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# Report on the Plankton Investigations Carried out by the PINRO in the ICNAF Area during 1960 and 1961

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Since 1959, plankton sampling has been carried out by the scientific staff of the Polar Institute during expeditions to the Northwest Atlantic. In 1959, 50 plankton samples were taken in the Grand Newfoundland Bank area. In 1960, a large area from the South Labrador and Newfoundland to the Bermudas was covered by investigations; 1156 samples of zooplankton were collected. In 1961, main attention was paid to the continental shelf waters and some of its fishing grounds where 859 plankton samples were taken.

The gear used was a 37 cm diameter Juday net of silk gauze No. 38. Samples were taken from the depths of 500-200, 200-100, 100-50, 50-25, 25-10 and 10-0 m. Furthermore, Euphausiacea distribution in the near-bottom layers was studied. For that purpose special nets with the reverse cone (50 cm in diameter) of a silk gauze No.0. These nets were attached to the trawl headline. In that way 105 samples were collected.

Studies of the quantity and composition of the plankton in different water masses were the main purpose of our investigations. This information is necessary for the elucidation of peculiarities of the hydrological regime of some areas and for the determination of the food base for plankton-eating fish.

In 1960, plankton investigations covered Subareas 3, 4 and 5, while in 1961 Subareas 3 and 5.

## Subarea 3.

According to the data obtained in 1960, there was established that Copepoda predominated in the Newfoundland waters, namely: Calanus finmarchicus, Pseudocalanus minutus and Oithona similis. In the coastal waters Temora longicornis and Pseudocalanus elongatus were abundant. Besides, Eukrohnia hamata, Limacina retroversa, Thysanoessa longicaudata, Oikopleura labradoriensis were common.

In accordance with the distribution of the cold Labrador Current and the warm Atlantic waters in the Grand Bank area and northward, there were recorded the following Arctic and subarctic species: Aeginopsis laurentii, Euphyse flammea, Calanus glacialis, Metridia longa, Apherusa glacialis, Limacina helicina). Species of the tropic origin (Nannocalanus minor, Mecynocera clausi, Clausocalanus arcuicornis, Calanus spp., Aegisthus mucronatus etc.) were observed in the waters to the north and east of the Grand Bank and in the Flemish Cap area. At the same time boreal forms (Metridia lucens, Pleuromamma robusta, P. abdominalis) were recorded.

Spring development of plankton in the Atlantic waters started much earlier than in the cold Labrador waters. Thus, in the warm Flemish Cap waters and to the east of the Grand Newfoundland Bank Calanus finmarchicus spawns as early as March, while in the Labrador waters its mass spawning was recorded only in June (Fig. 2), which means that the onset of the season of biological spring takes place there about two months later than in the Atlantic waters.

The cold Labrador waters of the Grand Newfoundland Bank are characterized by an active and prolonged spring development of Diatomeae (Thalassiotrix longissima, Chaetoceros spp.). Mass development of Diatomeae was not observed in Atlantic waters in contrast to Labrador waters. Peridineae (Peridinium depressum, Ceratium spp.) prevailed in phytoplankton.

From June to August 1959 and 1960, the study of Euphausiacea distribution in the Newfoundland shelf area was carried out by means of a net, attached to the trawl headline. The stations where Euphausiacea samples were taken, are shown as trapeziums in Fig.I. Thysanoessa inermis and Th.raschii dominated in the land drainage, while Meganyctiphanes norvegica and Thysanoessa longicaudata were met in the main stream of the Labrador Current.

Euphausiacea were found in the inshore stream of the Labrador Current in small numbers and all the species were almost in equal proportion (Fig.3).

To the south and east of the Newfoundland Shallows at the depths of 1500-2000 m Nematoscellis megalops and Thysanoessa ambliops were met.

Euphausiacea standing crop on the slopes of the Newfoundland Bank is formed under the influence of surrounding water masses. On the northern slopes of the Bank where the current velocity of the main Stream of the Labrador waters is higher than on the southern, the fauna typical for the Atlantic waters keept its

oceanic character.

On the southern slopes of the Bank where waters of the main stream loose their speed and mix with Bank waters, neritic species prevail.

The largest quantities of Euphausiacea (90800 specimens per one hour's trawling) were observed in the centre of the eastern slope of the Newfoundland Bank. On the northern slopes Euphausiacea were present in less numbers (20-50 specimens per one hour's trawling).

A lot of Th. longicaudata was caught in the Flemish Cap area (10.000-11.000 specimens per one hour's trawling).

On the northern slopes of the Newfoundland Bank the number ratio of individuals of different species of Euphausiacea changes from season to season. In early spring (March) Th. longicaudata prevailed, while by the end of summer (August) the importance of Th. inermis increased. Apparently, these changes depend upon season variation of the strength of the Labrador Current. Season quantitative variations of individuals of different species of Euphausiacea were not found on the eastern and southern slopes of the Newfoundland Bank. The neritic species (Thysanoessa inermis and Th. raschii) constantly dominated in plankton.

Subareas 4 and 5.

According to the data obtained during the expedition of 1960 (Chart I), in May-June, the water temperature being $15^{\circ}$-$23^{\circ}$C, the bulk of plankton consisted of warm-water subtropic organisms: Rhincalanus cornutus, Calanus tenuicornis, Mecynocera clausi etc. They were sighted to the southwest of the Grand Bank of Newfoundland and the Flemish Cap Bank, in the open ocean ($50^{\circ}$-$65^{\circ}$W, $40^{\circ}$-$30^{\circ}$N). Westward beyond $65^{\circ}$W, in the area between the continent and the Bermudas at the end of July at a temperature up to $28^{\circ}$C representatives of the tropic fauna (Corycaeus sp., Copilia, Sapphirina and Euclio) dominated in plankton.

Plankton is poor in the Gulf Stream waters both in composition and in quantity (Luca, Povelco, 1961).

High standing crops of feeding plankton (Calanoida, Euphausiacea, Hyperiidae) were observed in the summer of 1960 along the continental shelf near the mouth of the Gulf of Maine and to the north, near Nova Scotia (Subarea 3).

During the spring-summer season of 1961 we carried out investigations on the plankton state on the fishing grounds of Banquereau, Atimon and Georges Bank with purpose to clear up its suitability for the fattening of herring. In April we observed rich development of phytoplankton on the fishing grounds of Banquereau and Artimon. Diatomeae (Chaetoceros sp., Thalassiothrix longissima) were dominating. Peridineae were rather poor. Zooplankton was also scarce on these grounds. Calanus finmarchicus (copep. stages III, IV and V). Pseudocalanus minutus, Sagitta sp. and Limacina retroversa were the most abundant species.

On the slopes of banks, at the depths of 100-200 m plankton became more various. Calanus hyperboreus, Metridia sp., Euphausiacea and Hyperiidae appear in plankton catches.

The increase of total biomass of plankton on banks till 1000 mg/$m^3$ is caused by the mass development of Diatomeae. The biomass of Copepoda at the same time did not exceed 200 mg/$m^3$.

Calanus finmarchicus, Euphausiacea and Hyperiidae were the main items of food for herring in these areas.

On Georges Bank, April 18-28, Diatomeae (Thalassiotrix sp., Thalassiosira sp., Rhizosolenia sp.) and Peridineae were abundant. The total biomass was 327-840 mg/$m^3$, chiefly due to phytoplankton. By May the development of Diatomeae is over, while Peridineae continued its development and their number increased by June. Holosphaera viridis was frequently met in June on Georges Bank.

Calanus finmarchicus and Pseudocalanus minutus were the most abundant on Georges Bank. Calanus finmarchicus spawns here in the second half of April when its nauplii were numerous in plankton. In May, specimens of all the stages of development (I-V) were met in the Calanus finmarchicus population (the total biomass of plankton was 500-1000 mg/$m^3$). A small number of its nauplii was also observed. Calanus finmarchicus and Pseudocalanus minutus dominated in the plankton of Georges Bank, and in June they constituted the bulk of the standing crop of plankton.

In the centre of the Bank of patch of high zooplankton biomass (up to 3000 mg/$m^3$) was observed in June 1961.

In the south-west part of Georges Bank the biomass of plankton varied from 500 to 1000 mg/$m^3$, but its main part was due to phytoplankton (Ceratium fucus and Peridinium sp.).

On the northern and eastern slopes of banks the number of plankton was less. Approaching the Gulf Stream in June, the biomass of plankton decreased from 1000 to 50-100 mg/$m^3$ (Fig. 5). In May and

## Figures

Figure I. Chart of plankton stations worked in 1960 and 1961.
I. Trip I, "Boguchar" and "Balaklava", 1960. 2 and 3. Trip 2, "Boguchar" and "Balaklava", 1961.
4. R/v "Sevastopol", trip 17, 1960.
5. R/v "Sevastopol", 1960.
6. Sampling of Euphausiacea by a hauling net.

Figure 2. Spawning of Calanus finmarchicus in the Newfoundland waters (according to the data of 1960).
I. Stations where spawning Calanus finmarchicus was not observed.
2. Stations where mass spawning of Calanus finmarchicus was sighted.

Figure 3. Composition and quantity of Euphausiacea on the section to the northeast of the Gulf of White Bay (R/v "Sevastopol", trip 14, July 1959).

Figure 4. Quantitative distribution of plankton in the Northwest Atlantic in May-June 1960 (Luca, Pavelko, 1961).

Legend:

I. Less than 50 $mg/m^3$;
2. 50-100 $mg/m^3$;
3. 100-200 $mg/m^3$;
4. 200-500 $mg/m^3$;
5. 500-1000 $mg/m^3$;
6. More than 1000 $mg/m^3$.

Figure 5. Quantitative distribution of the plankton on Georges Bank in the 0-100 m layer in June 1961.
(The legend is the same as for figure 4.).

June 1961, herring were intensively feeding on Georges Bank. Their food consisted of Calanus finmarchicus, Hyperiidae and young fish (Klimenkov and Pahorukov, 1961).

## References


| | |
|---|---|
| I. Klimenkov A.I. and Pahorukov V.I. | New fishing grounds for herring in the Northwest Atlantic. -Scientific-Technical Bulletin of PINRO, No.4 (18, 1961). |
| 2. Luca$G.I. and Pavelco A.I. | Brief characteristics of the plankton of the Northwest Atlantic in summer, 1960. -Ibid., No.I (15), 1961. |

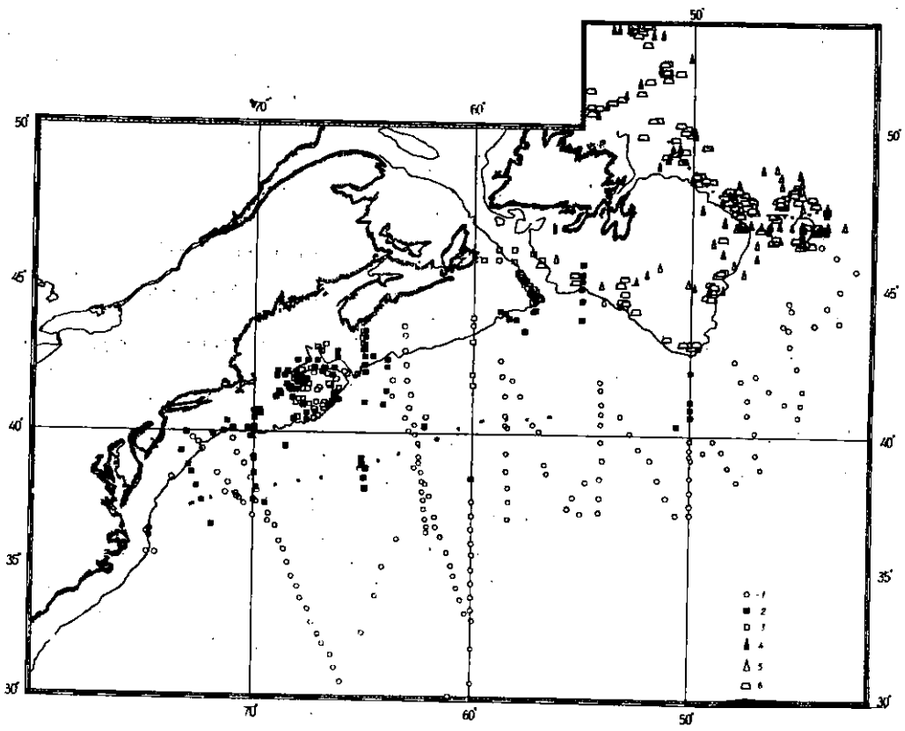


Fig. I. Chart of plankton stations worked in 1960 and 1961.

I. Trip I, " Boguchar " and " Balaklava ",1960.
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Trip 2, " Boguchar " and " Balaklava, 1961.
4. R/v " Sevastopol " , trip 17, 1960.
5. R/v " Sevastopol ", trip 16, 1960.
6. Sampling of Euphausiacea by a hauling net.

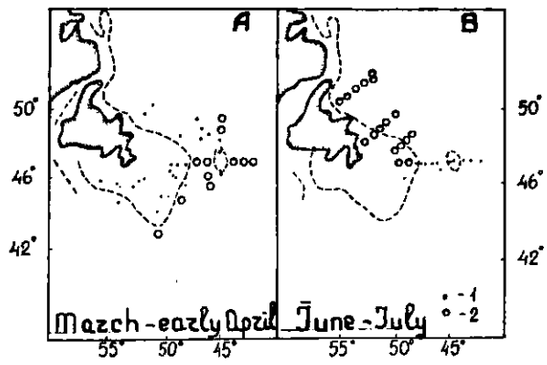


Fig.2. Spawning of Calanus finmarchicus in the Newfoundland waters ( according to the data of 1960).

1. Stations where spawning Calanus finmarchicus was not observed.
2. Stations where mass spawning of Calanus finmarchicus was sighted.

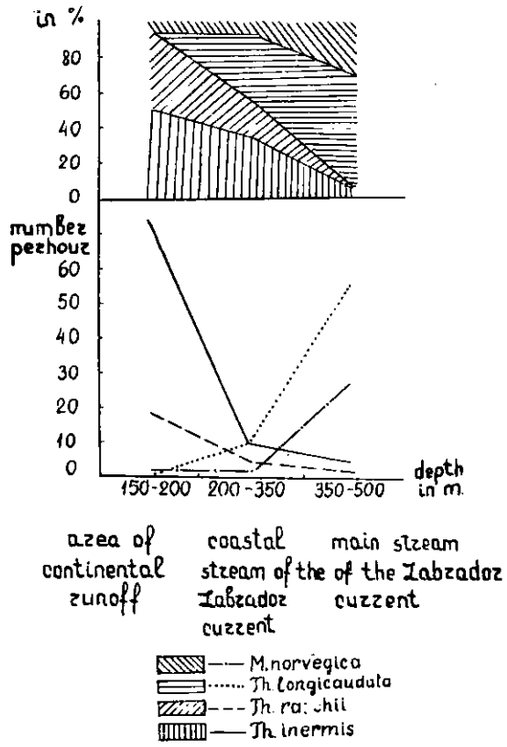


Fig. 3. Composition and quantity of Euphausiacea on the section to the northeast of the Gulf of White Bay ( R/ v " Sevastopol", trip 14, July 1959 ).

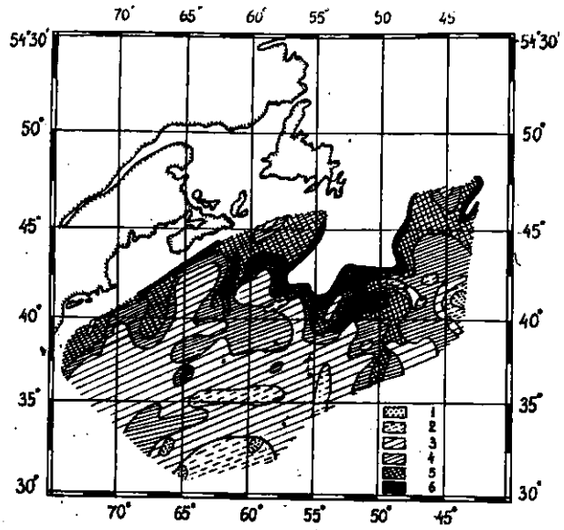


Fig. 4. Quantitative distribution of plankton in the Northwest Atlantic in May- June 1960 ( Luca, Pavelko, 1961 ).

Legend :

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5. 500-1000 mg/$m^3$;
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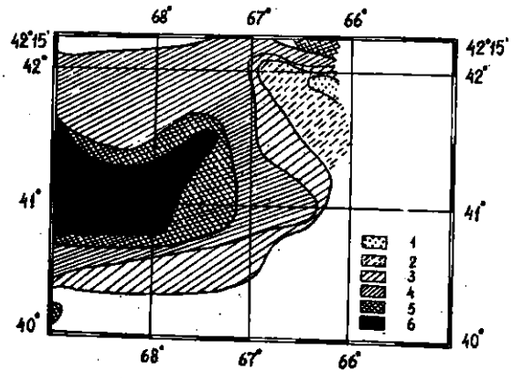


Fig. 5. Quantitative distribution of the plankton on Georges Bank in the 0 - 100 m layer in June 1961.

( The legend is the same as for figure 4 ).