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# THE ROLE OF NATURAL AND ANTHROPOGENIC FACTORS IN SHAPING STURGEON POPULATIONS AND THEIR ECONOMIC DIMENSION: INSIGHTS FROM THE STURNET PROJECT

Sturgeon species are among the most ancient representatives of ichthyofauna, having existed for over 200 million years. They serve as bioindicators of river ecosystem health due to their high sensitivity to environmental changes. In Ukraine, sturgeon populations have experienced a significant decline due to a combination of natural and anthropogenic factors, including climate change, river flow regulation, water pollution, and poaching. This study examines the impact of these factors on sturgeon populations, with a focus on data collected from the Lower Danube (Vylkove region) and the Dnieper River (Zaporizhzhia region, downstream of Khortytsia Island). Additionally, the study explores the potential economic implications of the SturNet project.

The analysis is based on historical multidisciplinary data on water temperature, salinity, hydrodynamics, phytoplankton, and anthropogenic pressure. The study utilizes hydrological monitoring data, findings from ichthyological research, and ecological assessments of water quality in two key regions.

**The SturNet Project and Its Significance.** The international research project "Network for the Preservation of Sturgeon and for the Sustainability of the Black Sea Basin Ecosystem" (SturNet, BSB00172) is dedicated to the conservation of the genetic pool of sturgeon species and the restoration of their

populations within the Black Sea Basin. The initiative is implemented under the Interreg NEXT Black Sea Basin Programme and is based on an integrated approach to bioecological monitoring, the introduction of conservation measures, and the restoration of ecosystem conditions essential for sturgeon survival. The project fosters synergy among leading scientific institutions and environmental organizations, ensuring a comprehensive and coordinated effort toward sturgeon preservation. The project consortium includes partners from various countries: Ukraine, Bulgaria, Romania, Moldova, Greece, and Turkey.

In Ukraine, the project is represented by the State Organization "Institute of Market & Economic & Ecological Researches of the National Academy of Sciences of Ukraine" (IMEER), which has extensive experience in international projects. As a project partner, IMEER coordinates and implements scientific research within Ukraine, facilitates the integration of the SturNet network into the national scientific framework, and ensures the adaptation and implementation of results obtained from previous initiatives in the field of aquatic ecosystem conservation and restoration.

Natural factors influencing sturgeon populations, anthropogenic factors influencing sturgeon populations (Table 1).

Key Directions of the SturNet Project:

- Aquatic Environment Monitoring – Analysis of pollution, hydrodynamic changes, and their impact on sturgeon spawning.
- Development of Ecological Strategies – Implementation of conservation measures and restoration of sturgeon ecosystems.
- Creation of a Digital GIS Platform – Integration of data for real-time monitoring of sturgeon population dynamics.
- International Cooperation – Uniting efforts of scientists, non-governmental organizations, and governmental institutions for sturgeon protection.
- Temperature Regime and Climate Change – A trend of increasing average annual water temperature in the Danube and Dnieper has been observed, affecting sturgeon spawning and juvenile survival rates.
- Water Salinity – In the estuarine part of the Danube, salinity variability is influenced by interactions with the Black Sea, impacting the distribution of juvenile sturgeons, which depend on optimal salinity conditions.
- Hydrodynamic Characteristics – The Lower Danube maintains a natural flow regime, contributing to water self-purification and the preservation of spawning sites. In contrast, the Dnieper has undergone significant alterations due to the construction of a cascade of reservoirs, leading to the loss of primary migration routes for sturgeons.

- Hydrotechnical Structures – The construction of dams on the Dnieper, particularly the Dnieper Hydroelectric Station (DniproHES) and the Kakhovka Hydroelectric Power Plant, has significantly obstructed sturgeon migration to spawning grounds. Following the destruction of the Kakhovka HPP in 2023, the first recorded cases of sturgeon returning to the Zaporizhzhia aquatic zone were observed.
- Water Pollution – Major sources of pollution include industrial discharges, agricultural runoff, and household waste. The accumulation of heavy metals and microplastics in aquatic environments negatively affects sturgeons, particularly by disrupting their reproductive functions.
- Eutrophication – Excessive enrichment of water with nutrients (nitrogen, phosphorus) due to agricultural activities leads to the proliferation of cyanobacteria (blue-green algae), which reduce oxygen levels and create a toxic environment for fish.

Table 1

**Factors influencing sturgeon populations**

| Factor category | Factor | Impact on sturgeon populations |
|---|---|---|
| Natural factors | Temperature regime and climate change | Increasing water temperature in the Danube and Dnieper affects sturgeon spawning and juvenile survival |
| Natural factors | Water salinity | Salinity variability in the Danube estuary influences the distribution of juvenile sturgeons |
| Natural factors | Hydrodynamic characteristics | The Lower Danube supports water self-purification and the preservation of spawning sites, while the Dnieper's reservoir cascade has disrupted migration routes |
| Anthropogenic factors | Hydrotechnical structures | The construction of dams (DniproHES, Kakhovka HPP) has obstructed sturgeon migration. The destruction of Kakhovka HPP in 2023 has created new migration opportunities |
| Anthropogenic factors | Water pollution | Industrial discharges, agricultural runoff, and household waste negatively affect sturgeon due to toxin accumulation |
| Anthropogenic factors | Eutrophication | Excessive enrichment of water with nutrients promotes the growth of toxic algae, reducing oxygen levels in the water |
| Anthropogenic factors | Poaching | Illegal fishing significantly reduces sturgeon populations, especially during the spawning period |

The analysis of historical and contemporary ecological data indicates that natural factors play a crucial role in sustaining sturgeon populations. However, anthropogenic pressures significantly hinder their survival. The Lower Danube remains a strategic region for sturgeon conservation, whereas comprehensive measures are required in the Dnieper to restore its ecosystem. The SturNet project represents a significant step toward international cooperation, ecological monitoring, and the implementation of conservation measures, which will contribute to the improvement of sturgeon populations in the Black Sea Basin and promote sustainable economic development in Ukraine's regions.

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