

THE HYDROBIOTOPIC DIVERSITY OF THE LAKES OF THE LOWER PRUT RIVER, REPUBLIC OF MOLDOVA

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Abstract

This paper proposes the presentation and analysis of the fish fauna and the specific benthic resources of the Prut River and its tributaries: Costești-Stânca, Belev, Manta. An important objective of the paper is to present the differences in hydrobiotop diversity in different riparian sectors. A healthy ecosystem has a rich ichthyofauna due to the diversity of vegetation and fish species capable of withstanding resistance to aggressive external factors and threats. The aquatic biodiversity of the Prut River is a major complex consisting of phytoplankton and zooplankton. To optimize production of fish, an important factor is maintaining the balance quantity and quality of the entire water system. From this point of view, the paper presented also quantitative aspects of zoobenthos, which is different in the analyzed areas, being influenced by the degree of pollution, the hydrological regime or the physico-chemical conditions.

Research has revealed significant differences between different areas of the aquatic fauna of the Prut, mainly due to the human factor. The study is a preliminary one, preparing a broader analysis of the impact of the human factor in the aquatic areas of the Republic of Moldova.

Identifying and analyzing the factors that have led to the modification of aquatic structure and diversity can serve as arguments for achieving viable measures for the protection and sustainable use of natural aquatic resources at national level.

Keywords: hydrobiotopic diversity, the Prut River, sustainable valorisation.

Introduction

The Prut River is a wetland with a specific vegetal rug and a major fish variety that is of interest to both the Republic of Moldova/Romania and the Southeastern Europe. Most studies conducted in the Prut water meadow have highlighted areas of valuable vegetation, representing favourable areas for the growth and reproduction of many species of fish. Over many decades, the man has negatively influenced the vegetation in the Prut water meadow, knowing that the Prut River is characterized by pits, meanders and shady trees, being a favourable area for the on-going growth of the catfish due to the deforestation of the Prut meadow for the purpose of widening the surfaces of agriculture which has caused many changes in the structure and dynamics of phytocoenosis. The zoobenthos layer in the natural aquatic ecosystem also functions under profoundly modified ecological conditions due to

aggressive factors such as the penetration of various pollutants, the domestic and toxic waste, as well as the accidental penetration of agricultural herbicides.

1. Short literature review

The Republic of Moldova has a small area and limited natural water resources. Even under such conditions, natural water resources are exploited inefficiently, and wasted by qualitative and quantitative worsening thereof under the influence of the anthropogenic factor (Florea et al., 2009). The wetlands of the Republic of Moldova, which are the main fish species, are the drainage basins of the rivers Nistru (67%) and Prut (24%), Danube effluents basins (9%) and small rivers flowing directly into the Black Sea (Munteanu et al., 2018). According to the studies elaborated, biomass formation plays an important role in the formation of the trophicity of an ecosystem. For example, in the accumulation lake Costesti-Stânca there was an increase of zoo benthos biomass, and in the lower section of the Prut river, namely in Beleu lake, Manta, a reduced biomass of 2.5 times got settled (Toderaş et al., 2006).

Usatîi (2004) analyzes the valuable fish species in the area of Lake Stanca Costesti, considering that they have been strongly affected by excessive fishing and pollution of natural areas.

The fishery production is unevenly located along the sectors of the Prut River due to the increased hydrobiotic diversity (Bulat, 2017). In order to solve the crisis situation in the ecosystem, it is necessary to install artificial nests by expanding the surfaces of the spawning ground, which would favour the deposition of the spawn in the lower section of the Prut River and its effluents Beleu and Manta (Leuca, 2006). Munteanu Pila and Stanciu (2018) have shown that there can be solutions for the preservation of natural fauna by investing in repopulations of the main river basins financed from national funds. The restocking measures were carried out on the main lakes Dubasari and Costesti-Stanca. In order to achieve significant long-term results, it is necessary to adopt measures to reduce pollution, protect endangered fish species and rehabilitate areas affected by the anthropic factor.

2. Materials and methods

The information on the biodiversity of the natural aquatic ecosystem and the zooplankton composition of the Prut River and effluents was obtained from scientific database. For bibliographic documentation, the Web of Science Clarivate Analytics and Google Academic have been used. Unfortunately, the specialty information in the scientific literature is quite low. Unfortunately, the scientific information from the scientific literature is quite low, with few authors approving aspects of the impact of human and industrial factors on the fish species in the Republic of Moldova. The data collected have been processed statistically, presented in graphics and interpreted. The results were compared with data from the scientific literature for an appropriate interpretation.

3. Hydrobiotic diversity in different sectors of the Prut River

The Prut River starts from the Carpathians, in Mount Goverla (Ukraine), and flows into the Danube. Its length is of 967 km, of which 695 km are on the territory of Romania – the

Republic of Moldova and 211 km on the territory of Ukraine. The Prut valley is branched, forming many islands, shallows and sandy or slimy thresholds. Within the Republic of Moldova, the Prut River is divided by the dam of Costești - Stânca Lake.

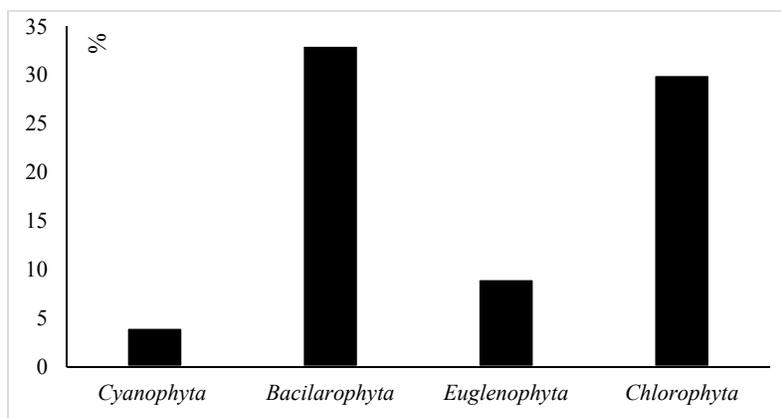
The fish species of the Prut River are diverse, differentiated by ecological areas where various fish species predominate (Table 1).

Table 1. Fish species and habitats in Prut River

| Areas of the Prut river | Fish species |
|--|--|
| Threshold area | Common Schneider, Monkey goby, Dark Barbus, Bleak, Gudgeon |
| Typical bed area | Catfish, Common bream, European chub, Asp, Common barbus, vimba bream |
| Costești – Stânca accumulation lake | Common bream, Common roach, Perch, Asp, Zander, Common bleak, Carp for aquaculture, Asian Cyprinids |
| Beleu and Manta natural lakes | Silver Prussian carp, Common bream, White bream, Common roach, Carp, Ruffe and rudd species |
| Flooded areas with temporary or permanent water coverage | Pumpkinseed, Amur catfish, Moroko stone, European bitterling, Perch, Common roach, Pike, Ukrainian stickleback |

Source: Data processed from Bulat (2017).

Ecological areas of the Prut River have a large diversity of fish species. To protect and develop of the ichthyofauna is necessary to study the details the area of interest and its effluents. The growth, fattening and the reproduction of many species of fish need "bed of the river", and flora or fauna must have correlated to maintain the trophic chain and to preserve the biodiversity and the natural assets of the river. The aquatic biota of this river is composed of phytoplankton and zooplankton. The phytoplankton of the Prut River includes 76 taxons (*Cyanophyta*, *Bacilarophyta*, *Euglenophyta*, *Clorophyta*), biodiversity that are involved in the formation of a natural aquatic ecosystem (Figure 1).



Source: Authors, using data from Ministry of Ecology and Natural Resources of the Republic of Moldova (2004).

Figure 1. Phytoplankton composition of the Prut River

The Lake Costesti-Stânca Prut River

The accumulation lake Costesti-Stânca has a specific modest diversity, which combines a substantial biomass with a fish variety with a maximum valence on the species of limn-erophile fish (*Common roach*, *Perch*, *the Bleak*, *Common ruffe*, *Neogobius fluviatilis*) (Table 2).

Table 2. Fish population in the Costești-Stânca lake

| Species of fish | Density of fish species (individuals/ha) |
|---|--|
| Pike (<i>Esox lucius</i>) | 16 |
| Common roach (<i>Rutilus rutilus</i>) | 342 |
| Asp (<i>Aspius aspius</i>) | 47 |
| Danube bream (<i>Abramis brama</i>) | 378 |
| Vimba bream (<i>Vimba vimba</i>) | 517 |
| Carp (<i>Cyprinus carpio</i>) | 35 |
| Catfish (<i>Silurus glanis</i>) | 29 |
| Perch (<i>Perca fluviatilis</i>) | 482 |
| Zander (<i>Stizostedion lucioperca</i>) | 380 |
| Common Bleak (<i>Alburnus alburnus</i>) | 1000 |
| Biomass (kg/ha) | 40.46± 2.017 |

Source: Data processed from Crepis (2006).

According to the elaborated studies and the trophic classification of the natural aquatic ecosystems of the affluent of the Prut River, according to the average value of the zoobenthos biomass, the accumulation lake Costesti-Stânca falls within the mesotrophic ecosystem class and the Beleu and Manta accumulating lake in the eutrophic eco-system class (Table 3).

Table 3. Density of zoo benthos biomass in Costești Stânca and Beleu Manta lakes (individuals/sqm)

| Taxonomic family | Costești-Stânca lake | Manta lake | Beleu lake |
|------------------------|----------------------|-------------|--------------|
| <i>Oligochaeta</i> | 2347/2.32 | 12293/12.95 | 8130/12.93 |
| <i>Molluscs</i> | 507/114.47 | 7/51.39 | 23/92.50 |
| <i>Crustaceans</i> | 155/1.28 | 80/1.73 | 33/0.16 |
| <i>Chironomidae</i> | 4837/1.53 | 1253/2.03 | 1853/3.46 |
| <i>Zoobentos Total</i> | 7908/120.08 | 13950/69.54 | 10232/110.95 |

Source: Authors, using data from Toderas (2006).

According to Toderas (2006) in Beleu and Manta lakes prevail Gibel carp (*Carassius gibelio*) and common bleak (*Alburnus alburnus*), while in the Costesti-Stânca lake the common bleak (*Alburnus alburnus*), European perch (*Perca fluviatilis*) and white bream (*Blicca bjoerkna*) are the predominant species of fish.

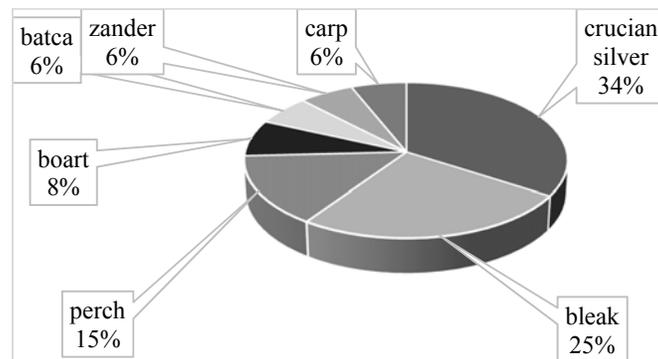
Beleu and Manta Lakes

Beleu and Manta lakes are located in the floodplain of the Prut River and feed through the river brooks Rotariu, Manolescu and Dracele.

Beleu Lake is the first area protected by Convention on Wetlands Ramsar Convention, being located at the confluence area with the Danube River. A few decades ago (30 years), the maximum water level in Beleu Lake was of 7-8 m.

Due to the fact that the clogging process was not expressed, the water entered the lake against the flow of the Prut River, and therefore the water supply was only from flooding. A very important factor is that on the area of the water there were floating islands of vegetation (floating islets), which was a place of refuge and shelter for many species of fish.

Nowadays, it has to mention that the depths of this lake barely reach 1 m, which is caused by the sudden intensification of the clogging processes that resulted from the construction of the Manolescu brook. In Beleu Lake, the Ichthyofaunistic diversity consists of about 30 species of fish (Figures 2 and 3).

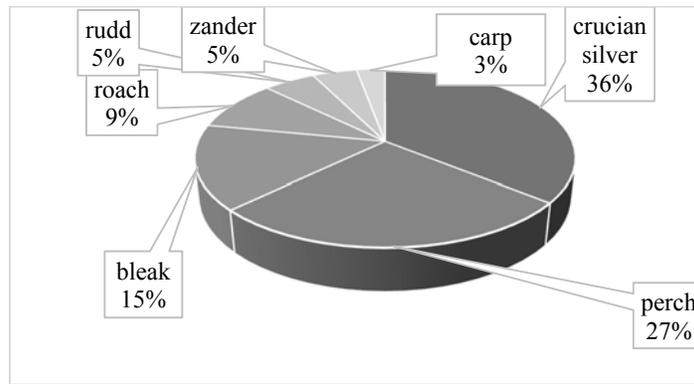


Source: Authors, using data from Leuca (2006).

Figure 2. Fish species in Beleu Lake

Due to the fact that the clogging process was not stopped, it was not possible to feed the lake from the Prut River and therefore the water supply was only from the flood. An important factor is that on the surface of the water there were floating islands of vegetation, which was a place of refuge and shelter for many species of fish.

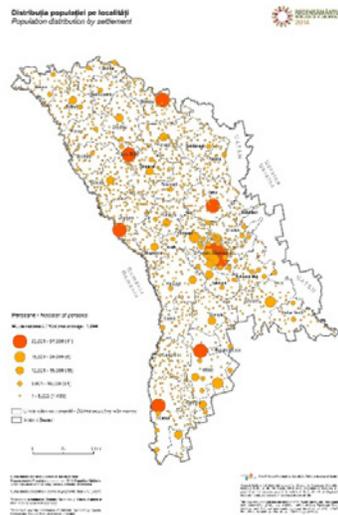
At present, the depth of the lake barely reaches 1 m, caused by the sudden intensification of clogging processes in the Manolescu creek area.



Source: Authors, using data from Leuca (2006).

Figure 3. Fish species in Manta Lake

The data presented show a differentiation of the fish species in the two analyzed areas, which can be due to a different density of the human population (figure 4). Thus, valuable fish species, such as the carp, have a higher density in the Beleu Lake due to the measures to protect against excessive fishing.



Source: National Bureau of Statistics of the Republic of Moldova (2018).

Figure 4. Demographic distribution in the Republic of Moldova

Conclusions

The process of degradation of natural aquatic ecosystems has led to a loss of biodiversity of fish stocks and negative consequences on local food resources. The results of the studies on the structural and quantitative changes of the fish fauna due to the anthropogenic factor can be used as a basis for the implementation of the conservation measures and the sustainable use of the biological resources, as well as for the restoration of the fishing potential of the Republic of Moldova. The analysis revealed the total lack of rare and economically valuable species, characteristic of all ecological areas in the Prut river basin. Applying measures to improve fishing and clean up pollutant lakes could favour the migration of the fish population to the Prut River tributaries and improve the conditions for the natural reproduction of many valuable fish species.

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