Conference Paper

Distribution of Polychaeta Communities in the Western and Northern Part of the Barents Sea

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Abstract

Species composition and quantitative characteristics of polychaetes in the western and northern parts of the Barents Sea were analyzed on the basis of the material collected in July and November 2017 on MMBI expeditions aboard the RV ``Dalniye Zelentsy''. Three faunistic polychaete complexes were revealed, depending on environmental conditions in the study area. A change in species composition and structure of communities from the bottom topography, structure of bottom sediments and bottom hydrodynamics were noted. An increase in biomass and density of polychaetes settlement was revealed in deep-water areas of the Barents Sea, on soft silty-clay soils, where the dominant species is *Spiochaetopterus typicus*. A decrease in quantitative characteristics of polychaetes was observed in shallow areas, on hard soils, in the zone of intensive erosion of bottom sediments as a result of warm and cold currents interaction, where the polychaete *Nothria hyperborea* dominated.

Keywords: polychaeta, communities, Barents Sea

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1. Introduction

Bottom relief significantly affects the distribution of bottom sediments, circulation of water masses, as well as the composition of bottom fauna. We described the effect of the Barents Sea marginal deeps on species composition and quantitative distribution of polychaetes in our previous studies [1]. Warm Atlantic waters [2, 3] flow into the Barents Sea along boundary trenches, contributing to an increase in species diversity of benthic organisms. Stations located in a study area intersect South Cape Trench and Bear-Hope Islands flat, Storfjord Strait and the northern region of the Barents Sea. These areas are subject to South Spitsbergen Current warm waters and East Spitsbergen and Bear Currents cold waters influence, which affect species composition and structure of benthic communities. A complex pattern of water circulation and bottom topography determines interest in studying fauna in a given area. Despite the sufficient study of benthic communities in western and northern parts of the Barents Sea [4--8], researches on species and quantitative composition of polychaete worms in the study area are

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not enough [1, 9]. Structure and diversity of Polychaeta settlements reflect development trends of benthic communities [10]. Therefore, the study of modern species composition and quantitative characteristics of polychaetes in this area is of particular interest. The purpose of the research is to study changes in species composition and quantitative characteristics of polychaetes depending on environmental conditions.

2. Methods

The material studied was 61 quantitative samples withdrawn from the board of the research vessel ``Dalnie Zelentsy'' at 21 stations during the integrated expedition of the Murmansk Marine Biological Institute in July and November 2017 (Figure 1). Sampling from a depth of 79 to 331 m using a Van Veen bottom grab (capture area, 0.1 m^2) was made in triplicate. After washing the soil through a polycaprolactam sieve with a mesh size of 0.75 mm and fixation in 4% formalin, the invertebrates were placed into 70% alcohol. Polychaete were identified by us. To assess their biogeographical composition, we used the polychaete areas classification proposed by Zhyrkov [11]. To determine the groups of stations with similar species compositions, we used cluster analysis by the weighted average method based on the Bray--Curtis similarity coefficient [12]. The relative metabolic rate, an index of a species contribution in terms of biomass and the number of individuals, was used as a measure of abundance to determine the dominant species group:

$$M = K \cdot N^{0.25} \cdot B^{0.75}$$

where N is the number of individuals, B is biomass, K is taxon-specific coefficient of the specific metabolic rate [13].

3. Results

In the area studied, 114 Polychaeta taxa have been identified, of which 89 were determined down to the species level. The number of species at stations varies from 21 to 52, the maximum number of species is noted on silty-clay soils with stones and shells. The minimum amount is marked on sandy soils with clay, shell and gravel (Table 1).

The biogeographic composition is dominated by boreal-arctic species (83%), the number of boreal species (10%) exceeds the number of arctic species (7%). The largest number of boreal species is noted at st. 19, 20, 21, in the area of warm waters of Spitsbergen Current influence.

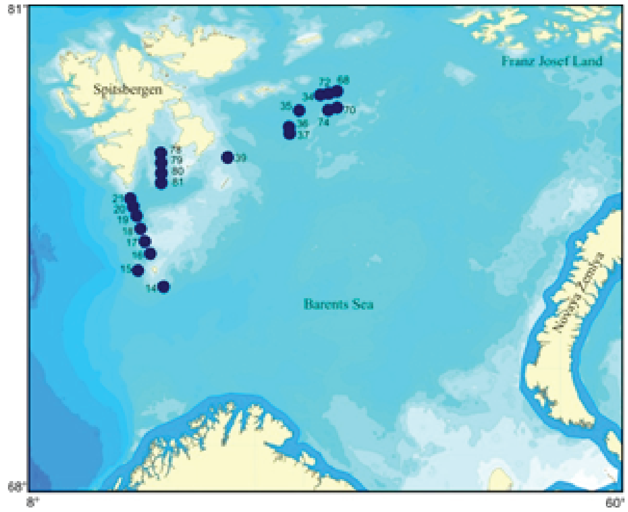

Figure 1: Layout scheme of the benthic stations in the Barents Sea.

TABLE 1: Quantitative parameters of the polychaete communities in the Barents Sea.

Station no.	Depth	Temperature, °C	The number of species	Biomass, g/m^2	Abundance, ind./m^2	Dominant species (in terms of metabolism)
14	150	4.2	50	18±6	1600±540	*Nothria hyperborea*
15	144	4.5	25	13.5±4	1040±133	*Nothria hyperborea*
16	199	4.6	50	80±11	6747±700	*Spiochaetopterus typicus*
17	101	3.8	21	3.5±1	473±223	*Nothria hyperborea*
18	142	5.3	50	48±7	2517±224	*Nothria hyperborea*
19	250	4.7	51	30±10	1223±270	*Spiochaetopterus typicus*
20	320	4	41	25±10	1750±240	*Spiochaetopterus typicus*
21	285	3.3	42	29.5±29.5	2750±2750	*Asychis biceps*
34	281	0.8	37	56±18	1147±95	*Spiochaetopterus typicus*
35	242	-0.5	44	11±3	1780±193	*Maldane arctica, Spiochaetopterus typicus*
36	250	-1	52	82±11	2410±442	*Spiochaetopterus typicus*
37	234	0.8	51	51±5	3100±362	*Spiochaetopterus typicus*
39	79	0.4	49	11±3	1770±580	*Terebellides stroemi*
68	331	0.7	36	28±5.5	1160±153	*Spiochaetopterus typicus*
70	184	0.9	37	23.4±2.5	1463±222	*Nicomache lumbricalis*
72	300	-0.9	34	32±12	893±135	*Spiochaetopterus typicus*
74	112	-0.3	39	14±3.5	1607±200	*Lumbrineris fragilis*
78	151	-1.9	36	63.5±21	4203±143	*Maldane sarsi*
79	130	-1.8	39	41.5±9	3110±79	*Maldane sarsi*
80	157	-1.2	27	97±11	4237±20	*Spiochaetopterus typicus*
81	218	0.8	49	88±13	4340±225	*Spiochaetopterus typicus*

Biomass of polychaete in the research area varied from 4 to 100 g/m^2, high values were noted in the northern region of the Barents Sea, in the region of Bear Island, in

Storfjord area on silty-clay, silty-sandy soils. Population density of polychaetes varied from 470 to 6750 ind./m^2, maximum values were noted in the same areas as biomass. Collecting detritophage *Spiochaetopterus typicus* dominates by biomass at stations, and *Galathowenia oculata* by settlement density.

Three faunistic polychaete complexes were distinguished by a cluster analysis method in the studied area (Figure 2).

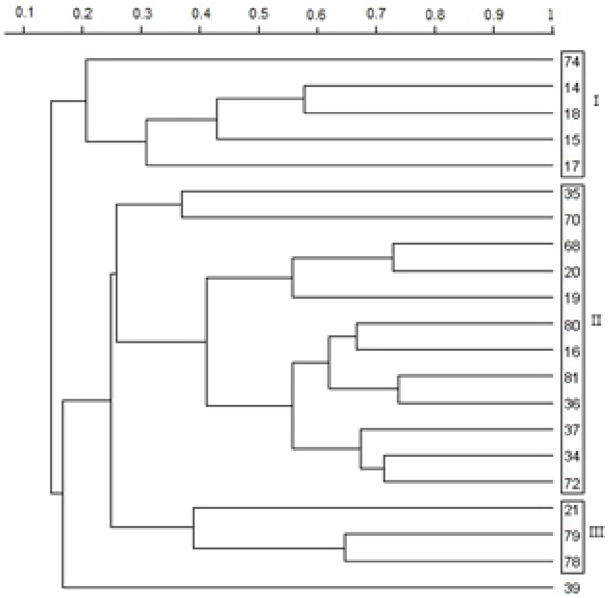

Figure 2: Dendrogram of the polychaete species similarity in the Barents Sea.

The first complex is located in Bear-Hope Islands flat area, and in the northern region of the Barents Sea on sandy soils with shell, pebbles and stones at depths from 105 to 150 m, with water temperatures from -0.3 to + 5.3°C. Carnivorous polychaete *Nothria hyperborea* and *Galathowenia oculata* dominate in terms of metabolic intensity and biomass share in this complex. The complex is characterized by minimal biomass values (19 ± 4 g/m^2) and low settlement density (1310 ± 263 ind./m^2). The biogeographic composition is dominated by boreal-arctic species (83%), the number of boreal species (11%) exceeds the number of arctic species (6%).

The second faunistic complex was found in Southcape trench deep-water areas, at a station in Bear Island -- Hope Island plateau area north of Bear Island, in the external part of Storfjord strait and in the northern part of the Barents Sea at depths from 190 to 328 m, on silty-clay soils, with water temperature from -0.9 to 4.7°C. Here *Spiochaetopterus typicus* dominates in terms of metabolic intensity and biomass share, and *Galathowenia oculata* in terms of the number. The complex is characterized by high biomass (50 ± 12 g/m^2) and an average settlement density (2520 ± 420 ind./m^2). The biogeographic composition is dominated by boreal-arctic species (90%), the number of boreal species is 10%, the number of arctic species is 7%.

The third complex with a dominance of subsurface deposit feeder *Maldane sarsi* was noted in the inner part of Storfjord strait and on the southern slope of West Spitsbergen on silty-clay soils with sand, gravel, shell, at depths from 130 to 285 m, at a temperature of -1.25 to 3.3 °C. The complex is characterized by average values of biomass (44 ± 20 g/m^2) and high population density (3355 ± 990 ind./m^2).

A station (39) was distinguished separately and was not included in clusters, located at a depth of 79 meters on stony sandy soils, characterized by minimal biomass values and average settlement density, where *Terebellides stroemi* dominates in terms of metabolic rate share.

4. Discussion

Results of our research have shown that faunal complexes in the study area have a spotty distribution. However, in each section of bottom, they replace each other in accordance with relief and hydrodynamic bottom conditions causing composition and abundance of food material.

An increase in biomass and density of polychaetes was observed on silty-clay soils in deep-water areas of South Cape Trench, Bear Island Bank, in Storfjord Strait, as well as in northern regions of the Barents Sea. *Spiochaetopterus typicus* is a dominant species by biomass and metabolic rate. Favourable conditions for detritophages are created in hollows of the bottom with weakened hydrodynamics, where sedimentation process of suspension predominates over its transfer [4], which leads to biomass increase.

A decrease in biomass and population density of polychaete communities was noted with a decrease in depth along Bear Island-Hope Island flat, as well as in northern regions of the Barents Sea. Polychaeta *Nothria hyperborea* is the dominant species in this area. Unfavorable conditions for the development of detritus phages are created on hard soils with a predominance of coarse clastic material, in the zone of intensive erosion of bottom sediments, as a result of warm and cold currents interaction, where precipitation processes transfer dominate over formation processes, which leads to a decrease in biomass and density of polychaete.

The obtained data confirm results of past studies. According to A.P. Kuznetsov, *Spiochaetopterus typicus* and *Galathowenia oculata* play the main role in fauna composition in the area of Bear Island-Spitsbergen Plateau [4]. Also, detritophage *Spiochaetopterus typicus* dominated in the deep-water areas of South cape trench, on

Bear Island and St. Anna slopes in previous studies [1, 9]. Trenches, being areas of sedimentary substances accumulation [14, 15], increase the food supply for benthic organisms that contribute to an increase in quantitative characteristics of polychaetes.

5. Conclusion

Thus, obtained data confirm previously published results on the effect of the bottom structure, bottom sediments, depth, and bottom hydrodynamics on the distribution of polychaetes fauna in the Barents Sea [1, 9]. As a result of the research, three faunistic complexes of polychaetes were identified depending on environmental conditions. An increase in polychaetes quantitative characteristics is noted in the study area in bottom depths, on soft soils, where the dominant species is the detritophage *Spiochaetopterus typicus*. Current results significantly complement the data on species composition and quantitative distribution of Polychaeta communities in the western and northern parts of the Barents Sea.

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