JOURNAL OF UNIVERSAL SCIENCE RESEARCH

ISSN (E): 2181-4570 ResearchBib Impact Factor: 6,4 / 2023

УДК 502.211.

MODERN HYDROECOLOGICAL STATE OF REGIONAL FISHING PONDS

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Annotation

In the work, the problems of the geoecological state and the use of surface waters were divided into three large groups: natural hydrological and hydrogeological phenomena that interfere with human life; irrational use of water bodies; negative anthropogenic impacts on water resources. For each of the groups, a scientific review was made, in which the main features and characteristics of the identified problems are indicated.

Key words: pond, reservoir, hydroecology, hydrogeology, anthropogen, flora, fauna, fisheries

Аннотация

В работе проблемы геоэкологического состояния и использования поверхностных вод были разделены на три большие группы: естественные гидрологические и гидрогеологические явления, мешающие жизнедеятельности человека; нерациональное использование водных объектов; негативное антропогенное воздействие на водные ресурсы. По каждой из групп составлен научный обзор, в котором указаны основные особенности и характеристики выявленных проблем.

Ключевые слова: пруд, водоем, гидроэкология, гидрогеология, антропоген, флора, фауна, рыболовство.

Introduction. The first group of problems includes natural hydrological and hydrogeological phenomena that interfere with human life. Among these processes, one can distinguish: surge phenomena, the density of the river network, the shallow occurrence of groundwater, and the increased level of iron in watercourses.

The second group of problems of the region is related to the irrational use of water bodies. A network of small hydroelectric power plants was well developed,

ISSN (E): 2181-4570 ResearchBib Impact Factor: 6,4 / 2023

supplying electricity to small settlements and enterprises. Fish were actively bred in rivers and lakes, which diversified the flora and fauna and provided people with additional food. Parks were erected near water bodies located within the city, trees and bushes were planted in order to increase their recreational potential. The reclamation network on agricultural lands was actively developed[2]. To date, the entire huge potential of water bodies is not actually being developed or is being developed irrationally.

To date, surface water bodies of the region's land have a wide range of uses in the following areas: hydropower; recreation; agriculture, fisheries, public utilities; shipping and industry. Despite the wide area of use, a small part of the possible potential of water bodies is used, and the one that is currently used is characterized as unproductive and having a negative impact on water resources [1].

Despite the dense hydrological network, many water bodies are not used properly. Rational use of water resources can improve the lives of the population and contribute to the overall economic development of the region.

The third group of problems that will be considered in this paper is the negative anthropogenic impact on water resources. The current hydrochemical state of water bodies is mostly assessed as moderately favorable and unfavorable, which is a consequence of their widespread and environmentally inefficient use.

Do not forget about unaccounted for discharges of polluted wastewater. There is a large amount of runoff from agricultural land in the region, which is not treated, as a result of which they have a serious negative impact on water bodies. Due to the specific nature of wastewater data, it is difficult to control them, as well as to more accurately assess their impact on water resources. Many enterprises carry out unauthorized discharges of polluted wastewater into water bodies.Port activity is also a rather negative factor for water quality [4].

Summarizing all of the above, we can conclude that the geoecological state of water resources as a whole is in an unsatisfactory state due to anthropogenic pressure. The study of these problems is considered relevant.

Materials and research methods. The research materials were scientific works in the field of hydrology, land reclamation, ecology, geography and geoecology, as well as Internet resources competent on this issue. The main

ISSN (E): 2181-4570 ResearchBib Impact Factor: 6,4 / 2023

sources of factual information related to the state of surface water bodies in Uzbekistan.

The methodology of work is the collection and analysis of modern and historical information on the research topic. Found, processed and structured information about the state of water bodies. The problems of the geoecological state and the use of surface waters were divided into 3 large groups in order to briefly and consistently describe the work.

Results and its discussion. Let's analyze the ecological state of the ponds. When considering the ecological state of artificial reservoirs in the region, the approach developed by V.B. Mikhno, A.I. Dobrov (2000) [1-3]. In this approach, based on the anthropocentric positions of the authors, the "ecological state" of the pond, based on the stage of their development, and the degree of adverse influence of water bodies on adjacent landscapes are used as the main evaluation feature. They identified 4 classes of the ecological state of ponds and reservoirs: 1 - favorable; 2 - unfavorable; 3 - unfavorable; 4 - very unfavorable.

The main number of ponds and reservoirs, according to the authors, has a positive impact on the landscape and ecological situation in the region. Many of them are in good ecological condition and create more favorable environmental conditions for human life and activities. The ecological state of such reservoirs belongs to the first class. According to A.G. Kurdova (1995), the rating of this group of ponds and reservoirs among the population in relation to recreation is the highest.

The second class includes ponds and reservoirs that have an "unfavorable state". As a rule, these reservoirs do not cause negative changes in the landscape and ecological situation of the surrounding territory, do not reduce the natural resource potential of the NTC, do not violate the stable relationships of physical and geographical components, and do not worsen the environmental conditions for human life and activity. But these ponds are at the last stages of development, they have a thick layer of secondary sediments, often most of their surface is overgrown with higher aquatic vegetation, which significantly reduces the possibility of their use by humans. In addition, during extremely hot years, these ponds usually dry up almost completely. With further evolutionary development, they will go out of operation, but

ISSN (E): 2181-4570 ResearchBib Impact Factor: 6,4 / 2023

after reconstruction (mainly cleaning from bottom sediments), their ecological state may become “favorable” (1st class)[7].

The third class includes ponds with an "unfavorable" ecological state. These are special-purpose ponds (mainly fish-breeding) with a short period of operation, small areas and volumes of water. The quality of their water differs sharply over the years and strongly depends on the ecological state of the catchment area (anthropogenic disturbance, the degree of plowing, fertilization, etc.) and the operation and condition of the pond (the introduction of fish food, the accumulation of silt deposits, overgrowing, etc.)[7].

The reservoirs of the fourth class include ponds with a very unfavorable ecological state, used mainly for highly specialized purposes. For example: storage ponds of enterprises that have a high concentration of pollutants, and therefore they can have a negative impact on the landscapes of adjacent territories (storage ponds at sugar factories, livestock farms, etc.). Constant management of their regime and monitoring of their functioning is required.

The hydroecological structure of each reservoir is complex in different ways, it is formed and transformed in different ways during the period of its existence, each reservoir has individual features of the hydrological regime and the ecological state of the biota. Therefore, it is difficult to compare them, and it is almost impossible to find two identical reservoirs in nature. Lake scientists pay much attention to the classification of lakes[5]. A large number of private classifications of land water bodies have been created, taking into account the diversity of various structural components or processes of their interaction. However, repeated attempts to obtain a unified, comprehensive classification of lakes or reservoirs have not yet been crowned with success and general recognition.

According to sanitary requirements, in all water bodies in all seasons of the year, the oxygen content should not be lower than 4.0 mg/l. For fishery reservoirs, this approach of regulation is unacceptable. When establishing the permissible oxygen content in fishery reservoirs, it is necessary, first of all, to take into account the peculiarities of their gas regime in summer and winter periods, as well as the fishery value of reservoirs (category) [4-7]. Fishery oxygen standards must meet the following requirements:

ISSN (E): 2181-4570 ResearchBib Impact Factor: 6,4 / 2023

• the content of dissolved oxygen should not decrease in all seasons of the year to the minimum requirements of fish and other aquatic organisms, even for a short time;

• there should always be some reserve of oxygen in the water (safety factor) in case of unexpected changes in its amount as a result of, for example, a sharp change in temperature, pH, carbon dioxide content, the appearance of toxicants, etc.;

• for reservoirs of different types, the flowing rivers of Chirchik have different requirements for oxygen content in different seasons of the year, since they are inhabited by different species of fish with different sensitivity.

According to the fishery value and the distribution of different fish species in water bodies, mainly due to the oxygen regime, all fishery water bodies can be divided into two groups (categories). The first group includes water bodies in which valuable fish species (salmon, sturgeon, whitefish) live or enter, which are highly sensitive to the oxygen content in the water, and begin to experience respiratory depression when the oxygen content in the water is below 6.0 mg/l. In such reservoirs, when sewage or other pollutants are discharged into them, the oxygen content in winter should not be lower than 6.0 mg/l.

The second group includes all other water bodies. The oxygen content in them in winter should not be lower than 4.0 mg/l [9].

In the open period, the oxygen content in all fishery reservoirs should be above 6.0 mg/l. This requirement should be extended in winter to water bodies of the second category, into which heated waste water is discharged (in areas where the water temperature is above 0.5°C) [8–10].

The development of these requirements was based on the principle of creating normal conditions for the habitat and reproduction of fish and other aquatic organisms in water bodies and the preservation of their economic value. Therefore, all the main qualities of water - color, smell, taste, content of suspended solids, oxygen, etc. - should be subject to rationing.

Among environmental factors, the most important for the life of fish and other aquatic organisms are temperature and oxygen content. Different types of organisms react to temperature changes differently. The annual change of planktonic organisms depends on the annual course of temperatures in the reservoir, the period of spawning of fish and the conditions for the development of eggs depend on temperature

ISSN (E): 2181-4570 ResearchBib Impact Factor: 6,4 / 2023

changes. If during spawning the water temperature drops below the spawning threshold temperature, spawning stops. The temperature threshold for males and females is not always the same. The degree of influence of temperature on aquatic organisms depends mainly on the rate of its change and the duration of the changed conditions. Temperature fluctuations have the strongest effect on stenothermic organisms. Usually it does not exceed 5-7°C. Marine fish are more stenothermic than freshwater fish because they live in a more permanent environment. In contrast, eurythermal fish tolerate temperature fluctuations of several degrees [6].

The processes of nutrition, reproduction, and migration of aquatic organisms are associated with the temperature of the environment. To a large extent, the intensity of metabolism in the body depends on it. An increase in temperature within certain limits stimulates the development of microflora, the course of self-purification processes, accelerates metabolism and oxygen consumption. With a slow change in temperature to an unfavorable one, the fish leaves this area, and with a sharp change it may die. Trout, white salmon, haddock, cod, herring, etc. are especially sensitive to sudden changes [6].

An increase in temperature above 25–30°C, as noted above, has a harmful effect on most organisms in the middle latitudes, since these temperatures (27–33°C) are threshold temperatures for many of them. Prolonged exposure to high temperatures contributes to the creation of temperature barriers in water bodies that prevent fish migration.

In natural reservoirs of middle latitudes, the water temperature in summer most often fluctuates within 20-25°C, and its daily fluctuation does not exceed 7°C, and more often it is 2-4°C. With such fluctuations in temperature, the metabolism of fish is stable, and their vital activity proceeds normally. It is known that a sudden increase in water temperature by 5 ° C causes a violation of their vital functions.

Despite the fact that our studies were advisory in nature, they made it possible to determine several main provisions of the strategy for studying and optimizing the use of small artificial reservoirs:

– ponds are an integral part of the landscape and are essential for human economic activity;

ISSN (E): 2181-4570 ResearchBib Impact Factor: 6,4 / 2023

- ponds have a multilateral multidirectional impact on the eco-systems of the region. The development of a strategy for the design and use of artificial reservoirs should be differentiated, taking into account their typology;

- it is necessary to develop and implement a system of environmental monitoring of small artificial reservoirs;

- with scientifically based design and use, ponds can become centers of increased biodiversity and bioproductivity, an element of the sustainability of natural complexes, an ecological core along which animal species from neighboring natural zones settle; an essential component of the region's agriculture.

Conclusions. Most of the pollution entering water bodies is associated with anthropogenic impact on nature, and the smaller part is associated with natural processes. To date, the technological and socio-legal basis is not sufficiently developed for a quick exit from the current situation. It is necessary to increase the quality and capacity of treatment facilities, improve water treatment and wastewater treatment technologies, clean up already polluted water bodies, exert a social and legal impact on polluting enterprises, combat unauthorized discharges of wastewater, modernize the industrial, domestic and agricultural sectors, develop the regulation and treatment of agricultural waste water, support projects aimed at the development of environmentally friendly technologies, neutralize the impact of negative natural hydrological and hydrogeological phenomena.

The development of measures for the rational use of water resources is an important aspect in the development of the integral economic potential of the Kaliningrad region. It is required to take such steps as: the development of small hydropower and the fishery industry, the resumption of care for parks and recreational water bodies, the implementation of complex engineering and technical measures for the reconstruction and overhaul of reclamation hydraulic structures, the study of unexplored and little-studied water bodies in order to identify their potential for use.

These activities will allow the integral development of a high-quality water management complex in the territory, which over time will positively affect the level and quality of life of the population.

The evaporation layer from the water surface of key ponds was calculated taking into account regulatory documents using the well-known formula:

$$E = 0,14 \cdot n \cdot (e0 — e200) \cdot (1+0,72 \cdot U200) \quad (1)$$

ISSN (E): 2181-4570 ResearchBib Impact Factor: 6,4 / 2023

For the Central Asian region, we propose to transform this formula into the following form

E = 0, 14·n· (e0—e200) · (1+0, 72·U200) (0,1Tp) Ke (2)

Tп – temperature above the reservoir at a height of 200 cm, where: e0 - is the average value of the maximum elasticity of water vapor, calculated from the temperature of the surface of the water in the reservoir in mb;

e200 - is the average value of water vapor elasticity (absolute air humidity) above the reservoir at a height of 200 cm in mb;

n - is the number of days in the calculated time interval. The calculation time interval is taken equal to the duration of a calendar month;

U200 - is the average wind speed over the reservoir at a height of 200 cm; Tп - is the temperature above the reservoir at a height of 200 cm; Ke- environmental factor. dusty pollution over the water of the air.

Two terms are added to the equation: air temperature and air pollution, today considered acute natural phenomena. Tп - temperature above the reservoir at a height of 200 cm, takes into account faster than the downloading temperature. And Ke - the coefficient takes into account the environmental dust pollution of the environment, from chemical plants and cars.

Conclusions. Most of the pollution entering water bodies is associated with anthropogenic impact on nature, and the smaller part is associated with natural processes. To date, the technological and socio-legal basis is not sufficiently developed for a quick exit from the current situation. It is necessary to increase the quality and capacity of treatment facilities, improve water treatment and wastewater treatment technologies.

Calculation equations are proposed that determine the evaporation layer from the water surface of key ponds, taking into account air temperature and air pollution.

Recommendations for improving the ecological state of the pond:

- it is desirable to ensure systematic water exchange of the water mass in the pond;

- to deepen the bottom of the reservoir to create favorable conditions for the habitat of hydrobionts;

- clear the pond bed from macrophytes, leaving thickets of higher aquatic vegetation along the banks;

ISSN (E): 2181-4570 ResearchBib Impact Factor: 6,4 / 2023

- to prevent the deterioration of the habitat of objects of flora and fauna of the world, causing harm to human health;

- organic sediment obtained as a result of cleaning ponds can be used as fertilizer when creating a recreational landscape in the coastal zone of Vodvem;

- to carry out production, technological and other measures to ensure the protection of the pond from pollution, clogging and depletion;

- the initial link of the circulation of substances, that is, the link of autotrophic plants (green, blue-green and other algae and aquatic flowering plants), which creates organic matter - primary production, which is the basis of all production processes occurring in reservoirs, should not be disturbed either;

- it is unacceptable to violate the third, most important, link in the circulation of substances - lower heterotrophs (food organisms - plankton, benthos) and higher heterotrophs (commercial organisms - fish, mollusks, crayfish, etc.), which provide bioproducts useful to humans and serve as food for other hydrobionts.

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