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Biological research in the vicinity of Belarusian Antarctic Expedition's Camp "Vechernyaya Mountain", the Cosmonaut Sea (East Antarctica)

Uriy Giginyak in the vicinity of Belarusian Antarctic Expedition's Camp "Vechernyaya Mountain", the Cosmonaut Sea (East Antarctica)

The main goal of biological research in Antarctic carried out by Belarusian biologists was scientific research per se, as an element of State policy in the region. Research pursuance helps to maintain and strengthen positions of Belarus in Antarctic, which are related to long-term interests and practical activities of the country in the region.

The basic biological output was to establish reference environmental data for evaluation of potential changes in the Antarctic region in the future.

The area of the present investigation was the field camp of the seasonal Belarusian Antarctic Expedition (BAE) which was situated in immediate proximity to the Russian Antarctic expedition's field base "Vechernyaya Mountain". Geographical coordinates of the seasonal BAE's field camp were S67039.550/, E46009.496/, at height above sea level 79.7 m.

The work program included qualitative and quantitative estimation of marine, fresh-water and land flora and fauna. Biological objects were registered practically on all free from ice oasis sites, in fresh-water reservoirs and in the Cosmonaut Sea.

There are a lot of freshwater reservoirs around the Vechernyaya Mountain. Most of them are small, but there are also reservoirs with area up to 1 400 square meters.

Our research carried out in 2007–2009 allowed for the first time to define for this region species structure of fresh-water phytoplankton and zooplankton and to present their quantitative estimation, to define new for this region species of mosses and lichens, to define caloric content of fishes and to describe species structure of local populations of the fishes. For the first time for the given region migratory dynamics of Pinnipedia and birds were tracked, and their species communities were defined. Some specimens, e.g. seaweeds and fishes, were used as food for members of the BAE.

However, the data on taxonomic structure of vertebrate and invertebrate animals of the investigated region remain fragmentary. There are no data on species structure of such large taxa as Protista, Porifera, Plathelminthes, Nemathelminthes, Echinodermata, etc., and complexes of Coelenterata, Ctenophora, Bryozoa, Pantopoda remain poorly investigated.

In the Cosmonaut Sea, in the vicinity of the station Molodezhnaya (20 km from the BAE), the very first biological investigations were carried out by the Belarusian biologists in 1971 (U. Giginyak). Marine macrozoobenthos, photosynthesis, respiration peculiarities of sea hydrobionts, their fertility and caloric parameters were established. Single samples of zooplankton and bottom sediment from the lakes on the Vechernyaya Mountain, and samples of macrozoobenthos from the Cosmonaut Sea were studied by A. Gaidashov in 2008.

In 2008–2009 in the same area, O. Borodin as a participant of the 2nd BAE collected material on: microarthropods, lichens, mosses and land algae; phytoplankton and zooplankton from freshwater lakes; marine fishes and some representatives of sea ground fauna. He was also engaged in observations of birds and Pinnipedia. Material on freshwater biota was collected from 25 water bodies. The bathymetric survey conducted in six fresh-water bodies showed potential availability for diving only in lake Nizhnee. All the remaining water bodies were approximately 1.5–1.7 m deep.

All the material obtained was a basis for successful implementation of the task "To estimate prospects of use of renewed live sea resources of Antarctic around the Belarus station" of State target program "Monitoring of polar areas of the Earth and maintenance of activity of the Arctic and Antarctic expeditions for 2007–2010 and for the period till 2015".

It is noteworthy that in connection with *force majeure* conditions, some part of biological collections remained on the Vechernyaya Mountain and had not been delivered to Belarus.

In the study on ecosystems of Antarctic freshwater lakes, particular interest was paid to ancient bottom sediment. The taxonomic analysis of algae from bottom sediment of a fresh-water lake located around the Vechernyaya Mountain revealed three basic groups of microalgae as part of the community: Cyanobacteria, Chlorophyta and Euglenophyta. Among Cyanobacteria it is necessary to allocate representatives of *Lyngbya* Ag. and Oscillatoriaceae. These algae were found in bottom sediment. The similarity of algae-bacterial complexes of bottom sediment of Antarctic freshwater lakes and Kamchatka thermal spring was noted.

The similarity of species complexes from the bottom and water column were established.

In phytoplankton *Phormidium* sp., *Cyclotella*, *Oscillatoria agardhii*, *Diatoma*, *Epithemia* and still undetermined representatives of red algae were registered. *Oscillatoria agardhii* and *Lyngbya* sp. were the most common species both in water column and bottom sediment.

Of 79 algae species found in lakes of Antarctic 75 are known in fresh-water lakes of Belarus.

Nineteen species from nine families of lichens were registered in the investigated region. Lichens from genus *Lepraria* need further investigation. The most important role in the flora of the region is played by families *Acarosporaceae, Lecanoraceae, Lecideaceae, Parmeliaceae, Physciaceae* and *Umbilicariaceae*. A great bulk of lichens were represented by crustose lichens (11 species), foliose lichens (6 species) and fruticose lichens (2 species) (Table 2).

Table 1. **Comparative distribution of algae registered in Belarus and in the vicinity of the Vechernyaya Mountain (East Antarctica)**

Species	Belarus		Antarctica (BAE)	
	Number of species	% from all amount	Number of species	% from all amount
Cyanophyta	260	14.2	25	31.6
Cryptophyta	14	**0.8**	1	**1.3**
Dinophyta	25	**1.4**	3	**3.8**
Chrysophyta	70	**3.7**	2	**2.5**
Bacillariophyta	622	34.1	33	41.7
Xanthophyta	69	**3.8**	2	**2.5**
Euglenophyta	126	**6.9**	4	**5.0**
Chlorophyta	624	34.1	9	11.4
Charophyta	17	**0.9**	Not found	–
Rhodophyta	4	**0.2**	Not found	–

Table2. **Life form and occurrence of lichen species of the studied area**

Lichen species	Life form	Occurrence
1. Acarospora gwynnii C. W. Dodge & E. D. Rudolph	crustose	uncommon
2. Buellia frigida Darb.	crustose	quite frequent
3. Caloplaca citrina (Hoffm.) Th. Fr.	crustose	sporadic
4. Candelaria murraui (C. W. Dodge) Poelt.	foliose	uncommon
5. Candelariella flava (C. W. Dodge & Baker) Castello & Nimis	crustose	frequent
6. Lecanora expectans Darb.	crustose	sporadic
7. L. polytropa (Hoffm.) Rabench.	crustose	quite frequent
8. Lecidela lapicida (Ach.) Ach.	crustose	–
9. Lecidella stigmatea (Ach.) Hertel et Leuck.	crustose	sporadic
10. *Neuropogon sulphureus* (Koenig) Hellb.	fruticose	quite frequent
11. *Physcia caesia* (Hoffm.) Fürhr.	foliose	quite frequent
12. *Pleopsidium chlorophanum* (Wahlend.) Zopf.	crustose	uncommon
13. *Porpidia crustulata* (Ach.) Hertel	crustose	sporadic
14. *Pseudephebe minuscula* (Nyl. ex Arnold) Brodo & D. Hawksw.	fruticose	quite frequent
15. *Rinodina olivaceobrunnea* C. W. Dodge & G. E. Baker	crustose	sporadic
16. *Umbilicaria aprina* Nyl.	foliose	quite frequent
17. *U. decussata* (Vill.) Zahlbr.	foliose	quite frequent
18. *Rusavskia elegans* (Link) S. Kondr. & Karnefelt	foliose	quite frequent
19. *Xanthoria candelaria* (L.) Th. Fr.	foliose	uncommon

Most species belong to epiphytic lichens: *Buellia frigida* Darb., *Neuropogon sulphureus* (Koenig) Hellb, *Physcia caesia* (Hoffm.) Fürhr, *Pseudephebe minuscula* (Nyl. ex Arnold) Brodo & D. Hawksw, *Umbilicaria aprina* Nyl., *U. decussata* (Vill.) Zahlbr. and *Rusavskia elegans* (Link) S. Kondr. & Karnefelt were common on stones and rocks in the vicinity of the studied territory.

It is noteworthy that of 19 species of lichens registered in Antarctica seven were known in the territory of Belarus as well.

Lichens are important as good objects for monitoring and some are even suitable for food.

Taxonomic diversity of Bryophyta in the vicinity of Expedition's Camp "Vechernyaya Mountain" was low, as only three species: *Bryum arguiteum* Hedb.; *Brium pseudofriguetium* Hedw.; C*eratodon purpureus* (Hedw. Bridel.) were recorded. All species are also common for Belarus.

Zooplankton. Within the Belarus Expedition's Camp "Vechernyaya Mountain" six fresh-water lakes, namely Sandy, Deep, Summer, Snow, Red, Camp as well as a number of small water bodies are located.

Rotifera were the basic representatives of zooplankton of the investigated fresh-water lakes. In lake Camp (Molodezhnaya) – *Kellicottia longispina* (Kellicott, 1879), *Holopedium gibberum* Zaddach, 1848, in lake Nizhnee – *Bdelloida* sp., *Keratella cochlearis* (Rotifera) and Copepoda, in lake Superior (Vechernyaa Mountain) – *Bdelloida* sp., *Kellicottia longispina* (Kellicott, 1879), *Keratella cochlearis tecta* (Gosse, 1851); in lake Camp (Molodezhnaya) *Bdelloida* sp., Collotheca prevailed.

132 stationary and 29 routing observations were performed over birds and mammals and 111 supervisions executed on a course of Scientific Expedition Ship "Academic Fedorov". Seven species of birds from three orders in the vicinity of the Belarusian Antarctic Expedition's Camp "Vechernyaya Mountain" and two species of Pinnipedia were revealed. 350 samples of fishes associated with Notothenioidea were captured. Almost 100% infection of the captured fishes with nematodes and plerocercoids was noted. Absolute fertility of *Tr. hansenii* was approximately 11 641 berries.

Four species of Echinodermata – *Sterechinus neumayeri*, starfishes (2 species), basketfish were registered.

Mammals around the BAE's camp were represented merely by two species of seals: *Leptonychotes weddeli* and *Lobodon cancinophagus* (a crab-eater seal). A single sample of crab-eater seal was noted in January around station Molodezhnaya.

Birds were presented by the following species: Sphenisciformes – Adeli penguin (*Pygoscelis adeliae*), Emperor penguin (*Aptenodythes forsteri*); Waders (Charadriiformes) – South polar skua (*Stercorarius skua*); Procellariiformes – snow petrel (*Pagodroma nivea*), Cape petrel (*Daption capense*), Wilson's petrel (*Oceanites oceanicus*) and southern fulmar (*Fulmarus glacialoides*). Most often *P. adeliae* and *S. skua* were registered.

Calorimetric analysis of various fishes from region of the BAE camp "Vechernyaya Mountain"., the Cosmonaut Sea (East Antarctica) was carried out. The following results were obtained:

Trematomus hanseni – 4.1–5.0 cal/mg of organic matter,

Trematomus bernachii – 3.5–3.7 cal/mg of organic matter,

Trematomus niunesi – 3.5–4.1 cal/mg of organic matter,

Nototenia neglecta – 4.5–4.7 cal/mg of organic matter,

Trematomus hanseni (organs were withdrawn from the fixed sample):

Intestines and stomach fat – 7.4–7.6 cal/mg of organic matter,

Liver – 5.4–5.7 cal/mg of organic matter,

Spleen – 4.9–5.2 cal/mg of organic matter,

Heart – 4.3–4.6 cal/mg of organic matter,

Stomach without contents – 4.5–4.6 cal/mg of organic matter,

Hard roe – 4.9–5.1 cal/mg of organic matter.

Caloric content of *Calanus propinquus* was from 7.0 to 7.3 cal/mg of dry matter or approximately 8.5 cal/mg of organic matter. Depending on the season, the fat content of *C. propinquus* can reach 73% (in the beginning of April).

Hundred species of hydrobionts inhabit the seas surrounding Antarctica, many of which can be referred to as seafood, i. e. to be used for food. All species of fishes were included into a diet of polar explorers.

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