

THE RESULTS OF SOVIET RESEARCH OF BLUE WHITTING (*MICROMESISTIUS*  
*POUTASSOU* (RISSO)) OF THE BARENTS SEA (BASED ON THE MATERIALS  
OF 1947 - 1978 )

by

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The present report is based on the poutassou samples taken in 1947-1971 from scientific research vessels of PINRO (Murmansk) which carried out annual autumn-winter count of juveniles of the main commercial fishes and on the poutassou samples taken in 1972-1978 from commercial sweep vessels of the northern region (Murmansk) specially for the study of poutassou biology. The fishing gear used on PINRO vessels consisted of bottom 25 m trawl with inserted net in cod-ends 8-10 mm mesh. On sweep vessels there was used a midwater trawl with insertion in cod-ends 20 mm mesh.

During all the years sampling and analyses were carried out according to a uniform method adopted by VNIRO and PINRO for Gadidae study.

There are few indications of several scientists concerning poutassou distribution in the Barents Sea.

In particular, Jensen (1921) informs of poutassou frequency to the east of Nordkap in the Varanger Fjord area; N.M. Knipovich (1926) indicates the occurrence of this species along the Norwegian coast up to 70°30'N; Ehrenbaum (1936) assumes that poutassou enters the Barents Sea only up to Finnmarken. Later on, G.V. Boldovsky (1939) while analysing Gadidae distribution in the Barents Sea in 1938 which was warm by hydrographical standards, was the first to discover gadoid fish up to 40°E and to assume that the farthest penetration of this species to the east is due to happen in a hydrographical summer.

A.N. Svetovidov (1948) was the first to make a chart of poutassou distribution in the north-east Atlantic in which he marked its penetration northwards to 75°N. At the same time, A.P. Andrijashev (1954) and J.J. Marti (1952) pointed out that it is often met farther to the north, over big depths to the west of Spitsbergen. Later, Tåning (1958) gave the area of poutassou in the North Atlantic, but it did not include the area of Bear Island - Spitsbergen.

Our data which are based on long-term monitoring of poutassou occurrence in bottom and midwater trawl catches make it possible to determine much more precisely its distribution in the Barents Sea and where the north-east border of its area lies.

The farthest penetration of poutassou to the north was registered in the north Spitsbergen area (81°24'N, 21°58'E with a water temperature of 2.1°C). Penetration of poutassou to the north is connected with the direction of the west Spitsbergen warm current.

On the Medvezhinskaya and Kopytovskaya banks poutassou concentrations are distributed almost the whole year along the slopes at depths of 200-500 m, but most frequently in summer and spring. To the north-east and to the east of Bear Island, this species was found in the Sydkap Gut, in the area of Hopen Island, in the western part of the Central Height, in the south-western part of Perseus Height, in the Western Gut and on Demidovskaya Bank.

Along the Norwegian and Murmansk coasts at a depth of over 150-180 m poutassou was found in the area from the Lofoten Islands almost to Sukhoi Nos Cape (Zilanov, 1968).

In some years poutassou was also observed in the Motovsky Bay.

Poutassou was particularly abundant in December 1959 when up to 200 individuals per hour of trawling were taken up. In the eastern part of the Barents Sea, poutassou was observed up to the western slopes of Gusinaya Bank. The farthest eastern point of taking is  $72^{\circ}\text{N}$  and  $44^{\circ}45'\text{E}$ . Five individuals, 12-15 cm long, were taken there with a bottom trawl on 17 November 1963 at a depth of 240 m (water temperature at the bottom  $1.8^{\circ}$ ). These catches were made 90 mile further to the east than those of G.V. Boldovski (1939).

Special research allows to determine the north-east border of the area. It lies between Sukhoi Nos Cape and the western slope of the Gusinaya Bank, turns around the halistatistical part of the Central Gut, crosses the eastern slopes of the Murmansk Tongue, Demidovskaya Bank and goes along the border of the Western Gut, Central Height to the east of Hopen Island and the Sydkap Gut, and touches the south-eastern and northern parts of Spitsbergen (Figure 1). Poutassou distribution in the Barents Sea coincides well with the direction of the warm Spitsbergen, Nordkap, Murmansk currents and their branches, while the most active penetration to the east is observed in hydrographically warm summers. Although single individuals were found far to the east, even in cold years like in 1963, they were still registered there in years which followed a number of warm ones (1959-1968).

Therefore, one can speak of a stable occurrence of poutassou in the Barents Sea both in hydrographically warm and cold years, though the areas of mass distribution vary together with varying water temperatures in different years. Thus, in warm years poutassou is observed along the Nordkap and Murmansk currents and in cold years along the western, south Spitsbergen and northern branch of the Nordkap currents. Comparison of the data of poutassou distribution in the Barents Sea with water temperature shows that the areas of mass distribution coincides with the demersal isotherm  $3^{\circ}$  (Figure 2) both in cold and warm years.

Unlike many other Gadidae, poutassou live in a wide range of depths. They keep in pelagical large quantities, but they are also met at the bottom at a depth of 180-450 m, sometimes 150 m. In the Barents Sea over 80% of 702 trawlings which gave poutassou were performed at a depth of 200 m where mass concentrations of these fish were observed (Table 1).

Table 1 Depths at which poutassou occur in catches taken with bottom trawl in the Barents Sea (% of the total number of fish taken)

Depth in metres	51-100	101-150	151-200	201-250	251-300	301-350	351-400	401-450	451-500	501-550	551-750
Poutassou occurrence in %	0.9	4.1	10.7	18.8	20.5	13.8	17.0	9.7	3.4	0.7	0.4

According to the indication of hydroacoustic instruments the biggest concentrations of poutassou are distributed in water thickness at the depth of 20-400 m. In our opinion wide distribution of poutassou at various depths is due to eurythermic features of this species. In the western part of the Barents Sea, on the Norwegian Sea border, poutassou was caught in bottom trawls down to 700-800 m, where the water temperature was 0.0<sup>o</sup><sub>5</sub>-3<sup>o</sup>. The lowest water temperature at which this fish was taken was 0.7<sup>o</sup>, but these cases were rare. In the Barents Sea, poutassou live mostly in water temperatures of 2-7<sup>o</sup> with a mass distribution at 2-5<sup>o</sup>. (see Table 2).

Table 2 Relation between bottom trawl catches of poutassou and bottom water temperature in the Barents Sea (%)

Bottom water temperature, °C	-1.0-0.1	0.0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-7.0
%	0.1	3.8	15.8	30.8	25.6	18.5	1.5	4.0

From 1947 to 1978 in catches taken with bottom trawl individuals 8-45 cm long were registered (Table 3). Twenty cm long poutassou prevailed in 1947, 1948, 1952, 1953 and then from 1956 till 1960 and in 1964-1966. In recent years, small fish (up to 20 cm long) were rare in catches. Medium sized (21-25 cm) and big (over 26 cm) poutassou were periodically observed in all the years of study, but they were most numerous in catches in 1949, 1951, 1955, 1961, 1963 and particularly in 1967-1978. The prevailing number of small poutassou in hydrographically warm years attracts one's attention. The period studied may be divided into two parts according to the temperature of the water masses in the 0-200 m layer on the Kola meridian: the first one from 1947 to 1961, when positive anomalies prevailed, though in some years there were negative anomalies, and the second one from 1962-1978, when the water temperature was falling. Comparison of size composition shows that small poutassou was more prevailing in the first part compared to the second one (Table 3). This phenomenon may be due to low survival of juveniles in cold years. According to A.S. Baranenkova (1968), survival of eggs, larvae and juveniles of cod in the Barents Sea (a more cold-loving species compared to gadoid fish) is influenced by the drastic change of the water temperature. I.J. Ponomarenko (1968) and K.E. Fedorov (1967) pointed out the adverse influence of low temperatures on cod survival.

The distribution of poutassou of various sizes over the Barents Sea area is not even either. Summary data for 1958-1959 can be found in Table 4. They characterise size composition in the western, north-western, eastern and south-eastern parts of the sea. The conditional border between them is adopted along the meridians 29-30. It was considered possible to combine mass measurement data for two years because of too close similarity of size composition in these years and in order to cover the widest possible area. Table 4 shows that medium sized and big poutassou prevail in the western and north-western parts, while small fish prevail eastern and south-eastern parts. Similar regularity can be traced in any of the years of the research period which is determined by passive drifting of juvenile fish with the currents to the east and by its active migrations to the west while it is growing. Medium sized and big poutassou are distributed in the western part of the sea which is more influenced by the warm Atlantic waters than the eastern part. The same areas are, in fact, the northern and north-eastern borders of distribution of feeding schools which consist of big poutassou. In spite of the occurrence of all sizes in the Barents Sea and the considerable share of medium and big poutassou, there were no spawning areas found in this area and no individuals at the maturity stage III. All the year round juveniles or individuals at the maturity stages II and VI-II prevailed here. Consequently, the dynamics of size composition of poutassou in the Barents Sea are determined by the number of juveniles brought here, by the time which individuals of one generation spend in this area and by active migrations of feeding concentrations of big fish to the western part of the Barents Sea from the Norwegian Sea.

The diet of poutassou in the Barents Sea consists of Entomostraca and juvenile fish. Pelagic forms of Euphausiidae and Calanidae prevail among Entomostraca. Their role in feeding varies depending on age and area of distribution, but still Euphausiidae hold the first place in all cases. Juvenile fish make up a considerable part of poutassou food in the Barents Sea. Eight more fish species were discovered in food bolus of poutassou. Particularly often herring, capelin, redfish, cod, shanny and polar cod juveniles were found in stomachs with their summary occurrence reaching 23% (according to material gathered from 1961 to 1972). The area of adult gadoid fish and juvenile herring, redfish and cod basically coincides in the western part of the Barents Sea in summer and autumn which means the greater part of the year. The areas of poutassou, polar cod and capelin touch for a short time in September-November only in the area of Bear Bank, south of Spitsbergen and Hopen Island as a result of which the frequency of these species in food bolus is not stable and their share is small.

Poutassou does not differ from other Gadidae in feeding rhythm; its feeding lasts almost the whole year. Index of fullness reaches its maximum in spring, summer and autumn. In winter, the amount of food in the stomachs of poutassou is smaller compared to spring, summer and autumn, but still the average index of fullness remains at a rather high level.

The analysis of many years' material concerning poutassou fatness (proportion between liver weight and the weight of fish in percentage) shows that according to this characteristic poutassou of the Barents Sea surpass that of all other areas. Thus, gadoid fish fatness in different areas in June-August according to average data of many years for 1961-1971 was the following :

Barents Sea	-	7.6
Norwegian Sea	-	7.3
Iceland	-	5.8
Western Great Britain	-	3.9

These characteristics are well coordinated with well-known high productivity of the Barents and Norwegian Seas in feeding zooplankton (Pavshchikov, 1958, Marti, Martensen, 1972) which is the main food of poutassou. Analysis of feeding habits, fatness and maturity of poutassou of the Barents Sea shows that feeding conditions are the best here, consequently these are the same conditions for biomass reproduction. At the same time, the Barents Sea where the eastern and north-eastern borders of the species area lie is not favourable for the development of genital glands because of temperatures. As a result, the area of the Barents Sea is used for feeding excursions by adult individuals which are likely never to spawn later. Juveniles which are brought to the Barent Sea by the currents mainly from the spawning areas to the west of Great Britain are also unlikely to contribute to the spawning part of the Hebrides-Norwegian stock.

Thus, the north-eastern part of the poutassou area, the Barents Sea in this case, is the area of species expatriation, with its individuals having no significant part in the reproductive potential of the species.

In periods of its stay in the Barents Sea poutassou becomes food for cod, Greenland halibut, redfish and its mass concentration in the shelf area increases the food resources for these fish.

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Table 3 Size composition of poutassou taken by trawl in the Barents Sea in 1947 - 1978

19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	P	M
5.0	15.0	15.0	-	2.5	-	-	-	2.5	2.5	2.5	5.0	2.5	5.0														40	21.40
2.3	3.0	07	1.1	1.1	07	-	07	-	-	-	04	07															269	17.17
0.3	-	03	1.5	2.1	1.8	6.3	3.5	7.0	10.3	16.1	20.7	11.7	11.5	3.3	1.8	0.8											398	29.00
2.9	-	2.9	2.9	2.9	2.9	-	-	-	2.9	-	5.9	23.7	8.9	2.9	2.9	38.3											34	31.34
9.4	12.0	6.5	5.6	4.3	1.9	0.5	1.4	07	08	06	05	08	05	04	-	03											877	18.18
3.8	6.5	6.5	9.2	10.4	7.8	2.6	9.2	1.3	3.8	-	5.2	1.3	2.6	1.3	1.3	1.3	1.3										76	22.43
-	3.1	6.3	18.8	6.3	15.6	3.1	6.3	6.3	-	-	6.3	3.1	3.1	-	-	9.3											32	24.55
01	-	05	3.3	2.4	5.1	8.9	12.8	13.1	12.1	10.1	14.4	7.2	3.8	08	07	05	01										569	27.29
4.6	7.1	5.1	4.8	1.7	1.2	1.7	1.0	1.1	09	04	06	06	07	03	01												989	17.45
1.3	1.8	1.8	1.4	07	01	08	07	08	04	01		01	04	01													1 361	14.76
5.3	2.2	1.3	2.7	5.3	3.7	7.1	7.5	8.7	6.5	4.3	6.0	3.4	2.6	1.4	04	03	01										1 448	23.11
2.4	2.2	2.3	2.7	2.7	2.4	1.6	1.4	2.7	4.2	4.5	9.4	6.7	5.9	2.1	1.3	07	04										1 103	22.06
1.4	08	06	07	03	03	+	02	+	+	01	-	+	+	-	-	-	+										1 692	14.85
1.2	0.8	1.2	-	1.2	2.8	2.4	3.6	6.4	7.9	5.9	13.2	9.9	12.8	7.6	5.9	2.4	04										251	27.82
+	02	04	1.4	2.9	3.1	9.7	9.2	14.3	11.9	9.9	13.7	8.6	7.1	4.3	1.9	1.2	02	+									3 616	26.50
1.1	2.3	2.3	-	1.1	1.1	1.1	1.1	1.1	-	1.1																	88	17.38
-	05	1.9	2.9	3.5	5.6	7.2	4.5	8.8	9.7	8.0	8.0	6.4	2.9	1.1	08												374	22.87
-	-	-	-	02	08	1.4	4.3	7.3	10.2	6.6	16.2	6.6	6.2	3.9	07												483	23.95
-	-	-	02	04	-	02	4.4	13.5	14.0	14.8	24.2	13.3	8.7	4.4	1.1	06	02										473	29.51
-	-	01	-	01	-	03	2.5	8.8	14.4	14.1	12.8	18.5	12.8	11.5	2.7	09	04	-	01								730	30.19
-	-	-	-	01	-	1.7	3.8	8.5	8.1	8.3	21.4	13.4	17.8	8.7	4.2	1.9	03	03	01								763	30.17
3.9	5.5	3.8	1.9	0.7	0.3	0.5	0.5	3.4	5.3	6.7	13.3	16.1	15.7	11.5	4.6	2.1	0.6	0.5	0.4	+	+	+	+	+	+	+	3 625	29.07
+	+	0.1	0.3	0.7	1.8	2.2	1.8	3.0	5.5	8.1	20.1	16.4	18.2	10.3	5.9	3.8	1.2	05	01								11 824	30.73
+	+	+	+	+	+	+	0.1	0.6	1.8	1.9	10.8	21.8	22.0	16.3	9.6	9.6	3.5	1.7	02	01	+						35 014	32.42
02	01	01	01	01	01	0.1	03	08	2.2	4.7	13.2	15.3	19.2	16.9	9.5	10.1	4.5	1.9	0.3	+					+		9 334	32.17
+	+	+	+	+	+	+	01	04	1.5	4.6	9.4	15.3	19.9	13.7	13.5	11.5	5.4	2.0	04	02	+						14 102	32.51
+	+	01	01	01	02	01	02	06	2.3	4.0	5.7	12.4	20.9	21.9	13.8	8.1	4.8	1.9	0.5	01	+						12 527	32.63
+	01	01	01	03	03	09	1.4	2.6	5.1	11.1	14.6	17.0	17.7	12.7	8.5	4.7	1.6	0.7	02	01	+	+				14 336	31.26	
+	-	+	+	0.1	0.1	0.2	0.4	0.9	2.1	4.3	9.2	13.3	17.9	15.3	12.3	12.2	6.8	3.5	1.0	0.3	0.1	+	+			33 517	32.71	
+	+	+	0.1	+	+	+	0.1	0.5	2.6	5.1	9.9	16.2	21.1	21.5	12.0	5.8	3.6	1.2	0.3	+							6 529	32.44

Size composition of poutassou taken by trawl in the Barents Sea in 1947-1978

Year	Length in cm																							
	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1947							2.5	-	7.5	12.5	25.0	15.0	15.0	-	2.5	-	-	-	2.5	2.5	2.5	5.0	2.5	5.0
1948		07	-	-	-	07	8.2	34.2	30.2	15.3	2.3	3.0	07	1.1	1.1	07	-	07	-	-	-	04	07	
1949								0.5	03	03	0.3	-	03	1.5	2.1	1.8	6.3	3.5	7.0	10.3	16.1	20.7	11.7	11.5
1951											2.9	-	2.9	2.9	2.9	2.9	-	-	-	2.9	-	5.9	23.7	8.9
1952			0.5	1.2	1.3	3.5	9.3	14.7	14.0	9.3	9.4	12.0	6.5	5.6	4.3	1.9	0.5	1.4	07	08	06	05	08	05
1953		1.3	2.6	-	1.3	1.3	6.5	6.5	3.8	1.3	3.8	6.5	6.5	9.2	10.4	7.8	2.6	9.2	1.3	3.8	-	5.2	1.3	2.6
1954							6.2	-	3.1	3.1	-	3.1	6.3	18.8	6.3	15.6	3.1	6.3	6.3	-	-	6.3	3.1	3.1
1955				03	-	03	1.2	07	05	01	01	-	05	3.3	2.4	5.1	8.9	12.8	13.1	12.1	10.1	14.4	7.2	3.8
1956		01	03	5.4	5.5	8.9	18.3	11.8	12.6	5.2	4.6	7.1	5.1	4.8	1.7	1.2	1.7	1.0	1.1	09	04	06	06	07
1957	04	4.0	9.6	16.5	17.7	18.1	12.9	5.7	3.4	1.1	1.3	1.8	1.8	1.4	07	01	08	07	08	04	01		01	04
1958	02	04	03	01	05	2.2	4.7	5.6	8.6	8.6	5.3	2.2	1.3	2.7	5.3	3.7	7.1	7.5	8.7	6.5	4.3	6.0	3.4	2.6
1959	04	1.4	1.4	1.8	5.2	8.5	10.2	6.6	4.6	4.3	2.4	2.2	2.3	2.7	2.7	2.4	1.6	1.4	2.7	4.2	4.5	9.4	6.7	5.9
1960		04	1.6	5.3	14.9	27.2	22.6	14.3	7.4	2.2	1.4	08	06	07	03	03	+	02	+	+	01	-	+	+
1961	-	-	-	-	04	2.4	2.8	1.6	4.4	2.0	1.2	0.8	1.2	-	1.2	2.8	2.4	3.6	6.4	7.9	5.9	13.2	9.9	12.8
1963						+	+				+	02	04	1.4	2.9	3.1	9.7	9.2	14.3	11.9	9.9	13.7	8.6	7.1
1964	1.1	1.1	-	-	2.3	13.7	26.4	11.4	13.7	8.0	1.1	2.3	2.3	-	1.1	1.1	1.1	1.1	1.1	-	1.1			
1965		3.2	16.1	7.0	0.5	0.5	-	03	03	03	-	05	1.9	2.9	3.5	5.6	7.2	4.5	8.8	9.7	8.0	8.0	6.4	2.9
1966				3.1	3.9	13.7	14.1	0.8	-	-	-	-	-	-	02	08	1.4	4.3	7.3	10.2	6.6	16.2	6.6	6.2
1967														02	04	-	02	4.4	13.5	14.0	14.8	24.2	13.3	8.7
1968													01	-	01	-	03	2.5	8.8	14.4	14.1	12.8	18.5	12.8
1969						08	01	05	-	-	-	-	-	-	01	-	1.7	3.8	8.5	8.1	8.3	21.4	13.4	17.8
1970				+	+	-	+	+	06	2.4	3.9	5.5	3.8	1.9	0.7	0.3	0.5	0.5	3.4	5.3	6.7	13.3	16.1	15.7
1971									+	+	+	+	0.1	0.3	0.7	1.8	2.2	1.8	3.0	5.5	8.1	20.1	16.4	18.2
1972							+	+	-	-	+	+	+	+	+	+	+	0.1	0.6	1.8	1.9	10.8	21.8	22.0
1973				+	+	+	01	01	+	01	02	01	01	01	01	01	0.1	03	08	2.2	4.7	13.2	15.3	19.2
1974												+	+	+	+	+	+	01	04	1.5	4.6	9.4	15.3	19.9
1975				+	-	+	+	01	01	+	+	01	01	01	01	02	01	02	06	2.3	4.0	5.7	12.4	20.9
1976											+	01	01	01	03	03	09	1.4	2.6	5.1	11.1	14.6	17.0	17.7
1977											+	-	+	+	0.1	0.1	0.2	0.4	0.9	2.1	4.3	9.2	13.3	17.9
1978													+	0.1	+	+	+	0.1	0.5	2.6	5.1	9.9	16.2	21.1



Table 4 Comparison of size composition of poutassou of different areas of the Barents Sea (material collected from 1958 - 1959)

Length (cm)	Size composition (%) in the western part of the Barents Sea	Size composition in the eastern part of the Barents Sea (%)
9	0.2	0.3
10	0.9	0.7
11	0.9	1.1
12	0.4	2.9
13	0.6	6.6
14	0.7	11.6
15	1.1	15.9
16	1.2	13.2
17	1.1	15.4
18	1.2	14.0
19	2.5	7.4
20	1.9	1.9
21	2.6	0.7
22	3.6	0.9
23	6.6	0.8
24	4.6	0.9
25	7.6	0.5
26	8.7	0.2
27	11.1	0.3
28	9.1	0.1
29	9.0	1.0
30	10.2	0.7
31	6.4	0.9
32	4.5	0.7
33	1.9	0.3
34	0.6	0.5
35	0.4	0.2
35	0.2	0.2
I	1 549	1 068
M	25.84	16.99

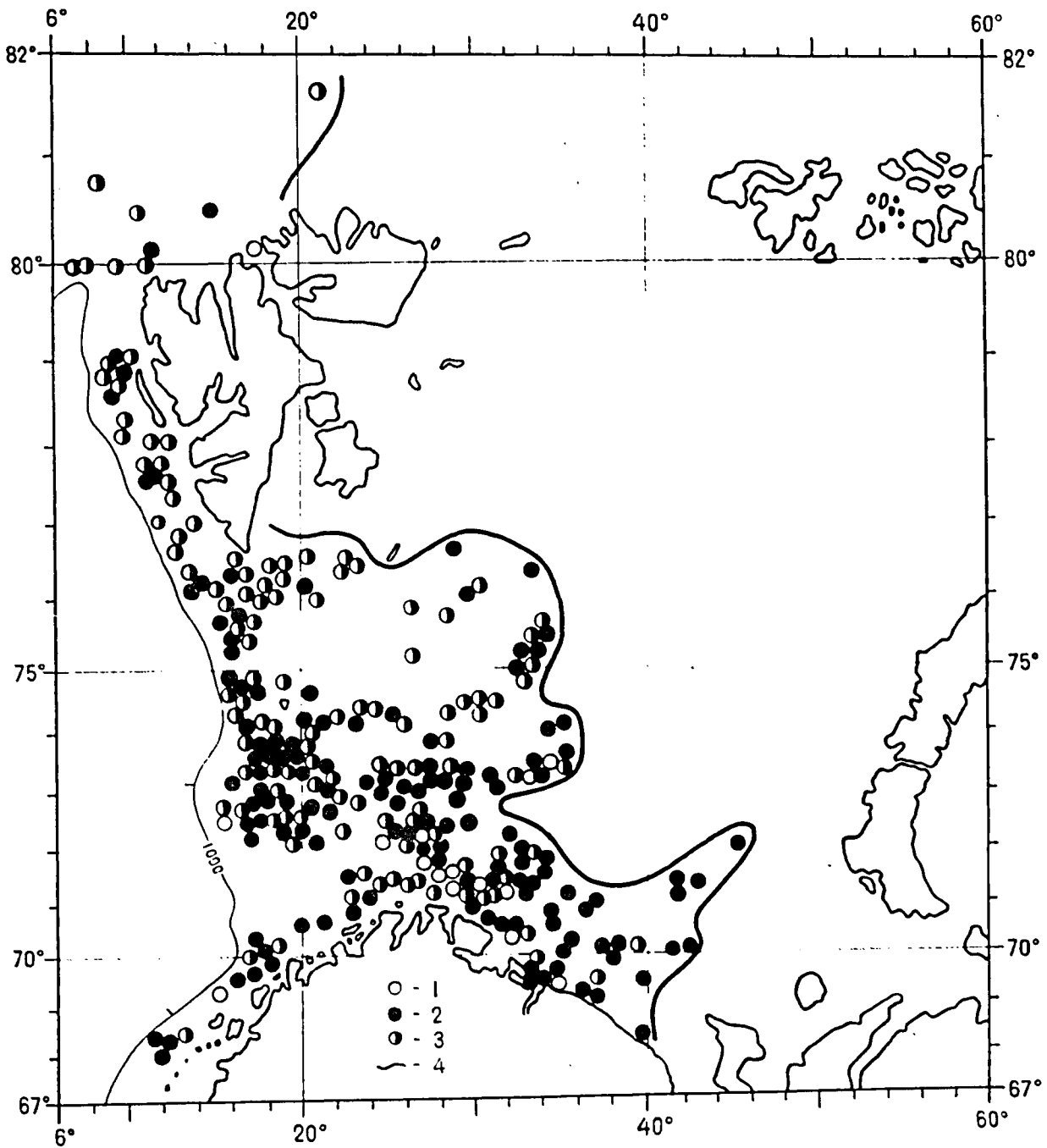


Figure 1 Occurrence of poutassou in the Barents Sea according to data obtained during 1947 - 1971

- 1 - up to 20 cm long
- 2 - up to 21 - 25 cm long
- 3 - over 25 cm long
- 4 - areal border

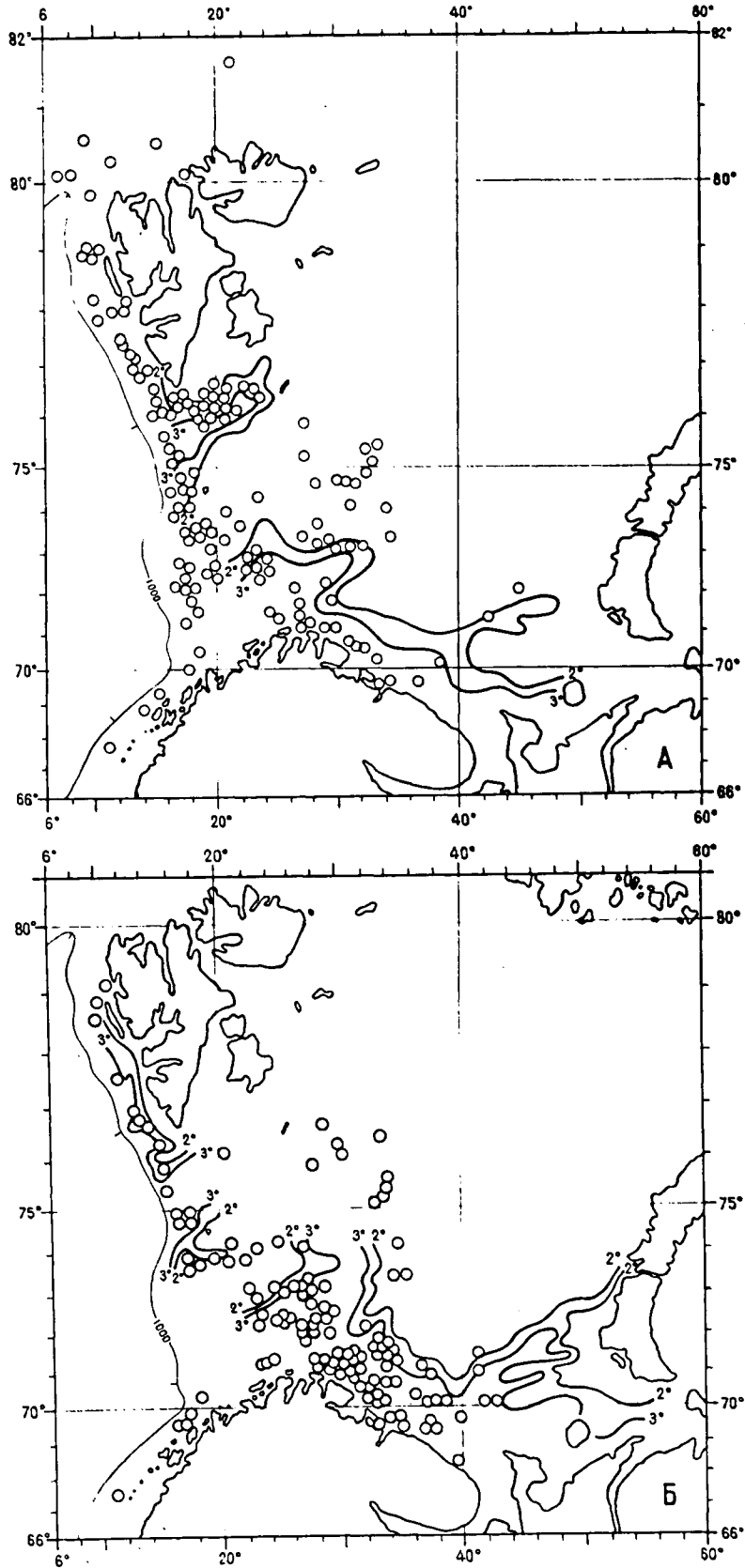


Figure 2 Occurrence of poutassou in the Barents Sea in cold years (A - data of 1947, 1948, 1952, 1953, 1958, 1962, 1963, 1965, 1968, 1969, 1971; demersal isotherm of 1966) and in warm years (B - data of 1949, 1950, 1951, 1957, 1959, 1960, 1964; demersal isotherm of 1959).