HUMAN IMPACT ON FISH FAUNA IN THE BALKHASH WATERSHED

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Introduction

Modern fish fauna of the Balkhash watershed consisted of approximately 13 indigenous and about 20 alien fish species which were successfully introduced here. Nowadays, alien fish species are dominant in the main water bodies of the watershed and thus indigenous species take refuges in tributaries. Investigations of some environmental conditions and diversity of fish populations were conducted during 2003-2015. The aim of the study was to compare fish diversity under varying anthropogenic impact and to evaluate modern state of indigenous fish populations within boundaries of the Republic of Kazakhstan.

Figure 1. Rapid urbanization happened in the Balkhash watershed at the last quarter of the XX[th] – beginning XXI[st] centuries.

Materails and methods

In 2003-2015 we have conducted a series of field studies evaluating the state of habitats and diversity of fish populations in the part of the Balkhash watershed situated within borders of the Republic of Kazakhstan. Conventional chemical, physical and microbiological methods were applied to analyze water and sediments [1-3]. Current state of fish were evaluated through changes of their diversity and morphology [4-6].

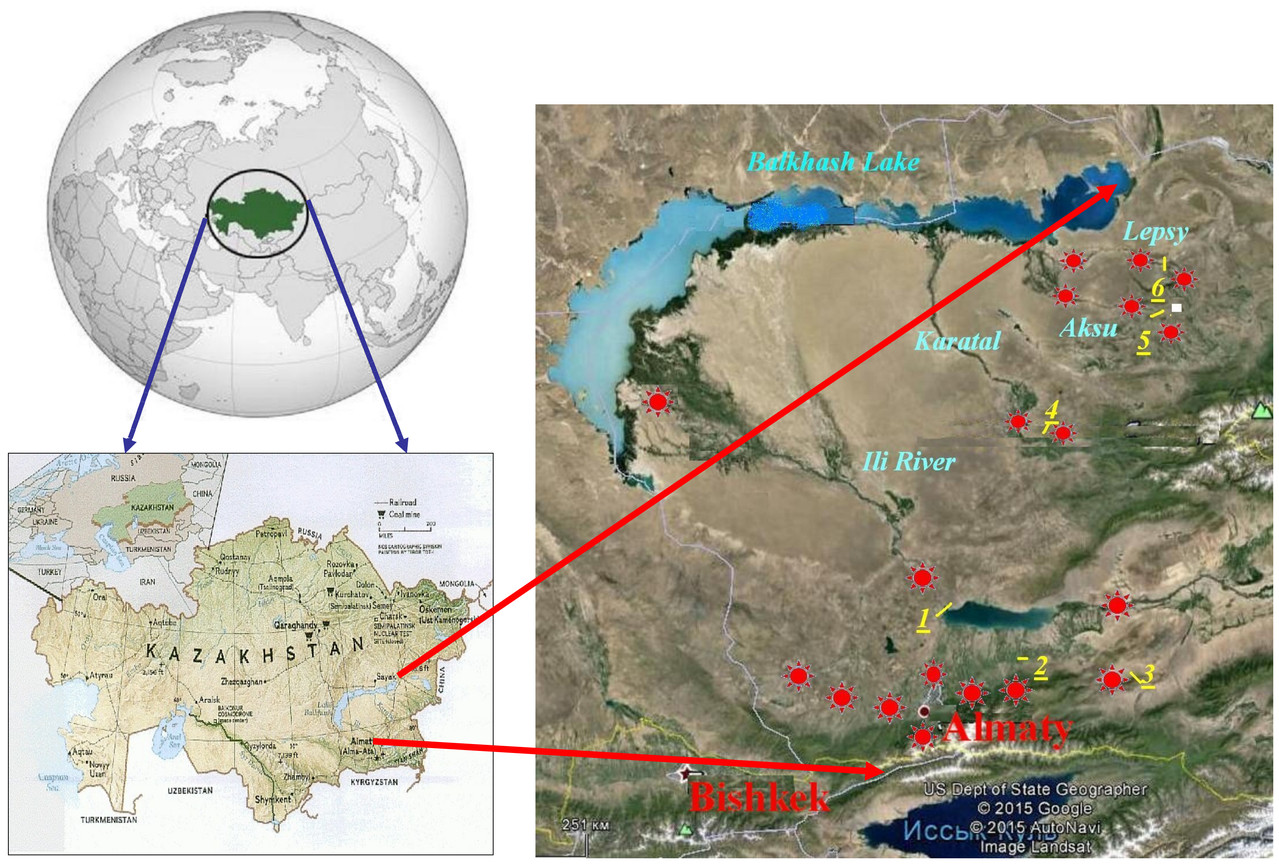

Figure 2. The investigated area (the main sites are indicated by asters). Yellow numbers show some weirs: 1 – Kapshagay, 2 – Bartogay, 3 – Tekes, 4 – Almaly, 5 – Aksu, 6 - Lepsy

Results

•Natural water flow regimen are destroyed now in many investigated sites (figure 3 and 4)

Figure 3. A solid dam (Tyshkan-su River)

Figure 4. A bungle dam (lower reach of Kaskelen River)

•Shrinking of habitats of all indigenous fishes species was detected. Naked osman (*Gymnodiptychus dybowskii*) and spotted stone loach (*Triplophysa strauchii*) are not rare yet. Balkhash marinka *Schizothorax argentatus* (fig.6), Ili marinka *Schizothorax pseudoaksaiensis,* scaly osman *Diptychus maculates,* Seven River's minnow *Phoxinus brachyurus,* Balkhash minnow *Rhynchocypris poljakowii,* plain thicklip loach *Triplophysa labiata*, Severtsov's loach *Triplophysa sewerzowi* and Balkhash perch *Perca schrenkii* (fig.7) urgently need special measures for habitat protection.

Figure 5. Naked osman (*Gymnodiptychus dybowskii*)

Figure 6. Balkhash marinka (*Schizothorax argentatus*)

Figure 7. Balkhash perch (*Perca schrenkii*)

•Significant changes in external morphology of naked osman (fig.8) and spotted stone loach (fig.9) during urbanization time were detected.

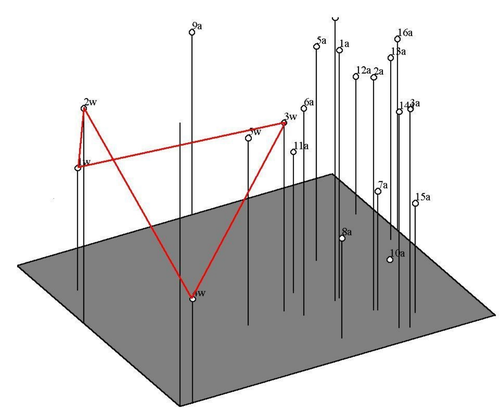

Figure 8. Comparative analysis of morphology of naked osman from Almaty ("w" detected individuals were fixed in the end of 1880[th] and "a" – in the 2008. Principal component analysis.

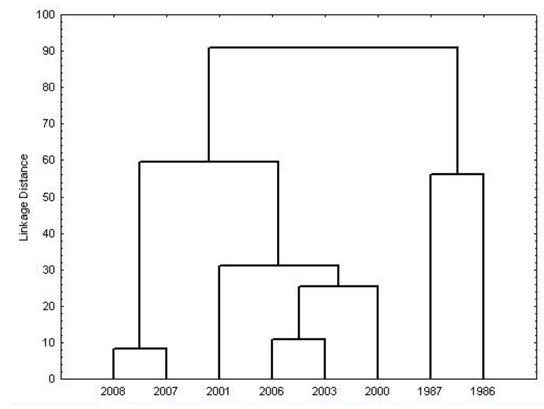

Figure 9. Comparative analysis of morphology of samples of spotted stone loach from Almaty.

•Dam impact on fish assemblages is different and has not well understood here

Dams	Fish assemblages		
	Upper dam	Below dam	Lower reach
Kapchagay	**Mostly alien species**	**Mostly alien species** (similar)	**Alien species only**
Kurty	**Mostly indigenous**	**Alien and indigenous**	**Mostly alien species**
Kaskelen	**Mostly alien species**	**Mostly indigenous**	**Mostly alien species**
Bartogay	**Mostly indigenous**	**Alien and indigenous**	**Alien species only**
Tekes	**Mostly indigenous**	**Mostly indigenous** (similar)	Did not investigated
Almaly	**Mostly alien species**	**Mostly indigenous**	**Alien and indigenous**
Aksu	**Indigenous only**	**Mostly indigenous**	**Alien species only**
Lepsy	**Indigenous only**	**Mostly indigenous**	**Alien species only**

•No significant correlations between water level in river, microbial activity of sediments, mineralization and pH of water were observed.

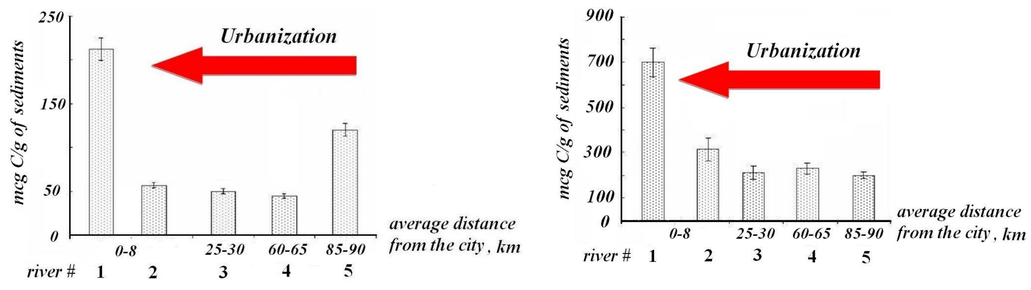

Figure 10 – Soluble organic matter (left) and biomass of microorganisms in rivers: #1 – Kaskelen middle, 2 – Kaskelen top, 3 – Kargaiyly, 4 – Karasu, 5 - Samsy

Chemical element	***River***		
	Kaskelen	**Kargaiyly**	**Samsy**
B, *ug/l*	18.00	30.00	92.00
Mg, *mg/l*	2.300	3.700	14.00
Al, *ug/l*	67.00	260.0	24.00
Si, *mg/l*	2.000	2.900	3.700
P, *ug/l*	31.00	41.00	38.00
S, *mg/l*	5.700	7.300	29.00
Cl, *mg/l*	4.300	7.100	39.00
K, *mg/l*	0.540	1.300	1.600
Ca, *mg/l*	9.400	11.00	20.00
Mn, *ug/l*	1.700	4.800	0.340
Fe, *ug/l*	140.0	380.0	130.0
Cu, *ng/l*	820.0	780.0	1.300
Zn, *ng/l*	750	800	420
Pb *ng/l*	77.00	150.0	20.00

•Composition of fish species was not stable and similar to native in many investigated water bodies. Bigger diversity of indigenous fish species was observed in remote rivers with lower level of human impact.

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