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Methods of Conversion of Roundnose Grenadier (Coryphaenoides Rupestris Gunnerus, Macrouridae) Ante-Anal Distance into Zoclogical Length

by

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ABSTRACT

Difficulties arising during measurements of roundnose grenadier zoological length are generally known. Both while fish lifetime and emptying trawl sacks tails of roundnose grenadier are frequently broken. Number of fish with broken tails in a catch sometimes exceeds 30-40%. The data on the ante-anal distance and zoological length measurements made it possible to work out keys for conversion of mass measurements into zoological length by ante-anal distance. Independent series were calculated. Errors in calculations of roundnose grenadier mean lengths did not exceed 0.5-1.0% of the actual data obtained during the surveys in the Hatton Plateau area and 1.5% of those obtained from the seamounts of the North Atlantic Ridge.

If combined keys are used the error in calculations of mean length is about 1.2% of actual data.

INTRODUCTION

Difficulties arising in the course of data on Macrouridae length composition collecting were described repeatedly (Jensen, 1976; Atkinson, 1979, 1980; Savvatimsky, 1981, 1984; Houston, 1983; Sahrhage, 1986).

During the long-term observations on roundnose grenadier length composition it was noted that in more than 50% of specimens tails were torn off. When the full length or zoological length measurements are impossible the measurements from the tip of the snout to the fork of the caudal fin (i.e. Schmidt's length),

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to the end of the scale-covering (standard length), to the insertion of caudal fin rays (commercial length), to the end of gill cover (length of head) and other measurements are used.

As Macrouridae have no caudal fin scientists use the ante-anal distance or length of head for measurements. Thus, Rannou used length of head of Nezumia sclerorhynchus as reference data during zoological length measurements (1976).

In 1976 Jensen proposed to use the ante-anal distance for mass measurements of roundnose grenadier (from the tip of the snout to the insertion of the first ray of the anal fin) and gave an equation for conversion of ante-anal distance measurements into zoological length. In subsequent years some scientists have published the results of conversion of roundnose grenadier ante-anal distance into full length and age, sometimes without dividing fish by sexes.

After publishing Jensen's article a detailed review of relevant literature was given in the papers of Atkinson (1980) and Savvatimsky (1984) where the necessity of studying the length composition separatly for males and females was proved.

In July 1980 the NAFO Scientific Council advised to make mass measurements of roundnose grenadier using the ante-anal distance. In 1981 the ICES came to the same conclusion (Sahrhage, 1986).

To our opinion, when we use a regression equation for conversion of ante-anal distance into zoological length the data calculated do not correspond to actual ones (Savvatimsky, 1984, 1985). The main reason for it is that the ante-anal distance increases non-linearly with fish growth and is characterized by a great variability in specimens of the same length.

Data on length-age composition of catches are the important part of the input data for calculating the stock assessment and the TAC by methods of mathematical modelling, for intraspecific structure analysis etc. To obtain objective data on length composition of catches mass measurements of roundnose grenadier with the use of the ante-anal distance are more preferable because of the absence of errors which are inevitable during measuring damaged fishes.

MATERIALS AND METHODS

During the cruises PINRO research vessels made measurements of zoological length and ante-anal distance of undamaged roundnose grenadier caught by the bottom and midwater trawls in the various parts of the species area of distribution (Table 1).

Zoological length was measured with 1 cm accuracy and the ante-anal distance - with 0.5 cm accuracy. Results of zoological length measurements were combined into length classes with 3 cm intervals (30-32, 33-35 etc.), those of ante-anal distance - into classes with 0.5 cm intervals. During working out keys for conversion of measurements the number of fish with the ante-anal distance measured in every 0.5 cm class were taken as 100 %. The keys were worked out for every region and for males and females separatly (Savvatimsky, 1984).

RESULTS

During conversion of length series into age composition scientists often use length-age keys taking into account length variability of fish of similar ages. We worked out analogical keys for conversion of mass measurements of roundnose grenadier ante-anal distance into zoological length. For every length-class we determined the ratio of fish of various zoological lengths using their ante-anal distance. Keys for conversion were made up for three regions of the North Atlantic for males and females separatly. Using the independent series has shown a plausible correspondence of calculated data to the actual ones (Fig. 1,2). Errors in calculated mean lengths of roundnose grenadier did not exceed 0.5-1.6 % of the actual data.

Usage of keys made by combining of data obtained in three regions (Tables 2,3) has given satisfactory results. Correspondence of calculated length series to the actual data was good, errors in mean length values were equal to 0-1.2 % (Fig. 3,4,5).

If conversion of mass measurements is made by a computer then collecting and processing of data on length composition of roundnose grenadier catches will be easier and more objective.

Mass measurements of ante-anal distance would be done with 0.5 cm accuracy, the results of measurements would be combined

into length series with 0.5 cm intervals between classes for males and females separatly. The proposed keys will allow to get the actual series of roundnose grenadier lengths.

CONCLUSIONS

Keys for conversion of mass measurements of roundnose grenadier ante-anal distances into zoological lengths are worked out separatly for males and females for three regions: Northwest Atlantic, North Atlantic Ridge and Hatton Plateau. Using these keys provides good correspondence of calculated data to actual ones. Errors in calculation of mean length did not exceed 0.5-1.6 % of actual data. Mass measurements of roundnose grenadier should be carried out by ante-anal distance (from the tip of the snout to the first ray of the anal fin), results of measurements should be combined into length series with 0.5 cm intervals between classes for males and females separatly.

The subsequent conversion of the obtained results of mass measurements using the combined keys will allow to get objective data on the length composition of roundnose grenadier in catches.

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Table 1 General characteristic of the material used

Areas	Years	Number of specimens	
		males	females
NW Atl., 3K + 2G	1978; 1983; 1986	474	497
North Atlantic Ridge	1984; 1986	533	328
Hatton Plateau	1983; 1986	571	329

Table 2 Combined key for conversion of mass measurements of roundnose grenadier males into zoological length by ante-anal distance, per cent (the North Atlantic area)

Ante-anal distance, cm	Zoological length, cm																											Number of spec.
	27-29	30-32	33-35	36-38	39-41	42-44	45-47	48-50	51-53	54-56	57-59	60-62	63-65	66-68	69-71	72-74	75-77	78-80	81-83	84-86	87-89	90-92	93-95	96-98	99-101	102-104	105-107	
6,0	100,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
6,5	40,0	20,0	40,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
7,0	-	42,9	42,8	14,3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7
7,5	-	25,0	75,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
8,0	-	6,7	20,0	53,3	13,3	6,7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15
8,5	-	-	-	11,8	52,9	35,3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17
9,0	-	-	5,0	5,0	15,0	35,0	25,0	15,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
9,5	-	-	-	-	-	27,8	36,1	33,3	2,8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	36
10,0	-	-	-	3,0	-	12,1	30,3	33,4	18,2	3,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	33
10,5	-	-	-	-	2,7	5,4	13,5	32,4	18,9	27,1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	37
11,0	-	-	-	-	2,4	4,9	9,8	14,6	17,1	24,4	19,5	7,3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	41
11,5	-	-	-	-	-	-	12,5	10,0	12,5	25,0	32,5	7,5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40
12,0	-	-	-	-	-	-	-	-	16,2	27,0	32,5	21,6	-	2,7	-	-	-	-	-	-	-	-	-	-	-	-	-	37
12,5	-	-	-	-	-	-	-	-	4,9	9,7	29,3	36,6	4,9	12,2	2,4	-	-	-	-	-	-	-	-	-	-	-	-	41
13,0	-	-	-	-	-	-	-	-	6,3	10,4	22,9	33,3	16,7	8,3	2,1	-	-	-	-	-	-	-	-	-	-	-	-	48
13,5	-	-	-	-	-	-	-	2,4	-	11,9	16,6	16,7	40,5	11,9	-	-	-	-	-	-	-	-	-	-	-	-	-	42
14,0	-	-	-	-	-	-	-	-	-	-	4,8	16,7	38,1	27,4	9,5	3,5	-	-	-	-	-	-	-	-	-	-	-	84
14,5	-	-	-	-	-	-	-	-	-	1,6	-	3,1	32,8	21,9	26,6	10,9	3,1	-	-	-	-	-	-	-	-	-	-	64
15,0	-	-	-	-	-	-	-	-	-	-	-	-	9,0	16,4	37,7	26,2	8,2	2,5	-	-	-	-	-	-	-	-	-	122
15,5	-	-	-	-	-	-	-	-	-	-	1,4	1,4	-	8,6	17,2	38,6	27,1	5,7	-	-	-	-	-	-	-	-	-	70
16,0	-	-	-	-	-	-	-	-	-	-	-	-	-	1,0	5,8	27,2	27,2	33,0	5,8	-	-	-	-	-	-	-	-	103
16,5	-	-	-	-	-	-	-	-	-	-	-	-	-	2,2	3,3	17,4	17,4	31,5	21,7	6,5	-	-	-	-	-	-	-	92
17,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4,5	19,1	36,4	22,7	14,6	2,7	-	-	-	-	-	-	110
17,5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,5	6,7	19,2	38,3	23,3	5,8	4,2	-	-	-	-	-	120
18,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,7	9,5	30,4	27,7	14,2	16,2	1,3	-	-	-	-	148
18,5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7,9	12,4	22,5	28,1	16,8	7,8	4,5	-	-	-	89
19,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4,9	19,8	21,0	29,6	19,8	4,9	-	-	-	81
19,5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14,3	57,1	14,3	4,8	4,8	4,7	-	-	-	38
20,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14,3	57,1	14,3	4,8	4,8	4,7	21
20,5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11,1	44,5	22,2	22,2	-	-	9
21,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100,0	-	-	-	-	2
21,5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100,0	-	-	-	2

Table 3 Combined key for conversion of mass measurements of roundnose grenadier females into zoological length by ante-anal distance, per cent
(the North Atlantic area)

Ante-anal distance, cm	Zoological length, cm																													Number of spec
	27-29	30-32	33-35	36-38	39-41	42-44	45-47	48-50	51-53	54-56	57-59	60-62	63-65	66-68	69-71	72-74	75-77	78-80	81-83	84-86	87-89	90-92	93-95	96-98	99-101	102-104	105-107	108-110		
I	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29		30
6,0	100,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		I
6,5	-	-	100,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		I
7,0	-	-	100,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		I
7,5	-	-	40,0	60,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		5
8,0	-	20,0	40,0	20,0	20,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		5
8,5	-	-	-	36,4	45,4	18,2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		II
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9,5	-	-	-	-	12,0	32,0	40,0	16,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		25
10,0	-	-	-	-	3,7	48,2	29,6	11,1	7,4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		27
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24,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100,0	-		1
24,5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50,0	-	50,0		2
25,0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100,0	-		1

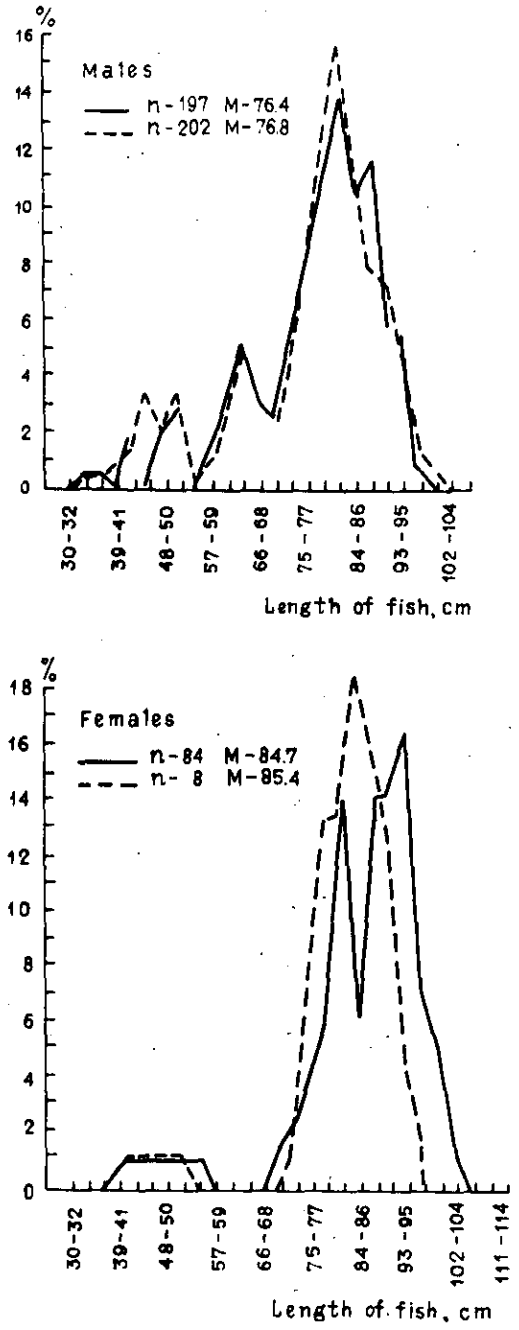

Fig. 1 Actual (solid line) and calculated (dashed line) length series for roundnose grenadier caught in the Hatton Plateau

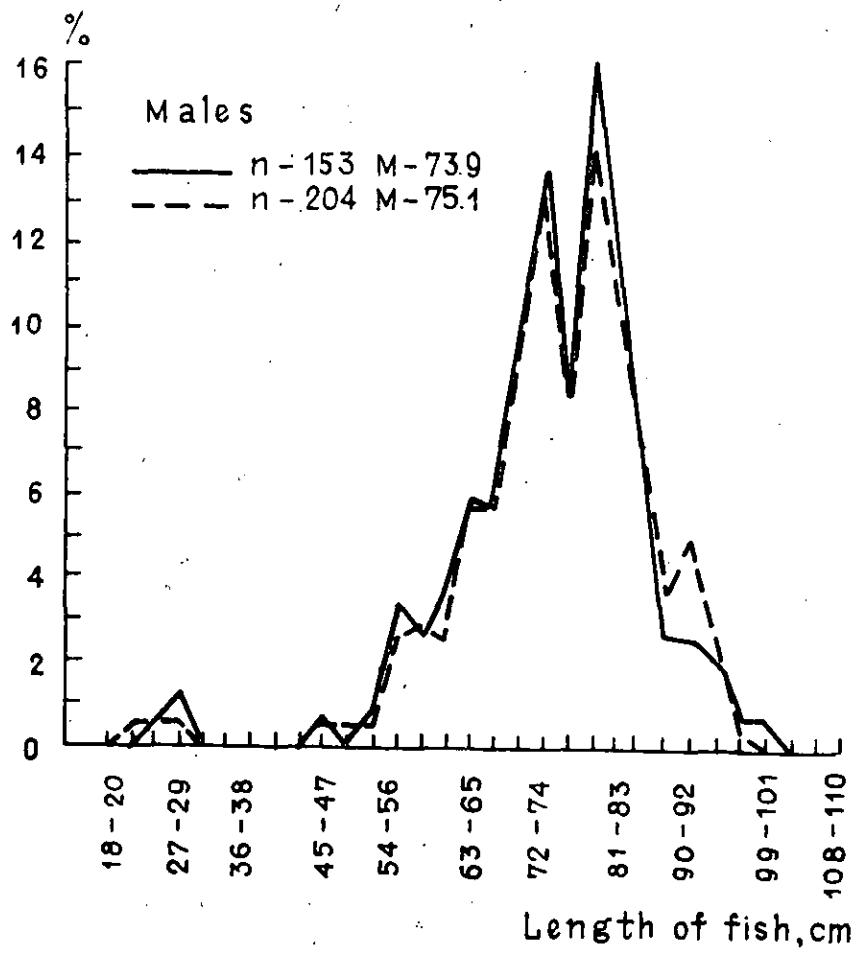

Fig. 2 Actual (solid line) and calculated (dashed line) length series for roundnose grenadier caught in the North Atlantic Ridge area

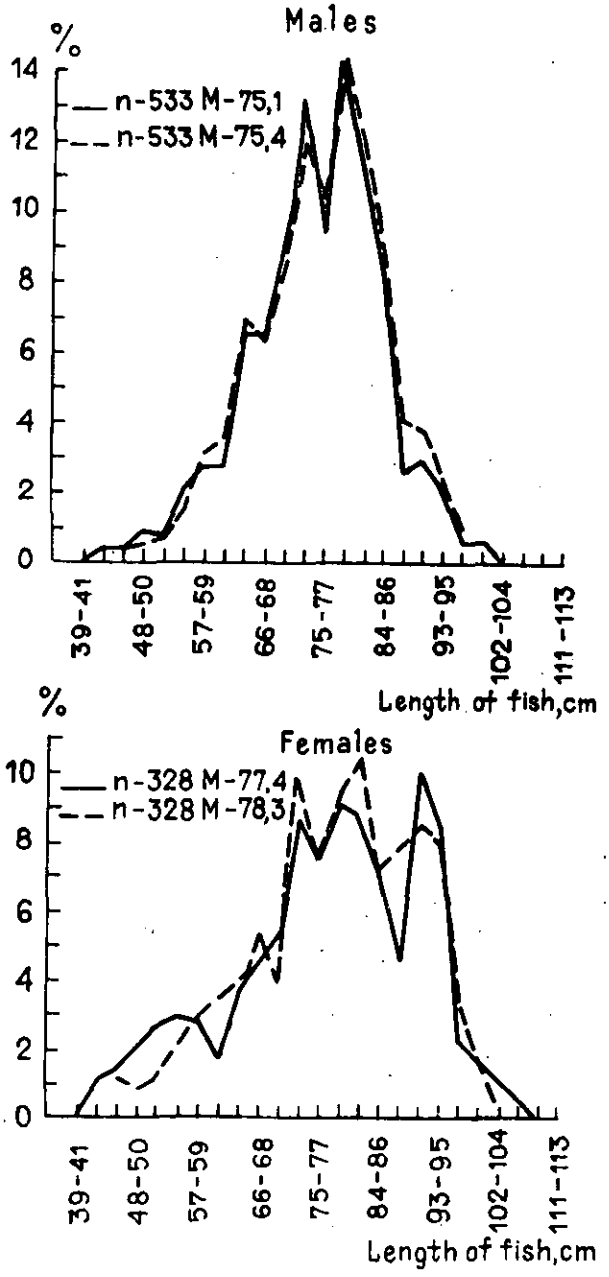

Fig. 3 Actual (solid line) and calculated by a combined key (dashed line) length series for roundnose grenadier caught in the North Atlantic Ridge area

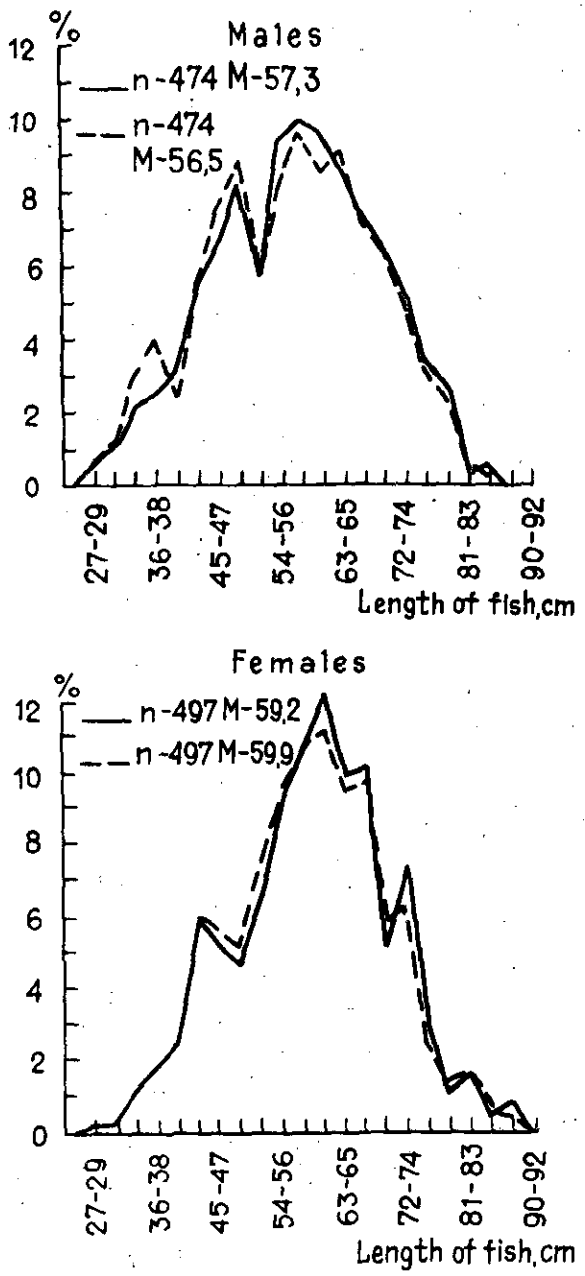

Fig. 4 Actual (solid line) and calculated by a combined key (dashed line) length series for roundnose grenadier caught in the North Atlantic Ridge area

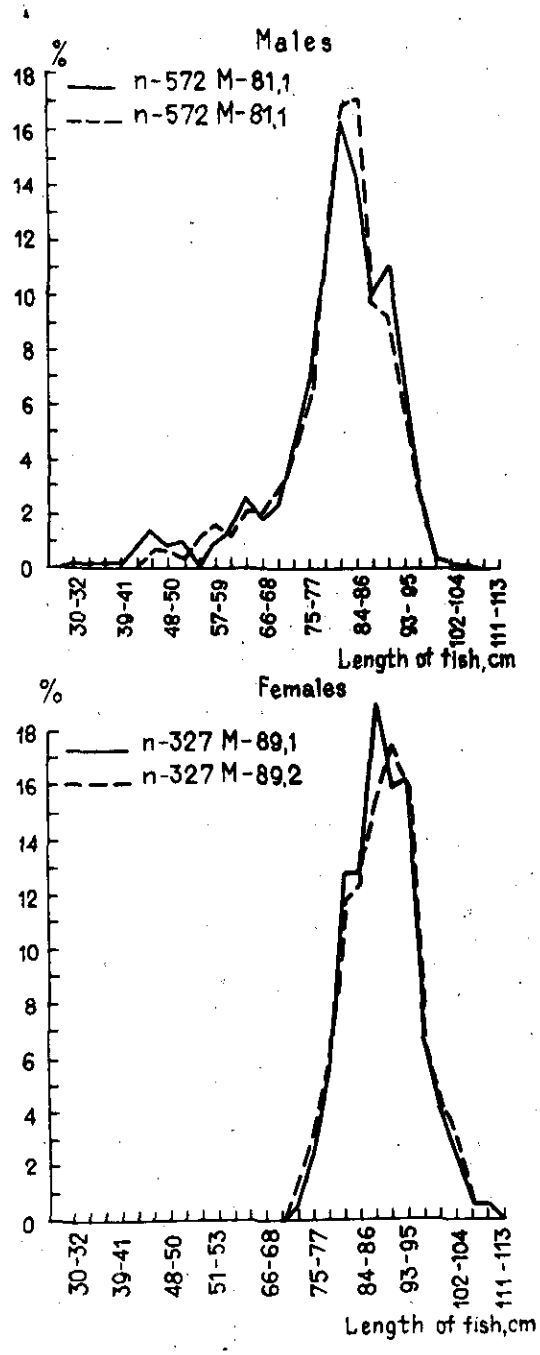

Fig. 5 Actual (solid line) and calculated by a combined key (dashed line) length series for roundnose grenadier caught in the Hatton Plateau area