



Section 1. Biology

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DYNAMICS OF FISHERIES IN INLAND WATERS OF THE REPUBLIC OF KARAKALPAKSTAN

**Matmuratov Muratbay Allamuratovich ¹,
Kosnazarov Kudaibergen Aitmambetovich ¹,
Kosnazarov Kuatbergen Kudaibergenovich ¹**

¹ Berdakh Karakalpak State University Republic of Uzbekistan

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Abstract

The paper presents the dynamics of fisheries in the Republic of Karakalpakstan in the 20th – early 21st centuries. It is shown that after stable catches in the Aral Sea (up to 220 thousand centners per year), as a result of its drying up, commercial fishing ceased in 1984. In subsequent years, fisheries are caught in inland waters and collector-drainage systems, where catches range from 3.5 to 47.1 thousand centners. The main causes of instability were water shortages and deteriorating environmental conditions.

Keywords: Karakalpakstan, fisheries, Aral Sea, inland waters

Introduction

In the 1960s–1980s, the negative consequences of centralized planning in the former USSR, associated with the implementation of large agricultural and industrial projects without regard for environmental and social factors, led to an ecological imbalance in the southern Aral Sea region. The Republic of Uzbekistan, and in particular the Republic of Karakalpakstan, acted as a domestic exporter of cheap agricultural and mineral raw materials, which accelerated the development of unfavorable processes that impacted the region's natural and social environment.

The main causes of environmental degradation were the reliance on cotton monoculture in agriculture, overuse of irrigation systems, and the depletion and pollution of water resources. Increased water withdrawal from the Amu Darya for irrigation, the discharge of drainage and industrial wastewater, and ineffective river flow regulation led to catastrophic changes in the natural environment. The Aral Sea level dropped from 53 to 26 meters (by 2008), and water mineralization reached 140–150 g/l. Approximately 5 million hectares of desert land, susceptible to dust and salt transfer, formed in the Amu Darya and Syr Darya

deltas, causing serious damage to agriculture and public health.

The Aral Sea's environmental crisis has had significant socioeconomic consequences. Pastures and forage lands in the delta have shrunk dramatically, many plant and animal species have disappeared, and biodiversity has been depleted. Fishing, once one of the oldest sectors of Karakalpakstan's economy, has been completely threatened: while the annual catch from the 1930s to the 1960s was 200,000 to 400,000 centners, it virtually disappeared by the 1980s. The last commercial catch was recorded in 1983, and fishing in the Aral Sea ceased in 1984.

In the post-Soviet period, attempts were made to stabilize the situation by creating artificial reservoirs and using drainage systems. However, high mineralization and water pollution from pesticides and fertilizers led to massive fish kills. Currently, fishing occurs primarily in inland waters and lakes in Karakalpakstan, but its volumes remain insignificant and depend on water shortages.

Thus, the degradation of the Aral Sea ecosystem has caused serious natural, climatic, socio-economic, and environmental changes, the consequences of which continue to impact the lives of the population of the Southern Aral Sea region.

Materials and methods

A variety of sources were used to conduct the study. The primary source was archival data from the Muynak Fish Canning Plant (based on materials by K. A. Kosnazarov), reflecting the dynamics of fish catches in the Aral Sea from 1929 to 1984. Statistical data characterizing the socioeconomic consequences of ecosystem degradation in the Southern Aral Sea region were also used. The study included information on the state of pastures, biodiversity, and water resources in the region, as well as fish catch data from inland water bodies and drainage systems in Karakalpakstan from 1990 to 2007.

Particular attention was paid to analyzing hydrological changes in the Amu Darya River basin and the characteristics of the republic's drainage systems. Data processing and systematization were conducted using a comparative-historical method, statistical

analysis, and ecological-economic interpretation methods.

The methodological basis of the study included a comparative-historical method for identifying the dynamics of changes in the natural resource potential of the region, statistical analysis for processing and summarizing quantitative data on fish catch, the state of pastures and water resources, as well as methods of ecological-economic interpretation for assessing the impact of ecosystem degradation on the social and economic spheres.

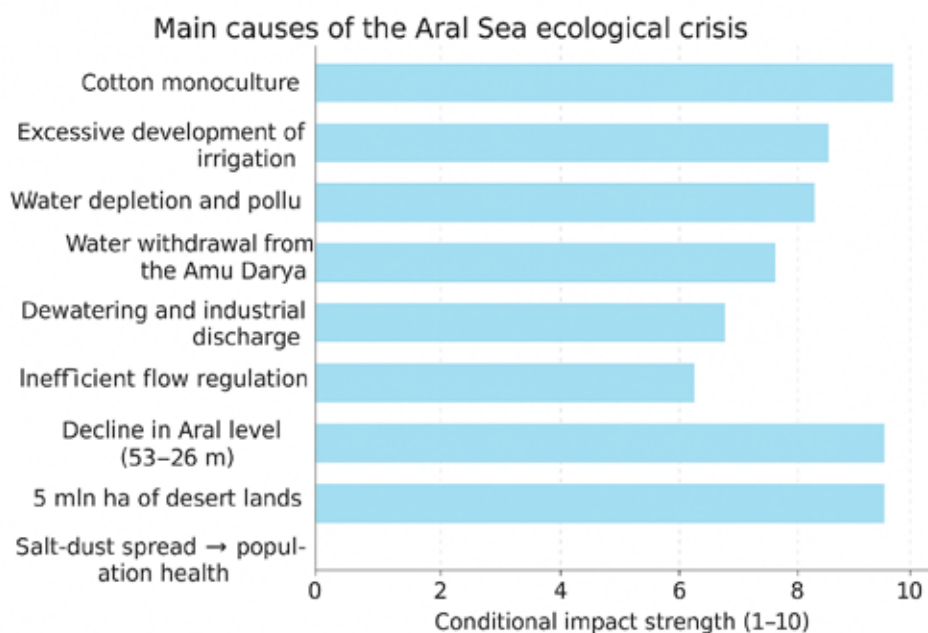
Results and discussion

The study found that between the 1960s and 1980s, the negative consequences of centralized planning in the former USSR, associated with the prioritization of agricultural and industrial projects without regard for environmental and social factors, led to significant changes in the environmental situation in the southern Aral Sea region. The Republic of Uzbekistan, including Karakalpakstan, played the role of a domestic supplier of cheap agricultural and mineral raw materials, which accelerated the process of environmental degradation.

The main causes of the environmental crisis were the reliance of agriculture on cotton monoculture, the overdevelopment of irrigation systems, and the depletion and pollution of water resources. Increased water withdrawals from the Amu Darya, increased discharges of drainage and industrial wastewater, and ineffective runoff regulation led to a drop in the Aral Sea level from 53 m to 26 m (2008), with water mineralization reaching 140–150 g/l. Approximately 5 million hectares of desert land, susceptible to dust and salt transfer, formed in the Amu Darya and Syr Darya deltas, negatively impacting public health and economic activity (Fig. 1).

The socioeconomic consequences resulted in a sharp decline in the delta's natural resources: reed beds shrank by 60 times, tugai forests by 70 times, over 115,000–120,000 hectares of licorice and several hundred thousand hectares of other hayfields and pastures were lost. Many species of forage and medicinal plants disappeared, and the fauna was depleted. Fishing, one of Karakalpakstan's leading industries, was virtually destroyed.

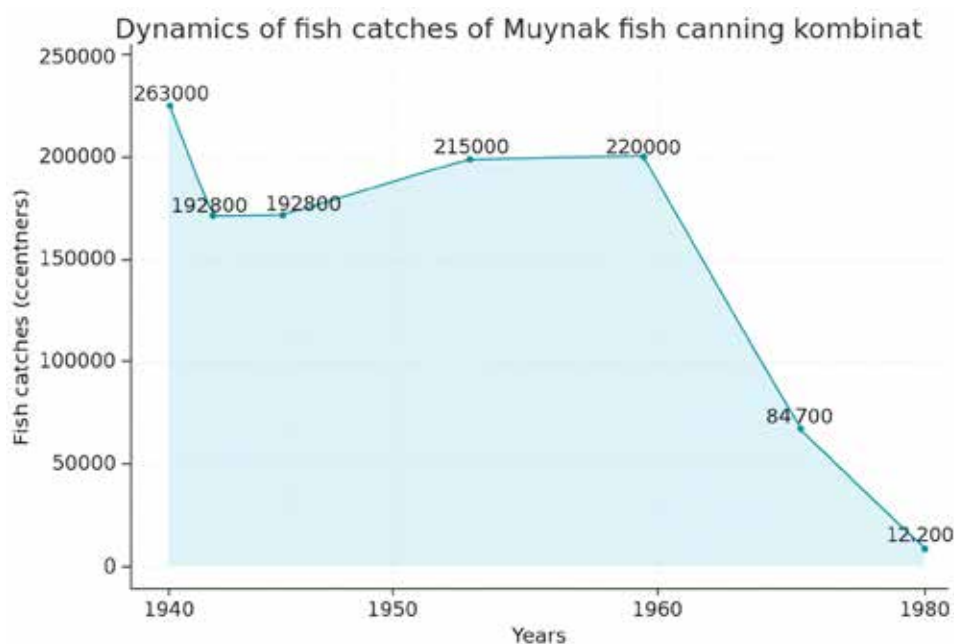
Figure 1. *The main causes of the Aral Sea ecological crisis*



An analysis of archival data from the Muynak Fish Canning Plant revealed that between 1929 and 1940, fish catches averaged 192,400 centners per year, peaking at 263,000 centners in 1938. Even during World War II, the annual catch remained at approximately 192,800 centners. In the post-war period (1946–1964), the catch stabilized at 210,000–220,000 centners per

year. However, beginning in 1965, a steady decline was observed: in 1972, the catch fell to 85,700 centners, in 1979 to 21,200, and in 1982 to 790 centners. The last commercial catch (530 centners) was recorded in 1983, after which fishing in the Aral Sea ceased. The native ichthyofauna, which comprised 24 species, completely disappeared (Fig. 2).

Figure 2. *Dynamics of the catch of the Muynak fish canning plant*



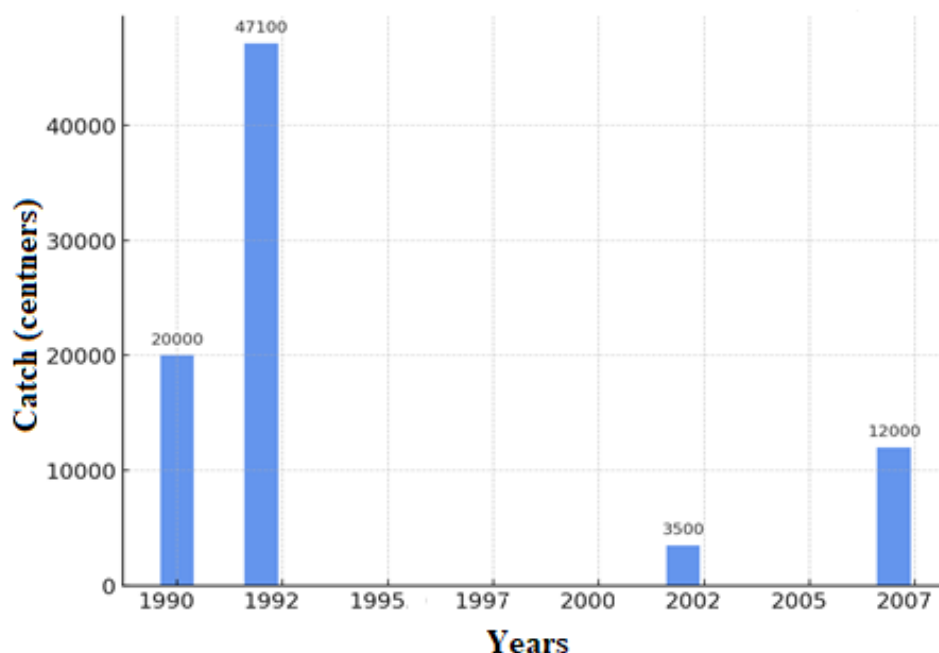
From 1990 to 2007, fish catches in Karakalpakstan were primarily from inland

waters and drainage systems. Annual catches ranged from 3,500 (2002) to 47,100 centners

(1992), with an average of 13,600 centners.

The main reason for this instability was water shortages (Fig. 3).

Figure 3. Fish catch in the Republic of Karakalpakstan (1990–2007)



In the post-Soviet period, efforts were made to create artificial reservoirs in former bays and depressions (Sarybas, Muynak, Zhyltyrbas, and others), covering a total area of approximately 100,000 hectares. However, high mineralization (1–14.2 g/L) and contamination by pesticides and fertilizers caused massive fish kills. In recent years, a number of reservoirs have been leased for fish farming, but low water availability and pollution remain a problem.

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Thus, the degradation of the Aral Sea ecosystem has had a complex impact on the region, triggering a combination of natural, climatic, socioeconomic, and environmental changes. Restoring fish stocks and stabilizing ecosystems is only possible with a comprehensive approach that includes rational use

of water resources, biodiversity protection, and the development of sustainable inland fisheries.

Conclusion

The study showed that the degradation of the Aral Sea ecosystem was the result of a combination of natural and anthropogenic factors, primarily unsustainable water use, monoculture agriculture, and large-scale interference with natural hydrological processes. These changes led to a catastrophic drop in sea level, increased water mineralization, the transformation of deltaic areas into deserts, and a sharp decline in biodiversity.

The socioeconomic consequences included the loss of the fishing industry, the destruction of the traditional livelihoods of the population of Karakalpakstan, a decline in food and medicinal flora, deteriorating human health, and a decline in quality of life. Analysis of archival data revealed the complete disappearance of native ichthyofauna and a critical decline in rare and endemic fish species, many of which are listed in the Red Data Book of Uzbekistan.

Despite measures taken to create artificial reservoirs and develop inland fisheries, high mineralization, pesticide pollution, and

water shortages continue to pose serious obstacles to the restoration of fish resources.

Thus, the experience of the Southern Aral Sea region confirms the need for an integrated and sustainable approach to water

resource management, biodiversity conservation, and the development of alternative economic activities aimed at the long-term environmental and social stability of the region.

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Contact: arzigull@gmail.com