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on the dissertation submitted for the degree of Doctor of Philosophy (PhD) in the educational program "8D08401 –Fish Industry and Industrial Fishery" on the topic "Parasites of commercial fish species of the Small Aral Sea"

ABSTRACT

General description of the dissertation. The dissertation summarizes the results of the parasitological and ichthyological studies conducted in the Small Aral Sea, and also presents scientifically grounded recommendations for ensuring epizootic welfare in the studied water area.

Relevance of the research topic. The development of the agro-industrial complex of the Republic of Kazakhstan, including ensuring the stable and efficient functioning of the fisheries sector, is one of the priority directions of state policy. In this regard, the rational use and conservation of the fish resources of natural water bodies, increasing the efficiency of their natural reproduction, maintaining biological diversity, and providing scientific support for measures aimed at the sustainable development of the fisheries sector are of particular importance.

Within the framework of the implementation of state programs, work is being carried out to gradually restore the northern part of the Aral Sea (the Small Aral) in order to develop the fishery and increase the fish productivity of the water body. Changes in the hydrological and hydrochemical conditions in this region directly affect the species composition, distribution, and living conditions of hydrobionts. In this regard, the need for a comprehensive study of the biological and ecological state of the organisms of aquatic ecosystems, especially commercially important fish species, is increasing.

Diseases of various etiologies reduce the productivity of fish, worsen their physiological condition, and may cause mass mortality, thereby inflicting significant economic damage on the fishery. Accordingly, studying the parasite fauna of fish, revealing the patterns of distribution of parasitic diseases, and developing scientifically grounded measures for their prevention and control constitute one of the important directions of modern ichthyological and parasitological research.

The aim of the dissertation is to study the parasite fauna of commercially important fish in the Small Aral Sea, to determine the indices of infection, and to develop scientifically grounded recommendations for the prevention of parasitic diseases and the assurance of epizootic welfare.

Research objectives:

1. To determine the species composition of the commercial ichthyofauna of the Small Aral Sea.
2. To study the parasite fauna of the commercial fish of the Small Aral Sea.
3. To carry out a statistical analysis of the level of parasite infection of the commercial fish of the Small Aral Sea on the basis of Wilson confidence intervals and the binomial distribution.

4. To develop scientifically grounded recommendations for ensuring epizootic welfare in order to conserve and sustainably use the fish resources of the Small Aral Sea.

Object of research. Commercial fish inhabiting the Small Aral Sea; metazoan parasites.

Scientific novelty of the research. New data on the commercially important fish of the Small Aral Sea were obtained. For the first time, their parasite fauna was comprehensively studied and the species composition of metazoan parasites was determined. In addition, widespread parasite species of high pathogenic significance were identified. On the basis of the results of the studies, scientifically grounded recommendations aimed at preventing the parasitic diseases of the commercial fish of the Small Aral Sea were developed.

Practical significance of the work. The results of the research supplement contemporary scientific data on the species composition of the commercially important fish species of the Small Aral Sea and their parasite fauna.

The scientifically grounded recommendations for the prevention of parasitic diseases may be applied in the practical activities of fishery, nature-conservation, and research organizations in the planning and implementation of measures to conserve fish resources, increase fish productivity, and ensure the sustainable development of the fishery of the Small Aral Sea.

Main provisions submitted for defense:

1) The species composition and main biological indicators of the commercially important fish of the Small Aral Sea.

2) The species composition of the metazoan parasites of the commercial fish of the Small Aral Sea.

3) The results of the statistical analysis of the level of parasite infection of the commercially important fish of the Small Aral Sea on the basis of Wilson confidence intervals and the binomial distribution.

4) Scientifically grounded recommendations for ensuring epizootic welfare in order to conserve and sustainably use the fish resources of the Small Aral Sea.

Main results and conclusions of the research.

1. As a result of the studies conducted in 2020–2025, it was established that the current ichthyofauna of the Small Aral Sea consists of 22 fish species, 16 of which are commercially important. These are: bream (*Abramis brama*), pikeperch (*Sander lucioperca*), pike (*Esox lucius*), asp (*Leuciscus aspius*), common carp (*Cyprinus carpio*), Prussian carp (*Carassius gibelio*), roach (*Rutilus lacustris*), sabrefish (*Pelecus cultratus*), snakehead (*Channa argus*), wels catfish (*Silurus glanis*), grass carp (*Ctenopharyngodon idella*), silver carp (*Hypophthalmichthys molitrix*), white-eye bream (*Ballerus sapa*), shemaya (*Alburnus chalcoides*), rudd (*Scardinius erythrophthalmus*), and flounder (*Platichthys flesus*).

Analysis of population dynamics showed that the numbers of bream and roach have decreased, whereas those of Prussian carp and common carp have increased. During the study period, flounder and rudd were not recorded in the catches, and white-eye bream was caught only in 2021, as a single specimen. In this regard, these species,

despite their commercial importance, are currently assessed as rare fish in the Small Aral Sea.

2. As a result of the ichthyoparasitological studies, 45 parasites were identified in the commercial fish: *Diplostomum helveticum*, *D. mergi*, *D. spathaceum*, *D. volvens*, *D. gobiorum*, *Ichthyocotylurus variegatus*, *Posthodiplostomum cuticola*, *Tylodelphys clavata*, *Ancyrocephalus paradoxus*, *Thaparocleidus siluri*, *Dactylogyrus sphyrna*, *D. tuba*, *D. pavlovskyi*, *D. extensus*, *D. simplicimalleatus*, *D. auriculatus*, *D. wunderi*, *Gyrodactylus gasterostei*, *G. cernuae*, *G. elegans*, *Diplozoon paradoxum*, *Sindiplozoon strelkowi*, *Inustiatus inustiatus*, *Paradiplozoon pavlovskii*, *P. vojteki*, *P. rutili*, *Glanitaenia osculata*, *Khawia sinensis*, *Ligula interrupta*, *Camallanus truncatus*, *C. lacustris*, *Porrocaecum reticulatum*, *Philometra ovata*, *Contracaecum microcephalum*, *Pseudocapillaria tomentosa*, *Achtheres percarum*, *Lamproglena pulchella*, *Ergasilus briani*, *E. sieboldi*, *Sinergasilus major*, *Argulus foliaceus*, *Dactylogyrus* sp., *Gyrodactylus* sp., *Nematoda* spp., and *Lernaea* sp.

The highest infection indices were recorded in five fish species. In pike, 7 parasite species were identified, among which *Diplostomum spathaceum* was dominant (EI – 40%, II – 1–66 specimens). In silver carp, 3 parasite species were recorded, with *D. spathaceum* determined as the dominant species (EI – 51.7%, II – 1–100 specimens). In wels catfish, 6 parasite species were identified, among which *Glanitaenia osculata* was predominant (EI – 35%, II – 1–100 specimens). In bream, the species diversity of parasites was the highest, with 17 species recorded, among which *Diplozoon paradoxum* was dominant (EI – 26.5%, II – 1–48 specimens). In pikeperch, 16 parasite species were identified, among which *Ergasilus sieboldi* was the predominant species (EI – 16.5%, II – 1–25 specimens).

An average level of infection was observed in six fish species. In sabrefish, 15 parasite species were identified, among which *D. spathaceum* was dominant (EI – 11.73%, II – 1–20 specimens). In roach, 17 parasite species were recorded, with *Tylodelphys clavata* determined as the dominant species (EI – 4.47%, II – 1–45 specimens). In grass carp, 6 parasite species were identified, with *Sindiplozoon strelkowi* predominant (EI – 16.1%, II – 1–15 specimens). In shemaya, 4 parasite species were recorded, among which *D. paradoxum* was predominant (EI – 32.3%, II – 1–11 specimens). In asp, 11 parasite species were identified, with *Lamproglena pulchella* dominant (EI – 6.5%, II – 1–2 specimens). In snakehead, 3 parasite species were recorded, among which *D. spathaceum* was dominant (EI – 25%, II – 2–6 specimens).

The lowest infection indices were recorded in Prussian carp and common carp. In Prussian carp, *D. spathaceum* and *C. microcephalum* were identified, and in common carp, *T. clavata* and *D. mergi*. For these parasites, the extensity of invasion ranged from 0.9 to 2.27%, while the intensity of invasion did not exceed one specimen.

A comparative analysis showed that, before the catastrophic desiccation of the Aral Sea, 70 species of metazoan parasites were recorded in commercial fish, whereas at the present stage 45 parasites have been identified in the fish of the Small Aral Sea. Although the species composition of the parasite fauna has changed, the level of parasite infection in the main commercial fish has remained high.

The molecular-genetic studies carried out confirmed the taxonomic affiliation of *Diplozoon paradoxum*, *Glanitaenia osculata*, *Lamproglena pulchella*, and *Argulus foliaceus* on the basis of the *18S rRNA* gene (97.4–100% similarity). Although a 97.4% similarity based on the *18S rRNA* gene was found in the *Achtheres percarum* samples, their morphological features indicated that they belong to this species. As for the *Porrocaecum reticulatum* sample, despite showing 99.6% similarity, its taxonomic status was not definitively established owing to the conservative nature of the *18S rRNA* gene. In addition, as a result of sequencing based on the COX1 mitochondrial marker, a high-quality nucleotide sequence was obtained only from the *L. pulchella* samples.

3. Statistical analysis showed that the extensity of parasite invasion is not uniformly distributed among the studied years and fish species. The statistically highest values of the extensity of invasion were recorded in pikeperch in 2020 (Wilson confidence interval – 34.63–52.23%; $p<0.001$), in shemaya (38.57–63.43%; $p<0.001$) and bream (26.01–50.59%; $p<0.001$) in 2021, and in bream (48.12–76.41%; $p<0.001$) and pikeperch (63.98–96.50%; $p<0.001$) in 2025. In 2024, no statistically significant differences in the extensity of invasion were found among the studied fish species ($p>0.05$).

4. On the basis of the research results, scientifically grounded recommendations aimed at ensuring epizootic welfare in order to conserve and sustainably use the fish resources of the Small Aral Sea were developed.

Relationship of the work with scientific research programs. The dissertation was carried out within the framework of budget program 217 of the Ministry of Education and Science of the Republic of Kazakhstan, under grant project No. AP08955829 “Study of the ichthyofauna and parasite fauna of the commercial fish of the Small Aral in order to develop recommendations for ensuring epizootic welfare” for 2020–2021, as well as within the framework of budget program 267 of the Ministry of Agriculture of the Republic of Kazakhstan, under scientific and technical program No. BR23591095-OT-24 “Comprehensive study of the conservation and sustainable use of aquatic biological resources on the basis of assessing the potential of water bodies and modeling the dynamics of stocks” for 2024–2026.

Personal contribution of the author. The field (expedition) work, including sampling; the laboratory studies on the processing of biological material and the identification of parasites; the analysis and statistical processing of the obtained data; the interpretation of the results; and the formatting of the dissertation were carried out independently and with the direct participation of the doctoral student. The formulation of scientific conclusions and the preparation of scientific publications were carried out with the methodological support of the scientific consultants.

Correspondence to the main directions of the development of science or to state programs.

– “State Program for the Development of the Agro-Industrial Complex of the Republic of Kazakhstan for 2017–2021,” Resolution of the Government of the Republic of Kazakhstan No. 423 of July 12, 2018.

– “Program for the Development of the Fishery for 2021–2030,” approved by Resolution of the Government of the Republic of Kazakhstan No. 208 of April 5, 2021.

– Law of the Republic of Kazakhstan No. 593 of July 9, 2004 “On the Protection, Reproduction, and Use of Wildlife” (with amendments and additions as of March 28, 2026).

Publication of the dissertation results. In total, 9 scientific works were published on the results of the dissertation research. These include 1 recommendation, 5 scientific articles in publications recommended by the Committee for Quality Assurance in the Sphere of Science and Higher Education of the Ministry of Science and Higher Education of the Republic of Kazakhstan, 1 article in the journal “International Journal of Parasitology: Parasites and Wildlife,” indexed in the Scopus and Web of Science databases, as well as 2 articles in the proceedings of international scientific and practical conferences.

Approbation of the research results. The results of the dissertation research were discussed at scientific and practical conferences:

– Proceedings of the “FARABI ÁLEMI” (“The World of Al-Farabi”) conference of young scientists and students. – Almaty, 2020.

– Proceedings of the international scientific and practical internet conference. – Pereiaslav, 2021. – Vol. 78.

Volume and structure of the dissertation.

The dissertation is presented on 152 pages of computer-typed text and consists of an introduction, a literature review, research materials and methods, the results of the author’s own research, an analysis and evaluation of the research results, a conclusion, a list of references, and appendices. The dissertation is illustrated with 35 tables and 56 figures. The list of references includes 185 titles.