Studii şi Cercetări	Mai 2018	Biologie	27/2	89-94	Universitatea"Vasile Alecsandri" din Bacău

WATER QUALITY ALTERATION REFLECTED IN THE STRUCTURE OF FISH COMMUNITIES IN THE BASIN OF VEDEA RIVER (DANUBE TRIBUTARY, ROMANIA)

Dorel Ureche, Camelia Ureche

Key words: *water quality, alteration, fish communities, biodiversity, Vedea River*

INTRODUCTION

The importance of the fish fauna for the assessment of the water quality is well known, as well as the advantages of using the fish for the assessment and monitoring the inland waters since they are among the most sensitive organisms to environmental changes. The deeper the changes in water quality, the greater the changes in the structure of fish communities.

This is the main reason for scientists to update the scientific data regarding the structure of the fish communities relative to the significant environmental changes in the last decades, mainly induced by the human activities.

In the last decade only few extensive studies were performed in the same area (Imecs & Nagy, 2016).

MATERIAL AND METHODS

The present study was carried out in 2007 in the basin of Vedea River, on the main course of the river, and on some of its tributaries (Fig. 1). Our research aimed to update the scientific data regarding the structure of fish communities and to highlight the significant changes in fish communities as a result of the human activities impact.

The biological material was sampled by electrofishing from 20 sampling sites; it was determined and immediately released. The taxonomic analysis revealed the presence of 22 fish species in the study area, one of them being non-native (*Psedorasbora parva*).

An ecological analysis was made for the quantitative structure of the fish communities in the study area.

The hydro-chemical characteristics in sampling sites (temperature, pH, conductivity) are presented in the Table 1.

The assessment of biodiversity was made based on some of the biodiversity indices (Margalef, Menhinick, Simpson, Shannon-Wiener), and evenness (equitability) (Table 2).

RESULTS AND DISCUSSIONS

The frequency of fish species in the whole study area ranges between 5.00% and 80.00%. The highest value of the frequency (80.00%) has recorded by *Squalius cephalus*, and it is followed by *Alburnus alburnus,* (75.00%) and then by *Cobitis taenia* (70.00%), and then by *Gobio obtusirostris, Pseudorasbora parva, Barbus meridionalis,* and *Carassius gibelio* (65.00%) (Fig. 2).

Vedea River

Vedea River is one of the left tributaries of the Danube. It springs from Cotmeana Platform and joins the Danube downstream Zimnicea town (Teleorman County). The total length of Vedea River from its source to its confluence with Danube is 224 km with a catchment area of 5,430 km^2, an average elevation of 166 m, and an average slope of 2‰.

Vedea River'tributaries

Teleorman River has a 169 km length, with a catchment area of 1427 km^2, an average elevation of 148 m, and an average slope of 2‰.

Cotmeana River has a 93 km length, with a catchment area of 498 km^2, an average elevation of 306 m, and an average slope of 5‰.

Plapcea River has a 56 km length, with a catchment area of 354 km^2, an average elevation of 246 m, and an average slope of 4‰.

Finaly, one of the sampling site is placed on Clanita stream, which is one of Teleorman River tributaries, having a 81 km length, with a catchement area of 267 km^2, an average elevation of 112 m, and an average slope of 2‰.

The fish community in the study area includes 22 species, three of them being the most common and recording the highest values of frequency: *Squalius cephalus* (80%)*, Alburnus alburnus* (75%)*, and Cobitis taenia* (70%)*.* They are followed by *Gobio obtusirostris, Pseudorasbora parva, Barbus meridionalis,* and *Carassius gibelio,* with a frequency of 65%. However, the most abundant species are by far *Squalius cephalus* (22.41%), *Rhodeus amarus* (17.28%), and *Barbus meridionalis* (14.86%).

Regarding the fish stocks we found that the numerical stock of fish species in sampling sites ranged between 0.3 and 3070.2 ind./100 m^2.

By far, *Squalius cephalus* is the dominant fish species, both in terms of numerical stock and frequency. The highest value of numerical stock was recorded in Teleorman tributary, Vitanesti village side.

Analyzing the numerical stock of the fish species in sampling sites, we found that the highest value was recorded in Vedea River, downstream Buzesti bridge (1871.2 ind./100 m^2), followed by Vedea, upstream Floru village bridge (1550.8 ind./100 m^2).

The best represented fish species are *Squalius cephalus* (21.43 ind./100 m^2), *Rhodeus amarus* (16.52 ind./100 m^2), and *Barbus meridionalis* (14.21 ind./100 m^2).

It can be seen that both in Vedea River and the tributaries in the study area, *Squalius cephalus* is an eudominant and euconstant species, and this finding leads to the conclusion that the study area overlaps on the European chub zone (Fig. 3).

Comparing Vedea River with the tributaries in the study area it can be seen that in both areas 18 fish species were identified, meaning that the species richness is comparable.

In Vedea River eight of the 18 fish species have recorded numerical stock values which exceed 1 ind./100 m^2. These are *Squalius cephalus* (16.50), *Gobio obtusirostris* (11.44), *Barbus meridionalis* (8.25), *Carassius gibelio* (6.54), *Alburnus alburnus* (3.43), *Cobitis taenia* (2.53), *Sabanejewia romanica* (2.27), and *Pseudorasbora parva* (2.08) (Fig. 3).

On the other hand, in the study tributaries, ten of the 18 fish species have recorded numerical stock values which exceed 1 ind./100 m^2. From this point of view *Rhodeus amarus* is better represented then in Vedea River (38.59), and it is followed by the *Squalius cephalus* (26.75), *Alburnus alburnus* (17.86), *Carassius gibelio* (17.10) and others (Fig. 4).

Overall, regarding to the fish stocks in the whole studied area we found that the numerical stock of fish species ranged between 0.13 and 234.81 ind./100 m^2, the highest value being recorded by *Squalius cephalus*, Figure 5 presents numerical stock of the most common fish species in in the whole study area (Fig. 5).

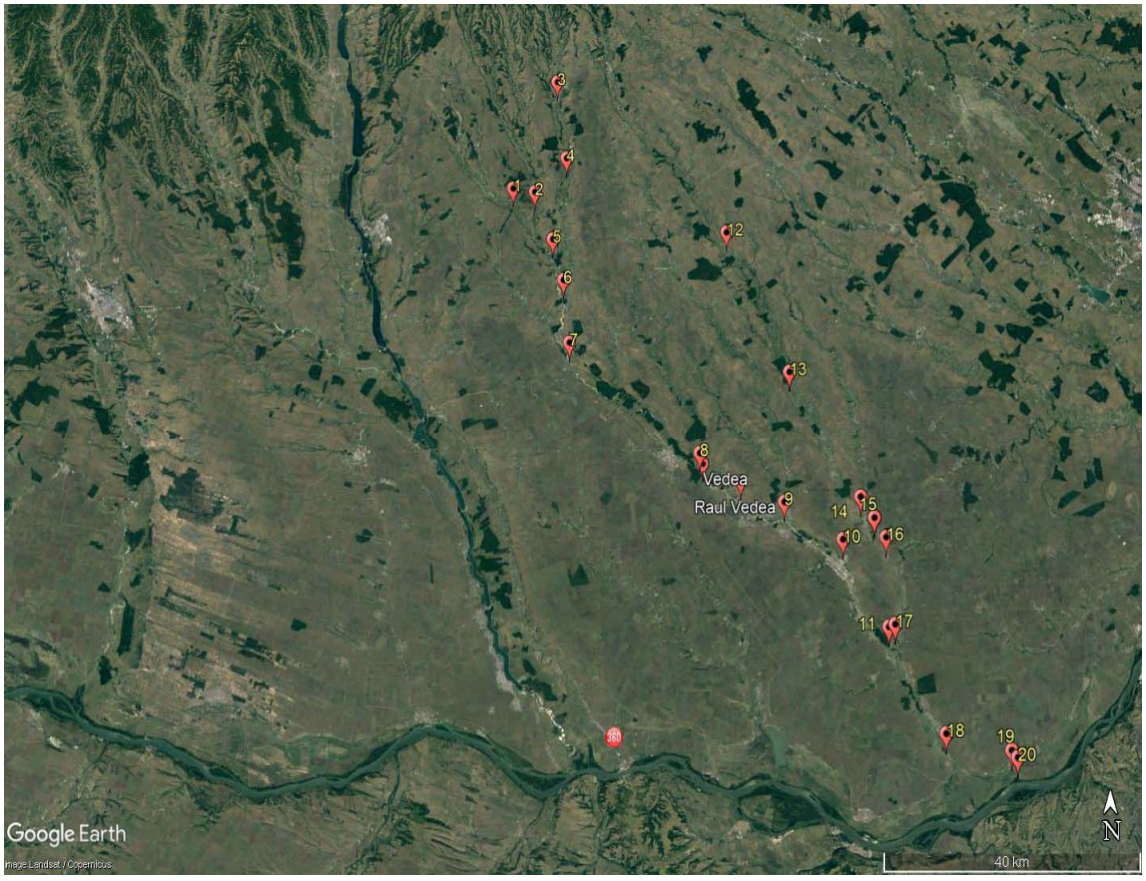

Fig.1. Sampling sites on the studied rivers: Plapcea (1), Vedea (2; 5-11; 18-20), Cotmeana (3,4), Teleorman (12, 13, 15-17), and Clanita (14)

Table 1. Biotope variables and hydro-chemical characteristics in sampling sites in the study area

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	Plapcea, downstream Sinesti bridge	8	44.27611	24.40094	156	29.7	6.8	466
2	Vedea, downstream Buzesti bridge	5	44.27424	24.42906	145	26.5	6.9	554
3	Cotmeana, upstream Falfani village	3	44.37226	24.45726	204	23.5	6.7	808
4	Cotmeana, downstream Martalogi bridge	6	44.30400	24.47111	169	21.7	7.2	744
5	Vedea, upstream Floru village bridge	8	44.23156	24.45149	131	32.4	7.3	2270
6	Vedea, Barza village side	2	44.19050	24.46779	118	34.5	6.8	5010
7	Vedea, upstream Valeni bridge	6	44.14489	24.47393	114	35.6	6.7	4210
8	Vedea, Vedea village side	7	44.05391	25.03524	70	33.8	7.3	2620
9	Vedea, upstream Mavrodin bridge	6	44.01621	25.13365	43	32.6	7.6	1772
10	Vedea, upstream Alexandria bridge	10	43.58861	25.20146	41	32.1	7.8	1483
11	Vedea, upstream Teleorman-Vedea confluence	6	43.51791	25.25916	28	31.8	8.2	1345
12	Teleorman, downstream Tatarastii de Sus bridge	10	44.24417	25.07314	113	26.8	7.9	725
13	Teleorman, Perii Brosteni village side	10	44.11990	25.14928	71	29.4	7.2	822
14	Clanita, upstream Clanita-Teleorman confluence	6	44.03041	25.23629	51	24.5	7.6	753
15	Teleorman, Vitanesti village side	11	44.00380	25.24590	45	23.4	7.3	904
16	Teleorman, Purani village side	12	43.58651	25.26011	40	30.5	7.6	931
17	Teleorman, upstream Teleorman-Vedea confluence	15	43.51698	25.26503	29	27.9	8.2	998
18	Vedea, downstream Bragadiru village	11	43.43703	25.31805	21	29.8	7.9	1143
19	Vedea, downstream Pietrosani village	2	43.42152	25.39674	19	32.5	8.7	1414
20	Vedea, upstream Vedea-Danube confluence	4	43.41299	25.31288	18	33.9	7.8	1130

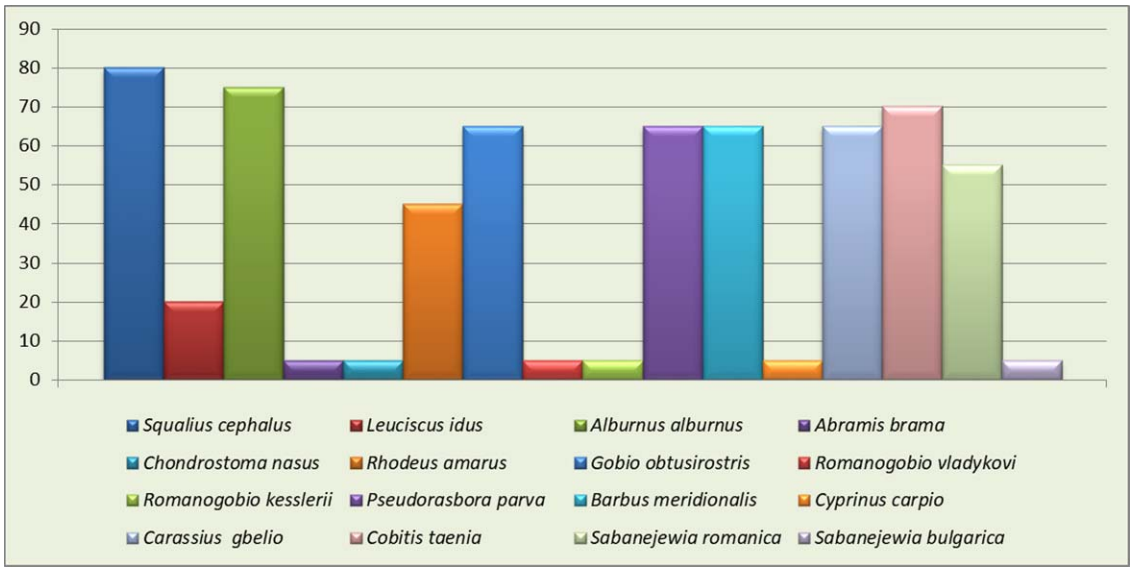

Fig. 2. The frequency of fish species in the study area

The biodiversity is quite high, during the study period, 22 fish species being identified, with an amount of 5944 individuals. One of the 22 fish species is non-native (*Pseudorasbora parva*).

The biodiversity assessment was made by using indices for species richness (Margalef, Menhinick), for the biodiversity of a habitat (Simpson). We used also Shannon-Wiener index (to measure the degree of organization or disorganization of the study systems), and eveness (equitability) to measure of the relative abundance of the different species making up the richness of an area.

Table 2 presents the biodiversity indices and equitability for the fish communities in the study area.

Analyzing the table 2 it can be seen that the highest diversity was recorded in two of the sampling sites: 17 (15 species) and 16 (12 species), both of them placed on Teleorman tributary. According to Margalef index, the highest species richness was recorded in three of the sampling sites, one of them placed on Vedea River, and the others on Teleorman tributary.

The Simpson index suggests the best situation for the sampling sites 13, 15, and 16, where the proportion of the total that occurs in each species (Table 2).

Having in mind all the biodiversity indices we can consider the fish communities in sampling sites 13, 15, and 16 seem to be the best balanced, even if the number of fish species is the highest in the sampling site 17.

In a recent study in Vedea River catchment (including 12 sampling sites on the main course of Vedea River) which was conducted in 2015, only 19 fish species were detected (Imecs & Nagy 2016), relative to 22 fish species in 2007. This finding should lead to the conclusion that the environmental conditions have undergone significant and unfavorable changes for fish fauna.

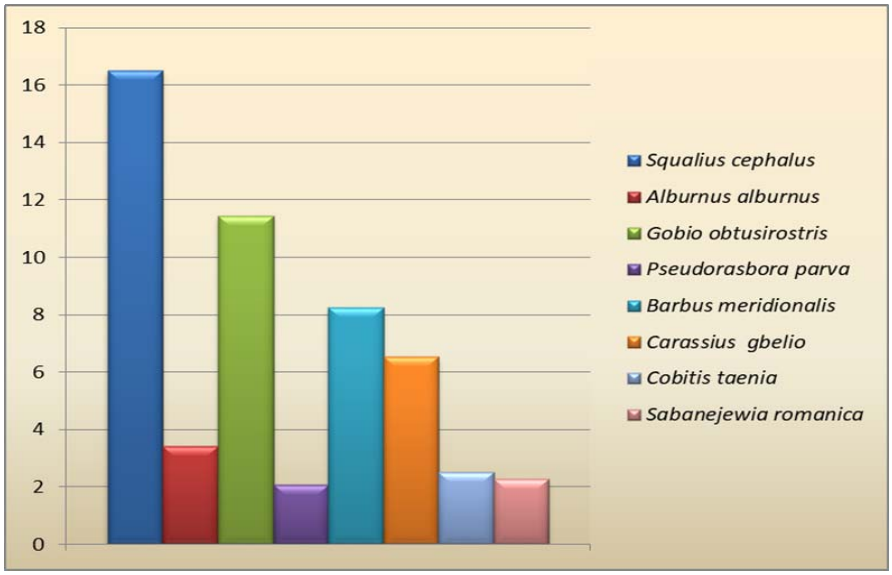

Fig. 3. Numerical stock of the dominant fish species in Vedea River

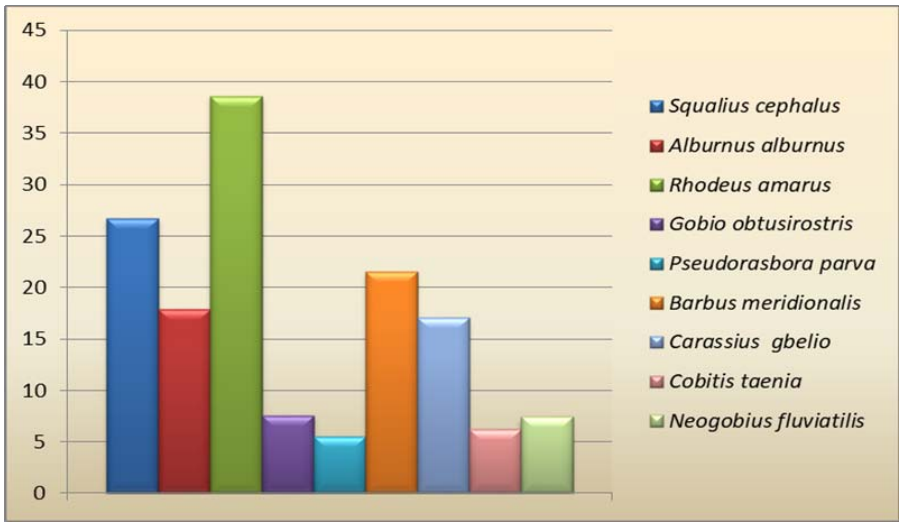

Fig. 4. Numerical stock of the dominant fish species in Vedea River tributaries

Regarding the presence of some fish species of community interest, the following considerations are necessary:

1. In our research study which has been performed in 2007 we could detect the presence of *Romanogobio kesslerii* in only one of the sampling sites but with a very low abundance.

2. Only 11 fish species were detected in both studies (2007 and 2015). This means that the probability of detecting all fish species is very low even if we have used electrofishing.

3. However, if some fish species could not be detected in the recent studies, this means that the environmental conditions are not appropriate for them but for others, less sensitive to this kind of changes.

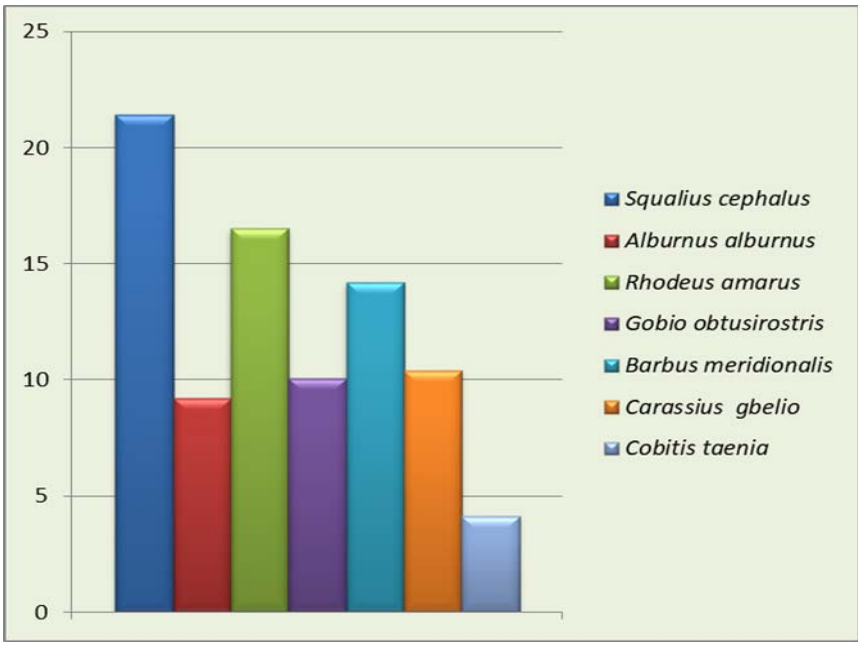

Fig. 5. Numerical stock of the most common fish species in the whole study area (ind./100 m^2)

Table 2. Biodiversity indices in the study area

No. of sampling site	No. of species	Margalef	Menhinick	Simpson (S-1)	Shannon-Wiener (H')	Evenness ( )
1	8	2,895	0,494	0,771	0,728	0,350
2	5	1,550	0,256	0,568	0,421	0,262
3	3	0,815	0,178	0,540	0,370	0,337
4	6	1,905	0,292	0,549	0,396	0,221
5	8	2,620	0,369	0,523	0,511	0,246
6	2	3,322	1,414	1,000	0,301	0,434
7	6	2,469	0,583	0,773	0,666	0,372
8	7	2,598	0,490	0,702	0,601	0,309
9	6	2,401	0,545	0,628	0,499	0,279
10	10	3,446	0,494	0,655	0,643	0,279
11	6	2,958	0,857	0,671	0,568	0,317
12	10	3,259	0,416	0,777	0,717	0,311
13	10	3,298	0,432	0,815	0,807	0,350
14	6	1,943	0,310	0,749	0,658	0,367
15	11	3,823	0,541	0,842	0,858	0,358
16	12	4,643	0,784	0,838	0,859	0,346
17	15	4,832	0,534	0,773	0,798	0,295
18	11	4,785	0,992	0,745	0,739	0,308
19	2	0,446	0,151	0,342	0,227	0,328
20	4	2,881	1,206	0,745	0,539	0,389

CONCLUSIONS

Taxonomic analysis highlighted 22 fish species, one of them being non-native. The most common species in the whole study area are *Squalius cephalus* (80%), *Alburnus alburnus* (75%), *and Cobitis taenia* (70%).

The numerical stock of fish species in sampling sites ranged between 0.13 and 234.81 ind./100 m^2, the highest value being recorded by *Squalius cephalus* in Vedea River, upstream Floru village.

After the analysis of the biodiversity indices we can conclude that the fish communities in sampling sites 13, 15, and 16 seem to be the best balanced.

ABSTRACT

The study was carried out in 2007 in Vedea River catchment area, including three of its tributaries (Plapcea, Cotmeana. Teleorman), and one of Teleorman River tributary (Clanita). 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.

Comparing the structure of fish communities in our study with that of a recent study in Vedea River catchment area we could highlight the main differences between the structures of fish communities in the two period.

REFERENCES

1. BĂNĂDUC D., BĂNĂDUC ANGELA, 2014 - The "Porţile de Fier/Iron Gates" Nature Park (Romania) some Danube northern tributaries fish fauna Transylvanian Review of Systematical and Ecological Research , Special Issue, 16:165-170;
2. BĂNĂDUC D., BĂNĂDUC ANGELA, LENHARDT MIRJANA, GUTI G., 2014 - "Porţile de Fier"/"Iron Gates" Gorges area (Danube) fish fauna, Transylvanian Review of Systematical and Ecological Research, Special Issue, 16:169-194;
3. BĂNĂRESCU P., 1964 - Fauna R.P.R., Pisces-Osteichthyes, XIII, Ed. Acad., Bucureşti.
4. BĂNĂRESCU P., 1968 - Lista revizuită a speciilor de peşti din România, Bul. Inst. Cerc. Pisc., 3: 53-62;
5. CIOLAC A. 2004 - Migration of fishes in Romanian Danube River (Nº 1), Applied Ecology and Environmental Research, 2(1): 143–163;
6. FROESE, R. AND D. PAULY. Editors. 2014 - FishBase. World Wide Web electronic publication. www.fishbase.org, version (06/2018);
7. IMECS I., NAGY A.-A., 2016 - Data concerning the fish fauna of the ROSCI 0386 Vedea River Natura 2000 site (Romania), Rom. J. Biol. – Zool., 61, (1–2): 75–90;
8. KOTTELAT M., FREYHOF J., 2007 - Handbook of European Freshwater Fishes, Kottelat, Cornol, Switzerland and Freyhof, Berlin, Germany;
9. URECHE D., URECHE CAMELIA, 2015 - Research regarding the fish communities in Bahna, Topolnita and Blahnita (Danube tributaries, Romania), Studii şi Cercetări Ştiinţifice, Biologie, 24 (2): 67-72.

AUTHORS' ADDRESS

URECHE DOREL, URECHE CAMELIA - University "Vasile Alecsandri" of Bacau, Faculty of Sciences, Department of Biology, Ecology and Environmental Protection, 157 Marasesti Street, 600115 Bacau, Romania, e-mail: dureche@ub.ro; urechec@ub.ro