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GEOGRAPHICAL AND ECOLOGICAL CHARACTERISTICS OF RAINBOW TROUT NATURALIZED POPULATION IN KAZAKHSTAN

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ABSTRACT

In the 1970s the rainbow trout species (*Parasalmo (O.) mykiss* Walbaum, 1792) had been introduced in Kazakhstan water bodies by three batches from Kamchatka nurseries (Russia). Investigations of condition of the introduced trout have not been performed since 1982. We conducted the field researches in two lakes and six rivers in the Almaty region (Republic of Kazakhstan) during 2015-2016. Geographical and hydrological characteristics had been studied directly during expeditions, made in six river heads, along their channels till the fishing places. We also travelled to the two high altitude lakes. We examined the rainbow trout population on the comprehensive analysis basis. The research results showed that the hydrochemical condition of investigated six mountain rivers was satisfactory. However we determined the rainbow trout presence only in three rivers of the Almaty region. The rainbow trout population level was high. Fish numbers varied with hydrochemical and trophic aquatic conditions. We tested water quality on nine physical and chemical water indicators. Biometric data of the trout bions showed a good growth and fatness according to Fulton's condition factor, as well as their high reproductive potential.

Keywords: river, geography, ecology, rainbow trout

INTRODUCTION

Parasalmo (O.) mykiss Kamchatka rainbow trout is a valuable object for naturalization acclimatization and fish rearing P. (O.) mykiss species is represented by the anadrous, estuarine and landlocked (non-anadromous) forms that are dwelling in water with a temperature from 14 to 20°C and an oxygen content of 7-8 mg/l [1]. In the 1970s the young rainbow trout species also known as Kamchatka rainbow trout (*Parasalmo (O.) mykiss* Walbaum, 1792) was transferred from the Russian Federation nurseries to Kazakhstan's water reservoirs [2]. Conditions for introduction and naturalization of the Kamchatka rainbow trout in Kazakhstan were the following.

The first rainbow trout batch from Kamchatka River population was released (pushed out) in the Ulken-Kakpak river (Almaty region) in 1975 [3]. The second batch was released (pushed out) in 1976 in the two rivers Emel and Tentek (Taldykorgan region),

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but there is no information about it. Third batch of the rainbow trout (fell) got into Uryukti and Buzumbay lakes (Almaty region) (in which) where they were (grown) growing well and (developed) developing (over) for some period of time [4]. Later there were almost no researches on the dispersal (resettlement almost was not) except for Shelek river in 2012 [5]. Thus information about the state of naturalized rainbow trout population in Kazakhstan was fragmentary, and researches were episodic.

OBJECTS AND METHODS OF INVESTIGATION

Previously, we drew out a schematic map of the Almaty region. We marked on it the expedition routes to the water reservoirs for the purpose of reconnaissance research of *Parasalmo* (O.) *mykiss,* Kazakhstan rainbow trout population (Walbaum, 1792).

The objects of research were Buzumbai and Uryukty lakes, along with six rivers: Shelek, Tekes, Ulken-Kakpak, Ornek, Sharyn and Bainkol where in the 1970s had been introduced the Kamchatka rainbow trout species.

Hydrography of research field

The Almaty region territory belongs to the Balkhash and Alakol water drainage basin. Hydrography is expressed in the pinnate type. The major basis of the local flow off is the Ile river. The rivers of this territory are typical high altitude glacial streams with flashy flows.

Brief description of the explored water bodies

The Buzunbai lake is the high altitude lake of the Zailiysky Alatau region. The Kakpak river runs into this lake. The Uryukty lake is located in the Zailiysky Alatau mountains. The Shelek river is one of the main waterways in Kazakhstan which flows through the Almaty region and is the largest river of the Zailiysky Alatau region (the Northern Tian Shan mountains). The length of river is 245 km. The Tekes river flows from the eastern most tip of the Terskei Alatau mountains taking course to the east to China territory. The length of the river is 438 km of which 100 km accrues to Kazakhstan's territory. The Ornek river is a small mountain river in the Almaty region. The Ulken-Kakpak river is a high altitude river of the Zailiysky Alatau region. It flows from the Kakpak gorge. The Sharyn river flows from the Zailiysky Alatau region as well and runs into the Ile river. The Bainkol river flows from the eastern most tip of the Terskei Alatau. All the rivers have the glacier-derived nourishment.

For the purpose of the hydrochemical analysis we took water samples from Tekes, Ulken-Kakpak, Ornek, Shelek Bainkol and Sharyn rivers in the cross-sections and dams. Water quality examination was carried out according to the following hydrochemical indicators: water odor and transparency, color, temperature t^0C, pH, Eh, biochemical oxygen demand BOD_5, total nitrogen N_{tot}, total phosphorus P_{tot}. Determination of the water general physical properties was conducted according to the Standards [6].

The water odor intensity is usually measured by scoring system from 0 to 5. The standard for drinking water is no more than 1 point: smell records at 20^0C and 60^0C. Measurement of water odor carried out immediately after a sampling of water (250 ml) in a conical flask. Flask was stoppered, vigorously shaken, and opened. This minute the kind of smell and its intensity determined organoleptically. Determination of

transparency we executed through the use of Secchi disks. The measurements were repeated 6 times.

Colour of water was determined through the photocolorimetrical method in a wavelength of 340 nm and was expressed in the platinum-cobalt scale's color degrees. The water temperature measurements were carried out during water sampling. For this purpose we used a combined mercury thermometer which was dipped into a depth from 0 to 30 cm and exposed during 10 min.

The hydrogen ion exponent (pH) and the oxidation-reduction potential (Eh, mV) were determined through the potentiometric method by using a portable pH tester [7].

BOD_5 (mg O_2/l) was determined through the titration-based method by the difference between the O_2 content before and after 5 days incubation in an anaerobic environment with no exposure to light [8].

We determined total nitrogen by fluid analyzer "TOPAZ-N" (Russian Federation) by means of a chemiluminescence intensity [9].

Total phosphorus was determined through combustion in colorimetric bomb in an oxygen atmosphere with water. The phosphorus content in the solution in mg/cm^3 was found out through the obtained optical density of test solution on the calibration curve [7].

The population sampling selection for biometric analysis we made according to the method based on ecological principle "to catch – to let go" [10]. We fished the rainbow trout in the three mountain rivers – Tekes, Ornek and Ulken-Kakpak in the Almaty region by hook and line gear. Fishes were measured and weighted, and then these were released into rivers.

RESULTS

Data on the present state of selected water bodies on the problem of detection of rainbow trout were obtained directly within these objects in expeditions 2015-2016.

At first we examined two high-altitude lakes: Buzunbai and Uryukty. The road to them was complicated and difficult due to the high mountains. It turned out that Uryukty and Buzumbai lakes were swamped by sill flow (mudflow) and practically disappeared. This happened in the 1990s. To the Shelek river we were also unable to drive up due to the bad dirt trail, with some places buried by landslides. We drove further toTekes, Ulken-Kakpak, Sharyn, Bainkol and Ornek rivers to search the rainbow trout. The rainbow trout were not been found in Sharyn and Bainkol rivers. We found this species in Ulken-Kakpak, Tekes and Ornek rivers.

Next, we conducted a hydrochemical monitoring of water quality in all six rivers for comprehension: why the trout was found in three rivers, while in the other 3 – were not.

Water samples were collected at a depth of 0.3 m. Table 1 shows the averaged data on hydrochemical indicators of water ecological state of the studied objects.

Table 1. The rivers' hydrochemical indicators in the Almaty region, 2015-2016

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River	Water hydrochemical indicator								
	Odor (score)	Transparency (sm)	Colour	t°C	pH	Eh (mV)	BOD_5 (mg O_2/l)	N_{total} %	P_{total} %
Tekes	0	20.8 ±0.6	0	14.6 ±1.6	7.7 ±0.2	-54.6 ±13.4	1.06 ±0.4	0.9 ±0.5	0.02 ±0.01
Slelek	1	15.8 ±0.3	0	17.0 ±1.4	6.4 ±0.2	-49.9 ± 13.8	1,16 ±0,6	0.8 ±0.4	0.02 ±0.01
Bainkol	1	16.3 ±0.7	0	16.2 ±1.7	6.6 ±0.3	-44.5 ±12.6	1.21 ±0.7	0.5 ±0.3	0.15 ±0.01
Ornek	0	20.1 ±0.5	0	15.5 ±1.2	7.1 ±0.2	-75.2 ±14.7	1.05 ±0.4	1.1 ±0.6	0.03 ±0.02
Sharyn	0	23.9 ±0.5	0	13.5 ±1.2	7,5 ±0,3	-70.5 ±15.1	1.08 ±0.5	0.7 ±0.5	0.04 ±0.02
Ulken-Kakpak	0	26.2 ±0.4	0	13.1 ±1.4	7.0 ±0.2	-78.7 ±16.4	1.01 ±0.3	1.2 ±0.6	0.02 ±0.01

According to the visual analysis of the physical and chemical properties (or the organoleptic properties of water) Tekes, Sharyn, Ornek and Ulken-Kakpakov rivers had a low turbidity water. The water of Shelek and Bainkol rivers we classified as turbid. Color index was normal, special mineral and organic impurities and pollutans had not been found. Water samples from the six rivers were colorless and transparent. The unpleasant smell was found in the water samples from Bainkol and Shelek rivers, most likely due to the large number of domestic animals, which are led to the watering.

Water temperature of six rivers corresponded to the season of the year, the water level and its volume and geographical location of sampling places: the higher in the mountains, the water is cooler. The pH indexes in water samples were within acceptable norms. The total phosphorus and total nitrogen concentrations in the tested water samples were within acceptable limits.

Thus, hydrological and ecological state of the rivers in the Almaty region territory was satisfactory. Consequently, the water is suitable both for drinking and for aquatic organisms, particularly trouts. The absence of trouts in Sharyn, Bainkol and Shelek rivers is related to the use of water for domestic animals watering, and enhanced fishing.

Biometric characteristics of rainbow trout sampling

The rainbow trout in Kazakhstan water bodies was initially introduced species that had a commercial value. Our data showed that rainbow trout population is presented in the piedmont and mountain parts of Tekes, Ornek and Ulken-Kakpak rivers in the Almaty region. We analyzed from our own catches 10 rainbow trout specimens from each river to explore the state of the population. From the population's morphometric characteristics we chose the length (L, mm) and weight (Q, g) of a fish body; the length (l, mm) and weight (q, r) of a fish head and the Fulton's condition factor (Table 2).

Table 2. Size and weight characteristics of rainbow trout in the Almaty region's rivers

Place of catching	Index	L	l	Q	q	Fulton's factor
Tekes river	min-max	120-240	80-180	86-175	56-135	0,005-0,001
	$\bar{x}$	174	130	131	96	0,001
Ornek river	min-max	120-210	80-160	84-168	54-137	0,004-0,001
	$\bar{x}$	146	120	109	75	0,003
Ulken-Kakpak river	min-max	120-210	79-169	83-155	52-121	0,004-0,001
	$\bar{x}$	151,5	119	112	69	0,003

In our catching were mainly presented by the juvenile fish at the age of 0±2 years. During the summer period 2015-2016 we noted a good morphometric indexes of body height and fatness by Fulton that indicated about the sufficient level of a forage availability for population. The largest specimens of juveniles were caught in the Ulken-Kakpak river, bass fishes – in the Ornek river, averages in size – in the Tekes river.

CONCLUSION

After the 1980s scientists did not carry out a monitoring of these populations condition in the Kazakhstan reservoirs of installation. Nobody studied the mykiss biology although it is a valuable harvested species. We celebrate an own start scientific work in the study of rainbow trout [11].

We examined the current condition of Kazakhstani rainbow trout population (allegedly, mykiss), introduced into mountain rivers and lakes of South Kazakhstan in the 1970th. Field researches were conducted in 2 lakes and 6 rivers. We used multivariate analysis of research objects. Under the hydrochemical and environmental attributes of water bodies, and biomentrics method was estimated a good condition of rainbow trout population. As a result, the research found out that environmental condition of mountain rivers Almaty region is satisfactory. Presence of rainbow trout is shown in 3 rivers. Trout's population level varies according to hydrochemical and trophic environmental conditions. Its population at the moment has a high breeding potential. At any later days it is supposed to undertake polimorphism genetic research of rainbow trout by dint of molecular genetic analysis.

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