

Alakol Lake as a Natural-Resource Subsystem of Local Territorial Tourist-Recreational System of Alakol Basin

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Abstract. The article deals the tourist-recreational assessment the Alakol lake and its using in the tourist and recreational purposes. The researches put scientific and special techniques used in the field of tourism and geographical research: a method of system analysis, factor analysis of geosystems, content analysis of the scientific literature, processing methods geographical statistics, comparative, structural and logical analysis, analytical methods. These results could be used in activities, which related with problems of protection and restoration the natural and cultural heritage of the region.

Keywords: Recreational geography, Assessment of environmental impact, Sustainable development, Allakol lake basin

1. Introduction

Elementary structure of the Territorial Tourist and Recreational System (TTRS) is a set of elements of recreation and tourism sphere, which combined by spatial relations and interactions [1]. As known, recreation takes a wide range of options to satisfy the needs of people in the rest, and tourism is one of the part of recreational activity types, which related with travel and people staying outside the place of permanent residence organization. Thus, “tourist-recreational” concept version is characterized mostly multi-faceted tourist activities, without excluding the needs of the rest in the process of organizing the tour. One of advantages of the TTRS as a model is that it focused on a study internal links, character of relations between system elements, knowledge essence of the phenomena.

Elementary structure of TTRS – one of the main problems of system formation. In conditions of high uncertainty on the level of theoretical interpretation the problem, it seems most appropriate classical approach, which allows to combine different quality sites within a heterogeneous system in several subsystems (natural and recreational, historical, cultural, infrastructural, organizational, managerial, etc.). All subsystems combined in direct and reverse connections, which ensures the integrity of the TTRS.

Geosystem analysis of TTRS provides a holistic view of hierarchically subordinated system at all levels: global, national, regional and local levels. On each hierarchical level TTRS influences to a social system.

Researched territory of Alakol basin, which located at the interface territories of Almaty and East Kazakhstan regions of Kazakhstan, should be read as a local territorial tourism and recreation systems of Kazakhstan.

Alakol lake is the largest reserve in Kazakhstan of nesting water birds, the lake is the place of their mass shedding and important place of staging through which annually migrate thousands of waterfowl and shorebirds. To save them it is important to create protected areas, taking into account the historical landscape of the complex and the existing social and economic conditions. To save and effective functioning of ecosystems, they must be guarded standards of the environment and have an extensive protected area [2].

Alakol lake located in the Alakol mountain hollow in the south-eastern part of Kazakhstan, where relict reservoirs occupying the lower part of the ancient lake basin tectonic origin. Study the patterns of the water balance of Alakol lake is the exclusive economic and environmental value for Alakol region.

At present, the lake Alakol a change is observed of hydrochemical, hydrobiological and bacteriological water quality and transformation of trophic levels of lake geosystems as a result of recreational activity and fast growth in the Alakol region in social and economic terms, which contribute inputs of hazardous heavy metals and organic compounds [3]. As a result, the question of the regulation of tourist traffic and nutrient inputs from human activities on the coast of the lake.

2. Methods of Researches

The researches put scientific and special techniques used in the field of tourism and geographical research: a method of system analysis, factor analysis of geosystems, content analysis of the scientific literature, processing methods geographical statistics, comparative, structural and logical analysis, analytical methods.

3. Materials

After analyzing the dynamics of number tourists, during more than 10 years (from 1997 to 2009.) in the researched area, we can see that there was increasing in the traffic of people in more than five times: in the summer of 2009 the load was about 369 people per day.

Indicators of quality and their compliance with state standards were considered by us:

- The content of organic matter (BOD 5, COD, koli-index, TMC);
- Dissolved gases (oxygen solubility);
- Nutrients (NH_4^+ , NO_2^- , NO_3^- , P);
- The main ions (chlorides, sulfates), rigidity;
- Turbidity (suspended solids);
- Smell and taste of water;
- PH value of pH.

In the overall assessment the salinity of rivers varies from 100 to 700 mg / l, the chemical composition of water belong to the hydrocarbonate class group of calcium, with a satisfactory oxygen regime (Table 1).

In the region there are about 800 rivers and streams, most of which dry up in summer-autumn period, more than 24 thousand lakes and artificial reservoirs, most of which are prevalent - minor surface area of less than 1 km², about 100 lakes have an area of 1 to 30 km².

Table 1: Basic parameters of Alakol Basin lakes [4]

Name of the lake	Running waters Regulation	Surface of area	Area, km ²		NP U	Water volume, km ³	Depth, m		Width, m		Length, km
			Watershed	reservoir			Medium	Maximum	Medium	Maximum	
Alakol	Closed		65200	2650	356,	58,6	22,1	54	25,5	52	104
Sasykkol	Closed		-	736	-	2,4	3,3	0,7	14,4	19,8	49,6
Zhalanashk	Closed		-	40,6	-	0,099	2,4	3,4	4,6	613	8,7
Koshkarkol	Closed		-	120	-	0,488	4,0	5,8	6,5	9,6	18,3

The analysis of hydrochemical and hydrobiological indices provides a basis to the following conclusions:

- Water can be classified as calcium bicarbonate-type;
- Hydrochemical and gas regime of Alakol lake between 1965 and 2009 gained tendency to eutrophication (acidification of the bottom layer) and increase in easily oxidized organic matter;
- The content of hydrogen ions decreased from 135 to 98.9 - is a decrease in acidity;
- the chloride content increased from 5-7 to 17.55 mg/dm³, obviously due to the increase of organic pollution;

- An indicator of dissolved oxygen has remained relatively stable (range 9,0-11,68 mg / l);
- PH is exceeded, so that instead of a neutral environment becomes alkaline (with area. Kamyskala);
- Average concentration of suspended solids in the "peak" days above normal and up 0.95 - 0.98 mg / dm³;
- The value of BOD 5 changed from 1.5 mg/0dm³ (1965), when the lake can be attributed to the net, up to 3.2 mg/0dm³ (2002) - 6.9 mg/0dm³ (1998), currently on degree of contamination of the lake can be estimated in different seasons from moderately clean to dirty;
- Coli index, the index, which determines the water content of coli form bacteria, varies within very wide - from 300 to 46000, although the rate of total microbial numbers in the normal (160);
- The identified indicator species saprobe indicate an average degree of water pollution by organic substances and water characterize as moderately polluted with organic substances [5].

Thus, the trophic status of lakes in our judgment, entered on the basis of studies in 1965, 1998-2009., corresponds to the mesotrophic water bodies, but in the summer "high" days, in many respects a lake can be classified as eutrophic.

Based on analysis of water quality parameters and phytoplankton state, it may be concluded that the state of geosystems of Alakol lake is relatively safe. The changes occurring in this recreational landscape under the influence of external factors, including human recreational activities, are reversible, but requires organization monitoring the flow of nutrients and organic matter in aquatic recreation locations, because due to the use of the lake, excluding those loads real intensification of eutrophication of the pond.

After analyzing the water quality and trophic level of the reservoir can determine its stability and acceptable recreational load. There are methods for determining the recreational capacity and allowable recreational load.

In the interim methodological guidelines (1982) the capacity of recreation forest zones of lake is determined by calculating the capacity of the beaches:

$$PTO = BM / B_p \times Kk \quad (1)$$

where the PTO - a one-time capacity of coastal recreation areas;

BM - the total length of the coast;

B_p - Standard length of the coastal beach, falling on one person, made up to 1 m;

Kk - Visitors shift index beach (the reciprocal of the regulatory load factor of one-time beach equal to 0.9) made 1.1 - 1.3.

Based on the data capacity, recreational Alakol lake area during summer vacation at the same time the mass is 3000-4000 people, in the winter - 1500-2000. However, at a load of this method doesn't take into account the bacteriological requirements.

Determination of the optimum capacity of the system under consideration the natural recreation complex analysis must be preceded under factors carrying capacity of the natural complex (PC) [6]. The basis of determining the carrying capacity of the natural complex accepted today performance of permissible recreational loads on the beach area, the parks, forest parks, forests and meadows. It should be borne in mind that none of these factors is not absolutely decisive. Beach resources can grow through the creation of artificial structures on the beach area in the coastal zone, etc. [7].

Recreational vessel area determined by the formula:

$$W = P \times N_c \times K_1 \times K_2 \times K_3 \quad (2)$$

where P - the area of the coastal area-wide water area with a length of shoreline, suitable for swimming, 500 will be 1 m;

N_c - standard allowable load on the lakeside recreational waters - 1,000 people. 1 ha;

K₁ - coefficient of time relative to the total loading capacity of the beach - 0.9;

K₂ - factor at a time, the total number of bathers on the beach - 0.4;

K_3 - factor at a time are in the area of the total number of bathing - 0.6.

As a result of a comprehensive assessment of the permissible carrying capacity of the lake. Alakol in view of the lake on the proposed formula of 4600 people. (Bandwidth beaches - 2250). This method doesn't account for sanitary-bacteriological requirements.

According to the "Regulation of human security in the waters," approved on April 4, 1997, № 107, § 2.8., and the results of the state ecological expertise № 142 of 27.05.1999 on the water surface area of one bathing is 15 m². Although the waters of the Alakol lake is 93 hectares (930,000 m²), a potential area for swimming, and much less on expert evaluation is (the average length of the shoreline area swimming 1100 meters, the width of the area swim 15 meters) 38 500 m². The length of the coastline, beaches equipped with existing, much smaller, summer camp - 150 m, recreation - 350m. Thus, in accordance with the existing "Rules", while on the lake potentially (in the case of equipment for the entire coastline of beach area) can swim around 2,500 people, is actually more than 600-700 people.

Thus, existing techniques allow to determine the allowable load on the lake geosystem by volume, the length of the coastline, but leave out of sight of the sanitary-bacteriological requirements.

To quantify the carrying capacity of water recreational N. Prudnikov suggests the following method, which takes into account not only the ability of the qualification beach regulations carrying capacity of the waters, and sanitary requirements [8]. To determine the allowable capacity of the territory, we used indicators of nutrients (nitrogen and phosphorus). The main parameters were the area of the shallow zone and the amount of water masses (coastal area of the reservoir and water areas used for recreation), as well as the capacity of the recreational area (calculated and the total number of people who have the ability to simultaneously rest on the selected area with a view to the sustainability of recreational geocomplexes loads). The average number of nutrients for the year can be defined as the amount of run-off from the body (along with the excrement of a rest), left in the recreational area during the bathing season.

The estimates revenue of contaminants (pollutants) from swimming (along with the products of human physiological exchange and cosmetics), there is a large spread, but their definition is very difficult. According to foreign researchers, at a daily rate of human excreta contains from 2 to 18 g of nitrogen and 2-5 g of phosphorus. By some estimates, the income of pollutants from one bathing ranged from 0.08 to 2.4 g of phosphorus and total nitrogen 0,7-14 g [9]. This is without taking into account the fact that, according to sanitary and epidemiological Services "fecal" of coasts is 80%. As a result, the load bathers can't be more than 50 to 100 persons / ha of beach per day [10].

These estimates are also affected by type of use of cosmetics, the degree of equipment of the beaches, the contingent of tourists and many other factors. The additional increase in the concentration of phosphorus is due to resuspension of bottom sediments in the area of swimming.

4. Results and Discussion

The researches of Alakol lake demonstrated that holidaymakers on the beach spend an average of 6 hours per day and only half of them use the toilet. Thus, with the excrement of swimmers, and also due to washout from the body of water is added daily from one person to 5.1 g nitrogen and 1.6 g of phosphorus.

With a length of shoreline on a beach vacation homes (maximum 100 m) in the camps and the private sector (maximum 100 m), the recommended width of the bath - 25 m, average depth of the coastal areas - 1.5 - 4 m and sanitation indicators and quality standards of stagnant water for recreational activities on the total nitrogen MCL - 1.5 mg / l and phosphorus - 0.5 mg / l of recreational load (nutrient inputs from recreational fishing are not included) per day into the waters of the lake shall not exceed average of 600 people. (For N - 588 people., And on P - 625). We estimate that at current loads especially in the summer weekends, when the beaches while relaxing 1000-1300 people., The lake receives about 5.1 - 6.6 kg of nitrogen, 1.6 - 2 kg of phosphorus per day from swimmers respectively, and is about 160 - 200 kg and 60 - 80 kg for the recreational season [10].

According to the industry standard in water volume of water to 1 million m³ (volume of 58.6 m³ Alakol Lake) at room 1000 people. day begins eutrophication of the reservoir, and at 400-500 - the ability to cleanse

itself remains. This figure is confirmed by our calculations - the optimum load to the lake is 450 people. per day.

The area around the lake is swampy and overgrown with vegetation, mainly in northern and south-eastern parts, which practically excludes them from recreational use. Currently, the lake is mesotrophic investigated unstable system (the processes of eutrophication).

At present, anthropogenic processes have not significantly affect the lake (except through aeralny transfer), this raises the problem of preventing a massive and widespread their impact on the landscape, thus preserving the stabilizing tendency of matter and energy cycling in ecosystems of the lake, and in the surrounding landscape.

5. Conclusions

Thus, the lake. Alakol is an unstable system and the load on geosystem, calculated by the method of N. Prudnikov, is in the range 100-200 for the recreational season. She is currently exceeded. During the summer of 2009 in the valley was visited by about 6 thousand people. Given the fact that almost all travel agencies Almaty and East Kazakhstan regions that organize tours to the Valley of the lake, be sure to include a program of visits to the lake, we can assume that in the near future, the lake's ecosystem will be subject to significant change.

If you use a water body for recreational purposes to the investigated parameters of water are added indicators of sanitary-toxicological monitoring. One of them - the value of coli index, which determines the water content in Escherichia coli. In surface water sources used for recreational activities shall not exceed 1,000 units. The value of coli index lake varies widely - from 160 to 46 000 (according to the district SES).

Thus, indicators of nutrients (nitrogen N, phosphorus P) and coli index can serve as the main parameters determining the stability of water. Stability of lake geosystems is a major criterion to assess the recreational, which depends on water quality changes with the seasons, which occurs through natural processes occurring in nature, which is superimposed on the anthropogenic impact. The latter helps to change the physico-chemical characteristics of water and its bacterial contamination and, consequently, the development of the eutrophication of water bodies, and in some cases can lead to the destruction of the ecosystem.

The researches results could be used in harnessing the tourist-recreational potential of Alakol basin, for the prediction possible tourist traffic in the region and control the tourist activity. These results could be used in activities, which related with protection and restoration of natural and cultural heritage of the region. Developed projects of tourist routes can be used by tourist firms for the domestic tourism development.

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