

## PRELIMINARY STUDIES ON SANDY LITTORAL MACROFAUNA AT PROTECTED AREAS OF THE POLISH OPEN BALTIC SEA COAST

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### Abstract

This paper presents results of summer research project on benthic macrofauna carried out in 1992. The project was conducted along three protected areas of the Polish open Baltic coast: the Wolin National Park, the Słowiński National Park and the Rozewie Cape. Species composition and average density reflected well the type of bottom sediment. The least populated was coarse sand, while fine and muddy sands were more densely populated. Crustaceans were dominating in each region, while the Rozewie Cape oligochaetes constituted 44% of species abundance.

### INTRODUCTION

This research was carried out along the future marine nature reserves which were proposed by HELSINKI COMMISSION (1994). The Commission has proposed to establish a system of marine reserves in the Baltic region, so called Baltic Sea Protected Areas — BSPAs. This system shall cover especially

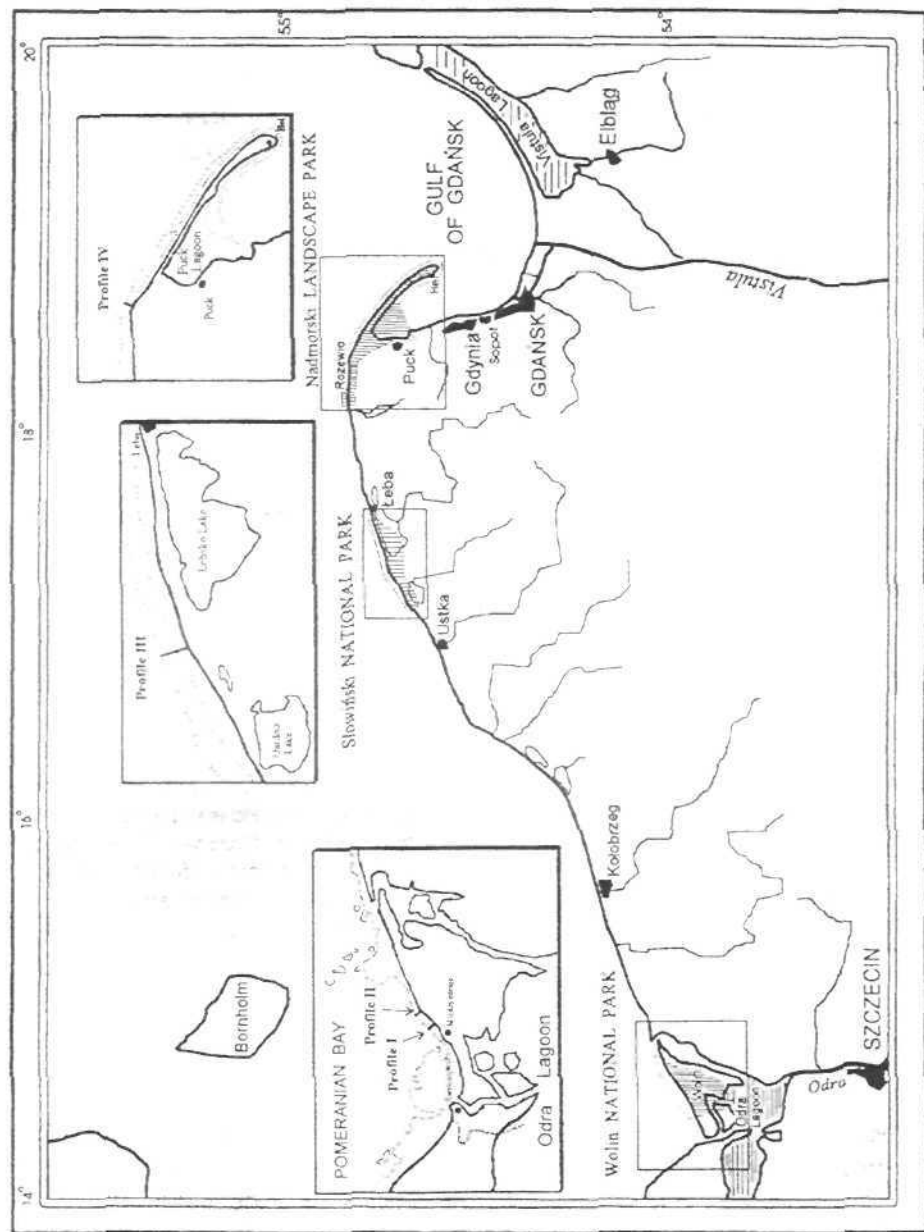


Fig. 1. Sampling profiles along the Polish Coast

valuable, relatively natural and unchanged marine areas existing in the Baltic region. There are five such areas located along the Polish coast: Wolin National Park, Słowiński National Park, Nadmorski Landscape Park, Redłowo Nature Reserve and Mierzeja Wiślana (Vistula Spit) Landscape Park (Andrulewicz 1994, Helsinki Commission 1994). All of them are located as an extension of land territory of already existing coastal protected areas. Three of them, situated along the open sea, were investigated for shallow water macrofauna during this study (Fig. 1). These areas as well as bottom fauna of many other shallow water areas along the Polish coast (excluding the Puck Bay) has not yet been investigated adequately. Shallow parts, especially till 10 m depth, were usually omitted during studies, because of the difficulties in getting access to these areas by research vessels.

Generally, it can be assumed, that sandy — mobile littoral zone is not hostile habitat for benthic species. It is due to highly dynamic, mobile features of bottom and lack of organic material which is washed out from inshore areas to deeper places. In coastal strip (till 10 m) mobile sand forms sandy bars and trenches. Some organic material (detritus), is temporally deposited between sand bars and exposed to rather quick decomposition. Therefore regular distribution of flocs of organic material is observed in trenches along the coast. A strip of the coastal waters (0–10 m) of the southern Baltic Sea in Poland composes an open, exposed, sandy and very often mobile shore type. Exposed beaches and swash zone (supralittoral) have usually no macroflora and macroinvertebrates. Breakers zone (upper littoral; 0–3 m), and lower zone (lower littoral; till 10 m) belong to the rarely studied marine areas, therefore the knowledge about zoobenthos of the coastal strip is very limited.

The shallowest part of the Polish coastal strip (till 2 m isobath) was investigated in the 70-ties by Zmudziński (1979), also by Warzocha (1995) and Haque et al. (1996). Similar studies were carried out by Olenin (1995), along the Lithuanian coast.

## MATERIAL AND METHODS

Altogether 29 samples of bottom sediments were collected from 26 July to 1 August 1992. Samples were taken along four profiles perpendicular to the coast line. Two profiles were located within coastal waters along the Wolin National Park, one along the coastal area of Słowiński National Park and one located at the Rozewie Cape (Fig. 1).

Samples were collected by plastic tube 62 mm in diameter which was interjected 15–20 cm deep into the bottom sediment by a diver. Sampling was done every 1 m depth till 7 m depth, or in some cases to 10 m depth (Table 1). The content of the tube was sieved through a 0.7 mm metal sieve

Table 1

List of sampling profiles and sampling places

Nr.	Sampling profiles	Sampling location and date	Depth [m]	Sediment type
1.	I	Wolin National Park Międzyzdroje 26.07.1992	1	coarse sand
2.			2	" "
3.			3	" "
4.			4	fine sand
5.			5	" "
6.			6	" "
7.			7	muddy sand
8.	II.	Wolin National Park Grodno 30.07.1992	1	coarse sand
9.			2	" "
10.			3	fine sand
11.			4	" "
12.			5	muddy sand
13.			6	" "
14.			7	" "
15.			10	" "
16.	III.	Słowiński National Park 31.07.1992	1	fine sand
17.			2	" "
18.			3	" "
19.			4	" "
20.			5	" "
21.			6	" "
22.			7	" "
23.	IV	Rozewie Cape 1.08.1992	1	fine sand
24.			2	" "
25.			3	" "
26.			4	" "
27.			5	" "
28.			7	" "
29.			10	muddy sand

and material which was left was preserved with 4% formaldehyde solution. Samples were then investigated for zoobenthos content in laboratory.

Sampling profiles along the Wolin National Park at profiles I and II were placed against cliff coast, pebble and gravel beaches. Coarse sand and gravel was observed down to 3–4 meters. Some finer sand was present deeper, till 10 meters. Between sand waves (rippelmarks) detritus flocks were observed. The profile No III at the Słowiński National Park was placed against sandy mobile dunes. Highly dynamic sandy beaches extended towards mobile sandy bottom of the sea. No visible organic material was observed between sand bars and rippelmarks. The profile No IV at the Rozewie Cape was located against cliff coast with sand and gravel beaches and occasional stones. Samples were taken between stones. This area is characterised by very strong currents (up to 100 cm/s). At depths below 5 meters very large rippelmarks, as deep as 30–40 cm, were observed.

## RESULTS

There were 31 taxa found in the samples (Table 2): 16 crustaceans, 4 polychaetes and 4 bivalves. Also larvae of insects and species of following groups: *Turbellaria*, *Oligochaeta*, *Nemertini*, *Bryozoa* and *Gastropoda* were recorded. Most common species was psammophil amphipod *Bathyporeia pilosa*. Oligochaetes and polychaetes: *Hediste diversicolor*, *Marenzelleria viridis* and *Pygospio elegans*, as well as amphipod *Corophium volutator* were also very abundant.

High density of bottom macrofauna reaching 36–40 thou. ind/m<sup>2</sup> was noted along the cliff shore while low density of bottom macrofauna was observed along dune coasts. Crustaceans were found to be dominated group of organisms in each sampled area. At the Słowiński National Park crustaceans composed 91% of the total number of macrozoobentos, in profile at the Wolin National Park — 51%, and in profile along the Rozewie Cape — 45%. At the Rozewie Cape Natural Reserve oligochaetes were almost equally abundant — 44% of the total number of macrozoobenthos, but in profile at the Wolin National Park their abundance was six times lower (7%) and in the Słowiński National Park, they were almost absent, composing — only 1% of macrobenthic fauna. Bivalves and polychaetes played an important role only in profile along the Wolin National Park (Fig. 2).

A crustacean *Corophium volutator* was the most common species along the Wolin National Park, while in two other investigated areas another crustacean *Bathyporeia pilosa* was the dominant one. In the Rozewie Cape Natural Reserve *Oligochaeta* and *Bathyporeia pilosa* were the most abundant while *Gammarus salinus* and *Marenzelleria viridis* were less common species.

Table 2

List of species found in three different areas

Nr	Taxon	Wolin National Park (I and II)	Słowiński National Park (III)	Rozewie Cape Reserve (IV)	Mean Values
1.	<i>Bathyporeia pilosa</i>	100	100	86	97
2.	<i>OLIGOCHAETA</i>	80	14	71	62
3.	<i>Hediste diversicolor</i>	93	14	29	59
4.	<i>Marenzelleria viridis</i>	53	0	86	48
5.	<i>Pygospio elegans</i>	60	14	29	41
6.	<i>Corophium volutator</i>	67	0	0	35
7.	<i>Mytilus edulis</i>	40	14	29	31
8.	<i>Mya arenaria</i>	47	0	14	28
9.	<i>Gammarus salinus</i>	27	0	43	24
10.	<i>Psectroclaudius sp.</i>	27	14	14	21
11.	<i>Cardium glaucum</i>	40	0	0	21
12.	<i>HYDROBIIDAE</i>	27	14	0	17
13.	<i>Macoma balthica</i>	27	0	0	17
14.	<i>Gammarus oceanicus</i>	20	0	14	14
15.	<i>NEMERTINI</i>	20	0	0	10
16.	<i>Cyathura carinata</i>	13	0	0	7
17.	<i>Idotea granulosa</i>	7	0	14	7
18.	<i>Jaera sp.</i>	7	0	14	7
19.	<i>Neomysis integer</i>	0	0	29	7
20.	<i>Crangon crangon</i>	0	29	0	7
21.	<i>Balanus improvisus</i>	7	0	7	5
22.	<i>Gammarus zaddachi</i>	7	0	7	5
23.	<i>Electra crustulenta</i>	13	0	0	5
24.	<i>TURBELLARIA</i>	7	0	0	3
25.	<i>Fabricia sabella</i>	7	0	0	3
26.	<i>Heterotanais oerstedti</i>	7	0	0	3
27.	<i>Euridice pulchra</i>	0	14	0	3
28.	<i>Gammarus duebeni</i>	7	0	0	3
29.	<i>Calliopius laeviusculus</i>	0	0	14	3
30.	<i>CHIRONOMIDAE</i>	0	0	14	3
31.	<i>Palaemon adspersus</i>	0	14	0	3

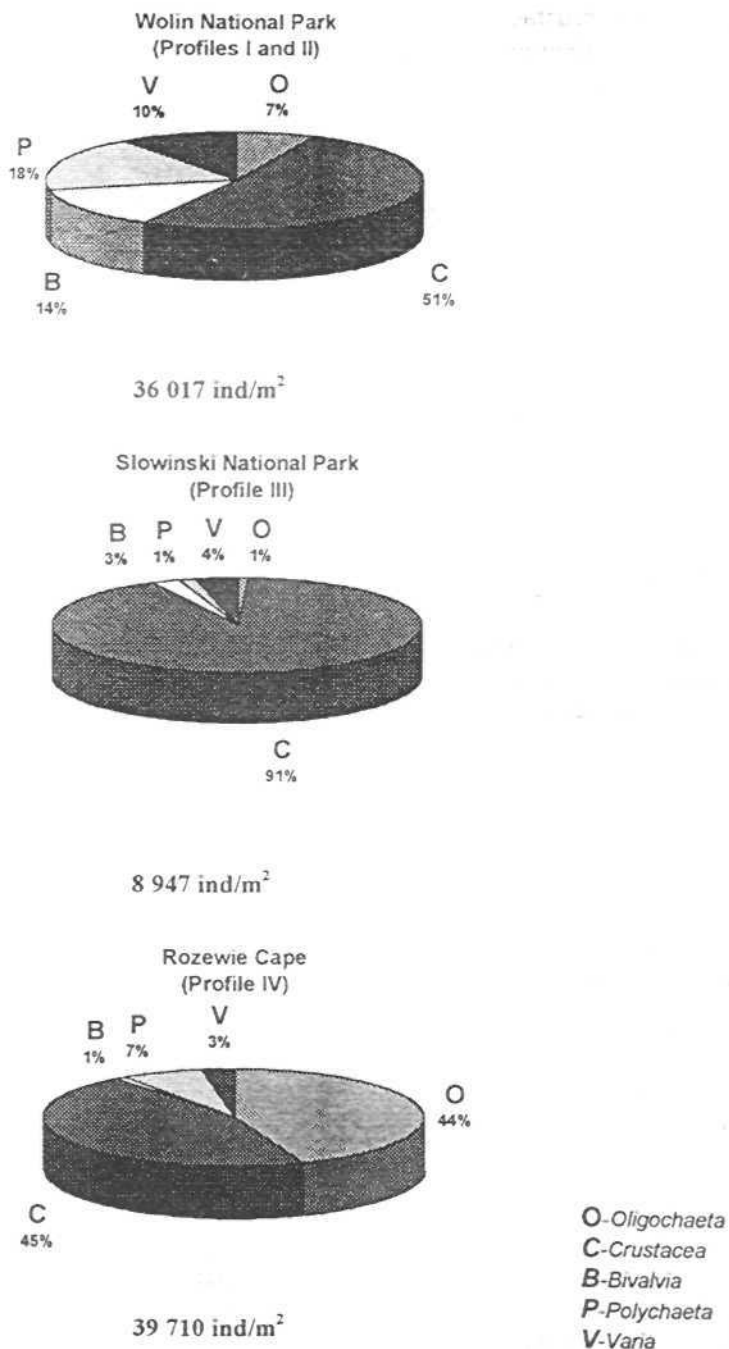


Fig. 2. Mean density and composition of macrofauna taxonomic groups at study areas

*Mytilus edulis* was the most abundant in the Wolin National Park. It is also interesting that crustacean *Corophium volutator* was present exclusively only at this profiles, what indicates relatively low water dynamics (Table 3).

The average density of macrofauna was 28–30 thou. ind/m<sup>2</sup> of bottom, while 13–17 thou. ind m<sup>2</sup> were crustaceans (Fig. 3). As depths increases there

Table 3  
Mean density of dominating invertebrates at different areas (ind/m<sup>2</sup>)

Taxon	Wolin National Park	Słowiński National Park	Rozewie Cape
<i>OLIGOCHAETA</i>	2 494	79	17 514
<i>Bathyporeia pilosa</i>	6 530	8 160	12 870
<i>Corophium volutator</i>	9 597	0	0
<i>Gammarus salinus</i>	2 246	0	5 117
<i>Mytilus edulis</i>	4 933	236	315
<i>Hediste diversicolor</i>	4 184	39	590
<i>Marenzelleria viridis</i>	793	0	1 653
<i>Pygospio elegans</i>	1 492	79	590

Table 4  
Mean density of dominating invertebrates at different depth range (ind/m<sup>2</sup>)

Taxon	< 2.5 m	2.5 - 5.0 m	> 5.0 m
<i>OLIGOCHAETA</i>	13 202	2 811	2 356
<i>Bathyporeia pilosa</i>	8 512	9 411	4 030
<i>Corophium volutator</i>	25	5 905	8 100
<i>Gammarus salinus</i>	4 098	23	4 050
<i>Mytilus edulis</i>	482	5 602	753
<i>Hediste diversicolor</i>	632	2 312	3 821
<i>Marenzelleria viridis</i>	69	643	1 656
<i>Pygospio elegans</i>	0	911	1 792

Table 5  
Mean density sediment type of dominating invertebrates on different (ind/m<sup>2</sup>)

Taxon	Coarse sand	Fine sand	Muddy sand
<i>OLIGOCHAETA</i>	852	6 084	3 358
<i>Bathyporeia pilosa</i>	3 617	11 194	5 025
<i>Corophium volutator</i>	188	3 766	6 168
<i>Gammarus salinus</i>	104	693	1 741
<i>Mytilus edulis</i>	104	516	3 096
<i>Hediste diversicolor</i>	442	1 492	3 915
<i>Marenzelleria viridis</i>	12	828	1 530
<i>Pygospio elegans</i>	200	828	1 530



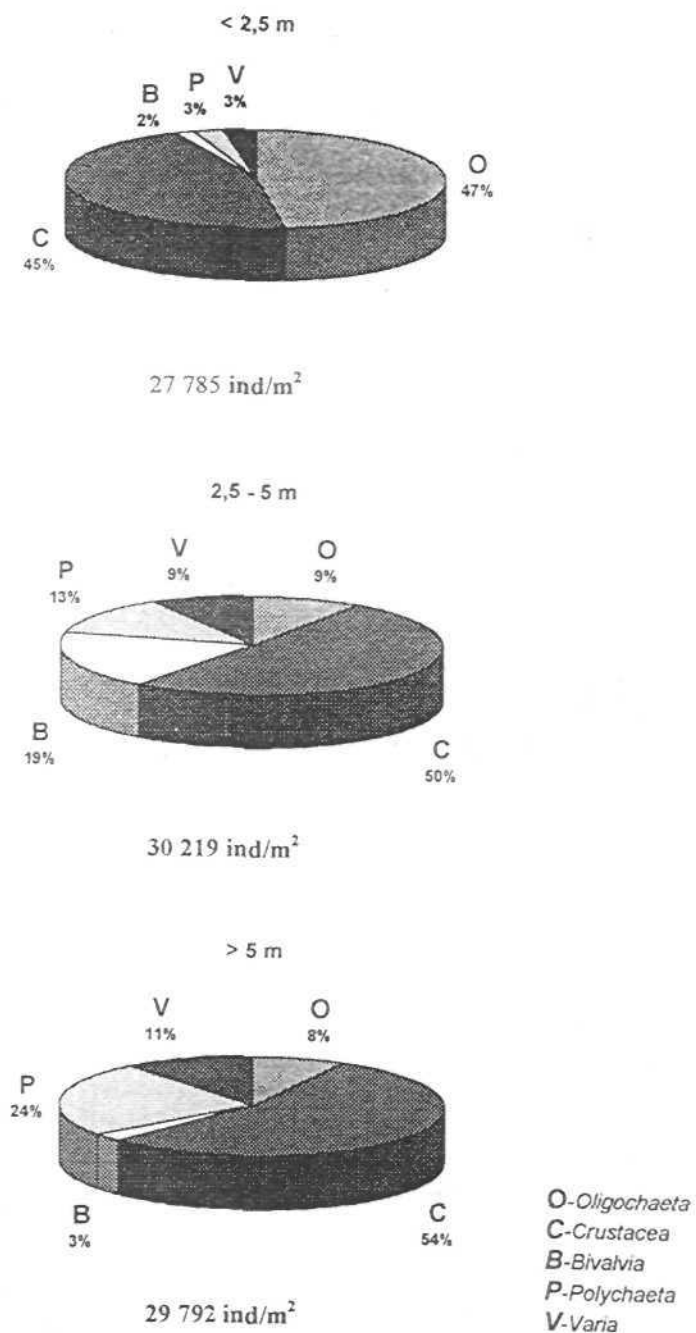


Fig. 3. Mean density and composition of macrofauna taxonomic groups on sandy bottom at different depths

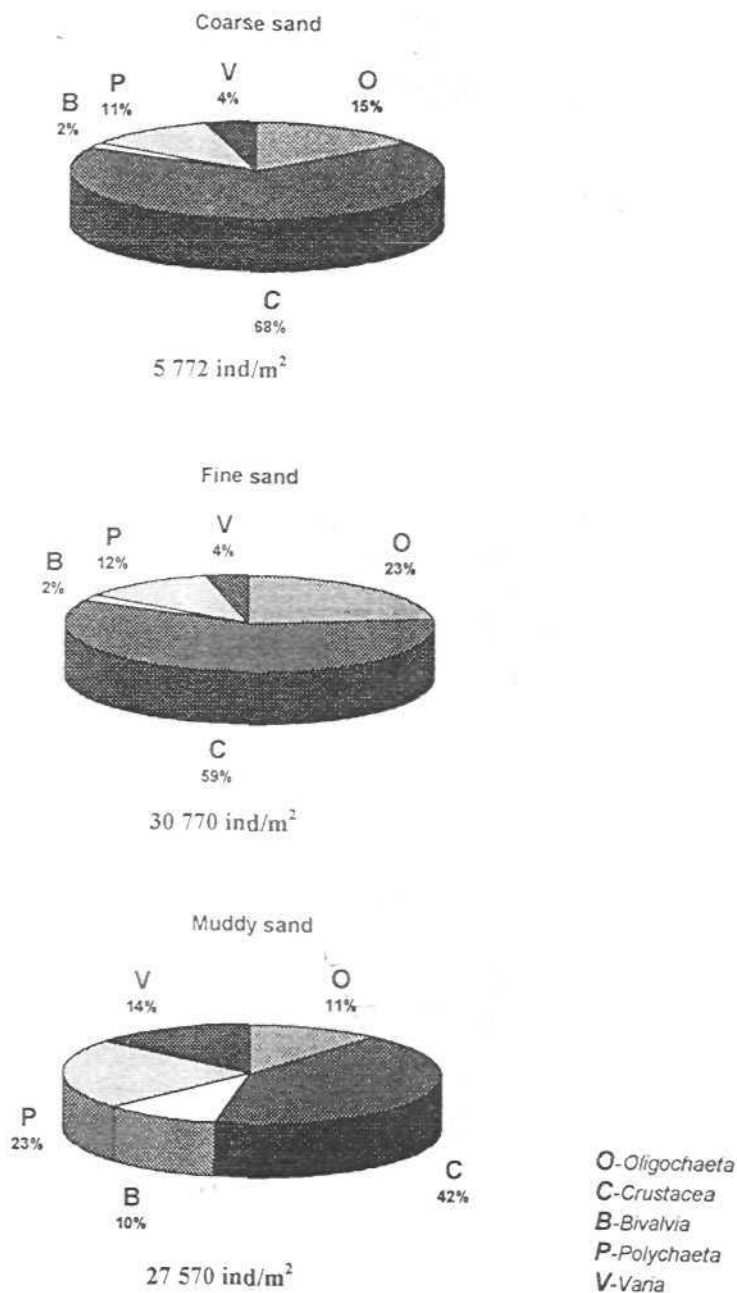


Fig. 4. Mean density and composition of macrofauna taxonomic groups on different types of bottom

is a steep decrease of crustacean species and increase of oligochaete and polychaete species (*Hediste diversicolor*, *Marenzelleria viridis* and *Pygospio elegans*) as well as crustacean *Corophium volutator* (Table 4). The maximum density of *Mytilus edulis* and *Bathyporeia pilosa* population was noted at medium depths (3–6m). At the same depths the density of *Gammarus salinus* reached its minimum.

## CONCLUSIONS

List of macrofauna species as well its mean density and species composition along open Polish sandy littoral coastal zone was determined. Dependence between the type of bottom sediments and average density of bottom macrofauna was noted. The least populated bottom was the coarse sand (6 thou. ind/m<sup>2</sup>), while on fine and muddy sands higher density of bottom macrofauna was observed (28–30 thou. ind/m<sup>2</sup>). That difference however is not reflected in the basic species composition structure. Crustaceans dominated on every bottom type, composing 48–68% of the total macrobentos. The co-dominating groups were oligochaetes and polychaetes. The only exception were mussels which avoid coarse sand bottom. The most diverse environments as well as the highest number of species were along cliff coast.

Find sand with limited organic material content was the most favourite habitat of small oligochaetes and crustacean *Bathyporeia pilosa*. All other taxons were most common on muddy sand containing more organic material. None of the species preferred coarse sand.

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