ANNOTATION

dissertation for the degree of Doctor of Philosophy (PhD)
in the specialty "8D08401 - Fisheries and industrial fishing"

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« Fish assemblages and state of fish populations in the Alakol watershed»

General description of work. In the dissertation work, fish communities and the state of their populations, the dynamics of the ichthyofauna, morphological features and genetic diversity of native fish species of the Alakol basin were studied.

Relevance of the research topic. The ichthyofauna is the most important part of the ecosystem of reservoirs. The species composition and population characteristics of the fish community are reliable indicators of the state of the reservoir as a whole. In recent decades, monitoring studies of aquatic ecosystems have become important due to the increased impact on the environment.

The rational use of fish resources cannot be carried out without a detailed study of the ecological features of hydrobionts. The fishery significance of reservoirs is determined by the diversity and current state of fish populations. In this regard, a comprehensive study of the fish communities of the reservoirs of the Alakol basin is becoming important. In conditions of constantly increasing anthropogenic impact on reservoirs, it is necessary to have reliable information about the state of the organisms inhabiting them. This makes it possible to determine the direction of changes, timely implement measures to prevent damage to the natural environment, and obtain the necessary fish products. This dictates the need to study materials on the ecology of fish and determine the causes that can reveal changes in the species' composition and the number of their communities.

The study of the composition and distribution of fish communities in the reservoirs of the Alakol watershed with different characteristics has a scientific and practical interest.

Purpose of the work. To study the diversity of fish communities and assess the state of their populations in the conditions of the Alakol basin.

Research objectives. In accordance with the purpose of the work , the following tasks were formulated:

1. To study the species composition of the ichthyofauna of the Alakol basin and assess the state of the fish habitat;
2. To study the long-term dynamics of the diversity of the ichthyofauna of the Alakol basin;
3. To study the variability of biological and morphological parameters of some fish species of the Alakol basin;
4. To investigate the genetic (and taxonomic) diversity of native fish species of the Alakol basin.

Objects of research: Fish communities in the Alakol basin: rivers of the Zhetysu Alatau (Shynzhyly, Tentek, Zhamants, Yrgayty, and Tokty), rivers of the Barlyk ridge

(Shagantogai and Tasty), rivers of the southern slope of the Tarbagatai ridge (Karakol, Urzhar, Katynsu, and Emel), shallow waters of lakes Alakol, Sasykkol, and Zhalanashkol.

Research methods: In the course of the work, ichthyological, morphometric, statistical, molecular genetics and cartographic methods were used.

Scientific novelty of the research. For the first time, the species composition, occurrence, indicators of diversity, and similarity of fish communities in the Alakol basin were determined.

The theoretical significance of the work. For the first time, as a result of a comprehensive ichthyological study, the Gobio sp. minnow was discovered in the Emel River, which is a new alien species for the Alakol basin.

The long-term dynamics of ichthyofauna diversity and interspecific similarity of fish distribution, as well as possible relationships between abiotic factors (mineralization, turbidity, temperature, pH, ammonium and nitrate content) and the number of species in 47 localities of the Alakol basin were studied for the first time.

For the first time, comparative biological and morphological indicators of populations of individual fish species of the Alakol basin have been studied using multidimensional statistics.

For the first time, the nucleotide sequence of the mtDNA marker COI of native species (Balkhash perch, naked osman, Spotted thicklip loach, Plain thicklip loach, Tibetan stone loach and Severtsov's loach) of fish of the Balkash-Alakol basin was determined.

For the first time, phylogenetic analyses were performed and haplotype networks of native fish species of the Balkhash-Alakol basin were constructed based on DNA barcoding analysis using the mitochondrial COI gene.

The theoretical value of the research.

The processes of microevolution in the populations of six native and one alien fish species new to the basin have been studied at the morphological and genetic levels. It is shown that the high morphological variability of isolated populations is more determined by habitat conditions than by genotypic differences.

The practical value of the research.

The study of the taxonomic composition and systematics of fish in the Alakol basin revealed the dynamics of diversity and the current state of populations of native species. The data obtained will help to avoid the loss of unique species and unnecessary economic costs for the preservation of temporary forms. Comparison of the external functional characteristics of fish in connection with their habitat allows for early diagnosis of changes in aquatic ecosystems. An integrated assessment of the state of aquatic ecosystems and fish populations makes it possible to rank the problems of their conservation in order to make the most adequate socio-economic decisions on the conservation and rational use of the existing fish diversity and to avoid significant economic costs due to the loss of environmental sustainability in the basin of the Alakol Lakes.

The main statements for defense.

1. The increase in anthropogenic load and climate changes have led to significant changes in the abiotic parameters of the habitat (water level, turbidity, temperature, mineralization, content of biogenic elements) in most of the studied reservoirs of the Alakol basin.

2. Currently, the ichthyofauna of the Alakol basin consists of 11 native and 14 alien fish species. Thus, the Alakol basin remained the last major refuge for endemic fish species of the Balkhash-Alakol ichthyogeographic province. In the long-term aspect, fragmentation of the habitats of native species and homogenization of the composition of the ichthyofauna in many reservoirs of the basin were noted.

3. In the long-term aspect, there was a decrease in the size and weight indicators of 5 native fish species, and the variability of most morphometric indicators remained within known limits.

4. The results of molecular genetic studies have not revealed taxonomic differences between the populations of Naked osman, Balkhash perch, Severtsov's loach, Plain thicklip loach, and Spotted thicklip loach from the Balkash and Alakol basins.

Personal contribution of the author.

The author was directly involved in collecting field materials, conducting biological and morphometric analyses of fish, performing molecular genetic and bioinformatic analyses, mapping and statistical processing of the data obtained. The author also analyzed, summarized and presented the results obtained, formulated conclusions. The text of the dissertation was written according to the plan agreed with the scientific supervisors. The share of the author's personal participation in joint publications is proportional to the number of co-authors.

Approbation of work.

The results of the research and the main provisions of the dissertation were reported and presented at various international scientific conferences: International Scientific Conference of Students and Young Scientists «Farabi Alemi» (Almaty, Kazakhstan, 2020, 2021, 2022), IX International Scientific and Practical Conference «Climate, ecology, agriculture of Eurasia» (Irkutsk, Russia, 2020), International scientific and practical conference of the teaching staff dedicated to the 155th anniversary of the K.A. Timiryazev Russian State Agricultural Academy (Moscow, Russia, 2020), The 5th Symposium on EuroAsian Biodiversity (Muğla, Turkey & Almaty, Kazakhstan, 2021), Sixth International Symposium «Invasion of Alien Species in Holarctic. Borok-VI» (Borok, Russia, 2021), All-Russian scientific conference dedicated to the 65th anniversary of the I.D. Papanin Institute of Biology of Inland Waters of the Russian Academy of Sciences «Biology of aquatic ecosystems in the XXI century: facts, hypotheses, trends» (Borok, Russia, 2021).

Publications. 14 scientific papers have been published on the topic of the dissertation, including 9 theses in the materials of International scientific and practical conferences, 4 articles in the scientific journals "Bulletin of KazNU" in the biological

and ecological series included in the list of the Committee for Quality Assurance in the Sphere of Education of the Ministry of Education of the Republic of Kazakhstan and 1 article in the journal "Diversity" included in the database Scopus and Web of Sciences.

The structure of the dissertation. The dissertation work consists of an introduction, 3 main chapters, a conclusion and a list of literature sources from 315 titles. The volume of the work is 131 pages and includes 47 tables, 25 figures and 3 appendices.