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RESEARCH REGARDING THE FISH COMMUNITIES IN DRINCEA, BALASAN, AND DESNATUI (DANUBE TRIBUTARIES, ROMANIA)

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Key words: *fish communities, biodiversity, stock, resemblance, Danube tributaries*

INTRODUCTION

The present study was performed in 2007 in three of the Danube tributaries, namely Drincea, Balasan, and Desnatui. Our research aims to analyze the structure of the fish communities in this area, and also to assess the state of fish communities from the ecological point of view.

The scarce, the outdated or even the lack of data in the study area were important reasons to carry out this study, and consequently to contribute to the knowledge update. In the last decade only two other studies were performed in the same area (Bănăduc & Bănăduc, 2014; Ureche & Ureche, 2015).

In addition, in the last century, in most of the rivers there were recorded significant changes in quality and habitat heterogeneity as a result of human impact. Consequently, and undoubtedly the fish communities were impacted and this is reflected in their structure.

MATERIAL AND METHODS

The biological material was sampled in 2007, by electrofishing from 15 sampling sites placed in three of the Danube tributaries: Drincea, Balasan, and Desnatui rivers (Fig. 1). The fish individuals were identified and immediately released in situ. The taxonomic analyze revealed the presence of 25 species in the study area: *Squalius cephalus, Leuciscus idus, Aspius aspius, Alburnus alburnus, Vimba vimba, Chondrostoma nasus, Rhodeus amarus, Gobio obtusirostris, Romanogobio vladykovi, Pseudorasbora parva, Barbus barbus, Barbus meridionalis, Cyprinus carpio, Carasius gibelio, Misgurnus fosilis, Cobitis taenia, Sabanejewia balcanica, Lepomis gibosus, Perca fluviatilis, Gymnocephalus cernuus, Sander lucioperca, Neogobius melanostomus, Neogobius fluviatilis, Ponticola kessleri and Proterorhinus marmoratus*.

For the quantitative structure description of the fish communities we used some of the ecological indices: relative abundance (A%), frequency (F%), numerical stock (ind./100 m2), weight stock (g/100 m2). Some of the biotope variables (altitude, riverbed width, depth, substratum types, channel modification, riverine vegetation) and hydro-chemical characteristics (temperature, pH, conductivity) were also assessed (Table 1).

For the assessment of biodiversity there were used some of the biodiversity indices (Margalef, Menhinick, Simpson, Shannon-Wiener), evenness (equitability) and similarity index (Table 2).

RESULTS AND DISCUSSIONS

The species frequency in the whole study area ranges between 93.33% and 6.66%. The highest value of the frequency (93.33%) has recorded by *Cobitis taenia*, and it is followed by *Alburnus alburnus* (86.66%) and then by *Squalius cephalus* (80%) and *Carassius gibelio* (73.33%) (Fig. 2).

Drincea River

Drincea River has a 79 km length, with a catchment area of 741 km^2, an average elevation of 171 m, and an average slope of 3‰.

The fish community in this tributary includes 20 species, four of them being the most common and recording the highest values of frequency (100%): *Squalius cephalus, Leuciscus idus, Alburnus alburnus and Cobitis taenia.* They are followed by *Carassius gibelio,* and *Barbus meridionalis,* with a frequency of 75%. However, the most abundant species are by far *Squalius cephalus* (33.69%), *Barbus meridionalis* (24.33%), and *Gobio obtusirostris* (13.26%).

Regarding to the fish stocks we found that the numerical stock in sampling sites ranged between 0.68 and 113.33 ind./100 m^2, while the weight stock ranged between 2.20 and 3483.33 g/100 m^2.

By far, the highest values, both in terms of numerical stock and weight stock, were recorded by *Squalius cephalus*, upstream Drincea-Danube confluence.

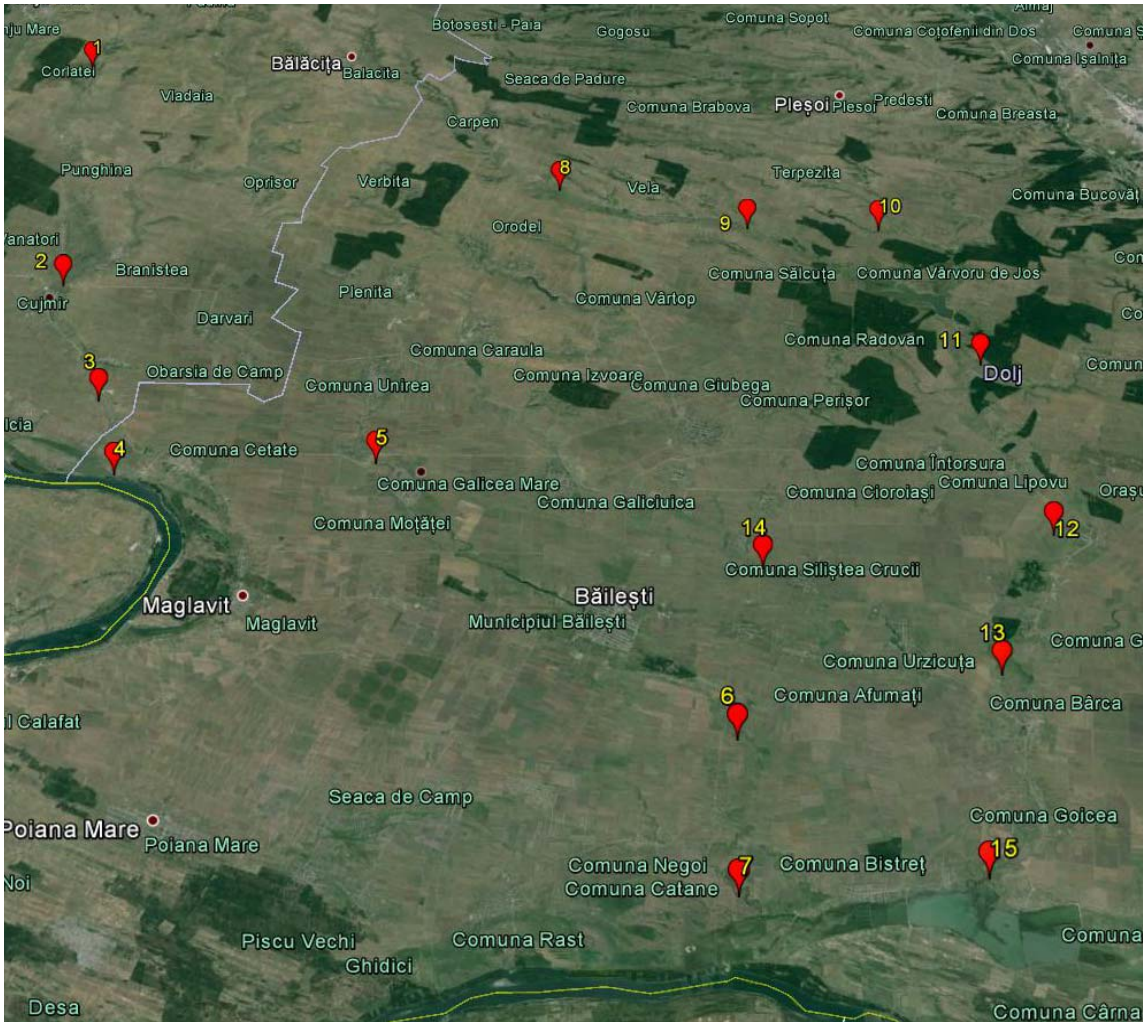

Fig.1. Sampling sites on the studied rivers: Drincea (1-4), Balasan (5-7), and Desnatui (8-15)

Table 1. Biotope variables and hydro-chemical characteristics on the three Danube tributaries in sampling sites in 2007

No.	STREAM / SAMPLING SITE	No. sp.	Geographical parameters			Hydrochemical parameters		
			Lat (N)	Long (E)	Alt. (m)	Water Temp. (^{0}C)	pH	Conductiv. µs/cm
1	Drincea, 5 km downstream Corlatel village	7	44.24287	22.58298	150	21.0	8.10	530
2	Drincea, upstream Cujmir village	11	44.13192	22.56127	66	18.0	8.40	963
3	Drincea, Salcia village side	14	44.07620	2259361	32	23.0	7.40	867
4	Drincea, upstream confl. of Danube	13	44.06109	23.00006	29	18.3	7.40	891
5	Balasan, upstream Motatei village	5	44.06667	23.40593	78	14.4	9.20	887
6	Balasan, downstream Covei village	5	43.58087	23.25006	42	20.7	8.30	1243
7	Balasan, 3 km downstream Catane village	8	43.54791	23.25886	30	23.6	8.90	1197
8	Desnatui, 3.5 km downstream Bechet village	6	44.18724	23.15161	164	26.4	7.40	1027
9	Desnatui, between Plopsor and Terpezita villages	5	44.15463	23.26887	128	22.1	7.90	883
10	Terpezita, 1 km upstream Gabru village	6	44.16180	23.33475	119	21.6	7.50	904
11	Desnatui, upstream Radovan village	9	44.10144	23.36789	82	25.1	8.30	725
12	Desnatui, Cerat village side	5	44.04292	23.39712	64	27.5	8.00	991
13	Desnatui, upstream Barca village	9	43.58459	23.36292	40	24.4	7.60	975
14	Baboia, downstream Cioroiu Nou village	9	44.03129	23.26500	58	17.9	7.90	914
15	Desnatui, downstream Plosca village	9	43.53780	23.34748	30	25.7	8.50	1011

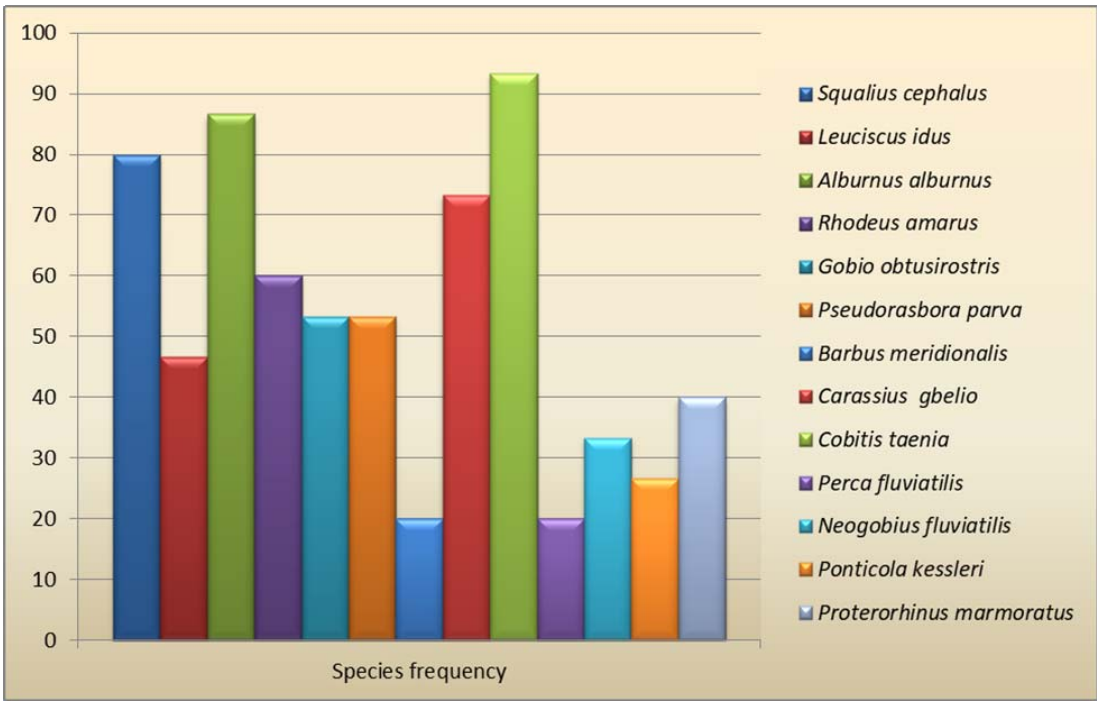

Fig. 2. Species frequency in the study area

Balasan River

Balasan River has a 51 km length, with a catchment area of 890 km^2, an average elevation of 70 m, and an average slope of 1‰.

The fish community in this river includes only 12 species, the most common being *Pseudorasbora parva* which recorded the highest value of frequency (100%). Other four species have had a frequency of 66,66%: *Carassius gibelio, Protehorhinus marmoratus, Leuciscus idus,* and *Gobio obtusirostris*.

However, the most abundant fish species were *Carassius gibelio* (29.06%), followed by *Protehorhinus marmoratus* (15.76%), *Gobio obtusirostris* (13.79%), and *Leuciscus idus* (11.82%).

Regarding to the fish stocks we found that the numerical stock in sampling sites ranged between 0.62 and 37.03 ind./100 m^2, while the weight stock ranged between 0.66 and 746.66 g/100 m^2.

In this case, the highest values for both numerical and weight stock were recorded by *Carassius gibelio* (numerical stock – 3 km downstream Catane village; weight stock – downstream Covei village).

Desnatui River

Desnatui River has a 115 km length, with a catchment area of 2015 km^2, an average elevation of 129 m, and an average slope of 2‰.

The fish community in this river includes 15 species, the most common being *Alburnus alburnus,* and *Cobitis taenia,* which recorded the highest value of frequency (100%). These two species are followed by *Squalius cephalus* which have had a frequency of 87.50%.

However, the most abundant fish species were *Rhodeus amarus* (31.97%), followed by *Alburnus alburnus* (21.33%), and *Squalius cephalus* (13.36%).

Regarding to the fish stocks we found that the numerical stock in sampling sites ranged between 0.14 and 302.77 ind./100 m^2, while the weight stock ranged between 0.17 and 596.59 g/100 m^2.

In this case, the highest values numerical stock was recorded by *Rhodeus amarus* (upstream Radovan village), while the highest value of weight stock was recorded by *Carassius gibelio* (Cerat village side).

Overall, regarding to the fish stocks in the whole studied area we found that the numerical stock of fish species in sampling sites ranged between 0.14 and 302.77 ind./100 m^2, the highest value being recorded by *Rhodeus amarus*, while the weight stock ranged between 0.17 and 3483.33 g/100 m^2, the highest value being recorded by *Squalius cephalus.*

Figure 3 presents numerical stock of the most common fish species in sampling sites (Fig. 3).

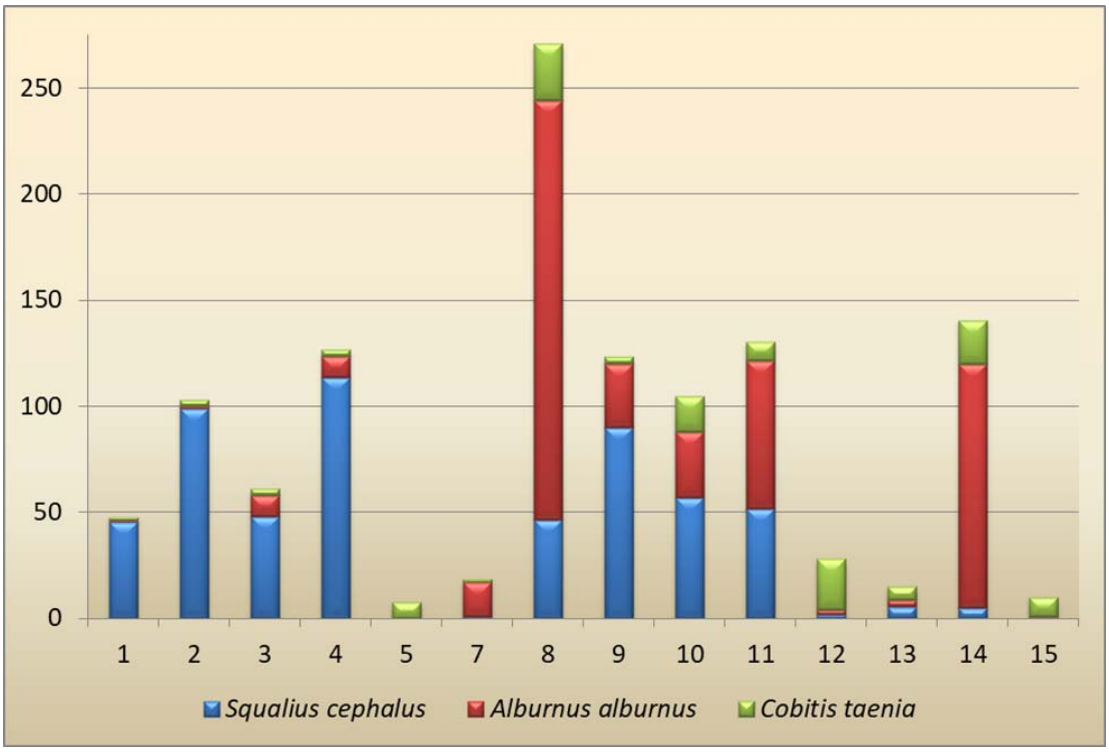

Fig. 3. Numerical stock of the most common species in sampling sites (ind./100 m^2)

The biodiversity is quite high, during the study period, 25 fish species being identified, with an amount of 3233 individuals and 25698.6 g. Only two of the 25 fish species are non-native (*Pseudorasbora parva* and *Lepomis gibbosus*) while the rest of 23 fish species are native. The biodiversity indices reveal that the species richness is highest in three of the sampling sites placed on Drincea River.

For the biodiversity assessment we used some indices as follows: Margalef, Menhinick, (for species richness), Simpson (for quantifying the biodiversity of a habitat), Shannon-Wiener (which is one of the most usual indicators which measures the degree of organization or disorganization of a system), and eveness (equitability) which is a measure of the relative abundance of the different species making up the richness of an area.

The values of different biodiversity indices and the values of equitability for the fish communities in the study area are presented in table 2.

Analyzing the table 2 it can be seen that the highest diversity was recorded in two of the sampling sites: 3 (14 species) and 4 (13 species), both of them placed on Drincea tributary. Although the highest value of the evenness has recorded in a sampling site with only 6 species and 325 individuals, the Simpson index suggests the best situation for the sampling sites 3 and 4, where not only the number of species and the total number of individuals are the highest, but also the proportion of the total that occurs in each species (Table 2).

The indices of community similarity reveal the highest similarity for the fish communities in the sampling sites 8 and 10 (placed on Desnatui and Terpezita Rivers), followed by those of the sampling sites 11 and 13 (placed on Desnatui River).

Table 2. Biodiversity indices in the study area

Sampling sites	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
No. of species	7	11	14	13	5	5	8	6	5	6	9	5	9	9	9
Margalef	1,038	1,934	2,760	2,240	0,918	1,125	1,555	0,882	0,786	0,864	1,197	0,932	1,741	1,474	1,757
Menhinick	0,389	0,829	1,328	0,892	0,566	0,845	0,843	0,352	0,392	0,332	0,318	0,411	0,904	0,597	0,923
Simpson	0,353	0,380	0,196	0,198	0,316	0,485	0,371	0,352	0,268	0,220	0,504	0,354	0,200	0,306	0,469
Shannon-Wiener	0,486	0,576	0,868	0,795	0,540	0,399	0,558	0,537	0,590	0,701	0,425	0,517	0,747	0,647	0,519
Evenness (equitability)( )	0,575	0,553	0,757	0,714	0,773	0,571	0,617	0,690	0,845	0,901	0,445	0,664	0,783	0,678	0,544

CONCLUSIONS

Taxonomic analysis highlighted 25 fish species, belonging to 5 families, two of them being non-native.

The most common species in the whole study area are *Cobitis taenia* (93.33%), *Alburnus alburnus* (86.66%), *Squalius cephalus* (80%), and *Carassius gibelio* (73.33%).

Overall, regarding to the fish stocks in the whole studied area we found that the numerical stock of fish species in sampling sites ranged between 0.14 and 302.77 ind./100 m^2, the highest value being recorded by *Rhodeus amarus* in Desnatui, upstream Radovan village, while the weight stock ranged between 0.17 and 3483.33 g/100 m^2, the highest value being recorded by *Squalius cephalus* in Drincea, upstream Drincea-Danube confluence.

Regarding the species diversity it is obvious that in the sampling sites 3 and 4 (on Drincea River) not only the number of species and the total number of individuals are the highest, but also the proportion of the total that occurs in each species.

The highest resemblance of the fish communities was found for the sampling sites 8-10 and 11-13 (in Desnatui catchment area).

ABSTRACT

The study was carried out in 2007 in three of the Danube tributaries, namely Drincea, Balasan, and Desnatui. Our research aims to contribute to the knowledge update by analyzing the structure of the fish communities in this area, and also to assess the state of fish communities from the ecological point of view. In this respect, after a taxonomical analysis, an ecological analysis was made, using some of ecological indices as well as biodiversity indices.

The fish communities of the Drincea, Balasan, and Desnatui rivers display a great richness in species, especially in Drincea River. The ecological analysis reveals well-balanced fish communities in all of the three tributaries.

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