

International Commission for



the Northwest Atlantic Fisheries

Serial No. 5193
(D.c.1)

ICNAF Res. Doc. 78/VI/32

ANNUAL MEETING - JUNE 1978

Distribution and abundance of silver hake eggs and larvae
and environmental conditions off Nova Scotia in September-October 1977

by

A. S. Noskov, V. P. Karaulovsky, A. N. Romanchenko and A. I. Sherstiukov
AtlantNIRO, Kaliningrad, USSR

I. Introduction

Silver hake is an abundant commercial species in the Nova Scotia area. The stock and catches of silver hake are subject to considerable fluctuations depending on the strength of the year class recruitment. In order to study the reasons determining the strength of individual year classes, an ichthyoplankton survey of the Nova Scotia shelf was conducted in the autumn of 1977 under the joint USSR-Canada Program. The distribution and abundance of the silver hake eggs and larvae, as well as hydrological and feeding conditions were studied. The length of the larvae in catches ranged between 2 and 21 mm, the 4 to 8 mm larvae prevailing. The number of larvae per haul fluctuated from 1 to 411 specimens/m², the majority of the larvae was observed in the area of the Sable Island shoals.

Material and Methods

The ecological survey of the Nova Scotia shelf was conducted by SRTM-8024 FOTON from 21 September to 14 October 1977, and covered the area between 53°30'0W and 64°45'0W (fig. 1). Complex studies were carried out including water temperature measurements and zoo- and ichthyoplankton sampling made at 162 stations.

Water temperatures were measured by means of BT. The ichthyoplankton sampling was made with the Bongo sampler (larger model, gauze net of 0.333 mm mesh size and smaller model, gauze net of the 0.570 mm mesh size), the neuston gauze net of the 1.070 mm

mesh size and the mid-water Isaaks-Kidd depressor net with the gauze chafer in the codend of the 0.471 mm mesh size. A total of 510 ichthyoplankton samples were collected.

The zooplankton sampling was made with the smaller model of Bongo, gauze net of the 0.076 mm mesh size.

The sampling was made at depths of 0 to 100 m with the haul duration of 30 min at the speed of 2.5 knots. At depths less than 100 m the plankton was sampled from the bottom to the surface.

To date, the ichthyoplankton samples collected with the smaller model of Bongo, gauze net of 0.570 mm mesh size, have been sorted out. The eggs and larvae were picked out of samples, counted and measured under the binocular.

The seston biomass was measured using the volumetric method and the zooplankton species composition and abundance from selected stations were determined.

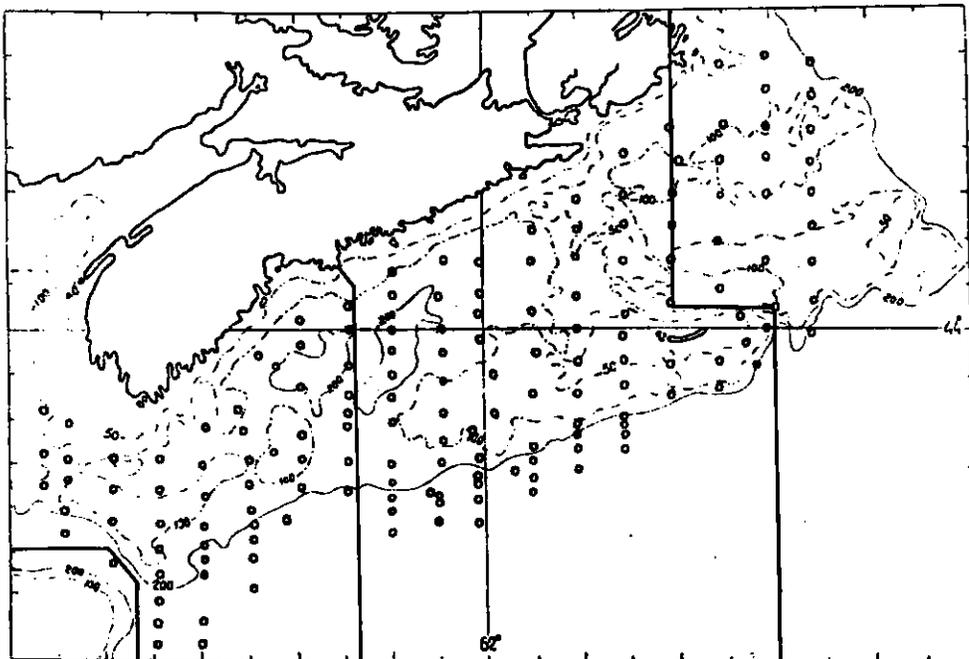


Fig. 1 . Scheme of stations occupied during the ecological survey conducted in the ICNAF Area in September-October 1977.

II. Results

1. Distribution and abundance of the silver hake eggs and larvae

During the survey of the Nova Scotia shelf conducted from 21 September to 14 October the eggs were mainly observed in three areas: on the slopes of Browns Bank at depths from 70 to 150 m, in the Emerald Bank area at depths from 100 to 200 m, the largest aggregations being observed in the Sable Island shallow water at depths from 50 m and above (fig. 2).

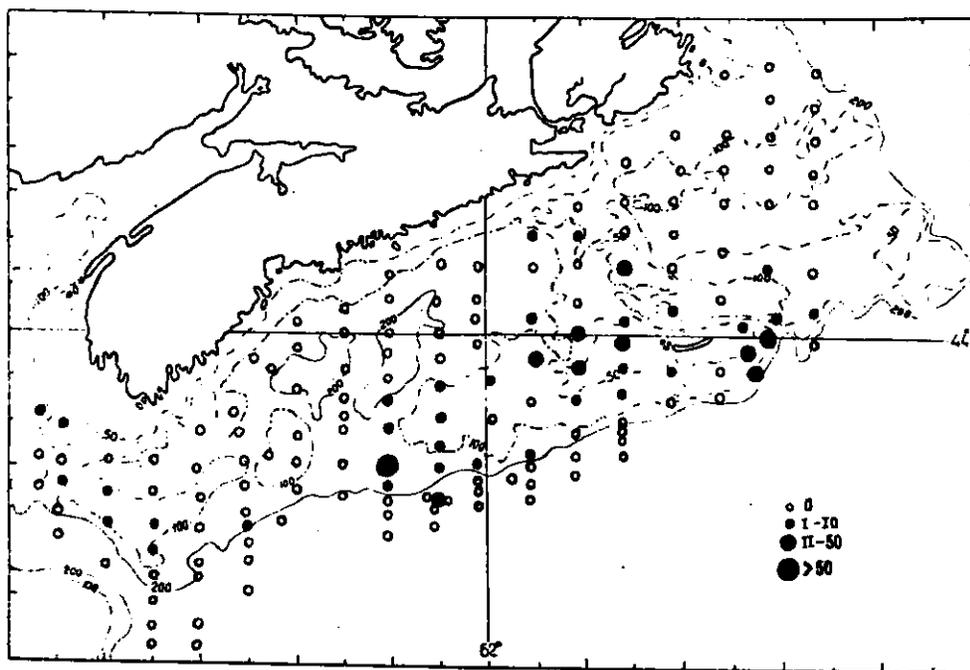


Fig. 2. Distribution of the silver hake eggs (nos. under m^2) in September-October 1977.

The distribution of the eggs coincides with the areas inhabited by the silver hake spawning concentrations. Thus, the densest concentrations of adult hake in the observation period occurred on the Sable Island shoals, where the peak spawning took place in September. The peak spawning on Browns Bank fell on August.

During the survey the larvae were observed over larger area than the eggs. They were most numerous to the east of Sable Island and in the Emerald Bank area. Smaller numbers of both the larvae and eggs were recorded on Browns Bank (fig. 3).

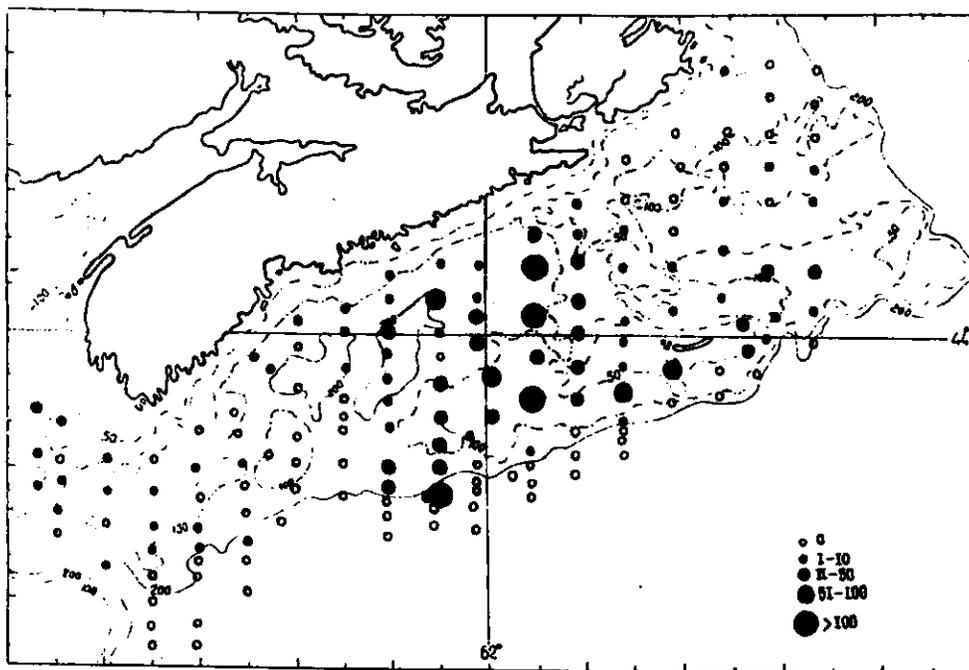


Fig. 3. Distribution of the silver hake larvae (sp. under m^2) in September-October 1977.

A wider larva distribution pattern compared to that of the eggs may be attributed to the influence of the current. The number of eggs under m^2 ranged between 1 and 60 with the average of 2.1 eggs under m^2 . The highest amount was recorded near the Sable Island shoal and Emerald Bank in Div. 4w with the average of 3.9 eggs under m^2 . On Browns (4x) and Banquereau (4v) Banks the number of eggs under m^2 averaged to 0.4.

The average numbers of the larvae in Div. 4w, 4x and 4v were 20.0, 0.6 and 3.8 specimens under m^2 respectively, the grand average amounting to 10.8 specimens under m^2 for the whole area.

In the Banquereau Bank area the larva length fluctuated from 3 to 11 mm, which made up 5.40 mm on the average. Accordingly, in the Sable Island shoal the average length was 6.43 mm (2-21mm) and in the Browns Bank area - 10.14 mm (6-18 mm) (table 1).

As is evident from the table, the largest larvae are observed in the western part of the area, where the spawning usually begins earlier and the smallest specimens occur in the eastern part, where the spawning is delayed.

The spawning is rather prolonged judging from the larva sizes, since along with the newly hatched larvae of 2-3 mm the specimens of 18-21 mm and 25-30 days old occur.

Table 1. Body length of the silver hake larvae (mm) off Nova Scotia in September-October.

Length (mm)	4V		4W		4X	
	No.	%	No.	%	No.	%
2	-	-	5	0.5	-	-
3	15	10.9	32	3.3	-	-
4	26	18.8	112	11.6	-	-
5	43	31.2	239	24.9	-	-
6	27	19.6	239	24.9	6	18.2
7	13	9.4	113	11.7	2	6.1
8	8	5.8	84	8.7	1	3.0
9	3	2.2	51	5.3	6	18.2
10	2	1.4	29	3.0	4	12.1
11	1	0.7	23	2.4	2	6.1
12	-	-	15	1.5	4	12.1
13	-	-	10	1.0	5	15.1
14	-	-	5	0.5	2	6.1
15	-	-	2	0.2	-	-
16	-	-	1	0.1	-	-
17	-	-	2	0.2	-	-
18	-	-	1	0.1	1	3.0
19	-	-	-	-	-	-
20	-	-	-	-	-	-
21	-	-	1	0.1	-	-
Total	138	100	964	100	33	100
Mean length (mm)	5.40		6.43		10.14	

2. Hydrometeorological conditions

In September the investigation area was influenced by some cyclons, two anti-cyclons and the hurricane "Dorothy". The winds of eastern directions (50% of cases), wind force 3-4 and 5-6 (42% each) were prevalent, the waves of eastern directions (48%), grade 3-4, (9-grade scale adopted in the USSR since 1954). The air temperature ranged between 9.8 and 18.8°C, the atmospheric pressure varied from 999.5 to 1024.3 mb.

In October the area was influenced by 4 anticyclons from the American continent and cyclons transferring from the south-west to the Newfoundland. In the first half of the month the winds of southern directions (45%), wind force 3-4 (53%) and

over 5 (45%), and the waves of grades 3-4 (39%) and 5-6 (34%) were prevalent. The air temperature ranged between 10.8 and 18.0°C, the atmospheric pressure varied from 1000.6 to 1024.6 mb.

The surface layer is well mixed (fig. 4, 7, 8) and characterized by more or less stable water temperature ranging between 12 and 15°C. Considerable horizontal temperature gradients of the shelf and warm ocean waters (up to 21°C) are observed over the continental slope. The thermocline is mainly formed in the layer of 30-50 m (figs. 7, 8). In the water temperature distribution the regions of cold Labrador waters (1-5°C) can be distinguished, especially along the continental slope in the layer of 50-100 m (figs. 7,8). In the near bottom layer (bottom - 200 m, fig. 6) warmer waters (6-10°C) are observed between the isobaths of 50 and 300 m. Cold waters with the temperatures of 1.9-3.7°C are observed southward of Sable Island; 1.8-4.1°C and 1.1-2.8°C are recorded respectively on Banquereau Bank and in the inshore waters off the Nova Scotia.

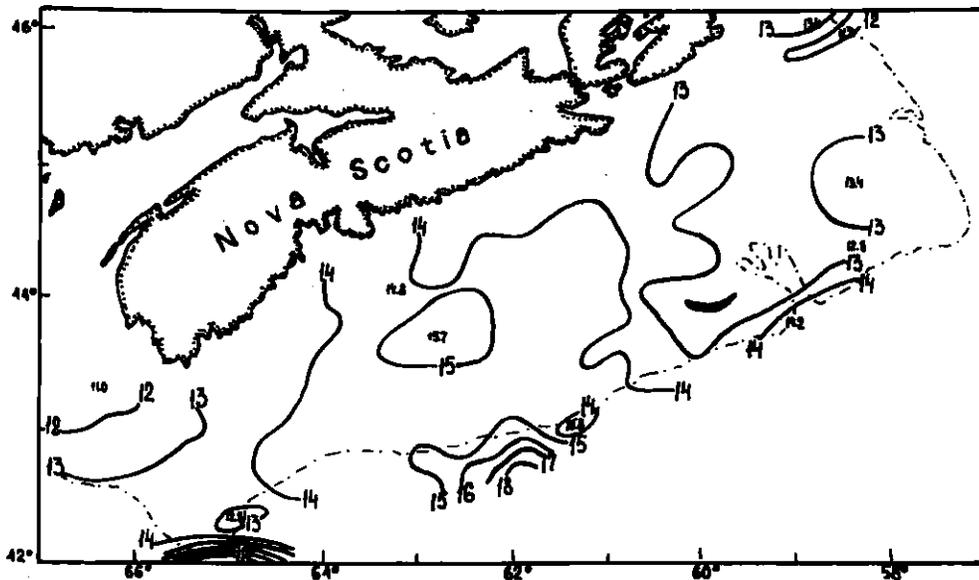


Fig. 4. Temperature distribution in the surface layer (0 m).

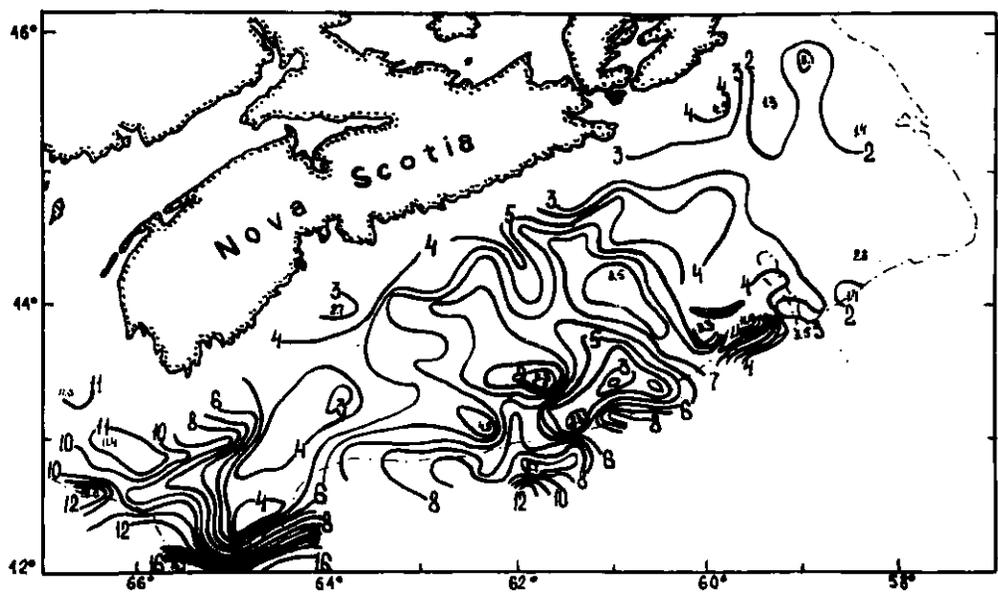


Fig. 5. Temperature distribution in the layer of 50 m.

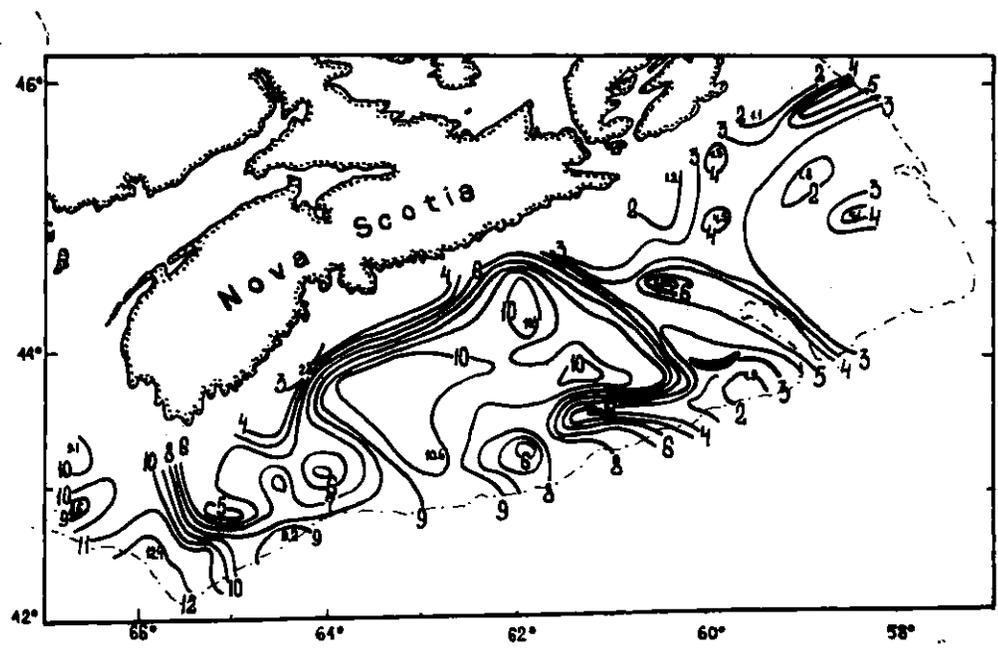


Fig. 6. Temperature distribution in the layer of 200 m - bottom.

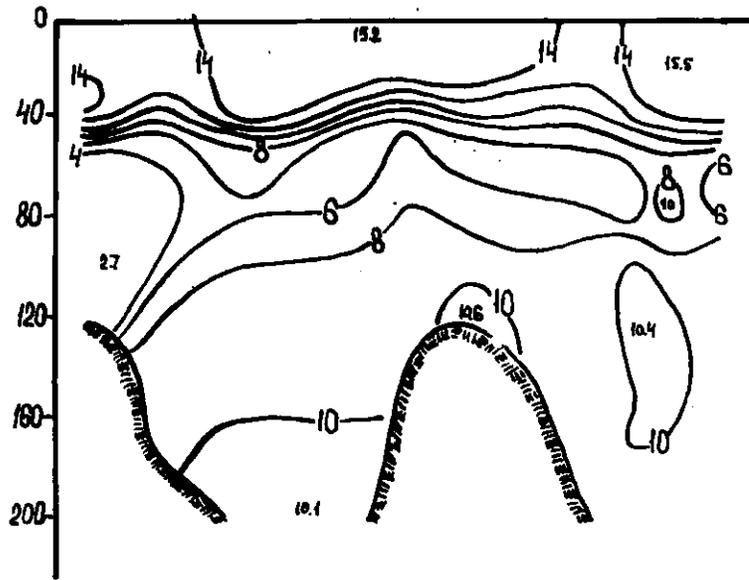


Fig. 7. Vertical distribution of water temperature along 60°30'W.

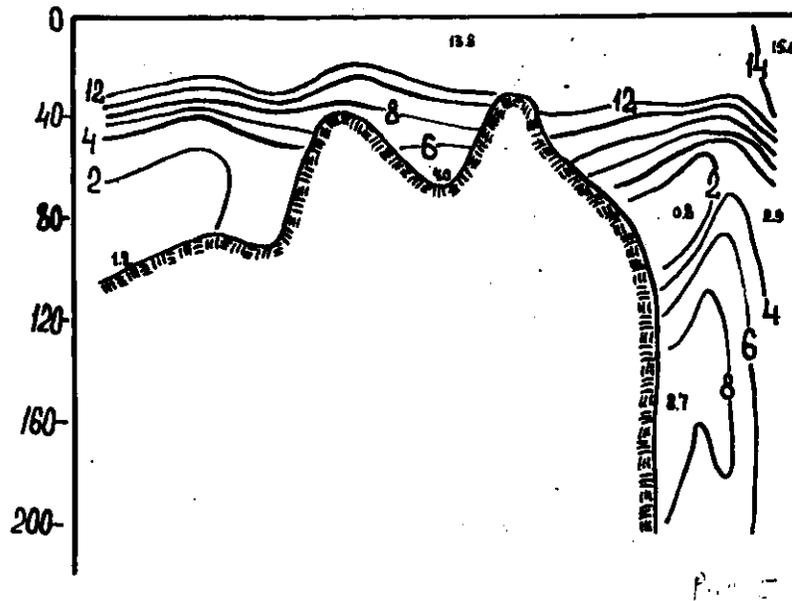


Fig. 8. Vertical distribution of water temperature along 63°00'W.

3. Plankton

The waters most rich in plankton were observed in the Browns Bank area, where the seston biomass exceeded 100 g under m² at some stations (fig. 9). To the north-east of Browns Bank the seston biomass was distributed more uniformly and fluctuated from 10 to 25 g under m², some more dense patches occurring from time

to time. On the Sable Island shoals relatively high biomass was observed, amounting to 25-50 g under m^2 . In September and October the seston biomass averaged to 20.8 g under m^2 .

A preliminary analysis of the data from selected stations showed that the zooplankton species composition on the Nova Scotia shelf is rather various and represented by over 50 species.

The cold water dwellers *Metridia longa*, *Limacina helicina*, the species of the gen. *Microcalanus* etc., prevailed in Div. 4v. The species preferring warmer habitat, *Calanus helgolandicus*, *Paracalanus parvus*, *Pleuromamma gracilis*, *Candacia armata* etc., were observed in the Georges Bank area (Div. 4x) and along the slope of the shelf. Div. 4w is characterized by the presence of boreal species, such as *Calanus finmarchicus*, *Metridia lucens*, *Centropages typicus*, *Oithona similis* etc., which are especially abundant there.

The presence of the nauplii and copepodite stages of the copepods was recorded all over the area.

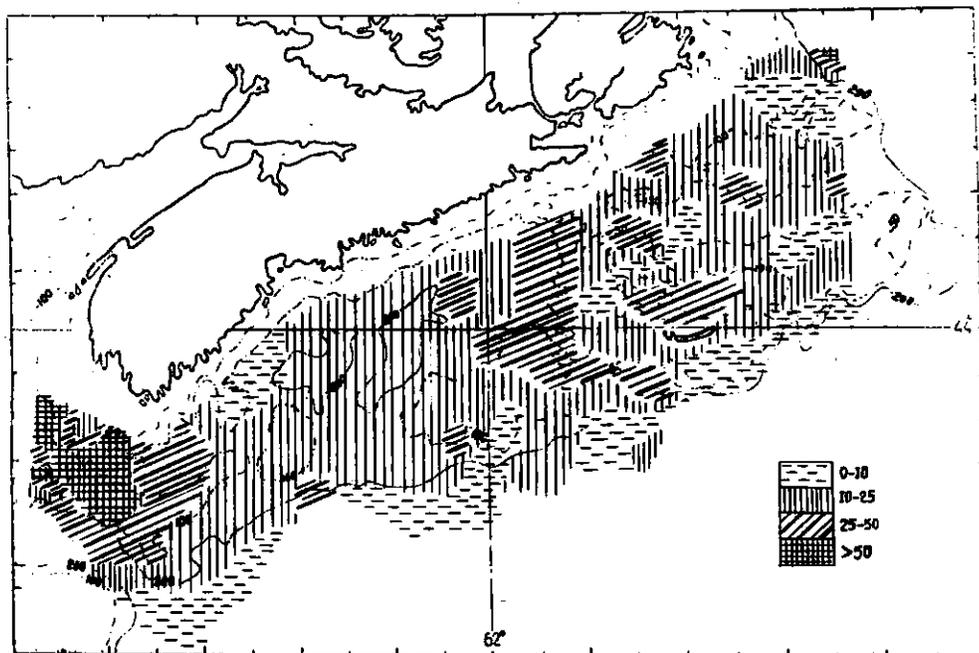


Fig. 9. Distribution of seston biomass (g under m^2) in September-October 1977.

The species composition and abundance of organisms in the area of the maximum concentration of the hake larvae westward of Sable Island are given in table 2. Smaller organisms most common in the intestines of the hake larvae make up over 80% in numbers [1].

Table 2. Species composition and abundance of organisms westward of Sable Island

Species	%	Sp. nos./m ²
Oithona sp. cop.	33.6	18210
Nauplii Copepoda	22.4	12140
Oithona similis	15.1	8180
Oithona plumifera	10.0	5470
Centropages typicus	6.0	3290
Pseudocalanus elongatus	5.9	3230
Copepodit Calanoida	5.3	2900
Calanus finmarchicus	0.7	410
Pisces larvae	0.2	90
Polychaeta	0.1	60
Decapoda	0.1	50
Sagitta sp.	0.1	50
Calanus helgolandicus	+	30
Euphausiacea	+	20
Metridia lucens	+	10
Amphipoda	+	10
Salpa sp.	+	10

III. Summary

During the ichthyoplankton survey the surface water temperature ranged between 12 to 15°C. The zones of warmer ocean waters (up to 21°C) and colder Labrador waters (1-5°C) are clearly pronounced over the shelf slope. In the near bottom layer the temperature fluctuated from 1.1 to 10.0°C.

Most dense concentrations of the silver hake eggs were observed in the Sable Island shallow waters (3.9 eggs under m²). Less numerous concentrations (0.4 eggs under m²) occurred on Browns and Banquereau Banks, which can be attributed to the distr-

istribution pattern of the silver hake spawning aggregations, to their spawning time and intensity.

The silver hake larvae were abundant near Emerald Bank (20.0 sp. under m^2), however, less numerous numbers were recorded near Banquereau and Browns Banks, 3.8 sp. and 0.6 sp. under m^2 , respectively. The mean larva lengths were 5.40 mm in Div.V, 6.43 mm in Div. 4w and 10.14 mm in Div.X.

Maximum aggregations of the seston biomass coincided in general with the areas of the mass concentrations of the silver hake larvae. The seston biomass amounted on the average to 20.8g under m^2 . The zooplankton species composition was rather various including the boreal species, the nauplii and copepodite stages of the copepods in numbers.

References

- SAMYSHEV E.Z., PTITSINA L.G. On the feeding of herring, silver and red hake larvae in the Georges Bank area. Trudy AtlantNIRO, vyp. 60, 1976, p. 139.

