

## ANNOTATION

**dissertation work of Zhumabayev Askhat  
on the topic «Veterinary and sanitary safety of fish in the reservoirs of the  
West Kazakhstan region» submitted for the degree of Doctor of Philosophy  
(PhD) in the educational program  
8D09102 – «Veterinary sanitary»**

**Relevance of the research topic.** Every year, the issue of food safety becomes increasingly relevant, as ensuring the safety of food products and raw materials plays a crucial role in determining people's health and preserving the gene pool. Ensuring high quality and safety of food products is essential for maintaining food independence and is a priority task of state policy in the field of healthy nutrition in the Republic of Kazakhstan.

In modern conditions, due to human impact on the environment, a significant amount of pollutants with varying degrees of toxicity enters water bodies, negatively affecting the living organisms residing in the water. Such factors include the widespread use of various protective agents in agriculture, insufficient treatment of wastewater from industrial and municipal enterprises, as well as the release of radioisotopes into the environment from uranium extraction enterprises. These processes lead to increased pollution of water bodies used for fish farming with toxic compounds harmful to aquatic organisms.

Additionally, parasitic diseases lead to a decrease in the quality of fish products. Infected fish exhibit stunted growth, and the development of clinical signs of helminthic infections renders them unsuitable for consumption by both humans and animals unless special disposal measures are taken. The increasing impact of anthropogenic factors on the environment results in unusual changes associated with excessive levels of highly toxic harmful substances such as lead, cadmium, selenium, arsenic, mercury, and others.

Due to their widespread presence in the hydrosphere and high toxicity to aquatic organisms, including fish, the study of these substances becomes particularly relevant.

**This dissertation study aimed** The aim of the research is to ensure veterinary and sanitary safety of fish inhabiting the water bodies of West Kazakhstan Region (WKO) and sold in retail outlets in the city of Uralsk. This includes determining the parasitic infestation of fish, assessing the content of antibiotics and radionuclides in the products, and developing a method for eliminating heavy metal compounds from the bodies of fish.

### **Research objectives**

1. Study the spread of invasive fish diseases in the West Kazakhstan Region (WKR).
2. Conduct veterinary and sanitary examinations of fish sold in retail outlets in the city of Uralsk.

3. Determine the levels of heavy metal salts and radionuclides in fish from water bodies in WKR.
4. Conduct experiments to eliminate heavy metals from the bodies of fish.
5. Present the results of chemical analysis of fish meat when exposed to biological and chemical factors.

**Materials and research methods** The research work and practical tests were conducted at the Higher School of "Veterinary and Biological Safety" and at the testing center. The testing center is accredited in the Republic of Kazakhstan's accreditation system in accordance with the requirements of GOST ISO/IEC 17025-2019 "General requirements for the competence of testing and calibration laboratories," under certificate number KZ.T.09.E0858 dated March 15, 2022. Research on fish regarding residual antibiotics, heavy metal compounds, and radionuclides was conducted at the West Kazakhstan branch of the Republican State Enterprise "Republican Veterinary Laboratory" under the Ministry of Agriculture of the Republic of Kazakhstan. Sample collection was carried out by visiting fishery water bodies in the West Kazakhstan region.

#### **The main provisions for defense**

1. Determining the level of pollution in the natural fish farming water bodies of the West Kazakhstan Region.
2. Assessing the quality and antibiotic residues in fish and fish products obtained from trading points in the city of Oral.
3. Investigating the biosecurity of fish in the water bodies of the West Kazakhstan Region.
4. Changes in fish meat due to parasitism and heavy metal exposure.
5. Studying methods for removing heavy metals from fish organisms.

#### **Description of the main results of the study**

The study of fish infestation in the water bodies of the West Kazakhstan region with ligulosis showed that out of 1726 specimens, the prevalence index (PI) was 5.8%, with 2 cases of infection found in crucian carp and roach. For postdiplostomosis, the PI was 10.6%, with 6 cases of infection found in crucian carp and redfin.

In the analysis of 61 fish specimens, the physicochemical parameters were only within the norm when reacting to 5% sulfuric acid copper; in five samples, there were slight flakes present, the Nessler number in five samples was  $1.1 \pm 0.01$ , the reaction to peroxidase was negative in five samples, and the extract immediately turned brownish-brown. The pH in five samples was  $7.1 \pm 0.01$ , indicating questionable freshness. According to the results of laboratory studies on fish products from trading points in Uralsk, all 52 samples met the standards.

In the trading points of Uralsk, 8 specimens of fish from the family *Aspidiotus* (pike perch) were found to have anisakid larvae, with a prevalence index of 28%, and 8 cases of infection. Among all 98 examined fish, anisakids were found in 8 specimens. In the river Bagyrlyay, 7 specimens of fish (*ide*) were diagnosed with opisthorchiasis, with a prevalence index of 17%, and 7 cases of infection.

The study of heavy metals and radionuclides showed that the detected levels

of lead, cadmium, arsenic, mercury, cesium-137, and strontium-90 did not exceed the permissible limits (GOST 33824-2016, GOST 26927-86, GOST 32161-2013), allowing for a positive veterinary and sanitary assessment of the quality and safety of the studied fish from the water bodies and trading points of the West Kazakhstan region.

The results indicated that the levels of residual lead compounds in the ichthyofauna of the water bodies in the West Kazakhstan region varied widely. In the river Berezovka, cadmium (0.02 mg/kg) and lead (0.33 mg/kg) were found, which is associated with the proximity to the Karashaganak oil and gas fields. In the other samples, heavy metals, arsenic, and mercury were not detected.

The widespread use of veterinary drugs and antibiotics in aquaculture is a significant issue concerning food safety, particularly the presence of antibiotic residues in fish products. In 5 samples of smoked swordfish purchased at the "Ayazhan" market, residual levels of chloramphenicol were detected within the permissible limit of  $0.076 \pm 0.012$ .

Out of 91 examined samples (2022-2023) of fish and other aquaculture products, residues (chloramphenicol and tetracycline group) were found in 6 samples, accounting for 12% of the total number of examined samples. The levels of chloramphenicol and tetracyclines ( $0.05 \pm 0.0014$ ) did not exceed the established permissible limits. These drugs are used in fish farms to prevent the rapid spread of infectious diseases, to store feed, and to preserve fish products.

In conclusion, it can be noted that the levels of tetracyclines and chloramphenicol in fish products do not exceed the established norms (GOST 31903-2012), which may be related to technological processing resulting from antibiotic use. The high rates of industrial development, the active process of urbanization, the growth of the food industry, and the intensification of the oil sector in the region all significantly impact the ecological situation, both locally and in terms of global resource management. When toxic substances enter the aquatic environment, they are distributed among the components of the aquatic ecosystem. Toxic substances can accumulate in the tissues of fish because they are the primary species of hydrobionts and serve as one of the last links in food chains.

For the first time, research has been conducted on the diagnosis of fish invasions that are dangerous to the population, the diagnosis of heavy metal salts and radionuclides in the water bodies of West Kazakhstan, and the veterinary and sanitary examination of fish sold in domestic trade outlets.

Based on parasitological indicators, the fish caught for study from the water bodies of the West Kazakhstan region, despite meeting the quality standards for fish products, are considered conditionally fit for human consumption due to the presence of anisakidosis, postdiplostomosis, ligulosis, and eustrongyloidiasis.

**Justification of the novelty and importance of the results obtained.** Methodological recommendations titled "On the Parasitological Study of Fish (Anisakidosis, Opisthorchiasis, Postdiplostomosis, Ligulosis, Eustrongyliasis)" have been developed, providing data on the prevalence of fish invasions in the water bodies of the West Kazakhstan region, as well as monitoring the content of toxic substances in fish that are hazardous for human consumption. This includes

"Monitoring the Safety of Fish and Fish Products Regarding the Content of Heavy Metal Salts, Radionuclides, and Antibiotics from the Water Bodies of WKR."

A total of 11 scientific works were published on the topic of the dissertation, including 1 article in peer-reviewed scientific journals indexed in the Scopus database, 4 in publications recommended by the Committee for Control in Education and Science of the Ministry of Education and Science of the Republic of Kazakhstan, and 3 in the proceedings of international scientific and practical conferences. Two recommendations were developed and published, and one protective document was obtained in Kazakhstan.

A method for removing heavy metal salts from fish bodies, titled "Method for Removing Cadmium from Fish Raw Materials," has also been developed and registered as a utility model No. 8012 on April 28, 2023.

#### **Relevance to scientific development directions or state programs.**

All results and conclusions presented in the dissertation were obtained and formulated with the direct involvement of the candidate in accordance with the individual research plan of the doctoral student. The doctoral student mastered all research methods, actively participated in the discussion and publication of the results obtained, and was involved in the preparation and formatting of scientific articles for publication in domestic and international journals.

#### **Description of the doctoral student's contribution to the preparation of each publication.**

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#### **Scope and structure of the dissertation.**

The dissertation is presented on 124 pages of computer text. It consists of an introduction, literature review, materials and methods, results of the author's research, discussion, and conclusion. The work includes 214 references, 28 figures, 12 appendices, and 19 tables.