada (M) in unknown months

Table 4: Breakdown of catches by gear type for redfish in Div. 3P.

Year	3Ps					3Pn					Totals
	Bottom Trawl	MW Trawl	Gillnets	LL	Misc.	Bottom Trawl	MW Trawl	Gillnets	LL	Misc.	
1976	9,096	3,461	409	169	100	1,904	3,971	3	25	29	19,167
1977	13,232	978	196	224	48	1,865	579	-	19	22	17,163
1978	10,107	1,455	385	220	36	2,234	787	-	15	6	15,245
1979	5,505	547	235	156	16	2,342	787	-	13	18	9,619
1980	4,645	143	244	139	21	2,072	287	-	10	3	7,564
1981	3,990	65	323	166	141	3,862	387	-	5	2	8,941
1982	1,777	-	219	76	18	3,817	-	1	1	1	5,910
1983	2,630	-	262	89	15	2,911	-	2	13	3	5,925
1984	1,730	-	139	134	2	2,380	-	1	9	6	4,401
1985	1,533	-	177	121	23	1,772	-	2	14	-	3,642
1986	542	152	428	121	3	2,138	-	-	-	-	3,384 a
1987	311	22	627	151	21	554	2,264	-	1	-	3,951 a

- a Does not include Nfld. offshore catches because Statistics Branch screwed up the offshore coding
 For 1987, only includes Scotia-Fundy statistics where redfish was main species.
 Also, 1987 does not include some Scotia Fundy catch which was not broken out by subdivision.

Table 5a: Regression of multiplicative model for redfish in NAFO Div. 3P.

MULTIPLE R..... 0.771
 MULTIPLE R SQUARED..... 0.595

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
-----	--	-----	-----	-----
INTERCEPT	1	3.210E2	3.210E2	
REGRESSION	71	2.725E2	3.838E0	28.177
TYPE 1	26	1.525E2	5.865E0	43.054
TYPE 2	11	1.400E1	1.273E0	9.343
TYPE 3	1	2.175E0	2.175E0	15.970
TYPE 4	4	2.914E1	7.284E0	53.475
TYPE 5	29	7.266E1	2.505E0	18.392
RESIDUALS	1361	1.854E2	1.362E-1	
TOTAL	1433	7.789E2		

Table 5b: Regression coefficients from the multiplicative model for redfish in NAFO Div. 3P.

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
1	3114	INTERCEPT	-0.329	0.121	1433
2	7				
3	37				
4	95				
5	59				
1	2114		0.132	0.043	96
	2124		0.272	0.155	6
	2125		0.610	0.068	35
	2154		0.307	0.066	39
	2155		0.896	0.068	36
	3124		0.034	0.048	82
	3125		0.251	0.035	165
	3144		0.477	0.081	25
	3154		0.260	0.068	36
	3155		0.834	0.064	42
	9114		-0.277	0.066	38
	9125		0.214	0.068	36
	11115		0.322	0.146	7
	11116		0.596	0.146	7
	11126		0.714	0.129	9
	11127		0.971	0.171	5
	14127		1.124	0.084	24
	16127		0.308	0.195	6
	20114		-0.567	0.072	32
	20127		1.496	0.077	27
	20157		1.596	0.130	9
	27114		0.141	0.075	33
	27124		0.367	0.081	26
	27125		0.410	0.064	61
	27155		0.640	0.136	13
	28154		0.380	0.115	12
2	1		0.110	0.057	66
	2		0.236	0.053	85
	3		0.117	0.049	108
	4		0.001	0.050	92
	5		-0.006	0.054	73
	6		0.094	0.043	131
	8		-0.035	0.041	162
	9		-0.089	0.042	151
	10		-0.113	0.043	136
	11		-0.169	0.043	140
	12		-0.119	0.046	114
	36		0.068	0.022	543
3	39		-0.634	0.067	37
4	65		-0.559	0.050	71
	75		-0.331	0.039	128
	85		-0.185	0.032	211
	60		-0.210	0.148	17
	61		-0.283	0.144	20
	62		-0.226	0.137	28
	63		-0.014	0.129	52
	64		-0.002	0.130	25
	65		0.207	0.137	28
	66		0.280	0.131	41
	67		0.204	0.131	50
	68		0.163	0.131	42
	69		0.043	0.129	54
	70		0.032	0.127	63
	71		-0.177	0.129	61
	72		-0.179	0.128	61
	73		-0.268	0.126	79
	74		-0.424	0.126	86
	75		-0.412	0.125	92
	76		-0.647	0.126	85
	77		-0.541	0.126	80
	78		-0.515	0.126	78
	79		-0.589	0.127	80
	80		-0.414	0.129	58
	81		-0.552	0.131	48
	82		-0.432	0.134	39
	83		-0.234	0.137	35
	84		-0.439	0.144	24
	85		-0.540	0.132	50
	86		-0.209	0.167	13
	87		-0.018	0.169	13
	88		-0.334	0.160	21

Table 6: Predicted standardized catch rate and effort for redfish in NAFO Div. 3P.

STANDARDS USED VARIABLE NUMBERS: 3114 7 37 95

YEAR	LN TRANSFORM		RETRANSFORMED		CATCH	EFFORT
	MEAN	S.E.	MEAN	S.E.		
1959	-0.3289	0.0146	0.765	0.092	3783	4946
1960	-0.5385	0.0091	0.622	0.059	9225	14833
1961	-0.6124	0.0081	0.578	0.052	9400	16264
1962	-0.5546	0.0058	0.613	0.046	13438	21921
1963	-0.3427	0.0035	0.759	0.045	13747	18122
1964	-0.3307	0.0064	0.767	0.061	13807	18009
1965	-0.1224	0.0059	0.944	0.073	18733	19835
1966	-0.0487	0.0044	1.017	0.067	20868	20512
1967	-0.1248	0.0043	0.943	0.062	32991	34988
1968	-0.1663	0.0043	0.905	0.059	13884	15349
1969	-0.2860	0.0038	0.803	0.049	32051	39927
1970	-0.2968	0.0034	0.794	0.046	37270	46925
1971	-0.5057	0.0038	0.644	0.040	27500	42674
1972	-0.5083	0.0036	0.643	0.039	26037	40506
1973	-0.5966	0.0032	0.589	0.033	18368	31208
1974	-0.7528	0.0031	0.503	0.028	22158	44010
1975	-0.7410	0.0028	0.510	0.027	28250	55443
1976	-0.9759	0.0031	0.403	0.022	19167	47585
1977	-0.8701	0.0031	0.448	0.025	17163	38332
1978	-0.8444	0.0030	0.459	0.025	15245	33181
1979	-0.9182	0.0031	0.427	0.024	9619	22542
1980	-0.7430	0.0036	0.508	0.030	7564	14880
1981	-0.8813	0.0041	0.443	0.028	8941	20203
1982	-0.7611	0.0049	0.499	0.035	5910	11847
1983	-0.5627	0.0057	0.608	0.046	5925	9743
1984	-0.7679	0.0075	0.495	0.043	4401	8894
1985	-0.8689	0.0042	0.448	0.029	3642	8128
1986	-0.5375	0.0147	0.621	0.075	6986	11253
1987	-0.3114	0.0157	0.778	0.097	6283	8077
1988	-0.6626	0.0127	0.548	0.062	9149	16683

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.073

Table 7: Process followed to derive estimates of the numbers of redfish caught-at-age in NAFO Div. 3P in 1988.

Frequency	Weight	Frequency	Weight	Frequency	Weight
PortJan3PnCNOT	14				
PortMar3PnCNMWT	1,131	-- Port3PnCN	3,218		
PortApr3PnCNMWT	1,388				
PortMay3PsCNOT	123	-- Port3PsCN	1,416	-- LF3P88	9,149
PortJul3PsCNOT	107				
PortFeb3PCMMWT	1,199	-- Port3PCM	1,416		
PortMar3PCMMWT	1,316				

Table 8: Estimates of the numbers caught-at-age along with their mean length and weight for redfish in NAFO Div. 3P from the 1988 commercial fishery.

age	average		catch		
	weight	length	mean	std. err.	c. v.
* 7	0.127	20.484	23	8.91	0.39
8	0.198	23.799	691	90.24	0.13
9	0.230	25.064	2160	155.57	0.07
10	0.258	26.014	1169	143.64	0.12
11	0.290	27.038	620	105.98	0.17
12	0.314	27.758	605	98.94	0.16
13	0.339	28.481	424	81.92	0.19
14	0.338	28.446	553	91.06	0.16
15	0.388	29.836	546	98.68	0.18
16	0.449	31.397	1180	157.76	0.13
17	0.473	31.927	1754	191.85	0.11
18	0.531	33.068	1724	199.49	0.12
19	0.555	33.518	1176	174.27	0.15
20	0.604	34.433	650	132.27	0.20
21	0.564	33.662	531	116.81	0.22
22	0.578	34.089	560	117.06	0.21
23	0.641	35.159	766	127.52	0.17
24	0.719	36.533	511	91.59	0.18
25	0.667	35.690	611	105.11	0.17
26	0.737	36.821	527	87.57	0.17
27	0.793	37.648	547	88.61	0.16
28	0.889	39.140	398	67.75	0.17
29	0.873	38.897	361	67.41	0.19
*30	0.992	40.488	786	83.09	0.11

* type note for an explanation

note

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 9: Catch-at-age (a) and weight-at-age (b) of redfish from the commercial fishery in NAFO Div. 3P, 1973-1988.

NAFO DIV. 3P REDFISH CATCH AT AGE																
26/ 4/89																
	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
6	13	102	393	39	262	1272	437	198	9	3	9	66	1424	223	10	1
7	11	867	681	53	500	3939	1501	1014	230	12	12	338	623	1146	251	25
8	16	1818	1832	249	508	6992	2687	1845	1751	85	9	366	342	1196	811	739
9	8	1596	866	549	805	7014	2842	2469	2172	262	67	427	332	450	1435	2311
10	20	1481	477	365	850	4944	1597	2004	1905	280	216	1173	48	289	692	1251
11	531	1774	1090	410	791	2240	891	1591	1518	679	267	2150	84	336	331	663
12	994	1356	611	478	989	1947	1014	1266	1396	959	465	1407	126	371	308	647
13	3046	3491	996	936	865	814	710	653	1499	1056	693	1197	147	327	379	454
14	6039	2964	1101	1058	1041	1031	706	833	717	1473	1101	964	178	456	490	592
15	9222	3075	2163	1013	1465	1104	493	601	585	1167	1225	765	512	605	729	584
16	5808	7425	3543	1698	808	881	446	325	434	1053	1301	793	911	1099	1021	1263
17	7228	2517	8265	1063	1322	752	599	380	393	513	1081	657	972	1025	1367	1877
18	1824	3809	5923	3927	1024	1014	545	320	343	361	1357	688	864	1337	1007	1845
19	869	1030	11826	1793	2708	810	528	327	451	261	705	388	415	1133	1069	1258
20	1138	1285	2957	5998	1518	1789	651	331	422	169	653	245	432	1315	835	695
21	583	679	2278	1383	4745	494	1015	445	323	211	556	178	184	657	764	568
22	381	1507	2040	2256	2323	1458	672	840	576	232	394	138	203	310	498	599
23	400	2734	1724	1850	2442	988	1256	503	990	217	311	126	117	443	313	820
24	479	1367	775	1238	2069	1026	727	827	589	338	312	139	211	193	424	547
25	166	2081	1182	2145	1103	1001	1047	501	1153	440	311	153	173	350	465	654
26	2	1829	976	1525	630	640	687	509	777	644	251	310	166	364	390	564
27	2	2	674	821	403	505	451	248	733	432	495	113	319	548	276	585
28	2	2	2	544	313	322	343	298	508	460	289	142	334	557	210	426
29	2	2	2	2	294	178	206	178	419	383	306	56	303	412	95	386

NAFO DIV. 3P REDFISH WEIGHT AT AGE																
26/ 4/89																
	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
6	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.113	0.060	0.076	0.082	0.066	0.071	0.069	0.070
7	0.142	0.142	0.142	0.142	0.142	0.142	0.142	0.142	0.137	0.098	0.114	0.113	0.088	0.095	0.112	0.127
8	0.177	0.177	0.177	0.177	0.177	0.177	0.177	0.177	0.177	0.184	0.164	0.148	0.145	0.125	0.157	0.198
9	0.213	0.213	0.213	0.213	0.213	0.213	0.213	0.213	0.220	0.220	0.214	0.176	0.183	0.209	0.198	0.230
10	0.247	0.247	0.247	0.247	0.247	0.247	0.247	0.247	0.266	0.266	0.258	0.202	0.231	0.249	0.228	0.258
11	0.286	0.286	0.286	0.286	0.286	0.286	0.286	0.286	0.290	0.326	0.269	0.234	0.232	0.276	0.282	0.290
12	0.331	0.331	0.331	0.331	0.331	0.331	0.331	0.331	0.340	0.361	0.318	0.275	0.243	0.287	0.302	0.314
13	0.369	0.369	0.369	0.369	0.369	0.369	0.369	0.369	0.355	0.373	0.347	0.308	0.273	0.328	0.324	0.339
14	0.406	0.406	0.406	0.406	0.406	0.406	0.406	0.406	0.417	0.396	0.376	0.346	0.287	0.371	0.348	0.338
15	0.445	0.445	0.445	0.445	0.445	0.445	0.445	0.445	0.426	0.416	0.394	0.350	0.376	0.398	0.377	0.388
16	0.481	0.481	0.481	0.481	0.481	0.481	0.481	0.481	0.465	0.441	0.412	0.404	0.420	0.433	0.427	0.449
17	0.516	0.516	0.516	0.516	0.516	0.516	0.516	0.516	0.515	0.514	0.454	0.417	0.476	0.471	0.464	0.473
18	0.553	0.553	0.553	0.553	0.553	0.553	0.553	0.553	0.541	0.518	0.464	0.457	0.472	0.536	0.496	0.531
19	0.587	0.587	0.587	0.587	0.587	0.587	0.587	0.587	0.621	0.573	0.490	0.519	0.513	0.544	0.545	0.555
20	0.621	0.621	0.621	0.621	0.621	0.621	0.621	0.621	0.625	0.599	0.495	0.538	0.553	0.581	0.566	0.604
21	0.657	0.657	0.657	0.657	0.657	0.657	0.657	0.657	0.601	0.655	0.533	0.575	0.574	0.650	0.548	0.564
22	0.688	0.688	0.688	0.688	0.688	0.688	0.688	0.688	0.650	0.665	0.579	0.544	0.602	0.739	0.584	0.578
23	0.724	0.724	0.724	0.724	0.724	0.724	0.724	0.724	0.652	0.699	0.606	0.627	0.534	0.689	0.670	0.641
24	0.770	0.770	0.770	0.770	0.770	0.770	0.770	0.770	0.707	0.678	0.673	0.598	0.632	0.786	0.665	0.719
25	0.816	0.816	0.816	0.816	0.816	0.816	0.816	0.816	0.726	0.707	0.684	0.638	0.648	0.696	0.722	0.667
26	0.865	0.865	0.865	0.865	0.865	0.865	0.865	0.865	0.784	0.745	0.740	0.673	0.657	0.719	0.749	0.737
27	0.913	0.913	0.913	0.913	0.913	0.913	0.913	0.913	0.811	0.850	0.711	0.795	0.686	0.730	0.850	0.793
28	0.948	0.948	0.948	0.948	0.948	0.948	0.948	0.948	0.872	0.820	0.820	0.780	0.713	0.765	0.781	0.889
29	0.985	0.985	0.985	0.985	0.985	0.985	0.985	0.985	0.883	0.932	0.845	0.854	0.764	0.800	0.817	0.873

Table 10: Mean numbers of redfish caught per standard tow in Division 3P during Canadian research surveys, 1973-1988.

(numbers in brackets indicate number of sets; • indicates strata estimated using multiplicative model)

(STRAP is stratified random estimate; SMA is combined estimate from STRAP and multiplicative analysis)

(Standards are stratum 309 and 1983)

Stratum	1973	1974	1975	1976	1977	1978	1979	1980
	ATC	ATC	ATC	ATC	ATC	ATC	ATC	ATC
302	173.33 •	253.17 •	539.31 •	658.48 •	284.63 •	211.06 •	194.70 •	36.57 •
303	1523.22 •	2224.71 •	4738.90 •	5786.42 •	2501.02 •	1854.62 •	1710.90 •	84.21 (2)
304	2496.01 •	3645.51 •	7765.35 •	9481.86 •	4098.27 •	3039.06 •	2803.55 •	601.22 (2)
305	506.63 •	739.95 •	1576.18 •	1924.59 •	831.85 •	616.86 •	569.05 •	36.17 (3)
306	1461.55 •	573.67 (6)	3198.00 (6)	4797.50 (2)	2159.20 (6)	2177.33 (6)	408.40 (5)	165.71 (2)
307	288.80 (5)	200.71 (7)	4067.03 (4)	1861.25 (4)	1252.50 (4)	234.25 (4)	20.50 (4)	12.38 (2)
309	3647.00 (3)	1386.75 (4)	8421.66 (6)	4500.33 (3)	1955.48 (6)	1019.33 (6)	2540.33 (6)	3908.91 (2)
310	95.00 (1)	175.00 (3)	2981.52 (6)	13340.00 (1)	110.50 (6)	622.33 (6)	316.00 (6)	35.64 (2)
311	3.78 (9)	495.00 (8)	7.00 (4)	805.67 (6)	1022.00 (4)	0.00 (4)	19.50 (4)	0.00 (2)
313	1.50 (2)	133.00 (5)	1010.33 (3)	833.33 (3)	78.90 (10)	130.00 (2)	80.00 (5)	15.55 (2)
316	228.33 (3)	150.00 (6)	165.00 (1)	1368.25 (4)	86.42 (6)	119.00 (6)	110.67 (3)	51.30 (2)
317	1.57 (7)	217.62 (8)	558.00 (4)	466.50 (4)	691.37 (4)	3.25 (4)	16.33 (3)	3.40 (2)
318	999.00 (1)	169.50 (2)	2034.29 (4)	1430.00 (2)	228.00 (6)	480.50 (2)	292.50 (2)	94.89 (2)
319	174.20 (5)	411.00 (2)	432.43 (4)	92.25 (4)	83.17 (6)	1241.00 (4)	156.00 (2)	0.79 (4)
705	476.50 (2)	56.75 (4)	154.94 (2)	69.50 (2)	79.50 (4)	251.67 (3)	73.50 (4)	62.65 (2)
706	640.00 (2)	226.57 (7)	175.00 (1)	24.00 (1)	112.28 (4)	71.00 (2)	312.00 (3)	26.33 (2)
707	871.70 •	590.00 (2)	785.25 (4)	596.50 (2)	210.01 (4)	649.50 (2)	740.50 (2)	38.82 (2)
708	796.82 •	1163.90 •	185.00 (3)	3027.28 •	364.21 (4)	473.00 (1)	592.50 (2)	15.43 (2)
709	11.09 •	16.20 •	34.50 •	42.12 •	18.21 •	13.50 •	12.45 •	2.34 •
710	44.13 •	64.45 •	137.26 •	167.63 •	72.45 •	53.72 •	49.55 •	9.30 •
711	244.44 •	356.97 •	760.27 •	928.75 •	401.27 •	297.55 •	274.48 •	15.66 (2)
712	274.60 •	401.02 •	854.08 •	1043.05 •	450.78 •	334.28 •	104.00 (2)	40.18 (2)
713	182.72 •	266.85 •	39.43 (3)	694.07 •	299.96 •	222.43 •	205.18 •	10.44 (2)
714	299.83 •	437.88 •	932.52 •	1138.91 •	492.22 •	127.00 (2)	145.00 (1)	41.09 (2)
715	588.00 (1)	62.75 (4)	318.00 (2)	655.00 (2)	124.00 (4)	343.75 (4)	717.00 (3)	472.84 (2)
716	412.00 (1)	108.00 (3)	658.48 •	18.00 (1)	127.50 (6)	473.50 (4)	173.00 (4)	22.02 (2)
Mean STRAP	563.07	357.37	1561.39	1497.04	585.02	566.71	313.01	906.95
SMA	524.16	520.24	1422.59	1651.77	657.60	569.19	389.42	154.38

Table 10: (cont.)

Siratum	1981	1982	1983	1984	1985	1986	1987	1988
	ATC	ATC	Needler	Needler	Templeman	Templeman	Templeman	Templeman
302	237.81 •	233.38 •	42.00 (3)	65.78 •	118.45 •	137.50 (2)	104.50 (2)	47.00 (2)
303	1939.33 (3)	2051.09 •	881.25 (4)	577.81 •	1040.87 •	481.00 (4)	1258.67 (3)	274.33 (3)
304	139.00 (2)	3360.99 •	3229.00 (3)	946.82 •	1705.60 •	854.50 (2)	1468.00 (2)	536.00 (2)
305	124.00 (5)	682.20 •	59.83 (6)	192.18 •	346.20 •	125.00 (1)	686.00 (2)	283.67 (6)
306	1830.67 (3)	934.67 (3)	421.50 (4)	15.50 (2)	313.00 (2)	623.67 (3)	231.25 (4)	493.50 (4)
307	924.67 (3)	150.00 (4)	121.25 (4)	127.00 (2)	53.33 (3)	17.00 (3)	36.33 (3)	44.50 (4)
309	7772.50 (2)	522.00 (2)	981.33 (3)	50.50 (2)	453.00 (3)	618.50 (2)	1142.50 (2)	535.00 (3)
310	252.50 (2)	5677.00 (3)	547.00 (3)	70.50 (2)	1225.33 (3)	303.00 (2)	33.50 (2)	801.33 (3)
311	6.50 (2)	7.67 (3)	0.00 (3)	41.00 (2)	11.00 (4)	0.00 (3)	0.00 (3)	1.50 (4)
313	187.00 (2)	4397.00 (2)	829.33 (3)	35.00 (2)	1033.50 (2)	988.00 (2)	150.50 (2)	181.00 (2)
316	175.00 (2)	457.00 (1)	653.75 (4)	127.00 (2)	140.00 (3)	57.50 (2)	313.67 (3)	210.00 (3)
317	1.00 (2)	112.00 (3)	7980.66 (3)	882.50 (2)	0.00 (2)	0.00 (2)	0.00 (3)	2.00 (2)
318	2093.81 •	6077.00 (2)	1688.33 (3)	138.00 (2)	1044.32 •	958.00 (2)	5547.50 (2)	58.50 (2)
319	8455.00 (2)	260.57 (7)	27.29 (7)	11.67 (6)	0.00 (2)	15.88 (8)	9.11 (9)	98.38 (8)
705	162.00 (2)	644.00 (2)	5.67 (3)	28.50 (2)	78.00 (2)	424.00 (2)	247.50 (2)	121.00 (2)
706	86.00 (2)	118.00 (4)	77.80 (5)	75.00 (2)	465.25 (4)	308.25 (4)	181.92 (5)	429.75 (4)
707	1192.44 •	1172.19 •	306.33 (3)	226.00 (2)	594.68 •	265.50 (2)	200.50 (2)	634.00 (2)
708	1090.64 •	1071.87 •	722.00 (2)	113.00 (2)	543.84 •	278.75 (2)	354.50 (2)	432.50 (2)
709	15.20 •	14.92 •	0.50 (2)	4.50 (2)	7.57 •	0.00 (1)	14.00 (1)	12.37 •
710	60.45 •	59.40 •	3.75 (3)	1.00 (2)	8.00 (2)	78.00 (2)	39.82 •	114.50 (2)
711	32.50 (2)	11.50 (2)	68.13 (8)	20.40 (5)	121.75 (8)	280.78 (9)	154.00 (7)	181.43 (7)
712	150.50 (2)	23.00 (3)	67.86 (7)	104.12 •	44.33 (6)	120.78 (9)	117.00 (4)	115.71 (7)
713	65.33 (6)	11.50 (2)	23.71 (7)	69.28 •	55.50 (8)	66.80 (5)	197.00 (4)	954.43 (7)
714	50.50 (8)	39.67 (6)	62.30 (10)	113.67 •	69.00 (1)	89.40 (5)	66.25 (4)	488.33 (9)
715	1015.50 (2)	20.00 (2)	71.33 (3)	43.50 (2)	2448.00 (1)	569.00 (2)	463.00 (2)	307.50 (2)
716	207.75 (4)	122.00 (2)	54.50 (4)	18.67 (3)	84.60 (5)	207.00 (4)	226.00 (3)	240.80 (5)
Mean STRAP	1368.86	432.14	376.57	74.04	164.03	227.89	331.63	323.34
SMA	1326.11	566.69	376.57	123.32	270.55	218.94	327.77	320.44

Table 11: Mean weight (kg) of redfish caught per standard tow in Division 3P during Canadian research surveys, 1973-1988.

(numbers in brackets indicate number of sets; • indicates strata estimated using multiplicative model)

(STRAP is stratified random estimate; SMA is combined estimate from STRAP and multiplicative analysis;

(MA is estimate from multiplicative analysis using depth, quarter and time)

(Standards are stratum 309 and 1983)

Stratum	1973	1974	1975	1976	1977	1978	1979	1980
	ATC	ATC	ATC	ATC	ATC	ATC	ATC	ATC
302	17.18 •	20.31 •	45.35 •	44.36 •	22.61 •	21.40 •	19.30 •	14.95 •
303	233.17 •	275.73 •	615.61 •	602.15 •	306.88 •	290.51 •	262.06 •	84.21 (2)
304	507.07 •	599.63 •	1338.74 •	1309.47 •	667.36 •	631.77 •	569.88 •	601.22 (2)
305	171.61 •	202.93 •	453.07 •	443.17 •	225.86 •	213.81 •	192.87 •	36.17 (3)
306	111.23 •	56.09 (6)	175.99 (6)	322.96 (2)	137.59 (6)	298.47 (6)	48.90 (5)	165.71 (2)
307	12.25 (5)	8.55 (7)	34.34 (4)	58.91 (4)	47.29 (4)	17.69 (4)	3.06 (4)	12.38 (2)
309	541.59 (3)	135.85 (4)	666.33 (6)	666.03 (3)	224.35 (6)	108.48 (6)	337.55 (6)	3908.91 (2)
310	2.27 (1)	34.62 (3)	256.09 (6)	835.36 (1)	29.22 (6)	96.61 (6)	59.35 (6)	35.64 (2)
311	0.30 (9)	30.53 (8)	0.11 (4)	17.69 (6)	61.12 (4)	0.00 (4)	3.69 (4)	0.00 (2)
313	0.90 (2)	16.51 (5)	153.62 (3)	127.61 (3)	12.60 (10)	24.94 (2)	11.25 (5)	15.55 (2)
316	25.71 (3)	20.26 (6)	82.00 (1)	290.30 (4)	13.61 (6)	14.17 (6)	10.89 (3)	51.30 (2)
317	0.52 (7)	16.22 (8)	49.05 (4)	8.16 (4)	41.94 (4)	0.21 (4)	1.74 (3)	3.40 (2)
318	97.16 (1)	23.13 (2)	373.83 (4)	198.90 (2)	32.51 (6)	56.70 (2)	22.46 (2)	94.89 (2)
319	12.91 (5)	64.41 (2)	70.35 (4)	8.96 (4)	5.62 (6)	86.64 (4)	6.58 (2)	0.79 (4)
705	241.31 (2)	19.28 (4)	90.15 (2)	25.40 (2)	22.34 (4)	115.21 (3)	44.03 (4)	62.65 (2)
706	91.17 (2)	53.27 (7)	39.38 (1)	18.16 (1)	31.91 (4)	28.12 (2)	60.18 (3)	26.33 (2)
707	152.85 •	93.89 (2)	237.12 (4)	121.79 (2)	58.59 (4)	100.24 (2)	126.60 (2)	38.82 (2)
708	176.32 •	208.51 •	82.25 (3)	455.35 •	124.44 (4)	87.17 (1)	201.03 (2)	15.43 (2)
709	4.21 •	4.98 •	11.12 •	10.88 •	5.55 •	5.25 •	4.74 •	3.67 •
710	18.95 •	22.41 •	50.03 •	48.94 •	24.94 •	23.61 •	21.29 •	16.48 •
711	72.09 •	85.24 •	190.29 •	186.15 •	94.86 •	89.80 •	81.00 •	15.66 (2)
712	116.60 •	137.88 •	307.80 •	301.10 •	153.45 •	145.26 •	83.91 (2)	40.18 (2)
713	81.59 •	96.48 •	30.50 (3)	210.69 •	107.37 •	101.64 •	91.68 •	10.44 (2)
714	129.18 •	152.75 •	340.98 •	333.57 •	169.99 •	89.36 (2)	110.67 (1)	41.09 (2)
715	201.40 (1)	26.99 (4)	99.79 (2)	159.66 (2)	39.12 (4)	70.31 (4)	383.81 (3)	472.84 (2)
716	258.55 (1)	25.93 (3)	198.36 •	4.99 (1)	32.66 (6)	155.13 (4)	73.26 (4)	22.02 (2)
Mean STRAP	85.21	45.66	125.20	145.52	52.40	89.19	67.64	159.57
SMA	118.37	103.21	228.33	244.09	113.62	117.39	97.75	153.84
MA	299.16	248.73	366.47	463.07	120.74	300.76	189.22	136.81

Table 11: (cont.)

Siratum	1981	1982	1983	1984	1985	1986	1987	1988
	ATC	ATC	Needler	Needler	Templeman	Templeman	Templeman	Templeman
302	14.78 •	12.98 •	11.40 (3)	7.33 •	13.00 •	14.75 (2)	10.25 (2)	8.40 (2)
303	178.67 (3)	176.19 •	383.25 (4)	99.41 •	176.53 •	87.00 (4)	184.17 (3)	100.17 (3)
304	42.75 (2)	383.16 •	2265.33 (3)	216.18 •	383.89 •	209.00 (2)	238.25 (2)	112.00 (2)
305	68.00 (5)	129.67 •	48.00 (6)	73.16 •	129.92 •	43.50 (1)	382.65 (2)	155.92 (6)
306	44.93 (3)	54.93 (3)	81.13 (4)	3.51 (2)	37.00 (2)	39.67 (3)	24.63 (4)	190.77 (4)
307	21.17 (3)	4.05 (4)	49.00 (4)	69.25 (2)	3.70 (3)	2.00 (3)	5.67 (3)	3.95 (4)
309	264.50 (2)	42.50 (2)	101.92 (3)	12.25 (2)	85.33 (3)	69.25 (2)	127.00 (2)	86.17 (3)
310	17.50 (2)	529.11 (3)	34.67 (3)	4.75 (2)	95.83 (3)	43.00 (2)	4.00 (2)	46.17 (3)
311	1.50 (2)	0.17 (3)	0.00 (3)	4.00 (2)	1.97 (4)	0.00 (3)	0.00 (3)	0.05 (4)
313	29.00 (2)	158.50 (2)	44.33 (3)	3.50 (2)	89.50 (2)	93.75 (2)	20.25 (2)	31.00 (2)
316	21.00 (2)	36.50 (1)	55.88 (4)	9.75 (2)	12.83 (3)	10.50 (2)	40.50 (3)	24.33 (3)
317	0.25 (2)	1.07 (3)	110.70 (3)	31.25 (2)	0.00 (2)	0.00 (2)	0.00 (3)	0.20 (2)
318	114.71 •	148.50 (2)	88.50 (3)	21.25 (2)	100.97 •	149.75 (2)	671.00 (2)	13.00 (2)
319	46.00 (2)	3.86 (7)	4.79 (7)	2.90 (6)	0.00 (2)	1.45 (8)	1.19 (9)	13.82 (8)
705	49.50 (2)	317.00 (2)	4.33 (3)	13.50 (2)	29.50 (2)	90.50 (2)	102.25 (2)	65.00 (2)
706	17.00 (2)	42.25 (4)	11.50 (5)	8.50 (2)	60.13 (4)	45.88 (4)	35.10 (5)	114.35 (4)
707	131.34 •	115.40 •	80.83 (3)	96.75 (2)	115.60 •	61.50 (2)	69.50 (2)	153.25 (2)
708	151.56 •	133.15 •	358.75 (2)	40.50 (2)	133.38 •	73.25 (2)	101.75 (2)	156.00 (2)
709	3.63 •	3.18 •	0.10 (2)	1.75 (2)	3.19 •	0.00 (1)	5.70 (1)	5.45 •
710	16.30 •	14.32 •	2.27 (3)	0.50 (2)	5.25 (2)	53.50 (2)	19.08 •	68.63 (2)
711	13.50 (2)	5.40 (2)	28.21 (8)	16.10 (5)	31.27 (8)	119.11 (9)	52.71 (7)	84.71 (7)
712	112.00 (2)	15.00 (3)	49.50 (7)	49.70 •	27.97 (6)	70.78 (9)	77.63 (4)	68.00 (7)
713	41.33 (6)	8.25 (2)	16.86 (7)	34.78 •	41.19 (8)	45.10 (5)	110.13 (4)	651.84 (7)
714	32.69 (8)	30.08 (6)	49.85 (10)	55.05 •	31.00 (1)	58.60 (5)	48.38 (4)	312.92 (9)
715	183.84 (2)	11.40 (2)	12.50 (3)	22.00 (2)	1137.00 (1)	97.25 (2)	127.50 (2)	133.00 (2)
716	22.25 (4)	25.25 (2)	15.50 (4)	10.07 (3)	27.50 (5)	71.63 (4)	147.50 (3)	100.06 (5)
Mean STRAP	56.61	39.64	85.29	15.75	30.60	57.20	93.80	154.82
SMA	57.23	57.00	85.29	34.91	64.37	55.77	92.75	153.46
MA	128.38	113.70	80.13	38.15	135.95	94.06	180.76	257.65

Table 12: Mean numbers and weights (kg) of redfish caught per standard tow in Division 3P during Canadian research survey, 1989.

(numbers in brackets indicate number of sets; • indicates strata estimated using multiplicative model)

(STRAP is stratified random estimate; SMA is combined estimate from STRAP and multiplicative analysis)

(Standards are stratum 309 and 1983)

Stratum	Templeman, 1989	
	Numbers	Weight (kg)
302	43.00 (2)	5.00
303	210.50 (4)	49.88
304	884.50 (2)	330.38
305	339.67 (6)	173.28
306	137.33 (3)	10.33
307	14.33 (3)	3.00
309	398.50 (2)	69.00
310	326.00 (2)	16.25
311	2.67 (3)	0.13
313	507.50 (2)	25.00
316	76.40 (3)	4.87
317	0.00 (2)	0.00
318	658.50 (2)	105.75
319	11.50 (8)	1.00
705	30.00 (2)	11.00
706	91.00 (4)	23.88
707	302.13 (2)	108.28
708	549.00 (2)	228.00
709	12.50 (2)	6.25
710	36.54 •	16.31
711	315.43 (7)	149.36
712	347.50 (8)	163.06
713	212.88 (8)	119.06
714	394.90 (10)	204.10
715	1542.00 (2)	735.43
716	123.25 (4)	52.88
Mean STRAP	248.78	101.77
SMA	248.07	101.48
MA		202.92

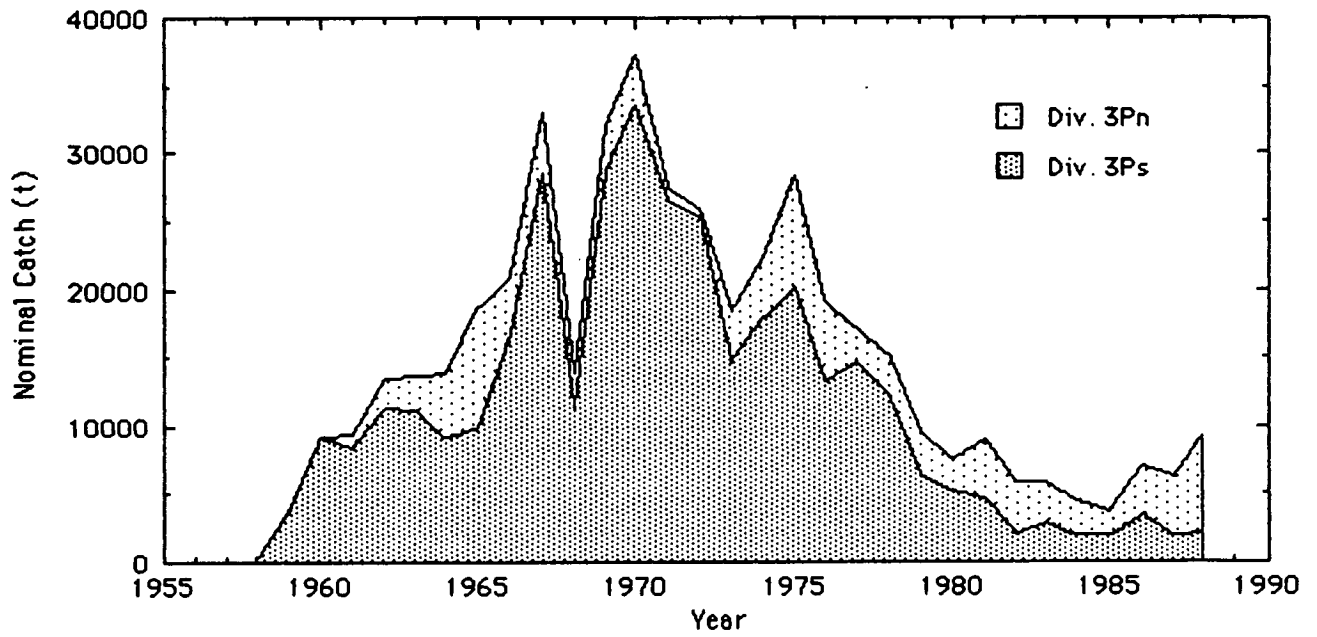


Figure 1: Nominal catches of redfish in NAFO Div. 3P, 1959-1988 (1986-1988 are provisional).

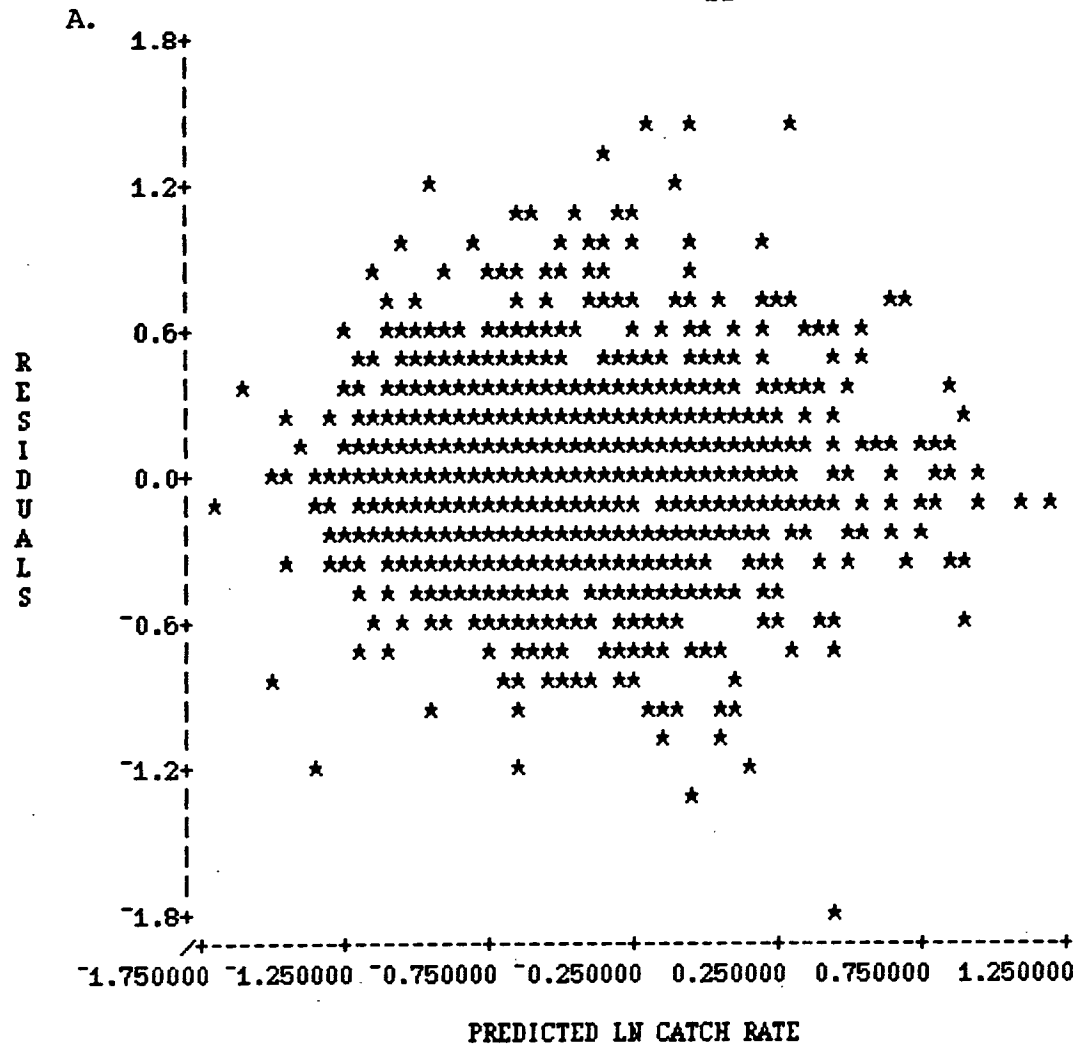


Figure 2: Residual plots from multiplicative analysis of catch and effort data for redfish in NAFO Div. 3P.

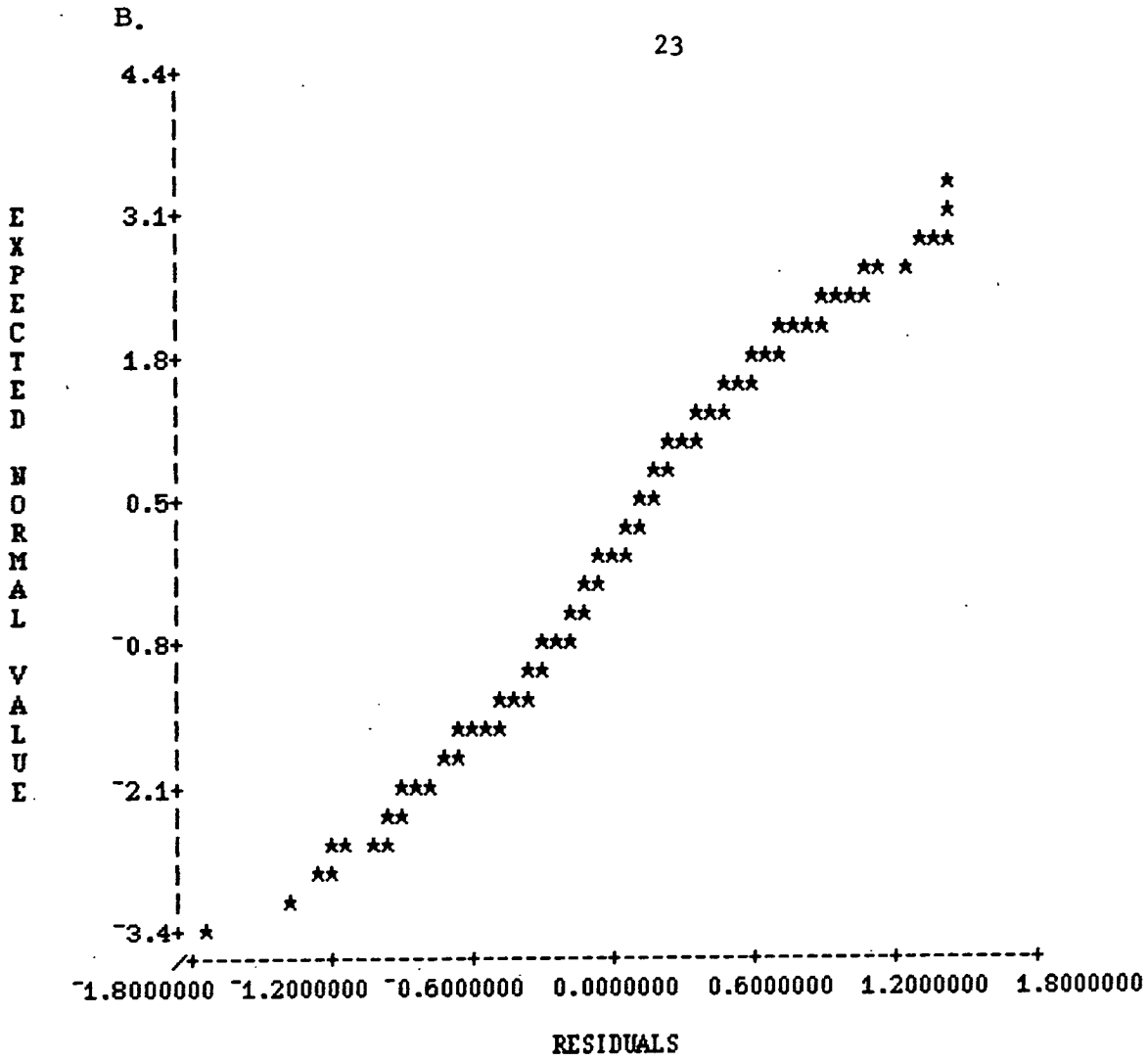


Figure 2: Continued.

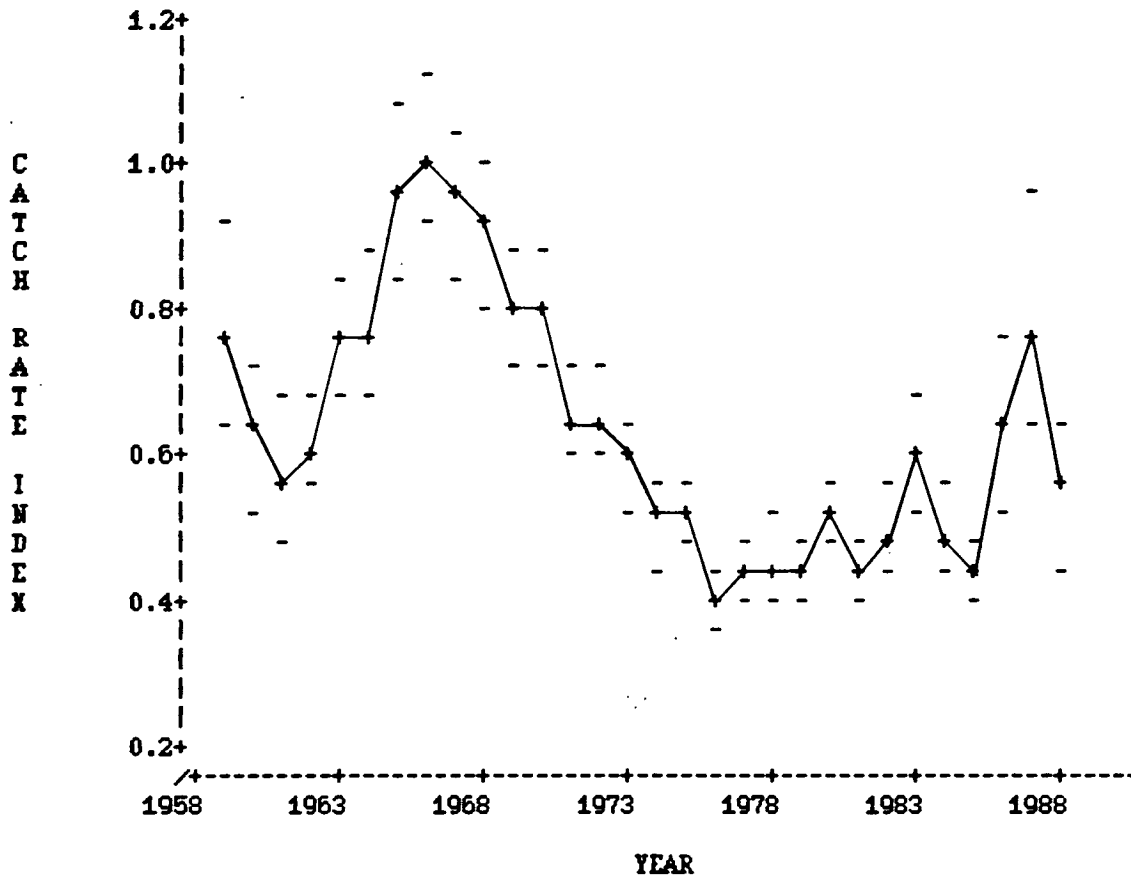


Figure 3: Standardized catch rates for redfish in NAFO Div. 3P as derived from the multiplicative analysis.

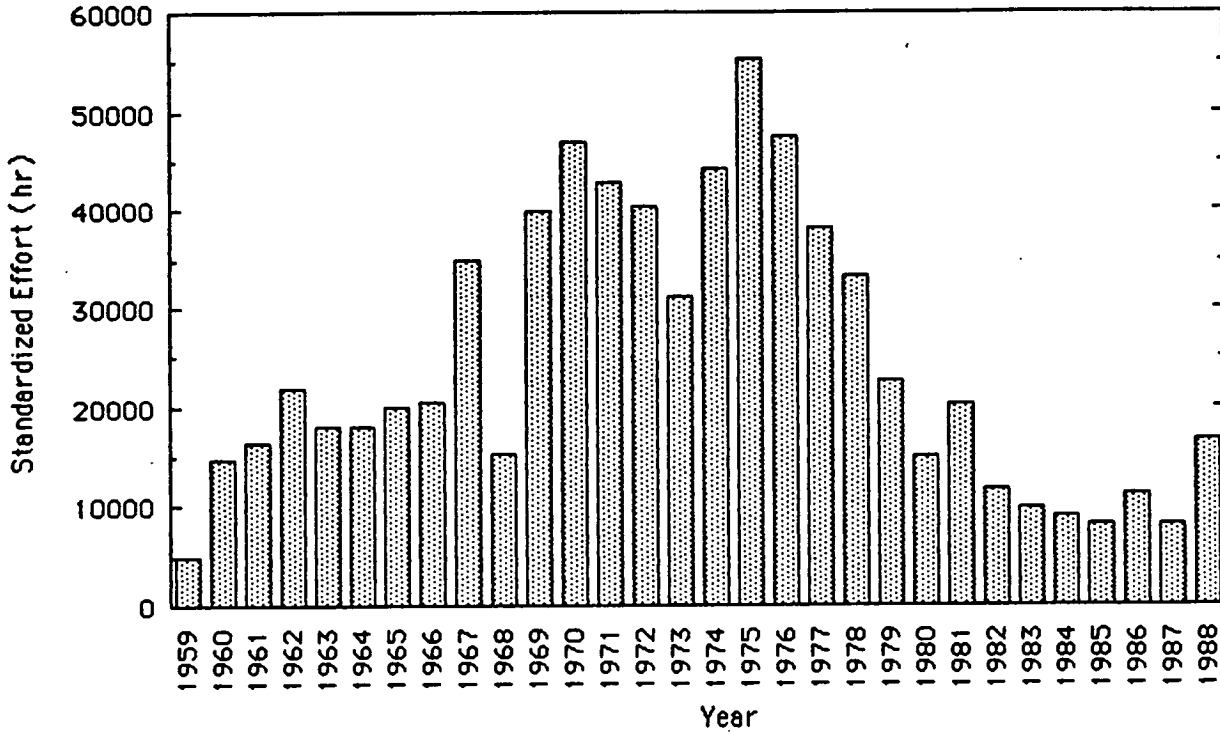


Figure 4: Standardized effort (hr) for redfish in NAFO Div. 3P as derived from the multiplicative analysis.

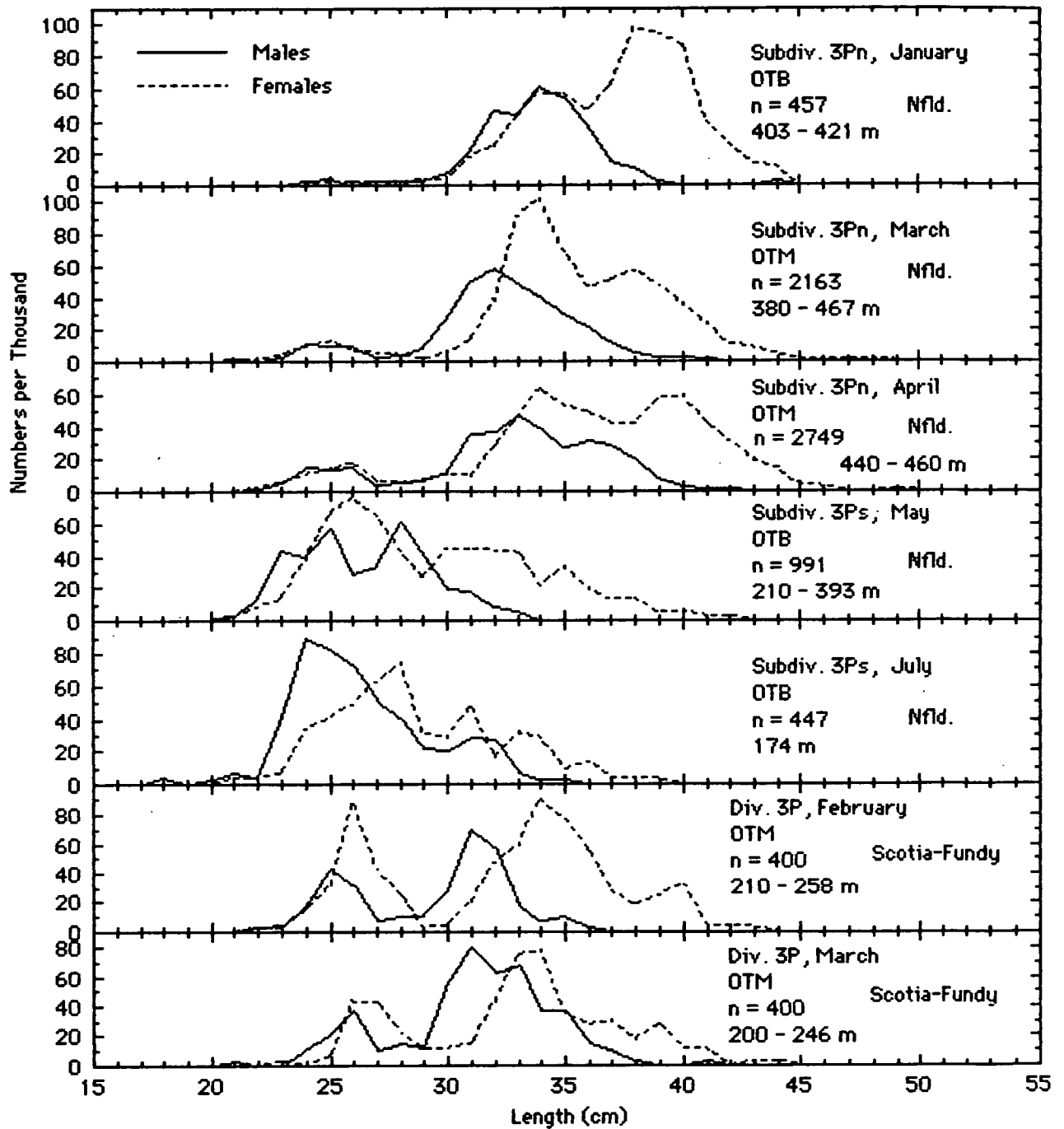


Figure 5: Commercial length frequencies of redfish caught during the 1988 commercial fishery in NAFO Div. 3P.

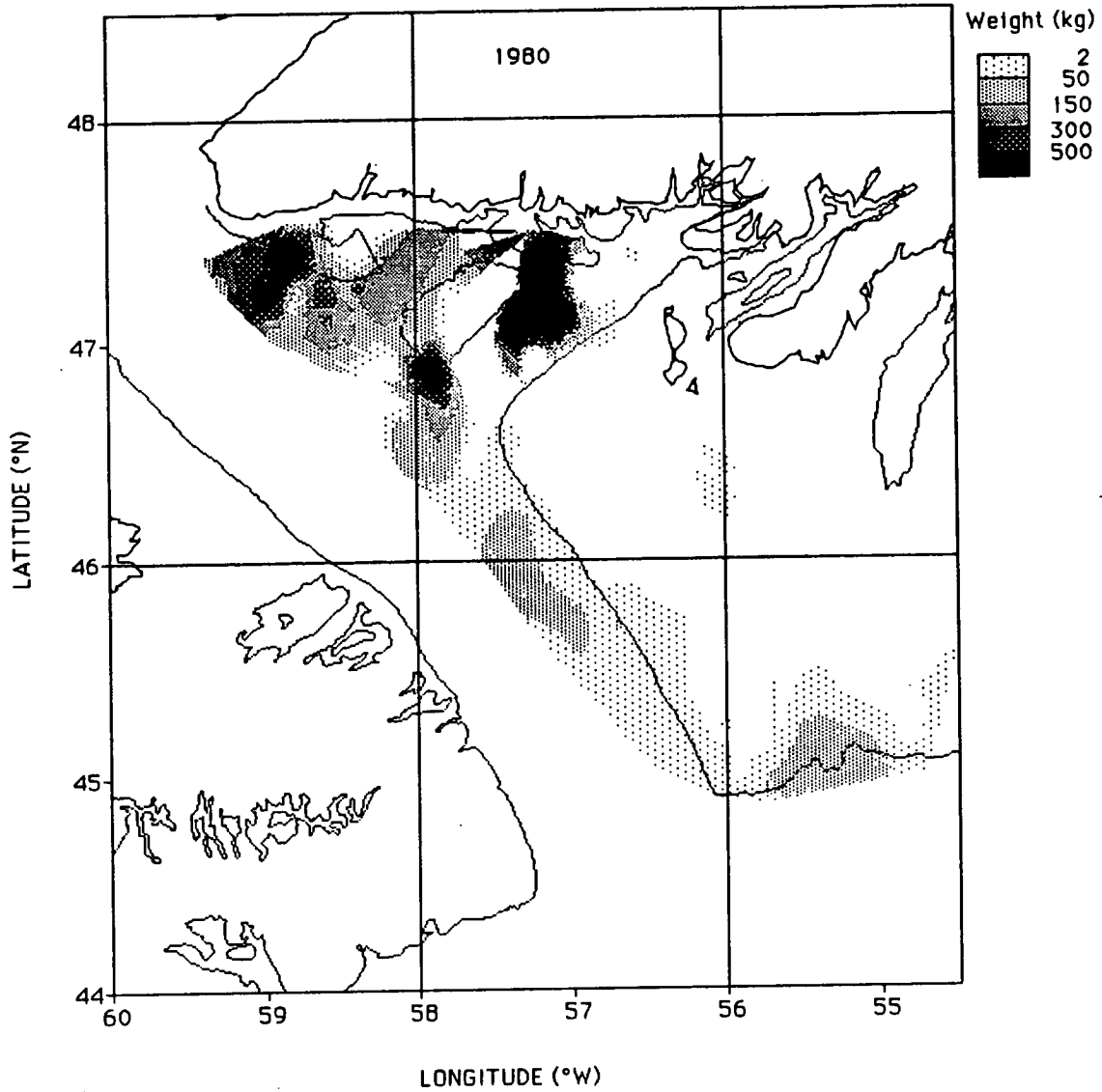


Figure 6: Contour plots of mean weight-per-tow of redfish caught during Canadian (Nfld.) research surveys in NAFO Div. 3P, 1980-1989.

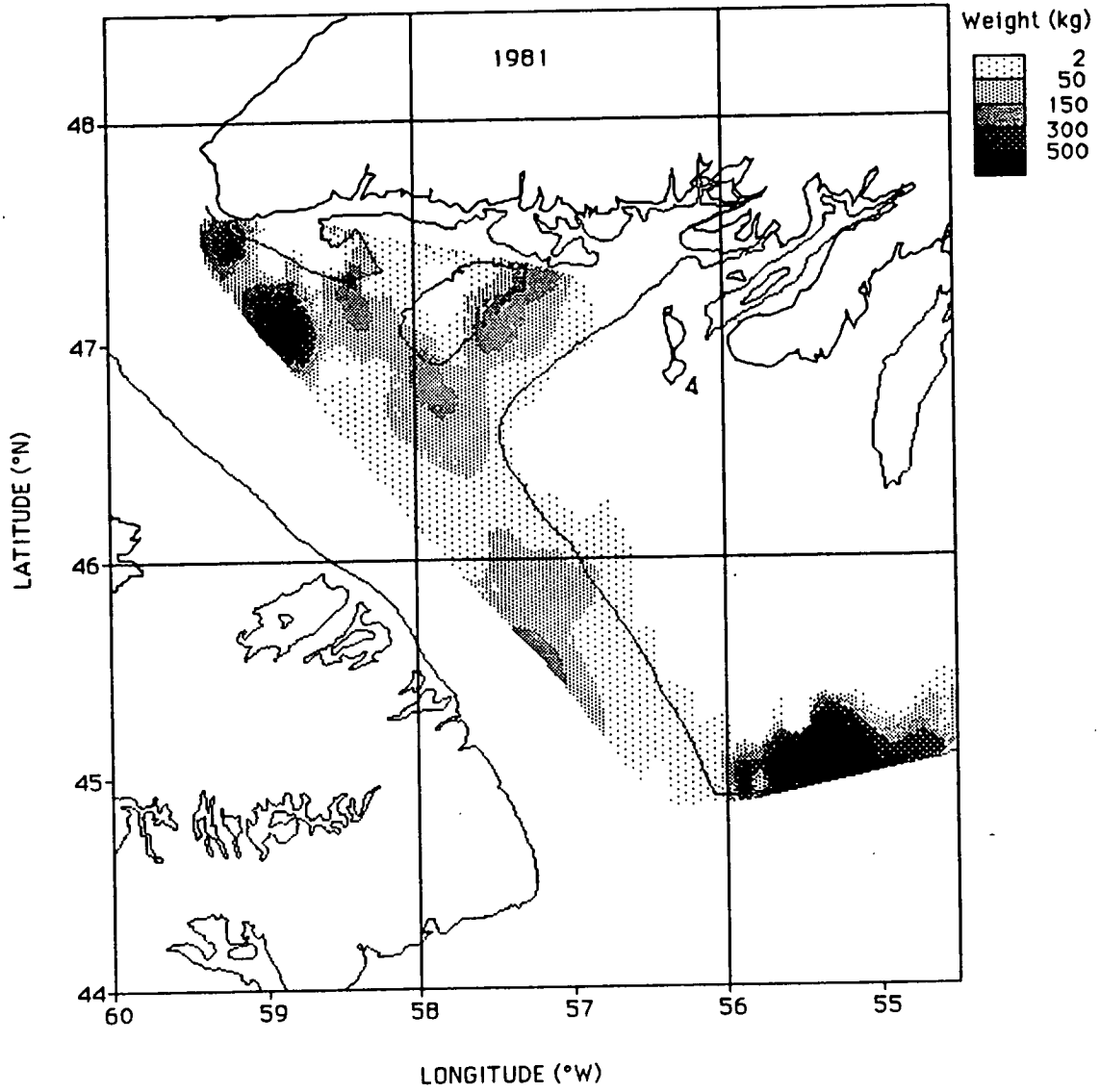


Figure 6: Continued.

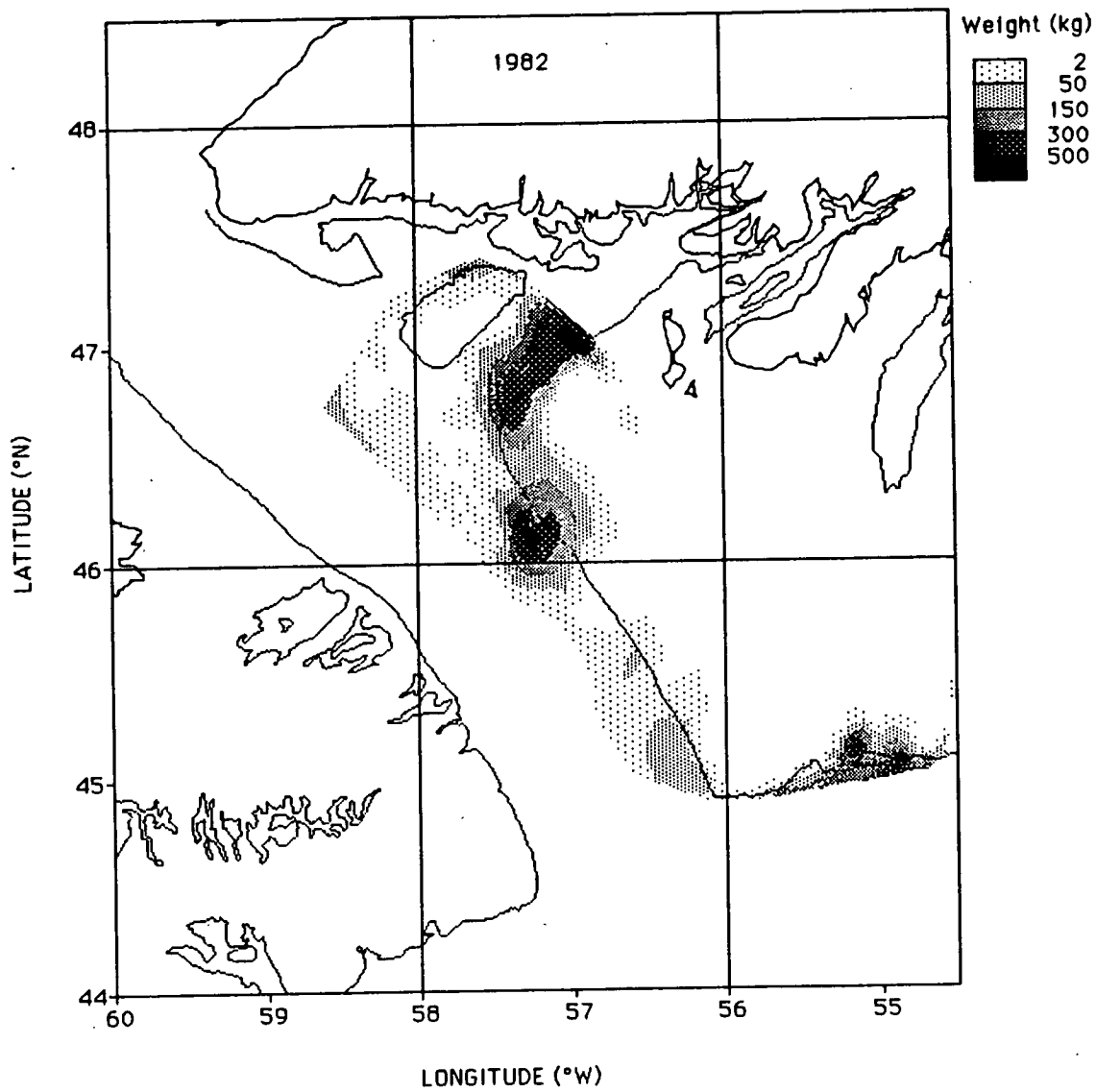


Figure 6: Continued.

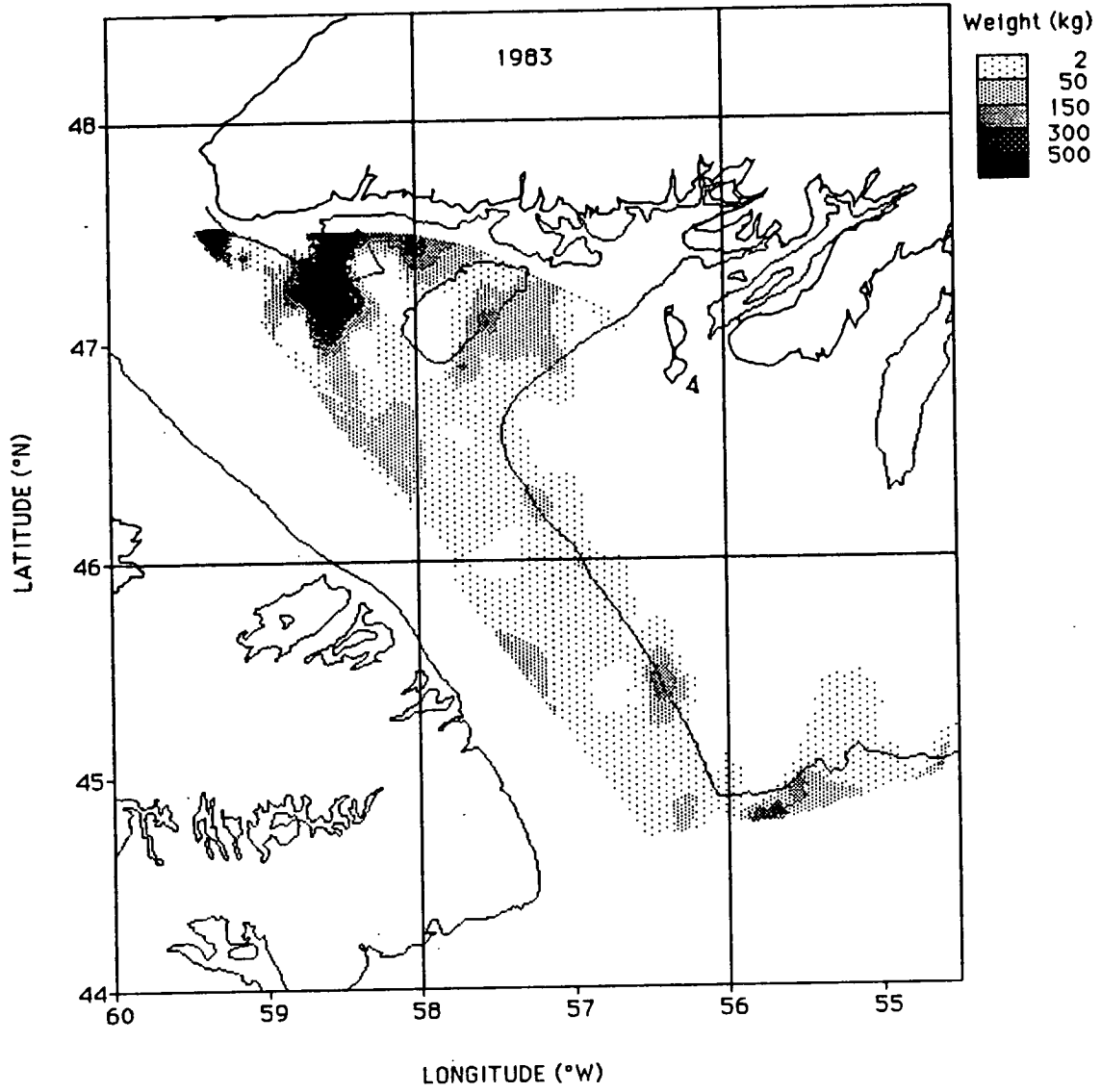


Figure 6: Continued.

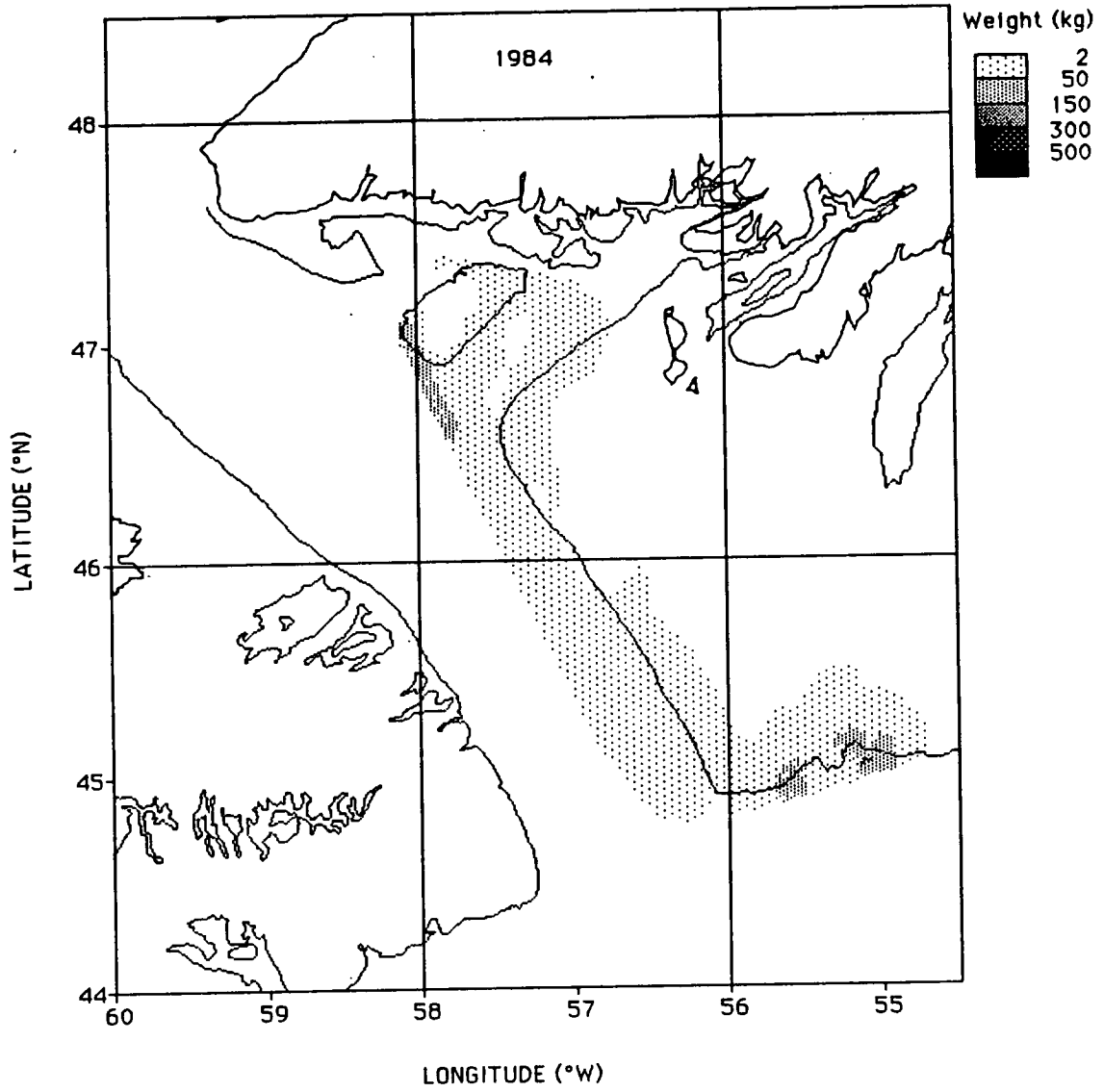


Figure 6: Continued.

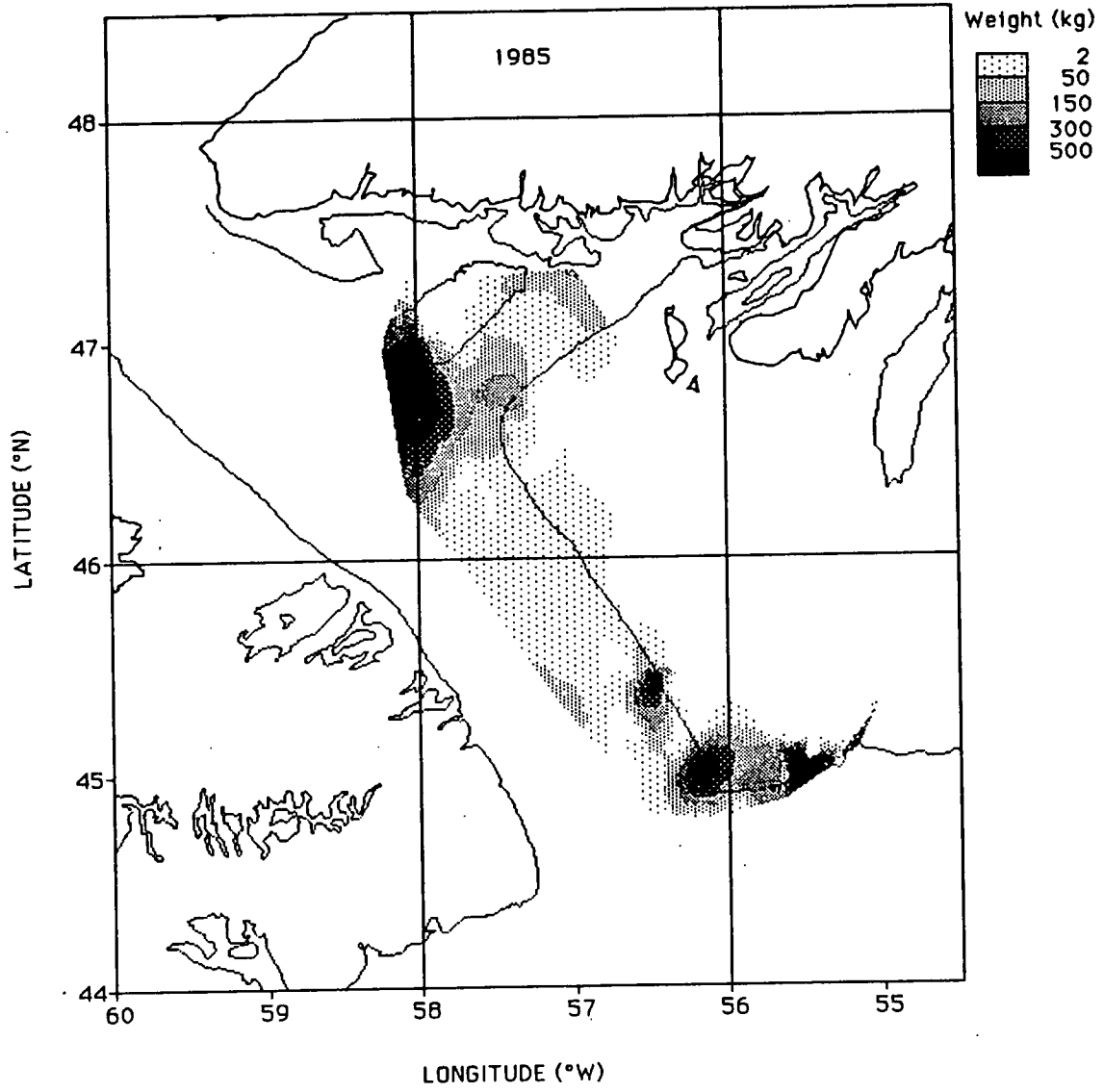


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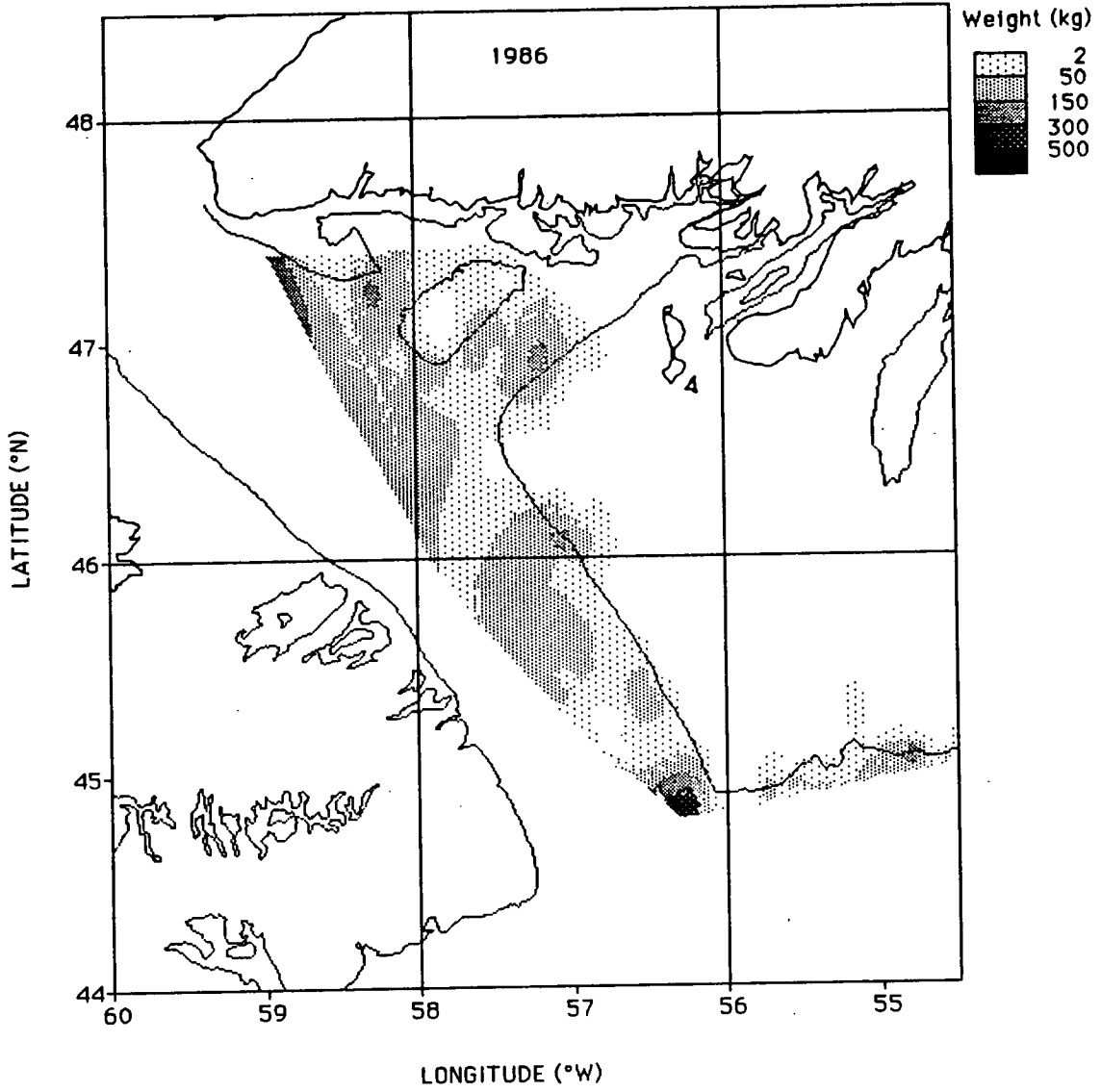


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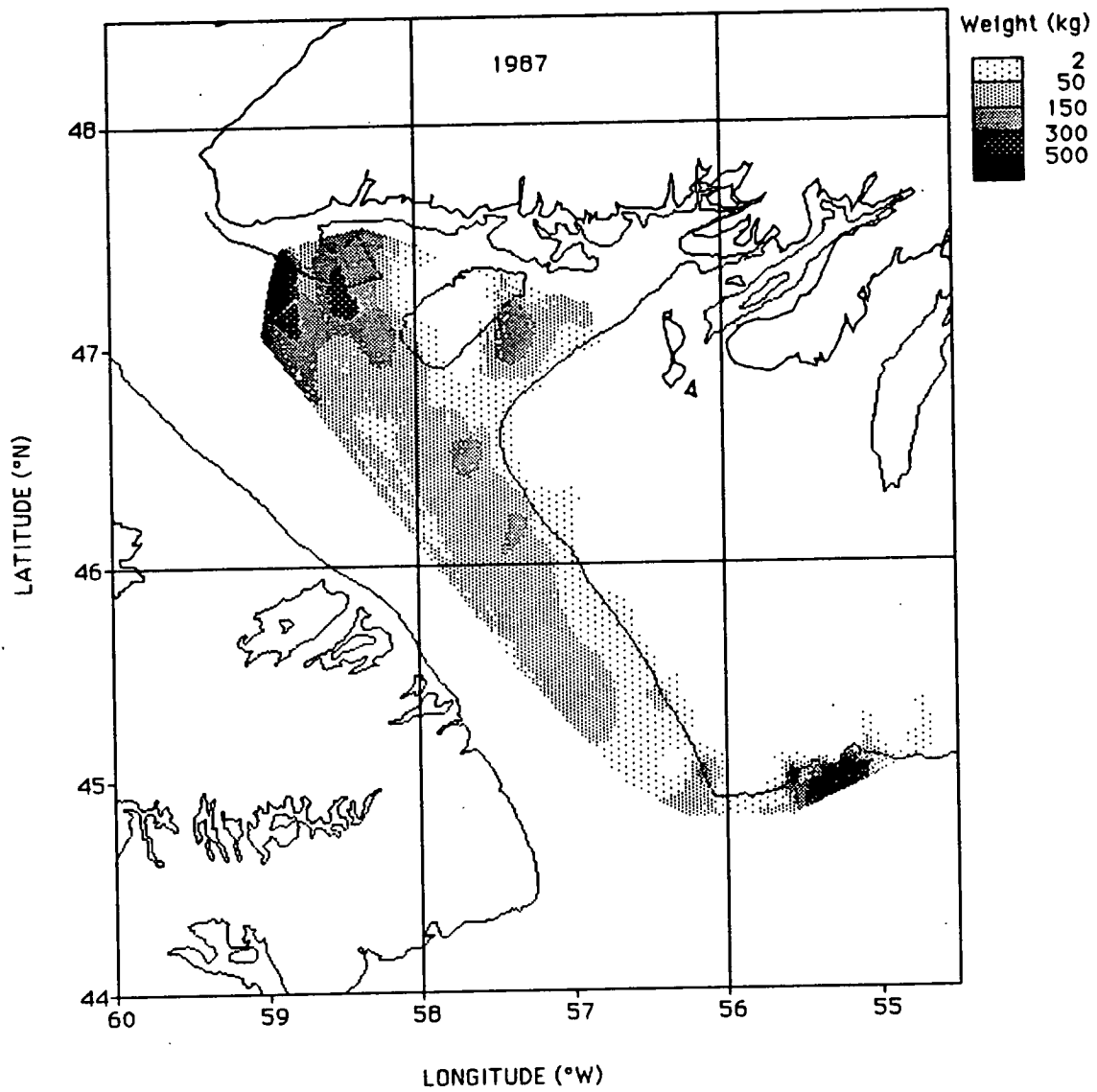


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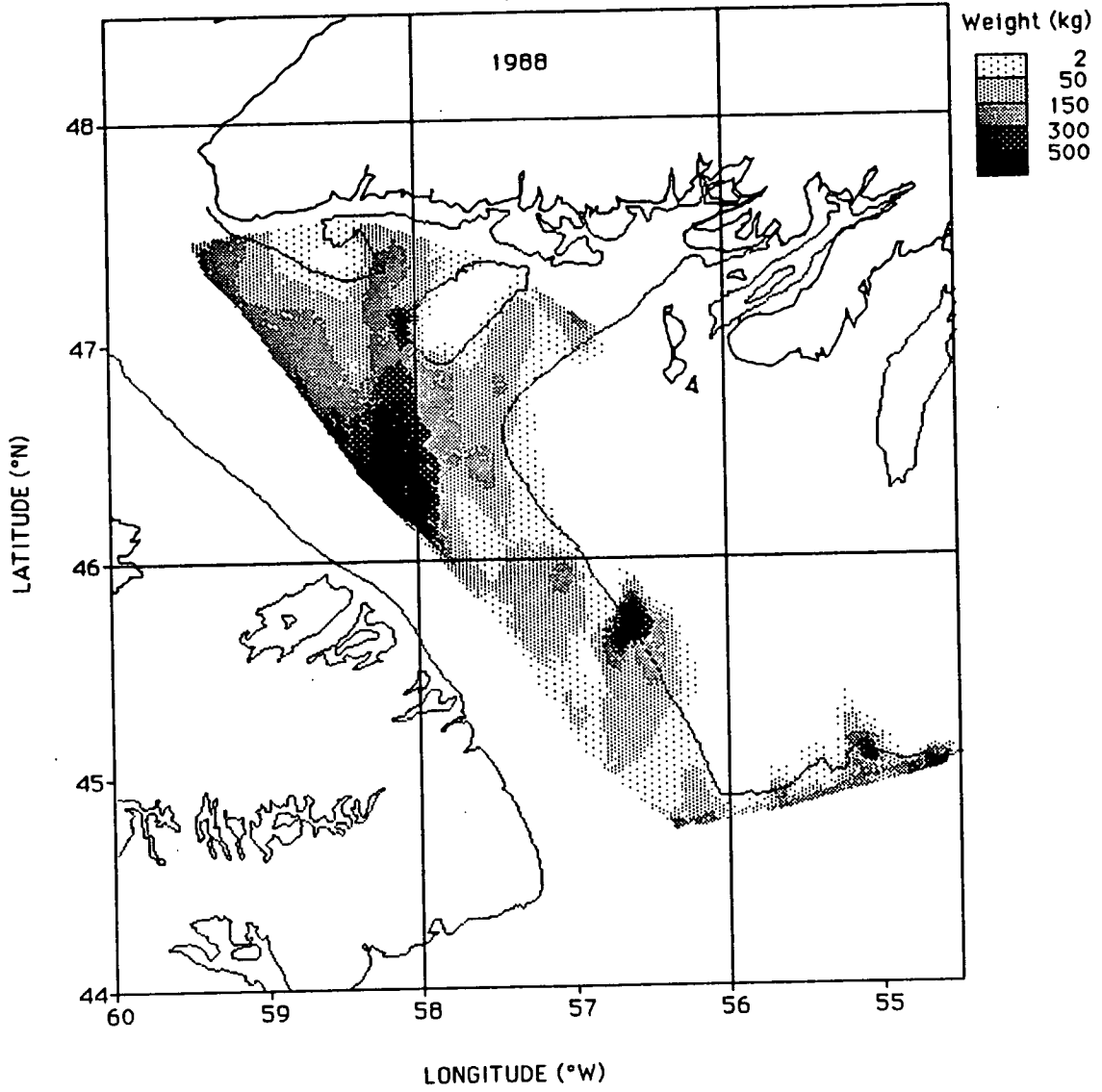


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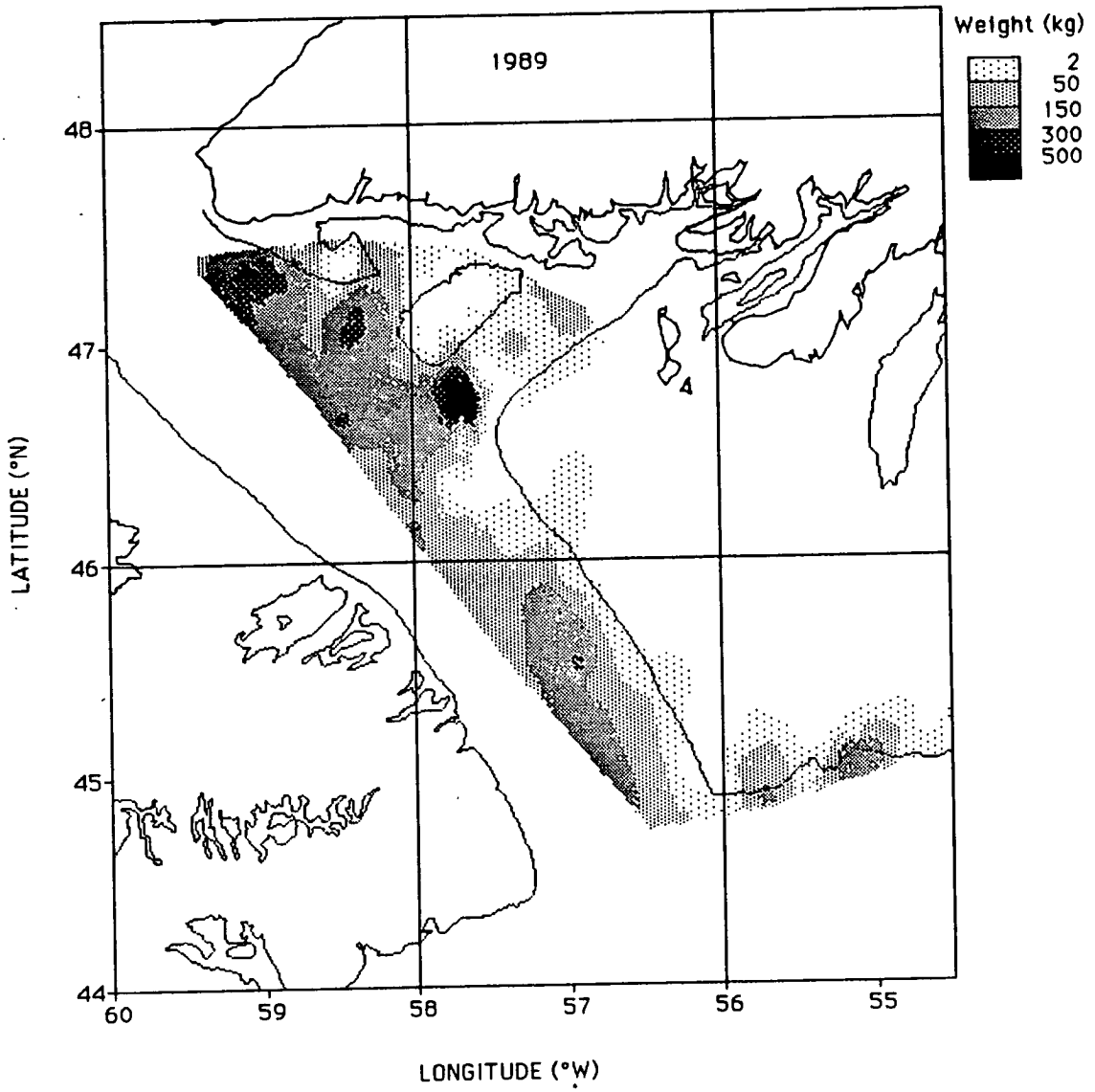


Figure 6: Continued.

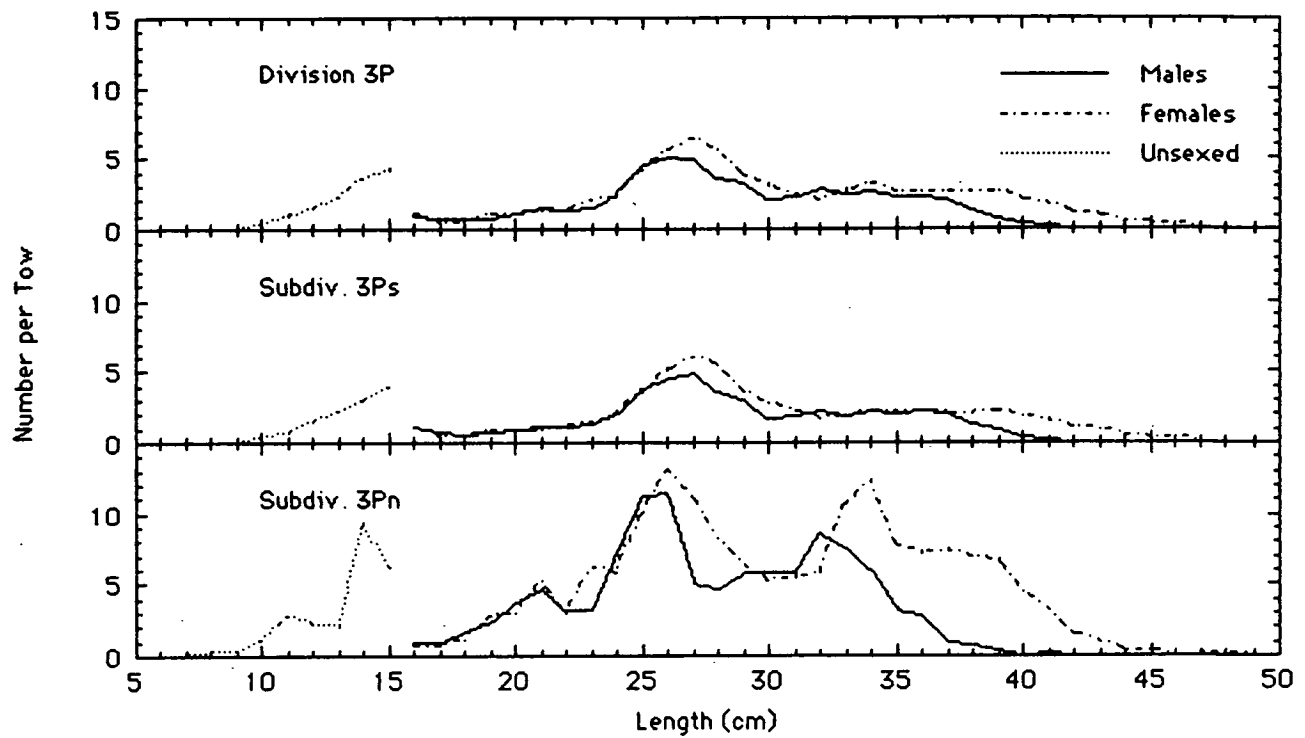


Figure 7: Mean catch of redfish at length per standard tow during Canadian research cruise to NAFO Div. 3P in February, 1989.