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"SHORT RESULTS OF THE SOVIET STUDY OF BLUE WHITING (MICROMESTIUS POUTASSOU (RISSO)) ECOLOGY IN NORTH ATLANTIC"

by

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Summary

On the basis of Soviet study there is given in the report the analysis of structure of blue whiting range distribution of size composition in the area and migrations, including active, passive, horizontal and vertical ones.

By comparison of gadid fish and herring areals and their feeding habbits the author comes to the conclusion that with depressive state of herring stock blue whiting fills in the niche in the Norwegian, Greenland and Barents seas.

Résumé

La publication contient l'analyse de la structure de la zone d'habitation du poutassou, de sa répartition par la taille, ainsi que l'analyse de sa migration active et passive, horizontale et verticale, faite à la base des travaux effectués par les chercheurs soviétiques.

En comparant les zones d'habitation du poutassou et du hareng et leur nutrition on peut en déduire que l'apparition du poutassou dans les mers de Norvège, de Groenland et de Barents comble le vide causé par l'état dépressif des ressources du hareng dans ces régions.

The special studies of poutasseau ecology in north Atlantic are conducted by the Soviet Union since 1965. Before that the material concerning poutasseau ecology had been collected along with the study of bottom and pelagic fishes (cod, haddock, perch, halibut, herring, capelin) in north Atlantic.

In 1965-1979 there were carried out 54 special expeditions on research and survey vessels (Table 1) which were studying poutasseau ecology according to uniform programme and method.

The results of this survey as well as the results of earlier studies of poutasseau ecology were published by Soviet scientists and specialists in fishery in their numerous articles. The list of these articles is given in bibliography to this report.

The main result of the Soviet studies of blue whiting 1965-1979 are given below.

The analysis of the collected material showed that blue whiting is widely distributed in north Atlantic, in the Norwegian, North, Greenland and Barents seas. The northern border of the areal lies from northern Spitsbergen through Mone sill to Jan-Maien then to northern Iceland, east and west Greenland and to Flemish Cap and Great Newfoundland banks (Fig.1). North-east border of the areal lies in the Barents Sea where poutasseau is constantly met in hydrologically warm and cold years. However the areas of mass distribution are not the same in these years, for in warm years poutasseau is distributed along Nord Cap and Murmansk currents. The maximum penetration of gadid fish in these years to the east in the Barents Sea up to 45°E is also known. In cold years the fish is distributed along west, south Spitsbergen and the northern branch of Nord Cap currents. As a rule distribution of this fish in the Barents Sea in cold and warm years coincides with demersal isotherm 3°.

As s whole this fish is met in north Atlantic at the temperature of 2 - 15°. Depending on physiological state the relation of the species towards water temperature is different. During the feeding period this fish is found at the temperature 2 - 3° up to 12°, but most often at 3 - 7°; in winter at 3 - 5°, during the spawning at 7 - 10°.

Unlike many cods this species spends the major part of its life in pelagialy, in water layers from the surface down to 360 - 500 m. During the spawning and the migrations towards shelf slope poutasseau stocks may be distributed in demersal layer (160 - 440m).

Gadid fish areal in north Atlantic may be subdivided according to its structure into a reproductive part which is situated in the south and a feeding part which lies to the north, to the border of the areal. The feeding part of the areal has a bigger surface, the reproductive part has a smaller one (Fig. 1).

Within the limits of the vast areal of blue whiting in north Atlantic there are subdivided 4 different populations (stocks) which differ in their distribution, inhabitance, spawning and feeding areas, size-age composition, certain morphometric features and the extent of vermin infection. These stocks are 1/ Mediterranean; 2/ West Atlantic; 3/ Biscay; 4/ Hebrides-Norwegian.

The last one is the most numerous which is due to vast spawning grounds, stable oceanologic conditions during the spawning, wide distribution of eggs, larvae and juveniles by the currents, long feeding migrations of adult fishes.

The reproduction areas of Hebrides-Norwegian stock of blue whiting are placed in the southern part of the areal and extend from west Ireland to Shetland and Farrer Isls in the south of Iceland. The feeding areas are the Norwegian, Greenland and west Barents seas.

By comparison of reproductive part of this fish areal in north Atlantic fixed by Schmidt (1909) 70 years ago with our data one may conclude that spawning area expanded and somewhat drifted to the north.

Earlier blue whiting was considered to spawn close to isobath 1000 m. These data did not prove to be correct. All over the spawning grounds this fish spawns in demersal layers over the depths of 180-440 m. The spawning takes place in February - June, in the south of spawning grounds - in February - March, in the north - in March - June. The most intensive spawning of this fish in north Atlantic happens to the west of Great Britain and Ireland.

Blue whiting larvae on early stages of development were found in many areas, as a rule beyond the 200 m isobath. The direction of larvae drifting is determined by prevailing currents in a particular region.

From western Great Britain and Ireland larvae and later on fingerlings drift along the main stream of North Atlantic current in the general north-west direction, to Farrer-Shetland channel and partly with the stream branches is drawn to the North Sea (Fig. 2). Some larvae and fingerlings drift along the branch which is formed under the influence of Rockall Bank relief to the left of the main stream. They move north-west and west reaching Farrer-Iceland Channel, south-east and south Iceland. The Iceland larvae drift with

Irminger current to the west and south-west.

In the Norwegian Sea larvae drift from Lofoten Isls to the north with the warm Spitsbergen current.

The larvae hatched out in the north of Biscay Bay are likely to drift both south-east and along the continental slope to the north.

Distribution of poutassoau juveniles 5-10 cm long is connected mainly with warm Atlantic waters. The majority of juveniles is observed to the north of 56-58°N.

The dynamics of poutassoau of different length distribution in the Norwegian and Greenland seas shows that for older individuals it is usual to inhabit west, north-west parts of the Norwegian sea and south, central and eastern parts of the Greenland sea (Fig.3). The highest number of juveniles is distributed in the Farrer area, along the continental shelf of Norway, particularly in the north of the North Sea. Juveniles are also met to the south of Iceland and in the Barents Sea.

Size-sex composition of this fish in all areas has one common regularity - with bigger size the number of females is higher. Among the fishes 28-29 cm long and more females always prevail. With the length 24-35 cm females make 90-100 % (Fig.4). The growth of females' number with bigger length ensures higher fertility of the population.

Blue whiting males mature at the length of 17-20 cm (at the age of 2) and at the length of 23-25 cm (at the age of 3-4 or more) 90% of fishes join the spawning part of the stock. In mass females mature later than males, at the length of 24-28 cm (at the age of 3-6). In all areas with the exception of the Barents Sea, the rate of male maturing exceeds that of females. No such difference is observed in the Barents Sea. All year round, irrespective of length or

sex poutassеau is in the I, II and VI-II stages of maturity. The main reason of abnormal maturing of this fish in this part of the areal is low water temperature in the Barents Sea.

Hebrides-Norwegian stock of this fish is characterized by: multiaged structure of the spawning part of the stock with older fish groups prevailing. Taking into account the length of gadid fish life, yearly spawning, multiaged structure of spawning concentrations, prevailing rematuring fish in spawning areas we come to a conclusion that the remainder of stock prevails over the new one.

Fertility of gadid fish 23-27 cm long ranges within 51-315 th. eggs. Individual fertility grows with bigger length. Gadid fish is referred to those with unbroken cycle of ovocytes' maturing. During one spawning season a female spawns 3-4 portions of eggs.

Long horizontal and vertical migrations are typical of Hebrides-Norwegian stock of poutassеau After spawning fish concentrations migrate from the area to the west of Great Britain and Ireland to the north for feeding, to the south of the Norwegian Sea through Farrer-Shetland channel and in smaller number through Farrer-Iceland sills. Mass migration of feeding this fish to the south Norway Sea happens in the first half of summer. The migration ways of the stocks in the Norway Sea and further on to the Greenland Sea lie annually in the northern direction, first along the brink of the East Iceland current then to the north and north-west and in the end of September-October a part of concentration moves to Jan-Maien area, Mone sill and reaches the south of Medvejinskaya Bank (Fig.5). Then the opposite migration takes place, to wintering grounds situated to the east of Iceland, to mixed waters.

lasts 2.5-3 months, from October till December. Blue whiting migration to spawning grounds begins in the end of December and lasts all January and the major part of February. By the end of February concentrations migrate to the area lying to the west of Great Britain and ditsribute over the spawning grounds along the bank and continental slopes. Migrations to spawning areas go not only through the Farrer-Shetland channel but also through Farrer-Iceland sill (Fig.6).

Thus long migrations of this fish are determined by feeding, wintering and spawning. The longest migrations take place in the Norway and Greenland seas where during feeding blue whiting reaches 70-72°N.

Vertical migrations of this fish depend on physiological state, hydrologic conditions, distribution of feed organisms and lighting.

In summer time the range of vertical migrations is smaller (25-150 m) than in autumn and spring (250-350 m).

Like for the majority of pelagic planktonophages it is typical of this fish to go down to lower water layers at dawn, as if to a protected zone, and to move up chasing the food at dusk. In other words, there is an obvious adaptation by detecting zooplankton, protection from predators and preservation of abundance - a triple biotic connection named "triotroph".

Poutasseau distribution of the Hebrides-Norwegian stock during feeding and wintering in the Norwegian, Greenland and Barents seas coinsides with the distribution of Atlantic Scandinavian herring. The feeding of these two species during the feeding period is based on the same feed organisms.

Thus the material collected in 1963-1971 in the Norwegian and Greenland seas shows that the rate of food similarity

Blue whiting and herring ranges in different months from 3.5 to 42.5 with the mean year value of 25.5. This last rate is not too high, nevertheless the growth of the rate of food similarity during the feeding period up to 42.6 may be regarded as a factor leading to the conclusion that feeding relations between gadid fish and herring are tense. However the time of mass feeding of these two species is different. Herring is the first to feed on the first generation of zooplankton in the south and central part of the Norwegian Sea. When it migrates farther to the north poutassеau moves to the area to feed on the second generation of zooplankton. The lack of coincidence between the time when poutassеau and herring start to feed is due to different ends of spawning time. That is why there are no tense feeding relat_ions or species competition between this fish and herring. On all stages of their life cycle poutassеau and herring are separated either in space or in time. Even during their wintering when the two species are distributed in the same geographic co-ordinates they are separated by different depths since blue whiting populations inhabit higher layer than herring. The two species occupy different ecologic niches which is the result of evolution and makes possible their coexistance due to which they use for the increase of population's biomass the most productive areas of the Norwegian, Greenland and Barents seas. Presently that the herring stock is in depressed state, poutasseau has favourable conditions for filling in the niche of poutasseau. This process is likely to be taking place, since lately this fish has been unusually widely distributed in the Norwegian, Greenland and Barents seas with its abundance considerably growing compared to the 50-ies and 60-ies. On the basis of calculation

of food ration of poutasseau there was stated that with the general stock of 5-7 mln.t this species annually eats out during its feeding excursions in the Norwegian sea about 20-28 mln.t of zooplankton, i.e. about the quantity which may be consumed by herring with population abundance 2.5-5 mln.t

The feeding basis of fishes-planktonophages in the Norwegian Sea is limited (yearly average of food zooplankton is about 55 mln.t) and in some years there may be observed tense feeding relations in pelagialy.

There should be pointed out that the energy of food assimilation is spent by poutassseau mainly on metabolism, much less on formation of genital products and quite insignificant part on growth. Owing to this the fish has low effectiveness of the consumed food compared to Atlantic Scandinavian herring. In other words the feeding of blue whiting in the Norwegian, Greenland and Barents seas is less economical from the point of view of the use of food compared to the feeding of Atlantic Scandinavian herring in the same seas.

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Number of specialized expeditions and days-vessels spent in the sea for the study of blue whiting ecology in 1965-1979.

Years	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Number of specialized expeditions	2	3	2	1	5	6	3	2	3	3	2	3	7	6	8
Number of days-vessels sent in the sea for the study	74	176	50	30	271	372	175	131	207	193	165	116	375	576	871

S U B T I T L E S

to the figures for the article by V.K.Zilanov "Short results of the Soviet study of blue whiting (Micromestius Poutassou (Risso)) ecology in North Atlantic".

Figure 1. Blue whiting areal according to material collected in 1947-1979. Symbols: 1 Poutasseau distribution; 2 northern border of the reproductive part of the areal.

Figure 2. Distribution of larvae, eggs, juveniles and the directions of drift migrations of poutasseau. Symbols: 1 spawning areas; 2 eggs occurrence; 3 larvae occurrence 4 juveniles occurrence; 5 drift ways.

Figure 3. Distribution of poutasseau of various size over the areas of Norway, Greenland seas. Materials collected in 1960-1971, n-85380.

Figure 4. The rate of males maturing (solid line) and females maturing (dotted line) for the poutasseau of the Barents Sea (A), Norway Sea (B), off Iceland (C) and west of Great Britain, Ireland (D).

Figure 5. Feeding excursions of poutasseau belonging to Hebrides-Norwegian stock. Symbols: 1 spawning grounds; 2 directions of feeding excursions.

Figure 6. Wintering and spawning migrations of poutasseau of Hebrides-Norwegian stock. Symbols: 1 wintering areas; 2 directions of migrations.

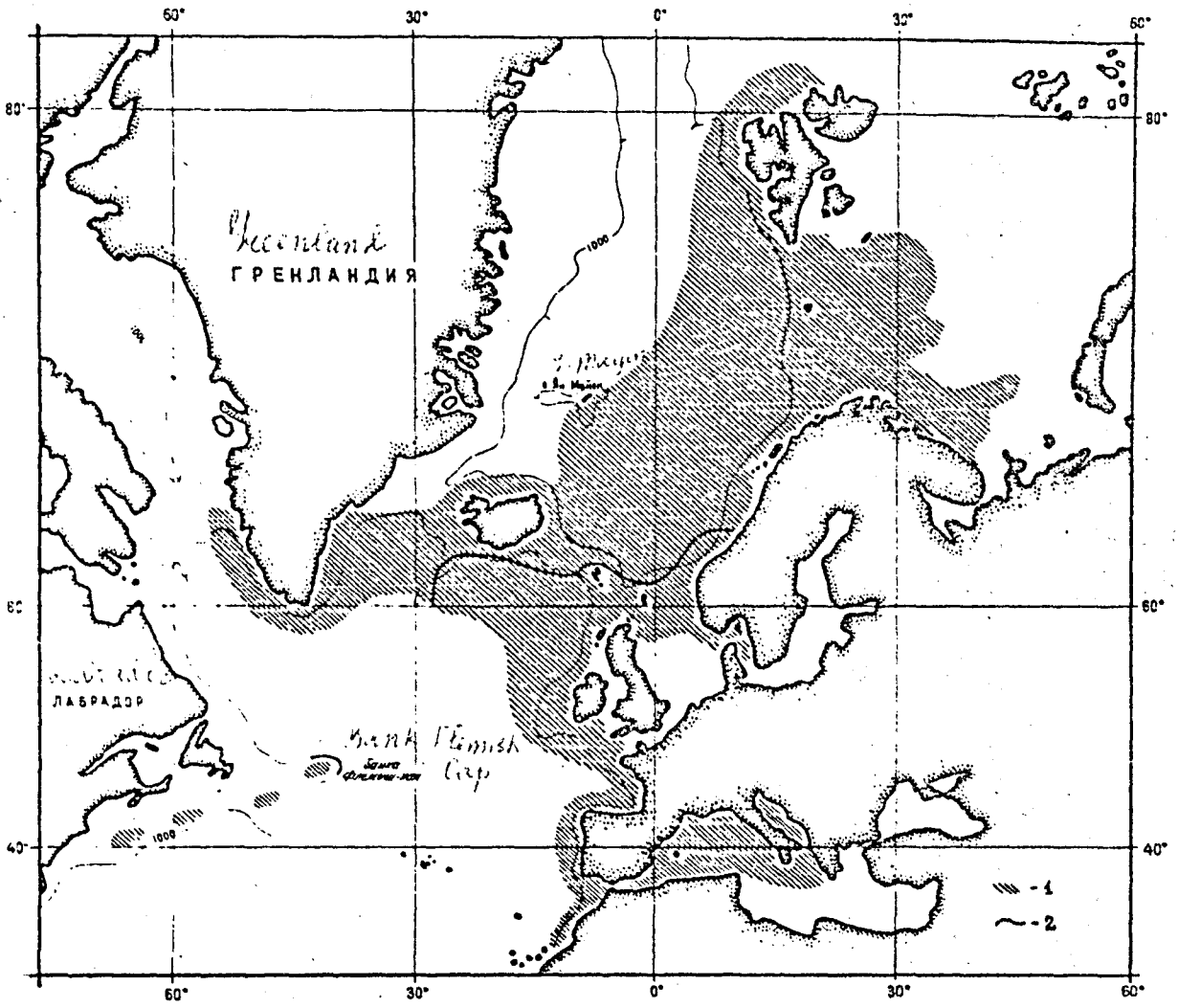


Fig. I

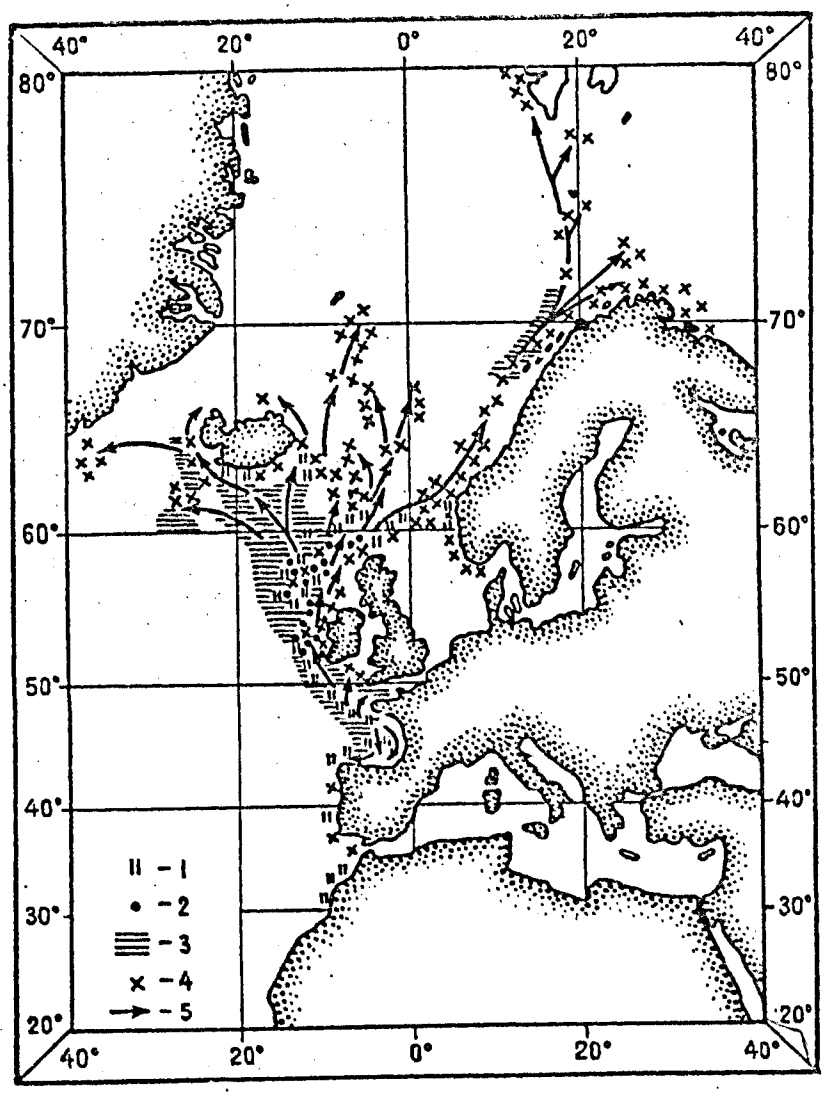
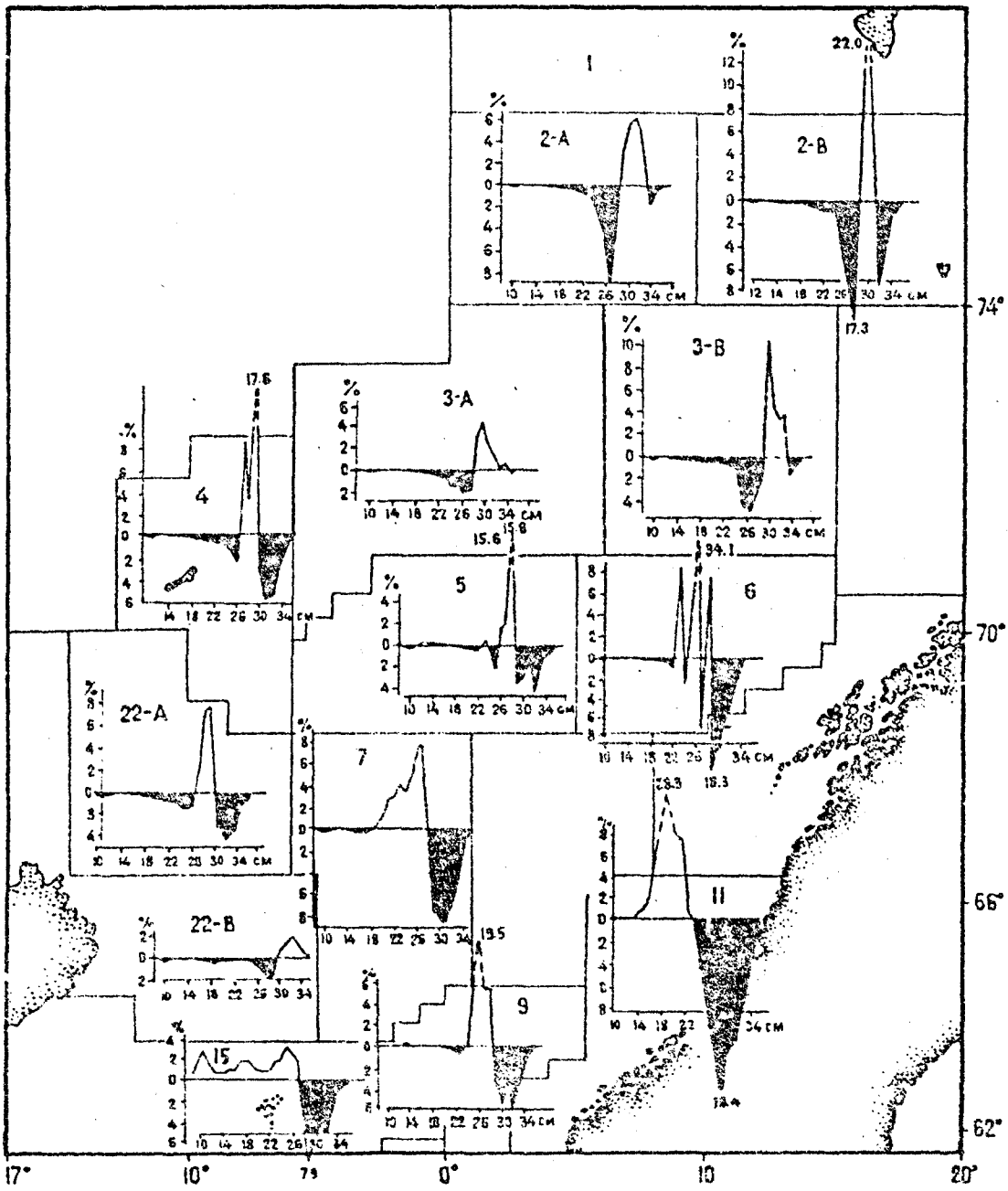


Fig. 2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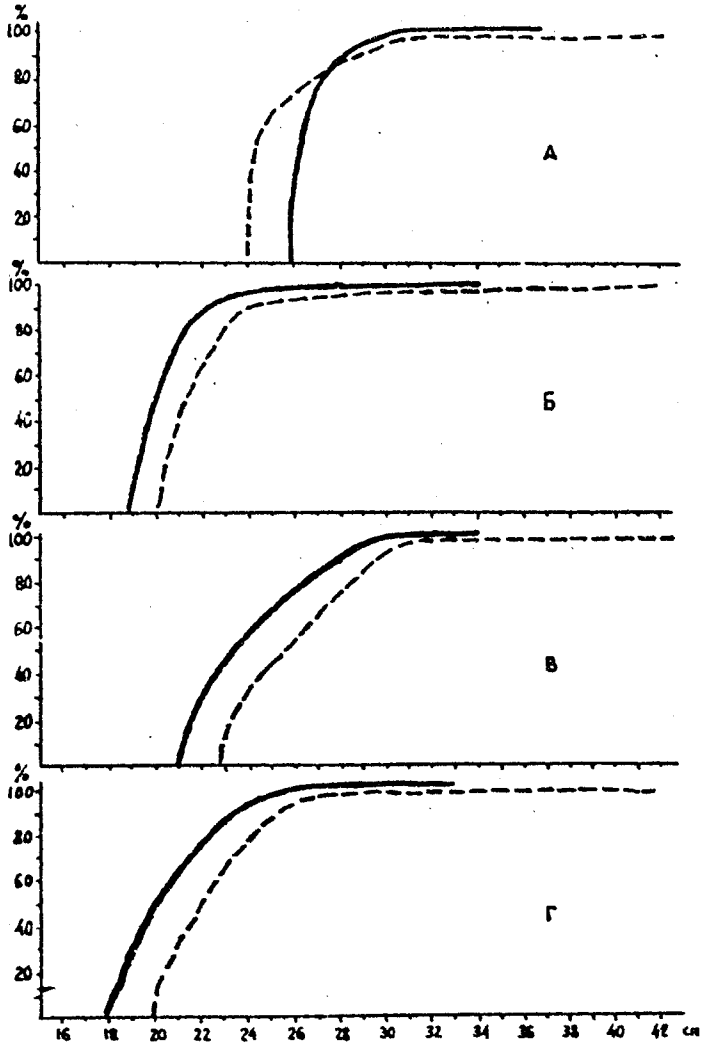

Fig. 4

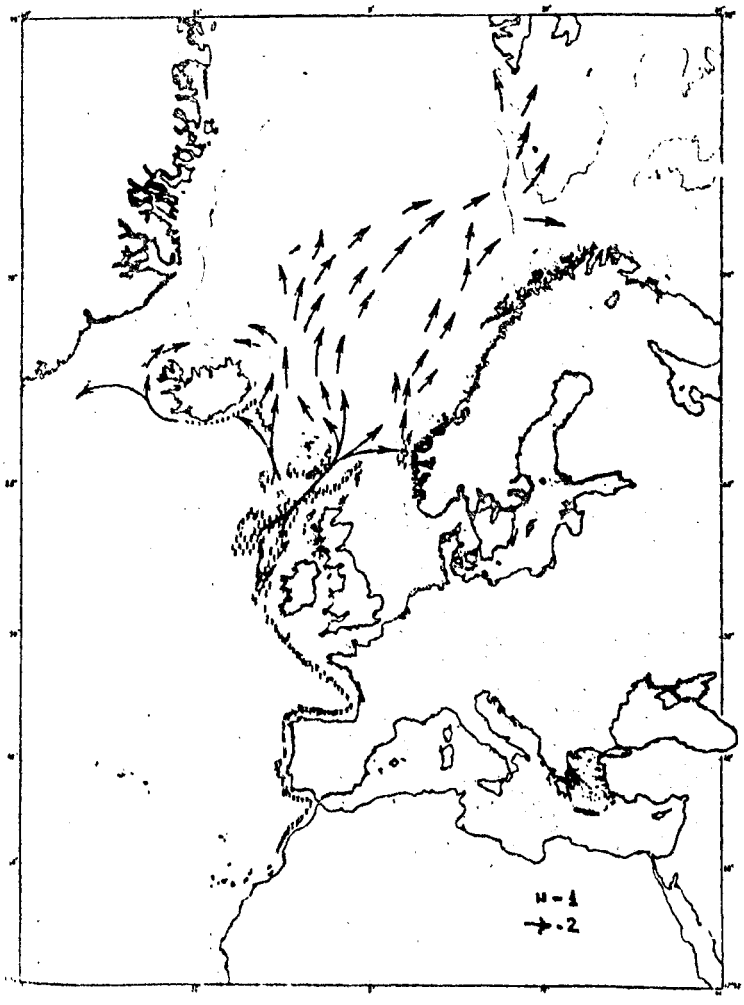

Fig. 5

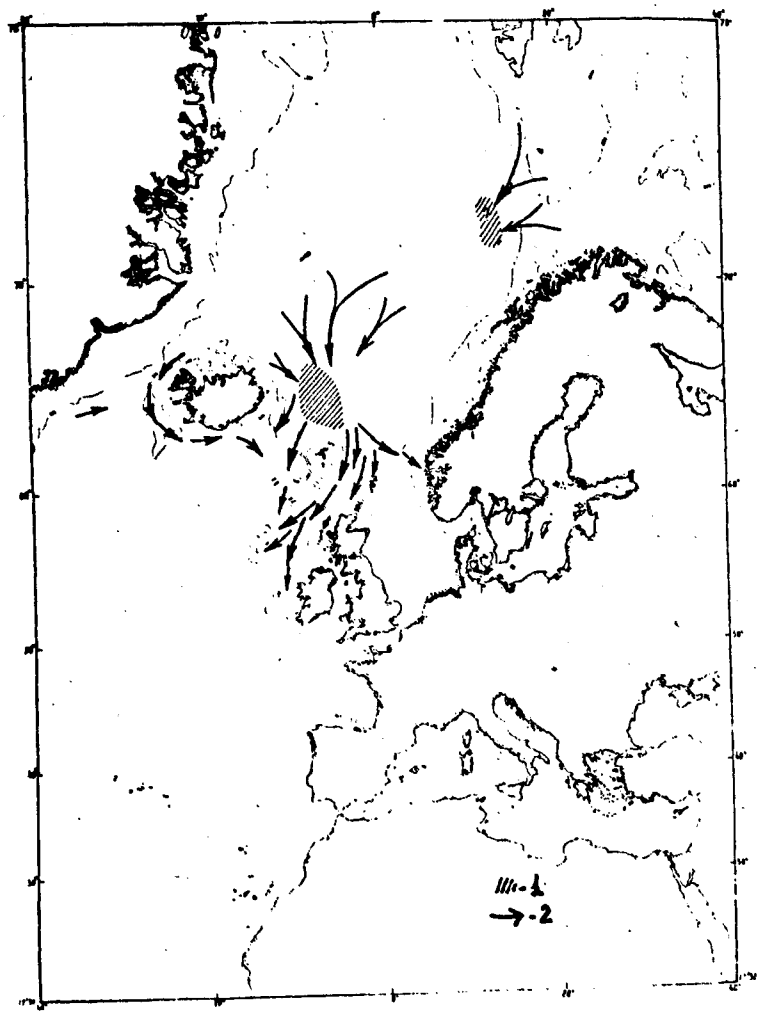

Fig. 6