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An Assessment of Roundnose Grenadier (*Coryphaenoides rupestris*) in NAFO Subareas 2+3 and
Catch Information on Roughhead Grenadier (*Macrourus berglax*)

by

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Nominal Catches and TACs

The first reported catch of roundnose grenadier in NAFO Subareas 2+3 was 17,000 t in 1967. Up to the extension of jurisdiction by Canada in 1977 nominal catches were on average about 23,000 t with the exception of the largest recorded catch of 75,000 t in 1971 (Table 1, Fig. 1). Catches declined to 8,000 t in 1979 and averaged about 5,000 t up to 1989. Catches declined rapidly to 800 tons in 1990 and have gradually declined to about 50 tons in 1996 and 1997.

It has been recognized for a number of years that recent catches of grenadiers by EU-Portugal and EU-Spain reported to NAFO as roundnose grenadier from directed Greenland halibut fisheries in the Div. 3LMN area were primarily roughhead grenadiers. EU-Portugal reported that all of their catch of grenadiers since 1988 has been roughhead grenadier and this has been changed in the NAFO catch statistics. Grenadier catches by EU-Spain for 1992-96 are also mostly roughhead grenadier (Junquera, MS 1998). The reason for this missclassification is because roundnose grenadier is the only name that appears in the statistical data reporting forms. This missclassification has not been resolved in the official statistics for 1992-96 but the species has been reported correctly for 1997. The resulting catch history for roughhead grenadiers since 1987 suggests that catches have ranged from 300 t to 7,500 t and have averaged about 4,500 t since 1990 (Table 2, Fig. 2) and have been taken primarily by Portugal and Spain (Table 3).

Over most of the years of the directed roundnose grenadier fishery, the bulk of the catch came from Div. 3K with the exception of 1971 when over 50,000 t was reported from Div. 2G. This traditional fishery was conducted by the former USSR and GDR (Table 4). These fleets fished before the extension of jurisdiction in 1977 and under bilateral arrangements with Canada afterward. Beginning in 1993 there have been no allocations to foreign vessels inside the Canadian zone.

During the years of the directed fishery for roundnose grenadier, most of the catch was taken during the second half of the year. The distribution of actual roundnose grenadier catches by area and season in the Regulatory Area in recent years has not been confirmed, but based on reports to NAFO, catches of roundnose and roughhead combined have been taken primarily during the first half of the year corresponding with the period of the most effort for Greenland halibut.

A TAC was first imposed for roundnose grenadier at 32,000 t in 1974, increased marginally to 35,000 t in 1977 and reduced to 27,000 t by 1982. A reduction to 11,000 t occurred for 1983 and the TAC was maintained at this level to 1993. From 1994 to 1996 a 3,000 t TAC was in effect for the Canadian zone only.

Currently there is a moratorium on the directed fishery imposed within the Canadian zone. Roughhead grenadier is an unregulated species.

Commercial Fishery Data

There was no sampling information available for the 1998 roundnose grenadier bycatch fisheries. Limited sampling information available for roundnose grenadier from the discarded bycatch of the Spanish trawler fleet in 1996 (Junquera MS 1997) suggested that the bulk of the 1996 bycatch in Div. 3L was composed of sizes between 6.5cm to 12.0cm based on pre-anal fin length. In Div. 3M, fish between 8.0cm-13.5cm pre-anal fin length dominated the yearly aggregated size distribution.

Research Survey Data

Relative Abundance and Biomass

Canada conducted a stratified-random multi-species bottom trawl survey in 1996 and 1997 from September to December in Div. 2GHJ and Div. 3KLMNO with allocation of sets proportional to stratum area with the constraint that each stratum have a minimum of 2 sets. During 1996 various segments of the survey were accomplished by the Alfred Needler, the Wilfred Templeman (the preceding two of the same design) and the Teleost, a larger tonnage vessel. The 1997 survey was conducted by the Teleost and Wilfred Templeman. The surveys in both years utilized a Campelen 1800 trawl with a small mesh lined in the codend (12mm) and a standard tow of 0.75 n. mi (15 minute tow on bottom X 3.0 knots). Bottom contact and general gear configuration was monitored with the SCANMAR net monitoring system. The surveys initially planned to cover down to 1500 m in all areas with the exception of Div. 3M where certain deep strata on the east and south were not covered.

For both years of the survey, highest abundance of roundnose grenadier occurred in strata beyond 900 m in all divisions (Tables 5-8). Div. 2H and Div. 3K were the most abundant in the 1996 survey. The survey biomass estimates ranged from 2 600 tons in Div. 3L to 26 000 tons in Div. 2H. The total 1996 survey biomass index amounted to about 68 000 tons. The 1997 survey showed a reduction in abundance and biomass in Div. 2H, Div. 2J and Div. 3K with an increase in estimates for Div. 3L and Div. 3M. The total 1997 survey biomass index for these divisions amounted to 34 000 tons. This is with complete coverage of the areas from 400m to 1500m for Div. 2GHJ3KL and the north and west strata of Flemish Cap in Div. 3M. Div. 2G was only partially covered in 1997 from 400m - 1250 m and even less coverage (<500 m) in 1996. In both years Div. 3N was covered from 367m - 732 m and similar depth strata were incomplete in Div. 3O but abundance was scarce in these areas.

Japan conducted a stratified-random trawl survey in Div. 2GH in August 1996 (Yokawa and Satani MS 1997). The survey covered strata from 201m to 1500m and utilized the same stratification scheme as the Canadian survey mentioned above. Tow duration was 30 minutes at 3.5 knots. The gear used had 140mm mesh codend with a 30mm liner. The survey biomass estimate for roundnose grenadier was 2,250 t for Div. 2G and 2,736 t for Div. 2H.

Russia conducted stratified-random trawl surveys in Div. 2GH from 1987 to 1992 directed to Greenland halibut (Savvatimsky MS 1998). The surveys covered depths to 1250m during 1987-1989 and to 1500m from 1990-1992 with the exception of no survey in 2H in 1990 and utilized the standard NAFO stratification scheme. The surveys were conducted with a 12mm liner in the codend and tows were of one hour duration. Coverage was incomplete in most years. The survey biomass index for roundnose grenadier ranged from 5,800 t (1988) to 67,200 t (1989) in Div. 2G and from 1,500 t (1992) to 14,000 t (1989) in Div. 2H.

Size distribution

Size distribution of roundnose grenadier (mean number per standard tow at length using pre-anal fin length measurements) from the Canadian survey by year and division (Fig. 3) indicate a smaller size range and predominantly smaller fish in the southern divisions, at least for 3LM, compared to the northern divisions 2HJ3K. The most striking pattern is the reduction in density in Divs. 2H and Div. 3K and the increase in Div. 3L and Div. 3M. The substantial decrease in Div. 2H and 3K occurred over most of the ranges observed in 1996. The increase for Div. 3L in 1997 occurred in the larger sizes (6.0cm to 11 cm) compared to the 1996 distribution. In Div. 3M the increase occurred in the same dominant size range (5.0 cm to 8 cm) that was sampled in 1996. There was very few fish captured in Divs. 3NO to draw any conclusions.

Discussion/Status of the stock

There has been very limited commercial data since the cessation of fishing within the Canadian zone in 1993. Deepwater surveys in Div. 3K in 1991 and 1994 suggested no change in status in Div. 3K over this time period, but a decline of about 70% was noted in 1995 (Bowering *et al.* MS 1995). The more recent Canadian surveys indicate a substantial decline in the survey biomass index between 1996 and 1997 for the divisions where the traditional directed fishery occurred (Div. 2GH3K) and an increase in the divisions where bycatches of roundnose grenadier are currently taken (Div. 3LM). The 1996 and 1997 Canadian surveys are not directly comparable to the data from the 1994-1995 Canadian surveys because a different gear was used. For the same reason the 1996 Div. 2GH survey by Japan and the 1987-92 Div. 2GH surveys by Russia are not comparable to the 1996 survey by Canada.

It is difficult to interpret the nature of the general decline from 1996 to 1997 in the Canadian surveys. Although these surveys cover down to 1500m for most of the area it is known from other investigations that roundnose grenadier inhabit waters down to 3,000m (Leim and Scott, 1966; Atkinson *et al.*, MS 1981, Sahrhage, 1986). It is also well known that grenadier size increases with depth so intuitively the surveys will be unable to track the full life cycle. Consequently there will be a degree of uncertainty as to whether this decline is due to mortality, emigration from the survey area or some catchability effect in the survey. Regardless of these cautions the status of the current stock compared with the historical period when a directed fishery occurred cannot be determined. This resource is currently under moratorium for directed fishing in the Canadian zone. Recent catches of this resource, in the range of 50 tons are taken as bycatch in other groundfish fisheries. Approximate exploitation rates (catch/survey biomass index) suggest this is light exploitation (0.14%) using the 1997 survey biomass index. The actual exploitation would be much less than this as the survey results are minimum estimates.

Reference Points based on the Precautionary Approach

It is not possible to determine limit or target reference points based on spawning stock biomass or fishing mortalities. The only readily available source of data were commercial catch rate data that showed relationships between standardized CPUE and effort were inconclusive (ANON, 1988) and therefore these data were not evaluated any further in a production model.

References

ANON (1988). NAFO Sci. Coun. Rep., 1988, pg. 70

Atkinson, D.B., Bowering, W.R., Horsted, Sv. Aa., and J. P. Minet. MS 1981 Grenadier (*Macrourus rupertis*), Greenland Halibut (*Reinhardtius hippoglossoides*), and shrimp (*Pandalus borealis*) in Davis Strait (NAFO Subareas 0 and 1). NAFO SCR Doc. 81/XI/22, Ser. No. 290, 58 p.

Bowering, W.R., D. Power and M.J. Morgan. MS 1995. Distribution and Abundance of Five Major Groundfish Species at the Continental Slope of Divisions 3KLMN Based upon Canadian Deepwater Surveys in 1991, 1994 and 1995. NAFO SCR Doc. 95/51. Ser. No. N2562. 26 p.

Junquera, S. MS 1997. Spanish research report for 1996. NAFO SCS Doc. No. 97/10. Ser. No. N2873. 9p

Junquera, S. MS 1998. A Proposal to Rename the STACFIS Section Dealing with Grenadiers. NAFO SCR Doc. No. 98/28. Ser. No. N3013. 9p

Leim, A.H., and W.B. Scott. 1966. Fishes of the Atlantic Coast of Canada. Bull. Fish. Res. Bd. Canada. No. 155, 485 p.

Sahrhage, D. 1986. Wirtschaftlichwichtige Grenadierfische des Nordatlantiks. Mitteilungen Ins. Seefischerei, No. 37, 81 p.

Savvatimsky, P. I. MS 1998. Results from the assessment of roundnose grenadier stocks in NAFO Divisions 2G and 2H by the data from Russian trawl surveys in 1987-1992. NAFO SCR Doc. 98/14. Ser. No. N2993. 9p.

Yokawa, K., and M. Satani MS 1997. Results of a stratified random bottom trawl survey in NAFO Divisions 2GH in 1996. NAFO SCR Doc. 97/23. Ser. No. N2853.19 p.

Table 1: Summary of STATLANT nominal catches (t) of roundnose grenadier by Division for Subarea 2+3.

Year	2G	2H	2J	3K	3L	3M	3N	3O	Other	TOTAL	TOTAL	TAC
										Reported	Excluding Roughhead	
1966												
1967	-	868	217	16,009					210	17,304	17,304	
1968	2,536	4,089	479	23,553					606	31,263	31,263	
1969	387	-	264	11,682					-	12,333	12,333	
1970	-	-	468	22,267					129	22,864	22,864	
1971	54,179	2,738	81	18,392					55	75,445	75,445	
1972	2,161	655	293	21,122					155	24,386	24,386	
1973	5,880	232	632	10,655					165	17,564	17,564	
1974	3,220	2,007	333	22,816					40	28,416	28,416	32,000
1975	6,489	3,536	1,754	15,388					258	27,425	27,425	32,000
1976	3,841	1,460	1,381	13,636					275	20,593	20,593	32,000
1977	2,597	525	206	11,935	48	0	75	0		15,386	15,386	35,000
1978	3,112	1,412	913	15,250	12	0	3	0		20,702	20,702	35,000
1979	1,035	3,090	438	3,200	16	0	2	0		7,781	7,781	35,000
1980	279	493	726	451	68	32	4	0		2,053	2,053	30,000
1981	967	1,693	463	3,920	24	0	18	0		7,085	7,085	27,000
1982	719	734	182	2,709	0	0	0	0		4,344	4,344	27,000
1983	140	1,390	36	1,916	85	2	0	0		3,569	3,569	11,000
1984	107	289	3	3,362	89	23	0	0		3,873	3,873	11,000
1985	0	80	13	4,642	181	18	0	14		4,948	4,948	11,000
1986	0	117	56	7,222	23	8	0	1		7,427	7,427	11,000
1987	80	254	213	6,682	51	1	16	0		7,297	7,297	11,000
1988	329	226	9	4,658	117	39	4	0		5,382	5,382	11,000
1989	32	202	47	4,361	2	9	2	11		4,666	4,666	11,000
1990	86	52	2	606	41	26	0	6		819	819	11,000
1991 a	178	84	45	94	56	9	0	0		466	466	11,000
1992	72	11	20	253	2,287	2,520	336	4		5,503	1,378	11,000
1993	128	8	14	145	2,105	10	46	4	5	2,465	411	11,000
1994 b	7	10	5	23	576	361	678	174	3	1,837	117	3,000
1995 b	12	10	1	18	1,063	797	763	86		2,750	229	3,000
1996 b	5	2	5	8	1,626	931	555	11		3,143	53	3,000
1997 b			3	2	44					49	49	0
1998												0

a 1991 catch could not be well estimated; based on revised data is estimated to be 8,000 - 14,000 t mixed Roundnose and Roughhead

b Provisional (TACs for Canadian zone only, Grenadiers are unregulated in the NAFO Regulatory area.

NOTE: Catches for Spain from(1992-1996) listed under Roundnose grenadier in NAFO statistics have been adjusted for Roughhead grenadier according to Junquera (1988)

Table 2: Summary of STATLANT nominal catches (t) of roughhead grenadier by Division.

Year	2G	2H	2J	3K	3L	3M	3N	3O	Other	TOTAL	TOTAL
										Reported	Including RNG from E/ESP
1987					912	7	82			1,001	1,001
1988		1			907		52			960	960
1989		2		3	289	28	11			333	333
1990		1	32		2,211	688	312			3,244	3,244
1991 a			12	113	2,543	497	1,093	10		4,268	4,268
1992			23	274	684	1,022	471	125		2,599	6,724
1993			10	193	174	812	1,064	61	27	2,341	4,395
1994 b	1		2	35	17	1,940	271	28	9	2,303	4,023
1995 b	22	6	16	16	115	970	292	20	4	1,461	3,982
1996 b					554	115	373	2		1,044	4,134
1997 b	36	5	63	100	1,774	922	1,797	43		4,740	4,740

a 1991 catch could not be well estimated; based on revised data is estimated to be 8,000 - 14,000 t mixed Roundnose and Roughhead
b Provisional

Table 3. Nominal catches (t) of reported roughhead grenadier with an adjustment for missclassification in Subarea 2+3 by country and year.

Country	1987	1988	1989	1990	1991	1992	1993	1994*	1995*	1996*	1997*
Canada				31	215	595	345	79	84		240
Former GDR		49	43								
E/ESP										257	3,738
E/PRT	1,001	911	290	3,211	4,053	2,004	1,996	2,224	1,377	787	762
Norway				2							
TOTAL Reported	1,001	960	333	3,244	4,268	2,599	2,341	2,303	1,461	1,044	4,740
Including "RNG" by (E/ESP)	1,001	960	333	3,244	4,268	6,724	4,395	4,023	3,982	4,134	4,740

* Provisional

NOTE: Catches for Spain from(1992-1996) listed under Roundnose grenadier in NAFO statistics have been adjusted for Roughhead grenadier according to Junquera (1988)

Table 4. Nominal catches (t) of reported roundnose grenadier with an adjustment for missclassification in Subarea 2+3 by country and year.

Country	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994*	1995*	1996*	1997*
Canada	-	9	10	2	20	155	152	409	273	54	42	27	3
E/GER	178	13	-	8	-	-	2	35	-	-	-	-	-
Former GDR	3,740	4,571	4,469	3,380	2,352	1	-	-	-	-	-	-	-
Poland	12	17	1	17	17	-	-	-	-	-	-	-	-
E/ESP	-	-	-	-	-	-	-	4,970	2,054	1,720	2,521	3090	-
Former USSR	1,018	2,801	2,725	1,890	2,230	538	132	-	-	-	-	-	-
Russia	-	-	-	-	-	-	-	4	-	-	130	-	-
Japan	-	13	79	85	46	125	156	80	134	63	57	26	42
E/FRA	-	-	-	-	-	-	-	-	-	-	-	-	4
Faroese	-	-	9	-	-	-	-	3	4	-	-	-	-
Norway	-	-	-	-	1	-	24	-	-	-	-	-	-
Cuba	-	-	4	-	-	-	-	-	-	-	-	-	-
Den(GRL)	-	-	-	-	-	-	-	2	-	-	-	-	-
TOTAL Reported	4,948	7,424	7,297	5,382	4,666	819	466	5,503	2,465	1,837	2,750	3,143	49
Excluding E/ESP	4,948	7,424	7,297	5,382	4,666	819	466	1,378	411	117	229	53	49

* Provisional.

NOTE: Catches for Spain from(1992-1996) listed under Roundnose grenadier in NAFO statistics have been adjusted for Roughhead grenadier according to Junquera (1988)

Table 5. Mean number per standard tow of roundnose grenadier from Canadian surveys conducted in Div. 2GHJ3K in autumn 1996-1997. Number of successful sets in brackets. The gear utilized was a Campelen 1800 survey trawl with a small mesh liner in the codend. Only those strata > 400 m that were sampled are considered in the analysis. W = Wilfred Templeman, A = Alfred Needler, T=Teleost.

Stratum	2G 1997		2H 1996		2H 1997		2J 1996		2J 1997		3K 1996		3K 1997	
	Depth Range (M)	Area (sq. n. mi)	Depth Range (M)	Area (sq. n. mi)	Stratum	Depth Range (M)	Area (sq. n. mi)	Stratum	Depth Range (M)	Area (sq. n. mi)	Stratum	Depth Range (M)	Area (sq. n. mi)	T55-57 W(217)
912	301-400	73	0.00 (2)	50	933	0401-500	0.00 (2)	288	204	0401-500	0.00 (2)	593	0301-400	0.00 (3)
903	401-500	80	3.60 (3)	55	942	0401-500	0.00 (2)	241	217	0401-500	0.00 (2)	691	0401-500	0.00 (3)
913	401-500	62	0.00 (2)	461	945	0401-500	0.00 (3)	598	227	0401-500	0.00 (2)	1255	0401-500	0.00 (5)
922	401-500	186	0.00 (2)	246	948	0401-500	0.00 (2)	414	235	0401-500	0.00 (2)	1321	0401-500	0.00 (6)
928	401-500	783	0.00 (3)	234	951	0401-500	0.00 (2)	133	240	0401-500	1.00 (2)	69	0401-500	0.50 (2)
904	501-750	153	0.00 (2)	107	960	0401-500	0.00 (2)	557	212	0501-750	0.00 (2)	216	0401-500	0.00 (2)
914	501-750	113	5.43 (2)	78	934	0501-750	135.00 (2)	362	218	0501-750	1.00 (2)	134	0401-500	0.00 (2)
921	501-750	142	1.50 (2)	89	941	0501-750	0.00 (2)	228	224	0501-750	12.00 (2)	230	0501-750	22.00 (2)
929	501-750	1261	0.13 (8)	721	946	0501-750	0.00 (3)	185	230	0501-750	11.00 (2)	325	0501-750	23.50 (2)
906	1001-1250	229	54.67 (2)	227	947	0501-750	0.00 (2)	120	239	0501-750	0.00 (2)	359	0501-750	14.33 (2)
919	1001-1250	316	166.29 (2)	211	961	0501-750	12.00 (2)	283	219	0751-1000	128.00 (2)	418	0751-1000	78.50 (2)
				96	935	0751-1000	--	348.00 (2)	231	0751-1000	73.50 (2)	360	0751-1000	62.00 (2)
				97	940	0751-1000	1008.50 (2)	76.00 (2)	236	0751-1000	52.00 (2)	516	0751-1000	30.00 (2)
				242	962	0751-1000	177.00 (2)	69.78 (2)	220	1001-1250	68.00 (2)	733	1001-1250	252.33 (3)
				78	936	1001-1250	--	92.50 (2)	225	1001-1250	49.50 (2)	228	1001-1250	50.14 (2)
				130	939	1001-1250	1442.00 (2)	71.50 (2)	232	1001-1250	87.50 (2)	531	1001-1250	20.72 (2)
				265	963	1001-1250	40.00 (2)	97.24 (2)	221	1251-1500	318.00 (2)	474	1251-1500	326.50 (2)
				94	937	1251-1500	--	401.50 (2)	226	1251-1500	66.50 (2)	212	1251-1500	50.00 (2)
				191	938	1251-1500	640.50 (2)	57.28 (2)	233	1251-1500	49.00 (2)	479	1251-1500	60.89 (2)
				342	964	1251-1500	343.10 (2)	135.00 (2)						
Upper (95% CI)			81.7	736.9		113.2		127.0		70.7		216.4		230.0
Stratified mean (by area			19.5	157.9		50.7		58.5		46.4		127.3		53.6
Lower (95% CI)			-42.7	-421.1		-11.8		-10.5		22.2		38.1		-122.8
Abundance of surveyed area (millions)			9.1	81.4		30.6		42.5		33.7		160.1		67.46

Table 6. Mean number per standard tow of roundnose grenadier from Canadian surveys conducted in Div. 3LMNO in autumn 1996-1997. Number of successful sets in brackets. The gear utilized was a Campelen 1800 survey trawl with a small mesh liner in the codend. Only those strata > 400 m that were sampled are considered in the analysis. W = Wilfred Templeman, A = Alfred Needler, T = Teibost.

Stratum	3L		3M		3N		3O							
	1996	1997	1996	1997	1996	1997	1996	1997						
Depth Range (M)	Area (sq. n. mi)	T41 WT196-198	Area (sq. n. mi)	T57-58 W213-217	Area (sq. n. mi)	T41 WT195-196	Area (sq. n. mi)	T42 A253 W200						
729	0367-549	166	0.00 (2)	0.00 (2)	512	0367-549	670	0.00 (4)	723	0367-549	155	0.00 (2)	0.00 (2)	
731	0367-549	216	0.00 (2)	0.00 (2)	513	0367-549	249	0.00 (2)	725	0367-549	105	0.00 (2)	0.00 (2)	
733	0367-549	468	0.00 (3)	0.00 (3)	514	0367-549	602	0.00 (4)	727	0367-549	160	0.50 (2)	0.00 (2)	
735	0367-549	272	0.00 (2)	0.00 (2)	515	0367-549	666	0.00 (3)	724	0550-731	124	18.22 (2)	0.00 (2)	
730	0550-731	170	2.18 (2)	9.50 (2)	516	0550-731	634	9.00 (4)	726	0550-731	72	0.00 (2)	0.00 (2)	
732	0550-731	231	1.80 (2)	0.00 (2)	517	0550-731	216	0.80 (2)	728	0550-731	156	0.00 (2)	0.00 (2)	
734	0550-731	228	37.00 (2)	8.44 (2)	518	0550-731	210	0.89 (2)						
736	0550-731	175	62.90 (2)	1.00 (2)	519	0550-731	414	0.00 (3)						
737	0732-914	227	61.00 (2)	32.50 (2)	528	0732-914	530	83.50 (2)						
741	0732-914	223	75.50 (2)	83.50 (2)	533	0732-914	98	22.20 (2)						
745	0732-914	348	7.50 (2)	21.00 (2)	529	0915-1097	488	293.07 (2)						
748	0732-914	159	30.50 (2)	8.00 (2)	532	0915-1097	238	53.00 (2)						
742	0915-1097	206	21.50 (3)	20.00 (2)	534	0915-1097	486	143.00 (2)						
746	0915-1097	392	15.50 (2)	45.50 (2)	530	1098-1280	1134	105.28 (2)						
749	0915-1097	126	66.00 (2)	145.78 (2)	535	1098-1280	92	81.50 (2)						
739	1098-1280	254	38.50 (2)	26.50 (2)	531	1281-1463	203	35.00 (2)						
743	1098-1280	211	50.27 (2)	80.00 (2)	536	1281-1463	112	83.56 (2)						
747	1098-1280	724	73.50 (2)	69.14 (2)										
750	1098-1280	556	44.00 (3)	121.72 (2)										
740	1281-1463	264	69.50 (2)	133.00 (2)										
744	1281-1463	280	42.00 (2)	57.00 (2)										
751	1281-1463	229	41.30 (2)	27.39 (2)										
			200.29 (2)	381.72 (2)										
Upper (95% CI)			60.4	128.3				132.2						574.2
Stratified mean (by area)			43.0	65.9				59.8						220.8
Lower (95% CI)			25.5	3.5				-12.6						-132.6
Abundance of surveyed area (millions)			36.4	57.7				57.9						102.7

Stratum	3N		3O	
	1996	1997	1996	1997
Depth Range (M)	Area (sq. n. mi)	T41-42 A253	Area (sq. n. mi)	T42 A253 W200
723	0367-549	155	0.00 (2)	0 (3)
725	0367-549	105	0.00 (2)	1.2 (2)
727	0367-549	160	0.50 (2)	0 (2)
724	0550-731	124	18.22 (2)	0.5 (2)
726	0550-731	72	0.00 (2)	39.5 (2)
728	0550-731	156	0.00 (2)	25.6 (2)
Upper (95% CI) a			34.8	58.1
Stratified mean (by area)			3.0	9.1
Lower (95% CI) a			-28.7	-39.9
Abundance of surveyed area (millions)			0.3	1.0

Stratum	3N		3O	
	1996	1997	1996	1997
Depth Range (M)	Area (sq. n. mi)	T41-42 A253	Area (sq. n. mi)	T42 A253 W200
717	0367-549	166	0.00 (2)	0.00 (2)
719	0367-549	76	0.00 (2)	0.00 (2)
721	0367-549	76	0.00 (2)	0.00 (2)
720	0550-731	105	0.00 (2)	5.50 (2)
722	0550-731	93	6.00 (2)	1.78 (2)
Upper (95% CI)			21.9	19.3
Stratified mean (by area)			1.6	1.7
Lower (95% CI)			-18.7	-16.0
Abundance of surveyed area (millions)			0.1	0.1

Table 8. Mean weight per standard tow of roundnose grenadier from Canadian surveys conducted in Div. 3LMNO in autumn 1996-1997. Number of successful sets in brackets. The gear utilized was a Campelen 1800 survey trawl with a small mesh liner in the codend. Only those strata > 400 m that were sampled are considered in the analysis. W = Wilfred Templeman, A = Alfred Needler, T = Teleost.

Stratum	3L		3M		3N		3O	
	1996	1997	1996	1997	1996	1997	1996	1997
	Depth Range (M)	Area (sq. n. mi)	Depth Range (M)	Area (sq. n. mi)	Depth Range (M)	Area (sq. n. mi)	Depth Range (M)	Area (sq. n. mi)
729	0367-549	186	0.00 (2)	0.00 (2)	512	0367-549	670	0.00 (4)
731	0367-549	216	0.00 (2)	0.00 (2)	513	0367-549	249	0.00 (2)
733	0367-549	468	0.00 (3)	0.00 (2)	514	0367-549	602	0.00 (4)
735	0367-549	272	0.00 (2)	0.00 (2)	515	0367-549	666	0.00 (3)
730	0550-731	170	0.04 (2)	0.40 (2)	516	0550-731	634	0.23 (4)
732	0550-731	231	0.22 (2)	0.00 (2)	517	0550-731	216	0.08 (2)
734	0550-731	228	0.99 (2)	0.10 (2)	518	0550-731	210	0.03 (2)
736	0550-731	175	1.85 (2)	0.08 (2)	519	0550-731	414	0.00 (3)
737	0732-914	227	2.40 (2)	0.55 (2)	528	0732-914	530	3.40 (2)
741	0732-914	223	2.17 (2)	1.58 (2)	533	0732-914	98	0.85 (2)
745	0732-914	348	0.33 (2)	1.03 (2)	529	0915-1097	488	21.61 (2)
748	0732-914	159	0.95 (2)	0.24 (2)	532	0915-1097	238	2.17 (2)
738	0915-1097	221	1.13 (3)	0.78 (2)	534	0915-1097	486	12.25 (2)
742	0915-1097	206	0.45 (2)	2.03 (2)	530	1098-1280	1134	16.97 (2)
746	0915-1097	392	4.18 (2)	5.00 (2)	535	1098-1280	92	13.38 (2)
749	0915-1097	126	1.65 (2)	0.94 (2)	531	1281-1463	203	6.18 (2)
739	1098-1280	254	5.31 (2)	3.96 (2)	536	1281-1463	112	20.03 (2)
743	1098-1280	211	6.60 (2)	3.95 (2)				
747	1098-1280	724	4.28 (3)	19.45 (2)				
750	1098-1280	556	5.60 (2)	11.75 (2)				
740	1281-1463	264	7.80 (2)	9.10 (2)				
744	1281-1463	280	4.46 (2)	4.20 (2)				
751	1281-1463	229	12.6 (2)	45.92 (2)				
Upper (95% CI)			4.3	11.5			37.6	45.5
Weighted mean (by area)			3.1	6.3			6.1	20.7
Lower (95% CI)			2.0	1.1			-25.4	-4.2
Survey biomass index (tons)			2647	5528			5921	9618

Stratum	3N		3O	
	1996	1997	1996	1997
	Depth Range (M)	Area (sq. n. mi)	Depth Range (M)	Area (sq. n. mi)
723	0367-549	155	0.00 (2)	0.00 (2)
725	0367-549	105	0.00 (2)	0.03 (2)
727	0367-549	160	0.01 (2)	0.00 (2)
724	0550-731	124	2.11 (2)	0.01 (2)
726	0550-731	72	0.00 (2)	0.90 (2)
728	0550-731	156	0.00 (2)	1.04 (2)
Upper (95% CI)			4.2	1.4
Stratified mean (by area)			0.3	0.3
Lower (95% CI)			-3.5	-0.8
Survey biomass index (ton)			36	32

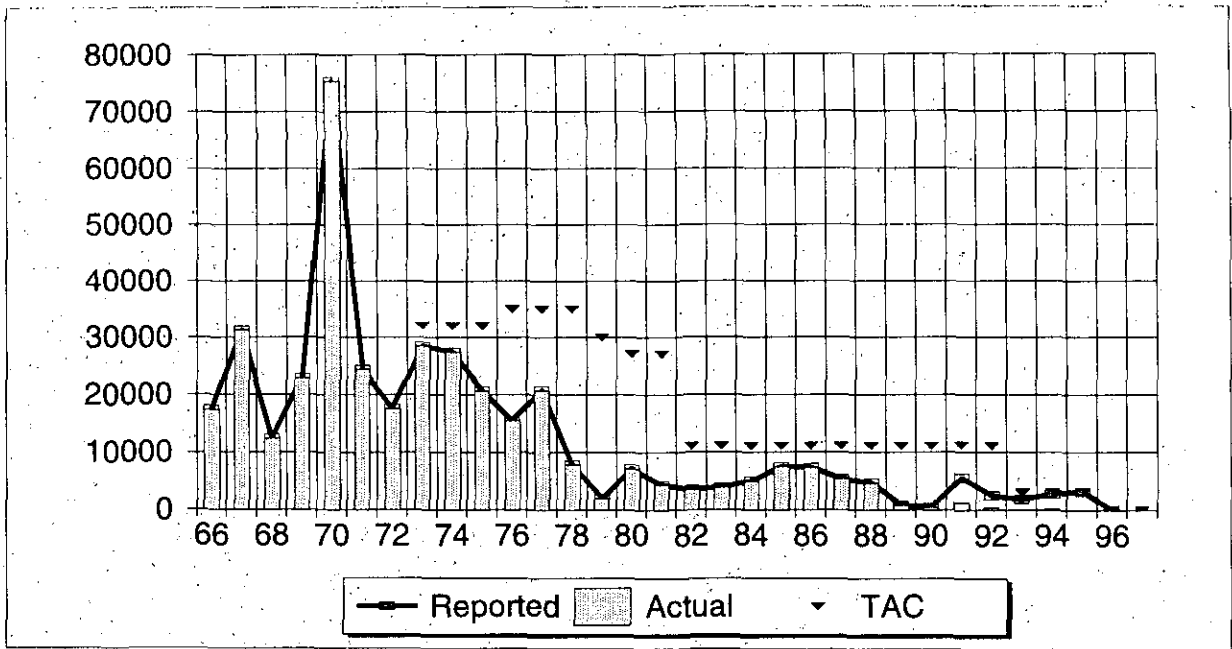


Fig. 1. Catches of Roundnose Grenadier in SA 2+3

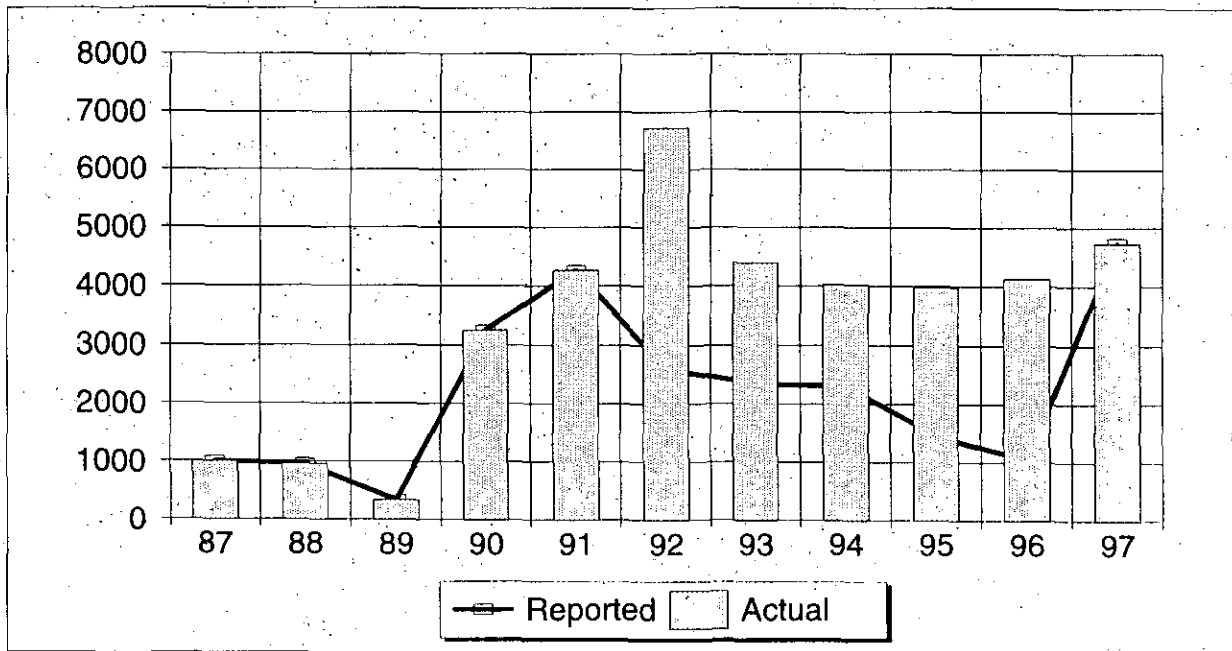


Fig. 2. Catches of Roughhead Grenadier in SA 2+3

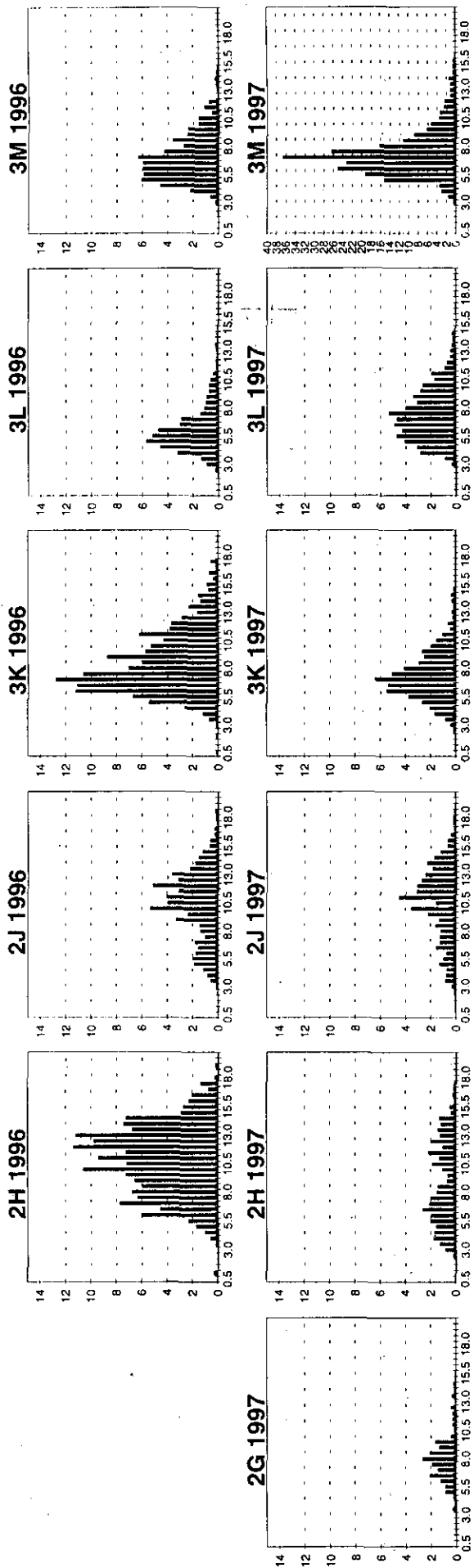


Fig. 3. Pre-anal fin length distributions from stratified-random research surveys conducted in Divisions 2HJ3KLM in autumn 1996-1997. Plotted above are stratified mean number per tow. X-axis is pre-anal fin length in 0.5 cm groupings.