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EFFECTIVE MANAGEMENT OF WATER RESOURCES OF RESERVOIRS AS A BASIS FOR THE STABILITY OF ECOLOGICAL PROCESSES

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Annotation
This article discusses the construction of an adequate ecosystem model, on the basis of which it is possible to make quantitative and a qualitative assessment of reservoir capabilities. Based on model studies, it is analyzed changes in the hydrochemical and hydrobiological regimes of water bodies and, accordingly, changes in water quality during the transformation of river flow. Also, models of environmental processes have been studied taking into account the appropriateness of the use of destratification and aeration of reservoirs, in particular on the example of Kashkadarya and Surkhandarya regions. Based on the study, the article presents proposals for improving the environmental situation of reservoirs, which serves as a source of water supply to the population.

Аннотация. В данной статье рассматривается построение адекватной модели экосистемы, на основе которой можно провести количественную и качественную оценку возможностей водохранилищ. На основе модельных исследований проанализированы изменения в гидрохимическом и гидробиологическом режимах водоемов и, соответственно, изменений качества воды при трансформации речного стока. Также, изучены модели экологических процессов с учетом целесообразности применения дестратификация и аэрации водохранилищ, в частности на примере Кашкадарьинской и Сурхандарьинской областях.
На основе проведенного изучения в статье представлены предложения по улучшению экологической ситуации водохранилищ, служащей источником водоснабжения населения.

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Key words: destratification, water catchment area, hydrochemical and hydrobiological conditions, eutrophication of water bodies

At present, Uzbekistan has accumulated a lot of information about the sources of pollution in the reservoirs of water supply systems. These reservoirs are located mainly in the mountainous and foothill territories of the Republic of Uzbekistan, the population of which rapidly increases in the summer and the traditional sources of pollution in the form of surface runoff from agricultural land and livestock farms have been replaced by sources in the form of discharges of municipal water from numerous summer cottages. Despite the improvement of the methods of cleaning the sewage systems of individual villages and buildings, this source of pollution is currently considered as one of the main ones in the water catchment areas. It plays a more significant role in the catchment areas of the reservoirs of the Surkhandarya and Kashkadarya regions for the following reasons:

- these territories are much larger than the catchments of reservoirs in the southern regions of Uzbekistan;
- the role of the catchment area in the reservoirs of the Surkhandarya region is much higher than in the water-fed reservoirs of the Kashkadarya region.
- the basic reservoir Gissarak - has an extremely small area of its own catchment and is strictly protected in sanitary terms.

It should be noted that the need for water in these regions increases annually and by 2035, for example, in the Surkhandarya region, it can reach 402532.86 m3/day (table).

Table Table of coverage of water demand in Surkhandarya region (for 2035)

№	Name	Required water consumption, m³/day	Coverage in m³/day for 2035				
			Reservoir "Tupolang"	Underground springs			
				North-Surkhandarya field	South Surkhandarya field	Sherabad field	Mountain ranges (spring)
1	**Angor district**	19761,05	19761,05				
	Angor urban-type settlement (UTS)	2895,25					
	UTS	6341,14					
	Villages	10524,66					
2	**Bandixan district**	10873,83	10873,83				
	UTS Bandixan	720,81					
	UTS	1680,12					
	Villages	8472,90					
3	**Boysun district**	17932,74					17932,74
	Boysun town	6313,67					

	UTS	3014,75					
	Villages	8604,33					
4	**Denau district**	58349,87	23000,00	35349,87			
	Denau town	16361,61					
	UTS	6634,42					
	Villages	35353,84					
5	**Djarkurgan district**	31797,90	31797,90				
	Djarkurgan town	4488,24					
	UTS	3313,04					
	Villages	23996,62					
6	**Kizirik district**	16926,52	16926,52				
	UTS Sarik	3640,10					
	UTS	1818,26					
	Villages	11468,16					
7	**Kumkurgan district**	34053,26	15000,00		19053,26		
	Kumkurgan town	2977,04					
	UTS	6954,87					
	Villages	24121,35					
8	**Muzrabad district**	20681,31	20681,31				
	UTS Baxt	570,89					
	UTS	8367,52					
	Villages	11742,90					
9	**Altinsay district**	26244,08		26244,08			
	UTS Batosh	1985,00					
	UTS	11354,64					
	Villages	12904,44					
10	**Sariasiya district**	30150,52	10000,00	20150,52			
	Shargun town	2351,69					
	UTS	4488,73					
	Villages	23310,10					
11	**Termez district**	11218,63	11218,63				
	UTS Uchqizil	663,24					
	UTS	3267,80					
	Villages	7287,58					
12	**Termez city**	40636,72	19000,00		21636,72		
13	**Uzun district**	24549,64		24549,64			
	UTS Uzun	2692,87					
	UTS	1182,07					
	Villages	20674,70					
14	**Sherabad district**	28583,53	10000,00			18583,53	
	Sherabad town	5489,57					
	UTS	2409,83					
	Villages	20684,13					
15	**Shurchi district**	30773,26	11781,82	18991,44			
	Shurchi town	4509,92					
	UTS	5830,18					
	Villages	20433,16					
	In total	**402532,86**	200041,05	125285,6	40689,99	18583,53	17932,74
		402532,86	**200041,05**	**202491,8079**			

Covering the needs for drinking water of the settlements of the region is provided taking into account the use of existing underground water intakes.

Thus, the possibilities of managing reservoir ecosystems through measures in the catchment can be assessed by carrying out coordinated calculations using the generalized information of the relevant services of the Basin Irrigation System Administration in Kashkadarya and Surkhandarya regions and by models of the hydrological regime [6].

So model studies can reveal changes in the hydrochemical and hydrobiological regimes of the reservoir and, accordingly, changes in water quality during the transformation of river flow. If a model is available, such calculations can be carried out without information on actual load changes, using different scenarios of load changes due to both anthropogenic and natural impacts. In this case, the calculations will be a significant help in developing the lines of activity of the relevant control services.

Most of the activities in reservoirs aimed on regulation of the hydrochemical and hydrobiological situation are high-cost and depend on the size of the reservoir. First of all, all existing measures related to the introduction of chemical compounds into the water of the reservoir should be completely excluded from the possibilities of using in the practice of managing water bodies - sources of municipal water supply.

Due to technical problems, it is impossible to carry out activities such as removal or screening of bottom sediments. The greatest danger in the form of internal load is represented by gray silts occupying the deepest parts of the reservoirs. One of the most common measures to regulate the ecological state of water bodies - destratification - is also unrealistic to use on the scale of water supply reservoirs in the Kashkadarya region. Mechanical aeration of hypolimnion in reservoirs with a volume of hundreds of millions of cubic meters will require such significant energy costs that the effect of improving water quality under no circumstances will compensate for these costs. In addition, the effects of large-scale aeration are not always positive for various reasons. An alternative to mechanical aeration can be the so-called bubble aeration, the technology of which was developed in some countries, where the problem of eutrophication of water bodies has become especially acute. [4] But in this case, with an unpredictable effect, you will have to go on significant material costs with an obvious loss of the recreational attractiveness of reservoirs. Thus, destratification by aeration of a reservoir is an event that cannot be applied in the practice of operating reservoirs - sources of water supply in the Kashkadarya and Surkhandarya regions.

One of the simplest and cheapest ways to regulate the hydrochemical and hydrobiological regime of reservoirs should be considered a change in the water regime by adjusting the flow regulation regime by the hydroelectric complex. This way

of water quality management has the greatest prospects in the water supply sources of the Kashkadarya and Surkhandarya regions. [5]

Purposeful drawdown of the reservoir or its containment can significantly change the intensity and nature of internal water exchange in the reservoir. In turn, a change in the structure of water masses inevitably leads to a change in the fields of hydrochemical substances and biomasses of hydrobionts in the reservoir, i.e. to a change in the quality of water in a reservoir. When regulating the ecological situation in the reservoir itself, a convincing substantiation of the consequences of a change in the level (namely, actions for additional or restraining depletion) of the reservoir are aimed at changing the level in separate phases of the water regime that are important from the point of view of water quality.

The ways of substantiating the effect of changing the regulation mode are unambiguously associated with the use of mathematical modeling.Possible modes can be played on the model and their consequences for water quality can be monitored. This is a very difficult task, since in scenario calculations it is necessary to take into account a huge variety of hydrometeorological situations in a reservoir.

The creation of reservoirs in the densely populated Shakhrisabz district of the Kashkadarya region is clearly inappropriate, while the implementation of the division of existing reservoirs by hydraulic engineering methods is a very real measure. Evaluation of the effectiveness of this measure required a special study using a mathematical model.

Conclusions

The results of the calculations performed showed, firstly, that the leading factor determining eutrophication - an increase in the bioproductivity of ecosystems and the size of bottom anoxia zones, in reservoirs is the external phosphorus load, which inevitably increases with the intensification of anthropogenic chemical load on the catchments of reservoirs due to the continuing increase in the number of permanent and seasonal residents of the Kashkadarya region. Second, from the results of calculating the daily characteristics of the ecological state of the reservoirs, it is obvious that with the onset of hot weather, the frequency of outbreaks of blue-green algae blooms increases. On some days, their average daily biomass can reach 15-20 g / m^3 and more with weak surging winds in the areas where there are water intakes.

The possibilities of managing the hydrochemical and hydrobiological situation in the ecosystems of reservoirs are determined by two types of impact - activities in the catchments of reservoirs and activities in the reservoirs themselves.

Among the complex of measures used in world practice in reservoirs, the most promising are measures for aeration of stratified reservoirs, selective discharge of water, regulation of external biogenic load by creating reservoirs and methods of biomanipulation.

In this regard, attention should be paid to improving monitoring of water quality in reservoirs, as well as measures to prevent dangerous changes in water quality in water sources and mitigate the negative consequences of extremely hot periods.

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