

THE INFLUENCE OF THE CHANGE OF HYDROLOGICAL MODE OF THE GNILNO GULF ON THE BIODIVERSITY OF NIZHNIYA – THE SVIRSKY RESERVE

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Abstract: The present study explains how the qualitative and quantitative zooplankton structure has influenced the ichthyofauna featured by the Gnilno gulf. The alteration of the Gnilno gulf's hydrological mode has inflicted structural changes on the zooplankton. The present ichthyofauna is already affected, thus leading to a scarcity of the food supplies for rare prey birds. Out of the prey birds the white-tailed eagle and the osprey are on the brink of extinction.

Keywords: fish-eating birds, fish fauna, gulf of Gnilno, zooplankton

Introduction:

It is known that the change of the hydrological mode influences the zooplankton (Ivanov and Telesh 1996), and in turn it leads to the change of the structure of biocenosis (Kuznetsova 2007). The changes in the structure of the community of a zooplankton can affect the fish fauna – the fodder being osprey and the white tailed eagle (Malchevsky and Pukinsky 1983; Chernova and Bylova 1988) because the organisms of a zooplankton feed on the majority of fish species, and also some adult fishes (Anisimov et al. 1983; Vinberg and Gutelmakher 1987). Therefore the object of the presented research is the zooplankton.

Work purpose: to define how the change of the hydrological mode influences the biodiversity of Nizhniya – the Svirsky reserve.

For achieving this purpose it is necessary to solve the following issues:

- to select zooplankton tests in the gulf of Gnilno
- to define the structure of this community
- to compare the structure of the zooplankton defined in 2007 with available data of the year 2003
- to find out how the changes of this community will affect the fish fauna and the avifauna reserve

Hypothesis: Might the change of the hydrological mode affect the zooplankton structure - the basis of the power-supply circuits of the water biocenosis – which could lead to a decrease in the number and variety of fish fauna, and, as a result, to a change in the number of rare fish-eating birds?

Materials and methods:

Work is performed in the territory of Nizhniya - the Svirsky National Natural Park, one of whose tasks is the protection of

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rare birds within the existing program «Studying Biodiversity». Among them are osprey (*Pandion haliaetus*) and the white tailed eagle (*Haliaeetus albicilla*) - the types included in the Red Book of Russia (Malchevsky and Pukinsky 1983). Breeding without hindrances in the reserve, they increase in number and thus they are compelled to leave its limits (Oliger et al. 2001).

However, now there are certain difficulties connected with the food supply of these birds. It is known that osprey, an ichthyophagist, is the food basis of a white tailed eagle, which is a fish, too (Malchevsky and Pukinsky 1983; Chernova and Bylova 1988). But recently, the number of the fish population in the reservoirs of the region of Leningrad has dwindled, thing connected with the influence of anthropogenous factors (Andreeva 2004). Even in the territory of Bottom Svirskogo of the national park where any economic activity is forbidden, the reservoirs are also subject to the action of anthropogenous factors.

As material, there served the data received after having studied the quantitative tests of a zooplankton selected in August, 2007 at two stations. Thus on each of them there were chosen three points in the following formations: *Nuphar lutea*, *Alisma plantago-aquatica* and *Equisetum*. The tests were selected in threefold frequency in the high layer of water. The planktonic network no. 70 through which 50 litres of water are passed is thus used. Formalin was applied to fixing the organisms of a zooplankton of 40 %. The qualitative structure of animals has been defined thanks to a Biolam microscope (Grishankov and Stepanova 2002); their quantitative account under test was carried out by aid of the chamber of Bogorov.

Results and discussion:

As the studied gulf is part of Bottom Svirskogo of the national park, no other anthropogenous factors render influence there, and it can be a modelling ecosystem

for studying the influence of the change of the hydrological mode. It speaks about an urgency of the research that has been carried out for it is known that now in the territory of Russia about three thousand reservoirs are being maintained; moreover, there proceeds the construction of small hydraulic engineering buildings without sufficient engineering justification leading to the change of the hydrological mode and, as a result, the violation of the structure of the water biocenoses (Novikov 1999). Besides, the obtained data allow to define possible ways of the development of the fauna of Nizhniya - the Svirsky reserve and to supplement the list of the inhabitants of its reservoirs.

It was established that in August, 2007 the zooplankton of the studied site was presented according to fifteen categories both at patrimonial and specific level, thus the marked-out animals treated types of arthropods and rotifers. Both in 2003 and 2007, the maximum specific variety and density were defined for cladoceran crustaceans; among this group of animals in 2007 being *Ceriodaphnia quadrangula*, and a minimum one, *Moina sp.*, had the maximum density; there are also comprised the following: *Ilyocryptus acutifrons*, *Daphnia longispina*, *Sida crystallina*, *Scaphoileberis mucronata*. In 2003 *Bosmina longispina* had the maximum density, and minimum for *Bythotrephes longimanus*, *Chydorus sphaericus*, *Ilyocryptus acutifrons*, *Polyphemus pediculus*. In the zooplankton of the studied site in 2007 there were revealed four species of rotifers, from which *Asplancha priodonta* had the maximum density. In 2003 on an estuary site of the gulf there were only three species of rotifers, though the maximum density of *Asplancha priodonta* was also revealed. In 2007, cladoceran crustaceans were present by the *Mesocyclops sp.*, and for it the maximum abundance (31,5 %) is defined. In the zooplankton of the studied site in the years 2007 and 2003 there prevailed floating forms, creeping forms being met less often. In 2007 in the community there were forms

attached to a substratum. In 2007 in this community there were 3 classes, while in 2003 alpha mezosaprobe was not allocated. Though during the studied period in the zooplankton of the studied site dominated beta mezosaprobe, the extent of their domination decreased from 97 % to 71 %.

The value of an index of the specific similarity, calculated for the zooplankton of the estuary site of the Gnilno gulf according to the data of 2003 and 2007, is of 56 %. It follows from this that throughout the studied period in this community there were considerable changes. These changes can be connected with the action of both natural and anthropogenous factors. But if the zooplankton of an estuary site was influenced only by natural factors, the value of the calculated index would be much higher and reaching about 90 % as it is defined in Kuta - a site on which the river does not render essential influence even at not-closed mouth. From here it is possible to assume that the zooplankton of the estuary site influences not only the natural, but also the anthropogenous factors (the change of the hydrological mode which has occurred because of the short circuit of the mouth of the gulf). Such changes led to the cessation of the hashing of the gulf's waters with Sviri's colder waters due to which the oxygen mode worsened, and, as a result, the water composition in suspension particles and the blue-green algae increased (Grishankov and Stepanova 2002). It is established that all these have affected the structure of the zooplankton of this reservoir's estuary site.

Thus, during the period from 2003 through 2007 in the zooplankton of an estuary site of the gulf there was a considerable change of structure and quantitative characteristics.

The established changes of a zooplankton may lead to a decrease in the biodiversity of the reserve because the studied group of animals is the food basis of many species of fish, which means that the change of its quality and the quantitative indices will affect the fish fauna – the supply

food basis of rare birds of prey. It is known that all fishes living in the gulf of Gnilno feed on zooplankton, and only in the process of growth their food requirements gradually disperse (Anisimov et al. 1983; Kirillov and Raspopov 1971; Vinberg and Gutelmakher 1987). For example, a yearling of northern pike (*Esox lucius*) eats per day a *Cyclops* of 160-175 % of the weight of its body (Anisimov et al. 1983). And as we established that the abundance of a *Cyclops* in the community during the period from 2003 through 2007 increased 10 times, it is also likely to expect an increase in the number of the northern pike population because of enough forage at early stages of its development.

It is known that zooplanktonic crustaceans that make 70 % of its food (Domrachev 1929) enter the diet of the adult bream (*Abramis brama*). As, according to our data, the number of *Bosmina longispina* has decreased, and the *Mesocyclops sp.* increased, it is possible to conclude that the food supply of the bream remains stable at the mouth's short circuit. According to literary data, in the range of the food of the pike perch (*Stizostedion lucioperca*) the planktonic rotifers and crustaceans (Vinberg and Gutelmakher 1987) dominate. The larvae of a pike perch eat mainly rotifers of the sort of *Polyarthra sp.* Considerably smaller, a share in their diet have *Mesocyclops sp.* and *Bosmina longispina* (Vinberg and Gutelmakher 1987). As once part of the community, *Polyarthra sp.* has disappeared and *Bosmina longispina*'s abundance has also decreased, and it is possible to expect that with the change of the hydrological mode this species will eat *Mesocyclops sp.* It is known that a third of the diet of the pike perch is the share of *Bosmina longispina*. Therefore, proceeding from our data, it is possible to predict a decrease in the number of this species.

As in the food of larvae of small fry, according to literary data, *Polyarthra sp.* prevails over *Asplanchna priodonta* and *Bosmina longispina* (Kirillov and Raspopov 1971; Vinberg and Gutelmakher 1987). It is

possible to expect a worsening of the food supply of this species at the short circuit of the mouth because it has disappeared from the community of *Polyarthra sp.*, the number of *Bosmina longispina* having decreased.

Although the number of *Asplancha priodonta* has increased, this quantity of the forage for the larvae of the small fry will not be enough to compensate the decrease in the number of *Bosmina longispina*. But the number of each representative of the fish fauna influences not only the condition of food supply, but also within, as well as the interspecific relations, and also the change of the abiotic factors (Anisimov et al. 1983). For example, the bream eats *Bosmina longispina*, but as its number has decreased, it passes to be food for the Cyclops (*Mesocyclops sp.*); it also should become the competitor of the northern pike and the pike perch. But the number of the pike perch in the gulf dwindles because of the deterioration of the oxygen mode (Anisimov et al. 1983), therefore from the diet of the northern pike this species will disappear completely. And as in the community the number of the perch (which eats *Bosmina longispina*) also decreases, in the diet of the northern pike remain only small fry and the bream. But, judging by the dynamics of the food supply, the number of small fry will not increase. It means that the northern pike in a large number will eat mostly bream, as it will lead to a decrease in the number of this species. Hence, for the northern pikes there will be no competitors for the forage. This is when the intraspecific competition can begin and, as a result, there will be a need for the stabilization of the number of the population of these species which could reach dispersion. But it is impossible because the mouth of the gulf has become isolated. For it is known that overpopulation affects the individuals' size (Chernova and Bylova 1988) comprising it, it is likely to expect that the size of the northern pike in this reservoir will be insignificant. Consequently, the number of the northern pike in the gulf in the next years remains high, but thus the size of the individuals will be insignificant, and the

number of the population of the bream will dwindle. So, the revealed changes in a zooplankton will lead to a decrease in some species of fish and to the decline of others. Regarding the diet of the ichthyophagus osprey, which lives in the territory of the Svirsky reserve, it may be considered according to the data received for the region of Leningrad. As it is known that the main forage of this bird here is the northern pike and that it frequently eats small fry (Malchevsky and Pukinsky 1983), it may be said that at the short circuit of the mouth of the Gnilno gulf the osprey's food supply will worsen. As the food range of the white tailed eagle is much wider (fishes, birds, rodents) (Pukinsky 1988; Lasukov 2000), at the separation of the gulf from the river the food supply of this bird will lessen, but it is still not so plentiful, just like in the case of the osprey.

Because the food supply of these birds on Lake Ladoga and the gulf of the river of Sviri Lakhta diminished (Andreeva 2004; Kuznetsova 2007), the decrease of the fish population of the gulf of Gnilno can cause the disappearance of these birds from the reserve territory.

Conclusions:

A factor influencing the number of rare fish-eating birds, living in Nizhniya – the Svirsky reserve, is the existence of fodder resources.

Comfortable conditions for the reserve of fish fauna in many respects are defined by qualitative and quantitative structure of the zooplankton.

Under the influence of the change of the hydrological mode in Gnilno's gulf there was a transformation of the community of the zooplankton: the specific structure changed, and the quantity of types at the expense of the emergence of secondary filtration organisms – the floating forms increased, the share of cladoceran crustaceans decreased.

The change of the structure of the zooplanktonic community led to the pauperization of the fish fauna of the gulf.

The pauperization of the ichthyofauna of the gulf worsens the food supply of rare birds of prey -white tailed eagle and osprey-, which can become the reason of decrease in their number and further - disappearances from the reserve territory.

Rezumat:

INFLUENȚA SCHIMBĂRII CONDIȚIILOR HIDROLOGICE DIN GOLFUL GNILO ASUPRA BIODIVERSITĂȚII DIN NIZHNIYA – REZERVAȚIA SVIRSKY

Prezentul studiu explică în ce mod structura calitativă și cantitativă a zooplanctonului influențează ihtiofauna din golful Gnilo. Modificarea condițiilor hidrologice ale golfului Gnilo a provocat schimbări la nivelul zooplanctonului. Ihtiofauna actuală este deja afectată, ceea ce duce la o diminuare a resurselor de hrănire pentru păsările rare de pradă. Dintre păsările de pradă, vulturul codalb și vulturul pescar au ajuns în pragul dispariției în zonă.

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