

Serial No. 1599Document No. 94ANNUAL MEETING- JUNE 1964On the Migrations of Cod in West Greenland

by I.N. Sidorenko

The regular observations for cod migrations and cod tagging experiments off the western coast of Greenland were started in the twentieths of this century. At first, the observations were made on a small scale as they were carried out by Denmark only. Then, with the development of fishery in this area, the investigations of cod were carried out by many countries-participants and on large scale. There has been a lot of papers on cod studies since establishment of the ICNAF. Nevertheless, we have still no clear understanding of the most important processes of cod life: of their distribution and migrations, studying of which is of great importance for the successful fishery.

The whole material on cod tagging obtained by the Danish and Icelandic scientists (the results were given in many papers) was analysed mainly in respect to the correlation between the West-Greenland cod and that of the areas of East Greenland and Iceland. These papers show that the cod of the southern and south-western parts of Greenland are most closely related to the areas of Iceland.

There are few papers on the seasonal migrations of cod to of the West Greenland stock located to the north of  $61^{\circ}30' N$  and which at present forms the basis of the fishery in the Davis Strait.

The scheme of the seasonal migrations of cod along the western coast of Greenland suggested by Rasmussen shows only the main migratory paths of cod to the south to the spawning grounds - in winter, and to the north to the feeding grounds - in summer. This scheme is of a little practical use for the commercial fishery as it does not reflect the cod migrations for a shorter period of time. With the object of studying cod migrations in the West Greenland area in 1960, the works on tagging of cod were started by the USSR. The results of tagging for the period of 1960/1962 were given in our report submitted to the 13th ICNAF Annual Meeting. The report shows that our data are an addition to the Rasmussen scheme in relation to the areas and time of cod migrations. In 1963 we marked 2659 specimens of cod which provided 1.2% returns. All the tags, except two, were recaptured in the West Greenland area.

This paper is the first attempt to summarize the data on our observations of cod migrations along the western coast of Greenland which we carried out from 1957 to the beginning 1964.

To get a more clear understanding of migrations, we analysed, in addition to the results of tagging, some data on the areas and time of fishery, size and age composition, maturity, cod feeding and hydrometeorological data. It should be noted that we have no quite sufficient data to solve this problem, and only the tagging on large scale and joint efforts of all the countries participating in the investigations on the West-Greenland cod will help to do it. The first years of our investigations of cod off the West Greenland coast (1957/1959) showed that in the first half of the year the denser and more stable concentrations of cod on the central

Banana and Fyllas Banks were observed. The results of the investigation and fishery during the subsequent years pointed out to the formation of the concentrations of wintering cod, mainly immature and at first maturity stage, on these banks. During the winter /spring period we usually found the small and less stable concentrations of cod (though of a larger size) on the southern banks (from Fiskenes to Bezymyonnaya). The tagging experiments carried out later showed that the larger mature cod ripening near the spawning grounds in the warm waters of the Atlantic origin spend the winter on the western slopes of these banks. The shoaling of cod in the wintering area (the southern part of the Lille Hellefiske Bank, the Banana Bank and the northern part of the Fyllas Bank) had usually been observed since the second half of December. At first, cod was keeping at small depths, 80-150 m, then, with cooling of shallow waters, fish were sinking to greater depths (150-250 m) where the favourable thermal conditions exist. In January/ February, cod are comparatively inactive in the wintering areas and perform only short local and vertical diurnal migrations. This period may be characterized by the most effective fishery which is in a good agreement with the results of the fishery in 1962/1964.

The size-composition of cod in catches changed from time to time. In January, the large mature fish, migrating over the central banks to the southern spawning grounds, constituted a great part of the catches. In February, the number of large cod in catches noticeably decreased. Late in March and in April the efficiency of fishery in the wintering areas decreased owing to disappearance of the ripening cod, mainly recruits spawning on the slope in the area of the Banana and Fyllas Banks. During this period the immature cod remaining on the banks fed intensively. Their concentrations were rather active, and that made fishing for them more difficult.

The spawning of cod off the coast of West Greenland lasts from the end of March to June, reaching its maximum in April/May. The spawning grounds of the West-Greenland cod are located on the slope from  $61^{\circ}30'$  N to  $64^{\circ}30'$  N. In the years when early heating of shallow waters was observed, the post-spawning cod moved into shallow waters, where they mixed with the immature cod and for some time fed on small fish, krill and different bottom invertebrates before moving to the northern banks. In the years when good insulation was observed the catches of cod were usually great on the central and southern banks (Banana and Frederikshaab) in the spring-summer period: If these banks were covered with cold water by the end of the spawning period (spring - summer period), cod did not stay on them and took the offshore routes moving with the warm streams of the currents into the northern areas for feeding. The cod tagged in April/ June on the Frederikshaab and Danas Banks occurred in the central areas (the Fyllas, Banana and Lille-Hellefiske Banks) in June/August. The cod tagged in the spring period on the Fyllas and Banana Banks were caught as a rule in June/August on the Store- Hellefiske Bank, the main feeding area of the West- Greenland cod in the summer/autumn period.

It has to be noted that mentioning the long feeding migrations of cod rather means the specimens of 55 cm in length. An analysis of size and age composition of the recaptures enables us to conclude that the longest migrations in the West Greenland area are performed by specimens of 60 - 80 cm long. The cod up to 60 cm long were usually caught either in the tagging area or near it. Large fishes, over 80 cm in length, were caught as a rule not far from the tagging areas, at a distance of 15/30 miles. During the feeding migrations cod moved to the North areas with the speed of about 5 miles a day.

The greatest number of recaptures were taken in July/August from the Store-Hellefiske Bank. The feeding area of the Greenland cod was not limited by this bank. Some specimens migrate much farther and feed in the fjords lying north of this bank. Some specimens tagged by us in April/June on the Banana and Fyllas Banks were recovered in September approximately near 69° N.

The return southward migrations of cod to the wintering and spawning grounds began already late in September. However, the time of the cod migrations from the Store-Hellefiske Bank as well as of their appearance varied from year to year due to many reasons, and mainly due to the hydrometeorological conditions. In certain years cod concentrated on the Store-Hellefiske Bank rather early. In such years the concentrations of spent fish which came from the central areas can be fished there already in May. In autumn of warm years cod was keeping at the Store-Hellefiske Bank longer than usual and the effective fishery might be carried out till mid-December.

Thus, our research work and experiments on cod tagging enable us to conclude that:

1. The large concentrations of wintering fish formed from December to March in the central part of the western coast of Greenland (the southern part of the Lille-Hellefiske Bank, the Banana Bank and the northern part of the Fyllas Bank).

2. Immature cod and cod at first maturity stage were observed in wintering areas for a longer time. The large mature specimens began to migrate southwards to the spawning grounds already in January (the slopes of the Fiskenes Bank in the north, the slopes of the Bezymyannaya Bank in the south). The paths of the spawning migrations of the young mature cod were shorter, they spawned near the wintering grounds.

3. The northern banks, particularly the Store-Hellefiske Bank, should be considered as the main feeding area.

4. The time and paths of feeding migrations both of immature and spent cod varied from year to year. In certain years cod began to migrate to the north already in March but usually these migrations were observed in April/June.

5. In the period of early cooling of water on the Store-Hellefiske Bank cod performed the return migrations in September-October but whereas the natural conditions favoured autumn feeding of cod, the latter remained there until mid-December.