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The Distribution and Concentration of Redfish Species in
Newfoundland and Labrador Waters

by

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Introduction

Knowledge of the distribution and concentration for different species of redfish is essential for biological studies, stock discrimination and assessment.

Templeman (1959) reported redfish distribution in the North Atlantic based on the research data collected from 1947 to 1954 by considering redfish as one single species. This distribution should be re-evaluated as the fishing ground have expanded to deeper waters and more recently it has been suggested (Templeman and Sandeman 1957, Barsukov 1972, Barsukov and Zakharov 1972, Litvinenko 1974, Templeman 1976, 1980, Ni 1981a and b) that there are three redfish species in the Northwest Atlantic. Thus effort should be given to delineate the species and stocks of redfish temporally and spatially in order to determine the separation of each species into their component stocks which would help in more accurate assessment.

No attempt has been made to date to estimate the relative proportions of S. marinus and S. mentella when assessing the redfish stocks. The importance of the different species becomes of particular importance with the use of analytical models as the data from the two species cannot be combined. Growth rates are significantly different as is the distribution by depth. Thus there is every possibility of introducing a bias from sampled length frequencies when calculated numbers at age. Further, if fishing patterns change from year to year the relative proportions caught in the fishery would change causing a further confounding of the data. It would seem, therefore, that some account of these problems should be taken into account in areas where the proportion of S. marinus to S. mentella is significant.

This report utilized the data collected from stratified random sampling

groundfish surveys in 1978 and 1979 attempting to differentiate geographic and vertical distributions of S. marinus and sharp-beaked redfish (S. mentella).

Materials and Methods

Stratified random sampling of groundfish survey for Northwest Atlantic Fisheries Centre was conducted by research vessels A. T. Cameron and Gadus Atlantica. Areas of operation included NAFO Divisions 2G, 2H, 2J, 3K, 3L, 3M, 3N, 3O, 3P, 4R, 4S and 4T at depths to 1500 meters. No attempt was made to correct differences in the data as a result of possible different catchabilities for the two research vessels. There were 2562 successful half-an-hour sets collected in 1978 and 1979.

The geographic concentrations were calculated in unit area per year by

$$\frac{\Sigma \text{ weight or number of all redfishes (} S. \text{ marinus or sharp-beaked redfish) }}{\Sigma \text{ number of sets fished for the unit area}}$$

The vertical concentration per depth stratum for each NAFO division was examined by separating S. marinus from sharp-beaked redfish, since Templeman and Sandeman (1957) pointed out that S. marinus distributed in relatively shallow waters.

Results

A total of 1331 and 1231 half-hour successful sets were recorded from random-stratified groundfish survey in 1978 and in 1979 respectively. The number of successful sets was divided into unit areas and are shown in Fig. 1 for 1978 and Fig. 3 for 1979. The distribution and concentration of all redfish (S. marinus and sharp-beaked redfish combined) are in Fig. 2 for 1978 and Fig. 4 for 1979. The general pattern of the redfish distribution was similar from the two years survey. Redfish catches were made from the Gulf of St. Lawrence, along the Laurentian Channel, around the edge of Grand Bank, Flemish Cap, and the Labrador coast. Concentrations of redfishes were found on the slopes of Flemish Cap, Northeastern and southern slopes of Grand Bank, eastern slope of Funk Island Bank, northern and eastern slopes of Belle Isle Bank, northeastern Hamilton Bank, and southwest Newfoundland waters (Cabot Strait) for both 1978 and 1979. The distribution as shown here however does not preclude that redfish are caught on the Scotia Shelf and North of Cape Chidley. Our surveys do not at present cover these areas.

The vertical concentrations of redfish were then evaluated by depth zones for each division by combining two years data. The average redfish weight and number per set, S. marinus mean number per set, S. mentella mean number per set, percent occurrence of redfish, S. marinus, and the percent of S. marinus to redfish in weight and in number are listed in Table 1. Redfish were found concentrating at depths from 300 to 750 meters, particularly in Div. 3M, 3N, 3Pn and 30.

S. marinus was mainly caught in relatively shallow waters and contributed a very small portion of total redfish catch. A few S. marinus were caught on the northern side of Larentian Channel, western edge of Grand Bank but catches increased on eastern edge of Grand Bank and in Labrador waters. A fair proportion of S. marinus were found along the shallow edge of Flemish Cap (<300 m), particularly on the west and north sides. A small proportion of S. marinus were located around Belle Isle Bank and Funk Island Bank.

There were only two groups of redfish, S. marinus and sharped-beaked redfish, recorded in stratified random sampling grounfish survey. This is because the separation of the two sharp-beaked redfish, S. mentella and S. fasciatus, is very time consuming and needs special skills (Ni 1981 a and b).

Due to the variability and concentration of coverage of the sample area from year to year the data was analyzed separately for 1978 and 1979 (Fig. 1, 3).

As there are little differences between these two years, it might be more appropriate to combine the data in further analyses.

Discussion

Redfish are found all around the Newfoundland and Labrador waters except in depths less than 200 m on the Grand Bank, Hamilton Bank, and Saglek Bank. Abundance of redfish were noted along the slope of Flemish Cap, northeastern slope of Grand Bank, eastern slope of Funk Island Bank, northern and eastern slopes of Belle Isle Bank, northeastern Hamilton Bank, and Cabot Strait. The data was analyzed by NAFO Division as the sample size was too small to give a more refined estimate. Interpretation of Fig. 2 and 4 give the concentrations independent of depth fished and in areas where bottom trawling was difficult.

The redfish were caught in abundance between 300 to 750 meters. S. mentella by far the most commonly caught species was abundant throughout the area surveyed but the highest average catches were in Div. 3M (>400 m), 3N (>300 m) and 30 (>300 m) (Table 1). S. marinus caught in relatively shallow water

(200-400 m) around the whole Newfoundland and Labrador waters but the largest abundances were in Div. 3M (<300 m), 3N (101-200 m) and 30 (<100 m).

The percent of S. marinus to S. mentella varied throughout the area surveyed. S. marinus were most abundant relative to mentella in Div. 3M where 52-56% of the catch in depths to 300 m in 1978-79 was marinus. In Div. 2J, 3K, 3N and 30, S. marinus comprise 2-11% of the redfish caught in shallower depths, but in other areas the relative catches were less than 1%.

In terms of assessing the stocks of redfish in the NAFO Area, these preliminary results indicate that the proportion of S. marinus to S. mentella is insignificant in all of the stock areas except perhaps on Flemish Cap.

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Table 1. The concentration of redfishes by depth in NAFO divisions.

YEARS 78 & 79		NAFO DIVISION	DEPTH (METERS)	TOTAL # OF SETS	(KG)			PERCENT MARTINUS OCCURRENCE OF SET	PERCENT MARTINUS OCCURRENCE OF SETS	PERCENT MARTINUS NUMBER TO REDFISH OF SET	PERCENT MARTINUS TO REDFISH OF WEIGHT
REDFISH OCCURRENCE	REDFISH WEIGHT				REDFISH MEAN PER SET	REDFISH NUMBER	MARTINUS MEAN PER SET			MARTINUS NUMBER	MARTINUS MEAN PER SET
2B			200	51.	3.42	0.022	0.392	0.0	0.0	0.392	0.0
			300	32.	53.12	1.364	20.156	5.882	0.031	20.125	0.155
			400	7.	85.71	111.219	479.428	0.0	0.0	479.428	0.0
			500	7.	100.00	125.108	253.000	14.286	0.286	252.714	0.113
			750	10.	100.00	79.040	202.300	20.000	0.200	202.100	0.099
			1500	1.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2H			100	3.	33.33	0.150	0.667	0.0	0.0	0.667	0.0
			200	36.	11.11	0.349	0.861	0.0	0.0	0.861	0.0
			300	24.	37.50	3.369	54.042	0.0	0.0	54.042	0.0
			400	24.	100.00	110.185	229.417	8.333	1.375	228.042	0.599
			500	14.	100.00	40.179	110.929	21.429	0.500	110.429	0.451
			750	17.	82.35	38.166	124.235	7.143	0.059	124.176	0.047
			1000	4.	100.00	2.612	6.500	0.0	0.0	6.500	0.0
			1350	2.	100.00	4.765	5.500	0.0	0.0	5.500	0.0
			1500	1.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2J			200	45.	6.52	0.104	1.348	33.333	0.043	1.304	3.226
			300	108.	62.03	26.068	89.500	37.313	1.731	87.769	1.935
			400	58.	97.10	320.779	720.172	29.630	1.069	719.103	0.148
			500	27.	96.29	244.788	591.111	19.231	0.370	590.741	0.063
			750	21.	95.23	417.742	977.238	25.000	1.190	976.048	0.122
			1000	3.	33.33	5.443	9.000	0.0	0.0	9.000	0.0
			1350	5.	20.00	3.628	5.600	0.0	0.0	5.600	0.0
			1500	2.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3K			300	137.	92.70	50.503	222.730	27.559	3.810	218.920	1.711
			400	100.	99.00	194.167	505.180	25.253	2.770	503.410	0.547
			500	20.	90.00	135.960	365.800	22.222	0.300	365.500	0.082
			750	8.	100.00	467.086	820.000	12.500	0.250	819.750	0.030
			1000	7.	71.42	5.241	7.286	0.0	0.0	7.286	0.0
			1350	6.	15.66	0.190	0.167	0.0	0.0	0.167	0.0
			1500	6.	50.00	0.947	1.000	0.0	0.0	1.000	0.0
3L			100	104.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			200	182.	16.48	0.373	0.703	0.0	0.0	0.703	0.0
			300	142.	81.69	49.338	145.951	14.655	0.430	145.521	0.294
			400	128.	100.00	156.630	332.758	9.375	0.234	332.523	0.070
			500	25.	100.00	303.167	517.000	8.000	0.480	516.600	0.093
			750	20.	100.00	281.954	470.500	25.000	0.250	470.250	0.053
			1000	1.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3M			200	43.	67.44	3.082	9.279	86.207	4.814	4.465	51.880
			300	120.	97.50	211.914	390.783	84.615	217.175	173.608	55.574
			400	88.	100.00	337.545	681.977	62.500	48.477	633.500	7.108
			500	27.	100.00	594.139	1313.593	14.815	0.333	1313.259	0.025
			750	32.	100.00	1046.387	1716.250	6.250	0.063	1716.187	0.004
3N			100	99.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			200	9.	22.22	0.278	2.222	50.000	0.222	2.000	10.000
			300	24.	95.83	2007.470	10515.125	8.696	0.167	10515.957	0.002
			400	12.	100.00	959.280	3500.583	8.333	0.083	3500.500	0.002
			500	6.	100.00	1023.475	1951.667	16.667	0.167	1951.500	0.009
			750	3.	100.00	381.123	551.667	0.0	0.0	551.667	0.0
3O			100	99.	5.05	0.021	0.091	20.000	0.010	0.081	11.111
			200	27.	48.14	26.023	220.185	0.0	0.0	220.185	0.0
			300	24.	100.00	269.431	1298.542	0.0	0.0	1298.542	0.0
			400	17.	100.00	932.160	4421.820	5.882	0.059	4421.762	0.001
			500	1.	100.00	4797.262	13821.000	0.0	0.0	13821.000	0.0
			750	5.	100.00	1277.761	2471.000	0.0	0.0	2471.000	0.0
3P _s			100	31.	6.45	0.063	0.065	0.0	0.0	0.065	0.0
			200	61.	63.93	22.996	240.738	12.821	0.082	240.656	0.034
			300	65.	100.00	135.086	863.062	7.692	0.969	862.092	0.112
			400	25.	100.00	98.539	243.080	4.000	0.240	242.840	0.099
			500	5.	100.00	114.252	215.400	0.0	0.0	215.400	0.0
3P _m			200	11.	100.00	34.820	246.000	36.364	0.455	245.545	0.185
			300	5.	100.00	183.728	637.200	0.0	0.0	637.200	0.0
			400	7.	100.00	1398.266	3219.286	0.0	0.0	3219.286	0.0
			500	7.	100.00	376.748	498.143	0.0	0.0	498.143	0.0
4R			100	3.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			200	63.	73.01	18.603	90.206	0.0	0.0	90.206	0.0
			300	65.	96.46	326.260	1501.338	4.688	0.046	1501.292	0.003
			400	19.	100.00	655.601	1752.158	5.263	0.158	1752.000	0.009
			500	5.	100.00	226.944	350.600	0.0	0.0	350.600	0.0
			750	2.	100.00	254.005	413.000	0.0	0.0	413.000	0.0
4S			100	8.	25.00	0.142	1.375	0.0	0.0	1.375	0.0
			200	37.	81.08	36.339	112.297	10.000	0.270	112.027	0.241
			300	50.	100.00	168.891	586.627	10.169	0.322	586.305	0.055
			400	29.	46.20	88.304	310.379	4.000	0.034	310.345	0.011
			500	7.	100.00	51.520	82.714	0.0	0.0	82.714	0.0
4T			200	1.	100.00	1080.520	2737.000	0.0	0.0	2737.000	0.0
			300	9.	87.50	42.502	149.475	0.0	0.0	149.475	0.0
			400	9.	100.00	25.018	45.313	0.0	0.0	45.313	0.0
			500	3.	100.00	10.280	39.000	0.0	0.0	39.000	0.0

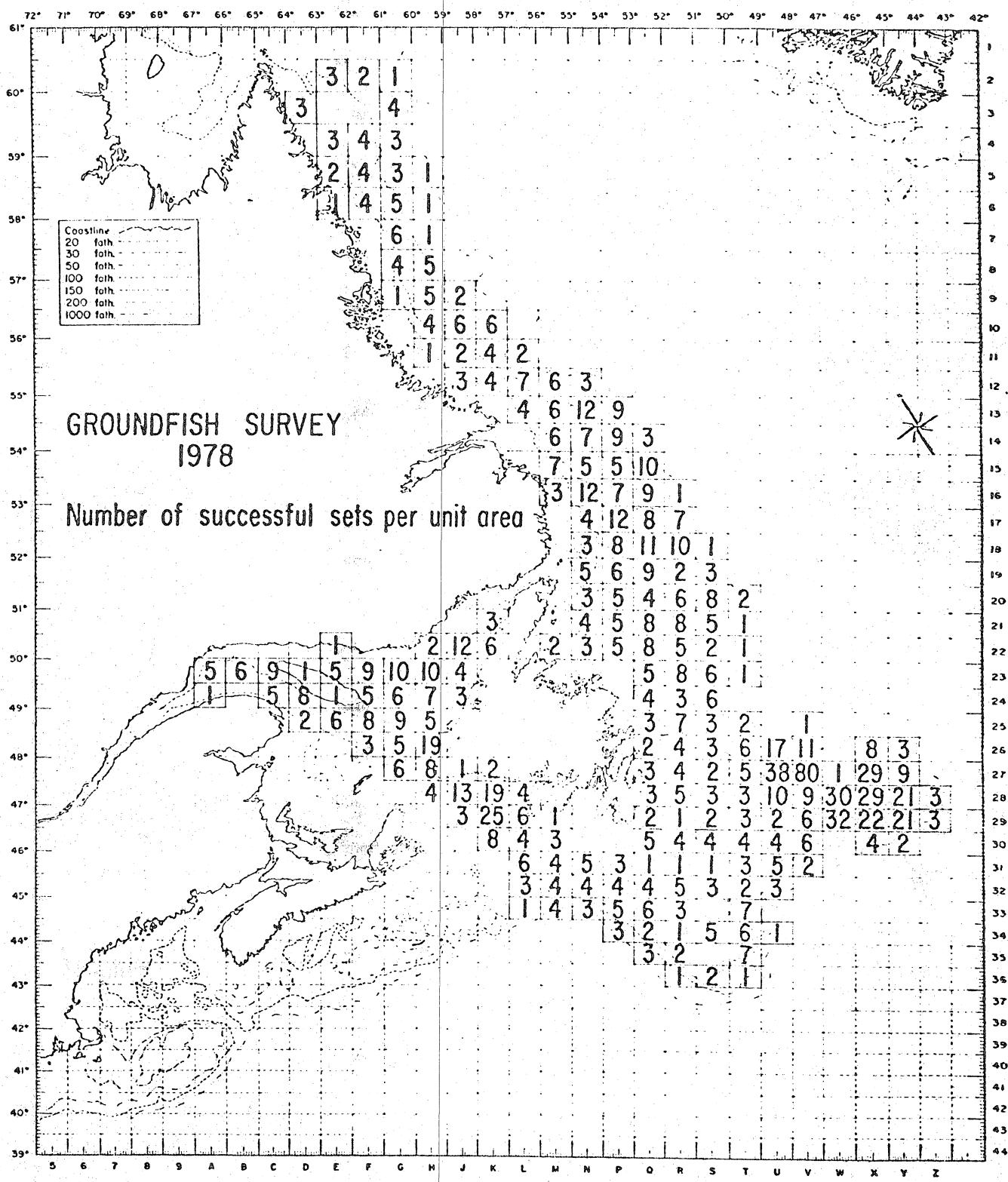


Fig. 1. Number of successful drags by research boats per unit area in 1978.

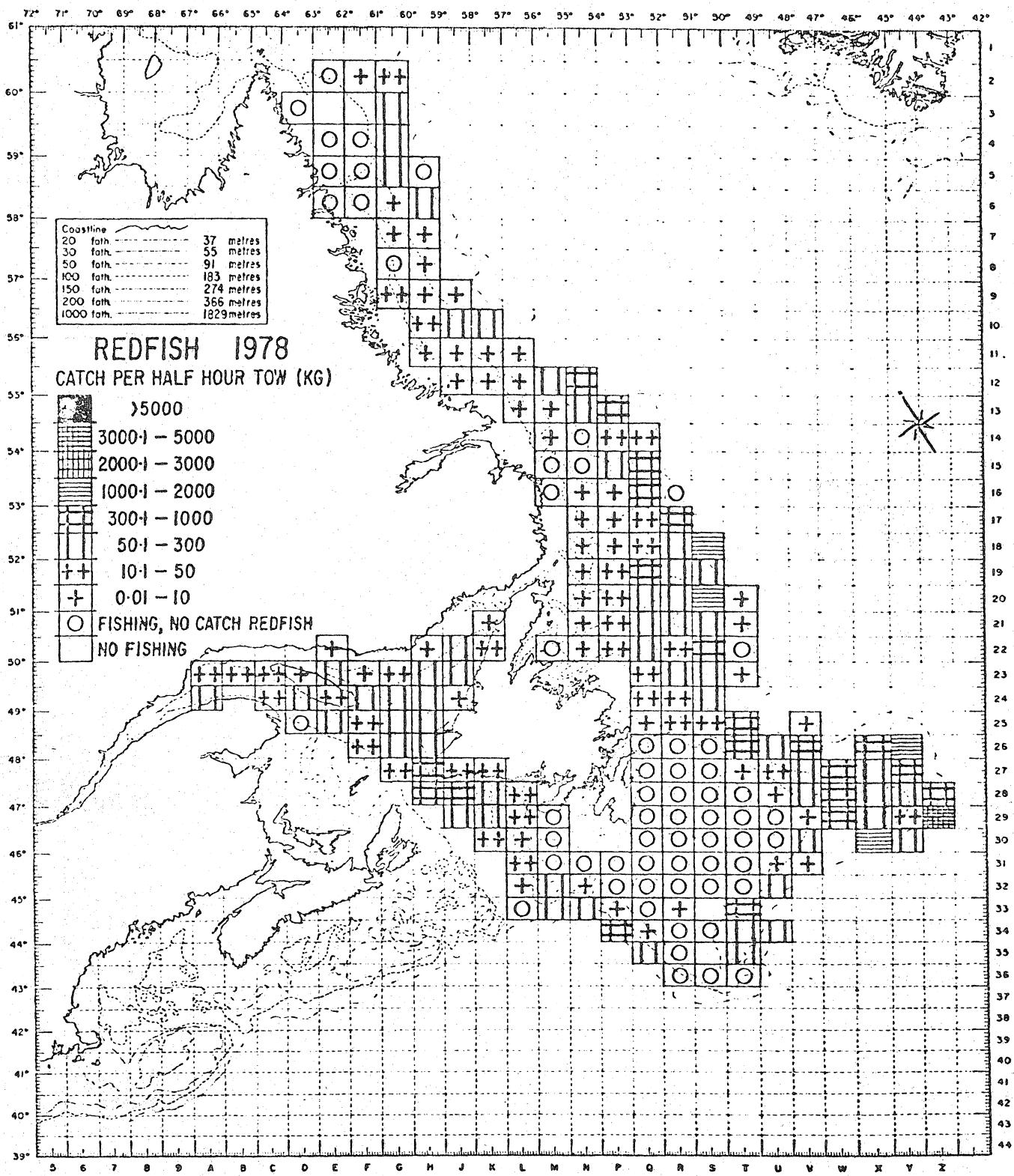


Fig. 2. Average redfish catches per half hour dragging of each unit are in 1978.

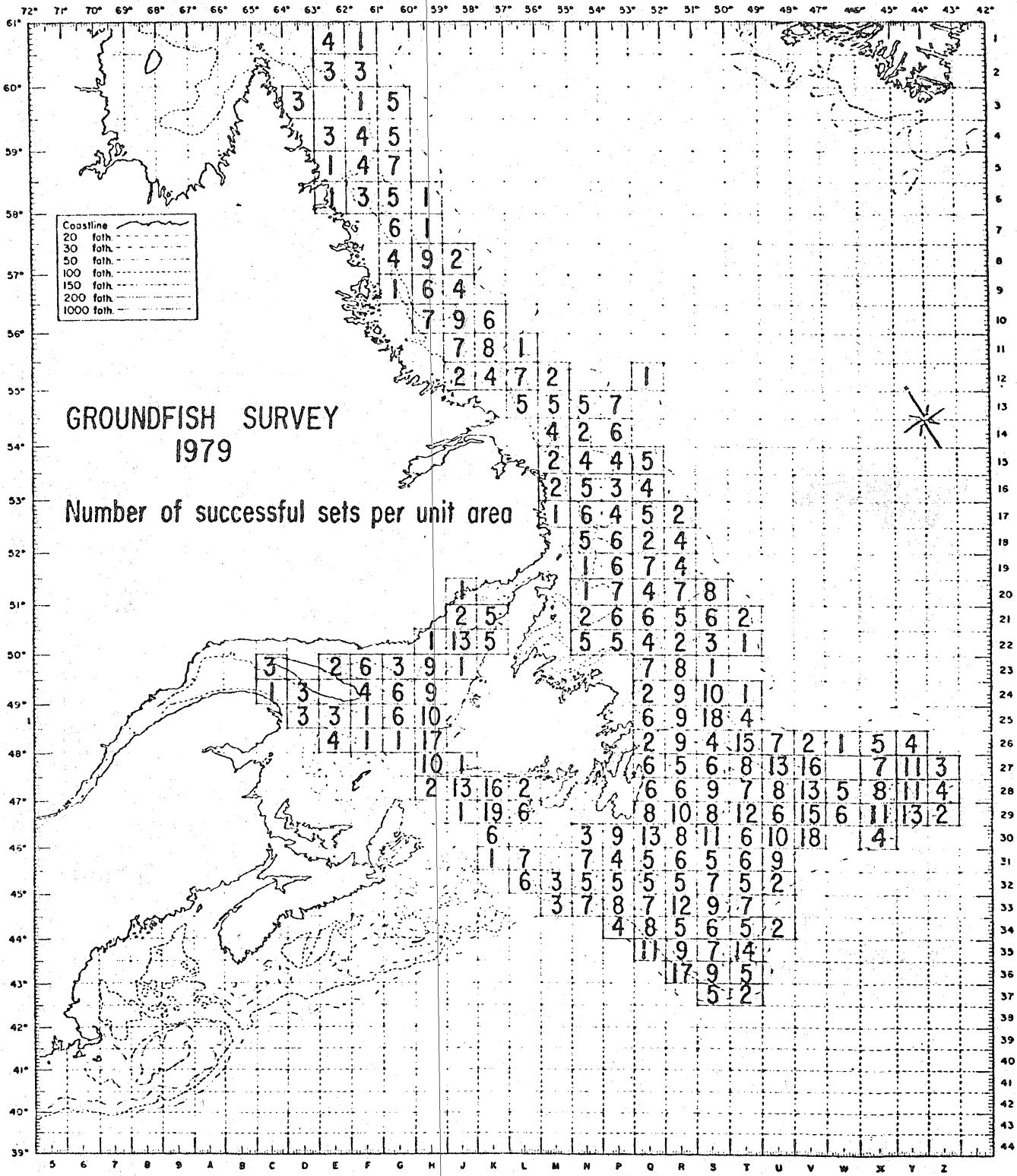


Fig. 3. Number of successful drags by research boats per unit area in 1979.

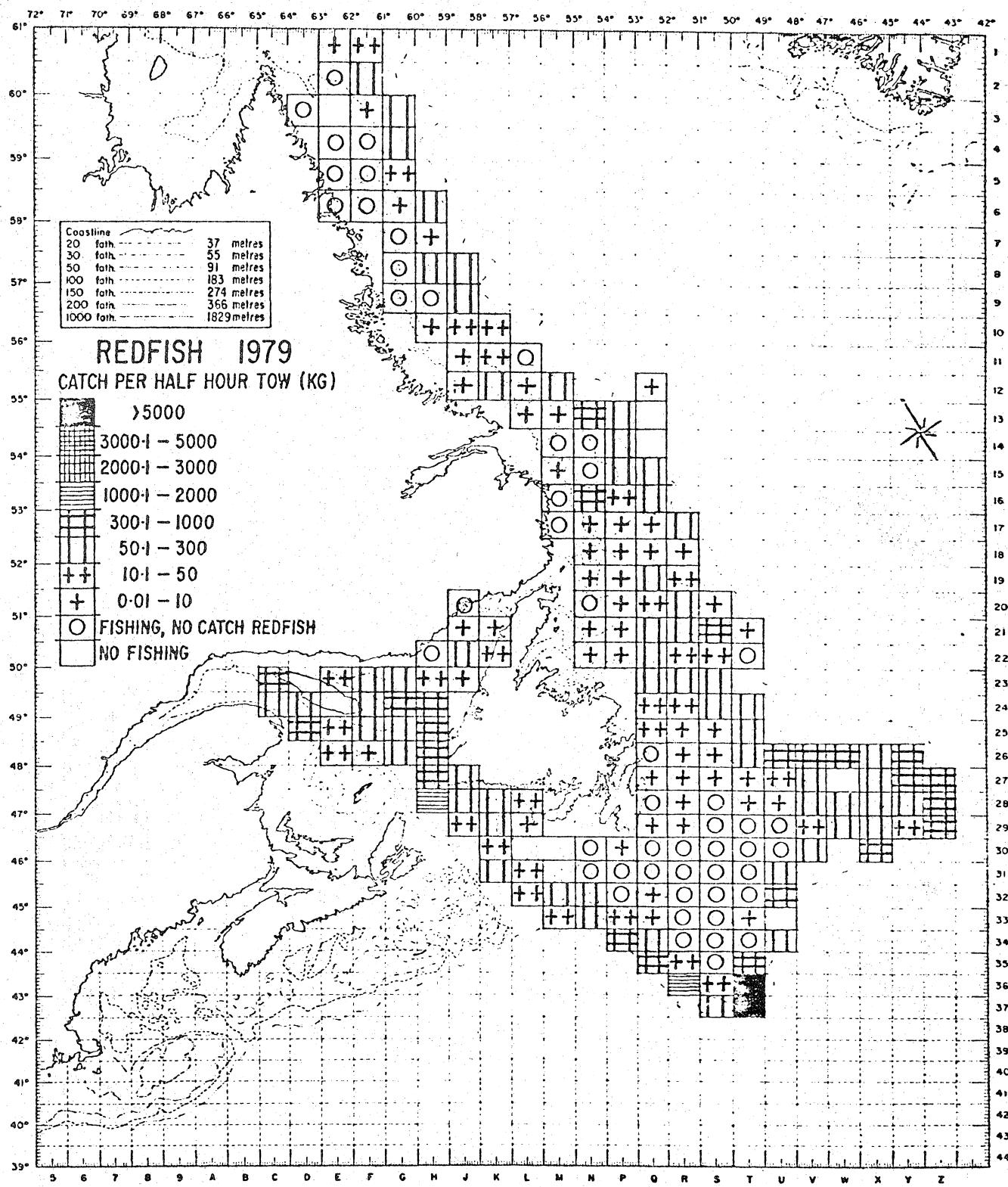


Fig. 4. Average redfish catches per half hour drags of each unit area in 1979.