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On the Transition to a New System of Measurement of the North Atlantic Roundnose Grenadier (*Coryphaenoides rupestris*) Length

by

A. P. Bajdalinov, R. S. Dorovskikh and L. I. Stulova
Atlantic Research Institute of Marine Fisheries and Oceanography (AtlantNIRO)
5 Dmitry Donskoy St., Kaliningrad, USSR

Abstract

Differences between male and female roundnose grenadier in the North Atlantic were analysed by the following indices: preanal length, body weight and age of the fish at the set values of total length, and total length, body weight and age of the same fish at the set values of preanal length. The data on tail breakages are given.

The results of studies indicate the necessity of transition to the preanal length measurement for the North Atlantic roundnose grenadier as adopted in NAFO.

Introduction

Till now the length of roundnose grenadier from the northern part of the Mid-Atlantic Ridge was measured from the tip of the snout to end of filamentous caudal peduncle. For some reason or other many of the fish have broken caudal part of the peduncle which make it difficult to obtain reliable length of the body.

In 1976, Jensen suggested that roundnose grenadier length should be measured from the tip of the snout to the beginning of the anal fin, i.e. preanal or anteanal distance. Atkinson (1980) found a significant linear relationship between total and preanal length, no differences between males and females being actually observed in measuring the preanal length.

Savvatimsky (1981, 1984) examined the variation in preanal length of male and female roundnose grenadier from two subareas of the Northwest Atlantic and Hatton area (Northeast Atlantic) at the set values of total length and body weight and concluded that there were pronounced differences in preanal length and weight of male and female roundnose grenadier of the same size. Sex dimorphism practically disappears when measuring the preanal length. Based on the above statement, Savvatimsky indicates the undesirability of using preanal length for measurements of roundnose grenadier. To evaluate the feasibility of transition to a new system of length measurements for roundnose grenadier inhabiting the waters southwest of Iceland, a comparative analysis was made between the variation in preanal length, weight and age of males and females at the set values of total length and the variation in total length, weight and age of males and females at the set values of preanal length. A number of samples was analyzed in order to evaluate the degree of caudal peduncle breakage for estimating the representativity of the data on length composition of the catches.

Materials and Methods

Materials were collected in three subareas of the North Atlantic: central and southern parts of Reykjanes Ridge and in the Gibbs area in 1981-1984. Roundnose grenadiers with scales and unbroken caudal peduncle were selected for analysis. However, since the materials were collected by various observers there is no complete guarantee that caudal peduncles of the studied fish were not broken. Preanal length was measured to the nearest 1 mm, and total length was recorded to the nearest 1 cm. Body weight was measured to the nearest 10 g. The age was determined under polarized transmitted light according to the methods described by a group of authors (Savvatimsky P.I., Koch Kh., Ernst P., 1977). The data of 1939 observations were used. Each observation included the information on total and preanal length, body weight and age of the same fish with regard for sex.

Using the program of selection and grouping of initial data by 3-cm total-length classes and 1-cm preanal-length classes, mean weighted values of total and preanal length, weight and age of males and females from three subareas of the North Atlantic were calculated.

To evaluate the degree of roundnose grenadier caudal peduncle breakage, 10 samples each containing 50 to 300 sp. from the Gibbs fracture area were used. The fish were classified by four groups:

- unbroken caudal fins;
- slightly broken caudal fins (the length of broken part did not exceed 1 cm);
- mean broken caudal fins (the fish with tails shortened up to 5 cm were included to this group);
- heavily broken caudal fins (the fish with tails shortened up to 1/3 of the caudal peduncle length).

Results and Discussion

From comparison of mean values of preanal length within a set range of values of total length of roundnose grenadier, the differences between males and females are significant. For example, in the fish with lengths of 75-77 cm from Divs 2K and 2G, Hatton, central and southern Reykjanes Ridge and Gibbs fracture, males have mean preanal lengths of 14.2, 14.7, 15.4, 16.5, 16.5, 16.7, and females 15.4, 14.7, 16.5, 16.9, 17.6, 18.0 cm, respectively (table 1). These data indicate that in the fish of the same length female preanal length is about 1.3 cm greater than in males. Consequently, postanal length is greater for males than for females. According to our data, if mean values of body weight of males and females from the above mentioned group be plotted against mean values of preanal length all points is practically in a straight line, i.e. with transition to the preanal length measurements sex differences in body weight disappear.

Therefore, Savvatimsky and the authors of the present paper found that sex differences in preanal length, body weight reaching 400-600 g for older fish (table 2), and other indices when

measuring total length, are associated with different rate of variation in preanal and postanal distance which has probably functional basis.

Postanal length is greater for males than for females with preanal length being equal, and the differences increase as the fish grow.

So, studies by Atkinson and Savvatimsky and our data made it possible to find out the peculiarities of variation in preanal and postanal lengths of roundnose grenadier which stipulate significant sex differences in majority of compared indices (preanal length, body weight, etc.) when measuring total length, and the absence of significant sex differences in the same indices when preanal length was measured.

It is worth of noting that a spread of points of means of preanal length, body weight and age of the fish is much greater in measuring total length compared to preanal length measurements which is attributed to inaccurate measurement of total length of the fish with broken caudal peduncle. In measuring total length of the fish with broken tails, an element of subjectivity is introduced into its estimate. The length of females is overestimated, and male length is underestimated.

Practically linear relationship exists between total and preanal length of males and females. Correlation coefficients did not exceed 0.9.

The table 3 data indicate that only 26.2% of the fish have unbroken caudal peduncle, and they are confidently referred to the samples of corresponding length classes; as for 40.7% of the fish, some doubts may arise in validity of relating these fish to corresponding length classes, and the other measurements of total length of the fish are not reliable, and the fish may be referred to samples of several length classes.

It should be noted that the fish with unbroken and slightly broken caudal peduncle belong mainly to younger age classes. The number of the fish with mean and heavy breakages increases with increasing length, and unbroken tails are rarely found for the

larger fish. The representativity of the data on length composition of roundnose grenadier catches is very low, and the data on weight composition of the catches may be to a great extent misrepresented.

Conclusions

Based on the studies undertaken, we consider it necessary to transit to a new system of measurement of roundnose grenadier length, i.e. preanal length measurements. The advantages of this system are as follows:

a) the representativity of the data on length composition of the catches is highly improved, and compilation of variational length frequencies is simplified;

b) sex differences in length and body weight decline;

c) with the presence of linear relationship between preanal length and age of the fish, age composition of the catches may be approximately evaluated using preanal length;

d) a comparison between grenadiers from different NAFO subareas of the North Atlantic is possible.

References

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Table 1 Preanal length (aA, cm) of male and female roundnose grenadier in the North Atlantic

Total length, cm	Preanal length (cm)											
	Males						Females					
	Northwest Atlantic		Northeast Atlantic				Northwest Atlantic		Northeast Atlantic			
	3 K	2 G	Hatton	I*	II	III	3 K	2 G	Hatton	I	II	III
1	2	3	4	5	6	7	8	9	10	11	12	13
27–29	6.6	–	–	–	–	–	–	–	–	–	–	–
30–32	7.1	–	–	–	–	–	–	–	–	–	–	–
33–35	7.2	7.1	8.7	8.4	6.8	–	7.3	6.5	–	9.0	8.5	–
36–38	8.3	7.8	8.6	8.6	9.7	–	8.5	–	–	–	–	–
39–41	8.7	8.9	–	9.5	8.8	–	9.1	8.9	–	9.8	9.5	–
42–44	9.6	8.6	9.7	9.5	10.5	–	9.5	8.8	–	9.2	9.3	–
45–47	10.0	9.6	10.0	10.1	10.3	–	10.3	9.8	–	9.7	–	–
48–50	10.3	9.8	11.5	10.9	11.0	10.3	10.5	10.1	–	11.1	11.0	10.6
51–53	10.8	10.7	12.6	11.4	12.0	–	11.0	11.0	–	12.0	12.5	11.4
54–56	11.4	11.3	11.6	12.1	12.2	12.7	11.6	11.5	–	12.2	11.9	12.4
57–59	12.0	11.7	12.5	12.5	12.9	13.6	12.2	11.8	–	13.1	13.1	13.0
60–62	12.7	12.3	13.2	13.2	13.5	13.2	12.5	12.9	–	13.5	13.7	13.8
63–65	13.3	12.8	13.5	14.3	14.1	14.4	13.2	13.3	–	14.3	14.2	14.2
66–68	13.4	13.2	14.3	15.1	14.7	15.0	14.2	13.5	–	15.0	14.6	14.3
69–71	13.7	13.6	14.7	15.1	15.3	15.6	14.5	14.2	–	16.2	15.7	13.9
72–74	14.9	14.4	15.1	16.0	16.2	15.6	14.8	15.0	14.7	16.2	16.6	–
75–77	14.2	14.7	15.4	16.5	16.5	16.7	15.4	14.7	16.5	16.9	17.6	18.0
78–80	–	15.6	16.1	17.8	17.0	16.8	–	15.9	17.1	17.7	18.1	17.4
81–83	–	14.8	16.9	17.8	17.4	17.4	–	16.9	17.8	18.5	18.5	18.3
84–86	–	–	17.3	17.8	18.0	17.9	–	18.0	17.8	19.3	18.9	18.4
87–89	–	–	17.8	18.5	18.7	18.2	–	19.0	18.5	19.5	19.3	19.4
90–92	–	–	18.3	19.1	19.5	18.9	–	18.9	20.0	20.1	19.8	19.7
93–95	–	–	19.3	19.7	19.7	19.4	–	21.5	20.5	21.3	20.7	20.1
96–98	–	–	19.6	20.0	19.6	20.1	–	20.2	20.4	21.1	22.3	21.8
99–101	–	–	20.3	20.8	–	–	–	–	21.4	22.1	22.1	22.5
102–104	–	–	20.0	–	–	–	–	–	21.2	–	–	–
105–107	–	–	–	–	–	–	–	–	23.5	–	–	–
108–110	–	–	–	–	–	–	–	–	21.8	–	–	–
	250	220	275	665	423	166	150	180	125	355	23	99

Note: I – central part of Reykjanes Ridge

II – southern part of Reykjanes Ridge

III – Gibbs fracture

Table 2 Total length, age and weight of female roundnose grenadier from three subareas of the Northeast Atlantic

Preanal length (sA), cm	Total length, cm			Age, years			Weight, g		
	I	II	III	I	II	III	I	II	III
1	2	3	4	5	6	7	8	9	10
6.6-7.5	-	-	-	-	-	-	-	-	-
7.6-8.5	-	34.0	-	-	10.0	-	-	70	-
8.6-9.5	42.6	41.5	-	10.4	11.0	-	190	160	-
9.6-10.5	41.7	45.7	-	11.5	11.7	-	175	187	-
10.6-11.5	51.7	52.4	50.0	13.4	12.0	12.5	287	280	210
11.6-12.5	53.7	57.1	54.0	12.3	12.7	12.5	352	386	345
12.6-13.5	58.3	58.1	60.7	15.0	13.8	15.2	454	449	453
13.6-14.5	64.3	63.1	63.4	15.2	14.9	15.3	577	540	541
14.6-15.5	68.5	67.9	68.6	15.7	15.8	16.8	659	654	943
15.6-16.5	74.5	75.1	78.3	16.7	16.3	15.0	857	777	943
16.6-17.5	77.0	75.7	81.0	18.5	17.0	18.3	954	929	1070
17.6-18.5	81.4	82.5	85.4	19.4	18.6	18.4	1121	1131	1259
18.6-19.5	85.7	83.6	86.9	21.0	19.0	19.6	1316	1234	1373
19.6-20.5	89.3	87.3	89.6	21.6	19.6	20.4	1469	1262	1529
20.6-21.5	90.5	92.7	91.2	22.2	20.1	21.3	1561	1673	1728
21.6-22.5	96.0	92.5	99.6	22.2	20.2	21.4	1664	1817	1996
22.6-23.5	98.1	96.7	100.5	23.3	22.0	23.0	1968	1953	1920
23.6-24.5	95.0	98.0	-	24.0	24.5	-	1800	2260	-
24.6-25.5	-	-	-	-	-	-	-	-	-
25.6-26.5	-	-	87.0	-	-	20.0	-	-	1480
	355	231	99	355	231	99	355	231	99

Note: I - central part of Reykjanes Ridge

II - Southern part of Reykjanes Ridge

III - Gibbs fracture

Table 3 Frequency of occurrence of North Atlantic roundnose grenadier with different degree of caudal peduncle breakage

NN	Degree of caudal peduncle breakage, %				
	Unbroken	Slight	Mean	Heavy	No. of fish
1	2	3	4	5	6
1.	24.7	47.3	17.0	10.0	300
2.	29.8	31.6	29.8	8.8	57
3.	34.5	29.1	27.3	9.1	55
4.	26.9	34.9	25.0	13.5	52
5.	15.9	30.2	39.7	14.2	63
6.	40.3	34.3	13.5	11.9	57
7.	30.4	48.2	10.7	10.7	56
8.	24.0	44.0	20.0	12.0	50
9.	16.0	38.0	22.0	24.0	50
10.	20.8	45.8	8.3	25.1	24
1-10	26.3	40.7	20.9	12.1	774