Monitoring of benthic biodiversity in the Pechora Sea (SE Barents Sea) as conservation of population of endangered species such as Atlantic walrus (*Odobenus rosmarus rosmarus*)

Denisenko S.G., Denisenko N.V., Sukhotin A.A.

Zoological Institute of the Russian Academy of Sciences, Saint-Petersburg, Universitetskaya emb., 1, 199034, Russia, <stanislav.denisenko@zin.ru>

INTRODUCTION Ecologists are far from able to assist all species in whole Arctic area. At best, their opportunities are limited by studies of the so-called hot spots areas. One of them is the Pechora Sea - the southeastern part of the Barents Sea. There has never been intensive fishing over there and marine biota remains unbroken. Recently, however, there began a large-scale oil production, and this activity will increase in future. This is a major concern of various environmental organizations. In particular, "Nenets" Reserve worried about the fate of the Atlantic walrus, which are constantly coming to the area of the Kolguev, Dolgiy and Vaygach islands. Their number constantly increases and has reached 968 animals in 2012. It was only males (Boltunov et al. 2010; Lydersen et al. 2012). Taking into account the number of females with calves the total number should be increased two times in winter as minimum. In that relation couple questions emerge: is enough food supply for such number of animals in the Pechora Sea and what is the food capacitance of the biological recourses of the area?

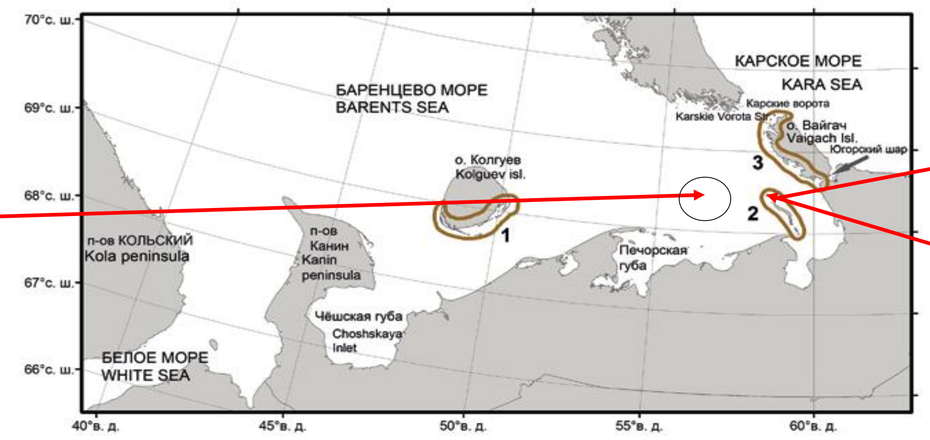

Fig. 1. The main areas of formation of coastal haul-out sites in the Pechora Sea (Lydersen et al. ; 2010; 2012)
1 – Kolguev Island; 2 – Dolgiy Island; 3 – Vaygach Island

No special studies of nutrition of the Atlantic walrus have been performed. But it is known the most important walrus prey-species are bivalve mollusks: *Serripes groenlandicus, Mya truncata, Macoma calcarea, Astarte spp., Panimya arctica* and low mobile crustationes: *Saduria spp*., *Pagurus spp*. and *Hyas spp*. The dense aggregations of these invertebrates (Fig. 3) are known from the area of the Pechora Sea shoals (Denisenko, 2006).

In that relation the **aim** of the study was to estimate bioresources of macrozoobenthos and its ecological status at walrus haul-out sites near the Dolgiy Island under the protection of “Nenets” Reserve.

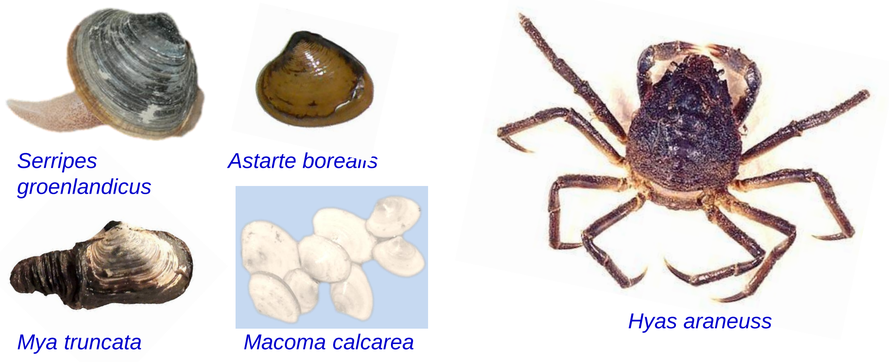

Fig. 2. Main feeding objects of the walruses in the Pechora Sea

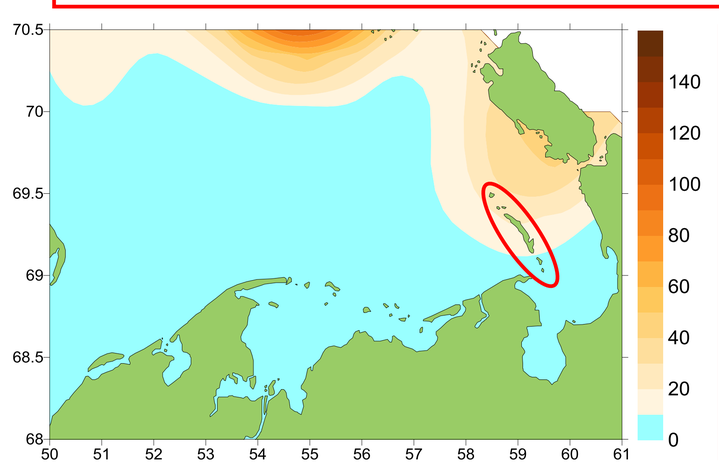

Fig 3. General biomass distribution of *Macoma calcarea* in the Pechora Sea (g.r/m^2 in wet mass) and the study area (red) in 2014.

Fig. 4. Contribution of key-taxa and different trophic groups in total value of bioresources of macrozoobenthos in the study area

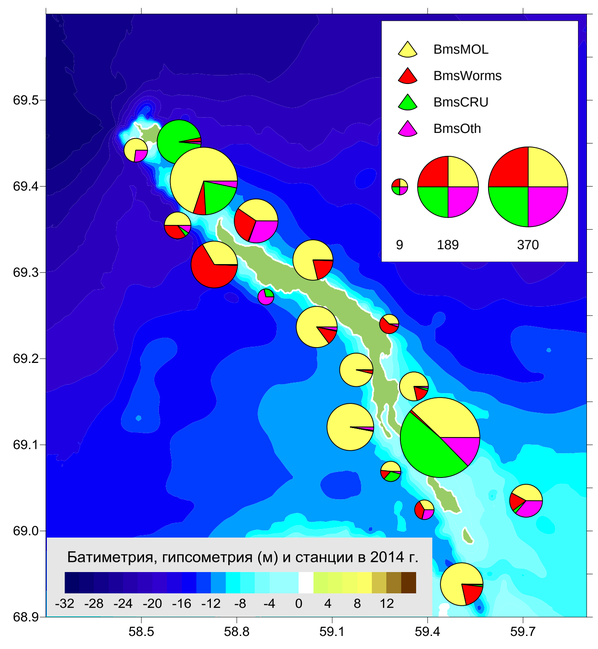

Fig. 6. Contribution of the key-taxa in total biomass of macrozoobenthos.

Results. Biomass of macrozoobenthos in the study area varied from 9.0 to 370.18 g wet w m^{-2} (Fig. 5). The largest contribution in the total biomass give mollusks (55%). The second key group was crustaceans (about 25 % of total biomass). Share of worms and rest found taxa in total biomass were approximately equal (12 and 10 % correspondently). At the same time, the ratios of key taxa biomass can varied considerably at different stations (Fig. 6). The highest biomass of crustaceans was found in the south and in the north-east of the study area. It was crab *Hyas coarctatus*. Mollusks dominated at the majority stations and the most abundant species were *M. calcarea, S. groenlandicus* and *M. truncata*. Locations of stations with mollusks predomination coincided with locations of walrus haul-out places on Dolgiy Islands. Polychaetes dominated only at three stations.

Among trophic groups the largest contribution in total biomass gave suspension filtrate feeders (up to 60 %). Share of both surface and subsurface deposit feeders constitutes about 15 % of total biomass. Quite large portion of total biomass belonged to omnivorous and predators (20 and 15 % correspondently). Analysis of variations of ratio of different trophic groups among stations showed a predomination of suspension filtrate feeders at majority of stations but at some stations, especially located near the walrus haul-out places, omnivorous and predators dominated. Presence of traumatized and debilitated animals in zoobethos populations, which were disturbed by foraging of walruses, generates conditions for presence of large amount of carnivorous.

The $D_{E'}$ index, reflecting an ecological status showed positive values (i.e.,affected sites) only at four stations. Suspension filtrate feeders trophic group dominated at the majority of them and deposit feeders prevailed only at Station 5. Also at three stations with positive Index values (St. 5, 8 and 9) mollusks were most abundant in biomass and at one station - crustaceans (St. 15) (Fig. 7).

Actually, multiply regression analysis showed the variations of $D_{E'}$ index on 52 % is determined by the structure of bottom sediments and by biomass of low motile crab H. coarctatus and bivalve mollusk *M. calcarea* widely distributed in the study area (Table). Both species are the feedstuff of walruses. Index values and, consequently, ecological stress in the bottom communities are increasing in case of decreasing of their biomass.

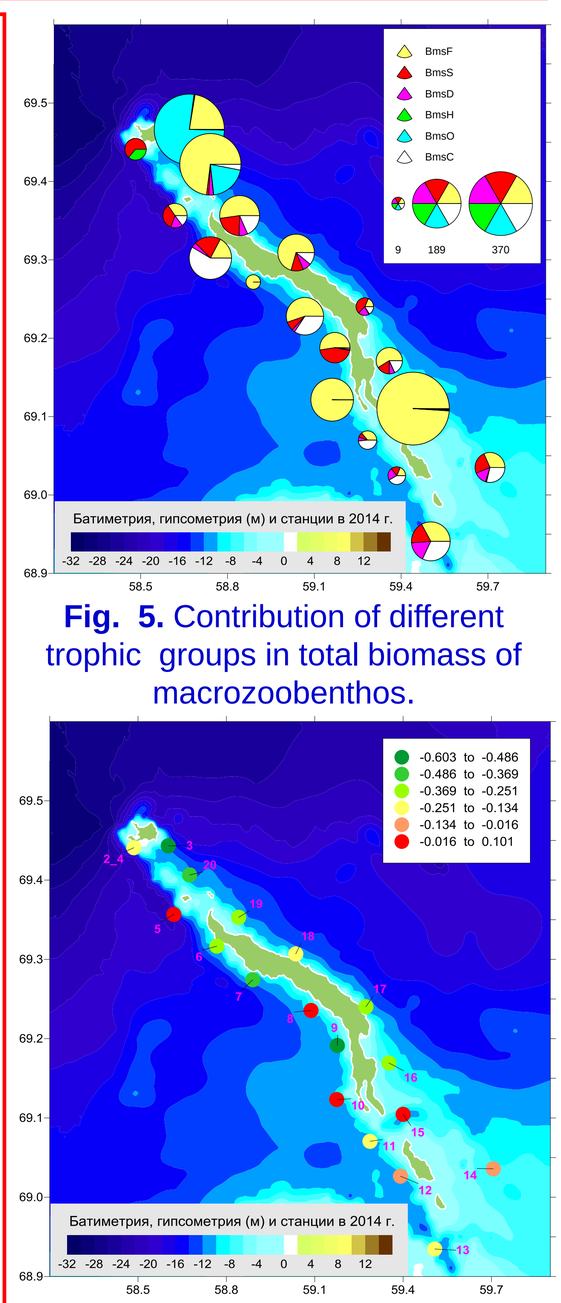

Fig. 5. Contribution of different trophic groups in total biomass of macrozoobenthos.

Fig. 7. Index $D_{E'}$ of macrozoobenthos in the study area.

Table

Regression coefficients (Beta values) from multiple linear regression models relating dependent variable $D_{E'}$ to biotic and abiotic variables.

R= 0.794 R^2=0 .631 Adjusted R^2= **.523**
F(5,17)=5.8172 **p<0.002** Std.Error of estimate: 0.124

	B	Std.Err. of B	b	Std.Err. of b	t(17)	p-value
Intercept			1.272	0.202	6.309	7.85E-06
Hyas coarctatus	-0.459	0.154	-0.002	0.001	-2.989	0.008
Macoma calcarea	-0.643	0.169	-0.012	0.003	-3.793	0.001
Type of sediment	-0.433	0.179	-0.045	0.019	-2.411	0.027
Serripes groenlandicus	-0.213	0.151	-0.002	0.001	-1.414	0.175
C org mg/l	-0.196	0.163	-0.531	0.437	-1.215	0.241

Similar effect gives the bottom sediment structure: decreasing of particles size is accompanied by increasing of ecological stress in communities. The last one correlated with intensity of sediment loosening due to ploughing of bottom by the walruses, the stronger damage was observed in communities on soft bottom than on hard bottom. At present time the listed stations can be regarded as transition zone or zone with a near-critical ecological situation because $D_{E'}$ 0.1 < 0 < (- 0.1).

Calculations of the $D_{E'}$ for other stations showed the stable state of zoobenthos populations. We excluded from the analysis other abundant species (*M. edulis* and *M. truncata*), which can be potentially regarded as walrus feedstuff: the first species inhabits the hard bottom, which is not suitable for walrus foraging, the second one buries deep oneself in sediment to get representative data catching them by van Veen grab, that we used during the survey. *S. groenlandicus* included in the analysis but calculations haven’t given the significant results.

At present time it is too early to determine finally the reasons of the disturbance of zoobenthos in the study area. We can only speculate that one of them can be impact of walrus foraging.