

Northwest Atlantic



Fisheries Organization

Serial No. N2189

NAFO SCR DOC. 93/12

SCIENTIFIC COUNCIL MEETING - JUNE 1993

Results of Investigations of Roundnose Grenadier
in NAFO Subarea 0, 2 and Div. 3K in 1971-92

by

P. I. Savvatimsky
Polar Research Institute of Marine Fisheries and Oceanography (PINRO)
6 Knipovich Street, 183763, Murmansk, Russia

ABSTRACT

The paper presents distribution of roundnose grenadier by depth, as well as age and length composition, sex ratio of fish in catches. Percentage of grenadier, Greenland halibut and redfish in catch from different depth is given. Mean length of roundnose grenadier was estimated to be 45.3 cm and mean age - 7.5 by the results of 1992 survey, that was lower than those in 1991. A sharp increase in fish mean length and in relative female number with depth was observed to be similar to that of recent years. Roundnose grenadier percentage in catches in 1988-1992 was much lower than in 1971-1977, while their catches decreased more than 10 times for this period. Trawl-acoustic survey for 1992 indicated a lack of grenadier concentrations at depth of traditional fishing.

INTRODUCTION

In the Northwest Atlantic, the total catch of grenadier (*Coryphaenoides rupertis*) have been accounted for tens thousands tons per year up to 1978. The total catch have been reduced sharply since 1979. Both catch and catch per unit effort were observed to decrease gradually in subsequent years. It could not be explained by overfishing since the catch was negligible. Data from trawl-acoustic surveys, conducted annually in autumn-winter on the Baffin Land, Labrador and Grand Newfoundland bank, indicate nearly a lack of grenadier fishing concentrations in the depth range from 500-1500 m. The aim of the paper is to analyse the results of 1992 survey and to compare them with those of recent years in order to study the reasons for catch decline.

MATERIAL AND METHODS

The results of surveys for bottom fish stocks assessment annually conducted in autumn-winter are used in the paper. Roundnose grenadier catches per hour towing by bottom trawl by 100 m depth intervals are presented. Survey methods were given in details previously (Bulatova, Chumakov, 1986). Tables show the age composition for 1983-1992, have obtained by length frequencies calculation using the combined age-length key for Div. 3K for 1969-1992. Age composition was estimated by Subareas 0 and 2 separately by calculation of an age sample taken from Div. 2GH in 1992, and that for Div. 3K - by an age sample taken from the same Division in 1992. Percentage series and length frequencies in Figures, as well as catch data from different depths for 1971-1992, presented in the Table, have been smoothed by the formula:

$$B = \frac{a+2b+c}{4}$$

where a, b, c - preceding, middle and subsequent members in the series;
B - calculated member.

RESULTS AND DISCUSSION

Biological characteristics and distribution of roundnose grenadier by area and by depth in 1992 were studied during trawl survey for bottom fish assessment by RV "Kapitan Shaitanov" in Divs. 3K, 0B, 2G, 2H and in the Flemish Pass area in the depth range 190-1460 m.

It is known, that in recent years in the Flemish Pass area deepwater fishing for Greenland halibut have been carried out by Spanish and Portuguese vessels. From 17 to 20 October 1992, total of 9 tows within the depth range 900 - 1150 m were done to study Greenland halibut and grenadier distribution in this area. Catches per hour towing were ranged from 20 to 180 kg. Greenland halibut

accounted for 40-90%, roundnose grenadier - 15-20%, with wolffish and roughhead grenadier constituting the by-catch remainder.

From 22 to 27 October 1992 in Div. 3K (traditional area for grenadier fishing), a series of bottom tows were done at every 100 m interval in the range from 500 to 1460 m to study the vertical distribution of bottom fish. No grenadier were found at depths above 800 m, while it was accounted for 65-68% in catches from below 800 m level (Table 1). Distributions by depths for the three main species -Greenland halibut, roundnose grenadier and redfish (*Sebastes marinus*) - were similar to those in 1991 (Savvatimsky, 1992), while catches were lower. Percentage of Greenland halibut, roundnose grenadier and roughhead grenadier (*Macrourus berglax*) in catches from maximum depth of 1401-1460 m was estimated as follows: 3%, 84% and 13%, respectively. At lower depths, roundnose grenadier by-catch was estimated to be 1-3%. The remainder of the by-catch was estimated at 7-9% and consisted of northern wolffish (*Anarhichas denticulatus*) mainly at depths between 500-900 m.

Trawl survey in Div. 0B was conducted from 25 to 29 November 1992 at depth range 500-1300 m. As well as in recent years, roundnose grenadier occurred as a negligible by-catch in Greenland halibut fishing. Maximum catch of grenadier have totalled 15 kg.

Trawl survey in Div. 2G and 2H was carried out from 30 November to 15 December 1992 at depth range 500-1400 m. The area between 58° and 59°N was not surveyed because of hard ice conditions. Grenadier occurred in catches from between 701-800 m and 901-1000 m and dominated the catches below the latter, while catches were not substantial. On the whole, catches in all Divisions were lower than those in 1991 (Table 2).

Therefore, trawl survey showed that no grenadier concentrations occurred at traditional fishing depths in all surveyed Divisions in 1992.

In 1992 in Divs. 0B, 2GH and 3K, the mean length of grenadier in catches was estimated to be 45.3 cm (Table 3), with mean age of 7.5, that was lower than those in 1991. Length frequencies of catches by every Division are presented in Table 5. Mean length of fish in catches was estimated as follows: 41.1 cm in Subarea 0, 42.8 cm in Subarea 2, 49.8 cm in Div. 3K, while the mean age was 7.8, 8.2 and 8.5, respectively (Table 6). These parameters depend on depths. As in recent years, a sharp increase in mean length of both males and females and in relative females number of grenadier with depth was noted in all Divisions (Table 7, Fig.1). These variations have been investigated by trawl surveys during series of years (Savvatimsky, 1989, 1990, 1991) and seemed to be a pattern.

Age-length composition and relative number of grenadier in catches are closely connected with their vertical distributions. The percentage of grenadier in catches in 1988-1992 was much lower than that in 1971-1977 (Fig. 2), and their catches at traditional depths of fishery decreased more than 10 times (Table 8). It could not be explained by overfishing, since total catch in 1975-1979 was negligible, and catch per effort decreased after total catch decline. Decrease in grenadier abundance, caused by variations in habitat conditions, as well as migration of concentrations to deeper layers could be considered as probable reasons for a lack of grenadier concentrations at traditional catch depths.

REFERENCES

- Bulatova, A. Yu. and A. K. Chumakov. MS 1986. USSR Trawl Surveys in NAFO Subareas 0, 2, 3. NAFO SCR Doc. 86/66. Ser. No. N1183. 13p.
- Savvatimsky P. I. MS 1989. Dynamics of roundnose grenadier catch in the Northwest Atlantic. NAFO SCR Doc. 89/8. Ser. No. N1572. 11p.
- Savvatimsky P. I. MS 1990. Variations in catch composition of roundnose grenadier from the Northwest Atlantic during 1971-1989. NAFO SCR Doc. 90/6. Ser. No. N1717. 16p.

Savvatimsky P. I. MS 1991. Causes of Decrease in Total Catch of Roundnose Grenadier (*Coryphaenoides rupestris* Gunn.) in the Northwest Atlantic in 1979-1990. NAFO SCR Doc. 91/8. Ser. No. N1880. 22p.

Savvatimsky P. I. MS 1992. Distribution and Biological Characteristics of Rock Grenadier (*Coryphaenoides rupestris*) as Shown by Trawl Surveys in the Northwest Atlantic in 1989-1991. NAFO SCR Doc. 92/9. Ser. No. N2051. 15p.

Table 1. Distribution and composition of catches from various depth in the trawl survey by RV "Kapitan Shaitanov" in 1992

Subarea or Div.	Depth, m	Mean catch kg/hr	No. of catches	Catch composition by weight, %			
				Greenl. halibut	Redfish (S. ment)	Rn. grenadier	Others
OB	601-700	32,5	4	59,2	37,7	-	3,1
	701-800	35,0	3	62,9	35,2	-	1,9
	801-900	47,5	4	96,4	2,6	0,5	0,5
	901-1000	43,7	3	84,7	-	-	15,3
	1001-1100	54,7	3	92,7	0,4	1,7	5,2
	1101-1200	334,2	4	93,3	-	4,0	2,7
	1201-1300	120,3	3	69,5	-	6,4	4,1
2	101-200	2,0	3	50,0	17,0	-	33,0
	201-300	4,0	6	66,7	-	-	33,3
	301-400	10,6	5	58,4	17,0	-	24,6
	401-500	21,8	5	71,6	22,0	-	6,4
	501-600	70,4	5	71,6	41,2	0,6	1,7
	601-700	70,7	6	35,6	62,8	1,4	0,2
	701-800	73,5	6	64,4	18,8	15,0	1,8
	801-900	147,1	7	70,5	11,0	17,6	0,9
	901-1000	136,7	3	36,8	1,0	62,2	-
	1001-1100	82,3	7	83,7	0,2	15,5	0,6
	1101-1200	209,7	7	42,6	-	37,2	0,2
	1201-1300	192,9	8	64,1	-	35,3	0,6
	1301-1400	136,4	5	44,1	-	55,9	-
3K	501-600	130,2	4	32,8	58,7	1,2	7,3
	601-700	157,7	3	22,0	69,1	0,9	8,0
	701-800	134,0	3	49,0	36,6	5,2	9,2
	801-900	198,3	3	25,2	0,2	65,4	9,2
	901-1000	93,0	3	29,0	0,4	70,2	0,4
	1001-1100	139,3	3	19,4	-	75,1	0,6
	1101-1200	207,3	3	25,2	-	74,0	0,8
	1201-1300	161,3	3	13,0	-	85,1	1,9
	1301-1400	100,0	3	6,7	-	86,0	3,3
1401-1500	36,0	2	2,8	-	84,7	12,5	
0,2,3K	101-200	2,0	3	50,0	16,7	-	33,3
	201-300	4,0	6	66,7	-	-	33,3
	301-400	10,6	5	58,4	17,0	-	24,6
	401-500	21,8	5	71,6	22,0	-	6,4
	501-600	97,0	9	42,4	51,7	-	5,0
	601-700	79,0	13	32,3	62,5	0,9	4,2
	701-800	79,0	12	37,7	28,2	9,2	4,9
	801-900	129,6	14	58,4	6,6	31,4	3,6
	901-1000	91,8	9	41,8	0,6	55,1	2,5
	1001-1100	85,4	15	64,7	0,1	31,9	3,3
	1101-1200	244,7	14	59,3	-	39,5	1,2
	1201-1300	170,6	14	37,6	-	41,0	1,4
	1301-1400	122,7	8	33,3	-	65,7	1,0
1401-1500	36,0	2	2,8	-	84,7	12,5	

Table 2. Distribution and composition of catches from various depth in trawl survey in Sub. CB, 2 and 3K in 1991, 1992

Year	Depth, m	Mean catch, kg/hr	Mean catch composition by weight, %					
			Greenhalibut	Redfish	Trn. (S. ment)	grenu-dier	Other	
1991	101-200	14,6	6	100,0	-	-	-	-
	201-300	14,2	22	57,0	11,9	-	2,1	1
	301-400	26,4	35	55,9	24,4	2,0	17,7	0
	401-500	57,0	38	63,8	30,1	0,6	5,5	0
	501-600	57,6	26	41,1	33,4	0,5	3,0	0
	601-700	80,0	20	33,8	43,2	2,1	0,9	0
	701-800	142,4	9	59,7	16,2	22,5	1,6	0
	801-900	112,6	21	76,3	1,3	20,0	0,4	0
	901-1000	127,6	14	59,0	0,3	40,4	0,3	0
	1001-1100	209,5	23	32,9	0,4	38,4	8,3	0
	1101-1200	274,6	15	32,1	-	66,9	1,0	0
	1201-1300	141,6	22	29,0	-	69,9	1,1	0
	1301-1400	206,5	13	23,1	-	76,9	-	0
	1401-1500	57,3	3	3,4	-	91,6	-	0
1992	101-200	2,0	3	30,0	16,7	-	-	33,3
	201-300	4,0	6	66,7	-	-	-	33,3
	301-400	10,6	5	38,4	17,0	-	-	24,6
	401-500	21,8	5	71,6	22,0	-	-	6,4
	501-600	97,0	9	42,4	51,7	0,9	-	5,0
	601-700	79,0	13	32,3	62,5	1,0	-	4,2
	701-800	79,0	12	57,7	28,2	9,2	-	4,9
	801-900	129,6	14	58,4	6,6	31,4	-	3,6
	901-1000	91,8	9	41,8	0,6	55,1	-	2,5
	1001-1100	85,4	15	64,7	0,1	31,9	-	3,3
	1101-1200	244,7	14	59,3	-	39,5	-	1,2
	1201-1300	170,6	14	57,6	-	41,0	-	1,4
	1301-1400	122,7	8	33,3	-	65,7	-	1,0
	1401-1500	36,0	2	2,8	-	84,7	-	12,5

Table 3. Length composition of research catches of roundnose grenadier in the NW Atlantic (Sub. 0,2 and 3K) in 1983 - 1992. (#-)

Lenb, cm	1192311984	1196811986	11987*1987	11968119691990	1199111992
15-17	0	0	0	0	0
18-20	0	0	0	0	0
21-23	0	0	0	0	0
24-26	1	1	1	1	1
27-29	2	2	2	2	2
30-32	3	3	3	3	3
33-35	4	4	4	4	4
36-38	4	4	4	4	4
39-41	4	4	4	4	4
42-44	4	4	4	4	4
45-47	4	4	4	4	4
48-50	4	4	4	4	4
51-53	4	4	4	4	4
54-56	4	4	4	4	4
57-59	4	4	4	4	4
60-62	4	4	4	4	4
63-65	4	4	4	4	4
66-68	4	4	4	4	4
69-71	4	4	4	4	4
72-74	4	4	4	4	4
75-77	4	4	4	4	4
78-80	4	4	4	4	4
81-83	4	4	4	4	4
84-86	4	4	4	4	4
87-89	4	4	4	4	4
90-92	4	4	4	4	4
93-95	4	4	4	4	4
96-98	4	4	4	4	4
99-101	4	4	4	4	4
102-104	4	4	4	4	4
Mean	36,3	38,3	52,2	34,3	51,4
Length, cm	51,5	46,5	51,9	49,3	50,0
No. of fish	13295	5837	9996	12797	15035
	11796	6679	11931	12340	11189

Subarea 1 data included

Table 5 Length composition of research catches of roundnose grenadier in the NW Atlantic (Sub. C, 2 and NW. P.) in 1992 (%)

Length, cm	0	1	2	3K
15-17	0,9	0,1		0,2
18-20	1,4	1,8		1,0
21-23	0,9	2,3		1,4
24-26	3,8	3,7		3,3
27-29	5,8	6,2		4,1
30-32	4,4	7,3		4,0
33-35	11,9	10,6		4,3
36-38	12,8	9,6		4,3
39-41	15,7	8,8		5,6
42-44	9,0	7,4		7,1
45-47	7,5	6,4		7,5
48-50	7,8	8,2		3,3
51-53	8,4	6,0		6,6
54-56	2,9	5,0		7,4
57-59	3,2	5,2		7,4
60-62	2,6	3,0		6,2
63-65	1,2	2,8		5,8
66-68	0,9	1,7		4,4
69-71	0,3	1,1		3,3
72-74	0,3	0,9		2,4
75-77	0,3	0,4		1,7
78-80	-	0,4		1,1
81-83	-	0,1		0,4
84-86	-	0,1		0,3
87-89	-	0,1		0,2
90-92	-	-		0,1
93-95	-	-		0,1
Mean length, cm	41,1	42,8		49,8
No. of fish	344	6843		4002

Table 4. Age composition of research catches of roundnose grenadier in the NW Atlantic (Sub. C, 2 and 3K) in 1983 - 1992 (%)

Age, years	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
2	2,2	0,3	1,9	1,9	0,6	1,9	0,6	2,4	2,4	2,0
3	2,9	1,1	2,7	2,8	3,6	4,2	3,0	3,6	4,1	7,3
4	3,5	1,8	3,5	3,3	6,9	6,9	5,1	6,1	6,5	9,0
5	5,9	3,6	6,4	5,6	9,4	13,1	9,4	9,5	8,8	12,0
6	7,2	6,1	3,0	6,6	9,0	12,2	8,9	10,9	8,9	11,5
7	9,5	9,7	11,9	9,9	10,9	12,7	10,8	12,6	10,6	11,6
8	11,1	12,5	13,6	12,2	13,2	13,4	13,2	12,1	12,2	11,3
9	11,2	13,4	13,0	12,2	12,6	11,2	12,4	11,1	11,7	9,2
10	10,1	12,0	11,6	12,0	11,0	8,9	11,2	10,0	10,7	8,3
11	9,1	11,2	8,9	10,0	8,5	5,5	8,7	7,5	8,1	5,8
12	8,8	9,8	7,6	8,9	6,6	4,1	7,2	6,0	6,6	4,9
13	6,3	6,5	5,1	6,3	3,9	2,1	4,5	3,8	4,1	3,0
14	5,0	4,7	2,7	3,7	2,1	1,0	2,8	2,2	2,4	1,8
15	3,2	2,8	1,5	2,4	1,1	0,4	1,6	1,2	1,4	1,0
16	2,0	1,8	0,6	1,4	0,6	0,2	0,9	0,6	0,7	0,6
17	1,2	1,1	0,4	0,9	0,4	0,1	0,6	0,4	0,5	0,4
18	0,4	0,5	0,1	0,2	0,1	-	0,1	0,1	0,1	0,2
19	0,4	0,3	0,1	0,1	-	-	0,1	-	-	0,1
20	-	-	-	-	-	-	-	-	-	+
21	-	-	-	-	-	-	-	-	-	+
Mean age	9,3	9,8	8,7	9,2	8,3	7,4	8,6	8,1	8,2	7,5
No. of fish	13296	11796	5837	6679	9996	11931	12797	13035	12340	11189

* Subarea 1 data included

Table 6 Age composition of research catches of roundnose grenadier in the NE Atlantic (Sub. O,2 and Div. 3K) in 1992 (%)

Age, years	0	2	3K
2	1,5	1,8	1,0
3	2,2	3,3	4,4
4	2,7	3,0	5,7
5	7,6	8,2	8,8
6	23,3	20,0	9,8
7	15,3	12,3	10,8
8	13,3	10,3	11,4
9	11,9	9,6	10,2
10	6,0	6,7	10,2
11	4,4	6,6	8,1
12	5,4	7,2	7,3
13	3,0	4,6	4,9
14	2,1	3,4	3,2
15	0,8	1,3	1,9
16	0,5	0,9	1,2
17	0,2	0,5	0,7
18	-	0,1	0,3
19	-	-	0,1
20	-	0,1	+
21	-	-	+
Mean age	7,8	8,2	8,5
No. of fish	344	6843	4002

Table 7 Mean length of male and female and percentage of female roundnose grenadier at various depth in Sub. OB, 2 and 3K in 1992

Subarea or Div.	Depth, m	Males		Females		Per-cent of female
		Mean length, cm	No. of fish	Mean length, cm	No. of fish	
0	801 - 900	31,0	1	37,0-2,2	6	85,7
	901 - 1000	-	-	-	-	-
	1001 - 1100	34,2±2,2	24	34,2±2,9	15	38,5
	1101 - 1200	39,3±0,9	129	41,7±0,8	95	42,4
	1201 - 1300	45,3±2,1	28	48,3±1,3	46	62,2
2	501 - 600	27,2±2,9	11	28,3±2,3	11	50,0
	601 - 700	27,8±2,0	25	32,5±1,8	30	54,5
	701 - 800	34,7±0,8	230	35,4±0,8	197	46,1
	801 - 900	33,0±0,5	509	31,5±0,3	342	40,2
	901 - 1000	37,4±0,4	602	38,6±0,5	301	33,3
	1001 - 1100	42,6±0,9	157	41,2±1,1	106	40,3
	1101 - 1200	43,9±0,3	1167	43,1±0,4	703	37,6
	1201 - 1300	51,7±0,5	774	51,1±0,6	511	39,8
	1301 - 1400	47,9±0,4	717	49,8±0,5	450	38,6
3K	501 - 600	36,6±2,4	17	36,0±1,2	21	55,3
	601 - 700	30,2±1,4	24	32,3±1,5	16	40,0
	701 - 800	46,2±1,2	50	39,4±1,6	38	43,2
	801 - 900	39,4±0,6	258	39,6±1,0	95	26,9
	901 - 1000	40,9±0,5	357	42,8±0,8	273	32,9
	1001 - 1100	42,8±0,6	341	47,0±0,8	175	33,9
	1101 - 1200	53,0±0,8	129	56,8±0,8	322	42,9
	1201 - 1300	55,5±0,6	477	59,0±0,7	322	40,3
	1301 - 1400	56,7±0,7	285	61,6±0,8	213	42,8
1401 - 1500	60,5±2,3	34	68,6±1,2	53	61,8	
0,2,3K	501 - 600	32,9±2,0	28	33,3±1,3	32	53,3
	601 - 700	29,0±1,2	49	32,4±1,3	46	48,4
	701 - 800	36,8±0,7	280	36,1±0,7	235	45,6
	801 - 900	35,2±0,4	768	33,3±0,5	443	36,6
	901 - 1000	39,1±0,3	1159	40,6±0,5	574	33,1
	1001 - 1100	42,3±0,5	322	44,3±0,7	296	36,2
	1101 - 1200	45,4±0,3	1725	46,9±0,4	1120	39,4
	1201 - 1300	52,6±0,4	1087	53,8±0,5	770	41,5
	1301 - 1400	48,4±0,4	751	51,9±0,6	505	40,2

Table 8 Distribution of mean research bottom catches (kg/hr) of roundnose grenadier from various depths in Subareas 0, 2, 3 in 1971-1977, 1990-1992 (smoothed series)

Depth, m	1971-1977		1990		1991		1992	
	Catch (kg/hr)	No. of catches	Catch (kg/hr)	No. of catches	Catch (kg/hr)	No. of catches	Catch (kg/hr)	No. of catches
20I - 300	31,5	55	-	-	-	-	-	-
30I - 400	169,3	72	-	-	0,46	35	-	-
40I - 500	475,9	191	-	-	0,39	38	-	-
50I - 600	683,9	459	-	-	0,68	26	0,85	9
60I - 700	743,6	362	-	-	8,90	20	2,42	13
70I - 800	855,7	453	8,6	4	22,0	9	14,0	12
80I - 900	1427,3	268	14,6	8	32,1	21	34,9	14
90I - 1000	2260,9	109	34,3	13	51,5	14	42,3	9
100I - 1100	2687,4	83	61,8	11	57,6	25	50,4	15
110I - 1200	2786,9	37	126,7	29	136,7	15	72,6	14
120I - 1300	2734,3	15	216,6	6	135,1	22	79,3	14
130I - 1400	-	-	257,1	7	124,1	13	65,4	8
140I - 1500	-	-	275,2	3	106,3	3	47,2	2

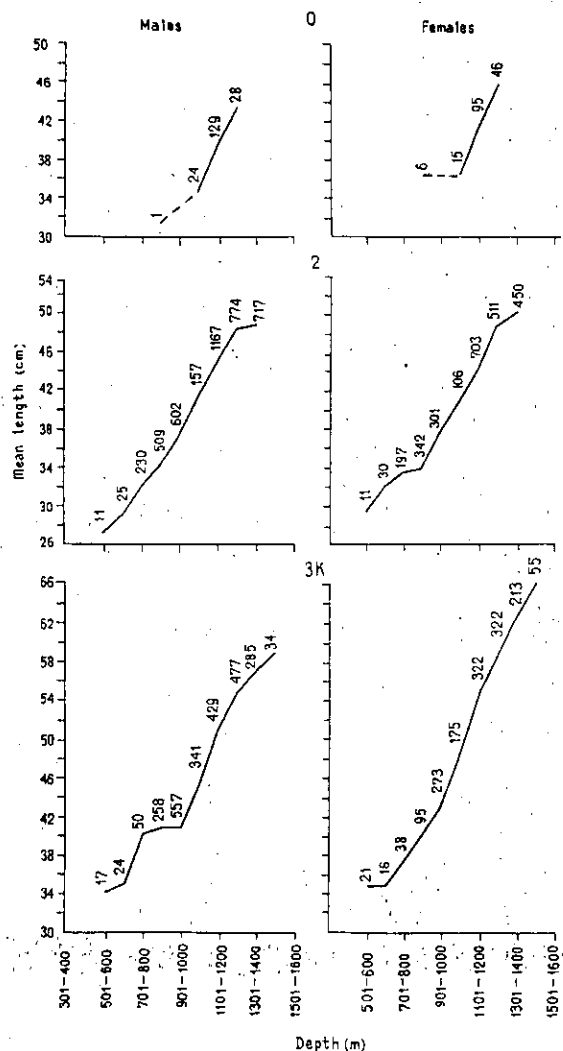


Fig. 1 Mean length of male and female roundnose grenadier at various depth in Sub. 0, 2 and 3K in 1992 (smoothed series, figures over the curves are number of fish).

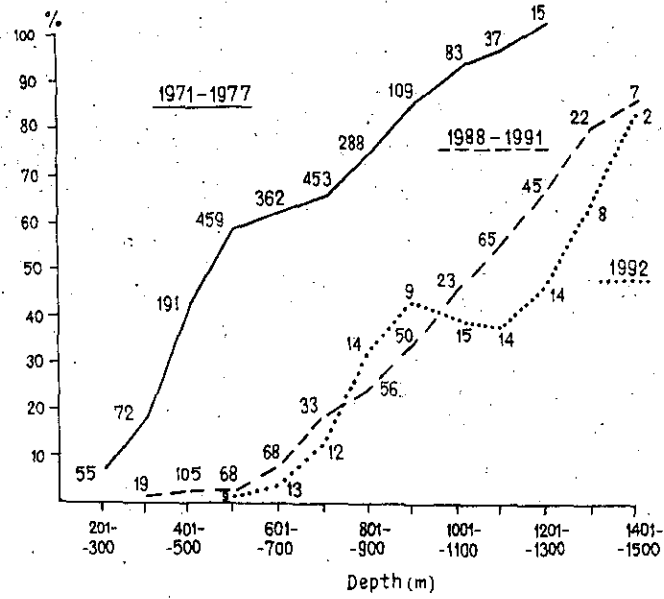


Fig. 2 Roundnose grenadier percentages by weight in bottom trawl research catches from various depth in Sub. 0, 2 and 3K in 1971-1977, 1988-1991, 1992 (smoothed series, figures over the curves are number of catches).