Tyaptirgyanov M.M., Tyaptirgyanova V.M.

QUALITY STANDARD OF THE WATER ENVIRONMENT AND HYDROBIONTS IN THE RIVER VILYUY BASIN

ABSTRACT

There were revealed numerous negative impacts of the diamond industry and Viluiskaya hydroelectric power plant on the aquatic environment and biological objects of the River Viluy basin, expressed to a greater extent in changing of the waters hydrochemical regime and, as its consequence, in violation of the structural and functional nature of the components of aquatic biota; change in the average biomass and abundance of planktonic populations (phyto-and zooplankton) and benthic organisms, and in general - change the flow of energy in an aquatic ecosystem.

Keywords: salinity, gas regime, biogenic element, zooplankton, benthos, the maximum permissible concentration.

INTRODUCTION

In the available scientific literature, there are almost no data on the content and distribution of heavy metals in fish freshwater bodies of the Republic of Sakha (Yakutia). Meanwhile, these studies are important, because fish are bio-indicators of water pollution and an important link in the food chain receipt toxic element in the human body.

Currently toxicosis diagnosis and prognosis of its outcome, are challenging a comprehensive assessment of the status of fish, taking into account the severity of the pathological process, including an assessment of the state of terminative system and the ability to reproduce. At the same time great importance is the differentiation diagnosis of infectious toxics, invasive and nutritional diseases. It should be noted that the fish belongs to the major products of human nutrition and in the assessment of its status the requirements of veterinary-sanitary examination must be taken into account [1,2,3,4,5,6,7,8,9,10,12,13,14,15,16,17].

In the diet of the inhabitants of Yakutia fish products consumption is in fourth place after the meat and dairy products, bread and bakery products. This fact was the basis for the study of the most common systems in the Republic of freshwater fish, and above all the representatives which are not engaged in large migrations and keep the same seats.

Material and methods. The intensity of the environmental situation in the basin of Viluy connected, on the one hand, with the deterioration of the qualitative composition of the water, on the other - with a sharp decline in species diversity of aquatic species and their quantitative indicators, which caused the whole substantial changes in the hierarchical structure of water bodies. From this perspective, we try to find out the main thrust of the changes, the depth of the processes through the following objectives:

- Assess the level of contamination of surface water with toxic substances;
- The study of the dynamics of the species composition of phytoplankton, zooplankton and benthic organisms;
- A preliminary assessment of river water quality for indicator organisms (bioindication) - assessment of the process of accumulation of certain trace elements in water and in biological objects. Chemical analysis of the water was carried out according to generally accepted in the hydrochemistry of freshwaters methods [8].

The results showed that the discharge of saline water from the temporary storage and drainage of polygons has a definite influence on the formation of the hydrochemical regime Irelyakh rivers, M. Botuobuya, Daldyn and Markha. The chemical composition of water is under the direct influence of highly discharges. The greatest changes in salinity is higher than background rates 14 times and amounted to 3.5 MAC. As a result, the chemical composition of the water has changed from bicarbonate-calcium to sodium-chloride.

In the river M. Botuobuya mineralization of water against the backdrop of increased 20 times and amounted to 2.7 MAC. The type of water was mixed. The high salinity of the water after the cessation of discharges, apparently associated with secondary contamination through the soil by salts accumulated in the sediments during low flow. Simultaneously with these processes in rivers increased content of nutrient elements, in particular all forms of nitrogen. In the waters of the riverIrelyakh content of ammonium nitrogen increased 2.5 times against the background, forming in winter 2 MAC, nitrite nitrogen - 10 times (up to 16 MPC); nitrate - in 2 times. The chemical oxygen consumption increased by 2 times. A similar increase in all forms against the background azaota noted at p. M. Botuobuya (ammonium - 3 times, the nitrite - 10, of nitrate - 2, COD - 2 times.

Mineralization of water in the river Daldyn (a group of "Udachniy") at stations located below technogenic discharges was also overpriced (2 times against the background values). A similar situation exists in the estuaries of rivers Daldyn and Markha. By limiting nutrients, in particular on all forms of nitrogen, the excess above the background values of 1.5-2.0 times. Inflated on all these rivers, compared with the background, and turned organic content. In areas exposed to man-made discharges, they turned 2-3 times more in August. Special mention should be noted large concentration of volatile phenols (average r. Daldyn - 8 MAC, the maximum - 19 MAC, while the average background rates - 5 MPC;. in r. Irelyakh - 5 MPC, while the average background - 3 MAC;. in r. M.Botuobuya - 7 MAC, the maximum - 20 MAC, while the average background rates - 2.5 MAC).

The river Viluy - from the village Chernyshevsky till Verkhnevilyuisk major changes in the chemical composition of micro-components were not observed, including the area of human impact. Only on individual stations (p. Bright, S. Syuldyukar, Verkhnevilyuisk) only for nitrates in July there was marked the maximum permissible concentration. However, the content of phenols remains high, at the level of previous years (5 MPC against the backdrop of 2-3 MPC). In the same areas, confined to villages, volatile phenols up to 15 MACs (n Light - 15 MPC;. With Syuldyukar - 10;. N Bordon - 10 MPC;. Verkhnevilyuisk - 8 MPC).

Synchronous changes occur in aquatic biota too. There is a process of continuous lowering of the quantitative development of planktonic organisms (phytoplankton and zooplankton) as a result of many years of dumping of highly mineralized water. Their specific action with respect to individual species. The effect is observed in the ratio of its constituent violation populations up to the loss of certain species, as noted, for example, river Markha, there is not detected early live in her blue-green algae. In the area of high salinity influence - Irelyakh, Tymtyydah, M. Botuobuya, Daldyn, Markha - previously found not marked saltwater species. It also recorded the prevalence of diatoms rheophilic complex.

On the basis of the data revealed that algae growing season adversely affected by the changing seasons and years in hydrological and thermal parameters of the river as a result of the discharge of water from the reservoir Vilyui. Reset mineralized waters from the temporary storage and drainage of polygons has a definite influence on the formation of zooplankton. In winter, the samples taken from the river. Irelyakh, Markha, M. Botuobuya, Daldyn Sytykanskogo from the reservoir, as well as in samples of seepage water processing factory number 9 recorded extremely low abundance and biomass of zooplankton, and in some cases - and their complete absence. In the background the same areas (above the effect of effluent) p. M.Boutobuya noted the presence in samples of zooplankton groups and especially filter feeders. Thus, the following can be cited as comparison. If these contaminated sites zooplankton abundance averaged 40 copies / m3 biomass 1.40 ind / m3, in the background in the spring -.., Respectively - 280 ind / m3 and 1.78 ind / m3... During the summer, indicators were as follows: the number of contaminated sites - 100 copies / m3 biomass 5.1 mg / m3, on background - respectively 450 ind / m3 and 11.56 mg / m3...

Dynamics of changes in the species composition of zooplankton is clearly seen on the example of the river Markha previously surveyed detail LE Komarenko (1962) [11]. Of the 17 previously recorded species of zooplankton in the present time there is only noted 14. Modern composition of zooplankton taxa river includes organisms living in less stained and polluted environment, significant changes have occurred not only in quality but also quantity. Thus, compared to 1958 in 1989 the number of zooplankton groups in the area of the river Markha decreased cladocerans-

from 18500 to 25 ind / m3, copepods -. From 4300 to 35, rotifers - from 60,000 to 175 ind / m3.. It revealed such that where there is no elevated salinity, zooplankton production goes through copepods, and vice versa, in areas with high salinity - in a population of rotifers. In areas of the downstream river. Viluy in the summer is characterized by a slight increase in zooplankton biomass of organisms by adult groups of copepods and cladocerans low quantitative terms. The main reason for the low numbers of these organisms, in addition to the thermal regime is the high content of suspended substances as a result of their accumulation in the water as a result of anthropogenic influences. Reset mineralized water companies adversely affected the diamond industry and representatives of bottom fauna. There is a qualitative and quantitative change in the structure of benthic organisms. So, if in 1958 in the district Viluy was registered 93 taxonomic groups, then in 1989 - only 16. The basis of the recorded species biocenoses were related to cold oxyphilous complex. The most numerous of them were presented eurybiontic species - subfamily ortokladiny chironomids larvae of mayflies, stoneflies and caddis flies. In the most polluted areas (. P Tymtyydah) found larvae of flies - ephedra and their cocoons, usually found only in waters with high salt content.

According to the degree saprobity hydrogeological objects studied water areas can be attributed to relatively clean - the river Viluy and normally soiled - Markha River, below the mouth of the river Daldyn. It should be noted that the classification of water quality is relative and does not give an objective assessment of the full impact of the diamond industry for the following reasons. Firstly, with the September 1988 stopped dumping of highly mineralized water in the river system Viluy career 'Mir' pipe. Secondly, the high volume and long time (since March 1989) discharge of water from the reservoir Vilyui caused erosion and dilution of highly mineralized water and precipitation.

It was revealed that the damming of the river flow, and with it the sharp daily fluctuations of the water level in the downstream lead to significant environmental changes spawning areas and fish to their spawning substrate mismatch, poor water flow, early freezing, etc.). At the same time water release in late June - early July for navigation in the downstream significantly reduce the water level in the reservoir, which often leads to desiccation and death of calves spring spawning fish (pike, perch, etc.), which significantly changes the dynamics their numbers. Long ice period (215-238 days) and the related changes in water temperature regime in the upper and downstream caused a shift in the timing of spawning and its duration at a later date, which negatively affects the whole course of development of the different periods of ontogeny, particularly in its early stages.

The rate of flow is significantly affected by the water level. If the dam part is very high and unstable, the spring flow rate in the middle and lower sections of lower than before (to the regulation), as a result of redistribution of the river flow. There is a low concentration of food items in the dam area of passive demolition and destruction in turbulent water movement. Simultaneously with the upstream dam comes a significant number of dead organic matter (plankton organisms, benthos, juveniles and large fish), who died when passing through hydroelectric turbines that ultimately reduces the oxygen content in the water, especially in ice time and degrades the overall environment aquatic habitat. At the present time, the negative effects of hydraulic works on aquatic biota is aggravated discharge of industrial effluents and the diamond industry with highly mineralized water dump sites. With the development of the diamond industry has increased the introduction of contaminants into the environment, in connection with what was the problem of assessing the level of biological contamination of water environment, the mechanism of their accumulation in organs and tissues of aquatic organisms. The study of the mechanism of accumulation of trace elements in biological objects has been directed by the scheme: water - algae - peaceful fish - predatory fish. Excessive poverty of zooplankton and benthic organisms in the river basin Viluy methodically not allowed to trace the migration of heavy metals through the food chain. In assessing the toxicological water pollution of great importance was attached to the study of algae as the primary producers of oxygen and organic matter in the water, also has extraordinary ability to actively accumulate heavy metals. Studies have revealed a significant accumulation of algae collected from the river Vilyuy basin, nickel and lead (4-7 times), cobalt (2 and 5 times) greater than the background concentration of algae collected in the zone of manmade waste diamond industry (Markha river, MA Botuobuya, Irelyakh).

The findings suggest a possible contamination of water under the influence of anthropogenic factors elements such as nickel and chromium. At the same time, the results obtained allow us to conclude on the need for special studies on the development of MPC for drinking and fishing industry and harmonization of the rules of the MPC for fish production ponds Yakutia.

Conclusion. Revealed numerous negative impacts of the diamond industry and Vilyuiskaya HPP on the aquatic environment and biological objects, that mainly expressed in the change of hydrochemical regime of waters of the basin district Viluy and as its consequence - in violation of the structural and functional nature of the components of aquatic biota; the change in the average biomass and abundance of planktonic populations (phytoplankton and zooplankton) and benthic organisms, fish population; reducing the number of higher taxa; replacing the dominant species in hydrobiocenoses, as well as the emergence of new forms for the ecosystem of aquatic organisms (brackish water); in reducing the number of separate groups, and abundant development of indicator species; in violation of the relations of production processes and the degradation of organic matter; and in general - inthe change of the flow energ in an aquatic ecosystem.

However, studies for many reasons (short duration of the observation period and the period of collecting material, high volume and high water for periods of time, a temporary cessation of dumping waste man-made production, the complexity of differentiating the negative impact of both man-made and altered environmental factor, determining background content trace elements in the environment, their migration and accumulating effects on aquatic biota, etc.) do not allow to do the full objective assessment of the impact of multifactor anthropogenic impacts (Viluiskaya hydroelectric, mining, agriculture, fishing and others.) on aquatic ecosystems Vilyui region's rivers although their negative role is obvious and significant. In order to solve fully tasks it is needed to continue started unique study on the basis of the monitoring, with more in-depth approach to the various levels of the organization, with obligatory coverage of all the major components of the environment.

REFERENCES

1. Knyazhev V.A. Baturin A.K. Onishhenko G.G. Tutel'yan V.A. Bol'shakov O.V. Aktual'nye problemy uluchsheniya struktury pitaniya i zdorov'ya naseleniya Rossii: Kontseptsiya gos. politiki v oblasti zdorovogo pitaniya naseleniya Rossii na period do 2000 goda [Actual problems of improving the diets and health of Russian population: the concept of state in the field of healthy nutrition policy of the Russian population till 2000]. Voprosy pitaniya [Nutrition]. 1998, № 1, P. 3-7.

2. Alekin O.A. Osnovy gidrokhimii [Basics of hydrochemistry]. Leningrad: Gidrometeoizdat, 1970, 444 p.

3. Arshanitsa N.M. Metodika patologoanatomicheskogo issledovaniya vvodnoj toksikologii. Pamyatnaya zapiska o simpoziume po vodnoj toksikolkogii (SEHV) [Methods of mortem examination in the aquatic toxicology. Memorandum on the Symposium on the aquatic toxicology (CEV)]. Leningrad, 1970, P. 96-98.

4. Arshanitsa N.M. Lesnikov L.A. Patologo-morfologicheskij analiz sostoyaniya ryb v polevykh i ehksperimental'nykh toksikologicheskikh issledovaniyakh [Pathological and morphological analysis of the status of fish in the field and experimental toxicology studies] Metody ikhtiologicheskikh issledovanij [Methods of ichthyologic research]. Leningrad: GosNIORCH NPO Promrubvod, 1987, P.7-9.

5. Arshanitsa N.M. Ryby kak indikatory kachestva vod [Fish such as water quality indicators] Materialy Vsesoyuznoj konferentsii «Metodologiya ehkologicheskogo normirovaniya [Methodology of environmental regulation: proceedings of the All-Union Conference]. Kharkov, 1990, P. 17-18.

6. Arshanitsa N.M. Vliyanie stochnykh vod sel'khozpredpriyatij na ikhtiofaunu v usloviyakh Severa-Zapada [Effect of wastewater in the fish fauna in the North –West] Ekologicheskie problemy ratsional'nogo ispol'zovaniya i okhrany vodnykh resursov Severo-Zapada Evropejskoj chasti RSFSR [Ecological problems of rational use and protection of the North -West Water Resources European part of the RSFSR]. Vologda, 1990, P. 42-43.

7. Arshanitsa N.M. Stekol'nikov A.A. Diagnostika toksikozov ryb i otsenka sredy ikh obitaniya [Diagnosis of fish toxicosis and their habitat assessment] Fiziologicheskie, biokhimicheskie i molekulyarno-geneticheskie mekhanizmy adaptatsii gidrobiontov [Physiological, biochemical and molecular genetic mechanisms of adaptation of aquatic organisms: proceedings of conf. with int. participation]. Borok, 2012, P. 269-274.

8. Belyaev E.N. Chiburaev V.I. Shevyreva M.P. Lagunov S.I. Zadachi sotsial'no-gigienicheskogo monitoringa kak vazhnejshego mekhanizma obespecheniya sanehpidblagopoluchiya naseleniya [The objectives of social and hygienic monitoring as an essential tool to ensure public sanitary-epidemiological well-being] Gigiena i sanitariya [Hygiene and sanitation]. 2000, № 6, P. 58-60.

9. Brown V.M. Ryby kak indikatory kachestva vod [Fish like water quality indicators] Nauchnye osnovy kontrolya poverkhnostnykh vod po gidrobiologicheskim pokazatelyam [Scientific basis for monitoring of surface water on hydrobiological indicators]. Leningrad, 1977, P. 194-206.

10. Izmerov N.I. Monisov A.A. Tutel'yan V.A. Normativno-metodicheskaya baza obespecheniya kachestva i bezopasnosti pishhevykh produktov v Rossii [Legal and methodological framework to ensure food quality and safety in Russia] Tr. Mezhdunar. konf. Politika v oblasti zdorovogo pitaniya Rossii [Policy in Russia healthy diet: Collections of the Intern. conf.]. Moscow, 1997, P.21.

11. Komarenko L.E. Plankton levykh pritokov Vilyuya – rek Markha i Tyung [Fauna of fish and invertebrates of Vilyui basin: The Institute of Biology of YB SB AS USSR Collections]. Moscow: Academy of Sciences of the USSR, 1962, Vol. 8, 163 p.

12. Lesnikov N.V. Chinareva I.D. Patologo-gistologicheskij analiz sostoyaniya ryb pri polevykh i ehksperimental'nykh toksikologicheskikh issledovaniyakh. Metody ikhtiotoksikologicheskikh issledovanij [Pathological and histological analysis of the state of fish at field and experimental toxicology studies: Methods of ichthyologic research]. Leningrad: GosNIORCH NPO Promrubvod, 1987, P.79-80.

13. Onishchenko G.G. Kachestvo, bezopasnost' pishhevykh produktov v Rossii [Quality, food safety in Russia] Politika v oblasti zdorovogo pitaniya v Rossii [Policy in healthy nutrition in Russia]. Moscow, 1997, P. 9.

14. Pokrovsky V.I. Struktura pitaniya i zdorov'e naseleniya Rossii [The structure of the food and health of Russian population] Politika v oblasti zdorovogo pitaniya v Rossii [Policy in the field of healthy nutrition in Russia]. Moscow, 1997, P. 8.

15. Reshetnikov U.S. Biologicheskoe raznoobrazie i izmenenie ehkosistem [Biodiversity and ecosystem change] Bioraznoobrazie: Stepen' taksonomicheskoj izuchennosti [Biodiversity: The degree of taxonomic study]. Moscow: Nauka, 1994, P. 77-85.

16. Reshetnikov U.S. Metod ehkspertnoj otsenki sostoyaniya osobi i populyatsii sigovykh ryb [The method of expert assessment of the state and the individual populations of whitefish] Biologiya i biotekhn. razved. sigovykh ryb [Biology and biotechnological breeding of whitefish]. SPb.: GosNIORCH Publishing, 1994, P. 115-118.

17. Tutelian V.A. Bondarev G.P. Martinchik A.N. Pitanie i protsessy biotransformatsii chuzherodnykh veshhestv [Nutrition and processes of biotransformation of foreign substances] Itogi nauki i tekhniki. VINITI [Results of science and technology. VINITI]. Toxicology, 1987, V. 15, p.212.

AUTHORS

Matvey Tyaptirgyanov - PhD, associate professor of Institute of Natural Sciences NEFU, matyap@mail.ru;

Victoria Tyaptirgyanova - MD, deputy chief medical officer, FBHF "Center of Hygiene and Epidemiology in the Republic of Sakha (Yakutia) », vtyap@mail.ru.