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Preliminary Results of the Ichthyoplankton Survey Carried
Out on the Flemish Cap in May-July 1978

by

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Abstract

To determine the abundance of commercial fish eggs and larvae the collection of ichthyoplankton was made by the RV "Protsion" on the Flemish Cap Bank in May-July 1978.

At that time larvae of redfish (*Sebastes* sp.) and eggs of long rough dab and cod were mainly found on the Flemish Cap Bank.

The abundance of redfish and long rough dab larvae decreased sharply over a period from May throughout July.

In 1978 mass spawning of the Flemish Cap cod occurred probably in February-March. Due to this fact cod eggs were observed in small numbers in May-July.

Eggs of long rough dab were mainly found in May-June. In May eggs were found at all embryonic stages with prevalence of stages I and II, and in June - only of stage I.

Occurrence of redfish larvae and long rough dab eggs over vast depths gives ground to consider that ichthyoplankton is transferred beyond the Bank limits.

Introduction

In May 1977 it was decided at the International symposium held in Murmansk to take the Flemish Cap Bank as a ground for studying the regularities of commercial fish abundance fluctuation.

tuations and reasons, provoking them, survival conditions of early stages and appearance of strong year classes.

Cod, beaked redfish (*S. mentella*) and redfish (*S. marinus*) are of main importance in fishery conducted on the Flemish Cap Bank. The abundance of long rough dab, Greenland halibut, witch, haddock and other commercial fish is not high.

The abundance of beaked redfish is higher than that of redfish, however it is difficult to determine their ratio in catches of commercial vessels as statistics do not divide these species. There is information that little redfish (*S. fasciatus*) are also found on the Flemish Cap Bank (Barsukov, 1972; Barsukov, and Zakharov, 1972). Data on the abundance of the last species in this area are not available.

The main commercial fish species form local populations on the Flemish Cap Bank (Postolaky, 1962; 1978; Templeman, 1962; Yanulov, 1962).

The most intensive spawning of cod on the Bank occurs in late February - March (Mankevich and Prokhorov, 1962; Postolaky, 1963).

Some specimens of cod can spawn from March till August (Serebryakov, 1967).

According to the available in PINRO data extrusion of beaked redfish larvae occurs from early February till July (the peak - in March/April). Extrusion of redfish larvae occurs approximately at the same time.

Spawning specimens of long rough dab are found from March till July; the peak of spawning occurs probably in April/May.

Material and methods

Detailed ichthyoplankton surveys on the Flemish Cap Bank were carried out twice by the RV "Protsion"; the first survey was made from 13 of May to 2 of June, the second survey - from 17 to 29 of July. Section 6-A (the Flemish Cap branch) was made from 26 to 27 of June (Table 1).

Table 1. Date of carrying out ichthyoplankton stations on
the Flemish Cap Bank in 1978

No. of survey	Date	Type of fishing	Number of stations
I	May 13 - June 2	Surface 25-30 m vertical	42 52 59
Section 6-A	June 26 -27	Surface 25-30 m vertical	4 7 11
II	July 17 -29	Surface 25-30 m vertical	12 14 19

Ichthyoplankton was collected with an egg net IKS-80 (diameter of admission opening 80 cm, gauze No.37). Three hauls were made at each station: vertical fishing from the bottom to the surface (if the sea depth was more than 500 m the 500-0 m depth was fished), fishing on the surface and at the depth of 25-30 m. During the vertical fishing the speed with which nets were set in was approximately 1m/sec. Fishing of ichthyoplankton in the surface layer and at the 25-30 m depth was conducted simultaneously for 10 minutes with the lowest speed of the vessel (about 0.1 knots). Nets used for fishing on the surface and at the 25-30 m depth were fixed in a wire 50 m apart. When lifting these two combined nets, the net fixed at a distance of 50 m from the net fishing in the surface, fished also in the layer from 25-30 m to the surface.

Fishing of ichthyoplankton on the surface was conducted so that the net was completely plunged into the water (i.e. the upper edge of the net ring was hardly seen in the water). To make the net placed at a distance of 50 m from the first

one plunged into the depth of 25-30 m a 20 kg load was fixed to it.

Ichthyoplankton samples were fixed in the four percent formalin solution. Treatment of samples was made at the Institute. To determine the species and developmental stages of eggs and larvae the paper by T.C.Fass (1949) was used.

Mean number of eggs and larvae per vertical fishing with an egg net during the whole time of the survey (i.e. mean number of eggs per 0.5 sq. m of the sea surface) was taken as an index of relative abundance.

Discussion

Cod. Distribution of cod eggs in May-July 1978 is shown in Fig.1: the largest number of eggs was found in the center of the Bank in July. The diameter of eggs ranged from 1.30mm to 1.45 mm (mean diameter was 1.38 mm).

Table 2. Developmental stages of cod eggs on the Flemish Cap Bank in 1978

Month	Developmental stages				Total number of eggs
	I	II	III	IV	
May	3	4	7	-	14
June	3	-	-	-	3
July	7	17	6	-	30

The above-cited data on developmental stages of cod eggs show that single specimens spawn during the whole spring-summer period. These data cannot be used as an index of cod spawning efficiency since the survey was carried out two months after the mass spawning occurred.

Redfish.(Sebastes sp.). Due to the fact that till now there is no reliable criterion for determining the species of redfish larvae, we give qualitative and quantitative characteristics

without dividing them by species. The quantitative distribution of redfish larvae is given in Fig.2.

During the first ichthyoplankton survey redfish larvae were distributed everywhere on the Bank within 1000 m isobath. It is explained by the closed system of currents on the Flemish Cap Bank.

Larvae were also found over the depths of 1000-4500 m far beyond the Bank limits except its western part.

It is established that in spring and in early summer (i.e. in the period of larvae extrusion) beaked redfish (more numerous species of gen. *Sebastes*) keep mainly to the depths of 400-700 m (Chekhova, 1972).

Thus, finding larvae at a large distance (60-120 miles) from the main reproductive zone gives ground to suppose that a considerable number of larvae is transferred beyond the Bank limits. However, we think that extrusion of redfish larvae is also possible over great depths.

In June and July redfish larvae were found over great depths (3000-4500 m) both within and beyond the Bank limits.

Occurrence of larvae up to 7 mm long in the samples collected in May-July is indicative of the fact that larvae extrusion takes place during the whole mentioned period.

Little difference in the length of the larvae caught over various depths gives ground to consider that all the larvae are of common, i.e. of the Flemish Cap, origin.

Fig.3 shows variations of redfish larvae lengths by depths of fishing during May-July. In May larvae length was approximately equal at all depths of fishing and it ranged from 5.6 to 12.5 mm.

In contrast to length frequency of larvae in May the length frequency in June was characterized by many peaks. Redfish fry were found in samples in small numbers. The length of redfish at early stages ranged from 6.1 to 18.0 mm, however larvae up to 12.5 mm long were observed in smaller number than those 12.6 to 18 mm long.

In July two groupings of redfish at early developmental stages were observed in ichthyoplankton samples: in the first grouping larvae were from 5.6 to 13.0 mm long, in the second - from 18.5 to 25.0 mm.

From June throughout July the mean length of redfish at various stages increased from 9.25 to 20.08 mm. Thus, average monthly growth rate of larvae made up more than 5 mm.

Differences in mean length of redfish larvae by depths of fishing are indicative of the fact that as larvae grow they sink from the surface to deeper layers.

It is seen from Table 3 that from May throughout July the mean number of larvae per fishing decreased for all three types of fishing which was caused by natural mortality (the loss). According to data of vertical fishing from May throughout June - the rate of natural mortality (Z) of redfish larvae made up 1.80 ($\varphi=0.83$); from June throughout July $Z=0.77$ ($\varphi=0.54$).

Decrease in eggs abundance on the sea surface and at the depth of 25-30 m from May throughout July occurs at the expense of natural mortality and due to the fact that as larvae grow part of them sink to lower layers. In this connection rates of abundance decrease (we use deliberately the term rate of abundance "decrease" instead of "mortality") are smaller according to data of fishing on the surface and at the depth of 25-30 m from May throughout June than those from June by July (for the depth of 25-30 m and for the surface Z is equal to 1.21 and 2.47, 0.47 and 1.36 respectively).

Long rough dab. Fig.4 shows quantitative distribution of long rough dab eggs on the Flemish Cap Bank in May/June. In May long rough dab eggs were distributed within the 500 m isobath. On the section 6-A long rough dab eggs were found in June only in the shallow part of the Bank limited by the 200 m isobath.

Table 4 shows the qualitative characteristic of long rough dab eggs on the Flemish Cap Bank in May.

Table 3. Number of redfish larvae (Sebastes sp.) on the Flemish Cap Bank in May-July 1978

Type of fishing	No. of survey, month	Number of stations	Total number of larvae	Mean number of larvae per fishing
Surface	I, May Section 6-A	42	991	23.6
	June	4	59	14.8
	2, July	12	45	3.8
25-30m	I, May Section 6-A	52	5320	102.4
	June	7	214	30.6
	2, July	14	36	2.6
Vertical	I, May Section 6-A	59	922	15.6
	June	11	29	2.6
	2, July	19	22	1.2

Table 4. Qualitative characteristic of long rough dab eggs on the Flemish Cap Bank in May 1978 (total for three types of fishing)

Developmental stages	Diameter of eggs, mm											n	%	mean diameter, mm
	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0			
I	1.5	3.9	10.3	18.2	13.8	31.5	7.9	4.9	3.4	-	0.5	203	44.9	2.37
II	2.1	4.1	11.3	13.9	14.9	28.4	16.0	5.7	3.1	0.5	-	194	42.9	2.38
III	7.7	7.7	11.5	11.5	34.6	9.6	13.5	3.8	-	-	-	52	11.5	2.41
IV	-	-	-	-	-	-	100.0	-	-	-	-	3	0.7	2.40

In June all the eggs of long rough dab were developing at the embryonic stage I. The diameter of eggs ranged from 2.0 to 2.7 mm, mean diameter was 2.34 mm.

In July only one egg of long rough dab at the developmental stage IV was found.

The Table shows the quantitative characteristic of long rough dab eggs in May-July.

Table 5. Number of long rough dab eggs by depths of fishing on the Flemish Cap Bank in May-July 1978

Type of fishing	No. of survey, month	Number of stations	Total number of eggs	Mean number of eggs per fishing
Surface	I, May	42	279	6.6
	Section 6-A,			
	June	4	37	9.2
	II, July	12	-	-
25-30 m	I, May	52	208	4.0
	Section 6-A,			
	June	7	6	0.9
	II, July	14	-	-
Vertical	I, May	59	60	1.0
	Section 6-A,			
	June	11	6	0.5
	II, July	19	1	0.05

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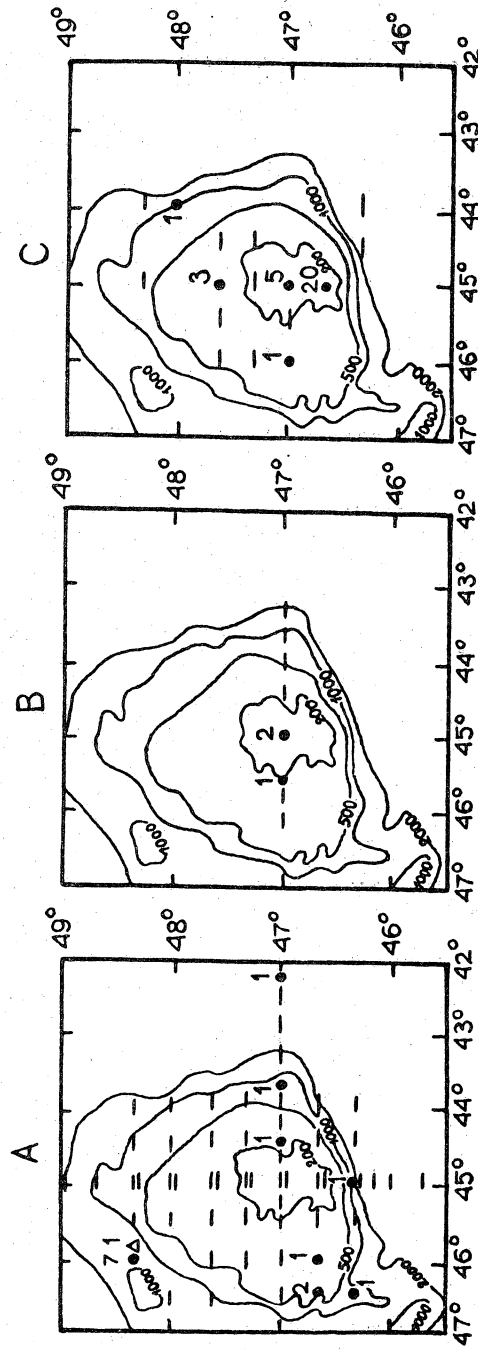


FIG.1. Distribution of cod eggs (dots) and larvae (triangle)
in May (A), June (B) and July (C).

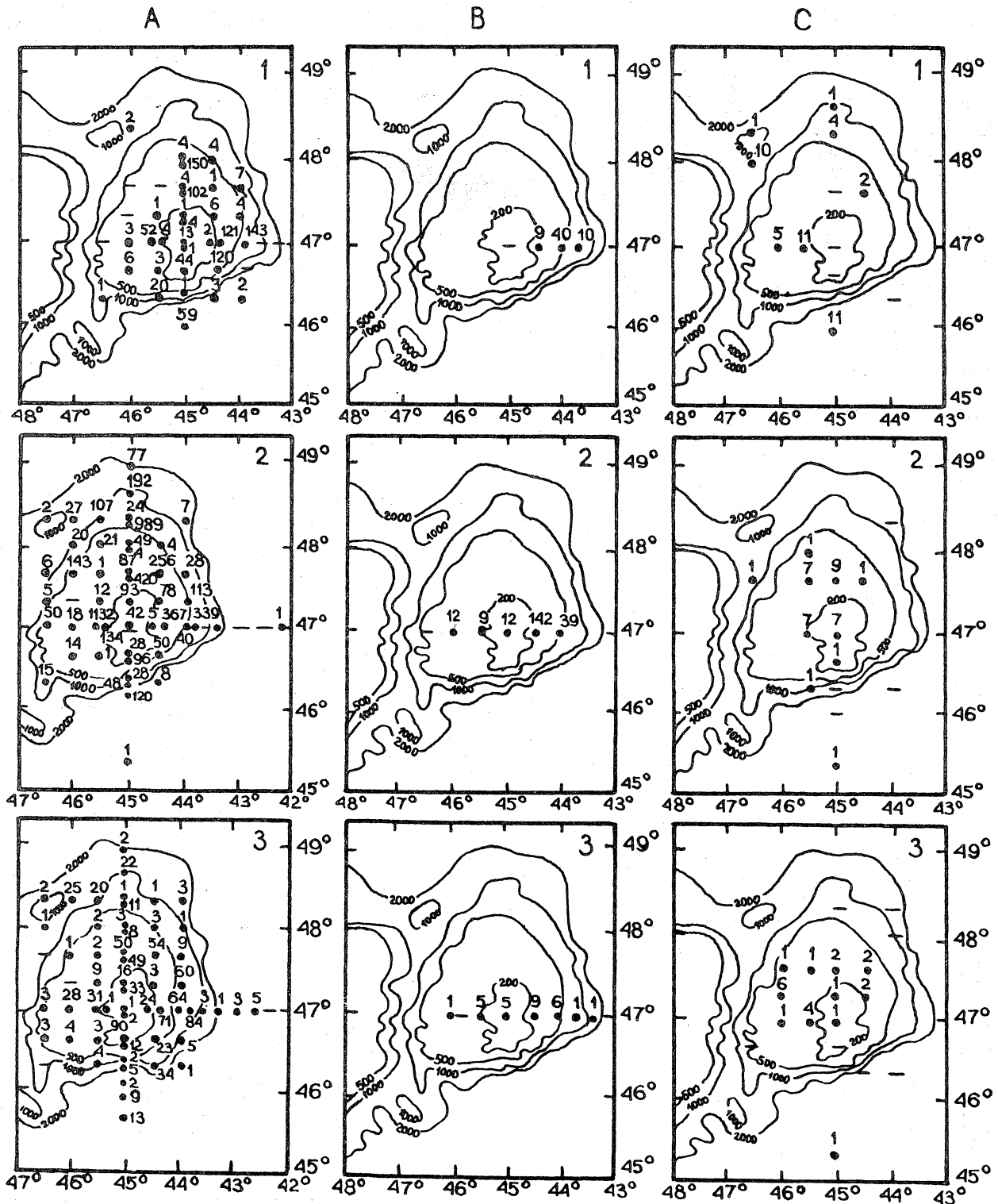


Fig.2. Distribution of redfish larvae in May (A), June (B) and July (C); 1-fishing on the surface, 2-fishing at the 25-30 m depth, 3-vertical fishing.

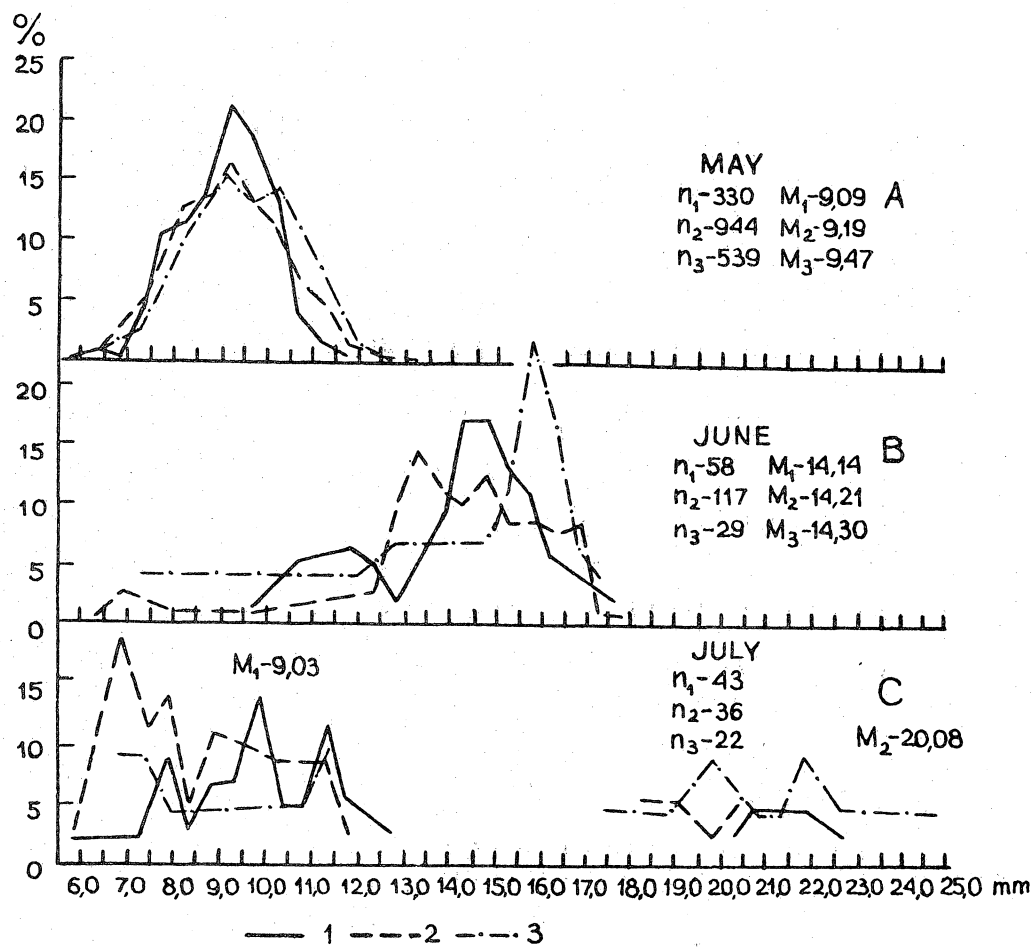


Fig.3. Length composition of redfish larvae in May (A), June (B) and July (C); 1-fishery on the surface, 2-fishery at the 25-30 m depth, 3-vertical fishing.

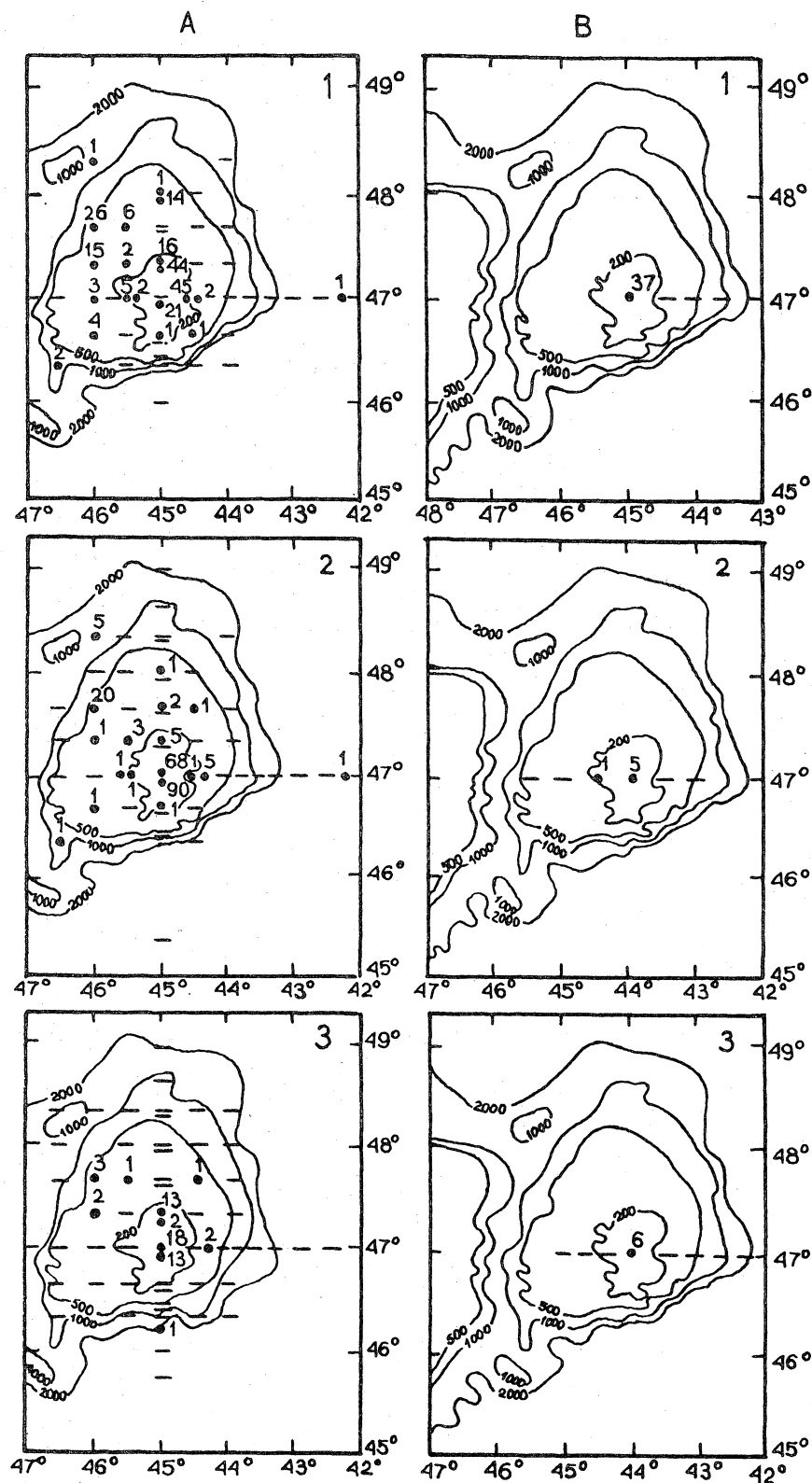


Fig.4. Distribution of long rough dab eggs in May (A) and in June (B); 1-fishing on the surface, 2- fishing at the 25-30 m depth, 3-vertical fishing.