

Northwest Atlantic



Fisheries Organization

Serial No. N1599

NAFO SCR Doc. 89/23

SCIENTIFIC COUNCIL MEETING - JUNE 1989

Expected Length Distribution of Cod in West Greenland Waters, 1989-91

by

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Introduction

In the West Greenland area, a legal minimum landing size for cod of 40 cm is presently in force. However the minimum landing size practised by the Greenland factories was 44 cm in 1988. The cod landed is subsequently sorted in two groups: 44-55 cm and above 55 cm.

In order to optimize the fisheries from an economical point of view, it is important for the managers of the fisheries to know the size distribution of cod in the coming years, and the Greenland Home Rule authorities have, therefore requested that the expected length distribution of the fishable stock in 1989-1990 should be described by the Scientific Council of NAFO.

Materials and Methods

For predicting length distributions it is necessary to have information on mean length at age and on the length distribution at different times.

Mean length of fish:

Mean length at age of cod in the West Greenland area shows very wide variations (Hansen, 1949, Hansen 1987) which has been attributed to growth conditions which vary between areas, years and year-classes. For this reason, it is difficult to rely on any previously used age-length relationship. Instead the observed mean length at age for the 1984 year-class, found by the Federal Republic of Germany surveys, has been used to calculate size-at-age using the von Bertalanffy equation (Table 1). As little growth occurs between the first and second quarters of the year, the annual length increment has been evenly distributed on the periods from 2nd to 3rd quarter, 3rd to 4th quarter, and 4th to 1st quarter.

Standard deviation on mean length:

It is assumed that length of cod at any specific age is normally distributed around the mean length. Based on samples from the commercial fisheries it has been shown that the standard deviation is proportional to the mean (Hovgaard, 1988 Fig.2).

From the results of the Federal Republic of Germany survey in 1988, the standard deviation of the length distribution of the 1984 year-class is calculated to 13.3% of the mean.

Therefore, in the following analysis it is assumed that the standard deviation is proportional to the mean with a coefficient of variation of 13.3%.

Weight distribution:

In managing the fisheries it is more important to know the proportion of different size groups measured in weight. For this

reason, mean weight was compiled as : $\text{weight} = K \times \text{length}^3$, where K is the condition factor. A condition factor of 1.0 seems to be a reasonable mean value as judged from Hansen (1987).

Results

The proportion of cod in three different size groups (<40, 40-55 and >55 cm) is given on a quarterly basis in Table 2. Based on numbers, the majority of cod occur in the 40-55 cm size group until the 4th quarter at age 6. From then on the majority of fish exceeds 55 cm. However, based on weight the two landing categories account for about equal parts of the landings in 4th quarter at age 5, whereafter fish above 55 cm dominate.

At present, the stock is dominated by the large 1984 year-class. The size of the 1985 year-class is estimated to be 18% of the 1984 year-class (Anon, 1989) whereas the 1986 year-class is very small. As the number of cod older than those of the 1984 year-class is also insignificant the expected size distribution of the cod catches during 1989-91 can be evaluated by considering only the 1984 and 1985 year-classes (Fig.1).

During 1989 only a small proportion of the stock (3-8% by number, 1-3% by weight) will be below landing size. The majority will be in the 40-55 cm group. However at the end of 1989 fish above 55 cm should constitute about half the stock by weight. In 1990 and 1991, cod above 55 should dominate the catches.

Discussion

Hovgård (1988) predicted a mean length of 50.5 cm of the 1984 year-class in the catches of the FRG trawl survey in 1988. However, the mean length showed up to be 48.2 cm indicating less growth than expected. The increase in mean length from 1987 to 1988 was only 5.5 cm. This has resulted in a low L estimate of 63.6 cm in von Bertalanffy equation given in this paper.

A relatively poor growth in 1988 was also the impression when reading the otoliths at the institute.

In the first quarter of 1989 a few commercial catches from the offshore area have been sampled. The mean length of the 1984 year-class in these samples ranged from 49.1 cm to 52.8. The size of the 1984 year-class in the commercial fishery in spring 1989

can finally be compared to mean sizes of 5 year old cod in the same fisheries in 1979-84 (Table 3). The present mean size is within the size range experienced although in the very low end.

It seems, therefore, that last years prediction of the growth was too optimistic. However, this years prediction can very well be to pessimistic as it is assumed that the very low growth rate is continuing in coming years.

References

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Table 1. Observed mean length from the Federal Republic of Germany autumn surveys and calculated length by the von Bertalanffy equation.

<u>Age</u>	<u>Observed Length</u>	<u>Calculated Length</u>
1	21.6	21.8
2	33.2	33.7
3	42.7	42.2
4	48.2	48.3
5		52.7
6		55.8
7		58.0
8		59.6

Table 2. Expected mean length and proportions of cod in three categories of cod of the 1984 year-class at age 4-7 given on a quarterly basis.

Age	Quarter	Mean Length		% of cod (numbers)		% of cod (weight)	
		Length	Std	< 40 cm	40-55 cm	< 40 cm	40-55 cm
4	1	44.2	5.88	21.2	76.1	11.1	83.2
	2	44.2	5.88	21.2	76.1	11.1	83.2
	3	46.2	6.14	13.8	79.8	6.5	81.2
	4	48.3	6.42	8.5	78.4	3.6	73.9
5	1	49.8	6.62	6.0	74.6	2.2	66.5
	2	49.8	6.62	6.0	74.6	2.2	66.5
	3	51.3	6.82	4.2	69.0	1.4	58.0
	4	52.7	7.01	3.0	62.6	0.9	49.7
6	1	53.7	7.14	2.3	57.6	0.7	43.9
	2	53.7	7.14	2.3	57.6	0.7	43.9
	3	54.7	7.28	1.8	52.6	0.5	38.4
	4	55.8	7.42	1.4	47.0	0.4	32.8
7	1	56.5	7.51	1.2	43.5	0.3	29.5
	2	56.5	7.51	1.2	43.5	0.3	29.5
	3	57.2	7.61	1.0	40.2	0.2	26.4
	4	58.0	7.71	0.8	36.5	0.2	23.2

Table 3. Number of cod examined and average length by age-group in samples of trawl catches from Div. 1CDE off West Greenland during the first two quarters of 1979-84 (from Hansen, 1987).

Age (yr)	Number of cod						Average length (cm)					
	1979	1980	1981	1982	1983	1984	1979	1980	1981	1982	1983	1984
2	—	—	—	1	—	1	—	—	—	22.0	—	16.0
3	2	46	—	118	1	93	38.0	34.3	—	32.2	27.0	26.1
4	520	233	234	40	471	92	47.6	47.6	48.0	41.9	45.2	39.3
5	736	533	86	1527	159	486	59.0	57.7	58.9	54.6	50.8	49.3
6	1052	277	207	293	1437	50	70.7	68.1	65.2	64.7	59.8	59.8
7	55	590	50	503	161	368	78.0	76.4	74.4	72.5	70.4	65.6
8	133	19	156	232	229	17	87.2	85.3	81.5	81.2	76.1	72.2
9	28	40	4	166	97	40	89.1	86.6	80.8	86.1	81.0	78.3
10	26	5	13	16	53	11	95.4	91.0	88.8	95.5	79.9	80.6
11	17	1	2	50	2	23	97.8	94.0	95.5	98.7	103.5	82.5
12	3	4	—	1	7	—	115.7	86.5	—	115.0	87.3	—
13	5	1	—	11	2	3	104.6	102.0	—	108.9	111.0	78.0
14	4	—	1	4	2	—	110.0	—	86.0	101.3	81.5	—
15	1	—	—	2	—	—	115.0	—	—	113.0	—	—
16	—	—	—	—	—	—	—	—	—	—	—	—
17	1	—	—	—	—	—	108.0	—	—	—	—	—

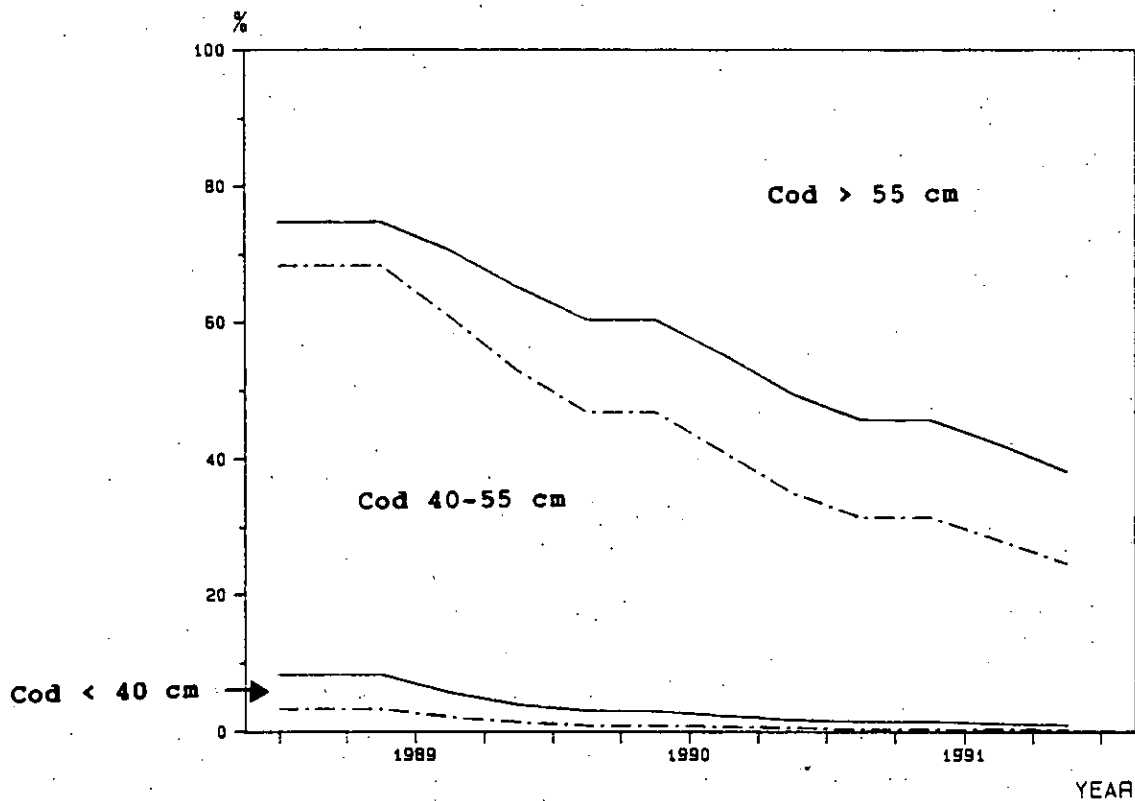


Fig. 1. Expected size distribution during 1989-91 of the year-classes 1984 and 1985 combined assuming relative year-class size of 100:18. Solid lines by number, broken lines by weight.