Northwest Atlantic Fisheries Organization

Serial No. N2259 NAFO SCR Doc. 93/74

SCIENTIFIC COUNCIL MEETING - JUNE 1993

The Roundnose Grenadier (*Corphaenoides rupestris*) Fisheries in NAFO Subareas 2+3

by

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Introduction

The roundnose grenadier fishery in NAFO Subareas 2+3 began in the late 1960s, with the first reported catch of about 17,000 t in 1967. Nominal catches were greater than 20,000 t in most years prior to 1979 (Table 1, Fig. 1), but declined to only about 2000 t in 1980. Catches increased somewhat during the late 1980's, fluctuating around 6,000-8,000 t due to increased catches by the USSR and to some extent, GDR (Table 2). Since 1989, catches have averaged between 4000-5000 t, although catches by "traditional" countries declined. Portugal reported increased catches during this period, primarily from Div. 3LM. These were made during the directed fishery for Greenland halibut. In 1992, EEC took almost 90% of the total reported catch. Previously, catches were greatest in the second half of the year (Table 3), but beginning in 1990, they have been spread more evenly throughout the year. This change in season is related to the change in the fishery from being directed primarily in Div. 3K, to the EEC bycatch fishery (Portugal) in the Div. 3LM area north of the Sackville spur.

Previous attempts to assess roundnose grenadier through use of trawl survey results have not been successful because the surveys do not cover the entire depth range of the distribution of these fish. Attempts using analytical assessment techniques have also been unsuccessful, again because of the limited distribution of the fisheries and research vessel surveys in relation to the overall distribution of the stock (Savvatimsky *et al.* 1990). It was also concluded previously that general production analyses are not possible because of poor relationships between catch rate and effort.

There are no new data available this year which will allow us to overcome the limitations noted in the past. This paper presents an update of the catch information as well as the catch rate series. Detailed information on the fishery inside the Canadian zone, as determined from Canadian observer data are presented. In addition, information on the distribution of the fish based on Canadian stratified random bottom trawl surveys in Div. 2J3KL is presented.

Methods and Results

Two sets of catch and effort data exist for roundnose grenadier in SA 2+3. Both of these contain information on the fishery in the "traditional" areas inside the Canadian zone. There are no comparable data available for the developing fishery in the NAFO Regulatory Area. The first is that contained in the NAFO database for the years 1967 (start of the fishery) to 1990 (there are no directed fishery C/E data for 1991). These data are aggregated

on a monthly basis. For this dataset, only those catches where roundnose grenadier comprised >50% of the total were used. The category types of country-gear-tonnage class (CGT), NAFO division, month and year were applied, similar to previous analyses. In addition, a percent total catch category was included (10% increments).

The second dataset is that compiled by Canadian observers (FOP) for 1978-1991 (no directed fishery C/E data available for 1992). Unlike the NAFO database, the FOP data are available, and were used on a set by set basis. This is different from past analyses where the data were aggregated by month (e.g. Atkinson and Power MS 1991). Sets with ≥25% roundnose grenadier were selected from the FOP database. In addition to the categories above (percentage in 25% increments), a further category of depth range was included for the FOP dataset (250 m increments).

The distribution of observed fishing sets and effort in Div. 2J3KL (Fig. 2 and 3) indicate that the major fishing ground is in Div. 3K at about 51° N latitude. In this area, catches of roundnose grenadier usually constituted > 75% of the total catch in each set, but when caught in other areas, were often much less of the total than this (Fig. 4). Fishing takes place both deeper and shallower than the 1000 m contour, although overall it appears that the highest catch rates for the entire area often occurred in shallower waters (Fig. 5).

Both datasets were analysed using a multiplicative model (Gavaris 1980) to derive standardised catch rates. To reduce bias associated with rounding of low values of catch and effort, all catch/effort <10 units were removed from the datasets. In addition, any category types with <5 points (except years) were removed prior to analyses. The data were not weighted within the analyses.

The regression explained about 61% of the variation in the NAFO data (Table 4a). No outliers were detected in the residuals (Figure 6a). Based on coefficients for the percentage category, catch rates increased as the percentage roundnose grenadier in the catch increased. This is not unexpected.

The results using the FOP data (Table 4b) indicate that the regression is significant, but explained only 29% of the variation in the data. This is less than the 42% explained using aggregated FOP data (Atkinson and Power MS 1991) but probably results from increased variability introduced by using the disaggregated data. All of the categories were significant. Examination of the residuals (Figure 6b) did not reveal any problematic outliers. Coefficients indicate that as with the NAFO data, catch rates are greater when roundnose grenadier make up a greater proportion of the total catch. Catch rates are also greatest in the 500-750 m depth range, and fall off gradually at greater depths. This supports the subjective observation above. The reason for this is unclear but may be related to restrictions on the Greenland halibut by-catch allowed in this fishery. Further examination of the data is necessary to clarify this.

Standardised effort from the NAFO data (Table 5a, Fig. 7) gradually increased from 1982 to 1987 coincidental with an increase in catches, but has declined since. Catch rates (Table 5a, Fig. 8) suggest a gradual and almost continuous decline since about 1975.

Effort from the FOP series increased from about 1984 to 1987, but has declined slightly since then (Table 5b, Fig. 7). Interpretation of the effort estimates since about 1989 is difficult since it represents the application of catch rates from Div. 3K inside the Canadian zone to catches predominantly taken outside the zone in Div. 3LM. Catch rates indicate no trend until 1987 (Table 5b, Fig. 8), but they have declined steadily since then. Once again it must be remembered that these only apply to the fishery within the Canadian zone.

It has been suspected previously (Atkinson and Power MS 1991) that the decline in catch rates in recent years may be due to a redistribution of the fish deeper and beyond the depths currently fished. In order to explore this possibility, the FOP database was examined using a multiplicative model for each depth range separately. If the fish have been gradually moving deeper, then the decline in catch rates should occur earlier in shallower water. The results (Fig. 9) indicate that catch rates did not decline in the 500-750 m range, and declines occurred over the remaining depth ranges at about the same time. This suggests that if the fish did move deeper, they must have done it suddenly and simultaneously. This is considered unlikely.

Distribution of catches during Canadian stratified random trawl surveys in Div. 2J3KL support previous arguments that the surveys do not cover the entire area of distribution of the stock (Fig. 10). The maximum depth surveyed is 1000 m, and catches are distributed along the outer edge of the survey area. Data from the commercial fishery indicate considerable effort beyond this depth. The most consistent concentrations found were in Div. 3K at about 51° N latitude. This is the same area of effort concentration in the commercial fishery. The biomass of fish in this area appeared to decline in recent years. Whether this is indicative of a real decline in biomass or a re-distribution to deeper waters outside the survey area is unknown. Concentrations of roundnose grenadier were also found at various locations in Div. 2J in most years. These too appeared to decline in recent years.

Discussion

It was noted previously (Anon. 1990) that SPA is not an appropriate tool to assess roundnose grenadier in SA 2+3 because of data limitations. Survey data available do not provide reasonable estimates of the stock size because all depths are not covered and the proportion of grenadier in deeper water (as well as how this might change from year to year) is not known. Throughout the 1980s, considerable effort was exerted in depths greater than 1000 m, the limit of Canadian surveys. If there is a trend in recent years for grenadier to be distributed deeper and redistribution is beyond depths currently fished, then the decline in catch rates may reflect this movement rather than stock status. At present this can not be evaluated, however detailed analysis of the FOP database did not give indications that this occurred, at least in a gradual manner. Instead, declines occurred at about the same time across all depths suggesting either a rapid movement from all fished depths to deeper water, or a decline in stock biomass.

The precautionary TAC of 11 000 tons, in place beginning in 1983 was derived based on the fishery in this traditional area. Declines have continued even with catches less than this precautionary limit. Catch rates, as derived from Canadian Observer data, remained stable through most of the 1980s until after 1987. Through this period, catches averaged about 6 000 tons. Since then, catch rates declined by approximately 50% to 1990-1991. The TAC for 1994 should therefore be set at a new precautionary level of 3 000 tons which is half the catch level for the period of catch rate stability. It is emphasised that this can only apply to fisheries in the "traditional" areas within the Canadian zone.

While declining in "traditional" areas of Div. 2GHJ3K, catches have increased in Div. 3LM in recent years. Effort has increased outside the Canadian zone because of the development of the Greenland halibut fishery in that area. It is unknown whether this new fishery is taking a portion of the roundnose grenadier resource that always existed in the area or whether fish have moved into the area in recent years. The possible impacts of this new fishery on the resource cannot be evaluated because of a lack of data, and therefore an appropriate catch cannot be proposed. It is noted however that the effort exerted on Greenland halibut in this region in recent years has been extensive, and the relatively low bycatch of roundnose grenadier may indicate a limited resource in the area.

There is concern that there may be considerable species misallocation of grenadier catches in the developing fishery (roughheads being reported as roundnose) and supports STACRECs recommendation to bring this matter to the attention of the Fisheries Commission.

References

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Table 1: Summary of nominal catches (t) of roundnose grenadier by Subarea and Division.

Year		2G	2H	2J	3K	Other	Total	TAC
1966								
1967		-	868	217	16,009	210	17,304	
1968		2,536	4,089	479	23,553	606	31,263	
1969		387	-	264	11,682	-	12,333	
1970		-	-	468	22,267	129	22,864	
1971		54,179	2,738	81	18,392	55	75,445	
1972		2,161	655	293	21,122	155	24,386	
1973		5,880	232	632	10,655	165	17,564	
1974		3,220	2,007	333	22,816	40	28,416	32,000
1975		6,489	3,536	1,754	15,388	258	27,425	32,000
1976		3,841	1,460	1,381	13,636	275	20,593	32,000
1977		2,597	525	206	11,935	123	15,386	35,000
1978		3,112	1,412	913	15,250	15	20,702	35,000
1979		1,035	3,090	438	3,200	18	7,781	35,000
1980		279	493	726	451	104	2,053	30,000
1981		967	1,693	463	3,920	42	7,085	27,000
1982		719	734	182	2,709	-	4,344	27,000
1983		140	1,390	36	1,916	87	3,569	11,000
1984		107	289	3	3,362	112	3,873	11,000
1985		-	80	13	4,642	213	4,948	11,000
1986		-	117	53	7,222	32	7,424	11,000
1987		80	254	213	6,682	1,069	8,298	11,000
1988		329	226	9	4,658	1,071	6,293	11,000
1989		32	202	47	4,361	314	4,956	11,000
1990	*	86	52	2	606	3284	4,030	11,000
1991	*	41	129	46	125	4,086	4,427	11,000
1992	*						5,364	11,000
1993								11,000

* Provisional (1991 catch estimated to be between 9 355 and 14 145 tons from various sources).

Table 2: Nominal catches (t) of roundnose grenadier in Subarea 2+3 by country and year.

Country	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990*	1991*	1992*
Canada (M)+	-	-	-	-	-	9	10	1	19	34	152	12
Canada (N)	-	-	-	-	-	-	-	1	1	121	220	487
FRG	-	-	-	23	178	13	-	8	-	-	2	-
GDR	1,407	1,640	2,586	3,650	3,740	4,571	4,469	3,380	2,352	1	-	-
Poland	18	15	50	51	12	17	1	17	17	-	-	-
Spain	-	-	-	-	-	-	-	-	-	-	-	2,860
USSR	5,660	2,689	933	147	1,018	2,801	2,725	1,890	2,230	538	-	-
Russia	-	-	-	-	-	-	-	-	-	-	-	2
Japan	-	-	-	2	-	13	79	85	46	125	-	4
EEC	-	-	-	-	-	-	-	-	-	-	-	-
Portugal	-	-	-	-	-	3	1,001	911	290	3,211	4,053	2,000
Faroes	-	-	-	-	-	-	9	-	-	-	-	-
Norway	-	-	-	-	-	-	-	-	1	-	-	-
Cuba	-	-	-	-	-	-	4	-	-	-	-	-
TOTAL	7,085	4,344	3,569	3,873	4,948	7,427	8,298	6,293	4,956	4,030	4,427	5,364

* Provisional.

+ Maritimes and Quebec were combined prior to 1979.

Table 3: Nominal catches (t) of roundnose grenadier in Subarea 2+3 by month and year.

Year		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total	
1978															
1979		103	32	44	6	136	683	1,169	1,612	1,691	611	745	949	7,781	
1980		3	4	48	13	2	-	-	130	376	794	577	106	2,053	
1981		40	14	1	2	4	1	168	1,636	1,391	759	1,751	1,318	7,085	
1982		4	-	3	5	3	4	559	563	410	698	1,465	630	4,344	
1983		3	18	4	-	3	1	1	74	1,292	861	868	446	3,569	
1984		31	13	6	19	-	5	-	45	460	3,018	123	153	3,873	
1985		44	7	1	96	73	-	54	873	1,869	1,361	537	33	4,948	
1986		9	5	-	-	-	-	117	2,818	2,093	1,555	494	336	7,427	
1987		71	111	45	96	75	5	22	2,732	1,633	1,561	1,319	628	8,298	
1988		415	33	38	-	8	87	841	837	690	1,485	1,608	251	6,293	
1989	*	76	23	25	23	39	54	579	1,497	704	902	946	88	4,956	
1990	*	108	322	598	1,171	488	152	139	393	77	116	212	133	4,030	a
1991	*	84	325	515	835	346	425	251	331	288	811	185	32	4,427	
1992	*	67	74	185	433	260	960	185	16	362	264	162	476	5,364	b

* Provisional.
a Includes 121 t from month 'unknown'.
b Includes 1920 t from month 'unknown'

TABLE 4a: REGRESSION OF MULTIPLICATIVE MODEL USING NAFO CATCH AND EFFORT (HOURS) DATA FOR ROUNDNOSE GRENADIER.

MULTIPLE R..... 0.780
MULTIPLE R SQUARED..... 0.609

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	1.987E0	1.987E0	
REGRESSION	33	6.088E1	1.845E0	11.265
CGT (1)	3	2.126E0	7.086E-1	4.327
MONTH (2)	2	6.637E-1	3.319E-1	2.027
DIVISION (3)	1	1.854E0	1.854E0	11.324
PERCENT (4)	4	1.263E1	3.157E0	19.281
YEAR (5)	23	3.212E1	1.396E0	8.528
RESIDUALS	239	3.914E1	1.638E-1	
TOTAL	273	1.020E2		

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
1	20127	INTERCEPT	0.504	0.279	273
2	9				
3	31				
4	95				
5	67				
1	11115	1	-0.392	0.190	10
	11125	2	-0.117	0.077	53
	11127	3	0.114	0.066	75
2	1	4	0.034	0.181	6
	6	5	0.107	0.053	147
3	22	6	0.223	0.066	58
4	55	7	-0.682	0.099	37
	65	8	-0.550	0.098	43
	75	9	-0.144	0.085	68
	85	10	-0.072	0.083	72
5	68	11	0.041	0.264	16
	69	12	0.224	0.398	2
	70	13	0.326	0.297	10
	71	14	0.034	0.284	18
	72	15	-0.088	0.304	8
	73	16	0.294	0.313	6
	74	17	0.253	0.298	11
	75	18	0.250	0.291	14
	76	19	-0.150	0.296	11
	77	20	-0.158	0.286	17
	78	21	-0.159	0.282	29
	79	22	-0.536	0.279	28
	80	23	-0.306	0.293	14
	81	24	-0.568	0.285	17
	82	25	-0.595	0.294	12
	83	26	-0.632	0.325	5
	84	27	-0.439	0.363	3
	85	28	-0.735	0.307	8
	86	29	-0.625	0.302	9
	87	30	-0.812	0.301	10
	88	31	-0.881	0.297	10
	89	32	-1.041	0.298	10
	90	33	-0.931	0.391	2

TABLE 4b: REGRESSION OF MULTIPLICATIVE MODEL USING OBSERVER PROGRAMME SET BY SET CATCH AND EFFORT (HOURS) DATA FOR ROUNDNOSE GRENADIER.

MULTIPLE R..... 0.541
MULTIPLE R SQUARED..... 0.293

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DF	SUMS OF SQUARES	MEAN SQUARES	F-VALUE
INTERCEPT	1	1.280E3	1.280E3	
REGRESSION	36	1.330E3	3.693E1	112.951
PERCENT (1)	2	6.186E2	3.093E2	945.932
CGT (2)	10	3.640E1	3.640E0	11.132
MONTH (3)	4	5.750E1	1.437E1	43.963
DIVISION (4)	3	3.927E1	1.309E1	40.034
DEPTH (5)	4	7.933E1	1.983E1	60.657
YEAR (6)	13	2.751E2	2.116E1	64.729
RESIDUALS	9809	3.207E3	3.270E-1	
TOTAL	9846	5.817E3		

REGRESSION COEFFICIENTS

CATEGORY	CODE	VARIABLE	COEFFICIENT	STD. ERROR	NO. OBS.
1	75	INTERCEPT	-0.403	0.039	9846
2	20127				
3	9				
4	31				
5	1000				
6	78				
1	25	1	-0.974	0.029	535
	50	2	-0.481	0.014	2723
2	11126	3	-0.127	0.020	2341
	11127	4	-0.104	0.019	1538
	11135	5	-0.670	0.177	11
	11137	6	-0.738	0.185	10
	14125	7	0.639	0.240	6
	14126	8	0.295	0.137	19
	14127	9	0.666	0.208	8
	15127	10	0.656	0.599	17
	20126	11	0.729	0.574	38
	20137	12	-0.104	0.092	43
3	6	13	0.076	0.018	2567
	7	14	0.323	0.030	698
	8	15	0.140	0.018	2663
	11	16	0.193	0.020	1560
4	21	17	0.311	0.036	401
	22	18	0.200	0.026	819
	32	19	-0.646	0.218	7
5	500	20	0.358	0.034	382
	750	21	0.122	0.018	1623
	1250	22	-0.075	0.014	2908
	1500	23	-0.239	0.030	440
6	79	24	0.084	0.056	174
	80	25	0.350	0.078	81
	81	26	0.226	0.042	845
	82	27	0.248	0.045	602
	83	28	-0.072	0.045	584
	84	29	0.677	0.047	429
	85	30	0.067	0.042	857
	86	31	0.219	0.041	1181
	87	32	0.262	0.039	1764
	88	33	0.047	0.040	1459
	89	34	-0.095	0.039	1353
	90	35	-0.223	0.057	171
	91	36	-0.598	0.583	54

TABLE 5a: PREDICTED CATCH RATE AND EFFORT (HOURS) FOR ROUNDNOSE GRENADIER FROM MULTIPLICATIVE MODEL USING NAFO CATCH AND EFFORT DATA.

	LN TRANSFORM		RETRANSFORMED			
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT
1967	0.5043	0.0779	1.729	0.474	17304	10009
1968	0.5457	0.0258	1.850	0.296	31263	16903
1969	0.7283	0.0914	2.148	0.636	12333	5741
1970	0.8299	0.0220	2.462	0.364	22864	9285
1971	0.5386	0.0141	1.847	0.219	75445	40839
1972	0.4166	0.0248	1.626	0.255	24386	14994
1973	0.7986	0.0328	2.373	0.427	17564	7401
1974	0.7570	0.0213	2.290	0.333	28416	12409
1975	0.7542	0.0192	2.286	0.316	27425	11997
1976	0.3547	0.0183	1.534	0.207	20593	13426
1977	0.3467	0.0157	1.523	0.191	15386	10099
1978	0.3456	0.0094	1.527	0.148	20702	13560
1979	-0.0319	0.0127	1.045	0.118	7781	7446
1980	0.1985	0.0185	1.312	0.178	2053	1565
1981	-0.0633	0.0171	1.010	0.132	7085	7012
1982	-0.0908	0.0211	0.981	0.142	4344	4428
1983	-0.1276	0.0380	0.938	0.181	3569	3807
1984	0.0650	0.0667	1.120	0.285	3873	3457
1985	-0.2305	0.0291	0.850	0.144	4948	5823
1986	-0.1209	0.0263	0.949	0.153	7424	7820
1987	-0.3082	0.0256	0.788	0.126	8298	10537
1988	-0.3764	0.0248	0.736	0.115	6293	8551
1989	-0.5363	0.0247	0.627	0.098	4956	7904
1990	-0.4271	0.0901	0.677	0.199	4030	5953

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.168

TABLE 5b: PREDICTED CATCH RATE AND EFFORT (HOURS) FOR ROUNDNOSE GRENADIER FROM MULTIPLICATIVE MODEL USING OBSERVER PROGRAMME SET BY SET CATCH AND EFFORT DATA.

	LN TRANSFORM		RETRANSFORMED			
YEAR	MEAN	S.E.	MEAN	S.E.	CATCH	EFFORT
1978	-0.4026	0.0015	0.787	0.031	20702	26314
1979	-0.3182	0.0024	0.856	0.042	7781	9094
1980	-0.0527	0.0051	1.114	0.080	2053	1842
1981	-0.1768	0.0007	0.986	0.027	7085	7182
1982	-0.1542	0.0009	1.009	0.030	4344	4306
1983	-0.4751	0.0008	0.732	0.020	3569	4876
1984	0.2742	0.0010	1.548	0.050	3873	2501
1985	-0.3356	0.0006	0.842	0.020	4948	5879
1986	-0.1831	0.0005	0.980	0.022	7424	7573
1987	-0.1406	0.0005	1.023	0.023	8298	8112
1988	-0.3552	0.0007	0.825	0.022	6293	7625
1989	-0.4978	0.0006	0.716	0.017	4956	6925
1990	-0.6257	0.0025	0.629	0.031	4030	6406
1991	-1.0007	0.3388	0.365	0.196	4427	12114

AVERAGE C.V. FOR THE RETRANSFORMED MEAN: 0.070

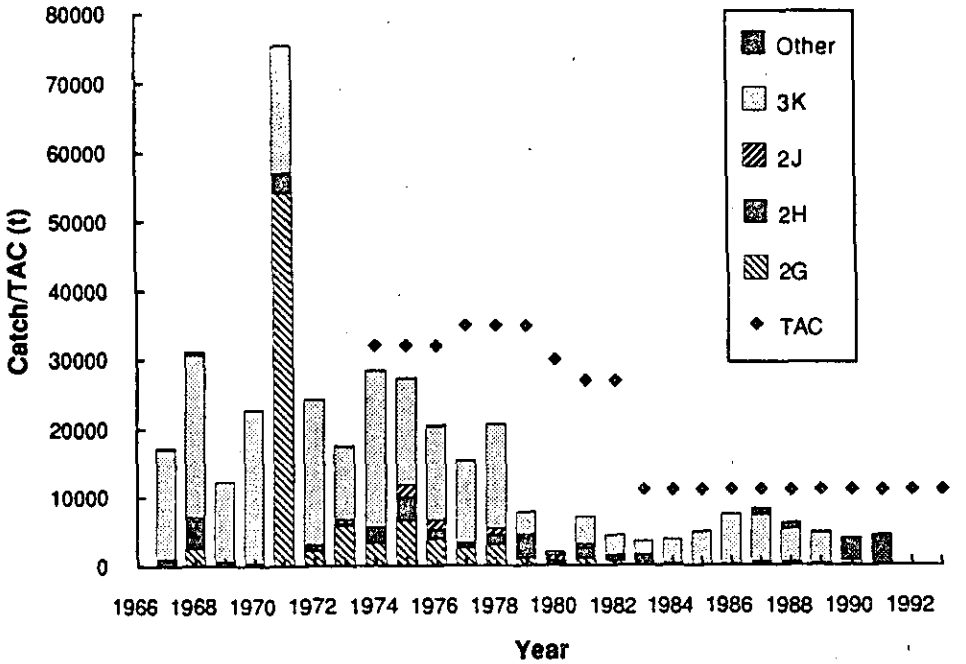


Figure 1: Nominal catches of roundnose grenadier in SA 2+3.

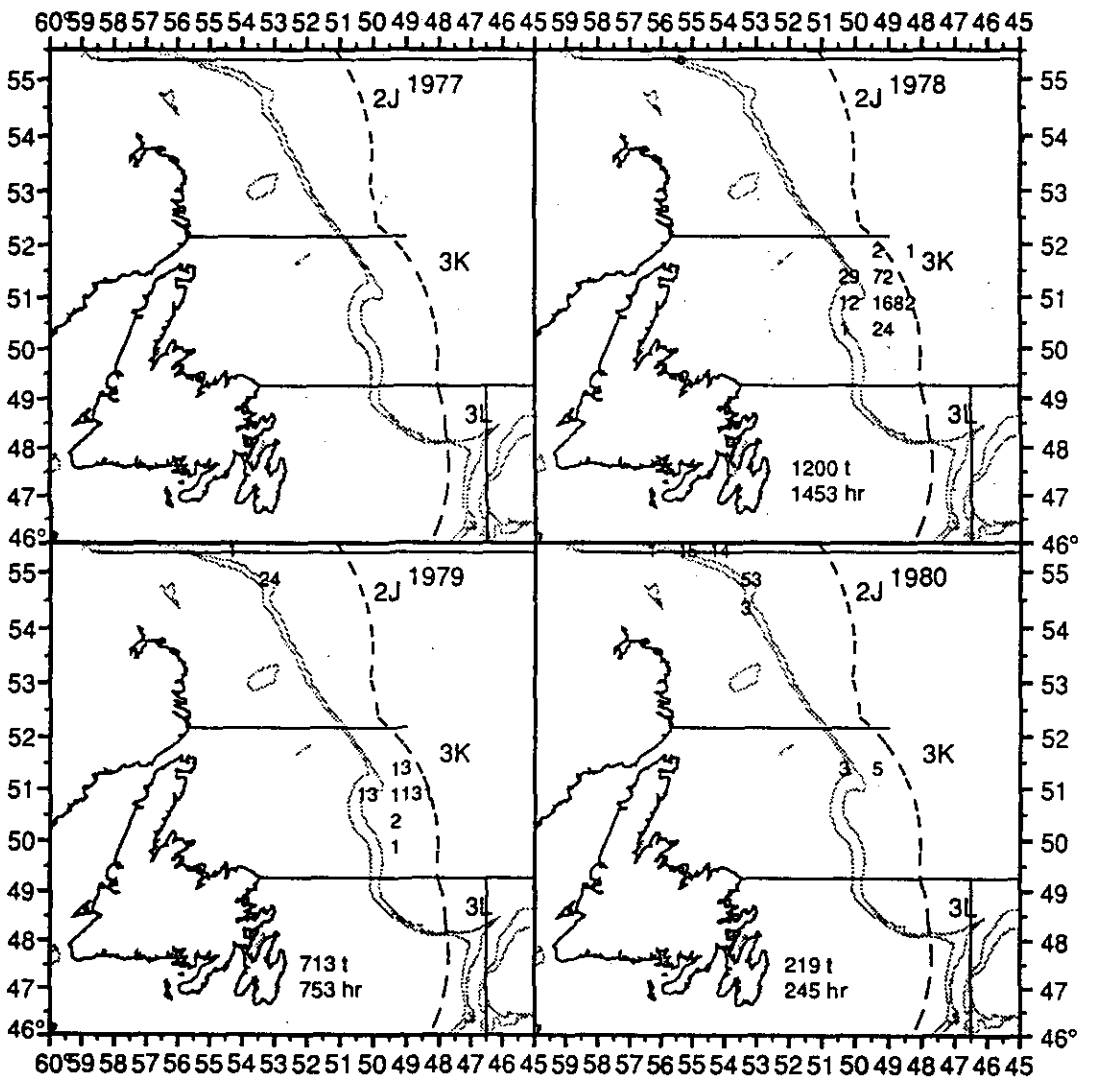


Figure 2: Distribution of commercial fishing sets for roundnose grenadier within Canada's 200 mile limit based on data collected by observers. The data were summed over half degree latitude by degree longitude units. The total observed catch and effort are also shown (RNG≥5% of catch).

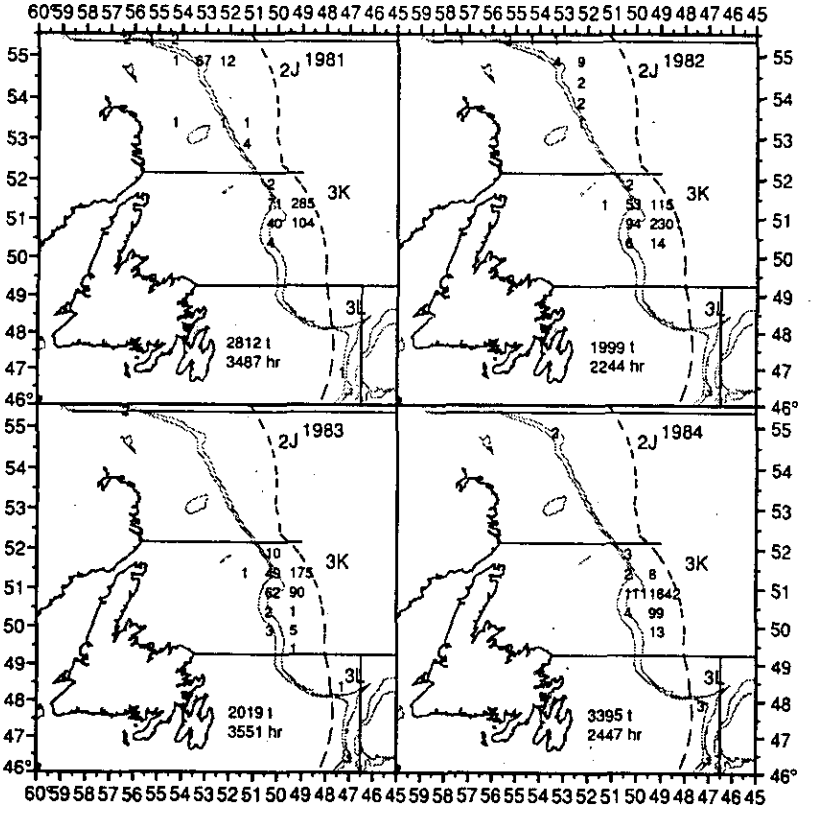


Figure 2: Continued.

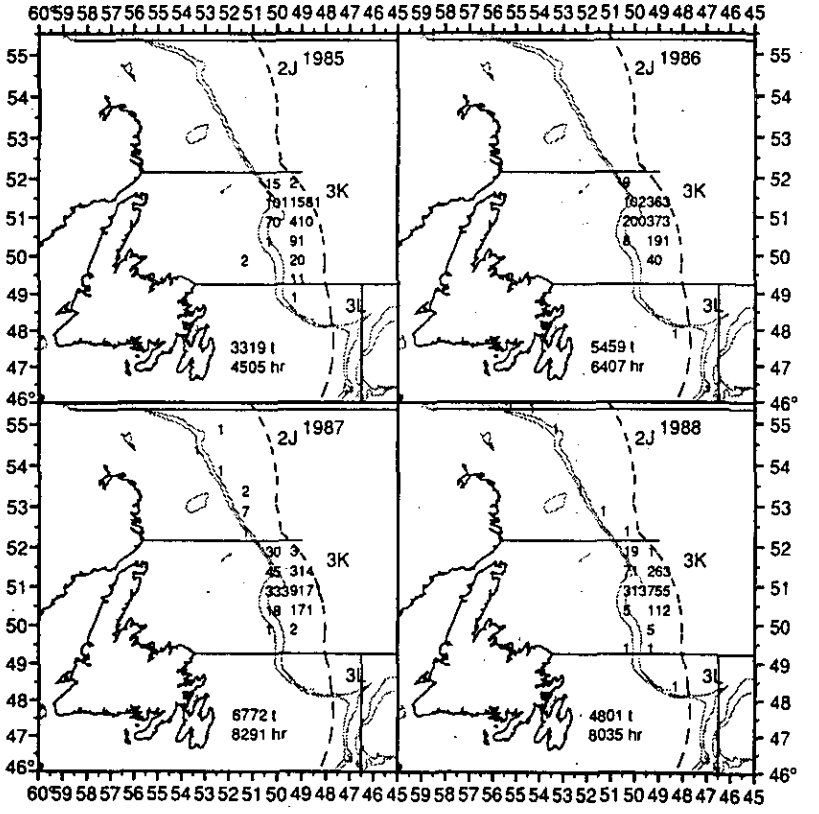


Figure 2: Continued.

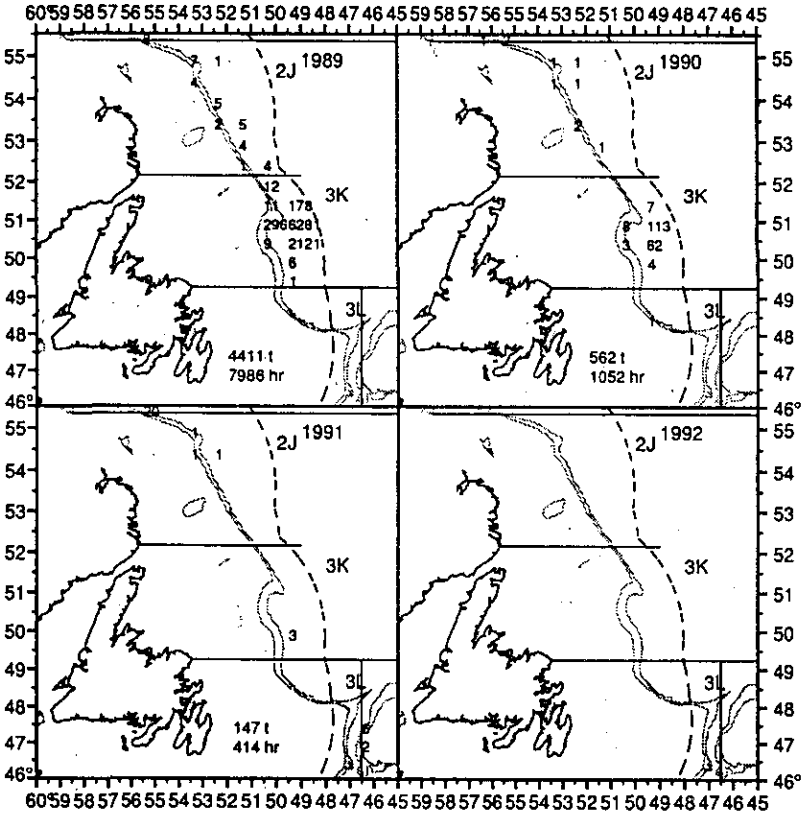


Figure 2: Continued.

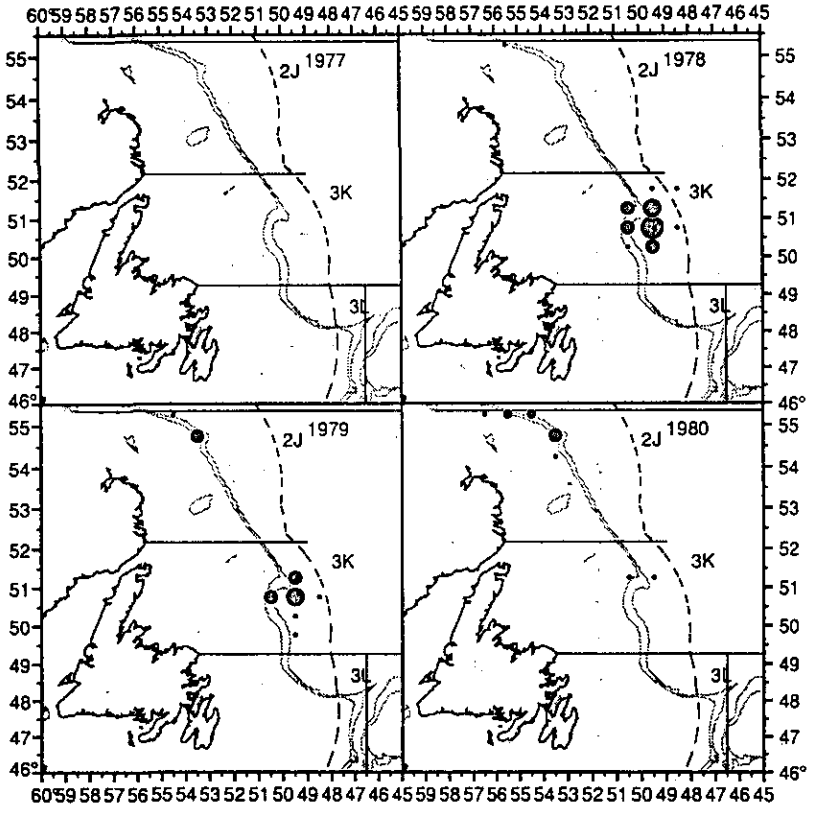
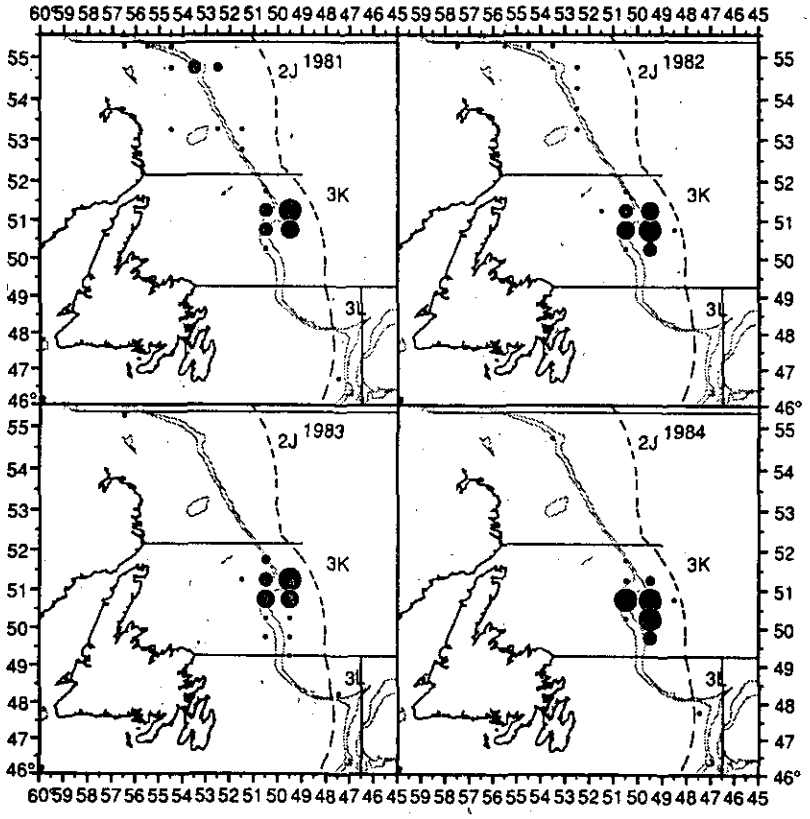


Figure 3: Distribution of commercial fishing effort (hours) for roundnose grenadier within Canada's 200 mile limit based on data collected by observers. The data were summed over half degree latitude by degree longitude units.



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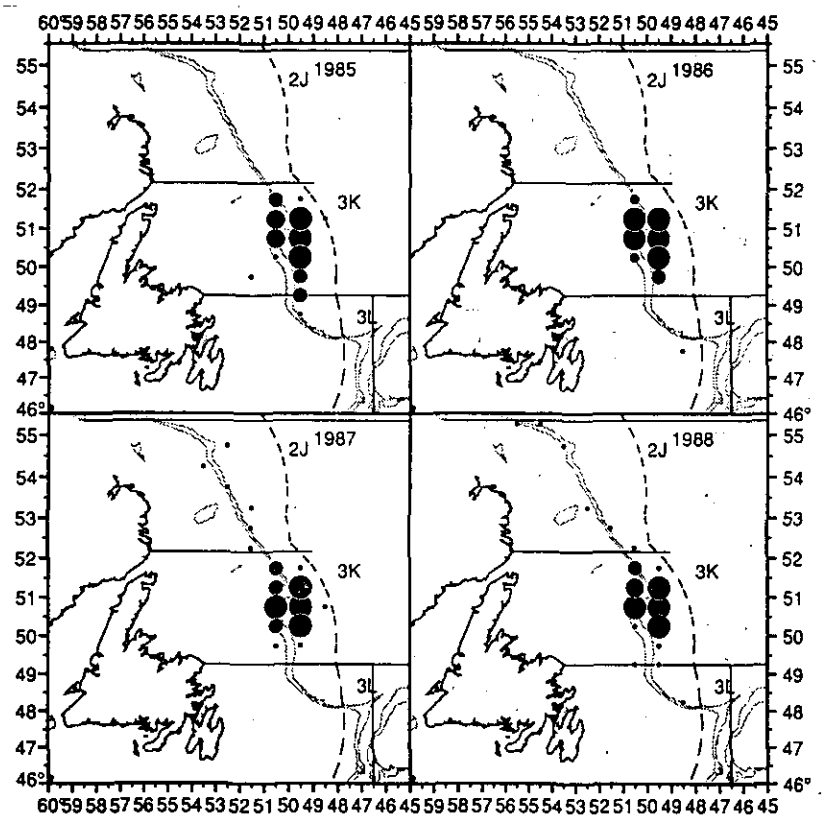

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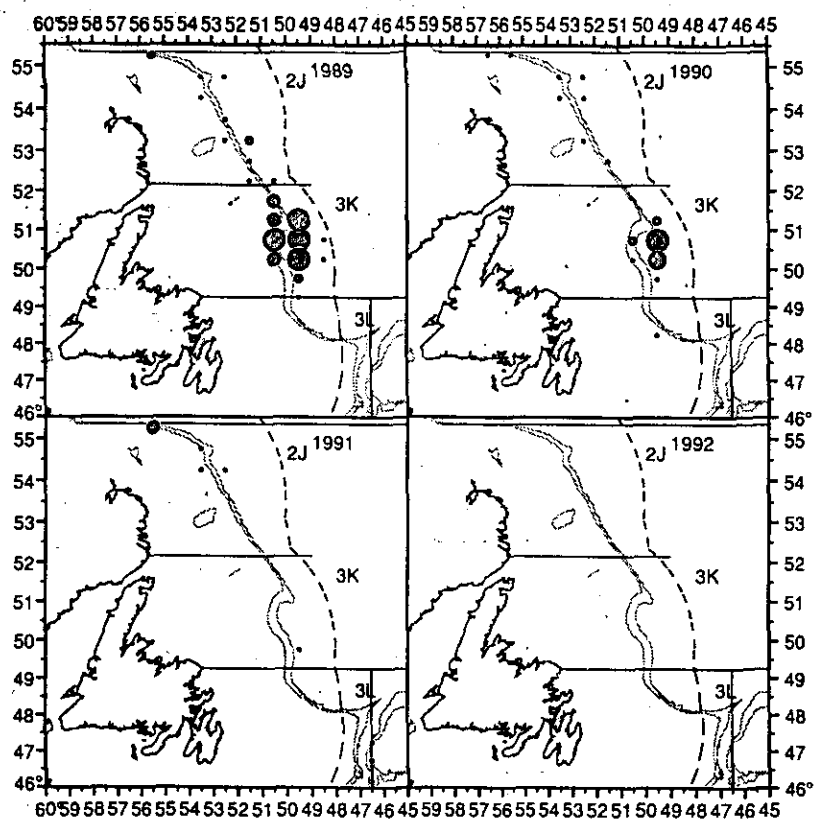
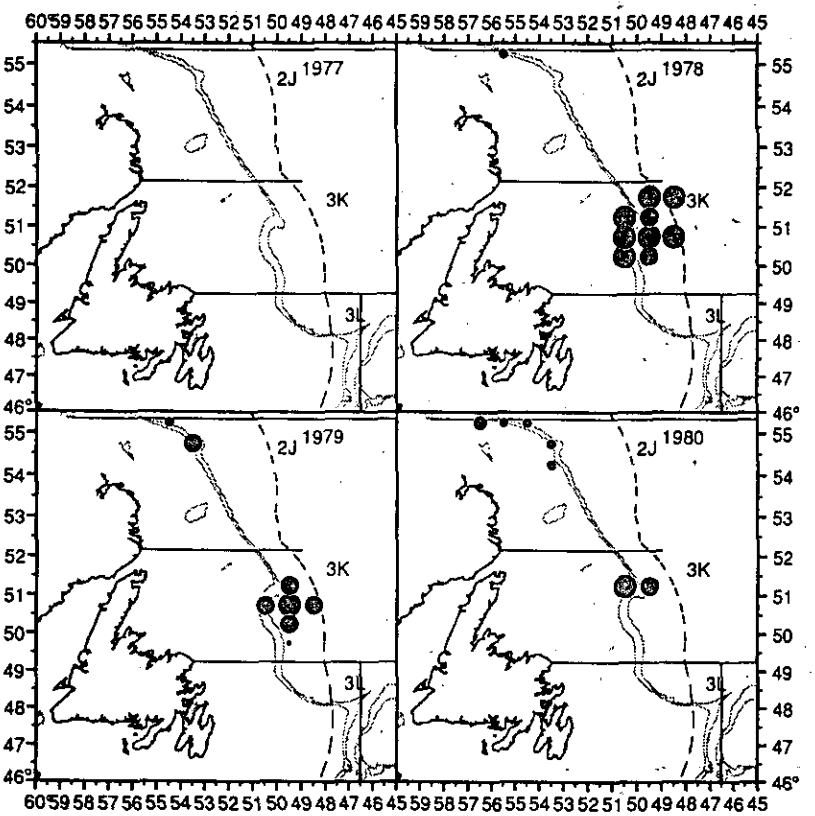


Figure 3 : Continued.



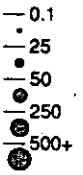
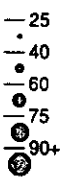
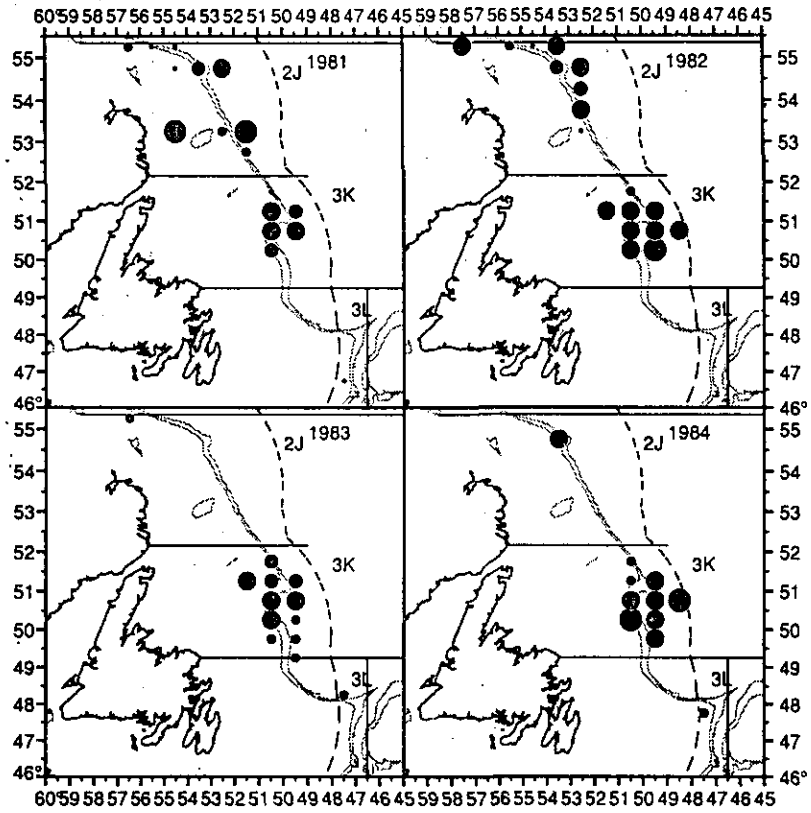


Figure 4 : Distribution of percent roundnose grenadier in commercial catches within Canada's 200 mile limit based on data collected by observers. The data were averaged over half degree latitude by degree longitude units.





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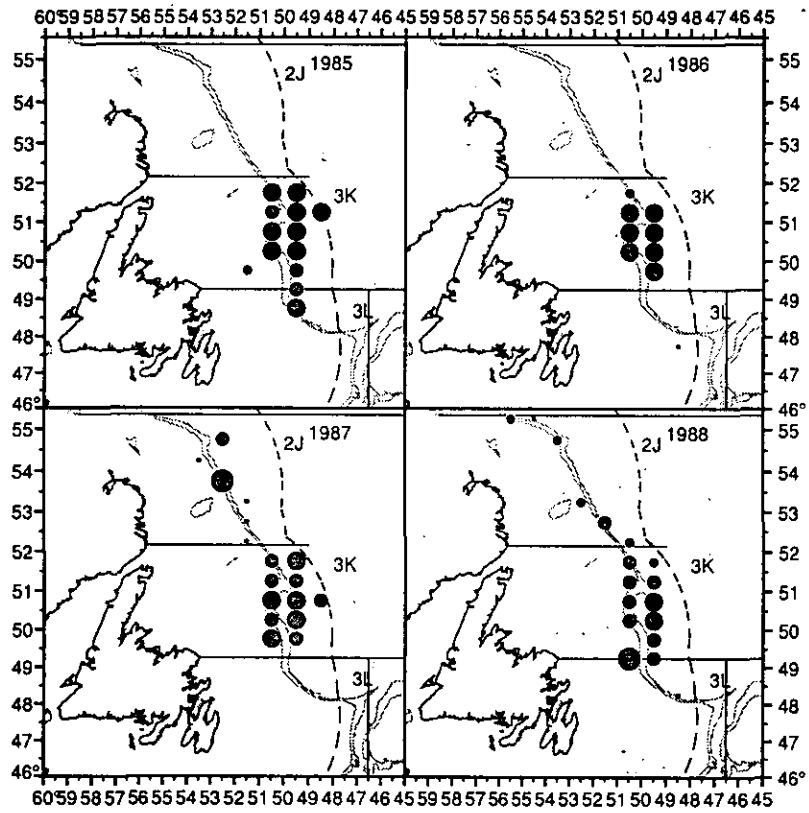

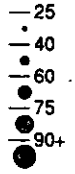

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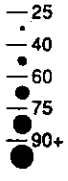

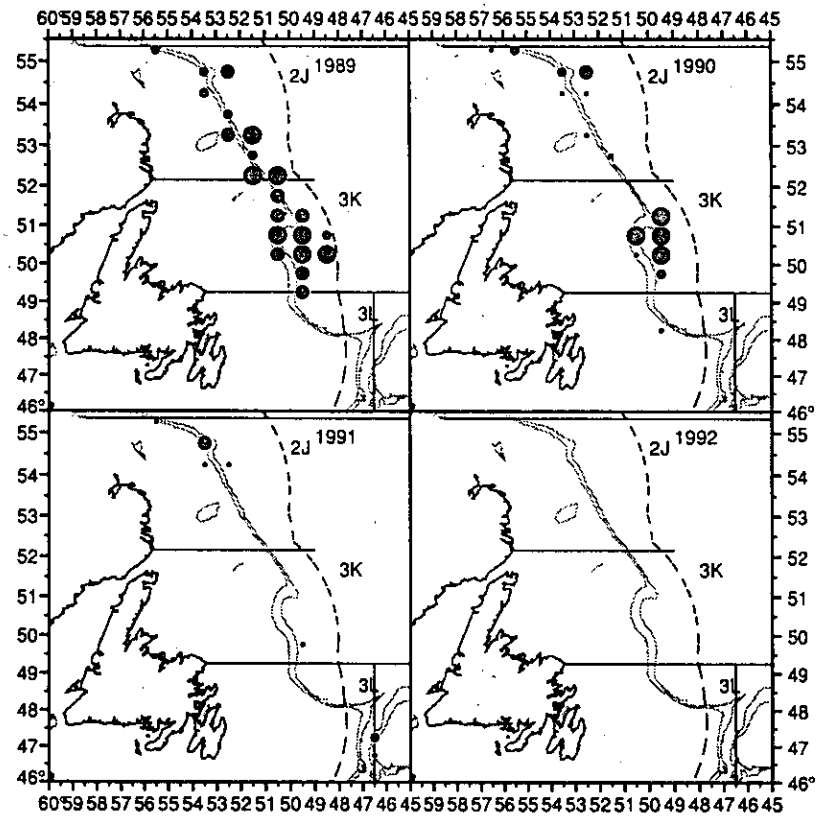

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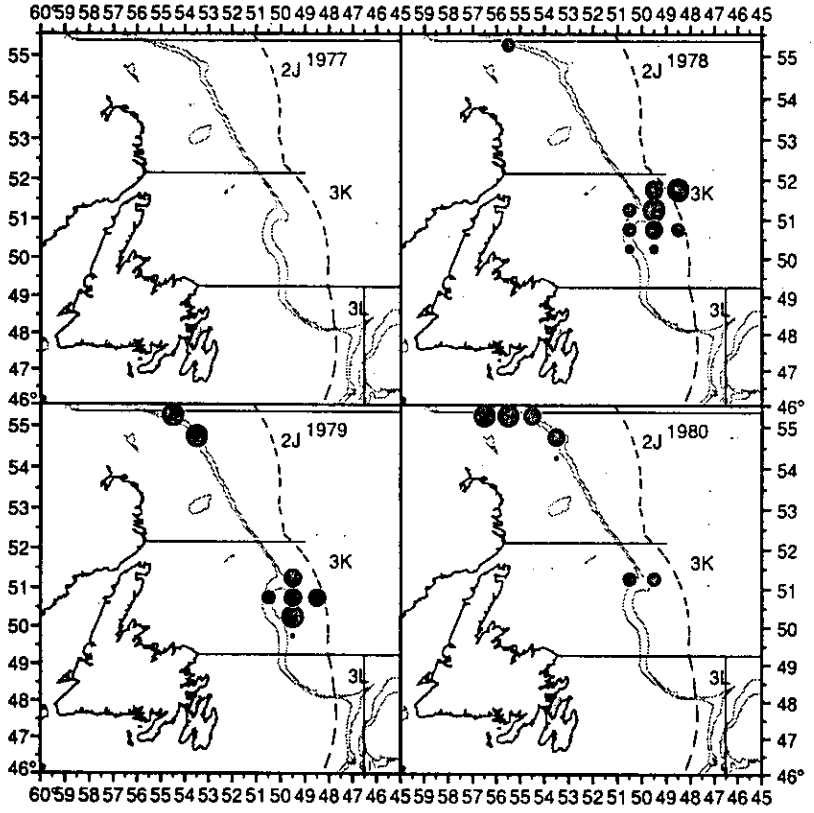
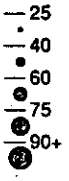




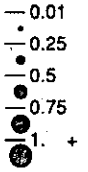
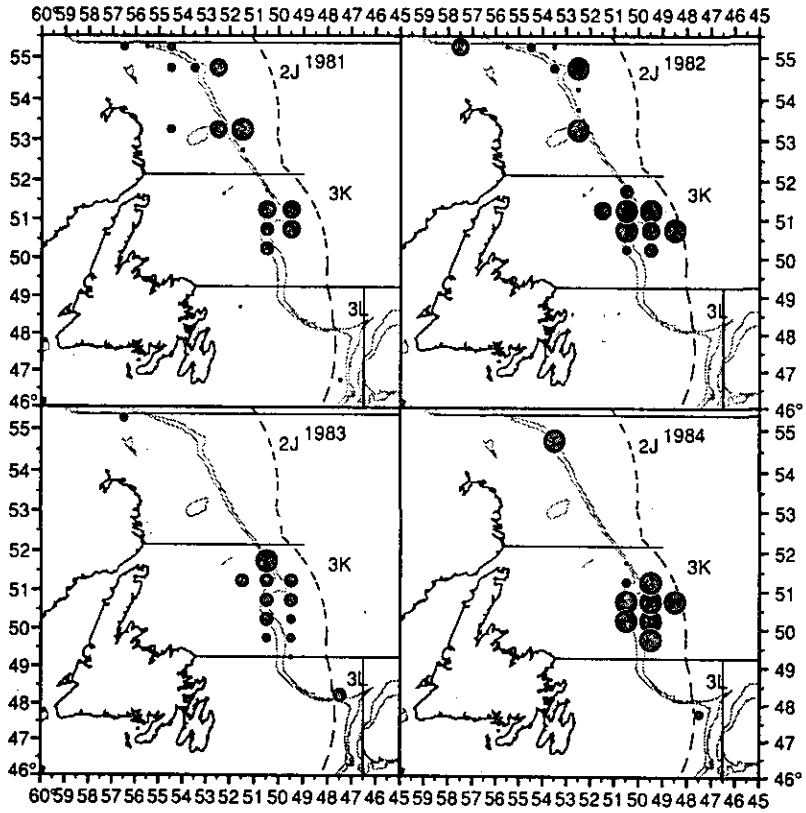


Figure 5: Distribution of commercial CPUE (t/hr) for roundnose grenadier within Canada's 200 mile limit based on data collected by observers. The data were summed over half degree latitude by degree longitude units.



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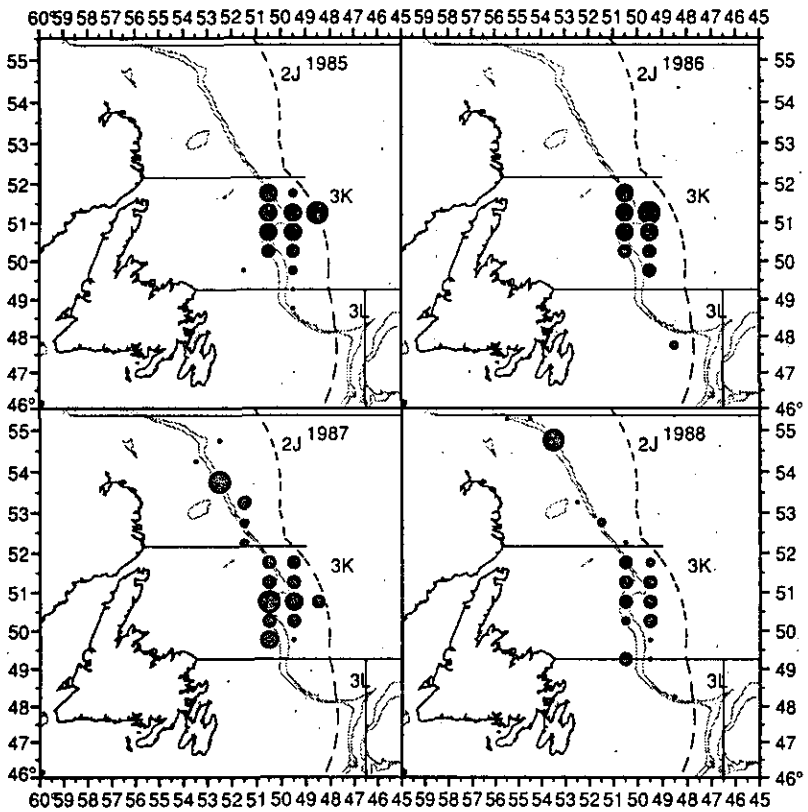

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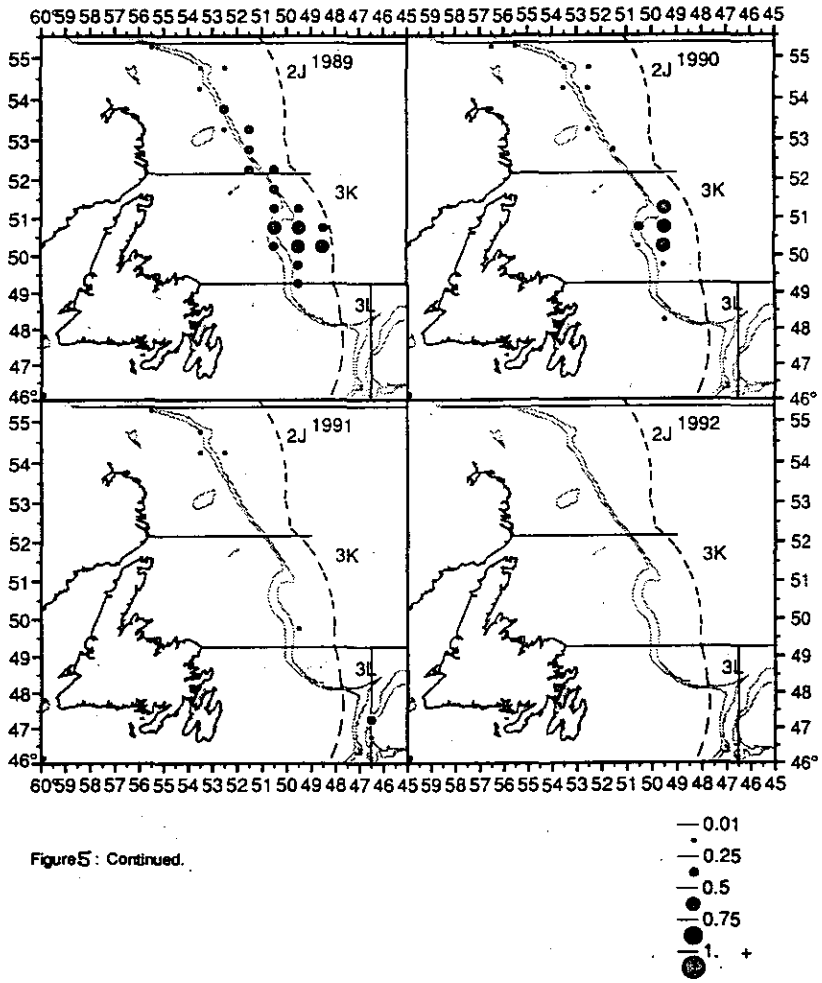


Figure 5 : Continued.

FIGURE 6a: RESIDUAL PLOTS FROM MULTIPLICATIVE MODEL USING NAFO CATCH AND EFFORT DATA FOR ROUNDNOSE GRENADIER.

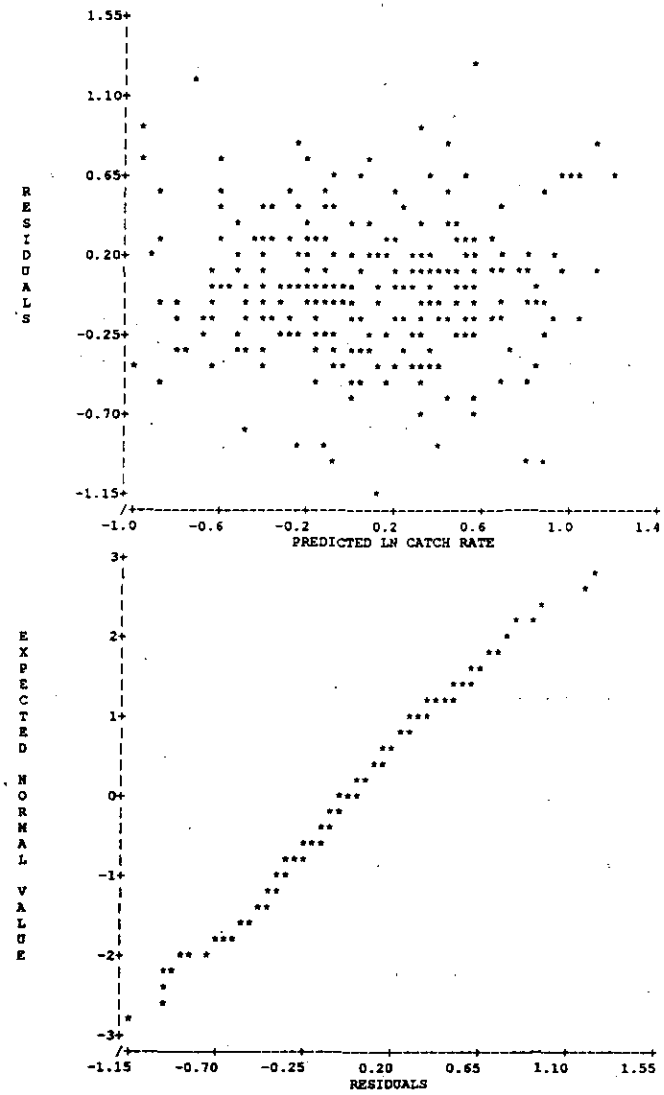
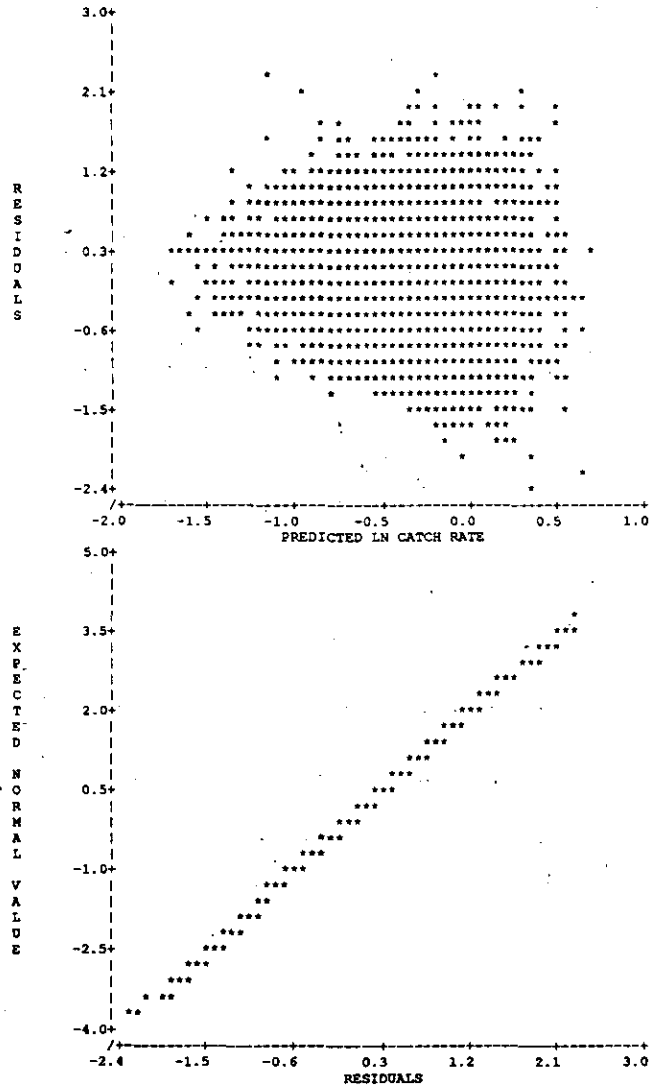


FIGURE 6b: RESIDUAL PLOTS FROM MULTIPLICATIVE MODEL USING OBSERVER PROGRAMME SET BY SET CATCH AND EFFORT DATA FOR ROUNDNOSE GRENADIER.



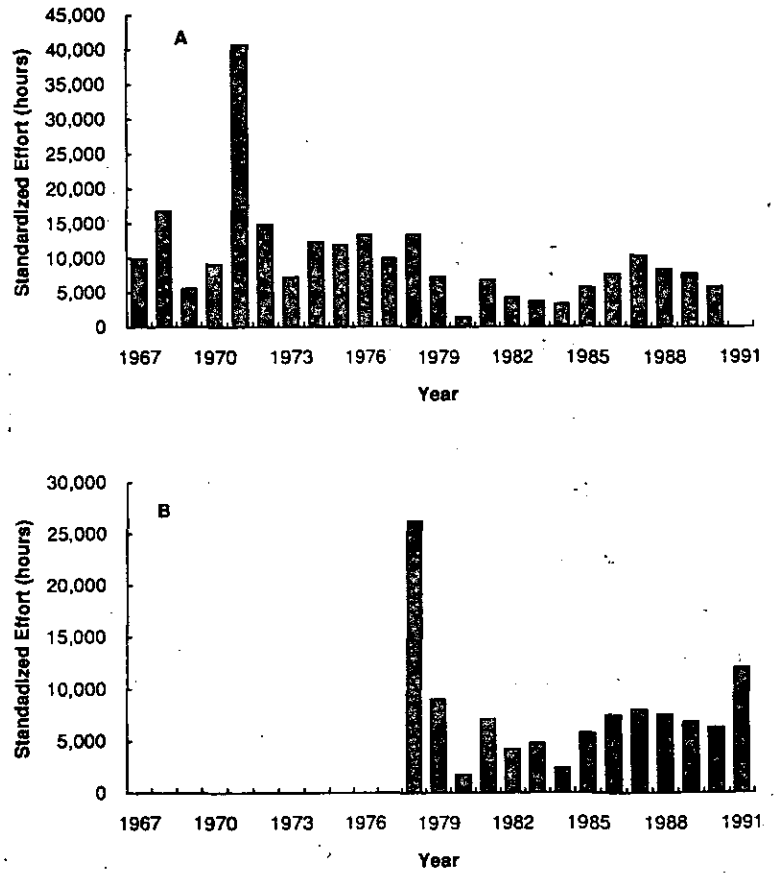


Figure 7: Standardized effort (hours) for roundnose grenadier based on A) NAFO data and B) Canadian Observer Programme set by set data.

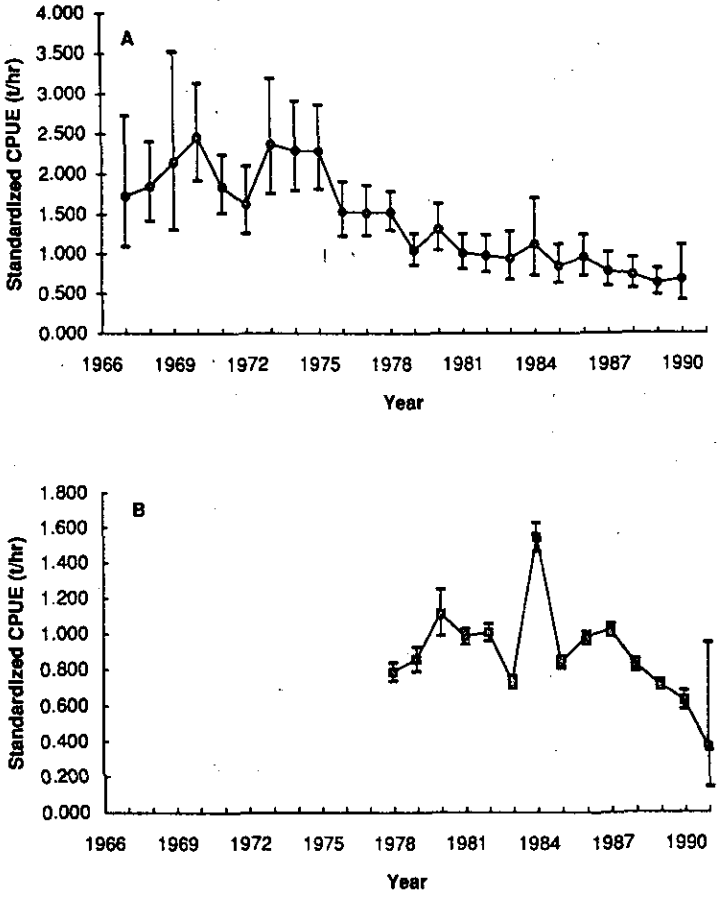


Figure 8: Standardized CPUE (t/hour) for roundnose grenadier based on A) NAFO data and B) Canadian Observer Programme set by set data.

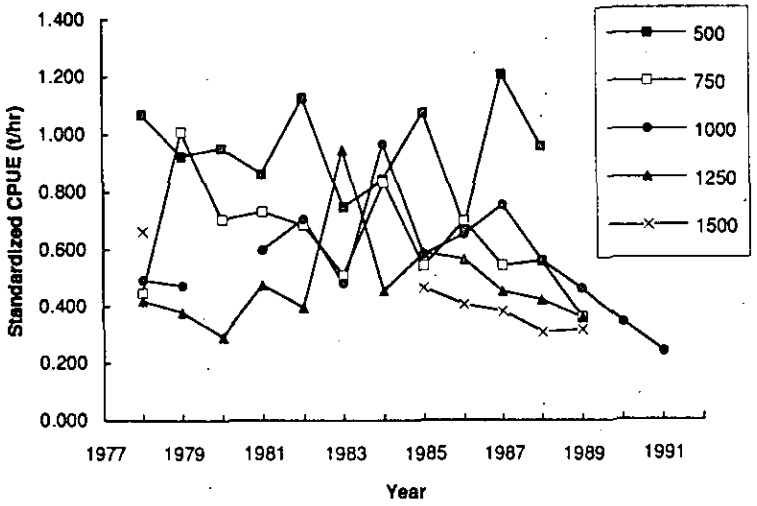


Figure 9: Standardized CPUE (t/hr) for roundnose grenadier from FOP data separated by depth range.

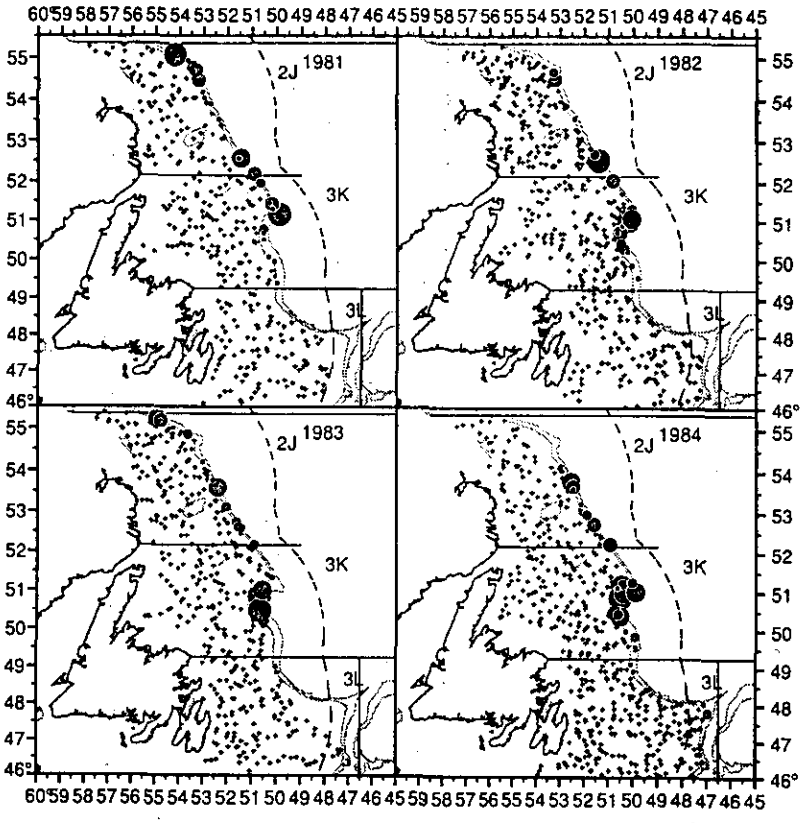


Figure 10: Distribution of roundnose grenadier (kg/tow) in Div. 2J3KL from Canadian stratified random bottom trawl surveys, 1981-1992.

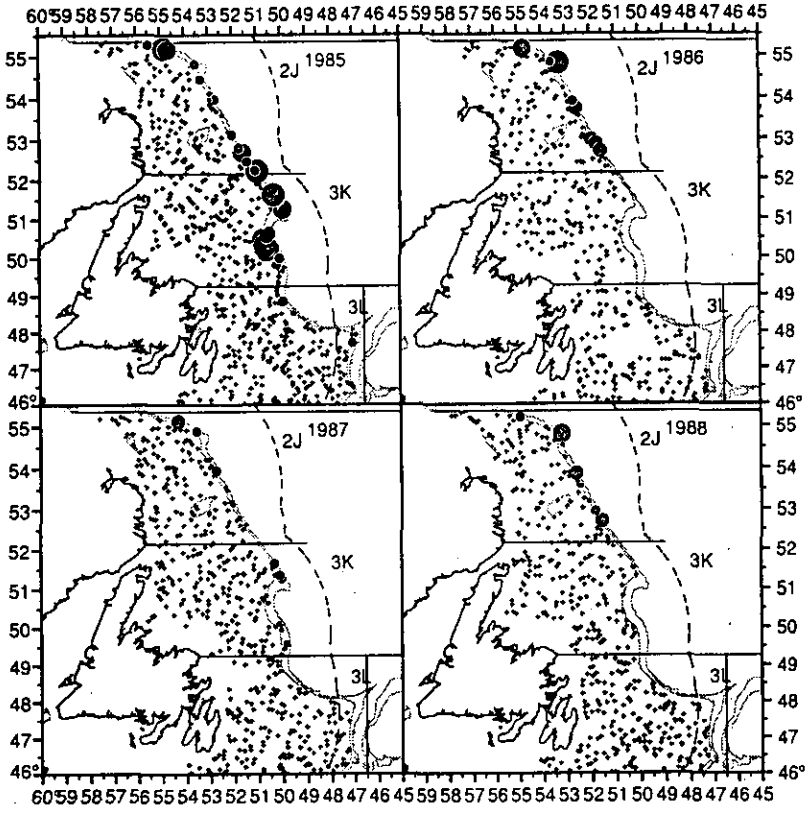


Figure 10: Continued.

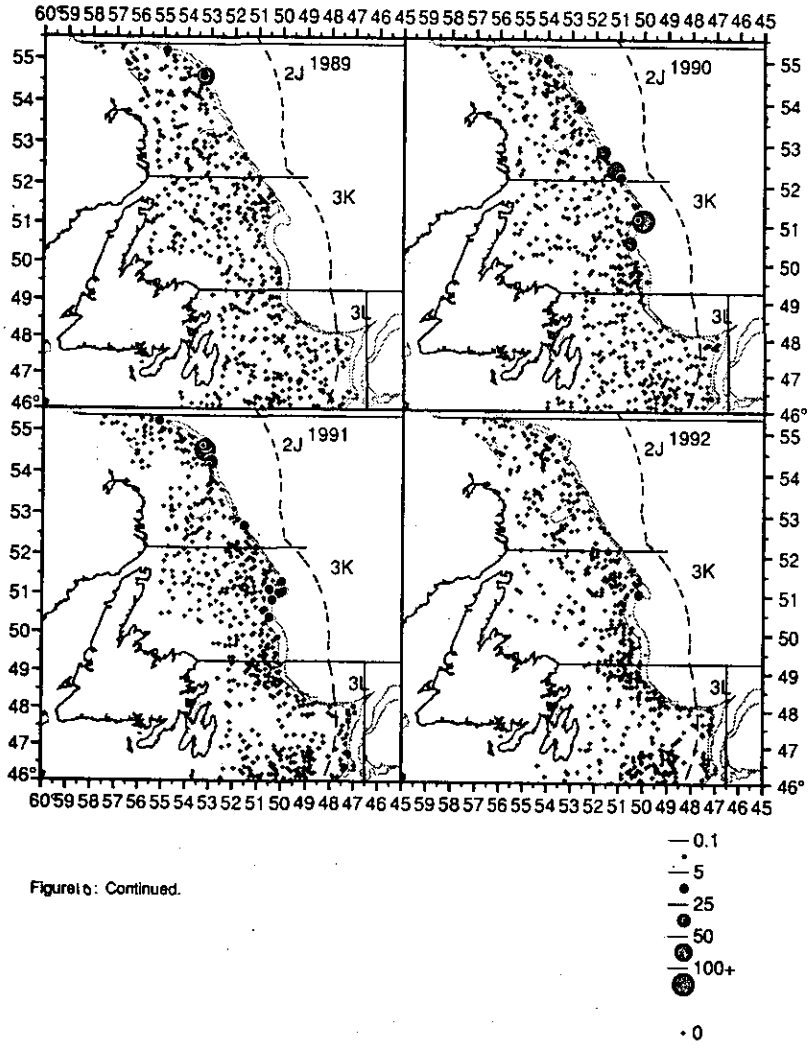


Figure 6: Continued.