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Roundnose Grenadier (*Coryphaenoides rupestris)* in NAFO Subareas 2+3

by

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Abstract

Roundnose grenadier are found throughout Subareas 2 and 3. It is believed that only one stock occupies the entire area including the Regulatory Area although there are different areas of concentration. Catches averaged about 23,000 tons from 1967-1977, about 5,000 tons from 1980-1989, declined rapidly to 800 tons in 1990 and have since been taken as bycatch. The traditional fishery prior to 1990 occurred in Canadian waters in Div. 2GH and 3K. Catches since 1991 have been taken as by-catch primarily in Greenland halibut fisheries in Div 3LMN. About 50 tons were reported for 1997 and 1998. Surveys have been conducted by various Canada (Div. 2G to Div. 3O) from 1996-98, Japan (Div. 2GH) in 1996 and Russia Div. 2GH from 1987 to 1992 but the time series is of limited value in determining resource status because of limited coverage and various vessel/gears conducting these surveys.

Introduction

Roundnose grenadier are found throughout Subareas 2 and 3 although the request for advice applies only to that portion of the resource lying within Canada's 200-mile economic zone. It is believed that only one stock occupies the entire area including the Regulatory Area although there are different areas of concentration.

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 reported 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 since been taken as bycatch primarily in the Div. 3LMN Greenland halibut fishery. Catches have been about 50 tons each year from 1996-1998.

It has been recognized for a number of years 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. The statistical data has been clarified for EU-Portugal. Grenadier catches by EU-Spain for 1992-96 are also mostly roughhead grenadier (Junquera, MS 1998). These data were misclassified because roundnose grenadier was the only name appearing in the statistical data reporting forms during this time. This misclassification has not been resolved in the official statistics for 1992-96 but the species has been reported correctly for 1997 and 1998.

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 2). 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.

Commercial Fishery Data

The only commercial sampling information for the 1998 roundnose grenadier bycatch fisheries suggested that in Div. 3LMN roundnose grenadier pre-anal fin length ranged from 13-84 cm with the bulk of the catch between 30 to 36 cm (Vaskov et. Al., MS 1999). These were based on samples collected in October and November.

Research Survey Data

Relative Abundance and Biomass

Canada conducted stratified-random multi-species bottom trawl surveys in autumn 1996-1998 during October 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 CCGS Alfred Needler, the CCGS Wilfred Templeman (the preceding two of the same design) and the CCGS Teleost, a larger tonnage vessel. The 1997 and 1998 surveys were conducted by the Teleost and Wilfred Templeman. All surveys 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 all surveys, highest abundance of roundnose grenadier occurred in strata beyond 750 m in all divisions (Tables 3-8). The series indicate a decrease in Div. 2H, Div. 2J and Div. 3K from 1996 to 1997 with little change in 1998 (Fig. 2). The total biomass index for Div. 2HJK declined from 59,000 tons in 1996 to 19,000 tons in 1997 and 1998, The index for Div. 3L and Div. 3M are similar in showing an increase from 1996 to 1997 followed by a decrease to a value lower than 1996. The total biomass for Div. 3LM increased from about 8,500 tons in 1996 to 15,000 tons in 1997 followed by a decline to 6,000 tons in 1998. The total biomass index for the survey area (Div. 2GHJ3KLMNO) indicates a decline from 68,000 in 1996 to 25,600 in 1998.

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 surveys 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 substantial decrease in Div. 2H and 3K from 1996 to 1997 occurred over most of the length ranges observed. 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 from 1996 to 1997 occurred in the same dominant size range (5.0 cm to 8 cm) that was sampled in 1996. The 1998 distributions were similar in Div. 2H and Div 2J with modes at about 4.0-4.5, 8.0 cm and 13.0. The largest mode for Div. 2H was 8.0 cm while the latgest in 2J was at 4.0 cm. Div. 3K had modes at 4.0 cm and 7.0-8.0 cm with largest at 8.0 cm. The largest mode in Div. 3L occurred at 5.0 cm while in Div. 3M there were modes at 4.0cm and 7.0-8.0 cm, the largest occuring at 8.0 cm. There were very few fish captured in Divs. 3NO to draw any comparisons.

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 (59,000 tons) and 1998 (19,000 tons) for Div. 2HJK where the traditional directed fishery occurred and an increase from 1996 (8,500 tons) to 1997 (15,000 tons) followed by a decrease in 1998 (6,000 tons) in the divisions where bycatches of roundnose grenadier are currently taken (Div. 3LM). The 1996-1998 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 1998 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 the surveys inherently only cover part of the distribution and part of the size range. Consequently there will be a degree of uncertainty as to whether the decline from 1996 to 1998 are 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 (0.20%) using the 1998 total survey biomass index or Div. 3LM survey biomass (0.83%). 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.

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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 Reporte	TOTAL Excluding Roughhead	TAC
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	229	103		11		363	363	3,000
1997 b			3	2	44					49	49	0
1998 b					34	3				37	37	0
1999												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. Nominal catches (t) of reported roundnose grenadier with an adjustment for missclassification in Subarea 2+3 by country and year.

Country	1986	1987	1988	1989	1990	1991	1992	1993	1994*	1995*	1996*	1997*	1998*
Canada	9	10	2	20	155	152	409	273	54	42	28	3	-
E/GER	13	-	8	-	-	2	35	-	-	-	-	-	-
Former GDR	4,571	4,469	3,380	2,352	1	-	-	-	-	-	-	-	-
Poland	17	1	17	17	-	-	-	-	-	-	-	-	-
E/ESP	-	-	-	-	-	-	4,970	2,054	1,720	2,521	256	-	-
Former USSR	2,801	2,725	1,890	2,230	538	132	-	-	-	-	-	-	-
Russia	-	-	-	-	-	-	4	-	-	130	53	-	-
Japan	13	79	85	46	125	156	80	134	63	57	26	42	37
E/FRA	-	-	-	-	-	-	-	-	-	-	-	4	-
Faroes	-	9	-	-	-	-	3	4	-	-	-	-	-
Norway	-	-	-	1	-	24	-	-	-	-	-	-	-
Cuba	-	4	-	-	-	-	-	-	-	-	-	-	-
Den(GRL)	-	-	-	-	-	-	2	-	-	-	-	-	-
													-
TOTAL Reported	7,424	7,297	5,382	4,666	819	466	5,503	2,465	1,837	2,750	363	49	37
Excluding E/ESP	7,424	7,297	5,382	4,666	819	466	1,378	411	117	229	363	49	37

* 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 3 . Mean number per standard tow of roundnose grenadier from Canadian surveys conducted in Div. 2GHJ in autumn 1996-1998.
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	Depth Range (M)	Area (sq. n.) mi	2G 1997 (T53)	2G 1998 (T71)
912	0301-400	73	0.00 (2)	0.50 (2)
903	0401- 500	80	3.60 (3)	0.00 (2)
913	0401- 500	62	0.00 (2)	0.00 (2)
922	0401- 500	186	0.00 (2)	--
928	0401- 500	783	0.00 (3)	--
904	0501-750	153	0.00 (2)	19.00 (2)
914	0501-750	113	5.43 (2)	5.00 (2)
921	0501-750	142	1.50 (2)	--
929	0501-750	1261	0.13 (8)	--
905	0751-1000	164	--	44.00 (2)
906	1001-1250	229	54.67 (2)	47.00 (2)
916	1001-1250	146	--	132.50 (2)
919	1001-1250	316	166.29 (2)	--
Upper (95% CI)			81.7	171.5
Stratified mean (by area)			19.5	40.0
Lower (95% CI)			-42.7	-91.4
Abundance of surveyed area (millions)			9.1	5.6

Stratum	Depth Range (M)	Area (sq. n.) mi	2H 1996 (T36-37)	2H 1997 (T53-54)	2H 1998 (T72)
933	0401-500	50	0.00 (2)	5.50 (2)	0.00 (2)
942	0401-500	55	0.00 (2)	0.00 (2)	70.5 (2)
945	0401-500	461	0.00 (2)	0.00 (3)	0 (2)
948	0401-500	246	0.00 (2)	0.00 (2)	0 (2)
951	0401-500	234	0.00 (2)	0.00 (2)	0 (2)
960	0401-500	107	0.00 (2)	0.00 (2)	0 (2)
934	0501-750	78	135.00 (2)	188.00 (2)	200.50 (2)
941	0501-750	89	0.00 (2)	65.00 (2)	81.00 (2)
946	0501-750	721	0.00 (3)	0.00 (5)	0 (4)
947	0501-750	227	0.00 (2)	0.00 (2)	0 (2)
961	0501-750	211	12.00 (2)	32.44 (2)	3.5 (2)
935	0751-1000	96	--	348.00 (2)	125.50 (2)
940	0751-1000	97	1008.50 (2)	76.00 (2)	402.00 (2)
962	0751-1000	242	177.00 (2)	69.78 (2)	113.5 (2)
936	1001-1250	78	--	92.50 (2)	525.00 (2)
939	1001-1250	130	1442.00 (2)	71.50 (2)	--
963	1001-1250	265	40.00 (2)	97.24 (2)	46.77 (2)
937	1251-1500	94	--	401.50 (2)	102.78 (2)
938	1251-1500	191	640.50 (2)	57.28 (2)	56.00 (2)
964	1251-1500	342	343.10 (2)	135.00 (2)	50.4 (2)
Upper (95% CI)			736.9	113.2	81.6
Stratified mean (by area)			157.9	50.7	50.7
Lower (95% CI)			-421.1	-11.8	19.9
Abundance of surveyed area (millions)			81.4	30.6	27.1

Stratum	Depth Range (M)	Area (sq. n.) mi	2J 1996 (T39)	2J 1997 (T54-55)	2J 1998 (T72-73)
204	0401-500	288	0.00 (2)	0.00 (2)	0.00 (2)
217	0401-500	241	0.50 (2)	0.00 (2)	0.00 (2)
227	0401-500	598	0.00 (2)	0.00 (2)	0 (2)
235	0401-500	414	0.00 (2)	0.00 (2)	0 (2)
240	0401-500	133	0.00 (2)	1.00 (2)	0 (2)
212	0501-750	557	0.00 (2)	0.00 (2)	0.00 (2)
218	0501-750	362	175.50 (2)	1.00 (2)	79.70 (3)
224	0501-750	228	0.00 (2)	12.00 (2)	4.89 (2)
230	0501-750	185	4.11 (2)	11.00 (2)	0.5 (2)
239	0501-750	120	0.00 (2)	0.00 (2)	0 (2)
219	0751-1000	283	248.17 (2)	128.00 (2)	80.50 (2)
231	0751-1000	186	77.50 (2)	73.50 (2)	31.73 (2)
236	0751-1000	193	106.00 (2)	52.00 (2)	86.89 (2)
220	1001-1250	303	108.00 (2)	68.00 (2)	83.50 (2)
225	1001-1250	195	121.00 (2)	49.50 (2)	26 (2)
232	1001-1250	228	25.50 (2)	87.50 (2)	22.06 (2)
221	1251-1500	330	85.71 (2)	318.00 (2)	67.95 (2)
226	1251-1500	201	100.28 (2)	66.50 (2)	192.15 (2)
233	1251-1500	237	121.86 (2)	49.00 (2)	124.65 (2)
Upper (95% CI)			127.0	70.7	72.8
Stratified mean (by area)			58.5	46.4	38.2
Lower (95% CI)			-10.5	22.2	3.6
Abundance of surveyed area (millions)			42.5	33.7	27.7

Table 4. Mean number per standard tow of roundnose grenadier from Canadian surveys conducted in Div. 3KLM in autumn 1996-1998.
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	Depth Range (M)	Area (sq. n.) mi	3K 1996 (T39-41) (WT198)	3K 1997 (T55-57) W(217)	3K 1998
617	0301-400	593	0.00 (3)	0.00 (3)	0.00 (3)
622	0401-500	691	0.00 (3)	0.00 (3)	0.00 (3)
627	0401-500	1255	0.00 (5)	0.00 (5)	0.00 (5)
631	0401-500	1321	0.00 (6)	0.00 (6)	0.00 (6)
640	0401-500	69	0.50 (2)	0.50 (2)	1.00 (2)
645	0401-500	216	0.50 (2)	0.00 (2)	2.00 (2)
650	0401-500	134	0.00 (2)	0.00 (2)	0.50 (2)
641	0501-750	230	21.00 (2)	22.00 (2)	53.00 (2)
646	0501-750	325	13.86 (2)	23.50 (2)	35.50 (2)
651	0501-750	359	9.00 (2)	14.33 (2)	13.50 (2)
642	0751-1000	418	285.50 (2)	78.50 (2)	168.50 (2)
647	0751-1000	360	673.50 (2)	62.00 (2)	68.00 (2)
652	0751-1000	516	66.50 (2)	30.00 (2)	30.00 (2)
643	1001-1250	733	407.67 (3)	252.33 (3)	252.00 (3)
648	1001-1250	228	592.14 (2)	50.14 (2)	74.00 (2)
653	1001-1250	531	75.50 (2)	20.72 (2)	37.00 (2)
644	1251-1500	474	430.50 (2)	326.50 (2)	227.00 (2)
649	1251-1500	212	213.00 (2)	50.00 (2)	43.50 (2)
654	1251-1500	479	66.50 (2)	60.89 (2)	79.00 (2)
Upper (95% CI)			216.4	230.0	126.2
Stratified mean (by area)			127.3	53.6	56.4
Lower (95% CI)			38.1	-122.8	-13.5
Abundance of surveyed area (millions)			160.1	67.5	70.9

Stratum	Depth Range (M)	Area (sq. n.) mi	3L 1996 T41 WT196-198	3L 1997 T57-58 W213-217	3L 1998
729	0367-549	186	0.00 (2)	0.00 (2)	0.00 (2)
731	0367-549	216	--	0.00 (2)	0.50 (2)
733	0367-549	468	0.00 (3)	0.00 (2)	0.00 (2)
735	0367-549	272	0.00 (2)	0.00 (2)	0.00 (2)
730	0550-731	170	2.18 (2)	9.50 (2)	0.00 (2)
732	0550-731	231	1.80 (2)	0.00 (2)	26.00 (2)
734	0550-731	228	37.00 (2)	8.44 (2)	11.11 (2)
736	0550-731	175	62.90 (2)	1.00 (2)	0.00 (2)
737	0732-914	227	61.00 (2)	32.50 (2)	92.50 (2)
741	0732-914	223	75.50 (2)	83.50 (2)	37.14 (2)
745	0732-914	348	7.50 (2)	21.00 (2)	17.00 (2)
748	0732-914	159	30.50 (2)	8.00 (2)	9.78 (2)
738	0915-1097	221	21.50 (3)	20.00 (2)	18.61 (2)
742	0915-1097	206	15.50 (2)	45.50 (2)	24.00 (2)
746	0915-1097	392	66.00 (2)	145.78 (2)	90.00 (2)
749	0915-1097	126	38.50 (2)	26.50 (2)	26.89 (2)
739	1098-1280	254	50.27 (2)	80.00 (2)	59.50 (2)
743	1098-1280	211	73.50 (2)	69.14 (2)	36.00 (2)
747	1098-1280	724	44.00 (3)	121.72 (2)	26.50 (2)
750	1098-1280	556	69.50 (2)	133.00 (2)	73.00 (2)
740	1281-1463	264	42.00 (2)	57.00 (2)	44.50 (2)
744	1281-1463	280	41.30 (2)	27.39 (2)	45.78 (2)
751	1281-1463	229	200.29 (2)	381.72 (2)	81.50 (2)
Upper (95% CI)			60.4	128.3	47.5
Stratified mean (by area)			43.0	65.9	34.4
Lower (95% CI)			25.5	3.5	21.2
Abundance of surveyed area (millions)			36.4	57.7	30.1

Stratum	Depth Range (M)	Area (sq. n.) mi	3M 1996 T41 WT195-196	3M 1997 T57-58	3M 1998
512	0367-549	670	0.00 (4)	--	--
513	0367-549	249	0.00 (2)	--	--
514	0367-549	602	0.00 (4)	--	--
515	0367-549	666	0.00 (3)	--	--
516	0550-731	634	9.00 (4)	--	--
517	0550-731	216	0.80 (2)	--	--
518	0550-731	210	0.89 (2)	--	--
519	0550-731	414	0.00 (3)	--	--
528	0732-914	530	83.50 (2)	102.19 (3)	7.85 (3)
533	0732-914	98	22.20 (2)	94.00 (2)	56.60 (2)
529	0915-1097	488	293.07 (2)	130.33 (3)	71.44 (3)
532	0915-1097	238	53.00 (2)	114.00 (2)	36.94 (2)
534	0915-1097	486	143.00 (2)	930.33 (3)	41.48 (3)
530	1098-1280	1134	105.28 (2)	90.05 (7)	77.51 (7)
535	1098-1280	92	81.50 (2)	203.00 (2)	282.00 (2)
531	1281-1463	203	35.00 (2)	16.40 (2)	73.50 (2)
536	1281-1463	112	83.56 (2)	144.50 (2)	19.70 (2)
Upper (95% CI)			132.2	574.2	79.8
Stratified mean (by area)			59.8	220.8	60.5
Lower (95% CI)			-12.6	-132.6	41.2
Abundance of surveyed area (millions)			57.9	102.7	28.1

Table 5. Mean number per standard tow of roundnose grenadier from Canadian surveys conducted in Div. 3NO in autumn 1996-1998. 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	Depth Range (M)	Area (sq. n.) mi	3N 1996 T41-42 A253	3N 1997 W212-214	3N 1998 WT230
723	0367-549	155	0.00 (2)	0 (3)	0.00 (2)
725	0367-549	105	0.00 (2)	1.2 (2)	0.00 (2)
727	0367-549	160	0.50 (2)	0 (2)	0.00 (2)
724	0550-731	124	18.22 (2)	0.5 (2)	6.67 (2)
726	0550-731	72	0.00 (2)	39.5 (2)	0.44 (2)
728	0550-731	156	0.00 (2)	25.6 (2)	1.00 (2)
752	0732-914	134	--	--	26.89 (2)
756	0732-914	106	--	--	16.50 (2)
760	0732-914	154	--	--	6.17 (2)
753	0915-1097	138	--	--	11.50 (2)
757	0915-1097	102	--	--	54.78 (2)
761	0915-1097	171	--	--	23.28 (2)
754	1098-1280	180	--	--	87.28 (2)
758	1098-1280	99	--	--	56.94 (2)
755	1281-1463	385	--	--	12.00 (2)
759	1281-1463	127	--	--	124.00 (2)
Upper (95% CI)			34.8	58.1	56.4
Stratified mean (by area)			3.0	9.1	25.4
Lower (95% CI)			-28.7	-39.9	-5.8
Abundance of surveyed area (millions)			0.3	1.0	8.3

Stratum	Depth Range (M)	Area (sq. n.) mi	3O 1996 T42 A253 W200	3O 1997 W212-213	3O 1997 WT229-230
717	0367-549	166	--	0.00 (2)	0.00 (2)
719	0367-549	76	0.00 (2)	0.00 (2)	0.00 (2)
721	0367-549	76	0.00 (2)	0.00 (2)	0.00 (2)
718	0550-731	134	--	--	0.00 (2)
720	0550-731	105	0.00 (2)	5.50 (2)	0.50 (2)
722	0550-731	93	6.00 (2)	1.78 (2)	11.11 (2)
764	0732-914	105	--	--	6.79 (2)
768	0732-914	99	--	--	46.61 (2)
772	0732-914	135	--	--	19.50 (2)
765	0915-1097	124	--	--	34.00 (2)
769	0915-1097	138	--	--	25.00 (2)
773	0915-1097	128	--	--	29.33 (2)
Upper (95% CI)			21.9	19.3	25.5
Stratified mean (by area)			1.6	1.7	14.8
Lower (95% CI)			-18.7	-16.0	4.1
Abundance of surveyed area (millions)			0.1	0.1	2.8

Table 6 . Mean weight (kg) per standard tow of roundnose grenadier from Canadian surveys conducted in Div. 2GHJ in autumn 1996-1998.
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	Depth Range (M)	Area (sq. n.) mi	2G 1997 (T53)	2G 1998 (T71)
912	0301-400	73	0.00 (2)	0.03 (2)
903	0401- 500	80	0.13 (3)	0.00 (2)
913	0401- 500	62	0.00 (2)	0.00 (2)
922	0401- 500	186	0.00 (2)	
928	0401- 500	783	0.00 (3)	
904	0501-750	153	0.00 (2)	0.73 (2)
914	0501-750	113	0.34 (2)	0.28 (2)
921	0501-750	142	0.36 (2)	
929	0501-750	1261	0.00 (8)	
905	0751-1000	164	--	4.55 (2)
906	1001-1250	229	7.56 (2)	7.30 (2)
916	1001-1250	146	--	9.75 (2)
919	1001-1250	316	16.97 (2)	
Upper (95% CI)			6.5	14.8
Stratified mean (by area)			2.1	3.9
Lower (95% CI)			-2.3	-7
Survey biomass index (metric tons)			990	548

Stratum	Depth Range (M)	Area (sq. n.) mi	2H 1996 (T36-37)	2H 1997 (T53-54)	2H 1998 (T72)
933	0401-500	50	0.00 (2)	0.43 (2)	0.00 (2)
942	0401-500	55	0.00 (2)	0.00 (2)	9.69 (2)
945	0401-500	461	0.00 (2)	0.00 (3)	0.00 (2)
948	0401-500	246	0.00 (2)	0.00 (2)	0.00 (2)
951	0401-500	234	0.00 (2)	0.00 (2)	0.00 (2)
960	0401-500	107	0.00 (2)	0.00 (2)	0.00 (2)
934	0501-750	78	9.22 (2)	6.83 (2)	13.56 (2)
941	0501-750	89	0.00 (2)	7.83 (2)	1.95 (2)
946	0501-750	721	0.00 (3)	0.00 (5)	0.00 (4)
947	0501-750	227	0.00 (2)	0.00 (2)	0.00 (2)
961	0501-750	211	0.57 (2)	0.87 (2)	0.17 (2)
935	0751-1000	96	--	33.11 (2)	12.45 (2)
940	0751-1000	97	147.98 (2)	9.38 (2)	29.48 (2)
962	0751-1000	242	13.55 (2)	3.13 (2)	5.05 (2)
936	1001-1250	78	--	14.75 (2)	103.90 (2)
939	1001-1250	130	378.52 (2)	11.88 (2)	--
963	1001-1250	265	15.43 (2)	8.56 (2)	8.97 (2)
937	1251-1500	94	--	88.48 (2)	51.33 (2)
938	1251-1500	191	289.33 (2)	27.87 (2)	23.95 (2)
964	1251-1500	342	184.05 (2)	55.70 (2)	17.22 (2)
			113.2	66.4	16.8
			50.7	10.9	8.5
			-11.8	-44.5	0.1
			26133	6043	4518

Stratum	Depth Range (M)	Area (sq. n.) mi	2J 1996 (T39)	2J 1997 (T54-55)	2J 1998 (T72-73)
204	0401-500	288	0.00 (2)	0.00 (2)	0.00 (2)
217	0401-500	241	0.28 (2)	0.00 (2)	0.00 (2)
227	0401-500	598	0.00 (2)	0.00 (2)	0.00 (2)
235	0401-500	414	0.00 (2)	0.00 (2)	0.00 (2)
240	0401-500	133	0.00 (2)	0.40 (2)	0.00 (2)
212	0501-750	557	0.00 (2)	0.00 (2)	0.00 (2)
218	0501-750	362	42.65 (2)	0.98 (2)	3.51 (3)
224	0501-750	228	0.00 (2)	0.60 (2)	0.04 (2)
230	0501-750	185	0.60 (2)	0.58 (2)	0.02 (2)
239	0501-750	120	0.00 (2)	0.00 (2)	0.00 (2)
219	0751-1000	283	64.25 (2)	28.05 (2)	6.80 (2)
231	0751-1000	186	9.43 (2)	4.05 (2)	0.95 (2)
236	0751-1000	193	7.18 (2)	8.38 (2)	6.21 (2)
220	1001-1250	303	28.65 (2)	17.63 (2)	18.37 (2)
225	1001-1250	195	38.28 (2)	16.08 (2)	7.68 (2)
232	1001-1250	228	11.18 (2)	31.93 (2)	5.66 (2)
221	1251-1500	330	40.25 (2)	130.83 (2)	26.71 (2)
226	1251-1500	201	45.83 (2)	25.65 (2)	73.61 (2)
233	1251-1500	237	54.96 (2)	20.72 (2)	46.22 (2)
			34.7	22.0	41.8
			17.3	15.1	9.0
			-0.1	8.3	-23.8
			12538	6007	6534

Table 7. Mean weight (kg) per standard tow of roundnose grenadier from Canadian surveys conducted in Div. 3KLM in autumn 1996-1998.
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	Depth Range (M)	Area (sq. n.) mi	3K 1996 (T39-41) (WT198)	3K 1997 (T55-57) W(217)	3K 1998
617	0301-400	593	0.00 (3)	0.00 (3)	0.00 (3)
622	0401-500	691	0.00 (3)	0.00 (3)	0.00 (3)
627	0401-500	1255	0.00 (5)	0.00 (5)	0.00 (5)
631	0401-500	1321	0.00 (6)	0.00 (6)	0.00 (6)
640	0401-500	69	0.04 (2)	0.03 (2)	0.05 (2)
645	0401-500	216	0.28 (2)	0.48 (2)	0.08 (2)
650	0401-500	134	105.16 (2)	14.78 (2)	0.22 (2)
641	0501-750	230	0.03 (2)	0.00 (2)	1.24 (2)
646	0501-750	325	18.10 (2)	4.81 (2)	2.35 (2)
651	0501-750	359	6.45 (2)	1.72 (2)	0.31 (2)
642	0751-1000	418	0.00 (2)	0.00 (2)	10.60 (2)
647	0751-1000	360	79.10 (2)	5.08 (2)	1.68 (2)
652	0751-1000	516	63.70 (2)	34.60 (2)	0.63 (2)
643	1001-1250	733	0.64 (2)	1.18 (2)	30.38 (3)
648	1001-1250	228	2.38 (2)	0.98 (2)	7.90 (2)
653	1001-1250	531	84.18 (2)	22.20 (2)	1.95 (2)
644	1251-1500	474	0.89 (2)	2.30 (2)	27.68 (2)
649	1251-1500	212	44.90 (3)	24.30 (3)	14.10 (2)
654	1251-1500	479	11.45 (2)	5.38 (2)	14.15 (2)
Upper (95% CI)			28.9	11.0	16.0
Stratified mean (by area)			16.6	5.6	6.0
Lower (95% CI)			4.2	0.2	-4.1
Survey biomass index (metric tons)			20861	7058	7505

Stratum	Depth Range (M)	Area (sq. n.) mi	3L 1996 T41 WT196-198	3L 1997 T57-58 W213-217	3L 1998
729	0367-549	186	0.00 (2)	0.00 (2)	0.00 (2)
731	0367-549	216	--	0.00 (2)	0.00 (2)
733	0367-549	468	0.00 (3)	0.00 (2)	0.00 (2)
735	0367-549	272	0.00 (2)	0.00 (2)	0.00 (2)
730	0550-731	170	0.04 (2)	0.40 (2)	0.00 (2)
732	0550-731	231	0.22 (2)	0.00 (2)	0.55 (2)
734	0550-731	228	0.99 (2)	0.10 (2)	0.13 (2)
736	0550-731	175	1.85 (2)	0.08 (2)	0.00 (2)
737	0732-914	227	2.40 (2)	0.55 (2)	2.13 (2)
741	0732-914	223	2.17 (2)	1.58 (2)	0.60 (2)
745	0732-914	348	0.33 (2)	1.03 (2)	0.73 (2)
748	0732-914	159	0.95 (2)	0.24 (2)	0.22 (2)
738	0915-1097	221	1.13 (3)	0.78 (2)	0.93 (2)
742	0915-1097	206	0.45 (2)	2.03 (2)	0.56 (2)
746	0915-1097	392	4.18 (2)	5.00 (2)	7.90 (2)
749	0915-1097	126	1.65 (2)	0.94 (2)	1.36 (2)
739	1098-1280	254	5.31 (2)	3.96 (2)	2.92 (2)
743	1098-1280	211	6.60 (2)	3.95 (2)	1.20 (2)
747	1098-1280	724	4.28 (3)	19.45 (2)	2.35 (2)
750	1098-1280	556	5.60 (2)	11.75 (2)	4.85 (2)
740	1281-1463	264	7.80 (2)	9.10 (2)	7.03 (2)
744	1281-1463	280	4.46 (2)	4.20 (2)	5.67 (2)
751	1281-1463	229	12.6 (2)	45.92 (2)	8.73 (2)
Upper (95% CI)			4.3	11.5	4.3
Stratified mean (by area)			3.1	6.3	2.4
Lower (95% CI)			2.0	1.1	0.6
Survey biomass index (metric tons)			2647	5528	2130

Stratum	Depth Range (M)	Area (sq. n.) mi	3M 1996 T41 WT195-196	3M 1997 T57-58	3M 1998
512	0367-549	670	0.00 (4)	--	
513	0367-549	249	0.00 (2)	--	
514	0367-549	602	0.00 (4)	--	
515	0367-549	666	0.00 (3)	--	
516	0550-731	634	0.23 (4)	--	
517	0550-731	216	0.08 (2)	--	
518	0550-731	210	0.03 (2)	--	
519	0550-731	414	0.00 (3)	--	
528	0732-914	530	3.40 (2)	5.26 (3)	0.40 (3)
529	0915-1097	488	21.61 (2)	16.92 (3)	7.61 (3)
530	1098-1280	1134	16.97 (2)	16.35 (7)	9.97 (7)
531	1281-1463	203	6.18 (2)	7.27 (2)	22.65 (2)
532	0915-1097	238	2.17 (2)	14.05 (2)	3.70 (2)
533	0732-914	98	0.85 (2)	5.25 (2)	2.90 (2)
534	0915-1097	486	12.25 (2)	62.40 (3)	3.75 (3)
535	1098-1280	92	13.38 (2)	18.00 (2)	27.27 (2)
536	1281-1463	112	20.03 (2)	27.00 (2)	4.17 (2)
Upper (95% CI)			37.6	45.5	12.4
Stratified mean (by area)			6.1	20.7	7.6
Lower (95% CI)			-25.4	-4.2	2.9
Survey biomass index (metric tons)			5921	9618	3548

Table 8. Mean weight (kg) per standard tow of roundnose grenadier from Canadian surveys conducted in Div. 3NO in autumn 1996-1998. 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	Depth Range (M)	Area (sq. n.) mi	3N 1996 T41-42 A253	3N 1997 W212-214	3N 1998 WT230
723	0367-549	155	0.00 (2)	0.00 (2)	0.00 (2)
724	0550-731	124	2.11 (2)	0.01 (2)	0.53 (2)
725	0367-549	105	0.00 (2)	0.03 (2)	0.00 (2)
726	0550-731	72	0.00 (2)	0.90 (2)	0.00 (2)
727	0367-549	160	0.01 (2)	0.00 (2)	0.00 (2)
728	0550-731	156	0.00 (2)	1.04 (2)	0.02 (2)
752	0732-914	134	--	--	1.11 (2)
753	0915-1097	138	--	--	0.50 (2)
754	1098-1280	180	--	--	7.50 (2)
755	1281-1463	385	--	--	1.18 (2)
756	0732-914	106	--	--	0.28 (2)
757	0915-1097	102	--	--	2.57 (2)
758	1098-1280	99	--	--	2.72 (2)
759	1281-1463	127	--	--	13.85 (2)
760	0732-914	154	--	--	0.42 (2)
761	0915-1097	171	--	--	1.73 (2)
Upper (95% CI)			4.2	1.4	4.7
Stratified mean (by area)			0.3	0.3	2.0
Lower (95% CI)			-3.5	-0.8	-0.7
Survey biomass index (metric tons)			36	32	656

Stratum	Depth Range (M)	Area (sq. n.) mi	3O 1996 T42 A253 W200	3O 1997 W212-213	3O 1997 WT229-230
717	0367-549	166	--	0.00 (2)	0.00 (2)
718	0550-731	134	--	--	0.00 (2)
719	0367-549	76	0.00 (2)	0.00 (2)	0.00 (2)
720	0550-731	105	0.00 (2)	0.63 (2)	0.01 (2)
721	0367-549	76	0.00 (2)	0.00 (2)	0.00 (2)
722	0550-731	93	0.57 (2)	0.17 (2)	0.73 (2)
764	0732-914	105	--	--	0.35 (2)
765	0915-1097	124	--	--	1.27 (2)
768	0732-914	99	--	--	3.11 (2)
769	0915-1097	138	--	--	1.51 (2)
772	0732-914	135	--	--	1.05 (2)
773	0915-1097	128	--	--	3.16 (2)
Upper (95% CI)			2.1	2.2	1.7
Stratified mean (by area)			0.2	0.2	1.0
Lower (95% CI)			-1.8	-1.8	0.2
Survey biomass index (metric tons)			7	14	182

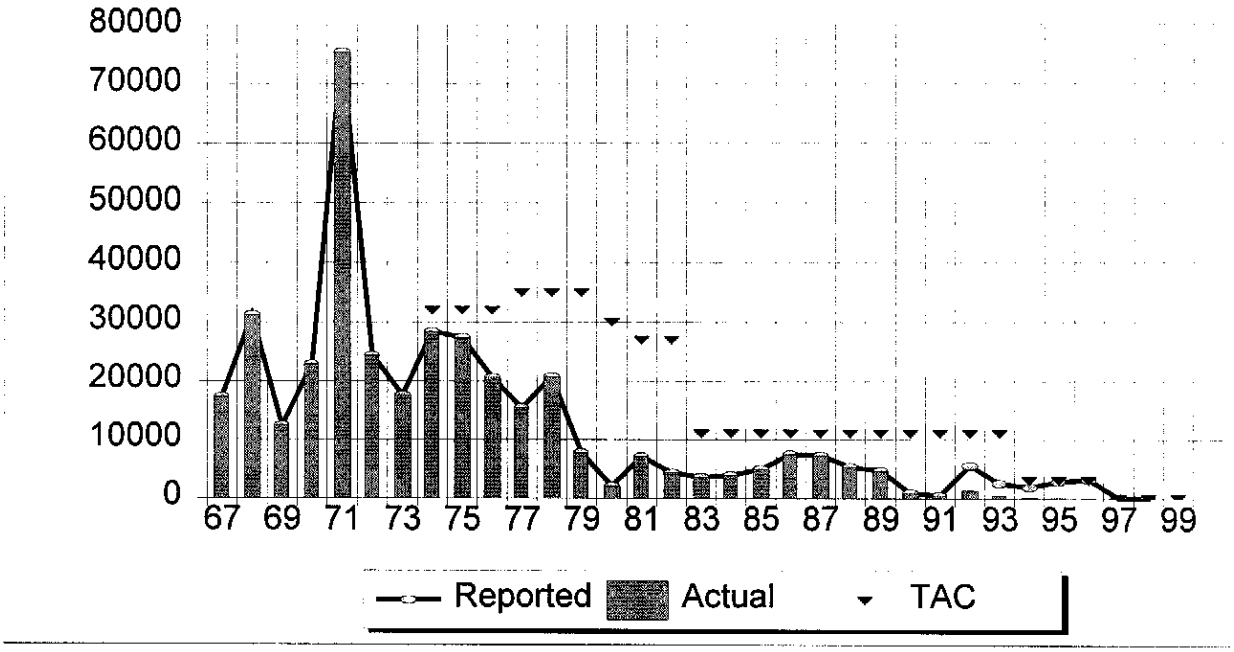

Fig. 1. Catches of Roundnose Grenadier in SA 2+3

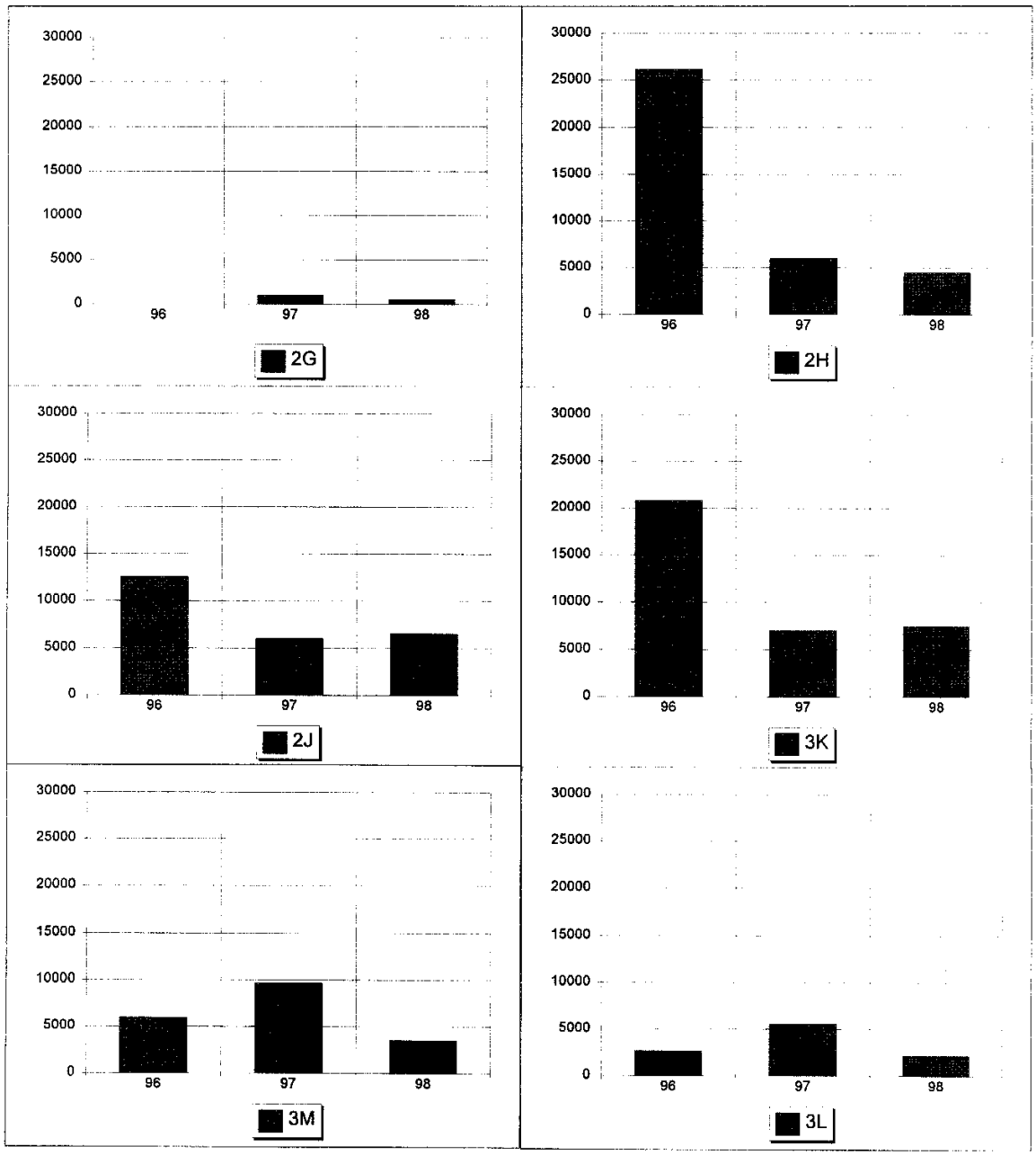

Fig. 2. Survey biomass index from Canadian autumn surveys in Div. 2GHJ3KLMN from 1996-1997

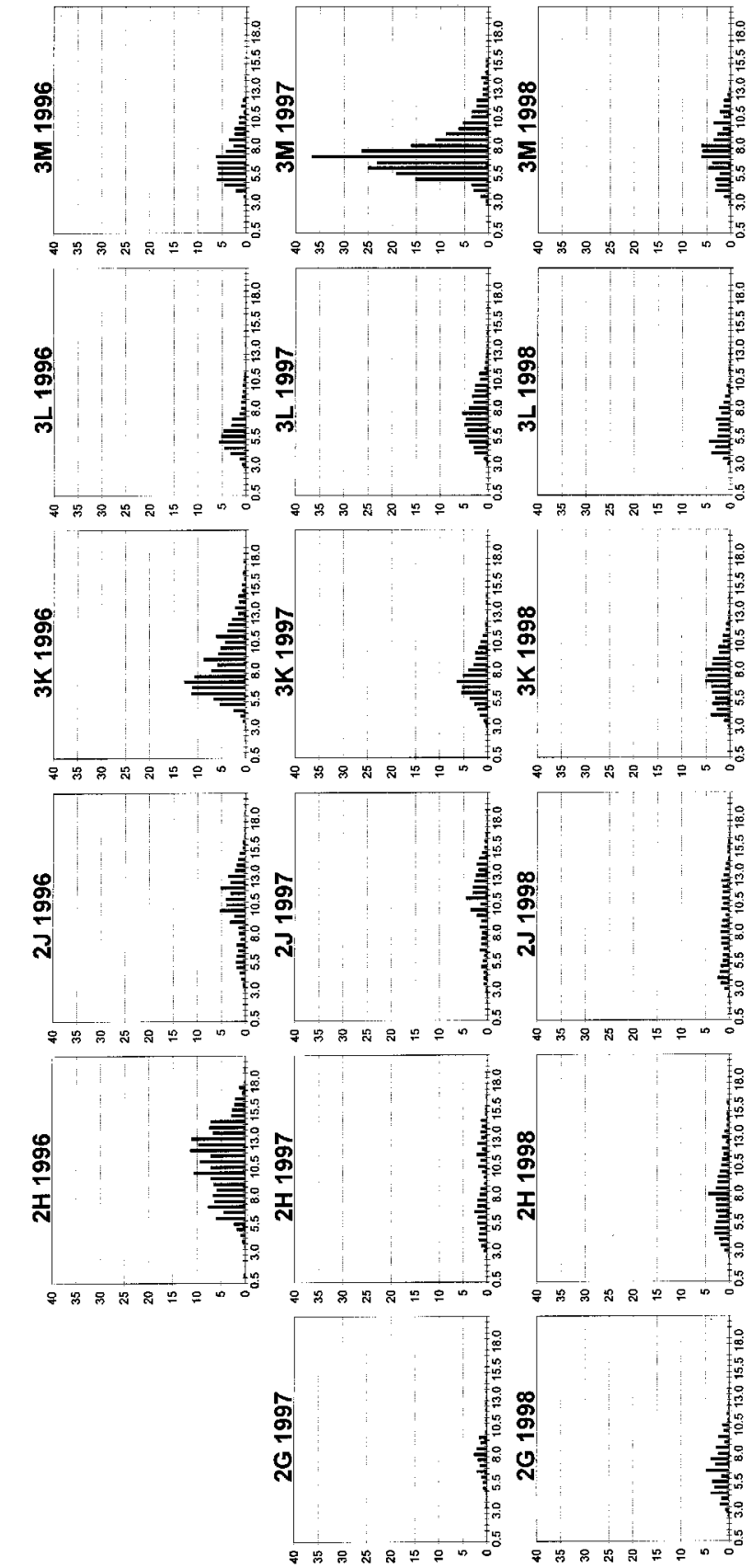

Fig. 3. Pre-anal fin length distributions from stratified-random research surveys conducted in Divisions 2GHJ3KLM in autumn 1996-1998.