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Dynamics of Roundnose Grenadier Catch in the Northwest Atlantic

by

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**ABSTRACT**

Poorer availability of roundnose grenadier (Coryphaenoides rupestris Gunn.) to fishing gears due to migration of fish to deeper waters, induced by overall cooling of waters on the continental slope, is assumed to be one of the reasons of the total catch decline in the period from 1978 to 1985. Size, age and sex compositions of grenadier from research bottom trawl catches changed since 1979, which was caused by redistribution of fish to deeper waters on the continental slope. By 1988, probably, due to a trend in water temperatures in the main branch of the Labrador current to rise the relative number and mean length of grenadier in catches increased, which might result from migration of fish to shallower waters and might be one of the reasons of catch increase in 1987-1988.

**MATERIAL AND METHODS**

Materials from annual autumn trawl surveys for bottom fish and data collected by research vessels operating in SA O-2 and Div. 3K are used in the paper. Age composition of fish in catches for 1983-1988 was obtained by referring length distributions to a size-age key for 1969-1987. Total catch estimates were taken from the NAFO Statistic Bulletins.

**RESULTS AND DISCUSSION**

Roundnose grenadier fishery in the Northwest Atlantic was ini-

tiated in 1967, when for the first time a catch of 16 000 t was obtained by the Soviet fleet in Div. 3K. In subsequent years the fish were fished along the entire continental slope of Canada from Div. 3K to the Greenland-Canada Ridge and West Greenland. In 1968 the catch amounted to 27 000 t and it reached a peak value of 78 000 t in 1971, when the mid-water trawl fishing in Div. 2G started. Inshore fishery near Canada is carried out chiefly in summer and autumn months, when owing to seasonal vertical migrations grenadier dwell in shallower waters and are better accessible to trawls. In the period from January to June monthly catch accounts for about 1% and for more than 10% from July to December (Table 1). In SA 1 commercially important concentrations of roundnose grenadier in depths accessible to trawls are also observed in winter and spring, this<sup>is</sup> due to the impact of relatively warm West Greenland current on the hydrological regime. The catch is evenly distributed between months of the year (Table 1).

Total annual catch of grenadier in the Northwest Atlantic (SA 0+1 and SA 2+Div. 3K) amounted on the average to 33 600 t in 1968-1978, with 90% of it taken by the USSR. By 1980 it decreased to 3 800 t. In view of a sharp catch decline and reduction of catch per unit effort STACFIS recommended a reduction of TAC for 1983 to 19 000 t. Canadian experts hypothesized that a catch decline was due to the impact of intensive fishing on the stocks. It should be noted that assessment of roundnose grenadier is associated with great difficulties because of their dwelling in deep waters - as deep as 3 000 m (Sahrhage, 1986), which makes it impossible for commercial and research fishing gears to cover the whole range of grenadier vertical distribution. Researchers from different countries noted that the 1967-1981 fisheries did not affect adversely grenadier stocks (Atkinson, 1981; Savvatimsky, Shafran, 1981) and the total catch had never exceeded the TAC recommended by STACFIS. It was also noted, that no changes occurred in the size and <sup>age</sup> compositions of grenadier in the period of most intensive fishing (1967-1979), this was an indication of stability of stock status. A decrease of grenadier size was ob-

served only in Div. 3K in the period 1967-1971, however, in subsequent years the size composition recovered (Savvatimsky, 1977). In other fishing areas and in Div. 3K too a decrease of the average fish size and relative number of females in catches was observed since 1979, when the commercial withdrawal of grenadier was at the lowest level on record.

In the period from 1966 to 1976 the mean length of grenadier from research bottom catch was 63.8 cm in SA 0, 58.0 cm in SA1, 63.0 cm in Div. 2G and 56.1 cm in Div. 3K (Savvatimsky, 1977). The average length of fish decreased gradually between 1979 and 1985, besides a considerable increase of the average length and the relative number of females with depth was observed (Savvatimsky, 1986, 1987). Increase of female and male size in SA 0 and Div. 2G was observed also in 1988 (Table 2). Grenadier had the smallest size in 1985-1986, and only in 1988 the average length increased to 55.2 cm and age to 9.2 years (Tables 3,4). The relative number of grenadier in catches from above 1000 m increased too (Table 5).

Experts of NAFO member-countries repeatedly showed that a limitation of Greenland halibut by-catch in a directed roundnose grenadier bottom trawl fishery (to 10%) with observed increase of halibut numbers was one of the reasons of decline in the total grenadier catch decline as well as catch per unit effort. Increase in numbers of Greenland halibut entailed increase in by-catch in both southern and northern inshore areas of Canada. Vessels fishing for grenadier had to work in marginal areas and to trawl in very deep waters, which hampered intensive exploitation of grenadier stocks. In 1986 with the increase of allowable by-catch of halibut from 10% to 30% vessels operating on the continental slope had the opportunity to exploit more productive fishing areas, this, undoubtedly, favoured intensification of grenadier fisheries. This fact might, probably, be partly responsible for a slight increase of the total catch in 1986 and 1987 (Table 6).

In 1984 experts from the GDR suggested that a decline in grenadier catch and changes in the percentage of grenadier and hali-

but in catches from different depths were caused by cooling of waters near the continental slope, which lessened the accessibility of grenadier to fishing gears due to migrations of fish to deeper waters (Ernst, 1984). Soviet research data confirmed redistribution of grenadier down to as deep as more than 1000-1200 m (Savvamimsky, 1986, 1987). Such migrations entailed changes in size, age and sex compositions of grenadier in catches from traditional depths as well as in the percentage of different fish species in the catch. Research data showed, that if prior to 1977 grenadier predominated in catches from 700 m and deeper, then in later years this species accounted for only 50% in catches from 1300-1400 m and deeper (Savvatimsky, 1988). Annual Soviet trawl surveys provided evidence, that in 1980-1985 the relative number of grenadier in catches from 1000-1200 m<sup>in SA 2</sup> did not exceed on the average 15-20%, whereas in 1987-1988 it increased to 50-60%, probably, due to a gradual redistribution of grenadier to shallower waters on the slope. If this trend remains, in 1989-1990 availability of grenadier to fisheries will be larger. Annual water temperature measurements on standard hydrological section 8A across the continental slope in Div. 2G provide basis for forecasting water temperatures in the Atlantic component of the Labrador current in 200-500 m and 500-1000 m for 1989-1990, which are expected to be close to the long-term mean for 1964-1985 (Chumakov, Savvatimsky, 1987). This may induce grenadier to migrate to shallower waters, and, hence, improve fisheries.

#### REFERENCES

- Atkinson D.B. MS 1981. Roundnose grenadier in NAFO Subareas 2+3. NAFO SCR Doc. 81/VI/60, Serial No. N344, 12 p.
- Chumakov A.K., Savvatimsky P.I. MS 1987. Distribution of Greenland halibut and roundnose grenadier in the Northwest Atlantic in relation to hydrographic conditions in 1968-1986. NAFO SCR Doc. 87/93, Serial No. N1397, 38 p.
- Ernst P. MS 1984. Contribution to by-catch levels of Greenland halibut (Reinhardtius hippoglossoides Walb.) in the roundnose grenadier (Coryphaenoides rupestris Gunn.) directed fishery in NAFO Subarea 2. NAFO SCR Doc. No.96, Serial No. N891, 8 p.

- Sahrhage D., 1986. Wirtschaftlich wichtige Grenadierfische des Nordatlantiks. Mitteilungen aus dem Institut für Seefischerei der BFA für Fischerei. Hamburg. Nr. 37, 81 s.
- Savvatimsky P.I. MS 1977. Prospects of roundnose grenadier fishery in the Northwest Atlantic. ICNAF Res. Doc. 77/VI/30, Serial No. 5055, 17 p.
- Savvatimsky P.I. MS 1986. Changes in the composition of the bottom fish catches at different depth along the continental slope in NAFO Subareas 0, 2 and 3 in 1970-1985. NAFO SCR Doc. 86/67, Serial No. N1184, 26 p.
- Savvatimsky P.I. 1987. Changes in species composition of trawl catches by depth on the continental slope from Baffin Land to northeastern Newfoundland, 1970-1985. NAFO Sci.Coun. Studies, 11:43-52.
- Savvatimsky P.I. MS 1988. Possible reasons for variations in roundnose grenadier catches composition in the Northwest Atlantic in 1971-1987. NAFO SCR Doc. 88/IX/100, Serial No. N1557, 21 p.
- Savvatimsky P.I., Shafran I.S. MS 1981. Status of roundnose grenadier stocks and possibilities for their commercial removal in the Northwest Atlantic. NAFO SCR Doc. 81/IX/106, Serial No. N410, 29 p.

Table 1. Total catch of roundnose grenadier in SA 0+1 and SA 2+3  
by month in 1976-1987

SA	Index	Month												Total
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0+1	Catch, t	2375	1396	1142	3472	3624	1487	191	1856	2037	2404	3946	2831	26761
	%	8.9	5.2	4.3	13.0	13.5	5.6	0.7	6.9	7.6	9.0	14.7	10.6	100.0
2+3	Catch, t	1391	1793	133	836	547	1211	10540	21956	17583	20783	15477	12708	104958
	%	1.3	1.7	0.1	0.8	0.5	1.2	10.0	20.9	16.8	19.8	14.8	12.1	100.0

Table 2. Average length of roundnose grenadier  
in research bottom trawl catch from  
different depths in SA 0 and Div. 2G  
in autumn 1988

Subarea, Division	Depth, m	Male		female		Male & female	
		Length cm	Number	Length cm	Number	Length cm	Number
0	I00I-II00	53,8	138	55,8	87	54,5	225
	II0I-I200	56,7	2640	57,6	1875	57,1	4515
	I20I-I300	58,2	449	58,7	371	58,5	870
2G	90I-I000	51,8	195	49,8	123	51,0	318
	I00I-II00	51,9	1376	53,7	857	52,4	2233
	II0I-I200	53,7	2562	53,4	1630	53,6	4192
	I20I-I300	55,0	342	54,3	247	55,0	589

Table 3. Size composition of roundnose grenadier from research catch in the Northwest Atlantic in 1983-1988, %

Length, cm	Year					
	1983	1984	1985	1986	1987	1988
18-20	0.2	-	0.2	0.1	0.1	-
21-23	0.5	0.03	0.4	0.4	0.2	-
24-26	0.8	0.1	0.9	0.8	0.3	-
27-29	1.6	0.3	1.7	2.3	0.8	0.1
30-32	2.4	0.5	1.6	2.0	2.5	0.2
33-35	3.5	1.2	3.0	3.1	4.2	0.9
36-38	4.4	2.1	4.3	3.6	5.8	2.0
39-41	4.7	2.2	5.7	5.0	6.6	3.5
42-44	5.9	3.9	7.6	6.0	8.3	6.9
45-47	8.0	6.0	9.1	7.1	8.4	7.4
48-50	7.6	7.9	10.2	9.9	10.6	10.4
51-53	8.3	8.4	9.6	9.4	8.8	11.7
54-56	9.2	11.2	10.5	9.4	9.6	11.6
57-59	6.9	11.1	9.0	10.3	9.8	13.4
60-62	8.2	10.3	6.8	7.7	6.9	9.5
63-65	8.0	10.1	6.9	7.6	7.2	9.9
66-68	5.2	7.5	4.5	5.4	3.9	5.2
69-71	4.6	5.6	3.4	3.7	2.5	3.0
72-74	3.3	3.9	2.1	2.7	1.6	2.5
75-77	2.4	3.0	1.2	1.4	1.0	0.9
78-80	1.1	2.0	0.7	1.0	0.6	0.5
81-83	0.9	0.8	0.3	0.4	0.3	0.2
84-86	0.4	0.8	0.2	0.4	0.2	0.02
87-89	0.2	0.4	0.1	0.2	0.1	0.02
90-92	0.2	0.4	-	0.1	-	-
93-95	0.1	0.1	-	-	-	-
96-98	+	0.1	-	-	-	-
99-101	-	0.02	-	-	-	0.02
102-104	+	0.01	-	-	-	-
105-107	-	-	-	-	-	-
108-110	-	0.01	-	-	-	-
Mean length, 56.3		58.3	52.1	53.2	51.4	55.2
Number	13296	11796	5837	4851	9996	12841



Table 4. Age composition of roundnose grenadier from research catch in the Northwest Atlantic in 1983-1988, %

Age	Year					
	1983	1984	1985	1986	1987	1988
2	2.2	0.2	1.9	2.0	0.7	-
3	2.9	1.1	2.7	3.3	3.2	0.5
4	3.5	1.8	3.5	3.4	4.8	2.0
5	5.9	3.6	6.4	5.7	7.6	5.2
6	7.2	6.1	8.0	6.8	8.6	7.2
7	9.5	9.7	11.8	10.5	11.9	10.5
8	11.1	12.5	13.7	12.7	13.5	14.9
9	11.2	13.7	13.1	12.6	12.7	15.3
10	10.1	12.8	11.8	12.1	11.8	14.2
11	9.1	11.1	8.9	9.6	8.8	11.3
12	8.8	9.7	7.5	8.4	7.2	8.8
13	6.3	6.4	5.1	5.8	4.6	5.2
14	5.0	4.7	2.7	3.1	2.3	2.6
15	3.2	2.8	1.5	1.9	1.2	1.3
16	2.0	1.8	0.8	1.1	0.6	0.6
17	1.2	1.1	0.4	0.7	0.4	0.3
18	0.4	0.5	0.1	0.2	0.1	-
19	0.4	0.4	0.1	0.1	0.0	-
Mean age	9.3	9.8	8.7	8.9	8.6	9.2
Number	13296	11796	5837	4851	9996	12841

Table 5. Distribution and composition of catches from different depths during trawl survey by RV "Kapitan Shaitanov" in 1988

Div.	Depth, m	Mean catch/hour, kg	Number of catches	Species composition, % by weight			
				Greenland halibut	Redfish	Grenadier	Other
3K	50I-600	92	1	12.0	88.0	-	-
	60I-700	116	3	21.9	72.6	-	5.5
	70I-800	70	3	76.1	7.7	1.4	14.8
	80I-900	83	3	93.2	-	-	6.8
	90I-1000	181	3	96.5	-	3.5	-
	100I-1100	136	5	59.3	-	39.5	1.2
	110I-1200	112	7	30.6	-	69.4	-
	120I-1300	117	1	7.7	-	92.3	-
2GH	10I-200	2	8	100.0	-	-	-
	20I-300	6	16	100.0	-	-	-
	30I-400	21	11	83.9	9.3	-	6.8
	40I-500	68	19	59.6	28.5	10.4	1.5
	50I-600	75	8	48.2	50.8	-	1.0
	60I-700	73	15	55.5	37.4	10.0	2.1
	70I-800	105	6	50.2	1.9	47.9	-
	80I-900	146	10	79.0	0.5	20.3	0.2
	90I-1000	143	3	54.3	2.1	46.3	-
	100I-1100	306	17	39.4	-	60.5	0.1
	110I-1200	266	2	48.6	-	51.4	-
0B	20I-300	2	5	100.0	-	-	-
	30I-400	13	10	98.5	-	-	1.5
	40I-500	19	11	63.2	36.4	-	0.4
	50I-600	47	4	73.9	26.1	-	-
	60I-700	54	7	88.0	12.0	-	-
	70I-800	225	2	74.4	25.6	-	-
	80I-900	178	5	74.8	-	24.3	0.9
	90I-1000	169	5	93.1	-	6.9	-
	100I-1100	376	6	40.5	-	59.5	-
110I-1200	201	2	100.0	-	-	-	
1BCD	20I-300	4	5	4.5	18.2	-	77.3
	30I-400	16	4	25.8	67.7	-	6.5
	40I-500	20	8	18.6	67.7	-	13.7
	50I-600	46	4	76.4	14.8	-	8.8
	60I-700	162	10	18.8	17.9	0.9	62.4
	70I-800	216	2	100.0	-	-	-
	80I-900	124	3	96.8	-	3.2	-
	90I-1000	460	4	59.9	-	40.1	-
	100I-1100	281	4	31.6	-	68.4	-
	110I-1200	351	3	33.2	-	66.8	-

Table 6. Catch (t) of roundnose grenadier in SA 2+3 in 1976-1987

Country	Year											
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986*	1987*
GDR	497	613	1801	480	898	1407	1640	2586	3650	3740	4571	4473
USSR	19978	14577	17760	7201	1087	5660	2689	933	147	1018	2801	2658
Other countries	118	196	1141	100	68	18	15	50	76	190	54	1098
Total catch	20593	15386	20702	7781	2053	7085	4344	3569	3873	4948	7426	8229

\* Preliminary data