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The Age-Composition of the Stock of Cod in West Greenland Waters in the Years 1924 to 1938.

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In order to investigate the occurrence of the year-classes in the stock of cod at West Greenland a great number of otoliths of cod has been collected and age-determined during the period: 1924 to 1938. Nearly all the cod from which otoliths have been taken are measured and sexed. Cod of the youngest groups, the I-, II- and III-group, have been fished for with the eel-seine near the shore. The length measurements and the results of the fishery for the youngest age-groups shall be dealt with in a future paper. Here the age-analyses on older cod only shall be mentioned.

The otoliths have been used for the age-determinations, not scales owing to their much more indistinct winter-zones. In the otoliths the winter-zones are very distinct and it is possible to read the age even when very old specimens are dealt with.

The material from 1924 is collected by Dr. Å. VEDEL TÅNING, who then began the investigations on board the H.M.S. "Islands Falk". The material from this year is collected mainly near the fishery stations of Godthaab and Sukkertoppen.

In 1925 the material is taken from the "Dana" on the offshore banks.

In 1926 and 1927 the present author collected the samples in the South Greenland districts, excluding the Julianehaab district.

In 1928 two samples were taken by the "Godthaab"-expedition, one at Sukkertoppen, another on the Lille Hellefiske-bank.

In 1929 a material was collected in Julianehaab district from the M/B "Otto Fabricius" and another sample was taken at Sukkertoppen by the fishery leader of the fishery station at this colony.

From 1930 to 1938 the author has collected otolith samples, the first year from catches made from the motorboat "Misilissok", the following years from catches from the motorboat "Umarissok".

On the offshore banks samples have been taken from commercial catches by a Faroe cutter, at the initiative of Dr. VEDEL TÅNING, who has kindly placed the material at my disposal for age-analyses.

From 1934 to 1938 a large number of samples has been taken at the different fishing stations along the Greenland coast from Claushavn to Cape Farewell on the instigation of "Grønlands Styrelse".

The samples originate from cod caught with the fishing gears generally used in West Greenland, viz., the Faroe hand-line and the long-line, but especially with the jig. The samples from the offshore banks are exclusively of cod taken with Faroe hand-line.

We have done our best to make the samples as representative as possible. The fishing gears used, however, must be selective of specimens and the analyses cannot be representative for the whole stock of cod, the smaller age-groups being absent.

Also another deficiency may be mentioned. The "Grønlands Styrelse" buy cod only when larger than about 60 cm. for production of salted cod, while cod of sizes below that limit are refused as undersized. In most cases the Greenlanders land such undersized cod for home consumption, but in other cases the small cod are liberated immediately when caught, which means that otoliths of the small cod are missing from the material. A cod of the size mentioned, viz. 60 cm., is usually five years old, and accordingly the percentages obtained can not be representative for the stock of cod belonging to the age-groups III—V (the still younger ones never being caught by commercial implements).

At the beginning the samples were collected over a short space of time only, but from 1930 to 1938, and especially from 1934 to 1938, we have tried to procure the samples from different periods of the fishery season, the greatest part, however, being from

the months when the best fishing takes place, viz., July and August.

The number of specimens age-determined from 1926 and 1927 is comparatively low. Supplementary length measurements, however, agree with the age-determination and show that one single year-class predominates and that the other year-classes are of no importance.

The material is divided into three groups according to different areas where it has been obtained, viz.: (1) the northern districts, (2) the southern districts and (3) the offshore banks.

The northern districts include the Godthaab district and more northerly ones. The samples are from the coast as well as the fjords.

The southern districts include the Frederikshaab and the Julianehaab districts. Also here the material is collected both at the coast and in the fjords.

The offshore banks include material from the following banks, mentioned from north to south: Store Hellefiske bank, Lille Hellefiske bank, Fylla bank, Fiskenes bank and Dana bank. Most samples are from the three northern banks.

The division between the northern and the southern districts is natural of several causes; thus:

1. Breeding places for cod have not been found in the southern districts but occur in the northern ones.

2. The emigration to spawning places at Iceland has been much more extensive from the two southern districts than from the northern ones. The results of age-analyses of catches of cod from 1924 to 1929 and from 1930 to 1933 have been dealt with at some length in previous papers by the present author (see list of literature), who is here dealing with the material in a somewhat different way, and some details of the material is therefore given below.

The material of otolith samples is distributed as follows as to areas and years:

Year	Northern Districts	Southern Districts	Offshore Banks	Total
1924.....	314	—	41	355
1925.....	—	—	108	108
1926.....	388	—	—	388
1927.....	144	122	—	266
1928.....	271	—	34	305
1929.....	500	579	—	1,079
1930.....	307	1,731	113	2,151
1931.....	1,431	176	172	1,779
1932.....	1,588	983	577	3,148
1933.....	2,074	670	691	3,435
1934.....	4,024	2,320	348	6,692
1935.....	2,696	1,109	298	4,103
1936.....	2,758	1,714	301	4,773
1937.....	1,499	1,470	473	3,442
1938.....	1,724	1,559	298	3,581
	19,718	12,433	3,454	35,605

The total number of otoliths that has been age-determined in 1924 to 1938 is 35,605; all analyses are carried out by the author.

The results of the age-analyses in the different years and in the three different areas are given in Fig. 1, the distribution of the year-classes has been given in percentage.

The figure shows that in the early years two or three year-classes are predominant in the catches while all other year-classes are of no importance and are frequently missing from the material. Since 1934 the fluctuations within the single year-classes are less pronounced than in previous years.

Fig. 2 gives the mean curves and the deviation of the age-groups from the mean in the different years. For the northern districts the mean curve is calculated from material of the thirteen years 1924 and 1926 to 1938. For the southern districts the material includes eleven years, 1927 and 1929 to 1938. The mean curve for the offshore banks is calculated from the material of the twelve years 1924, 1925, 1928 and 1930 to 1938.

The Northern Districts.

In this area eight year-classes predominate; they are: 1912, 1917, 1922, 1924, 1926, 1931, 1932 and 1934.

The 1912 year-class has been of small importance only during the period under discussion and from 1933 it disappeared from the catches.

The 1917 year-class has been of greater importance. In 1924 it was by far the richest year-class in the material. From 1926 to 1929, it was of minor importance which may be explained by the enormous magnitude of the 1922 year-class. The great number of individuals of the 1922 year-class prevented cod belonging to other year-classes to be caught. The Greenlanders succeeded in fishing this year-class in very shallow water, five to ten fathoms, and did not fish for the larger cod in deeper waters. In 1930, and especially from 1931 to 1935, an emigration of the 1922 year-class in particular to Icelandic waters took place as clearly demonstrated by marking experiments. The resulting decrease in number of individuals of this year-class raised the percentage occurrence of the 1917 year-class, that accordingly has been caught in numbers above normal during 1931 to 1933, when the percentages are above the percentages of the rich 1922 year-class even at corresponding ages.

This is shown by the following table in which N = the percentage of individuals, D = the deviation from the mean in percent.

Year-Class.....	1917		1922	
Age-Group	N	D	N	D
XIV-Group	13.6	11.1	6.7	4.2
XV —	11.8	9.9	4.9	3.0
XVI —	11.4	10.1	2.2	0.9

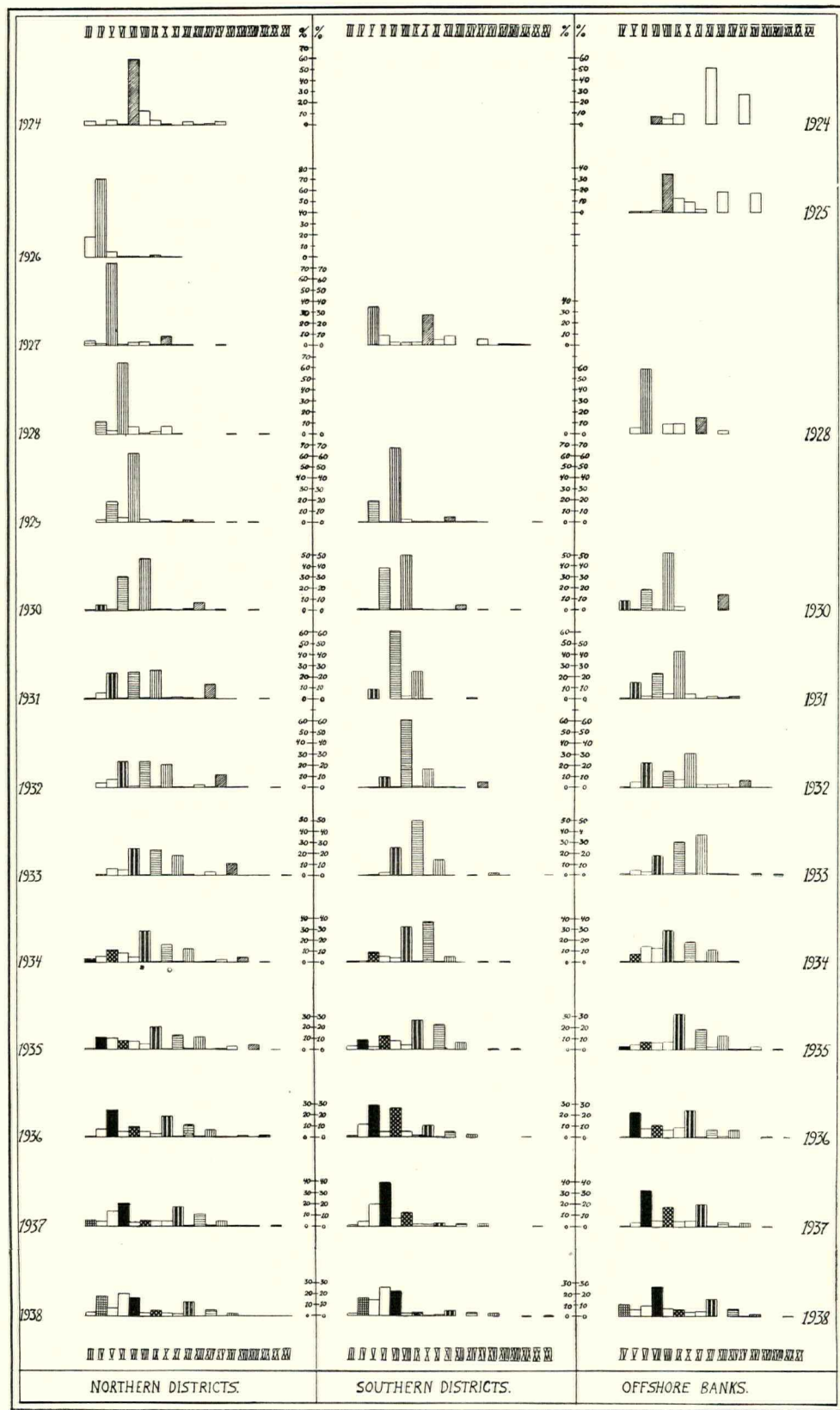


Fig. 1. Age-Composition of the Stock of Cod in West Greenland Waters, 1924–1938.

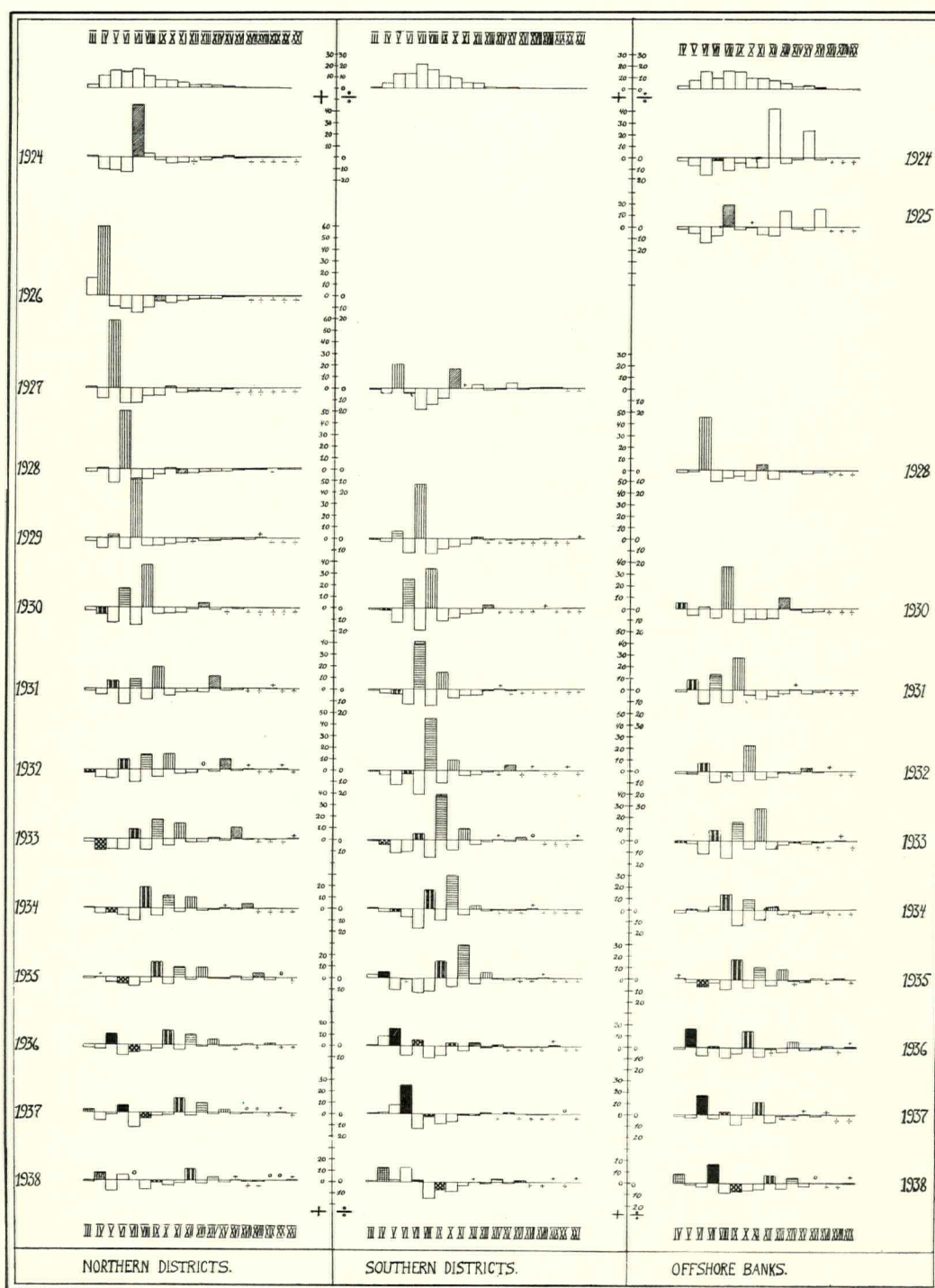


Fig. 2. Mean and Deviations from the Mean, 1924–1938.

This seems to indicate that individuals of the 1917 year-class did not emigrate to Iceland to any great extent.

The 1922 year-class has been the most important, especially during the period 1926 to 1931. In some years the whole fishery depended on that year-class only. From 1929 to 1931 the year-class shows a great decrease owing to extensive emigration to Iceland.

The 1924 and 1926 year-classes have both been of importance in the northern districts, but at no season in such enormous numbers as the 1922 year-class.

The 1931 year-class has been above the mean in 1936 and 1937 only, and in 1938 it just touches the mean.

The 1932 year-class has been above mean in 1938 only. The 1934 year-class has been present in small numbers in the commercial catches of 1938, but most individuals are as yet undersized cod, and it is too early to say anything definite about its future importance. Considering, however, the fact that the 1934 year-class in 1935 and 1936 as the I- and II-group was very common in the catches made with the eel-seine along the shores, it must be present in large numbers in the sea, and very likely this year-class, when it reaches a more suitable size, will be of importance in the fishery during 1939 and 1940.

The Southern Districts.

Predominant year-classes in this area correspond with those of the northern districts but the fluctuations seem more strongly pronounced.

The 1917 year-class has not occurred as numerous in these districts as in the northern ones. It is outstanding in the sample from 1927, but the material from this year has not been collected in such a representative way as in the other years and ought probably to be discarded. Measurements of samples show that we have much the same sizes represented in 1927 as in the northern area.

The 1922 year-class has decreased much more rapidly in the southern area owing to the greater emigration to Icelandic waters shown by the marking experiments.

The 1924 year-class has been of much greater importance than in the northern area, but also this year-class has decreased more abruptly in south than in north.

The 1926 year-class has been less numerous in the catches than in the northern districts.

From 1935 to 1936 a distinct change has taken place, the three older year-classes 1922, 1924 and 1926 have suddenly decreased, leaving three younger year-classes, viz., 1929, 1931 and 1932, to predominate in the material.

The 1929 year-class, however, is above mean in the year 1936 only, and in 1937 and 1938 of small importance.

The 1931 year-class has been stronger in 1935 to 1937 than in the northern districts but in 1938 it has decreased much and is only just above mean.

The 1932 year-class has been better than in the northern area and has been above normal in the commercial catches ever since 1935.

Also the 1934 year-class has been good. The percentage is similar to that for the northern districts, but still well above the mean, owing to the fact that material from 1926 and 1928 has not been available for calculating the mean for the southern districts.

The difference between the age-groups IV to VII is small only in 1938, the V-group, however, being less than the others.

As in the northern districts the stock of cod did not show the violently pronounced fluctuations in the year-classes during later years. (This phenomenon is accordingly similar in north and south.)

The Offshore Banks.

The material from the offshore banks is not so representative as that from the coastal districts, especially from the first three years.

In spite of this, the results from 1924 and 1925 seem, however, to agree very well. In the first of these two years only two year-classes, 1909 and 1912, predominate strongly; in 1925 the 1917 year-class occurs in greater numbers than the 1909 and 1912 year-classes which, however, both are very well represented. In the material from later years, viz., in 1928 and in the years 1930 to 1938, they are not present.

The analyses from the offshore banks agree well with those from the northern districts. From 1930 to 1933 the 1922 year-class, however, is stronger on the banks than in the northern districts.

It seems to be a rule that the three predominant year-classes, 1922, 1924 and 1926, are stronger as IX-, X- and XI-groups on the banks than in the northern districts.

The 1931 year-class also occurs on the banks. It has been the most numerous year-class here during the last three years.

The 1932 year-class has not been of similar importance — according to the analyses it was below normal.

In 1938 the 1934 year-class enters the catches as the IV-group and it has a considerable strength in spite of its young age. It seems to be a promising year-class for the fishery in the future.

Summary.

The results of the numerous age-analyses can briefly be summarised as follows:

The catches of cod at Greenland consist of a great number of age-groups, viz., up to about nineteen.

During the period 1924 to 1938 eight to nine year-classes have been of considerable importance in the catches taken at West Greenland, viz., 1909, 1912, 1917, 1922, 1924, 1926, 1931, 1932 and 1934.

Of these year-classes the three first-mentioned have now disappeared from the commercial catches owing to their great age.

1922, 1924 and to some degree 1926 are disappearing also from the catches.

The 1929 year-class has been of brief importance especially in the southern districts and has never been comparable with the other good year-classes mentioned.

Possibly the 1931 year-class has culminated and is decreasing; a drop in the percentage has been recorded from 1937 to 1938.

The 1932 year-class is probably good. Looking at Fig. 2 it appears that this year-class has not been so much above the normal as other well-known good year-classes neither in the northern nor the southern areas (the 1926 year-class excepted, however, in south). On the offshore banks this year-class is poorly represented.

The 1934 year-class is perhaps that of the younger year-classes which can be most relied upon as having some chance to be of importance in the future fishery in Greenland waters.

It may here be mentioned that the 1936 year-class in 1937 and 1938 has been taken in great numbers by the eel-seine in coastal waters (as the I- and II-group respectively). It may be expected that this year-class also will be of some importance when it enters the commercial catches in 1941 and 1942.

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