Report from

The cruise of «Dalnye Zelentsy»
from 20 July to 9 August 2001.

Operating authority:
Murmansk Marine Biological Institute,
Kola Scientific Center,
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Natural peculiarities of the Spitzbergen Archipelago have been attracting the attention of the researchers of different scientific directions for quite a long time: glaciologists, marine geologists, biologists, seismologists etc. The value of this object is like this: on the one hand it is a high latitudinal Arctic archipelago with a peculiar natural situation of which besides the Arctic climate the distribution of glaciation developed both on the land and at sea is typical. On the other hand in some parts of the archipelago active economic activity is carried out and this activity cannot leave the terrestrial and marine biota undisturbed.

Thus, the possibility to conduct parallel investigations in both the parts already subjected to the disturbance of natural environmental state and in nature clear regions impacted by natural technogenous geological processes is observed on the Spitzbergen.

Similar investigations not only enrich significantly our knowledge on the processes taking place in the ecosystems of Arctic archipelagoes but also allow to estimate the impact degree of the anthropogenic impact and in the long run to simplify the development of nature protection arrangements.

It should be borne in mind that the waters surrounding the Spitzbergen might be looked upon as a background region where local sources of contamination are practically absent. But instead there registered the presence of pollutants in the Atlantic water mass where they enter from the coasts of North America and West Europe and from the oil-gas excavations and marine transportation areas. Regular investigations of sea water, bottom sediments, and alive organisms for chemical and radiation contamination are of vital importance for the objective estimation of the transboundary transfers intensity and their influence on the marine environment of the Barents Sea and the Arctic basin as a whole.

In 2001 specialists of Murmansk Marine Biological Institute carried out complex investigations in West Spitzbergen area consisting of studies in the inland parts of the island and investigations in the coastal zone using small ships. Besides, a marine expedition for the investigations of West Spitzbergen coastal waters (Fig. 1) was carried out.

Aims and tasks of the investigations

- Investigation of biodiversity and structure of plankton, benthos, and fishes communities.
- Investigation of biology, fauna, and the conduct of sea birds (first of all colonial) and marine mammals abundance accounts.
- Investigations of parasite organisms circulating in the coastal complex ecosystems.
- Investigations of the water masses hydrological and hydrochemical characteristics;
- Sampling for hydrocarbons, chlorine organic compounds and heavy metals contents in water and in bottom sediment.

Carried out works

Hydrological and hydrochemical investigations

Estimation of thermohaline water masses structure by the way of STD profiling of water column down to the bottom.

Analysis of biogenic matters and oxygen concentrations on standard depths.

Phyto- and zooplankton investigations

- Investigations of quantitative parameters (abundance, biomass) and taxonomic composition of micro-algae community ;
- Investigations of quantitative parameters (abundance, biomass) and taxonomic composition of micro-zooplankton.
- Investigations of quantitative parameters (abundance, biomass) and taxonomic composition of mezo-zooplankton organisms

Benthos investigations

Investigations of quantitative parameters (abundance, biomass) and taxonomic structure of benthos communities.

Ichthyological investigations

Biodiversity estimation of the fish part of communities in the central part of the Barents Sea and in the West Spitzbergen fjords.

Population structure and feeding of the mass fish species investigations.

Marine mammals and birds

Investigations in the coastal zone of Is-fjord (West Spitzbergen). Besides, eastern coastal area of Green- fjord, southern coast of Is-fjord on the area Storheia-Hallendarbukta, the suburbs of the settlement of Pyramid were crossed as coastal routes. Birds accounts on board the ships were carried out along the southern coast of Is-fjord (from the entrance to Green-fjord to the zone of Longiirbyen airport) and over Bille-fjord area.

In the area of Is-fjord, Green-fjord, and Pyramid the material for the biochemical, cytological and parasitological analyses of the birds listed below was collected:

- Larus hyperboreus- Glaucous gull
- Rissa tridactyla- Kittiwake
- Calidris maritimus- Purple sandpiper
- Fulmarus glacialis- Fulmar
- Somateria mollissima- Eider
- Alle alle- Little auk
- Sterna paradisae- Arctic tern

Sedimenthological investigations

Bottom sediments samples collection for the analyses of regularities and processes of modern sedimentogenesis in order to obtain a complete and whole picture of the Holocene dynamics of the shelf and climate change.

Fig. 1 Sampling stations in the bays of the island of West Spitzbergen during the expedition on board the R/V «Dalnye Zelentsy» (5-10 August 2001)

Preliminary results of investigations

Investigations of the sea ecosystems contamination

12 samples of the surface water layer and 9 samples of the bottom sediment surface layer were collected. Subsequently these samples will be analyzed for the chemical contamination.

Hydrochemical investigations

In the West Spitzbergen fjords the thermohaline structure of the pelagic zone in general was typical enough: in the majority of the stations a sub-surface thermo-wedge was forming. And then subsequently at the general lowering of temperature and salinity gradients stiffness their vertical distribution preserved wedge character practically down to the bottom. A rather smooth increase of biogenic elements from the surface into the depth corresponded to this structure of water masses.

In Hornsynd the nitrites, phosphates and reaction capable silicon contents increased, correspondingly from 5-10, 3 and 50 on the surface up to 130, 30 and 170 mkg/l in the near bottom layers. In Bellsynd the corresponding values were 20, 0 and 70 on the surface and 160, 20 and 170 mg/l near the bottom. Nitrates, phosphates and silicates concentrations in the surface layers of Green-fjord and Is-fjord were 15, 1, 50 and 25, 2, 100 mkg/l, correspondingly, near the bottom - 200, 25, 150 and 170, 30, 200 mkg/l. As seen from the values above the largest reserves of biogenic elements in the euphatic zone were typical of the off-see zone of Is-fjord due to which the zone of diatomic algae mass development was registered in this very area (see below).

Plankton investigations

Vertical distribution of pelagic micro-algae in general reflected distribution of the density characteristics of water column and the main biogenic elements' concentrations: from the surface to the bottom a gradual decrease of phytoplankton abundance was observed.

In Hornsynd absolute dominance nannoplankton fraction was registered in the phytoplankton community composition. Cryptophytes from genera Plagioselmis and Cryptomonas, yellow algae (Dinobryon balticum) and dinoflagellata Katodinium rotundatum played a significant role in the community. Planktonic algae of micro-range were observed in the samples only episodically. Nearer to the bottom layers

nannoplankton abundance fell quickly, and algae less than 10 mkm remained in its composition.

Like in Horsynn in Bellsynn-fjord micro-phytoplankton actually did not take part in the plankton community formation. Nanno-phytoplankton abundance decreased rather quickly on vertical on layers lower than 20 m. Cryptophytes Plagioselmis prolonga and Cryptomonas acuta, and dinoflagellata Katodinium rotundatun were identified in the nannoplankton composition.

In Green-fjord and especially in its upper part (beyond Barentsburg) the abundance ratio of nanno–micro-phytoplankton changes to a significant degree. Here in comparison to the mentioned above fjords nannoplankton abundance was relatively low and did not exceed in the surface waters of 850 thousand cells/l for fractions smaller than 10 mkm and 440 thousand cells/l for the fraction 10-20 mkm. On the contrary algae abundance of micro-plankton fraction was significantly higher. Dinobryon balticum, Pseudonitzschia delicatissima and Pseudonitzschia seriata dominated in its composition.

In Is-fjord on depths 0 and 20 m complete dominance of nannoplankton algae was registered in the phytoplankton composition. In nannoplankton composition cryptophytes Leucocryptos marina, Plagioselmis sp. and Cryptomonas acuta and numerous dinoflagellates, among which Katodinium rotundatum and Gymnodinium veneficeum should be selected first of all, were identified in the nannoplankton composition. Micro-phytoplankton was represented insignificantly. In its composition there dominated Pseudonitzschia delcatissima, P. seriata and Dinobryon balticum. With the depth the nannoplankton abundance fell down.

Benthos works

By preliminary visual estimation, the fauna of West Spitzbergen fjords, though possessing a relatively low species' diversity, is distinguished by significant quantitative abundance. And the main part of biomass consists of several trivial for the Barents Sea fauna boreal-arctic species (*Ciliatocardium ciliatum, Maldane sarsi, Macoma calcarea*).

Benthos material collected in the gulfs and fjords of West Spitzbergen allows to estimate the distribution peculiarities, species composition, and quantitative abundance of bottom fauna of specific biotops of this Arctic region.

Sea birds

During the period of investigations 18 bird species were registered.

Fulmar (Fulmarus glacialis). It is registered in very large amounts. Usually we observed it on the southern coast of Is-fjord (Storheya) where in enormous amounts the birds fly along the coast to the exit from Is-fjord, crossing the Green-fjord bay a little bit to the north of Barentsburg, and over Is-fjord water area.

Black-throated diver (Gavia arctica). It is a rare for the Archipelago species. We noted only 1 specimen on June 30, flying over he area to the exit from Is-fjord.

Bean goose (Anser fabalis brachyrynchus). 2 specimens were registered on June 30 in the coastal area Storheya – Hallendarlen, flying along the coast to the East.

Barnacle goose (Branta leucopsis). A pair of geese with a nestling was discovered in the coastal zone of Storheya waste ground, in the vicinity of Hallendardalen.

Eider (Somateria mollissima). It is a common for the Is-fjord zone species. Males were observed in small (10-15 specimens) and large flocks (80-150 specimens) flying over the Is-fjord and Green-fjord areas. Only separate males were present in the small flocks consisting of females. Females with broods were noticed in the southern part of Green-fjord. Small groups up to 12 specimens, females and immature specimens were observed resting in the eastern coastal part of Green-fjord and in the mouth of Hallendardalen, in Bille-fjord (Pyramid).

The nests registered were located separately or in the tundra at approximately 1 km distance away from the coast (Storheya) or in the open sand gravel spits in the immediate vicinity of water (the mouth of Grendalen).

Kittiwake (Rissa tridactyla). In large numbers they were noted flying along the southern coast of Is-fjord (where they fly together with fulmars to the exit of the fjord) and over the area. Along the eastern coast of Green-fjord they were observed as single specimens and in flocks of 20 specimens.

Glacous gull (Larus hyperboreus). A common and relatively numerous in the investigated area species. It is registered along the coast and over the Is-fjord, Green-fjord, and Bille-fjord area. It nests on the Barentsburg buildings (forming a synanthropic colony up to 50 pairs abundance) and in the Barentsburg environs. Nestlings fly from the nests to the stony cover located under the bluff is registered at

the end of July, then nestings accommodate in the cracks, shelters in the immediate vicinity of the coast. A nesting death at the fall from the rock was observed. One of the food items are little auks, this fact is confirmed by direct observations and investigations of stomachs contents.

Arctic tern (Sterna paradisaea). Usually it was observed along the whole coastal area that was under investigation, where it fed in the coastal zone. A nesting colony not more than 20 pairs, is registered in the tundra near the coast in the zone of Barentsburg airport.

Great skua (Stercorarius skua). Registered near Storheya coast.

Arctic skua (Stercorarius parasiticus). It is a common but not numerous species. It was noticed twice in the coastal tundra in the area Grendalen-Hallendardalen where at the approaching the nest area attracted the attention by either attacking (or leading away from the nest) behaviour. A discovered nest area in Grendalen valley was located not far from the sea coast in the swamp moss - sedge tundra near the brook.

Ringed plover (Charadrius hiaticula). It is noticed on the littoral of the Green-fjord eastern coast (1 specimen at 6 km of the route).

Sand purple (Calidris maritima). It is a common and numerous species in this area, observed in all parts of the coast investigated either as single specimens or in pairs. A nest (4 eggs) was noted on July 3 on the tundra slope in the Barentsburg environs.

Brünnich's guillemot (Uria lomvia). A common and numerous species observed only over the Is-fjord area. From the Storheya coasts Brünnich's guillemots are observed constantly, flying to the West along the coast in flocks of 80-120 specimens or in pairs, rarely as single specimens.

Black quillemot (Cepphus grylle). A common species observed often near Is-fjord coast, less frequently - along the east coast of Green-fjord (on July 14 at the distance of 6 km of the land route 2 specimens were registered.).

Puffin (Fratercula arctica). Discovered only in the Is-fjord area either as single specimens or in pairs.

Little auk (Alle alle). A common species, in large numbers was observed over the Is-fjord area. In the colonies in the Barentsburg environs approximately 200 specimens were accounted by direct counts.

Alpine ptarmigan (Lagopus mutus hyperboreus). It was observed in the area of works only once - in the coastal tundra of the northeastern coast of Green-fjord.

Snow bunting (Plectrophenax nivalis). It is common in the suburbs of Barentsburg. Nestings learning to fly are noticed already in the beginning of July - flying accompanied by one of the parents.

Dominating by the abundance in the birds' accounts in the coastal zone *(Table. 1)* are fulmars, kittiwakes and Brünnich's guillemots. Eiders are observed less frequently, as a rule these are large flocks of males flying to feeding to the exit from Is-fjord. A part of species - great skua, puffin, little auk - is observed as single specimens in the coastal zone.

Table 1. Results of the sea birds coastal account from the stationary observation point Storheya (number of specimens per 30 minutes of account).

№	Fulmar	Murre	Kittiwake	Black guillemot	Glacous gull	Eider	Others
1	684	219	190	4	5	4	0
2	73	105	88	14	0	115	Great skua 1
3	450	203	207	4	1	5	Puffin 3, Little auk 1
4	805	351	323	15	4	83	-

Geology

On 20 scientific stations sea sediments samples were collected.

Samples were collected for granulometric analysis, foraminifera analysis, coarse debris materials in the surface layer of the sediments.

Table 2. Distribution of geological samples collection stations in the regions of the water area.

Region of sampling	**Amount of samples collection stations**

Bay Hornsynn (the Island of West Spitzbergen)	9
Bay Bellsynn (the Island of West Spitzbergen)	5
Green-fjord (the Island of West Spitzbergen)	1
Is-fjord (the Island of West Spitzbergen)	5

Perspectives of investigations

In 2002 the works for the ecosystems of the Island of West Spitzbergen investigations will be continued. Like in 2001 besides coastal investigations a sea expedition on board the R/V «Dalnye Zelentsy» will be also conducted. The work carried out by specialists of different scientific directions in 2001 will be included into the program of investigations of the year 2002. Besides, widening of investigations is planned. Thus, in 2002 it is planned to conduct studies of algae macrophytes communities, estimations of species diversity, and investigations of the algaecenoses formation peculiarities.

As the International Conference «Complex investigations of the Spitzbergen nature» held in MMBI in February 2002 showed, the interest to the Spitzbegen is rather high, and the results of works attract the attention of the widest scientific community.