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HYDROLOGICAL AND HYDROCHEMICAL HARACTERISTICS OF THE URAL RIVER IN THE WESTERN KAZAKHSTAN REGION

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ГИДРОЛОГО-ГИДРОХИМИЧЕСКАЯ ХАРАКТЕРИСТИКА РЕКИ УРАЛ В ПРЕДЕЛАХ ЗАПАДНО-КАЗАХСТАНСКОЙ ОБЛАСТИ

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Abstract. This article presents materials on the current state of the hydro-hydrochemical regime of the Ural River, within the Western Kazakhstan region. The hydrographic network of a catchment basin, annual fluctuations of level of the river, results of hydrochemical water analysis are given.

Keywords: Ural River, hydrology, hydrography, hydrochemistry, spawning areas

Аннотация. В данной статье представлены материалы по современному состоянию гидролого-гидрохимического режима реки Урал, в пределах Западно-Казахстанской области. Приводятся гидрографическая сеть водосборного бассейна, годовые колебания уровня реки, результаты гидрохимического анализа воды.

Ключевые слова: река Урал, гидрология, гидрография, гидрохимия, нерестилище

Introduction. The Ural river originating from the foothills of Ural Ridge in the Uchalinsky region of Bashkortostan proceeds across the territory of two countries: The Russian Federation (The Orenburg, Chelyabinsk areas and the Republic of Bashkortostan) and Kazakhstan (The West Kazakhstan, Aktyubinsk and Atyrau areas), flows into the

Caspian Sea. The river has the status of interstate, cross-border water object. Sources of the Ural river are located at the height of 637 m above sea level at a foot of the mountain of Nazhimtau and the ridge Uytash in the Uchalinsky region of Bashkortostan. These are five constant keys which merge in a uniform stream. The Urals is the third longest river in Europe, yielding only to the Volga and the Danube. The total length is 2428 km, within the Republic of Kazakhstan the length is 1084 km, the total area of the basin is 231 thousand km^2 [1].

The river is unique natural object – the only natural spawning area of many species of fish of the Caspian Basin. In lower reaches of the river, and also rising to an middle current in borders of the West Kazakhstan Region of Kazakhstan (WKR) checkpoints and species of fish semi-through passage as here it is located more than one thousand hectares of spawning areas of sturgeon, and about 5 thousand hectares of ordinary fishes come on spawning.

Materials and methods. Materials for researches gathered in 2017, on five stations of sampling on the Ural river in borders of the WKR. The grid from 5 stations was established taking into account possibility of fuller coverage of the studied site of the river. The geographical coordinates of the sampling stations are shown in Table 1.

T a b l e 1. **Coordinates of sampling stations**

Numbers and names of stations	Width	Longitude
Station No. 1 Burlin settlement	51° 27'22"N.L.	52° 40'38"E.L.
Station No. 2 Kabyl Tobe settlement	51° 18'43"N.L.	51° 52'33"E.L.
Station No. 3 Krugloozernoe settlement	51° 04'12"N.L.	52° 40'38"E.L.
Station No. 4 Chapayev settlement	50° 11'24"N.L.	51° 10'49"E.L.
Station No. 5 Taypak settlement	49° 02'51"N.L.	51° 53'41"E.L.

The sampling of water for the hydrochemical researches was made by means of a batometr. The chemical analysis of tests of water was carried out in the accredited "Oral-Zher" LLP laboratory. Hydrological data on the water mode of the Ural river were obtained from the West Kazakhstan regional center of hydrometeorology.

The depth of the water in the channel was measured by the Garmin Echo 150 echosounder, the flow rate of the hydrometric turntable GMCM-1. The water temperature and the content of the dissolved oxygen were defined by the Termo-oximeter "Samara 2".

Results of researches. According to the nature of the channel, the valley and the water content, the Ural river is divided into three parts (currents): upper, middle and lower. In the beginning the river flows directly to the south to the city of Orsk. This site is considered the upper course. Then it sharply turns on the West. Having passed in the width direction about 850 km to the city of Uralsk (a middle current), turns at right angle again on the South and keeps this direction to a confluence with the Caspian Sea (the lower current, distance of 840 kilometers). The Ural is pronounced type of the river of snow food. In the period of a spring high water (April-May) comes from 60 to 90 % of an annual drain here. During the post-flood period the water level is stabilized, with insignificant inter-seasonal fluctuations.

In 2017 the spring flood began in the first decade of April. In 2-3 decades of April the water level was doubled. The peak of the flood occurred on 2-3 decades of May. In the second half of June the water level recession began. In the third decade of July, at the low water level, the water level dropped to 229 cm.

The middle speed of a watercourse in April fluctuated from 0,88 to 0,93 m/s. In the second decade of May the speed of a current increased on middle to 0,96 m/s. In a summer low water level the speed of a current made 0,59 m/s [2].

The distinctive feature of the water mode of the Ural river is instability of volumes of middle annual drains. So, at an middle annual drain, at the Kushumsky hydropost, 10,6 km^3 in a year, this indicator made 14,0 km^3 in 2002 and only 4,45 km^3 in 2015 (figure 1). After 2007, optimum on water content, the annual decrease in volume of the annual drain reaching critically low point in 2015 is observed.

The volume of an annual drain for 2017 made 8, 76 km^3, improving the level and duration of a spring flood in comparison with 2015 and 2016. However, it is obviously not enough this volume for creating favorable conditions on all hydrographic network of the Ural river for the natural reproduction of trade species of fish on inundated spawning

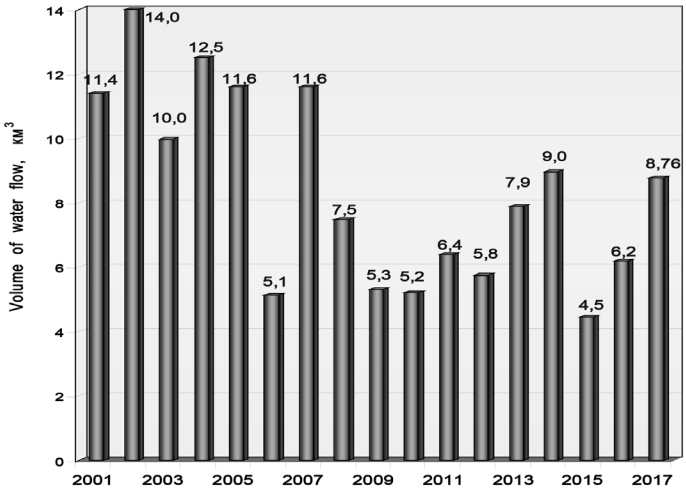

Fig. 1. Fluctuations of an annual water drain of the Ural river in the WKR in 2001–2017, in km^3

areas. The full flood of these spawning areas during a flood and efficiency of spawning on them in many respects defines character of a natural reproduction of the commercial reserves of all Uralo-Caspian Basin.

The modern hydrographic network of the Ural river in the WKR is represented by a 761 km of long root channel. The width of the river is from 70 to 110 m in low water period and from 180 to 300 m during a flood. The middle depth is about 5 m in low water period, and to 15 m during a flood. The middle watercourse passes in the north of area and lasts from border of the Russian Federation at the village of Burlin and further on the West to Uralsk (figure 2). Here river to the course smoothly turns on the South and further flows on the flat plain of Caspian Depression. This is the lower watercourse.

In the middle reaches of the Urals the rivers Utva, Embulatovka, Bykovka, Rubezhka, Chagan and Derkul fall into the river. In the lower current there is only one inflow – river of Barbastau, and three outflows – the rivers Kushum, Ashchisay, Solyanka. Two last on middle a current are connected by the proto which Karabas. The list of the small rivers of a hydrographic network is presented in table 2.

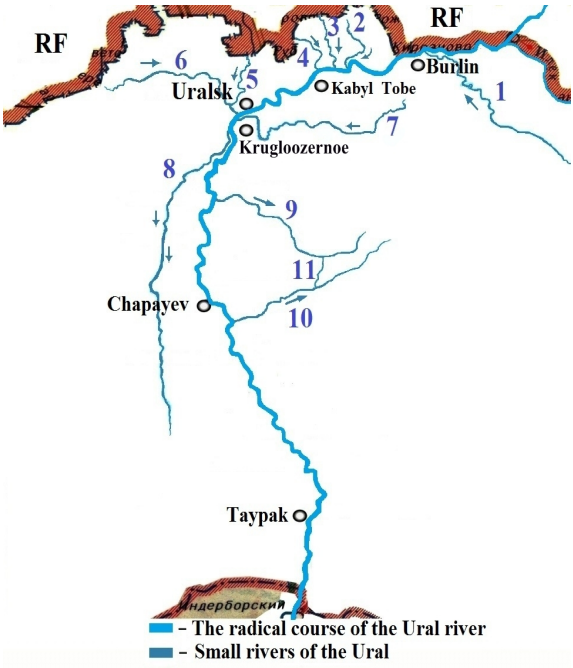

Fig. 2. Hydrographic network of Ural river within the West Kazakhstan region

T a b l e 2. The small **rivers of a river basin the Urals within the WKR**

№	Name of the small river	Characteristic
1	Utva	Left-bank inflow in the middle current
2	Embulatovka	Right-bank inflow in the middle current
3	Bykovka	Right-bank inflow in the middle current
4	Rubezhka	Right-bank inflow in the middle current
5	Chagan	Right-bank inflow in the middle current
6	Derkul	Right-bank inflow in the middle current
7	Barbastau	Left-bank inflow in the lower current
8	Kushum	Left-bank outflow in the lower current
9	Ashysay	Left-bank outflow in the lower current
10	Solyanka	Left-bank outflow in the lower current
11	Karabas	The river channel between the rivers Ashysay and Solyanka

The left inflow of the middle current – the river Utva begins in the Chingirlausky Area of WKR. Flowing further northwest the river passes through Burlinsky area and in vicinities of village Burlin runs into the Ural River. The water content of the tributary is uneven and depends on the flood. The bed is poorly washed, with excessive overgrowing by underwater soft vegetation. With the Ural, the reservoir is connected only during the spring high water. Total length is about 200 km. The width is from 20 to 30 m. The averages depths are 1,7–2 m.

The left inflow of the lower current – Barbastau's river originates in the Terektinsky area at the settlement of Fedorovka. Flowing further on the southwest the river flows into the Ural below the Uralsk city at the village Socialism. The water content of inflow is not great as a result of control of the course and formation of a number of reservoirs. The course which is badly washed out with considerable overgrowing. Barbastau's river is connected to the Ural all the year round, however inflow of water is observed only during a spring flood. The total length is about 70 km. The width is from 22 to 30 m. The middles depths are 1,8–2 m.

The right inflow of the middle current – Embulatovka's river stretches from the Russian Federation border in the North (the district of the Rozhkovo village) and further flows to the South, falling into the Ural river lower the village of Yanvartsevo. The weak water content of inflow is caused by control of the course and formation of a number of reservoirs and ponds. The bed of the river insufficiently profound, with the surface rigid and underwater soft vegetation raised by overgrowing of a reservoir.

With the Ural, the Eambutovka is connected only in deep-water years. Its total length is about 80 km. The width is from 20 to 25 m. The averages depths are in limits of 1,1–1,5 m.

The right inflow of the middle current – Bykovka's river also goes north from border with the Russian Federation in the neighborhood of the Chesnokovo village and goes to the South, falling into Ural river above the village of Krasnoarmeyskoye. Owing to control of the course the water content of inflow is minimum. The bed of the river which is insufficiently washed out with intensive overgrowing of a reservoir. With the Ural River, this inflow is connected only at a suf-

ficient level of spring flood. The total length is about 75 km. The width is from 18 to 20 m. The averages depths are 1,1–1,2 m.

The right inflow in the middle current – Rubezhka's river goes from Russian Federation border in the North (the village Razdolnoye) and further flows to the South, falling into Ural river lower the village of Rubezhka. The water content of inflow is low as a result of control of the course and formation of a number of reservoirs and ponds. The course which is badly washed out the coastal and shipped water vegetation is plentifully developed. This inflow connects with the Ural river only at the sufficient level of a spring flood. The total length is about 72 km. The width is from 15 to 20 m. The averages depths are 1,1–1,4 m.

The right inflow of the middle current – the river Chagan goes north from the Russian Federation border in the neighborhood of the village Red Zhayyk (Ural) and further flows to the South, falling into the Ural river in the western part of the Uralsk city. The river Chagan is connected to the Ural all the year round, however inflow of water on Chagan is observed only during a spring flood. The total length is about 78 km. The width is from 50 to 100 m. The averages depths are 3-4 m. The right inflow of the middle current – the Derkul river begins in the Tuskalinsky area near the village of Semiglavy Mar and then flows east, to the confluence with the Chagan river near the city of Uralsk. With Chagan, Derkul is connected all year round, but the flow of water along the river is observed only in spring flood. The total length is about 130 km. The width is from 30 to 50 m. The averages depths are 3-4 m. Above-mentioned channels play a certain positive role in the formation of bioresources of Ural river. They feed the river with waters from the catchment area, enrich the river ecosystem with planktonic fodder organisms.

The right outflow of the lower current – the river Kushum begins below the city of Uralsk near the village of Krugloozernoe and further flows on the southwest. The largest irrigation and watering system of the WKR – Ural-Kushumskaya irrigation and watering system was established on the river. The total length of Kushum is about 250 km. The width is from 30 to 50 m. The averages depths are 2-3 m. Kushum ends in the lake floods of Zhangalinsky area.

The left outflow of the lower current – the river Ashysay begins near the village of Akzhaik and further flows on the southeast. This outflow connects to the Ural only in the years of a high spring flood. The river bed is poorly washed, heavily overgrown. The total length is about 60 km. The width is from 20 to 25 m. The averages depths are 1,2–1,7 m.

From the neighborhoods of the Kamystykol village, another left outflow of the lower watercourse of the Ural river, the Solyanka river, begins and proceeds further to the northeast. This outflow connects with the Ural river only in the years of a high spring flood. The course is badly washed out, with the surface rigid and underwater soft vegetation raised by overgrowing of a reservoir. The total length is about 70 km, The width is from 18 to 23 m. The averages depths are 1,1–1,5 m.

The river Karabas is the sleeve going from the river Ashysay to the river Solyanka in the neighborhood of the village of Karabas. The bed of the river which is insufficiently washed out with intensive overgrowing of a reservoir. The total length is about 55 km, The width is from 20 to 25 m. The averages depths are 1,4–1,7 m.

Thus the drain of Ural river, is generally formed in an upper course where the river network numbering 7 inflows and 3 outflows is strongly developed. Below the Uralsk city, before flowing into the sea, the Ural river has no tributaries, except for the low-water river Barbastau.

As a result of hydrochemical researches at five stations it was established that the waters of the Ural river throughout the West Kazakhstan region are fresh (hypogaline), slightly alkaline. The concentrations of dissolved oxygen were at a sufficient level for the life of fish and varied within the range of 8,4–9,2 mg/dm^3. For all the surveyed sites, there was an excess of ammonium nitrogen and a fairly high content of dissolved organic substances, which is most likely a consequence of pollution of the reservoir by domestic and agricultural wastewater (Table 3).

The total mineralization of water did not rise above 430,0 mg/dm^3. Except for the concentration of ammonium ion, the maximum permissible concentrations were not exceeded for fishery reservoirs. According to the permanganate oxidation index characterizing the dissolved organic matter content, the waters of the Ural river in 2017 corresponded to the class “moderately polluted”.

Table 3. **Results of hydrochemical researches, summer post-flood period 2017**

Station	rn (pH)	O_2 mg/dm^3	Biogenous connections, mg/dm^3				Oxida-bility perman-ganatny mg/dm^3	Minerali-zation of water, mg/dm^3
			NH_4	NO_2	NO_3	PO_4		
Art. 1	8,4	8,5	1,4	0,016	1,75	0,043	12,8	405,0
Art. 2	8,4	9,2	5,6	0,020	2,75	0,031	12,2	430,0
Art. 3	8,3	9,0	2,8	0,020	5,0	0,030	12,0	405,0
Art. 4	8,4	9,0	2,1	0,020	1,5	0,031	11,4	345,0
Art. 5	8,4	8,4	3,5	0,046	4,0	0,030	12,6	342,0
PDK_{VR}	6,5–8,5	not less than 6,0	0,5	0,08	40,0	0,05	15,0	1500

Thus, when studying the hydrological mode of Ural river the volume of an annual drain for 2017 made 8,76 km^3 that is a little higher in comparison with 2015 and 2016. However, full flood of all hydrographic network of Ural river is necessary for creating favorable conditions for natural reproduction of trade species of fish on inundated spawning areas. By results of the conducted hydrochemical researches of Ural river it is possible to draw a conclusion that conditions for dwelling of hydrobionts on the main hydrochemical indicators in 2017 were accepted. The presence of a deviation from MPC norms for the content of ammonium ions reduced the quality of water, but in general the hydrochemical indicators correspond to the fishery norms.

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