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Barents Sea benthos survey, 2003-2006

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The Barents Sea has a unique position among the Russian seas in the basin of the Arctic Ocean for:
- being an area of very intensive fisheries (demersal fishery including);
- having abundant resources of oil and gas;
- being a place of introductions of non-indigenous species. Among the most extensive introductions the intentional releases of red king crab and accidental introduction of snow crab can be mentioned.

All of the above features contribute to an increased antropogenic impact on bottom communities in this region and suggest changes in their structure that have already taken place or can be expected.

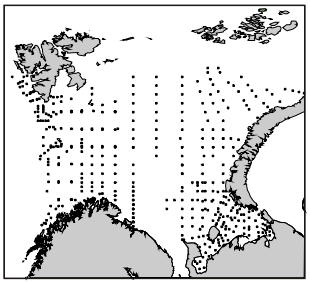

Fig. 1. Benthos survey by PINRO, 1968-1970

Regular benthos surveys are one of the most efficient instruments to identify large-scale changes taking place in the ocean under the impact of both climatic and man-made factors.

PINRO's history of benthos studies in the Barents Sea is quite long. The earliest benthos surveys in the Barents Sea were conducted by PINRO in 1923. One of the most comprehensive benthos studies by PINRO was a total benthos survey in the Barents Sea and adjacent waters in 1968-1970 (Fig. 1).

Aiming to identify the changes that occurred in the Barents Sea over the next 30 years, PINRO undertook another benthos survey in the Barents Sea in 2003-2006.

The main objectives were:

- to describe the contemporary status of bottom communities in the Barents Sea;
- to identify changes caused by climatic factors and antropogenic influences (fisheries, introductions of non-indigenous species, oil and gas development);
- to assess the impact of red king crab on bottom communities.

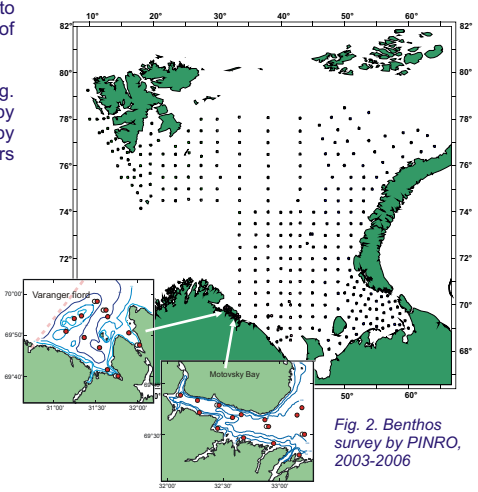

Fig. 2. Benthos survey by PINRO, 2003-2006

Fig. 3. Van Veen grab 0.1 m²

In the four summer field seasons during the survey 1616 quantitative benthos samples were collected at 335 stations that covered the whole Barents Sea (with the exception of the Norwegian economic zone) and West Spitsbergen area and 291 bottom trawlings with Sigsby trawl were undertaken (Fig. 2)

Quantitative samples were collected with Van Veen grab 0.1 m², with five replications in each station (Fig. 3), trawling was undertaken at the same stations with Sigsby trawl having a frame of 1x0.35 m and mesh size in the cod-end of 5 mm (Fig. 4). Benthos samples were drained through 0.5 mm mesh and trawl samples 5 mm mesh.

Where possible, the positions of stations were the same as in the 1968-1970 survey. For a more in-depth study of the impacts of introduced red king crab on benthos a detailed surveying of the Russian part of the Varangerfjord and the Motovsky Bay was undertaken (Fig. 2).

Collected samples are now being processed. Samples processed so far provide an overall insight into the contemporary status of benthos in central areas of the southern part of the Barents Sea and coastal waters of West Murman (Varangerfjord and Motovsky Bay).

Fig. 4. Sigsby trawl

Identified in the survey area were 1027 species of macrozoobenthos (383 species in the Varangerfjord, 451 in the Motovsky Bay and 855 in offshore areas). Polychets, crustaceans, molluscs and bryozoans showed widest species diversity, 82% of the total species list (Fig. 5).

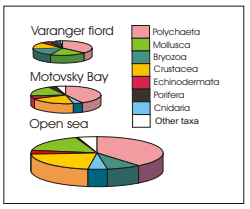

Fig. 5. Taxonomical composition of the benthic fauna in Varanger fiord, Motovsky Bay and open waters of the Barents Sea

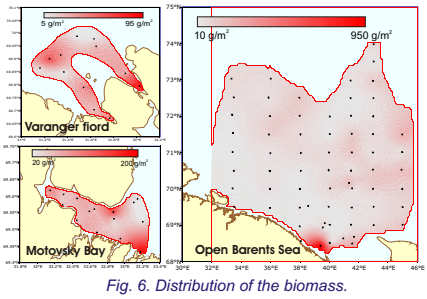

Fig. 6. Distribution of the biomass.

Highest average indices of biomass were recorded in the offshore areas of the southern part of the sea, somewhat smaller in the Motovsky Bay and Varangerfjord (Table, Fig. 6). Unlike biomass indices, highest average abundance indices were noted for the Motovsky Bay, minimal for the Varangerfjord (Table, Fig.7).

Index of ecological welfare (D) (Denisenko, 2006) based on the Shennon information measure indicates that at present the Varangerfjord has the least ecological situation compared to other surveyed areas (Fig. 8).

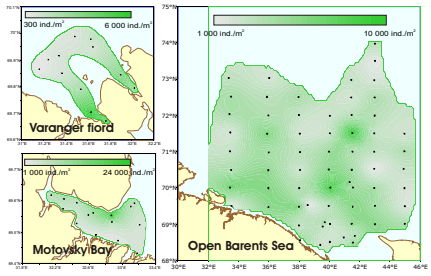

Fig. 7. Distribution of abundance.

Average benthos status indices for Varanger fiord, Motovsky Bay and open waters of the southern part of the Barents Sea.

Mean parameters	Varanger fiord	Motovsky Bay	Open sea
Biomass, g/m²	36,7±7,6	74,7±12,7	95,2±15,4
Abundance, ind./m²	2060±496	6875±1355	3940±228
Species richness per grab sample (sp./0,1 m²)	38,2±3,1	55,4±1,8	63,3±2,4
Margalef index	10,80,6	13,4±0,7	15,9±0,5
Simpson's domination index	0,09±0,01	0,13±0,02	0,22±0,02
Pielou evenness index	0,53±0,03	0,43±0,01	0,49±0,01
Shannon-Wiener diversity index (calculated through biomass)	3,32±0,19	2,92±0,10	3,48±0,12
Shannon-Wiener diversity index (calculated through abundance)	4,80±0,15	4,53±0,20	4,95±0,09
Simpson's diversity index	0,91±0,02	0,87±0,02	0,77±0,02
Biomass of carnivorous, %	18	9	11
Index of ecological stress or difference of the evenness (D_E) (Denisenko, 2006)	-0,24±0,04	-0,23±0,03	-0,39±0,01

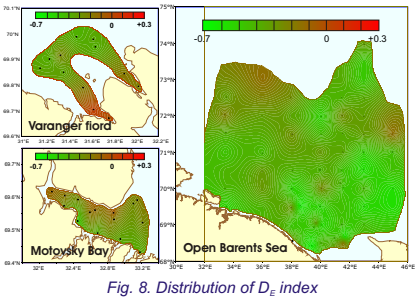

Fig. 8. Distribution of D_E index

References :
Denisenko S.G. Shannon information measuring and its application to estimation of a biodiversity (on example of marine zoobenthos // Explorations of the fauna of the seas, 56(64), 2006. P. 35-46.