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MODERN HYDROECOLOGICAL STATE OF HORDASHOVKA RESERVOIR OF THE HIRSKY TIKYCH RIVER

Mityay I., Khomych V., Demchenco V.
National University of Bioresources and Natural Resources of Ukraine
15, Heroyiv Oborony St., Kyiv, 03041
rectorat@nubip.edu.ua

Наведені результати досліджень гідрохімічного та гідробіологічного (фітопланктон, зоопланктон, бентос) режимів Гордашівського водосховища річки Гірський Тікич. За оцінкою виявлених показників зроблено висновок, що водойма відповідає рибогосподарським нормативам і може ефективно використовуватись у рибному господарсві. *Ключові слова:* гідрохімічний режим, фітопланктон, зоопланктон, бентос, Гордашівське водосховище, річка Гірський Тікич.

Современное гидроэкологическое состояние Гордашовского водохранилища реки Горный Тикич. Митяй И.С., Хомич В.В., Демченко В.А. Приведены результаты исследований гидрохимического и гидробиологического (фитопланктон, зоопланктон, бентос) режимов Гордашевского водохранилища реки ГорныйТикич. По полученным данным сделан вывод, что водоем соответствует рыбохозяйственным нормативам и может эффективно использоваться в рыбохозяйственных целях. *Ключевые слова:* гидрохимический режим, фитопланктон, зоопланктон, бентос, Гордашевское водохранилище, река Горный Тикич.

Modern hydroecological state of Hordashovka reservoir of the Hirsky Tikych River. Mityay I., Khomych V., Demchenco V. Research results of hydrochemical and hydrobiological (phytoplankton, zooplankton, benthos) modes Hordashovka reservoir of the Hirsky Tikych River are presented. According to figures the studied reservoir corresponds to the fishery standards and can effectively be used in respect of fisheries. Keywords: hydrochemical regime, phytoplankton, zooplankton, benthos, Hordashovka reservoir, the Hirsky Tikych Rive.

In connection with the problem of energy supply in Ukraine over the past decade, the importance of recreating the mini-HPP on small rivers has become important. The process of creating reservoirs itself has a number of negative and positive changes, the values of which must be assessed on a case-by-case basis through in-depth comprehensive research. In preparing scientific recommendations, it is usually necessary to balance between the economic necessity of the reservoir and the state of biodiversity. Small rivers are at the same time an integral part of shared water resources and are often the main and sometimes the only source of local water supply, a condition for the development of agriculture through watering and one of the options for providing the population with fish. At the same time, a construction of dams leads to a flooding of territories and drying up of small rivers below them, and due to insufficiently substantiated choice of a dam construction site, negative changes in aquatic ecosystems with loss of biodiversity, primarily an ichthyofauna of rivers, can occur. The complex nature of the use of reservoirs requires consideration of all variants of the impact of economic activity on a reservoir. In this case, the study of their hydroecological regime (hydrological, hydrochemical, hydrobiological regimes and the state of the ichthyofauna) is important and necessary, as it enables not only to reveal the present state of the reservoir, but also to predict the possible consequences of one or another influence on it. The purpose of the work was to study the hydroecological state of the Hordashovka reservoir of the Hirsky Tikych River are in connection with the restoration of the work of the same hydroelectric plant and to assess the prospects of its use for fishery.

Material and research methods. The hydroecological state of the reservoir was studied in June 2014 at 8 stations - from the headwaters to the dam of the Hordashovka HPP. The hydrochemical state of the water environment parameters was studied in accordance with generally accepted methods [1, 2]. Chemical analysis of water was carried out in the laboratory of the Department of Hydrochemistry of the Ukrainian Research Institute of Hydrometeorology of the Ministry of Emergency Situations of Ukraine.

Phytoplankton samples were collected according to known methods [3-5]. The species composition, number and biomass were determined by the employee of the Institute of Hydrobiology of the National Academy of Sciences of Ukraine, Manturov O. Samples of zooplankton were selected by the Apstein mesh (No. 72), filtering 100 dm^3 of water, and macrozoobenthos samples by a sectional bottom grab with a gripping area of 100 cm^2 [6-8]. The processing of samples was carried out by the staff of the Department of General Zoology and Ichthyology, Demchenko L. and Degtyarenko O. Analysis of the ichthyofauna was carried out according to the results of hatching capturing with drag net by traditional methods [9]. Additional information was received from the local population and amateur fishermen.

Research results and their discussion. The Hordashovka reservoir was founded due to the construction of the same-name hydroelectric power station in the 50s of the last century, the resumption of which was held in 1998. The work of the hydroelectric power plant directly influences the hydrological regime of the river and indirectly - on the hydrochemical and hydrobiological regimes. Studying the degree of this impact will help to identify possible environmental risks in a timely manner and develop recommendations for their minimization or complete elimination. The study of these regimes yielded the following results.

The chemical composition of the water of the Hordashovka reservoir of the Hirsky Tikych River in June 2014 was characterized by the following chemical indicators (Table 1).

According to the hydrochemical parameters, the Hordashovka reservoir meets all the rules of the fishery and can be used for growing commercial fish.

The phytoplankton of the Hordashovka reservoir at the end of June 2014 was represented by 87 species of algae from eight divisions: Bacillariophyta, Chlorophyta, Euglenophyta, Cyanophyta, Dinophyta, Cryptophyta, Chrysophyta, Xantophyta (Table 3).

Table 1

The chemical composition of water of the Hordashovka reservoir

Chemical indicators	Collecting points							
	1	2	3	4	5	6	7	8
pH	8,35	8,07	7,93	7,91	7,99	8,06	7,50	8,16
Mineralization	623,9	611,4	618,7	604,1	651,6	652,7	635,7	597,2
Hydrocarbonates, mg/l	414,8	396,5	457,5	402,6	420,9	390,5	408,7	396,5
Sulfates, mg/l	18,0	14,0	52,0	16,0	46,0	54,0	44,0	20,0
Chlorides, mg/l	53,25	49,7	37,28	44,38	39,05	53,3	39,05	40,83
Magnesium, mg/l	58,8	44,4	38,4	48,0	57,6	45,6	52,8	42,0
Calcium, mg/l	52,0	70,0	56,0	50,0	44,0	72,0	54,0	48,0
Hardness, mg equiv/l	7,5	7,2	8,0	6,5	7,0	7,4	7,1	5,9
Potassium, mg/l	9,0	15,6	12,5	12,9	14,7	12,5	12,4	16,61
Sodium, mg/l	18,03	31,2	25,04	25,89	29,39	25,0	24,8	33,22
Iron mg/l	0,02	0,02	0,05	0,02	0,04	0,02	0,05	0,01

Table 2

The content of biogenic elements of water in the Hordashovka reservoir

Indicator	Collecting points							
	1	2	3	4	5	6	7	8
Ammonium nitrogen, mgN/dm^3	0,129	0,12	0,14	0,013	0,11	0,12	0,06	0,024
Nitrogen nitride, mgN/dm^3	0,0	0,00	0,01	0,0	0,00	0,01	0,0	0,528
Nitrogen nitrate, mgN/dm^3	0,190	0,13	0,02	0,114	0,14	0,01	0,05	0,169
Mineral nitrogen, mgN/dm^3	0,319	0,14	0,13	0,127	0,2	0,14	0,11	0,721
Phosphates mP/dm^3	0,124	0,09	0,2	0,094	0,15	0,49	0,31	0,197
Manganese, mg/dm^3	0,01	0,02	0,01	0,02	0,02	0,02	0,01	0,02

Table 3

Distribution of major groups of phytoplankton in the Hordashovka reservoir

Groups	Species	Number of cells	%	Mass	%
CYANOPHYTA	5	1731,7	25,1	0,0073	0,7
DINOPHYTA	2	13,3	0,2	0,042	4,2
CRYPTOPHYTA	2	40,0	0,6	0,0146	1,5
EUGLENOPHYTA	13	80,0	1,2	0,1727	17,2
CHLOROPHYCOPHYTA	36	4525,0	65,6	0,5074	50,6
CHRYSOPHYTA	1	108,3	1,6	0,0119	1,2
XANTHOPHYTA	1	1,7	0,0	0,0003	0,0
BACILLARIOPHYTA	27	395,0	5,7	0,246	24,6
SUM	87	6895,0	100	1,0026	100

By species composition, green and diatom algae (26 and 28 species) prevailed, in terms of quantitative indices, diatoms dominated. Throughout the reservoir one species - *Sinodraatsus* dominated. At station No 1, 34 species of plankton algae from six groups were registered. The share of *Synedraacus* dominant in abundance and biomass was 70.5 and 60.2%, respectively. Phytoplankton at points at stations No. 2 and No. 3 was almost identical in species composition and quantitative indicators, but the number of species slightly increased compared to station No. 1, where representatives of Isochrysis galbana - *Synura* sp. and *Dinobryondivergens*. At station No 4, the number of species increased and one more dominant was noted - *Fragilariapinnata* (its share in number and biomass was 23.0 and 10.9% respectively). It is possible that this species was veheted at the bottom and in the points No. 1-3, and its appearance in the plankton test at station No. 4 is explained by hydrological conditions (low depth, wind blending). This assumption is confirmed by the presence of a significant number of perifytonic species (*Gomphonema* and *Cymbella* species) and coarse-shaped bottom forms in this test. Euglenic species were represented in the reservoir in 9 species, but only single cells occurred. Green algae (mainly chlorococci) were varied (26 species), but at the time of sampling no significant quantitative indicators were achieved.

As part of the zooplankton of the Hordashovka reservoir, 46 species of the three main systematic groups have been registered: rotaria (*Rotatoria*), cluster (*Sladocera*) and copepoda (*Crataeus*) (Table 4).

The main systematic group, dominant in species numbers, was rattles (29 species), which accounted for 58% of the total number of species (taxa). Gilastovus crustaceans were represented by 6 species. Vessel-like crustaceans comprised 11 species. Background species in large numbers were found in all samples, were rotifers *Euchlanisdilatata*, representatives of the Brachionidae family - *Brachionusdiversicornis*, B. *angularis*, B. *quadridentatus*, and also the branchy fours *Chydorussphaericus*, *Daphnialongispina* and Copepods *Thermocyclopsoithonoides*. The number of species in the samples varied from 23 to 28. The dominant groups in terms of number were the pyloric rocks and veslonogy crustaceans, and for biomass - veslonogi due to the mass development of the larvae and young and branchedvovaya crustaceans.

Table 4

The number (thousand copies / m3) and biomass (g / m3) of the zoroplankton of the Hordashovka reservoir

Samples	Rotatoria	Copepoda	Cladocera	Total
1-2	15,22 / 0,01	1,33 / 0,01	0,36 / 0,02	16,91 / 0,04
3-4	78,07 / 0,29	34,70 / 0,45	1,96 / 0,12	114,73 / 0,56
5-6	93,05 / 0,20	102,14 / 0,30	0,59 / 0,16	195,78 / 0,66
7-8	2,38 / 0,01	2,90 / 0,03	4,98 / 0,14	10,26 / 0,17

In the zoobenthos species composition 42 species were found: flat worms (Turbellaria) and roundworms (Nematodes) were represented by 1 species each; 3 species of oligochaeta (Oligochaeta) 3 species of leeches (Hirudinea) isopods crustaceans (Isopoda) -1 species; class insects, which included rows of grandmother (Odonata) freckles (Plecoptera) and semisweet or bug (Heteroptera) had 1 species; larvae of beetles (Coleoptera) numbered 3 species; 2 species of chironomids (Diptera), 25 species of mollusks (MOLLUSCA), of which 20 are (Gastropoda) and 5 are bivalves (Bivalvia). Among taxonomic groups in the group as a whole the leading role was played by mollusks and chironomidnogo-oligocet complex, accounting for 64% (Table 5).

Table 5

The number and biomass of the main groups of zoobenthos

Taxons	No. 1	No. 2	No. 3	No.4	No. 5	No. 6	No. 7	No. 8
Oligochaetes	76 / 0,069	144 / 0,153	184 / 0,191	136 / 0,128	110 / 0,096	203 / 0,215	181 / 0,178	216 / 0,211
Larvae of dragonflies and plecoptera	52 / 0,709	21 / 0,415	28 / 0,633	72 / 1,109	69 / 1,084	84 / 1,214	78 / 1,152	46 / 0,688
Chironomidy	160 / 0,954	67 / 0,371	228 / 1,544	541 / 5,238	506 / 4,534	560 / 5,254	488 / 4,370	510 / 4,853
Molluscs	81 / 24,95	112 / 31,15	61 / 19,32	427 / 24,95	674 / 58,15	881 / 58,95	694 / 61,15	908 / 74,95
Total	369 / 26,68	344 / 32,09	501 / 20,15	1176 / 31,43	1359 / 63,87	1728 / 65,63	1441 / 66,85	1680 / 80,70

The dominant set of species at all stations was formed by 8 species, among which the densities in the water body as a whole were the largest oligochaetes and chironomids and less molluscs, while for biomass the dominant group was molluscs.

According to the local residents, the ichthyofauna of the Hirsky Tikych River was very poor since the channel was deep and often dried up in the summer. After filling the reservoir, the species composition of the fish gradually increased, and in Ju*ne 2014 we registered 19 species: Cyprinuscarpio - carp, Carassiusauratus - crucian, Tincatinca* - common roach, *Rutilusrutilus* - common roach, *Scardiniuserythrophthalmus* - raspberd, *Alburnusalburnus* - vetch, *Bliccabjoerkna* - silver bream, *Abramisbrama* - bream common, *Hypophthalmichthysmolitrix* - white carp, *Rhodeusamarus* - gorchak, *Pseudorasboraparva* - Amur chub, *Gobiogobio* - common minnow, *Cobitistaenia* (sl) - earwig, *Esoxlucius* - pike, *Sanderlucioperca* - pike perch, *Percafluviatilis* - perch, *Lepomisgibbosus* - sun perch, *Ctenopharygodonidella* - Chinese carp, *Aristichthysnobilis* - bighead.

Conclusions

The Hirsky Tikych River before the creation of the reservoir was characterized by a slight watercourse with drying of the riverbed during the dry period. Potential fishery value it received due to the constructed reservoir and the stabilization of the hydrochemical and hydrobiological regimes. Improvement of the state of the ichthyofauna of the Hordashovka reservoir is possible with intensification of fish protection, carrying out of ribomeliorative measures and reproduction of fish stocks due to the organization of fish-breeding enterprises.

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