BIOSCIENCES BIOTECHNOLOGY RESEARCH ASIA, April 2015. Vol. **12**(1), 1017-1021

Environmental Monitoring of Reservoir Deed-hulsun and its Adjacent Areas

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DOI: http://dx.doi.org/10.13005/bbra/1753

(Received: 02 March 2015; accepted: 04 April 2015)

The article presents the results of field studies on the hydrological regime of the reservoir Deed-Hulsun, located on the Caspian depression. The composition and structure of the components of the ecotone system "water-land" in the tapering zone of backwater reservoir are considered. It is shown that in recent years there is an increase in salinity of the reservoir, ecotone areas are influenced by a significant anthropogenic stress.

Key words: Artificial ponds, Water surface area, Mineralization, Alteration, Vegetation ecotone systems.

One of the urgent tasks of modern wildlife management is to develop a comprehensive research of reservoirs as a combination of natural and technical systems, the base of which should be the study of the relationship of processes both within the artificial reservoirs, as well as their interaction with the environment. Hence there is a need to organize a special information system monitoring and analysis of the state of the environment - an integrated environmental monitoring reservoirs based on geosystem approach[1]. The most important functions of the environmental monitoring is the assessment of changes in the environment[2]. Assessment of ecological status of experimental facilities should be based on quantitative similar or close to the similar attributes (parameters) describing the different aspects of studied objects where should be physico-gegraphic (landscape), ecological (geoekological), anthropogenic, medical and demographic attributes[3]. They can be expressed as absolute and relative values[4]. On this basis, we selected quantitative atributes defining landscape characteristics (hydro-chemical composition of the surface and ground water, the relative elevations of the heights of mesorelief, the depth of groundwater, soil composition and structure, composition and productivity of the ruling phytocenoses of ecotone areas). Environmental attributes of the assessment, in our case, characterize the change of indicators of manifestations of degradation of natural and anthropogenic processes in time (reduction of water surface area of reservoirs, changes in salinity, the deterioration of the hydrological and hydro-chemical parameters of water bodies, exceeding the target of MPCs, reducing the productivity of phytocenoses). To the third group of symptoms we assigned indicators of anthropogenic impacts, such as pollution of the environment, building of parking lots livestock and pollution of the ecotone area[5, 6].

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METHODS

Methodological basis of this study is the approach based on the concept of a view of water object and the landscape of the coast as a single eco-dynamic system - ecotone "water-land" and its block structure[7]. According to this approach, areas (blocks) of the reservoir and the coast, experiencing different effects reservoirs wave abrasion and prolonged flooding on the bottom of the reservoir bares (fluctuation block) are marked out; flooding, abrasion and accumulation of deposits in the area of a short flooding of the coast (dynamic block); flooding of by the shallow groundwater at a more remote from the water area of the coast (distant block), an indirect effect of the reservoir through the micro-climate - the marginal unit. Studies were performed according to previously established and proven techniques of integrated study of artificial reservoirs and ecotone zones "water-land" for the arid areas[8]. This technique combines ground research with geo-information technologies. GIS systems have now become an important tool for the storage, handling and use of diverse and complex accumulated information. Ground-based studies included monitoring of the surface water reservoirs and the study of the adjacent territories in the zone of influence of reservoirs called ecotone zones "water-land." Field studies were conducted during the growing season from April to October. On the banks of the reservoirs topoekologicheskie profiles were laid perpendicular to the water's edge, from the coast to inland to the zonal vegetation. Topoekologic tool profiling of the coasts included the inception of sample plots with a detailed study of soils, vegetation, groundwater, and the definition of elevation terrain on the profile with the help of leveling. Throughout the topoekological profile wells were laid before the level of ground waters. The number of wells wereregulated by topography and vegetation. At the opening of the soil and groundwater depth was observed, the rate of rise of water was measured, steady level was recorded. Additionally, sampled of the exposed subsoil water were selected in the tank capacity of 1.5 liters. Characteristic of the soils is given on the basis of morphological description of the soil profile as a result of drilling. In labaratory we determined the degree of mineralization of the residue, and the chemical composition of salts. All descriptions were accompanied by sampling for the study: the water salinity in water basin and groundwater; morphological structure and the salt composition of the soil; species composition and biological productivity of plant communities[9]. Analysis of the chemistry and salinity of surface and groundwater was carried out in Kalmykia branch GNU VNIIGIM RAAS Rosselkhozacademia AN Kostyukova in accordance with GOST 26449.1-85: cation-anion composition -titrimetricheskim method, determination of dry residue - gravity, the definition of pH - potentiometric. Water extract of soil samples was analyzed in the laboratory in accordance with State standards: 26425-85; 26424-85; 26426-85; 26427-85; 26428-85; 26483-85.

Identification of a set of indicators characterizing the effects of changes in water basins over a long period of their operation, as well as identifying characteristics of the formation of natural systems on the shores of reservoirs in the arid region of Kalmykia is a prerequisite, allowing to assess the ecological status of the water basin for the management of its resources. In order to determine the current ecological status of water basins of the Caspian depression was carried out environmental monitoring on the example of reservoir Deed-Hulsun, and the study of ecotone areas of the reservoir is an important task of research dictated by the need to preserve the rich biological diversity of the gene pool of the steppe and desert biot.

Main part

Reservoir Deed-Hulsun, according to the map of natural zoning of the Volga-Caspian province[10] located in the landscaped Davanskiy area Priergeninsko-Sarpa-Davanskoy subdomain of the Caspian region. Reservoir Deed-Hulsun was created in 1970-80 in the estuary of river Yashkul (catchment area 1938 km2). Previously there was a small liman filled by rains and dried up in the summer. However, after the construction in 1960 Chernozemelsky-watering irrigation system (CWIS) and earthen dam reservoir was fed not only by the river Yashkul, but and drainage - waste waters coming from CWIS via canel US-3. In 2003, the salinity of the reservoir was 2.07 g / l by the dam and 7.73 g / l in its back part. Type of the salinity of water - sodium-sulfate-chloride[11]. Water

from the reservoir to the distribution canel, coming out of the dam is used for liman irrigation. On the shores of the reservoir, there are two functioning livestock parking lots where are bred cattle and small cattle pond water is used for watering livestock. Analysis of remote sensing data from 1975 to 2004 shows that the maximum filling of the reservoir was observed in 1988, its area was 17.21 km^2, the minimum content and size - 6.54 km^2 was in 1999[11]. Area of the reservoir as a result of satellite imagery for October 28, 2013 was 13.53 km^2 (PPE «Landsat-7", ETM +).

The study of the structure of components of ecotone "water-land" reservoir Deed-Hulsun conducted on two key areas: in the dam portion and tapering zone of backwater. In this article topoekologic profile inherented in the tapering zone of backwater is discussed. Profile Deed-Hulsun-1 is located on the northern coast of the reservoir, at a distance of 5.1 km from the dam, in the tapering zone of backwater. The length of the ecotonehere is more than 100 m. Ecotone structure of a key area the following blocks are divided: amfibialny, fluctuation, dynamic, distant and marginal. A detailed description of the components of natural ecosystems in the blocks of ecotone system is shown in the table.

Amfibialny unit was presented with rare discontinuous stripes of cane south (Phragmites australis), a width of up to 2-3 m in height and 1.5 m and an estimated coverage of 50%. Mineralization of water reservoir in this location was 9.17 g/l. Type of the salinity of water - sodium-sulfate-chloride. Fluctuation block width of 37 m, was located on the relative elevations from 0 to 0.48 m. Groundwater in the fluctuation block lies at a depth of 0.55 m in the spring and had a salinity of 26.41 g/l. During autumn they become deeper up to 1 m, but their mineralization remained virtually unchanged (26.33 g/l). In this block cane tamariksovye community (Tamarix ramosissima-Phragmites australis), of halophytes were marked Sweda saline (Suaeda salsa), solyaros European (Salicornia europaea), Franken hairy (Frankenia hirsuta), sarsazan bossy (Halocnemum strobilaceum), of mesophytic grew pribrezhnitsa coast (Aeluropus littoralis), quinoa spreading (Atriplex patula), goniolimon Tatar (Goniolimon tataricum), bedstraw (Galium verum) grew.

Dynamic block is characterized by relative

Tabl 1. Components of natural ecosystems in the blocks of the ecotone system of the zone of wedging backwater of the reservoir Deed-Hulsun (4.05.2012 y.)

Components of ecosystems soils	Water of the basin	Fluctuation (0-10) m salt marsh meadow	Dynamic (10-37) m salt marsh meadow	Distant (37-113) m actually meadow	Marginal (from 113 m) Brown semidesert in combination with salt marshes meadow brown
UGV, m	0	0,55	1	2-2,5	> 3,5
mineralisation PV/GV, g/l	9,17	26,41	20,15		
Type of water salinity	$Cl^- - SO_4^{2-} - Na^+$	$Cl^- - SO_4^{2-} - Na^+$	$Cl^- - SO_4^{2-} - Na^+$		
Communities	*no plants*	*Tamarix* ramosissima-Phragmites australis	*Suaeda* salsa+Eremopyrum triticeum	*Poa bulbosa* - Anabasis aphylla - Suaeda salsa	*Artemisia taurica-Poa* bulbosa
Weight of air-dry biomass, g	0	64	18	2	28
Number of species	0	10	8	7	4

elevations of heghts from 0.48 to 0.89 m. Groundwater in spring lies at a depth of 1 m and had a salinity of 20.15 g/l. During autumn their level decreased to 1.3 m, water mineralization increased slightly (21.08 g/l). In these edaphic conditions mortukovo-seepweed (Suaeda salsa + Eremopyrum triticeum) grew. Among halophytes here Franken hairy (Frankenia hirsuta), sarsazan bossy (Halocnemum strobilaceum), quinoa stalked (Halimione pedunculata) grew, mesophytic grasses were represented by Ostrets (Leymus ramosus), bulbous bluegrass (Poa bulbosa). From grasses we may note Lerch wormwood (Artemisia lerchiana). Vegetation is very relieved, as it is evidenced by the abundance of ruderal species and emerging single copies camel thorn (Alhagi pseudalhagi).

Width of the distant block of ecotone was found to be 67 m. Relative elevations ranged from 0.8 to 1.3 m. Ground water was at a depth of 2 m. *Vegetation of the unit was presented by saltwort-anabazisovo-bluegrass communities (Poa bulbosa -Anabasis aphylla - Suaeda salsa) communities*. Besides the dominant in the community was marked milfoil tansy (Tanacetum millefolium), sarsazan bossy (Halocnemum strobilaceum). Community has a very strong degree of grazing, as it is evidenced by the presence here of species such as Garman ordinary (Peganum harmala), camel thorn (Alhagi pseudalhagi). From a distance of 113 m from the water, there is a marginal unit ecotone system. *The vegetation consists of bluegrass-tauride-wormwood communities (Artemisia taurica-Poa bulbosa*). Strong solidity and pasturing of this area is reflected in an increase iof the part of ruderal species - Garman ordinary (Peganum harmala), camel thorn (Alhagi pseudalhagi), amaranth (Amaranthus albus).

Monitoring of surface water during 2012 year showed a small (2 g/l) increase in the degree of mineralization of the water basin to fall. In the spring of 2012 salinity of surface water was 9.17 g/l, and in autumn - 11.16 g/l. The chemical composition of water is sodium-sulfate-chloride. Groundwater throughout the season on this profile deepened by 0.3 - 0.5 m, slightly (by 1 g/l) changing the degree of salinity and water quality.

Observations have shown that the profile of the reservoir salinity is somewhat higher in the tapering zone of backwater (9.17 g/l) and lower in the dam (8.88 g/l). By the fall of mineralization SW slightly increased by 0,9-1,9 g/l. The type of salinity is sodium-sulfate chloride in spring and sulphate-chloride-sodium in autumn. Analysis of groundwater showed that the mineralization of GW practically identical in the tail and the dam of the reservoir. By the fall GW deepened by up to 0.5 m. The extent of mineralization by the autumn increases in average in reservoir ecotones at 2-4 g/l.

CONCLUSIONS

Currently, the main purpose of the reservoir is a water intake of drainage water from a watering Chernozemelsky-irrigation system. In spite of the poor water quality (high salinity of water 8-11 g/l), collected in the water intake water in spring is used for liman irrigation. In addition, surface water reservoirs are used for watering livestock, fishing, fish farming (reservoir is leased since 2000s.). Ecotone areas of the reservoir are used for hay, liman irrigation, grazing. Over the time, there was a decrease of water features of the reservoir. However, reservoir Deed-Hulsun, as part of the national wildlife reserves, has an important environmental role. Wetland refers to the main sites of nesting, recreation, flight of waterfowl and water birds from the central patt of Kalmykya. Here nest such rare species as the Dalmatian and pink pelicans, spoonbill, black-winged stilt, avocet, black-headed gull, demoiselle. On migration bustard, white-fronted goose, lesser white are common.

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