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WATER QUALITY AND STRUCTURE OF FISH POPULATIONS IN DIFFERENT AREAS OF THE TIMIS RIVER

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Abstract

Researchers have been conducted on the Timis River, during which 6 fishing stations were established where 6 determinations of the chemical composition of water were made and the existing fish populations were evaluated. In the water of Timis River, from springs to the mouth, increased the 5 days-biochemical oxygen demand (BOD5 from 1.80 to 3.58 mg O_2/l), also the accumulation of nitrates (from 1.82 to 2.77 mg/l), nitrites accumulation (from 0.015 to 0.045 mg/l), chlorides (from 2.50 to 8.51 mg/l) and hardness (from 1.27 to 5.52 dH°). In the Timiş river 36 fish species have been identified, which proves a good ecological status. Depending on the physic-chemical properties of the water, salmonids fish population was spread only in the mountain area, and cyprinids in hills and low land area. A large distribution was expressed in Barbel, Chub, Chased the Umber and Spirlin, which were found between the Teregova fishing station (mountain area), Lugoj stations (hilly area) and stations from Sag and Graniceri (lowlands area). In the warm waters of low lands were found: Bream, ide, pike-perk, sterlet, Verner, eels and Wheatear.

Key words*: Timis River, chemical composition of water, species of fish, areas of river course.*

INTRODUCTION

The Timis River, the largest drainage river in the Banat hydrographic area, collects the waters from a basin area of 5673 km. It takes water from rivers that drain the Tarcului-Godeanu Mountains, the Semenic Mountains and Poiana Ruscă Mountains. From the Ţarcu-Godeanu mountains receives the Cold River (Hidişelul), and from the Semenic Mountains receives the Bistra River. The middle course of Timiş River crosses the depressed area of Lipova and Buziaş Hills. In the lower course it has a wide riverbed, with low slope, generating floods. Through a double interconnection Timiş-Bega, the natural hydrological regime of the two rivers is regularized. In the lower course, Timiş River receives as the most important affluent, Pogăniş River (Catalogul habitatelor, speciilor şi siturilor. Info-natura 2000 în România, 2013).

MATERIALS AND METHODS

Along the Timiş River 6 fishing stations were established, where were made determinations of the chemical composition of the water and the existing fish populations were evaluated. The fishing stations were set at: Accumulation Three waters – Fenesti Confluence (Figure 1), Teregova (Figure 2), Lugoj-CFR Bridge (Figure 3), Lugoj-Timişana Confluence (Figure 4), Şag (Figure 5) and Grăniceri (Figure 6).

The first two fishing stations were included in the mountain area of Timiş, the two from Lugoj in the hilly area and the last two (Şag and Grăniceri) in the area of lowland.

For the study of the chemical composition of the water of each fishing station, the 5 days-biochemical oxygen demand was determined (BOD5), dissolved oxygen, pH, nitrates (NO_3^-), nitrites (NO_2^-), chlorides and hardness.

RESULTS AND DISCUSSIONS

Table 1 presents the average, the dispersion indices and the significance of the differences between the chemical compositions of the water in different fishing stations of the Timiş River.

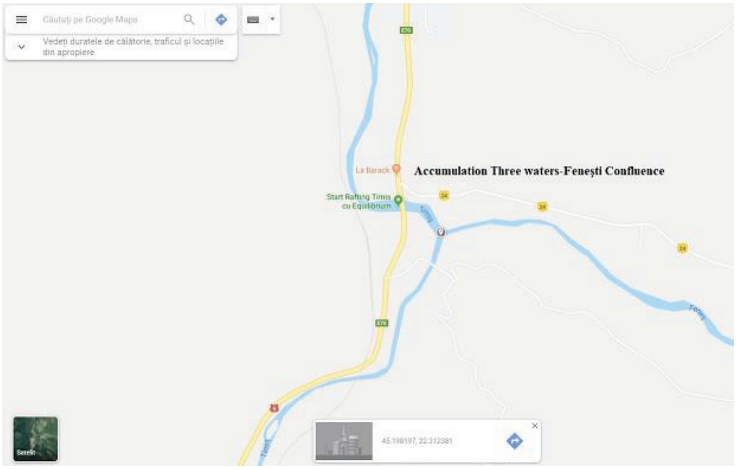

Figure 1. Timiș River at Accumulation Three waters-Fenești Confluence on Google Maps

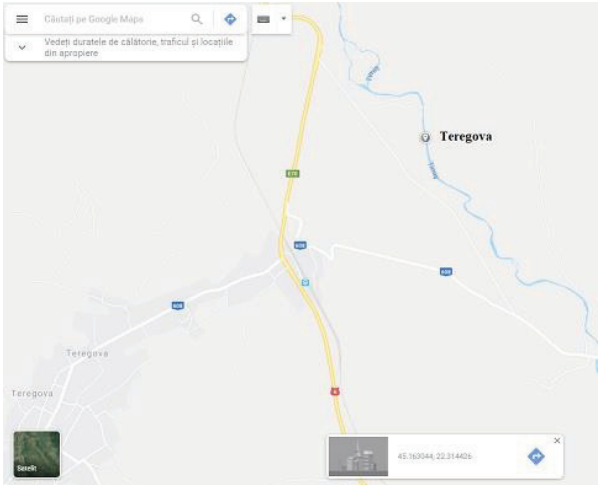

Figure 2. Timiș River at Teregova on Google Maps

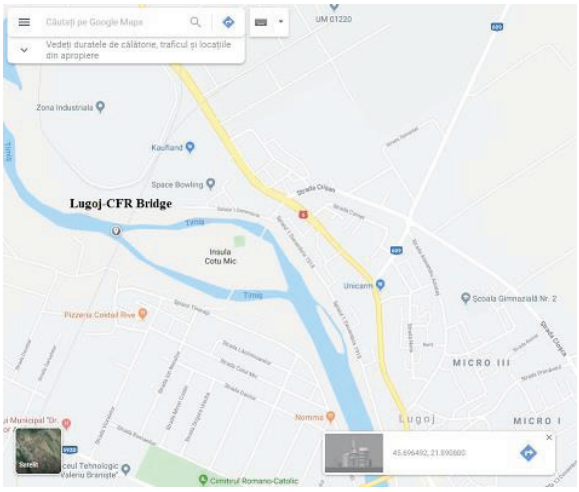

Figure 3. Timiș River at Lugoj-CFR Bridge on Google Maps

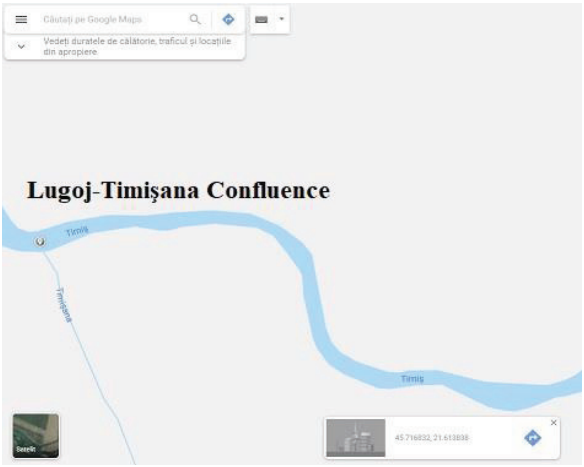

Figure 4. Timiș River at Lugoj-Timișana Confluence on Google Maps

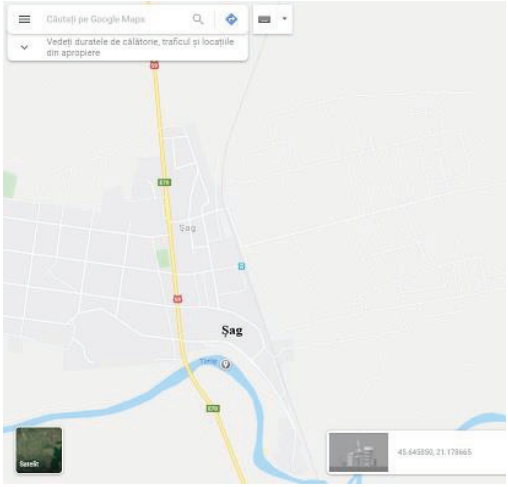

Figure 5. Timiș River at Șag on Google Maps

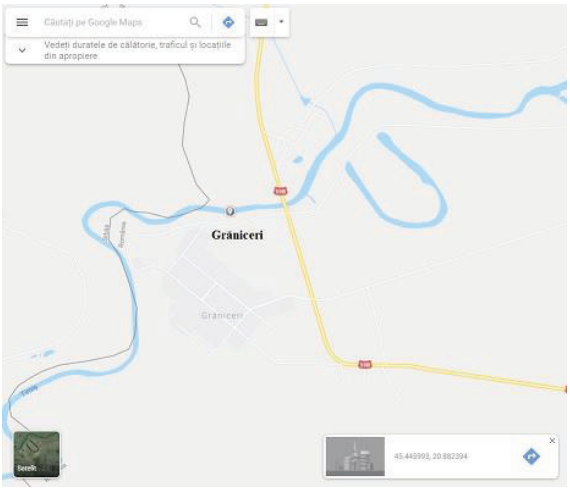

Figure 6. Timiș River at Grăniceri on Google Maps

During the passage from the springs to the discharge, in the water of the Timiş River, the level of 5 days-biochemical oxygen demand increased from 1.8 ± 0.05 to 3.58 ± 0.08mg O_2/l, the nitrates level increased from 1.82 ± 0.05 to 2.77 ± 0.31mg/l, and the chloride level increased from 2.50 to 8.51mg/l. BOD5 may be influenced by the discharge of dairy by-products, such as whey, into the river water, leading to a higher BOD5 with direct effect on fish species that do not tolerate low oxygen concentrations (Ahmadi et al., 2018, 2019).

Table 1. The mean and dispersion indices of chemical composition of water in different fishing station of Timiş River

Fishing station		Accumulation Three waters-Feneş Confluence	Teregova	Lugoj-CFR Bridge	Lugoj-Timişana Confluence	Şag	Grăniceri
5 days-biochemical oxygen demand (BOD5) (mg O_2/l)	x ± SE	$1.8^{a} \pm 0.05$	$1.9^{a,c} \pm 0.1$	$2.74^{a,d,e} \pm 0.255$	$2.8^{b,c,e} \pm 0.235$	$2.41^{a,c,d,f} \pm 0.215$	$3.58^{b,e} \pm 0.08$
	SD	0.07	0.414	0.36	0.332	0.304	0.113
Dissolved oxygen (mg O_2/l)	x ± SE	$10.90^{a} \pm 0.15$	$10.85^{a} \pm 0.05$	$10.01^{a} \pm 0.28$	$8.47^{a} \pm 0.14$	$9.11^{a} \pm 0.02$	$9.39^{a} \pm 1.15$
	SD	0.212	0.07	0.395	0.197	0.028	1.62
pH	x ± SE	$7.22^{a} \pm 0.175$	$7.25^{a} \pm 0.15$	$7.37^{a} \pm 0.125$	$7.09^{a} \pm 0.04$	$7.25^{a} \pm 0$	$7.52^{a} \pm 0.025$
	SD	0.247	0.212	0.176	0.056	0	0.035
Nitrates (NO_3^-) (mg/l)	x ± SE	$1.99^{a} \pm 0.46$	$1.82^{a} \pm 0.05$	$1.93^{a} \pm 0.23$	$2.33^{a} \pm 0.34$	$2.33^{a} \pm 0.35$	$2.77^{a} \pm 0.31$
	SD	0.65	0.07	0.325	0.48	0.494	0.438
Nitrites (NO_2^-) (mg/l)	x ± SE	$0.02^{a} \pm 0$	$0.015^{a} \pm 0.005$	$0.05^{a,b} \pm 0.01$	$0.085^{a} \pm 0.015$	$0.06^{a,b} \pm 0.01$	$0.045^{a,b} \pm 0.005$
	SD	0	0.007	0.014	0.021	0.014	0.007
Chlorides (mg/l)	x ± SE	$2.5^{a} \pm 0$	$2.5^{a} \pm 0$	$2.5^{a} \pm 0$	$5.945^{a,c,d} \pm 1.145$	$7.09^{b,c} \pm 1.42$	$8.51^{b,d} \pm 0$
	SD	0	0	0	1.619	2.008	0
Water hardness (dH°)	x ± SE	$1.26^{a} \pm 0.11$	$1.28^{a} \pm 0.16$	$3.78^{b} \pm 0.21$	$4.86^{b} \pm 0.285$	$5.24^{b} \pm 0.775$	$5.8^{b} \pm 0.19$
	SD	0.155	0.226	0.296	0.403	1.09	0.268

Note: ● between the means with the same letter there are insignificant differences ($p > 0.05$)
● between the means with different letter there are significant differences ($p < 0.05$)

Contrary to the upward evolution of these parameters, the level of dissolved oxygen in water decreased from 10.9 ± 0.15 to 9.39mg O_2/l, the level of nitrites decreased from 0.15 ± 0.005 to 0.045 ± 0.005mg/l, and the pH of the water recorded relatively uniform values, ranging from 7.22 ± 0.175 and 7.52 ± 0.025.

The water hardness of the Timiş River varied between 1.26 ± 0.11 and 5.8 ± 0.19 dH°.

The 5 days-biochemical oxygen demand was significantly lower ($p<0.05$) in the Feneş fishing station than in the Lugoj - Timişana Confluence stations and the Grăniceri one.

For the level of nitrites, significant differences ($p<0.05$) were recorded in the water from the fishing stations Feneş and Lugoj- Timişana Confluence, as well as between that of the station Teregova and Lugoj-Timişana Confluence.

Chlorides levels showed significant differences ($p<0.05$) between the waters of the fishing stations in Feneş and those of Şag and Grăniceri, between those of Teregova and those of Şag and Grăniceri, as well as between those of Lugoj station-CFR Bridge and those from Şag and Grăniceri.

The water hardness of the mountain stations (Feneş and Teregova) was significantly ($p<0.05$) lower than those of the stations of Lugoj-CFR Bridge, Lugoj- Timişana Confluence, and also Şag and Grăniceri.

Between the other components of the water chemical composition the differences were insignificant ($p>0.05$).

Table 2 shows the average, the dispersion indices and the significance of the differences ($p <0.05$) between the chemical composition of water in different areas of the Timiş River.

The 5 days-biochemical oxygen demand was lower (1.8 ± 0.054 mgO_2/l) in the upper area, recorded an average value (2.77 ± 0.142mg O_2/l) in the middle area and recorded the value higher (2.947±0.349mg O_2/l) in the lower area.

Table 2. The mean and dispersion indices of chemical composition of water in different areas of Timiș River

Area		Upper	Middle	Lower
5 days-biochemical oxygen demand (BOD5) (mg O_2/l)	x ± SE	1.8^{a} ± 0.054	$2,771^{b}$ ± 0.142	2.947^{b} ± 0.349
	SD	0.108	0.285	0.698
Dissolved oxygen (mg O_2/l)	x ± SE	10.881^{a} ± 0.066	$9,24^{b}$ ± 0.462	$9,25^{b}$ ± 0.476
	SD	0.132	0.925	0.952
pH	x ± SE	7.235^{a} ± 0.094	7.232^{a} ± 0.098	7.387^{a} ± 0.08
	SD	0.188	0.196	0.160
Nitrates (NO_3^-) (mg/l)	x ± SE	1.905^{a} ± 0.195	1.9^{a} ± 0.168	2.55^{a} ± 0.229
	SD	0.39	0.336	0.458
Nitrites (NO_2^-) (mg/l)	x ± SE	0.017^{a} ± 0.002	0.067^{b} ± 0.012	0.052^{b} ± 0.006
	SD	0.005	0.025	0.012
Chlorides (mg/l)	x ± SE	2.5^{a} ± 0	4.222^{a} ± 1,098	$7,8^{b}$ ± 0.71
	SD	0	2,197	1.42
Water hardness (dH°)	x ± SE	1.27^{a} ± 0.079	4.31^{b} ± 0.342	5.522^{c} ± 0.363
	SD	0.158	0.684	0.726

Note: ● between the means with the same letter there are insignificant differences ($p > 0.05$)
● between the means with different letter there are significant differences ($p<0.05$)

In the water of the Timiș River the dissolved oxygen content was highest in the upper zone (10.881 ± 0.066 mg O_2/l) and almost as small in the lower area (9.25 ± 0.476mg O_2/l) as in the middle one (9.24 ± 0.462mg O_2/l).

The chlorides level in the water of the Timiș River increased from the upper area (2.5 mg/l), to the middle one (4.222 ± 1.098 mg/l), to reach the maximum value in the lower area (7.8 ± 0.71 mg/l).

The water from the Timiș River recorded a nitrates content of 1.905 ± 0.195 mg/l in the upper area, 1.9 ± 0.168 mg/l in the middle area and the highest concentration 2.55 ± 0.229 mg/l, in the lower area.

Nitrites content was low, of 0.017 ± 0.002 mg/l in the upper area, 0.067 ± 0.012 mg/l in the middle area and 0.052 ± 0.006 mg/l in the lower area.

Significant differences ($p<0.05$) were registered for the 5 days-biochemical oxygen demand between the upper area and the middle and lower areas, for the oxygen dissolved in the water between the upper area and the middle and lower areas, as well as for the nitrites content between the upper area and the middle and lower areas, and for chlorides between the lower and upper and middle areas.

The water hardness increased from upstream to downstream, being 1.27 ± 0.079 dH° in the upper area, 4.31 ± 0.342 dH° in the middle area and 5.522 ± 0.363 dH° in the lower area.

For water hardness, significant differences ($p<0.05$) were reported between the middle and lower areas.

Among the other characteristics of the chemical composition of the waters in different areas of the Timiş River, the differences were insignificant ($p>0.05$).

In the researches reports it is noted that between the amount of dissolved oxygen in water and the fish species there is a conditionality ratio, oxygen being a limiting factor, of extension and of numerical regulation.

Depending on the oxygen requirement, fish species may be steno-oxibionts that require large amounts of oxygen dissolved in water (Vasiliu, 1959). Of this category belong: trout, grayling, Danube salmon, minnow, common chub, barbell, loach, European bullhead, and others, which require more than 6 mg O_2/l water. Euri-oxibiont species of fish require less oxygen in water (3-4 mg O_2/l water or even less). Most of the cyprinids (carp, goldfish, crucian carp, tench, asp, common rudd, common bream, ide and others), wels catfish, European weatherfish, Northern pike (Păcală et al., 2006) belong to this group.

In order to illustrate these characteristics, in table 3 we present the spreading areas of the fish species from the Timiş River.

From the analysis of the table, it appears that the salmonid species are widespread in the mountain area, and the cyprinids in the hilly and lowland areas (Bates et al., 2003; Bănărescu, 1964; Bud et al., 2001, 2016; Bura and Bănățean, 2017). A high biological plasticity we find at the barbell, common chub, riffle minnow, barley, clean and grassy, which

are presented starting from the area of the fishing station Teregova (mountain area), the stations of Lugoj (the area of hills) and the stations of Şag and Grăniceri (area of lowland).

Table 3. Spreading areas of fish species from Timiş River

Crt. no.	Species	Fishing stations					
		Feneş	Teregova	Lugoj-Timişeana Confluence	Lugoj-CFR Bridge	Şag	Grăniceri
1.	Danube lamprey (*Lampetra danfordi*)	+					
2.	Danube salmon (*Hucho hucho*)	+					
3.	River Indigenous Trout (*Salmo trutta fario*)	+	+				
4.	Minnow (*Phoxinus phoxinus*)	+	+	upstream			
5.	Grayling (*Thymallus thymallus*)		+				
6.	European bullhead (*Cottus gobio*)		+	+			
7.	Loach (*Nemacheilus barbatulus*)		+	+		lost	
8.	Romanian Barbel (*Barbus petenyi*)		+	+	+		
9.	Common nase (*Chondrostoma nasus*)		+	+	+		
10.	Danube streber (*Zingel streber*)		+	+	+		
11.	Ling or bubbot (*Lota lota*)		+	+	+	+	
12.	Barbel (*Barbus barbus*)		+	+	+	+	+
13.	Common chub (*Leuciscus cephalus*)		+	+	+	+	+
14.	Riffle minnow (*Alburnoides bipunctatus*)		+	+	+	+	+
15.	Romanian loach (*Cobitis romanica*)			+	+		
16.	Spined loach (*Cobitis taenia*)			+	+	+	+
17.	Asp (*Aspius aspius*)			+	+	+	+
18.	Tench (*Tinca tinca*)			+	+	+	+
19.	Northern (*Esox lucius*)			+	+	+	+
20.	Wels catfish (*Silurus glanis*)			+	+	+	+
21.	European pech (*Perca fluviatilis*)			+	+	+	+
22.	Common bleak (*Alburnus alburnus*)			+	+	+	+
23.	Vimba bream (*Vimba vimba*)			+	+	+	+
24.	Kessleri (*Gobio kessleri*)			+	+	+	+
25.	European carp (*Cyprinus carpio*)			+	+	+	+
26.	Roach (*Rutilus rutilus*)				+	+	+
27.	Common dace (*Leuciscus leuciscus*)				+	+	+
28.	Silver bream (*Blicca björkna*)				+	+	+
29.	Goldfish (*Carassius auratus gibellio*)				+	+	+
30.	Crucian carp (*Carassius carassis*)					+	+
31.	Sterlet (*Acipenser ruthenus*)					+	+
32.	Zander (*Stizostedion lucioperca*)					+	+
33.	Common bream (*Abramis brama*)					+	+
34.	European weatherfish (*Misgurnus fossilis*)					+	+
35.	Ide (*Leuciscus idus*)					+	+
36.	Common zingel (*Zingel zingel*)						+

Only in the warm waters of the lowlands have the following species: common bream, ide, crucian carp, starlet, common zingel, zander, and European weatherfish.

CONCLUSIONS

During the flow of springs to spills in the water of the Timiş River the 5 days-biochemical oxygen demand has increased (from 1.80 to 3.58 mg O_2/l), accumulating nitrates (from 1.82 to 2.77 mg/l), nitrites (from 0.015 to 0.045 mg/l) and chlorine (from 2.50 to 8.51 mg/l). Compared to these parameters, the dissolved oxygen in water decreased (from 10.90 to 9.39 mg O_2/l), and the pH was slightly uniform alkaline (between 7.22 and 7.52).

The Timiş River water recorded the lowest hardness in the upper zone (1.26 dH°), which increased in the middle zone (4.31 dH°) and

reached the maximum value in the lower area (5.52 dH°).

The good ecological status of the Timiş River is reflected by the diversity of the aquatic fauna, composed of 36 species of fish of community interest.

By correlating the physico-chemical properties of the water along the Timiş River with the habitats reached by the fish species, it has been found that salmonid species are widespread only in the mountain area, and the cyprinids are present in the hilly and lowland areas. High plasticity was proved by of the barbel, Romanian barbel, common chub, common nase, and riffle minnow that were encountered between the fishing station Teregova (mountain area), the stations of Lugoj (hilly area) and the stations of Şag and Grăniceri (the lowland area). Only in the warm waters of the plains were found; the common bream, ide, crucian carp, sterlit, zander, European weatherfish, and common zingel.

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