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Ecological survey in the Gulf Stream zone southward of Nova Scotia, 1974

by

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Introduction

The ICNAF zone covers the area in the North-West Atlantic both over the shelf, and in the open ocean.

Since the surveys were made almost exclusively in the shelf area, the data on the stock size and environmental conditions for the fishes beyond the shelf are very limited. To study the hydrological and hydrobiological conditions, a complex survey in the open ocean area adjacent to the Nova Scotia shelf between 57° and 65°W and limited by 40°N in the south was made in November and December 1974 by RTM BELOGORSK.

Methods

The survey was made according to a grid of stations given in Fig.1. At each station complex observations included water temperature measurements, salinity determinations along the standard horizons, and zoo- and ichthyoplankton sampling. A 100m horizon was the maximum depth in hydrological observations, and later on it was taken as a reference "zero" surface when the charts of dynamic topography were drawn (Fig.2). The zoo- and ichthyoplankton samples were collected by a smaller modification of the Bongo plankton sampler fitted by the nets of 0.168 and 0.626 mm mesh-size having the opening square of 0.03 m². The oblique haulings were made for 25-30 min within the 0-100 m layer.

The zooplankton species composition and abundance have been determined based on 45 samples collected by the net of 0.168 mm mesh size. To determine the ichthyoplankton species composition the fish eggs and larvae, and separately invertebrates were selected from the samples collected by the net of 0.621 mm mesh size.

Results

The results of the analysis revealed a complex current structure in the survey area (fig.2), which can be attributed to the interaction between the Gulf Stream frontal zone and slope water. Separate parts of the Gulf Stream meanders can be seen on the chart of dynamic topography, one of which with the axis passing along 62°W and shelf oriented top is most clearly pronounced. It is inside of the meander curves that the cyclonic and anticyclonic gyres are observed. The surface water temperature distribution (fig.3) confirms the presence of the Gulf Stream frontal zone with the pronounced temperature gradients. Different origin of waters comprising a hydrological structure of the area, which includes the waters of the Gulf Stream structure, the Labrador Current waters and their modification, stipulates a large variety of the zooplankton species composition represented in the samples by 135 species. The bulk of the zooplankton (about 80%) is made of Copepoda. In the samples there occur both the boreal, Arctic species drifted by the Labrador Current, and heat-loving species carried by the Gulf Stream. The number of the latter makes up approximately the half of the total abundance. Among these dominate the species of Eucalanus, Neocalanus, Candacia, Pleuromamma, Clausocalanus genera and others. Besides, the ocean boreal zooplankton of the Calanus, Microcalanus, Metridia, Scolecithricella genera and others are also numerous in the samples. From the seston biomass consideration (fig.4) it follows that within about the half of the area covered by the survey the biomass ranges from 0 to 10g under m^2 averaging to 13.6g under m^2 . Significant amounts of seston biomass (over 50 g under m^2) were observed in concentrations foll-

owing the meander curves along the borders of cyclonic and anticyclonic gyres. The example of the species and quantitative zooplankton composition at the station No. 368/58 (fig.1), where the biomass was 57.6g under m^2 is given in table 1. As is evident from the table, the zooplankton is represented by a tropical form, *Pleuromamma glacilis*, a boreal form, *Oithona similis*, and an Arctic one, *Microcalanus pygmaeus*. It is worthy noting that some abyssal species occurred in the samples: *Undeuchaeta plumosa*, *Haloptilus* sp., *Gastanus minor*.

Most abundant were *Oithona similis*, *Pleuromamma gracilis*, *P.abdominalis*, *P.xiphias*, *Clausocalanus arcuicornis*, *C.furcatus*, which comprised about the half of all the zooplankton abundance (table 2). The analysis of age composition showed that immature specimens predominated among the prevailing species and groups (table 3).

In conclusion it should be noted that the area under investigation belongs to relatively productive areas, where the seston biomass averages 13.6g under m^2 exceeding at individual stations even 50g under m^2 . The fourth part of the total zooplankton was represented by *Oithona similis*, its aggregations being mainly observed in the north-east area along the continental slope.

The analysis of the ichthyoplankton samples showed that the eggs of the fish were not available at the time of the survey. Individually, the larvae of the following families were discovered: Myetophidae, Parolepididae, Bothidae, Gonostomatidae, Gempilidae, Labridae, Callionymidae, Trichiuridae, Congridae, Scorpenidae, Scombridae.

The squid larvae of the *Bartrema* genus were found in the Gulf Stream gradient zone at water temperatures of 16-18°C. Their abundance was also low and did not exceed 2 specimens per hauling.

Table 1. Zooplankton numbers in thous.sp.
under m² at station No. 368/58

Name of organisms	: Numbers	:	%
<i>Pleuromamma gracilis</i>	1913		20.1
<i>Oithona similis</i>	1666		17.5
Calanoida copepodit	1358		14.2
<i>Microcalanus pygmaeus</i>	1110		11.6
<i>Metridia lucens</i>	789		8.2
Nauplii copepoda	679		7.1
<i>Pleuromamma abdominalis</i>	615		6.4
<i>Clausocalanus arcuicornis</i>	432		4.5
Salpidae	395		4.1
Cladocera	185		1.9
<i>Paracalanus parvus</i>	123		1.2
<i>Limacina helicoides</i>	123		1.3
<i>Undeuchaeta plumosa</i>	12		0.1
<i>Pareuchaeta</i> sp.	18		0.1
<i>Euchaeta marina</i>	12		0.1
<i>Gaetanus minor</i>	12		0.1
<i>Gaetanus</i> sp.	12		0.1
<i>Limacina retroversa</i>	12		0.1
<i>Phronima sedentaria</i>	12		0.1
<i>Chaetognatha</i>	12		0.1
Euphausiacea	6		0.05
<i>Calanus minor</i>	6		0.05
<i>Neocalanus gracilis</i>	6		0.05
<i>Vibilia</i> sp.	6		0.05
Total	9514		100.0

Table 2. The average number of organisms under m^2 in %

Name of organisms	%
Chaetognatha	0.4
Ova and Nauplii copepoda	2.4
Oithona spp	25.5
Euphausiacea	1.1
Salpidae	2.6
Calanus spp	0.7
Pleuromamma spp	12.7
Metridia spp	1.9
Decapoda	0.2
Clausocalanus spp	10.5
Pseudocalanus spp	0.7
Other organisms	41.6
Total	100

Table 3. Age composition of the major zooplankton forms in the survey area

Name of organisms	Mature, %	Copepodite stages, %
Oithona spp	10	90
Euphausiacea	23	77
Metridia spp	31	69
Pleuromamma spp	43	57
Calanus spp	44	56
Clausocalanus spp	64	36
Decapoda	11	89

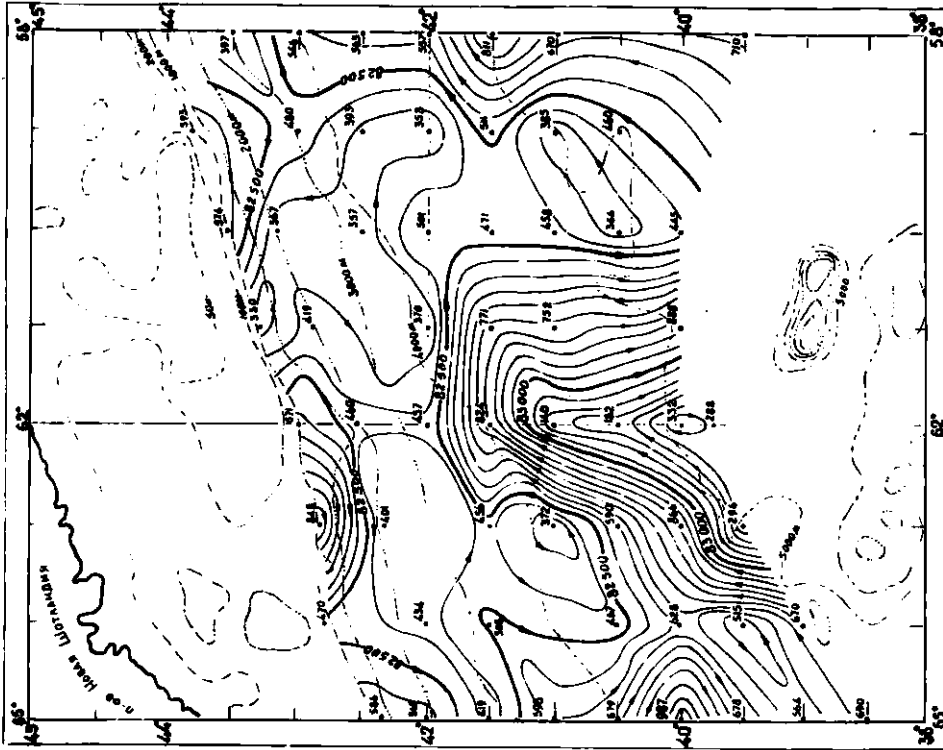


Fig. 2. A chart of dynamic topography.

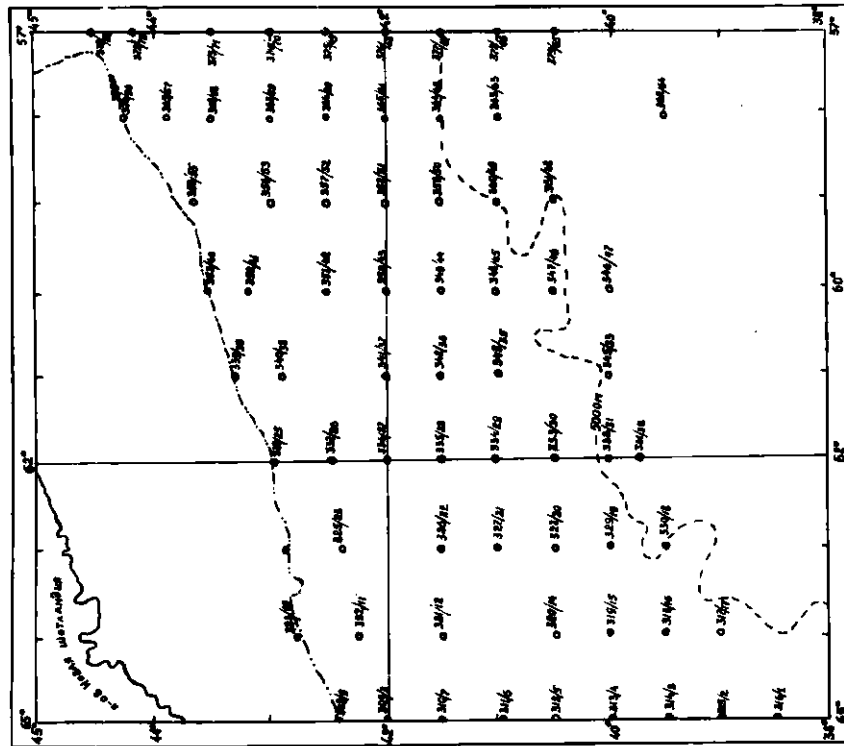


Fig. 1. A grid of survey stations.

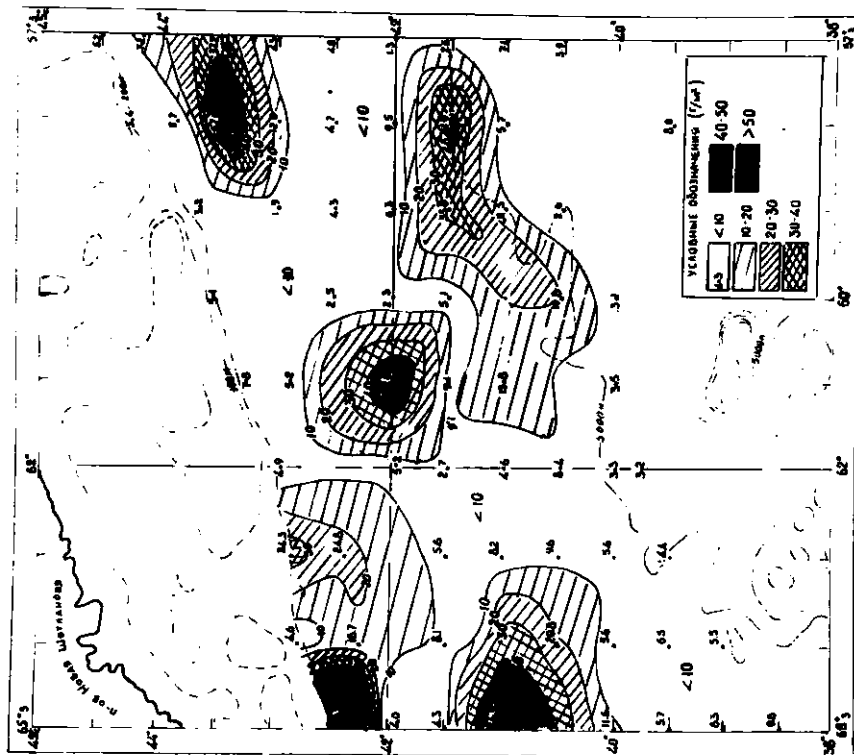


Fig. 3. The distribution of water temperature on the surface.

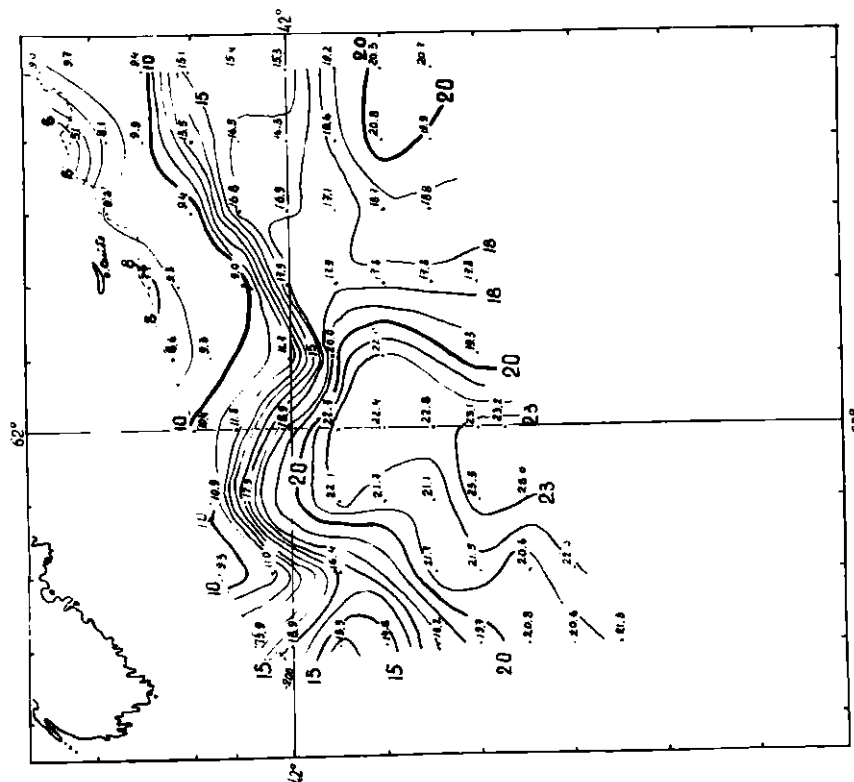


Fig. 4. The distribution of the seston biomass, g under m².

