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<u>On Length Measurements of Roundnose Grenadier (Coryphaenoides rupestris)</u> in the Northwest Atlantic

by

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Abstract

The problem of length measurements arose in connection with grenadier fishery development and need for regular biological sampling for stock assessment and optimum catch. It is difficult to measure total length of fish because of the breakage of thin thread-like tails in more than 50% of fish. Many researchers suggest to measure pre-anal length instead of total length. This length is different in males and females of the same size and its relative value varies with growth of fish length. The new method of mass measurements may impede calculation of total length and comparison of the received data with those of the previous years.

Introduction

During collecting of data on length-weight and age composition of roundnose grenadier catches (and other species of grenadier, e.g. roughhead grenadier - <u>Macrourus berlax</u>) the problem of determining total length of fish arises. In research catches there may be more than 50% of fish whose tails were broken during winching the trawl and earlier but regenerated and fin rays appeared. During mass measurements some difficulties are caused by the selection of undamaged specimens*.

*There exists an opinion that large specimens of roundnose grenadier have their tails broken more often than small ones, that is why during selection of undamaged fish mostly small specimens are chosen, and this somewhat misrepresents the real size composition of the catch. This opinion is not corroborated by practice. When it is impossible to measure total (zoological) length of fish incomplete length (to the fork of the tail fin, to the end of the caudal peduncle,etc.) or length of any part of the body are measured. Thus, besides total length, Merrett (1978) has chosen length of a head as a criterion for larvae and young grenadier size, because many specimens were damaged during winching the nets.

In 1976 Jensen (1976) suggested to start mass measurements of roundnose grenadier from tip of snout to the beginning of anal fin (i.e. to measure pre-anal length) to the nearest 0.5 cm and to use 1/2 cm groupings. As a result of converting such length into total length 3.5 cm groupings are obtained. Jensen presented a formula for conversion of pre-anal length into total length of roundnose grenadier. Parsons etal. (1978) supported Jensen's suggestion.

Later several reports by researchers from different countries on the same problem were presented. Atkinson (1980) reviewed in details the information given in the reports. Data presented in these reports do not show clear-cut differences of pre-anal lengths in specimens of the same size and different sexes. Moreover, some authors do not differrentiate fish by sexes while measuring pre-anal and total length. Atkin; son (1979) informs that the results of preliminary studies of round nose grenadier in Canada show possible differences of pre-anal length in males and females having the same total length, and in order to settle the problem it is necessary to have the data on fish length to within 1 mm. He warns that Jensen's formula should be handled with great care. Pre-anal length measurements of roundnose grenadier given in this paper are made with appropriate accuracy and show clear distinctions between males and females.

Material and methods

Two sets of roundnose grenadier measurements were performed in the North Labrador area (Div. 2G): 2 November - 5 December 1971 (Table 1) and 24 - 26 November 1979 (Table 2). A set of length measurements of large roundnose grenadier specimens caught south-west of the Faroes was carried out 22 - 25 November 1980

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(Table 3). Undamaged specimens were taken out of bottom catches of research vessels, their total length to the nearest cm and length from tip of snout to the first ray of anal fin to the nearest mm were measured. Total length of fish was joined into 3 cm groupings: 30-32, 33-35, 36-38 and so on to simplify statistic processing.

Curves are smoothed in Fig. 2. Smoothing of size frequences was performed by the formula $B = \frac{a+2b+c}{4}$, where a, b, c preceding, medium and subsequent members of size frequency, B = calculated term.

Significance checking of difference between means by pre-anal length of grenadier males and females was performed by standard methods (Kolkot E., 1978, pp.72-75).

Results

Our experiments show that measurements of total length of fish are more accurate, because pre-anal length is small relatively total length (20 - 23%) and, apparently, the accuracy of its measurement to 0.5 cm is not significant. Variations of pre-anal length in grenadier of the same size are rather great by our data. In 1971 sample difference in pre-anal length of fish 60-62 cm long is 2-3 cm. The same can be seen from numerous samples taken in 1979 and 1980 (Fig.1). Besides, pre-anal length in males and females having the same total length is different (Table 1, 2 and 3). In the sample taken in 1979 the greatest number of fish belongs to 63-65 cm grouping (40 males and 27 females). On the average pre-anal length in males of this grouping is 13.9 cm, and in females - 14.4 cm. The range of pre-anal length in males is 17.3% and in females - 14.6% of the mean value of pre-anal length (Table 4).

In order to determine if the difference of male and female pre-anal length is important, significance checking of difference between means was performed, pre-anal length being expressed in % of total length of fish. All specimens in 1971 sample, those 48-80 cm long from 1979 sample (Table 4) and fish 63-110 cm long in 1980 sample were analysed (Table 5). Estimated values of significance criterion ($t_{calc.}$) in all cases are greater than table values (t_{table}) with 95% probability value, hence, the difference may be considered statistically reliable.

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In 1979 sample there were enough fish 63-65 cm long (40 males and 27 females) to compare mean values of pre-anal length without calculating them in % of fish length. In 1980 sample a sufficient number of fish were 87-89 cm long (25 males and 22 females) to compare them this way (Table 6). In both cases the difference with 95% probability value is also significant.

It is interesting to note that with growth of fish length relative pre-anal length (in % of total length) decreases (Fig.2), the process developing differently in males and females. The given information is unimportant for determining if these changes are proportional or connected by curviliniar dependence.

Conclusions

The above-mentioned difference in pre-anal length of grenadier males and females and its variability is examined on the basis of few data. Some difficulties may arise in accurate measuring of pre-anal length because of different fullness of stomachs. Some complicated keys for conversion of these dimensions into total length may be needed while starting mass measurements of pre-anal length.

The new method of roundnose grenadier mass measurements will likely lead to additional difficulties when comparing the received data and those of the previous years when total length of fish was measured. Atkinson, D.B. 1979. Roundnose grenadier in ICNAF Subareas 0+1 and 2+3. ICNAF Res.Doc. 79/VI/57, Ser.No.5397,pp.16.

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of the roundnose grenadier fisheries in ICNAF Subareas 0+1 and 2+3. ICNAF Res.Doc. 78/VI/47, vol. 3, pp.9.

males	and female:	s in Div.20	G 2 Nove	mber - 5	December 19)71
س حسر محت فشم مسع م مراجع الم	: MA]	LES		FEM	LES	29 Alfreda Matania Kalifa
cm	:aA,cm	:aA,%	number	raA, cm	:aA, %	:ber
36-38	8,4	22,7	2	8,7	22,9	I
39 - 4I	8,5	21,8	I	9,3	23,I	3
42-44	9,7	22,6	4	9,8	22,7	3
45-47	IO,2	22,5	2	I0,4	22,5	4
48-50	10,7	21,8	3	I0,9	22,3	3
5I - 53	II , 4	2I,8	3	II,7	22,4	3
54-56	I2,4	22,6	3	12,3	22,4	3
57-59	I2,8	22,I	3	I2,9	22,3	3
60-62	I3,6	22,2	4	13,7	22,5	3
63–65	I3,8	21,6	3	I4,5	22,7	3
66 –5 8	I4 , 3	2I,4	3	I5,0	22,3	3

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I5,6

I6**,**8

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22,3

23,3

22,3

21,7

22,3

2I,I

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2

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57

h.)

69-7I

72-74

75-77

78-80

81-83

84-86

87-89

90-92

93-95

96-98

36-98

I5,0

I5,6

I6,I

16,5

17,I

I7,8

I8,3

17,4

19,7

20,4

2I,5

21,4

2I,2

20,9

20,8

21,0

2I,0

I9,3

20,8

2I,0

Table 1 Pre-anal length (aA) of roundnose grenadier males and females in Div.2G 2 November - 5 December 1971

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anno Aprico canto ayuro Guitto a		g Balanda Auguna (2000) 1				
Length of	MAL.	ΕS		: FEMA	LES	
fish, cm	aA, cm	: aA, %	number	· aA, cm	. aA, %	number
30-32	7,5	23,4		anta cumo puoro terno entre porte	WARTER Bynitty annun Antitas ay	9000 20000 00000 02000 .
33–35	8,2	23,9	2	8,0	23,5	I
3638	8,6	23,0	3	8,2	22,3	2
39-4I			ананананананананананананананананананан	9,4	23,5	I
42-44	9,9	23,3	3	an an an Araban An Araban An Araban		
45-47	I0,5	23,0	3			
48-50	I0,9	22,2	IO	12,1	24,I	3
5 I -53	II,5	22,2	IO	12,I	23,4	5
54-56	12,2	22,4	21	I2,6	23,I	8
57-59	I2,9	22,3	19	13,0	22,4	I5
60–62	I3,3	2I,8	30	I3,6	22,3	24
63–65	I3,9	2I,7	40	14,4	22,6	27
66–68	I4,2	2I,I	32	15,1	22,4	19
69 - 7I	I4 , 9	2I,3	31	15,4	22,I	12
72-74	I5,3	2I,0	24	16,1	22,I	16
75-77	I5,5	20,5	9	16,5	21,6	9
78-80	16,6	2I,I	9	I7,6	22,I	3
81-83		China di Sana d		I8,0	22,0	3
84-86				18,4	2I,6	I
87-89			e,	18,9	2I,6	2
30-89			244			I50

Table 2 Pre-anal length (aA) of roundnose grenadier males and females in Div. 2G 24-26 November 1979

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Table 3 Pre-anal length (aA) of roundnose grenadier males and females in the area of the Faroes 22-25 September 1980

Length of :	MAI	LES		: FEM	ALES	
:	aA, cm :	aA, %	:number	:aA, cm :a	A, %	number
63–65	12,8	19,9	6	I3,8	2I,6	3
66–68	I4,3	21,2	5	14,3	2I,4	6
69 - 71	I4,0	20,0	8	I4,5	20,5	5
72-74	14,9	20,3	13	15,7	2I,5	7
75-77	15,I	20,0	15	16,6	21,7	7
78-80	15,9	20,I	20	16,7	2I,2	9
81-83	I6 , 5	20,0	23	I7,4	21,2	17
84–8 6	16,9	19,9	24	17,8	20,8	14
87-89	17,7	20,2	25	I8,3	20,8	22
90-92	I7,8	19,7	IO	19,0	20,9	18
93–95	I8,6	19,8	IO	20,2	2I,5	12
96–98	I8,0	I8,6	3	20,5	2I,I	II
99-I0I	I8,5	I8,6	5	2I,5	2I,5	14
102-104	20,8	19,9	2	21,9	21,3	7
105-107	· · · ·	- -	-	-	-	_
I08-II0				22,2	20,5	2
6 3- II0	•		169			154

Table 4 Pre-anal length in roundnose grenadier males and females 63-65 cm long in the sample taken in Div.2G in November 1979

Sex	Pre-ar	al lengt	h, cm	Range of	pre-anal	length,Numb	er
• • •	from :	to :	mean	: cm		% spe	c.
Males	I2,5	I4,9	13,9	2,4	I7,	3 40	
Females	I3,5	I5,6	14,4	2,1	I4,	6 27	

Table 5 Difference of pre-anal length (in % of fish length) of roundnose grenadier males and females in 1971, 1979 and 1980 samples

Year	Sex	M <u>+</u> m	S	Deg - rees of free	tcalc.table
1971	Males	21,55 ± 0,37	0,82	38	4,050 2,020
	Females	22,42 <u>+</u> 0,22	0,49		
19 79	Males	21,60 <u>+</u> 0,40	0,64	20	2 240 0 070
	Females	22,56 ± 0,48	0,7I	20	3,349 2,018
1980	Males	19,87 <u>+</u> 0,36	0,65		
	Females	21,21 <u>+</u> 0,19	 0,35	26	6,815 2,060

Note: M - mean value of pre-anal length (%);

m - mean error; S - standard deviation;

t - confidence criterion

Table 6 Difference of pre-anal length (in cm) of roundnose grenadier males and females 63-65 cm long in 1979 sample and 87-89 cm long in 1980 sample

Year	Sex	M [±] m	S	Degrees: of freedom	tcalc.	table
1 9 79	Males Females	13,92 <u>+</u> 0,18 14,44 <u>+</u> 0,24	0,58 0,62	65	3,54I	2,000
1980	Males Females	$17,70 \pm 0,25$ $18,32 \pm 0,42$	0,6I 0,98	45	2,621	2,020

Note: For symbols see _____able 5.

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