

Brief communication

Hydrobiological effects of gathering reindeer at an arctic lake in Russia

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Abstract: For the separation of reindeer, animals are collected on the shore of lake Laya-to (67°60'N, 56°E) about one month in every summer. Feces and urine produced by the herd are washed directly into the lake, which results in changes in the water quality and lake biota. When for instance in 1991 the herd numbered about 1000 animals, ammonium concentrations and zoobenthic biomass increased markedly after the period of separation.

Key words: eutrophication, pollution, species composition, zoobenthos.

Rangifer, Special Issue No. 13: 39-40

Study and discussion

Tundra water bodies contain water biocenoses with communities of hydrobionts which may be easily disrupted or destroyed and recover only with difficulty. Hydrobionts play an important role in self-purifying processes of the waters (Shcherbina, 1993; Marchenko *et al.*, 1997).

We have investigated lake Laya-to (67°60'N, 56°E) which is a natural water body situated in the Bolshezemelskaya Tundra (Fig. 1) for effects of eutrophication and compared with an unaffected lake.

The water vegetation of Laya-to, is dominated by *Arctofila fulva*, *Potamogeton* sp., *Ceratophyllum demersum*, *Nostok* sp. and water mosses. The mean temperature of the water in July is 9.05 °C, pH = 6.6-6.7, O₂ = 13.0 mg/l, CO₂ = 3.0 mg/l. The lake was studied in 1991 and 1992.

Reindeer herders often organize their resting and working places near large lakes. On the northeast bank of Laya-to, the animals were corralled for a month in June/July. During this time new antlers were cut before the herd was driven back to the grasslands. In June 1991 reindeer herders gathered about one thousand reindeer in the corral. Urine and dung flowed down into the lake and the shoreline

was damaged. In 1992, there were only a few reindeer there during our investigation and no drainages to the lake.

Chemical parameters in both years were similar and indicated eutrophication. Increased level of ammonium nitrogen (NH₄-N) was registered in both years. During the first year (1991) when concentrated reindeer urine and dung entered the lake, the level of ammonium nitrogen measured up to 112.5 mg/l. However, this local situation was temporary, and was typical to the presence of the reindeer herd. In 1992, the content of NH₄-N was 140 times less than in 1991 since ammonium nitrogen oxidates to nitrites (NO₂⁻) and nitrates (NO₃⁻) which are subsequently consumed by water plants and phytoplankton.

During the study period 12 species of plankton organisms and 18 groups of bottom invertebrates were found in the lake. The total number of bottom invertebrates in 1991 was 2.5 times higher and biomass 1.5 times higher than in 1992 testifying that wastewater enhances development of organic matter leading to an increase of bottom fauna, especially Oligochaeta, Mollusca, Nematoda and Chironomidae. Thirtyfour species of Chironomidae larvae

Fig.1. Map of study area lake Laya-to and localization of sampling stations

- hydrochemical stations
- hydrobiological stations

were observed in the lake. A vast number of larvae of *Procladius ferrugineus* (K.), *Polydora* sp., *Chironomus* sp. indicated eutrophication (Zinchenko, 1997).

The water fauna of Laya-to included mostly wide-spread eurybiontic species. The high eutrophication is most probably due to anthropogenic factors; of them reindeer wastes are supposed to be the main factor. The relation between a lake and pollution depends on many hydrological and hydrochemical factors like water supply, distance from the source of pollution, and the presence of macrophyte belt in the littoral. Normally the lake will overcome pollution well when the water-exchange is good. Water plants also contribute to the self-purification processes. In comparison with Laya-to no eutrophication was observed in 1991 in the lake Bolshoe Shapkino which is similar to Laya-to in origin and hydrological indices but was not directly affected by reindeer

(Kuzmina, 1993).

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Revised manuscript accepted November, 2001