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THE CURRENT STATE OF HYDROECOLOGICAL PROBLEMS IN THE SOUTH ARAL REGION

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Abstract :

Aral Sea region, hydroecology, water resources, quality of water, river AmuDarya, water ecosystems, ecological factors.

INTRODUCTION :

At present, the study of dynamic processes in the biosphere, its actual changes and the identification of patterns in the development of ecosystems in changed and rapidly changing conditions is one of the important tasks of modern ecology. An ecologically destabilized environment is characterized by abnormally rapid changes in the structural organization of natural systems and intersystem interactions [4, 6].

The ecologically destabilized natural environment of arid zones causes the manifestation of a number of new patterns of development and dynamics of natural systems, as a result of which not only their composition and type of organization change, but also the conditions themselves and the strategy of evolutionary processes of the entire organic world undergo changes [1]. The revealed regularities must be taken into account when developing a strategy for the use of natural resources and when planning natural resource use, taking into account the concept of a balanced load on different components of the natural environment. This is important to bear in mind when making environmental forecasting.

Global trends in the deterioration of the ecological situation are also characteristic of the territory of the Central Asian countries. The processes of degradation of the natural environment on the territory of the countries of Central Asia have reached a regional scale and in a number of places manifested themselves in the form of crisis situations for a person [1, 2]. Changes in the hydrological regime of aquatic ecosystems lead to a deterioration in their sanitary and ecological indicators, which in turn aggravates the general ecological situation in the South Aral Region.

In recent years, the ecological situation in the Southern Aral Sea region, due to the drying up of the Aral Sea and the deterioration of the composition of surface and ground waters, has become particularly acute. One of the reasons for this disaster is the scientifically unjustified use of the region's water and land resources. It should also be taken into account that the change in the hydrological and hydrochemical regime of the Amu Darya River, as well as increasing anthropogenic loads, have led to a significant transformation of the natural environment of the region.

The anthropogenic factor, leading to numerous successions of biogeocenoses, significantly changes and destroys the composition and relationships of organisms. With the violation of hydrological regimes in the region, significant changes in the natural situation take place: desertification, anomalous natural phenomena, and increased climate discomfort have increased. All this makes the basis for an increase in the incidence of the population, contributes to the pollution of natural environments with alien compounds (pesticides, heavy metals) and salinization of water, soil, crop products [3, 4].

The deficit in the water balance of the countries of the Aral Sea basin is associated with the current historical and economic situation, with full economic development. Therefore, when it comes to

water resources today, it is impossible to exclude from their components waste and ground waters, as well as waters of lakes, reservoirs, of course, taking into account their quality [6, 7].

In recent years, the impact of human activities on water resources has increased dramatically. The most important factor in the sustainable existence and development of deltas in arid territories, maintaining their stable ecological state is the conditions of watering of water bodies. The main type of economic activity that has the greatest impact on the region's water resources is the use for agricultural, industrial and municipal purposes.

MATERIAL AND METHODS :

The main material for the work was the results obtained in 2015-2019 when studying the ecological state of various water bodies subject to intense anthropogenic impact and at one stage or another of anthropogenic degradation. Each of the categories of these objects has a number of features (in particular, they are very different in their scale, origin and nature of water use), however, the studies carried out on them were united by a common goal - to understand the patterns of the development of anthropogenic degradation of water bodies.

Hydrochemical analysis of water was carried out in the laboratory of ecology of microorganisms and the laboratory of hydrochemistry and hydrobiology of the Karakalpak Scientific Research Institute of Natural Sciences according to the generally accepted method described by N.S. Stroganov, N.S. Buzinova (1980), Yu. Lurie (1984), Yu.V. Novikova et al. (1990), in the Guidelines for the Chemical Analysis of Surface Land Waters (1977), The following regulatory and methodological documents were also used: SanPiN RUz No. 0067-96 "Hygienic criteria for the quality of drinking water", Guidelines for the ecological and hygienic zoning of the territory of the Republic Uzbekistan according to the degree of danger to public health [7], etc.

Statistical processing of materials was carried out using the "STATISTICA" software package

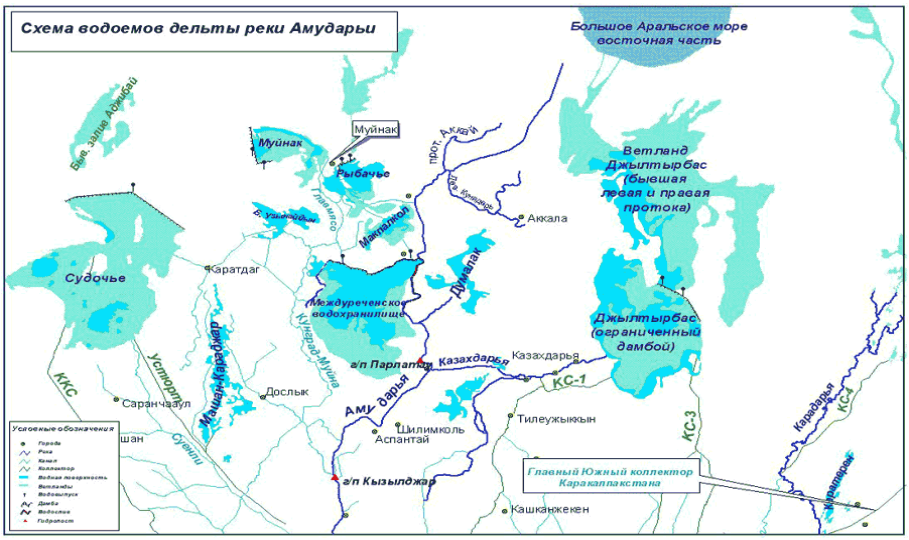
RESULTS AND DISCUSSION :

One of the main indicators of degradation in the Southern Aral Sea Region is the deterioration of water quality resulting from a significant anthropogenic impact on water resources. The main factor in the hydrological state of the delta is the inflow of water through the Amu Darya River and, less significant, but still important, the inflow of water through collectors that feed some lakes in a mixture with fresh water or independently.

The delta of the Amu Darya River was formed under the influence of long-term natural fluctuations in the river flow, as a result of which, under the influence of various processes of a marine, river nature, erosion dynamics, the delta landscape and its hydrological and hydrogeological profile with a large number of water bodies were formed. Previously, such reservoirs as Sudochye, Karateren, Kokchiel, Akchakul were lakes of the coastal delta plain, periodically flooded by river and sea waters and had a connection with the bays of Ajibay, Dzhiltyrbas. In high-water years, these lakes were almost completely mixed by the deep river runoff. During the period of a decrease in the inflow of fresh water in low-water periods, these reservoirs were partially flooded by seawaters; as a result, there was a sharp change in the physical and chemical properties of water, respectively, their flora and fauna and biological productivity changed.

In recent years, various pesticides used in agriculture have entered the Amu Darya with the collector-drainage waters [2, 4]. The excess of the standards for the content of pollutants was: phenols, copper, chromium by about 4 times, oil products by 5 times, pesticides by 8-10 times [4]. The results

of a survey of about 40 lakes and reservoirs in the Amudarya delta (Fig. 1) also indicate high mineralization, increased content of phenols (10-15 MPC), oil products (3-5 MPC), copper, chromium (up to 6MPC).



Pic. 1. Scheme of the current state of water bodies in the Amu Darya delta (*www.econews.uz)* The environmental monitoring of the Sudochye wetland carried out earlier shows that the water salinity in the wetland supply canals for the extremely low-water years 2000-2001. in Lake Akushpa it was 16.1-30.61 g / l, in lakes Karateren, Begdulla-Aydin, Bolshoy Sudochie 3.28-5.78 g / l. The result of a decrease in the volume of incoming water, loss of flow and a high level of natural evaporation was a sharp increase in the salinity of water in all lakes in the wetland. Mineralization of water in the period 2010-2019 in lakes Akushpa reached 21.3-70.0 g / l, Karateren 10.9-15.5 g / l, Begdulla-Aydin 6.6-7.7 g / l, Bolshoye Sudochie 11.9-13.1 g / l, which exceeds the MPC by 5-69 times. The pH of the lakes was slightly alkaline, 7.1–8.26.

During the growing season of the study period, the water inflow into the wetland lakes practically decreases, which led to severe shallowing and partial drainage of the lakes in the summer and to the complete drying out of most of the water bodies, in the fall and, as a consequence, to a sharp increase in water salinity. Indicators of water turbidity in lakes ranged from 8 to 160 units. The content of dissolved oxygen O2 in the water of Lake Akushpa corresponds to 94% saturation, in Lake Begdulla-Aydin 9-10, which corresponds to 90% saturation. The content of bioelements in the water of lakes is uneven, in Lake Akushpa NH4 - 0.05 g / L, NO3 - 112.1-123 g / L, NO2 - 0.04-0.1 g / L, PO4 - 2.5-4 µg / L, in Lake Karateren NH4 - 0.06 g / l, which is almost 10 times lower than the MPC for fishery water bodies (0.5 g / l), NO3 - 217.1-332 g / l, NO2 - 0.02-0.01 g / l, P - 9.5-91 µg / l, in Lake Begdulla-Aydin and in Bolshoy Sudochie, the content of residual P was about 12.3 µg / L.

In the KKS collector feeding the lake, the water salinity averaged from 5.2-14.4 g / l. According to the classification, the collector water refers to salty waters (3-10 g / l) and waters of increased salinity. pH = 7.5-7.8. Turbidity of water from 17-19 units. O2 content -8-9 g / l (80-85% saturation): NH4 - 0.07-0.2 g / l, NO3 - 46.3 g / l, NO2 - 0.19-0.5 g / l, P - 5-27 mg / l ...

Note that a sharp increase in water salinity and an increased content of biogenic elements in the water of lakes, exceeding the MPC by tens of times, the intense oxygen regime makes it possible to classify water bodies as an etrophic type, with elements of hypereftrophy. The studied reservoirs - lakes Koksu and Shegekul - are located adjacent to the delta zone of the Amu Darya River. The studies of these lakes were carried out in 2017-2019. The salinity of lake water reaches 2.78 g / l,

reservoirs have seasonal changes in the ionic composition of water. The surveyed lakes differ significantly in terms of BOD5. The highest BOD5 values were recorded in Lake Coke - 2.04 mg O2 / L low - in the lake. Shegekul - 1.28 mg O2 / l. The content of dissolved oxygen in the surface layers of water is higher, with a decrease in depth. In the lake. For coke, the oxygen content is within 6.4-5.7 mgO2 / l, lake. Shegekul -6.72-6.0 mgO2 / l.

At the moment, there are many different methods for assessing the state of aquatic ecosystems according to various parameters. General information on the distribution of biogenic elements (BE) available in aquatic ecosystems is obtained using generalized integral indicators. However, for a comprehensive assessment of the peculiarities of the presence of BEs in natural water and the development of their distribution, it is necessary to analyze significant series of observations of the variability of the measured integral indicators [8].

Currently, the use of multidimensional statistical methods and, in particular, the method of principal components (PC) is very promising for assessing the state of aquatic ecosystems [9, 10]. The GK method is essentially a way of transforming a wide range of information to characterize the processes under study, their arrangement, and consider only the most significant parameters that are important in the observed fluctuations of indicators and the system as a whole.

The work used observational data from 2015 to 2019. in the spring, summer seasons, as well as November in the Dautkul lake system. At the initial stage, the following parameters were used: water sampling horizons h, O2, suspended organic matter (SOM) or seston content, total phosphorus Ptot, total nitrogen Ntot, mineral nitrogen Nmin, organic nitrogen Norg. The possibilities of using these parameters are discussed in the works of Berdavtseva et al. (1984), Leonova et al. (1990), Skopintseva et al. (1986). The oxygen content was determined by the Winkler method. Determinations of Ptot, Ntot, Nmin and Norg were carried out in accordance with the practical guidelines [7]. The methodology for analyzing a number of observations using the GC method is considered in [9].

The analysis showed that the Cv values in the spring period (March) correlate with the P content (R = 0.78). The average annual content of Ntot at all observation periods is largely determined by the contribution of Norg (R = 0.68). It can also be observed that the values of water temperature and the percentage of dissolved oxygen are inversely related to the observation horizon in the summer-autumn periods. The percentage of oxygen during this period strongly correlates with the values of water temperature (R = 0.82).

The analysis shows that, on the whole, the studied system of characteristics of the state and distribution of nutrients in the investigated water body does not differ in the stability of correlations; in certain periods of observation, correlations between the studied parameters are weakened or even absent. Correlation coefficients indicate the interdependent relationship between the original parameters.

Causal relationships help to reveal the analysis of the relationships of the parameters characterizing the GC, which determine the internal structure of the processes and phenomena of the system under study. In the course of the analysis, we identified 4 GCs that explain 80-90% of the variability of the components of the aquatic ecosystem. Calculations show that in the autumn period (November) the contribution of HA I to the dispersion of the system was 26%, its positive load is determined by the permanganate oxidizability. Apparently, in this season the effect of abiotic environmental factors is not very pronounced. The contribution of HA II to the variance of the system in March is 16%, in June - 23%, its positive loads are formed by the indicators Cv, and negative ones - by the nitrogen components (Ntot, and Norg). In November, the contribution of the II GK to the variance of the

system is 18%. The contribution of III GC in March to the variance of the system was 17%. Its positive and negative loads are formed by suspended organic matter. In the summer period (June), the contribution of GC III to the total variance of the system was 16%. Positive and negative loads of this HA are formed by variables characterizing the content of Norg and phosphorus fractions in the aquatic environment. In November, the contribution of the III GK to the variance of the system was about 17%. Negative loads are formed by the concentrations of nitrogen (Nmin) and phosphorus forms. IV GC was identified according to the series of observations carried out in June-November. The contribution of this HA to the variance of the system was 12-19%. Its loads in different periods of observation depend mainly on the variables characterizing the content of Ptot, Ntot, and Norg in the environment. Therefore, it can be assumed that HA is probably associated with the influence of biogenic elements (nitrogen and phosphorus) on the development of oxidative transformation of organic substances.

The role of internal and external flows in the formation of the balances of individual forms of phosphorus and nitrogen is different. The results obtained confirm that external flows (inflow and outflow, exchange between water and the bottom of the lake) are most significant in the formation of the annual BE balance, and internal ones - in the formation of the balance of Ptot and Norg in living matter. However, it should be taken into account that the situation may change during the year, which in turn may be reflected in the ratio of BE fractions in the studied reservoir.

The formation of water quality in water bodies is a complex, multifaceted process, depending on a complex of various factors associated with the functioning of aquatic ecosystems, and with the conditions of the surrounding landscape and the bed of the reservoir.

Conservation of biodiversity and increasing the natural productivity of biological resources is one of the important ecological and social tasks of the Aral Sea region, the decisive importance in the solution of which belongs to lakes and wetlands, since, having a high potential biological productivity, they are natural shelters for local and global fauna.

The regime of water supply to wetlands, especially in dry years, should be based on the priority of their ecological and social significance. In this respect, the undoubted priority belongs to permanent lakes, since in dry years they should preserve the role of biodiversity refugium. The experience of the past dry years has shown that the ecosystems of non-permanent and temporary lakes are degrading and completely perishing within one or two years. Under these conditions, the restoration of their biodiversity will occur mainly due to the biological resources of permanent reservoirs. The role of the main refugium of biodiversity and the main sources of biological resources of the Aral Sea region necessitates the maintenance of hydrological and hydrochemical regimes in these lakes, ensuring the preservation of their biological potential. In the southern Aral Sea region, the status of such lakes can be given to Rybachy, Muinak and Sudochy.

CONCLUSION :

Thus, the studied reservoirs are characterized by a disturbed biological regime and are micro-foci of secondary pollution. The study of anthropogenic impact on the natural environment, including on aquatic ecosystems in the process of agricultural production should be considered not only from the standpoint of the economy, but also taking into account the possible consequences of an ecological nature, and it is also necessary to develop measures aimed at optimizing the use of natural resources, primarily at careful use of water resources. For many decades, lakes Karateren, Akchakul, Sudochye and other lakes have been used as receiving waters for waste and drainage waters from the territory of irrigated lands.

Thus, the GC method can be applied to generalize significant series of observations in order to streamline the available information. Even with a small set of different characteristics of the environment and biota, one can get an idea of the state of the ecosystem as a whole and the variability of the missing components. Undoubtedly, the results of the study make it possible to explain the observed features of the functioning of aquatic ecosystems and the specificity of the dynamics of biogenic elements, where they act as one of the parts of the trigger mechanism in the process of eutrophication of water bodies in the Southern Aral Sea region. Component analysis showed that the transformation of the BE distribution in certain periods can be characterized by various variables. The role and significance of the indicators revealed through the analysis reveal a logical variability of the influence of variables in the direction of the processes of transfer of substances in a water body.

These lakes in the near future, if the supply of fresh water is not resumed, will generally not be used for fishery purposes and reeds for animal husbandry. Prevention of negative hydroecological problems mainly depends on efficient water use. At the same time, the main tasks remain the organization of constant observations of the state of various ecosystems, the identification of changes caused by human activities, the determination of constant trends in the biosphere of the region, the assessment of changes and the forecast of trends of changes. Clarification of these issues will allow making decisions to prevent unwanted consequences and optimize human relations with the environment.

LITERATURE :

1. Abdirov CH.A., Konstantinova L.G., i dr. Kachestvo poverkhnostnykh vod nizov'yev Amudar'i v usloviyakh antropogennogo preobrazovaniya presnovodnogo stoka. - Tashkent: FAN. - 1996.- 325 s.
2. Atanazarov K.M. Ekologicheskaya rol' biogennykh elementov poverkhnostnykh vod nizov'yev Amudar'i v usloviyakh antropogennogo pressa: Avtoref. ... kand. biol. nauk.- Tashkent, 1999.- 23 s.
3. Berdavtseva L.B., Tsytsarin G.V. Gidrologo-gidrokhimicheskiye aspekty prevrashcheniya organicheskogo veshchestva v Mozhayskom vodokhranilishche // Vodnyye resursy.- 1984.- № 4.- s. 121-129.
4. Yeshimbayev D. Gidrokhimicheskoye sostoyaniye vodoyemov Karakalpakii v usloviyakh vodokhozyaystvennykh meropriyatiy v basseyne Amudar'i. – Tashkent: FAN, 1975. - 88 s.
5. Konstantinova L.G. Antropogennaya evtrofikatsiya poverkhnostnykh vod nizov'yev Amudar'i.// Biologicheskiye resursy Priaral'ya. – Tashkent: FAN, 1986. – S.61-90
6. Rossolimo L.L. Izmeneniye limnicheskikh sistem pod vozdeystviyem antropogennogo faktora. - L.: Nauka. – 1977. – 144 s.
7. Unifitsirovannyye metody analiza vod // Pod red Lur'ye YU.YU.- M.- Khimiya.- 1971.- 375 s.
8. Leonov A.V., Berdavtseva L.B. Otsenka protsessov razlozheniya organicheskogo veshchestva po kineticheskim parametram BPK // Vodnyye resursy.- 1986.-№ 4.- s. 111-127.
9. Andrukovich P.F. Primeneniye metoda glavnykh komponent v prakticheskikh issledovaniyakh. Vyp. 36,- M.- MGU.- 1973.- 124 s.
10. Maksimova M.P. Primeneniye metoda glavnykh komponent v ekosistemnykh issledovaniyakh Belogo morya // Vodnyye resursy.- 1986.- № 3.- s. 106-112.

11. Berdimuratova, A. K., & Mukhammadiyarova, A. J. (2020). Philosophical and methodological aspects of the interaction of natural environment and man. International Journal of Pharmaceutical Research. https://doi.org/10.31838/ijpr/2020.12.03.235
12. Pirnazarov, N. (2020). Philosophical analysis of the issue of spirituality. International Journal of Advanced Science and Technology, 29(5).
13. Pirnazarov, Nurnazar; Eshniyazov, Rustam; Bezzubko, Borys; Alimov, Atabek; Arziev, Amanbay; Turdibaev, Alauatdin; ,Bachelor degree programs in building materials technology,European Journal of Molecular & Clinical Medicine,7,10,1780-1789,2021,
14. Nurnazar, Pirnazarov; ,Scientific and Philosophical Analysis of the Concept of «Spirituality»,Адам ?лемі,83,1,3-10,2020,"050010, Алматы ?аласы,«Философия, саясаттану политологии и религиоведения …"
15. Алима, Бердимуратова; ,Хабар ?ам оны изетрлеўдин философиялы? методологиялы? усыллары,Вестник КГУ,47,2,127-130,2020,Государственный университет имени Бердаха
16. Бердимуратова, Алима; ,ТІЛЕУБЕРГЕН Ж?МАМ?РАТОВ ШЫ?АРМАШЫЛЫ?Ы ФИЛОСОФИЯЛЫ? АНАЛИЗДІ? ОБЪЕКТІ РЕТІНДЕ,Адам ?лемі,85,3,19-27,2020,?аза?стан Республикасыны? м?дениет ж?не а?парат министрлігі А?парат ж?не …
17. Алима, Бердимуратова; ,Хабар ж?мийети т?синиги: теориялы?-категориялы? анализлеў тийкарлары,Вестник КГУ,47,1,144-149,2020,Каракалпакский государственный университет
18. Pirnazarov, Nurnazar; Utebaev, Madiyar; ,METHODS AND FORMS OF GREETINGS,Scientific enquiry in the contemporary world: theoretical basics and innovative approach [L 26],,,,2016,
19. Alimbetov Yu., Pirnazarov N; ,Culture: tradition and novation,East European Scientific Journal,54,2,38-41,2020,"Aleje Jerozolimskie 85/21, 02-001 Warszawa, Polska»"
20. Pirnazarov, Nurnazar; ,Structural model of spirituality as a philosophical phenomenon,Адам ?лемі,88,2,10-17,2021,
21. Pirnazarov Nurnazar Rashid uli. (2021). Spirituality of the Human Being as A Philosophical Problem. Zien Journal of Social Sciences and Humanities, 1(1), 15–20. Retrieved from https://zienjournals.com/index.php/zjssh/article/view/
22. Sultanov Atabek, & Pirnazarov Nurnazar. (2021). The Phenomenon of Mass Culture. Zien Journal of Social Sciences and Humanities, 1(1), 49–52. Retrieved from https://zienjournals.com/index.php/zjssh/article/view/19
23. Pirnazarov Nurnazar, & Sultanov Atabek. (2021). Mass culture: towards the essence of the concept. Journal of Pedagogical Inventions and Practices, 1(1), 40–43. Retrieved from https://zienjournals.com/index.php/jpip/article/view/37
24. Ul?, Pirnazarov Nurnazar Rahsid; ,INFLUENCE OF VIRTUAL REALITY ON THE SPIRITUALITY OF INFORMATION SOCIETY,Евразийский Союз Ученых,,2-2 (71),,2020,ООО «Евразийское Научное Содружество»
25. Pirnazarov Nurnazar Rashid ul?. (2021). Development Of a Person's Spirituality in Dialogue with Another. Zien Journal of Social Sciences and Humanities, 1(1), 133–135. Retrieved from https://zienjournals.com/index.php/zjssh/article/view/83
26. Pirnazarov Nurnazar Rashid uli. (2021). Spirituality of the Human Being as A Philosophical Problem. Zien Journal of Social Sciences and Humanities, 1(1), 15–20. Retrieved from https://zienjournals.com/index.php/zjssh/article/view/12
27. Gerdruang, Atiporn; Panwatanasakul, Chaipat; Nurnazar, Pirnazarov; ,THE DESIRABLE MANAGEMENT OF EDUCATION IN URBANIZATION AREA UNDER THE OFFICE OF NON-FORMAL AND INFORMAL EDUCATION IN BANGKOK THAILAND,?????? (???),48,10,,2021,

28. Atiporn Gerdruang ,Chaipat Panwatanasakul, Pirnazarov Nurnazar; ,The Development of Administrators Affiliated with the Office of Non-Formal and Informal Education (NFE),Review of International Geographical Education Online (RIGEO),11,9,250-258,2021,RIGEO