ANALYSIS OF THE IMPACT OF ECOLOGIC FACTORS ON THE FISH FAUNA OF THE RIVER TISZA

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ABSTRACT

The conditions of existence of river organisms and the mapping of their habitats have been studied using the example of the Tisza River in Transcarpathia, which plays a key role in preserving biodiversity and the stability of natural environments. River ecosystems are important components of nature conservation practice, and their study contributes to understanding the impact of natural factors on the biotic component of river systems. The influence of hydrodynamic and hydrochemical indicators on river fauna, as well as the characteristics of fish migration under the influence of temperature changes and floods, have been investigated. The results of the research indicate a great diversity of fish species in the Tisza basin, including those listed in the Red Books. The methodology of the study, based on the analysis of normal living conditions and the use of geoinformation technologies, allows obtaining important data for further improvement of nature conservation measures in the region.

Keywords: analysis, impact, ecologic factors, fish species, river Tisza.

INTRODUCTION

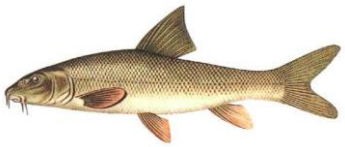
Studying the living conditions of river organisms and mapping their habitats in the Tisza River region of Transcarpathia is an essential component of contemporary scientific inquiry and nature conservation practices. River ecosystems play a crucial role in preserving biodiversity and ensuring the stability of natural environments. The territory surrounding the Tisza River in Transcarpathia stands out due to its uniqueness and significant ecological importance, serving as a habitat for numerous species of river organisms, including diverse fish, waterfowl, and invertebrates.

Main Section

Preserving and protecting the biotic component is crucial for the normal functioning of river ecosystems. Species biodiversity of hydrobionts, as well as the mechanisms shaping the structure of biotic communities in rivers under the influence of natural factors, remain poorly studied. Along the river channels, the ichthyofauna is constantly influenced by hydrodynamic factors such as zonal variations, excessive precipitation, flood events, channel processes, substrate quality, and others.

Particularly noticeable impacts on river fauna occur during periods of temperature fluctuations and changes in hydrochemical characteristics due to precipitation. Seasonal and rainfall floods lead to significant fluctuations in water levels, redistribution of suspended and bedload sediments, resulting in high mobility of bottom sediments within the channel. This significantly alters water temperature and turbidity, increasing flow velocity in mountainous river sections. During pollution events, fish tend to leave unfavorable areas of the river and drift intensively with the current of the Tisza River. Increased turbidity due to natural causes triggers the migration of most fish towards the turbid flow, with fish subsequently concentrating at the boundary between turbid and clear water (e.g., at confluences, in the mouths of tributaries and bays), where they find comfortable conditions and opportunities to feed on drifting invertebrates. According to researchers, various periods have witnessed the presence of 58 fish species within the Tisza basin within Ukraine (Zhukynskyi, Viatchanyna, & Shcherbukha, 1995). Hungarian researchers have recorded 68 fish species in the Tisza basin (Gyore, Sallai, & Csikai, 1999; Harka, 2001). The Cyprinidae family is represented by 25 species, including the nase (Chondrostoma nasus), barbel (Barbus barbus), crucian carp (Carassius carassius), bleak (Alburnus alburnus), and European chub (Squalius cephalus), among others. Six species of perch (Percidae) are found in the foothill sections, including the European pikeperch (Sander lucioperca) and European perch (Perca fluviatilis). In the mountainous sections of the Tisza River, four species of salmonids have been identified: brown trout (Salmo trutta morpha faris Pall), rainbow trout (Salmo irideus Pall), European grayling (Thymallus thymallus), and Danube salmon (Hucho hucho).

Table 1. Characteristics of normal living conditions for river organisms (Red Book of Ukraine, 1994)

№	Organism Name	Water Flow Speed	Depth	Water Temperature	Organism Appearance
1	Barbel (Barbus barbus) - a fish of the Cyprinidae family, listed in the IUCN Red List, European Red List, and Red Book of Ukraine. Age - 3 years.	Fast flow	up to 1.2 m	15°C	
2	Nase (Chondrostoma nasus) - a freshwater fish of the Cyprinidae family. Length up to 40 cm, weight up to 1.6 kg. Lifespan up to 10 years.	Fast flow	2-3 m	10-12°C	
3	Bleak (Alburnus alburnus) - a fish of the Cyprinidae family, with a body length of 10-12 cm, rarely exceeding 17 cm, weight up to 60 g.	Medium flow	up to 50 cm	10-12°C	
4	Zander (Sander lucioperca) - a fish of the Percidae family. Age 2 years. Length up to 40 cm, weight up to 0.5-0.8 kg.	Slow to medium flow	2-5 m	10-12°C	
5	Danube salmon (Hucho hucho) - a member of the Salmonidae family. Age 1-3 years, body length 15-60 cm, weight 1.2-1.6 kg.	Slow to medium flow	0.3-1.2 m	15-20°C	

The methodology for studying the normal living conditions and development of living organisms in river ecosystems described by Rusyn, V., Moskal, M., Feketa, I., & Leta, V. (2023) is used as the primary research method in this scientific work. It's worth noting that during data processing, ArcGIS and HEC-RAS software products were utilized.

To create a model of zones with constant water flow, a series of statistical observations on water discharges in the Tisza River at a given section were applied, according to which the average annual discharge is 800 m3/s.

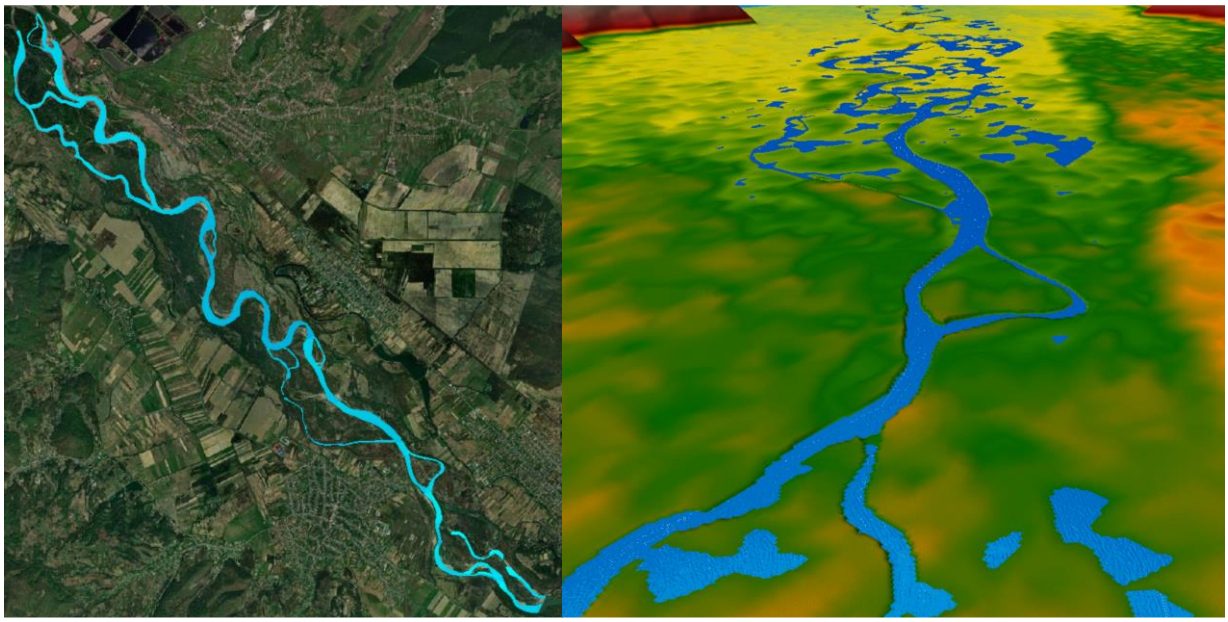
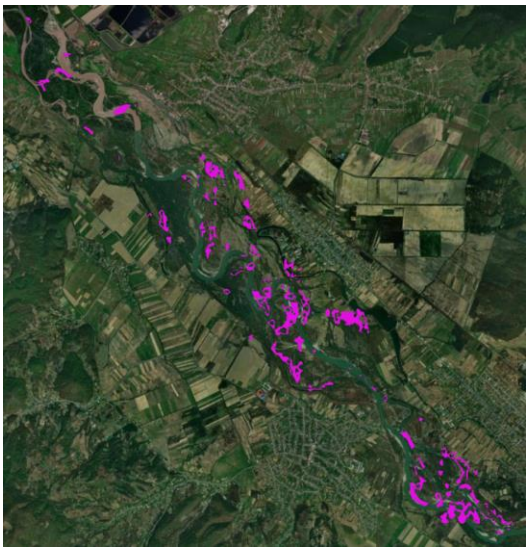
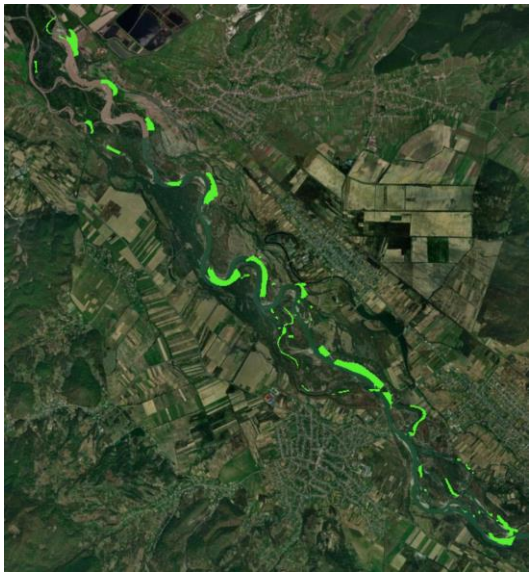
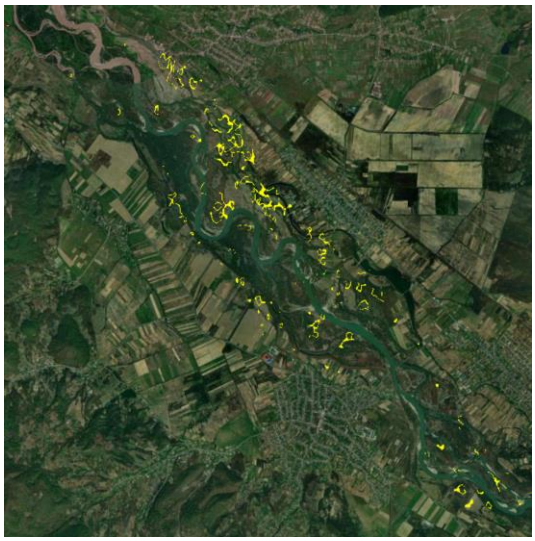


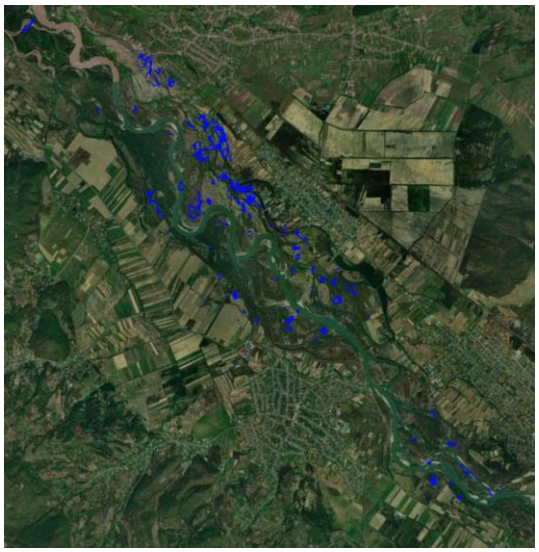
Figure 1. Model of constant flow in 2020 (left) and 3D view of DEM (Digital Elevation Model HEC-RAS) (right)

Table 2, presents the results of the investigation into the habitats of fish under normal conditions.

Table 2. Habitats under normal living conditions for river organisms

Organism Name	Habitat under normal living conditions as of 2020
Barbel (Barbus barbus)	

Nase (Chondrostoma nasus)	
Bleak (Alburnus alburnus)	

Zander (Sander lucioperca)	
Danube salmon (Hucho hucho)	

CONCLUSIONS

- The use of raster calculator and other geoprocessing methods allowed us to analyze and map conditions favorable for ichthyofauna life in the studied regions.
- Based on the obtained data, optimal habitats for Barbus barbus, Chondrostoma nasus, Alburnus alburnus, Sander lucioperca, Hucho hucho were identified and visualized on the researched territory. This includes displaying zones with suitable water depths, optimal flow rates, and other factors crucial for their survival.
- The research identified zones where conditions for ichthyofauna life may be unfavorable due to human activities, water body pollution, or other factors.
- Our results can serve as a guide for developing and implementing strategies for the conservation and management of river ecosystems. This may involve establishing reserves, monitoring water resources, and other measures.

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