

Zoobenthos of cave systems of Pinega district (Arkhangelsk region) – biodiversity of fauna and ecological complexes of species

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The fauna of zoobenthos of reservoirs of Pripinezhye by now has not been fully studied. It is typical that practically all existing publications about zoobenthos of Pripinezhye are dedicated to the analysis of fauna of ground ecosystems and absolutely do not mention cave reservoirs variously presented in this area of the Arkhangelsk region.

The main purpose of the present work: the description of faunistic structure and ecological complexes of zoobenthos inhabiting reservoirs of cave systems of Pripinezhye.

Materials and methods.

In January, 2011, in the caves of the ravine Zhelezniye Vorota (partial reserve "Zhelezniye Vorota"): Olympiyskaya, Museynaya, Khrustalnaya caves, and also in the caves of the nearest vicinities of the settlement Golubino (Pinezhsky reserve): Golubinsky Proval and Kitez, we collected 40 samples of zoobenthos. The samples were located at 10 stations (st.) covering lacustrine shallow waters (Museynaya cave – 2 st.), river and stream bars and reaches (Olympiyskaya cave – 4 st. and Khrustalnaya cave – 1 st.), and also siphon sites (Golubinsky Proval cave – 2 st. and Kitez – 1 st.). In the Khrustalnaya cave where main reservoirs are located in the grotto near the entrance which is subject to freezing, and neighbor halls, organisms of benthos haven't been revealed.

All species observed in the caves we have divided into three ecological complexes:

troglobiont - organisms living exclusively in caves and having specific features connected to the cave way of life;

troglophile - organisms reaching in caves significant number, but occurring as well in neighbor ground ecosystems;

trogloxenes - the organisms which have casually got into the cave community, owing to drift by waters, or as a result of penetration from the surface of a maternal individual.

Results and discussion.

In total in the collected samples, 17 species of Invertebrata have been revealed belonging to four classes: Nematoda, Oligochaeta, Crustacea and, most variously presented, Insecta. The average number of species on sample varied from 1 up to 8. The abundance of organisms in sample varied from 1 up to 26 individuals.

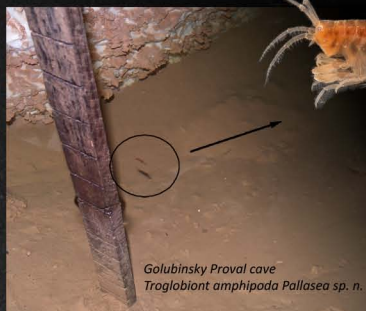
Among found taxons, only one species of amphipoda – *Pallasea* sp. n. is troglobiont; two species are troglophile: copepoda *Megacyclops viridis* and oligochaete *Enchytraeidae* indet. The troglloxenes presented exclusively by insects and their larvae, are the most numerous – 14 species. The general list of fauna of the investigated caves is presented in the table 1.

The benthos fauna of the Olympiyskaya cave through which the river Nasonikha passes, appeared to be the most diverse – 11 species. The river Nasonikha is not completely a cave water-current, and has its headstream in superficial lakes and streams. In this connection, practically all organisms observed in the underground part of the river, are troglloxenes. On the second place concerning diversity of benthos there is Museynaya cave – 7 species. In two large lakes of this cave, both troglloxene and troglophile (*Megacyclops viridis* and *Enchytraeidae* indet.) organisms are presented. In comparison with Olympiyskaya cave, the reservoirs of Museynaya cave are more difficult to access for fauna of ground ecosystems. The lakes in Museynaya cave have poor currents and are filled only due to freshet subsoil waters, but not stream drain from the surface. The absence of the drain of superficial waters considerably limits opportunities of penetration of troglloxene organisms into lakes. However, the distance between the main entrance to the cave and the lakes makes no more than two hundred meters, which, despite of rather narrow routes, poorly interferes the penetration into halls of the cave of flying imago of insects.

Table 1. Occurrence of taxa of zoobenthos in the explored caves*

Species list		Caves			
		Olympiyskaya	Museynaya	Kitez	Golubinsky Proval
Class Nematoda	Nematoda indet.	+	-	-	-
Class Oligochaeta	Enchytraeidae indet.	+	+	-	-
Class Crustacea	Order Copepoda <i>Megacyclops viridis</i>	-	+	-	-
	Order Amphipoda <i>Pallasea</i> sp. n.	-	-	+	+
Class Insecta	Order Ephemeroptera <i>Baetis rhodani</i>	+	-	-	-
	Order Ephemeroptera <i>Cloeon luteolum</i>	+	+	-	-
	Order Ephemeroptera <i>Siphonurus lacustris</i>	-	+	-	-
	Order Plecoptera <i>Diura nanseni</i>	+	-	-	-
	Order Plecoptera <i>Taeniopteryx nebulosa</i>	+	+	-	-
	Order Plecoptera <i>Nemurella pictetii</i>	+	-	-	-
	Order Plecoptera <i>Nemoura sahlbergi</i>	+	-	-	-
	Order Plecoptera <i>Nemoura</i> af. <i>avicularis</i>	-	+	-	-
	Order Heteroptera <i>Sigara semistriata</i>	+	-	-	-
	Order Diptera <i>Dicranota bimaculata</i>	+	-	-	-
	Order Diptera <i>Eloeoephila mundata</i>	+	-	-	-
	Order Diptera <i>Cnetha</i> sp.	+	-	-	-
	Order Diptera <i>Guttipeloplia guttipennis</i>	-	+	-	-
Number of species	17	12	7	1	1

* All species listed in the table are not marked for aquatic fauna of Pinezhsky State Reserve.



Golubinsky Proval cave
Troglobiont amphipoda *Pallasea* sp. n.

For the caves Golubinsky Proval and Kitez, where the siphon sites located at the distance not less than 400 meters from the entrance were investigated, the only one species has been observed – troglobiont *Pallasea* sp. n. This new for the science amphipoda occurs on clay bottom of siphon sites, sometimes even in significant number – up to 6 individuals on a sample (Golubinsky Proval cave). Till now, in Eurasia the most northern troglobiont species has been amphipoda *Crangonyx chlebnikovi*, which has been found out in Kungurskaya cave. At the same time, Kungurskaya cave is located in Perm region in Middle Ural, which is approximately 1000 kms to the south from Pinezhsky karstic massif. Thus, *Pallasea* sp. n. found in the caves Golubinsky Proval and Kitez, is the most northern discovery of troglobiont organisms in Eurasia. This fact represents doubtless interest both concerning the biogeographical analysis of distribution of fresh-water amphipoda, and model estimation of distribution of relict cave faunas as a whole.