

## **Annotation**

dissertation work on the topic: "Study of the taxonomic composition and condition of the ichthyofauna of small reservoirs of South-Eastern Kazakhstan"  
for the degree of Doctor of Philosophy (PhD)  
in the educational program  
"8D08401 – Fisheries and industrial fishing"  
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General characteristics of the work. The dissertation work is devoted to the study of the taxonomic composition, species diversity and the state of ichthyofauna in lowland, foothill and mountain reservoirs of Southeastern Kazakhstan.

Relevance of the research topic.

Small bodies of water are among the most significant freshwater ecosystems from an ecological point of view. Currently, the importance of small bodies of water is increasingly recognized, given their prevalence, importance for freshwater biodiversity, contribution to ecosystem services, as well as their vulnerability to anthropogenic impacts.

The problem of efficient use of small reservoirs is especially relevant in Central Asia. In the Republic of Kazakhstan, the Lake Balkash basin is one of the largest oases, represented by an extensive hydrological network of river systems, tributaries and small reservoirs. Over the past three decades, the population in the basin has increased rapidly, which has led to negative changes in natural landscapes, an increase in anthropogenic pressure on reservoirs during recreation, a decrease in river runoff and pollution of reservoirs. Small rivers and reservoirs of the Lake Balkash basin remain the last refuge of the native ichthyofauna. Despite the importance of small rivers, the state of biological diversity and the possibilities of using their biological resources are still poorly understood.

The taxonomic composition and species diversity of fish has been studied sporadically in some reservoirs of the basin under consideration. In the species composition of large reservoirs of the basin of the In recent years, several species new to the basin have been discovered. Changes in the species composition of small reservoirs, which are now the main habitats of native ichthyofauna, have not been practically studied over the past 20 years, in general, the inventory of the ichthyofauna of small reservoirs of the Ile – Balkash basin is far from complete.

The purpose of the work is to study the species diversity, taxonomic composition and current state of the ichthyofauna of small reservoirs in Southeastern Kazakhstan in connection with the increasing anthropogenic load.

Research objectives:

1. To study the physico -chemical parameters of water in small reservoirs and watercourses of the Ile river basin
2. To study the current distribution and taxonomic diversity of fish in natural and artificial watercourses and reservoirs of Southeastern Kazakhstan (Ile–Balkash basin);
3. To study the patterns of distribution of the fish population in small reservoirs of the Ile – Balkash basin;
4. To analyze the morphobiological variability of some alien and native fish species in the studied reservoirs of the Ile river basin
5. To analyze the prospects for the conservation of the native ichthyofauna of the Ile - Balkash basin;
6. To assess the impact of economic activity on the ichthyofauna of small reservoirs in Southeastern Kazakhstan.

Object of research: ichthyofauna of small reservoirs of Southeastern Kazakhstan.

Subject of research: distribution, taxonomic composition, species diversity, fish population status, abundance.

Research methods. The dissertation work used traditional methods of biological and morphometric studies of fish and their statistical processing, methods of systematic ecological analysis and multidimensional mathematical analysis.

Scientific novelty of the work:

- for the first time, the modern species composition, occurrence, indicators of diversity and species similarity of fish communities in small reservoirs of Southeastern Kazakhstan have been determined;

-for the first time, as a result of a comprehensive ichthyological study, the oriental loach *Misgurnus anguillicaudatus* (Cobitidae) was discovered in the Shelek River;

- for the first time, the spatial distribution of fish in small reservoirs of the Ile – Balkash basin was analyzed;

- for the first time, the analysis of the conjugation of the structure of the fish population with the environmental factors of the fish habitat in the Ile – Balkash basin at the present stage was carried out.

Theoretical significance of the work: Based on the data obtained, information on the diversity of the taxonomic composition of the ichthyofauna of small reservoirs of the Ile - Balkash basin is summarized. The obtained original ichthyological data on a new species - the oriental loach *Misgurnus anguillicaudatus* (Cobitidae), which expand the understanding of the species diversity of alien fish of the Ile – Balkash basin and will replenish the ichthyological collection of the laboratory of the department. The results of the research on the taxonomic diversity of fish will expand and complement theoretical knowledge and practical data in the field of ichthyology, biology and ecology of fish.

The practical significance of the results obtained. The data obtained can be used:

-during monitoring work in aquatic ecosystems of small reservoirs;

-individual results from the study of native fish can be used in fish farming, in order to expand aquaculture facilities;

-collected ichthyological materials from reservoirs of various types will replenish the stock of collection material of the Department of Biodiversity and Bioresources in the Ile - Balkash basin;

- collection materials can be used to conduct laboratory classes for students, undergraduates and doctoral students of the educational programs "Fisheries and industrial fisheries", "Aquaculture and aquatic biological resources".

The main provisions submitted for protection:

1. The complex impact of anthropogenic factors has led to an increase in the taxonomic composition of the ichthyofauna of small reservoirs in Southeastern Kazakhstan;

2. The main patterns of transformation of fish communities in the mountain rivers of the Ile-Balkash basin consist in an increase in species richness in the direction from the sources to the mouth

3. Non-commercial alien fish species have high ecological plasticity and morphobiological variability, which ensure their wide distribution in various types of reservoirs and watercourses of the Ile – Balkash basin.

4. Joint cultivation of carp in polyculture with Balkhash marinka and Balkhash perch can be one of the solutions for the conservation of valuable native fish species.

The relationship of work with the research program.

The dissertation work was performed by the dissertation candidate himself, as well as within the framework of the program "Studying the diversity of communities and the state of fish populations in a fluctuating environment" (N. Mamilov) 2012-2014

All desk and laboratory studies were performed in the laboratory of the Department of Biodiversity and Bioresources (Kazakhstan), statistical processing was performed during the doctoral student's foreign internship at the ISiEH Zoomonitoring Laboratory (Novosibirsk, Russia) with funding from the Ministry of Internal Affairs of the Republic of Kazakhstan.

The main results and conclusions of the study.

1. The physico –chemical parameters of the aquatic environment of the studied reservoirs showed satisfactory water quality for the existence of most fish species. According to the studied

indicators, the water quality from the mountain sections of the Shelek, Esik and Talgar rivers corresponds to mountain rivers; in most ponds, the water is also in a satisfactory condition, however, in the outgrowth ponds of the Kapshagai spawning farm, an increased content of ammonium ions was observed, which is extremely undesirable for the maintenance of juvenile fish;

2. The modern composition of the fish population of the reservoirs of the Ile - Balkash basin consists of 42 species of fish from 15 families and 8 orders. We have discovered a new alien species of Chinese ichthyofauna – the oriental loach *Misgurnus anguillicaudatus* (Cantor, 1842). In the mountainous and foothill sections of the rivers Yoshik, Talgar, Shelek, Kegen, Shalkodesu, Emel, Shinjila, 8 species of 13 species of native ichthyofauna have been preserved.

3. The results of the multidimensional analysis showed a clear division of the studied reservoirs into several groups in the gradients of the studied abiotic factors. A separate group was formed by mountain reservoirs, with the least number of species. The second group contains the most accessible lowland rivers, where the composition of the fish population is represented by alien species: crucian carp, bream and roach. The third group included reservoirs of medium distance, level of protection and temperature, inhabited by the aboriginal Balkhash marinka, naked Osman, spotted sponge and alien mikizha.

4. The biological and morphometric characteristics of some alien and native species have shown the relative well-being of the studied communities of small reservoirs. The results of a morphobiological study of alien non-commercial species (Amur chebachok, river abbotina, Chinese eleotris, Chinese goby) confirmed the high ecological plasticity and the ability of these species to adapt to various habitat conditions.

5. Small reservoirs of the Ile River basin are acutely experiencing an increasing anthropogenic pressure. The main factors negatively affecting the diversity of the ichthyofauna of small reservoirs in Southeastern Kazakhstan are: reduction of surface runoff, construction of dams, soil erosion; permanent introduction/introduction of new fish species; pollution of surface waters; development of tourism in reservoirs.

6. In some of the studied farms, the co-existence of valuable native fish species with carp was revealed: Balkhash marinka and Balkhash perch. As a result, in the future there is an opportunity to offer fish farmers the technology of multicultural cultivation of carp together with Balkhash marinka and Balkhash perch in polyculture to preserve valuable native ichthyofauna.

The author's personal contribution consists in the collection and analysis of literary data, in the systematic conduct of field and laboratory research. The reliability of the results was based on real material processed by methods of mathematical statistics.

Approbation of the work.

The main provisions of the dissertation are presented in 17 printed works, of which: 3 articles in an international scientific publication included in the Scopus database:

1. Nadir Mamilov, Sayat Sharakhmetov, Fariza Amirbekova, Dinara Bekkozhayeva, Nazym Sapargaliyeva, Gulnar Kegenova, Ainur Tanybayeva, Kanatbek Abilkasimov. Past, Current and Future of Fish Diversity in the Alakol Lakes (Central Asia: Kazakhstan) // In the journal included in the SCOPUS database. Diversity 2022, Volume 14, Issue 1, 11. <https://doi.org/10.3390/d14010011>

2. E. D. Vasil'eva, G. B. Kegenova, S. E. Sharakhmetov and N. Sh. Mamilov. *Misgurnus anguillicaudatus* (Cobitidae): a New Non-Native Species Naturalized in Water Bodies of the Balkhash-Ili Basin, Kazakhstan // Journal of Ichthyology, 2024, Vol. 64, No. 1, pp. 90–98. <https://DOI:10.1134/S0032945224010107>

3. N. Sh. Mamilov, M. Tursynali, G. K. Khassengazyeva, Jan Urban, Dinara Bartunek, S. E. Sharakhmetov, N. Sapargaliyeva, Zh. Urgenishbayeva, G. B. Kegenova, E. Kozhabaeva, M. Baimukanov and B. Levin. Alien Rainbow Trout *Oncorhynchus mykiss* in the Balkhash Basin (Kazakhstan, Central Asia): 50 Years of Naturalization. Animals 2024, 14 (20), 3013;

<https://doi.org/10.3390/ani142030133>

3. Articles in journals from the list recommended by the Committee for Control in the field of Education and Science of the Ministry of Education and Science of the Republic of Kazakhstan:

1. Kegenova G.B., Sharakhmetov S.E., Musagali A. Morphological variability of Amur chebachka *Pseudorasbora parva* (Schlegel, 1846) in small reservoirs of the Balkhash basin//Bulletin of KazNU: biological series. No.1.T 90. 2022. pp.138-147 <https://doi.org/10.26577/eb.2022.v90.i1.12>

2. Kegenova G.B. Morphobiological characteristics of river abbotina from small reservoirs of the Balkhash basin// Bulletin of KazNU: ecological series. No.3.T 72. 2022. pp.94-112. <https://doi.org/10.26577/EJE.2022.v72.i3.09>

3. Kegenova G.B. Fish communities in small reservoirs of the river basin. Ile // Fish communities in small reservoirs of the Ile river basin. <https://doi.org/10.26577/eb.2023.v94.i1.011>

The results of the dissertation were reported and discussed at 6 international scientific and practical conferences:

1. Mamilov N.S., Amirbekova F.T., Kegenova G.B., Sharakhmetov S.E., Tursunali M.T. Problems of fish farming in small reservoirs of the Balkhash basin (Republic of Kazakhstan)//Reports of the TLC: a collection of articles. Moscow State Agricultural Academy named after K.A. Timiryazev. - Moscow, Publishing House of the Russian State Agrarian University. The Ministry of Agriculture, 2021. pp.550-552.

2. Mamilov N.S., Sharakhmetov S.E., Amirbekova F.T., Khasengazieva G.K., Kegenova G.B., Tursunali M.T. Modern problems of rational use of fish resources in the foothill zone of the Balkhash basin// in the mat.conf. "Global Science and Innovation 2021:Central Asia", Series: Ecology/Earth Science, No.1 (12), Nur Sultan, February, 2021. pp.39-43.

3. Kegenova G.B., Mamilov N.Sh., Musagali A.K. Dynamics of fish diversity in some small water bodies in the Balkhash basin (Central Asia) // "Invasion of Alien Species in Holarctic. Borok-VI». Book of abstracts. 11-15 october, 2021. p.102.

4. Kegenova G.B. Species diversity of weedy fish in pond farms of the Almaty region // in the VI international conference. "The current state of aquatic bioresources", Novosibirsk, 2021. pp.132-136.

5. Mamilov N.Sh., Sharakhmetov S.E., Amirbekova F.T., Sapargalieva N.S., Kegenova G.B., Tursunali M.T., Urgenishbaeva J.I. Resource potential of small rivers of the Balkhash basin // in mat.conf. Borok – 65, Borok city. 2021. pp.154-160.

6. Kegenova G.B., Kegenov E.B., Tursynali M.T. New aquaculture facilities in warm-water fish farms//"Global science and innovation 2021:Central Asia". №4 (15). 2021. Series: "agricultural sciences". pp. 41-43.

7. Kegenova G.B. Diversity of alien fish species in pond farms of the Almaty region//Materials of the international scientific conference of students and young scientists "Farabi Alemi" on April 5-6, 2022, pp.78-79.

8. Kegenova G.B., Yerlikyzy B. Balkhash – Ile bassinde zhurgizilgen zhersindiru zhymystaryn natizheleri // Materials of the international scientific conference of students and young scientists "Farabi Alemi" April 5-6, 2022. – Almaty: Kazakh University, 2022. 102-103 b.

9. N.Mamilov, G. Khassengaziyeva, M. Kossaibay, G.B.Kegenova, I. Magda Towards ecological friendly pond aquaculture in the Ili River basin (Kazakhstan, Central Asia) BIO Web Conf.Vol.100, (2024).International Scientific Forum “Modern Trends in Sustainable Development of Biological Sciences” (IFBioScFU) <https://doi.org/10.1051/bioconf/202410004028>

Publications. Based on the materials of the dissertation, 17 scientific papers were published, including 3 articles in an international peer-reviewed journal with an impact factor indexed by Web of Science and in Scopus, 3 articles in journals recommended by the Committee for Quality Assurance in Education and Science (COXON) The Ministry of Foreign Affairs of the Republic of Kazakhstan, 11 international scientific conferences.

The structure of the dissertation. The dissertation work consists of an Introduction, 3 main chapters, a conclusion and a list of literature sources from 330 titles. The volume of the work is 159 pages and includes 58 tables, 37 figures and 4 appendices.