South Western Journal of Horticulture, Biology and Environment
P-Issn: 2067- 9874, E-Issn: 2068-7958

Vol.3 , No.1, 2012
pp.1-8

DATA UPON THE ICHTYOFANA OF THREE RESERVOIRS FROM THE JIU RIVER, ROMANIA

Oliver Cristian DUMITRAŞCU[1,*] and Ion MITREA[2]

1. National Administration "Romanian Waters" – Jiu River Basin Administration, Bvd. N.Romanescu, no.54, Craiova, Romania.
2. University of Craiova, Horticulture Faculty, Str. A.I.Cuza 13, Craiova, Romania.
* Corresponding author, O.C.Dumitrascu, E-mail: liver.dumitrascu@daj.rowater.ro

Abstract. *During 2008 we studied the ichthyofauna from three dam lakes situated on the Jiu River course from south-western Romniei, using both gillnets and electro-fishing. In the three accumulations we identified 17 fish species. 14 native: Cyprinus carpio*, *Silurus glanis*, *Squalius cephalus*, *Esox lucius*, *Perca fluviatilis*, *Scardinius erythrophthalmus*, *Rutilus carpathorossicus*, *Gobio gobio*, *Gobio albipinnatus*, *Alburnus alburnus*, *Rhodeus sericeus*, *Barbus barbus*, *Cobitis taenia*, *Misgurnus fossilis* and three exotic species: *Carassius auratus gibelio, Lepomis gibbosus*, *Pseudorasbora parva*. *We observed the presence of two invasive species in all three lakes (stone moroko and pumpkinseed), which have developed a lot numerically, because the impact that the accumulations have through the phenomena of stagnation and clogging water suspension. The results obtained using the two study methods are similar.*

Key words: *ichthyofauna, dam lakes, Jiu, gillnets and electric fishing, invasive species.*

INTRODUCTION

Monitoring the ichthyofauna is considered an indicator of the state of aquatic ecosystems, standardizing the monitoring methods being therefore very important (see in: Battes 2009). The changes produced in the aquatic habitats in the recent period, as a consequence of human activities, have profoundly affected fish communities (e.g. Karr 1981). In context, a strong anthropogenic pressure is recorded in the Jiu River hydrograph basin, the impact on the ichthyofauna being amplified by the important human settlements (Chiriac et al 2007). The main factors are building dams and lakes and polluting the water. Dams have a strong influence on fish communities and on the normal functions of water flows (see in: Søndergaard & Jeppesen 2007). Natural and anthropogenic changes make the condition of fish communities from rivers and lakes in the catchment Jiu must bear signifi-

cant external pressure. Highlighting the level of transformation of the fish fauna but also of the changes on the community level can be realized through monitoring actions for both species and communities. Following certain paramentes of the fish populations can offer important data for the protection of the entire quatic ecosystem. Thus, criteria can be established in order to assess the risk degree to which the ecosystem is exposed as well as a plan to reduce negative effects. Towards this goal, our study represents a contribution to the knowledge of the ichthyofauna from the three dam lakes on the Jiu River course.

MATERIALS AND METHODS

The fishing trip took place in July 2008. We analyzed the ichthyofauna from three reservoirs situated on Jiu river, south-western Romania: Isalnita reservoir (44°24'17 "N and 23°41'24" E), Turceni reservoir (44°43'46 "N and 23°22'36" E) and Vadeni reservoir (45°04'26 "N and 23°16'49" E). They were built for water use with multiple hydropower role, flood protection and water supply. Jiu River basin is located in the south - west of Romania, between 43°45'-45°30' north latitude and 22°34'-24°10' east longitude. We used a combined method of fishing, both the fish netting (gill nets) panels type with multi-mesh (from 6-50mm), and electro-narcosis We used a ELT 60 device produced by Scubla Aquaculture, Italy, with 1.5 kW power. The device was placed on a fiberglass boat. Electrical fishing is the method most used today for scientific study of ichthyofauna of inland waters. The method is standardized at European level (SR EN 14 011/2003). In the sections that were possible, fishing was carried out by moving the team through the water, using hip boots (eg accumulation Turceni). For more precise filling of sample ballot it was necessary a GPS (to determine the geographical coordinates), ihtiometer and electronic scale (for some biometric measurements of fish), thermometer (to determine temperature) and lasermeter (for measuring fished surfaces). Gill nets were set in the evening and set out in the morning, according to SR EN 14757: 2006 - "Sampling of fish using nets with different mesh sizes in assessing water quality." We tried that the fixing time to be as short (maximum is 12 hours according the standard mentioned above), because the campaign took place in summer and so there is a risk that all fish caught die from suffocation.

Estimating absolute densities is difficult in large lakes. In these water bodies, a representative sample regarding the number and specific composition, abundance, is actually a series of numerical subprobe proportional with diversity of habitat types. Therefore a stratified sampling methodology is required. Number of samples to be taken depends on the type and number of determinations to be made (Bayley 1990). For example, if the number of samples taken is low (less than 50-100 individuals), the entire catch is used for determination, and when the catch is large (200-500 individuals), number of samples taken may be a minimum of 80-100 individuals. Examination of samples involves counting, studies of biometry (measure-

ments), gravimetry (weighings), removal of scales or other hard structures used to determine age stage later (Lagler 1971). The fish have been manipulated to avoid losses and injuries. Aeration of water from the storage tanks it was essential to reduce fish mortality due to handling. Species identification was performed according with the scientific literature (Banarescu 1964, Kottelat & Freyhof, 2007, Otel 2007, Burian & Grama 2005). All fish were released immediately after processing was completed. Processing and release made by every stage and traveled length. Fish were released in a quiet and deep portion, near the bank. The methodology is according with the standard SR EN 14011/2003. Also we calculated: Shannon-Wiener index (INCDPM 2008), measuring the degree of organization / disorganization of a given system and the Simpson index (index of species diversity) (INCDPM 2008), which takes into account not only the number of species but also proportion of each.

RESULTS AND DISCUSIONS

The number of species caught using reversible electric fishing, was largely similar to those caught using nets with multiple mesh. Thus we captured a total of 1216 individuals from 17 species: *Cyprinus carpio* (carp), *Carassius auratus gibelio* (crucian carp), *Silurus glanis* (catfish), *Squalius cephalus* (chub), *Esox lucius* (pike), *Lepomis gibbosus* (pumpkinseed), *Perca fluviatilis* (perch), *Scardinius erythrophthalmus* (rudd), *Rutilus carpathorossicus* (roach), *Gobio gobio* (gudgeon), *Gobio albipinnatus* (white finned gudgeon), *Alburnus alburnus* (bleak), *Rhodeus sericeus* (bitterling), *Pseudorasbora parva* (stone moroko), *Barbus barbus* (barbel), *Cobitis taenia* (spinned loach), *Misgurnus fossilis* (weather loach), both with gill nets and with electricity fishing. The list of these species constitutes the species composition of the three lakes: Isalnita, Turceni and Vadeni. Among the 17 species, 14 are native and three are exotic (*Carassius auratus gibelio, Pseudorasbora parva* and *Lepomis gibbosus*). The number of species from the three lakes is smaller than the number of species from the entire Jiu River Basin, where recently 37 species were documented (Chiriac et al 2007). The reduced diversity of the fish species from the lakes in comparison to the flowing waters was signaled in other cases, too (Araújo & Santos 2001, Irz et al 2006).

We calculated the numerical abundance in both biomass and number of individuals. Thus, a total of four fixing fishing nets on Isalnita reservoir following results were obtained (Table 1). Also, the numerical abundance was calculated for data obtained from electric fishing (Table 2). From a total of three fixing fishing nets on Vadeni accumulation were obtained results from

the Table 3. After electric fishing on the lake Turceni were obtained results from Table 4.

Table 1. The numerical abundance - Isalnita Lake (gill nets fishing).

Species	Nr. of specimens caught	Density sp/100m²	Biomass (g)	Measurements (lenght, weight)
Carassius auratus gibelio	7	1.33	906	15-25cm, 58-258g
Silurus glanis	2	0.38	1944	43-61cm, 782-1162g
Squalius cephalus	10	1.9	479	11-21cm, 13-84g
Scardinius erythrophthalmus	8	1.52	157	9.5-14cm, 12-28g
Alburnus alburnus	104	19.8	1161	6.5-12cm, 1-15g
Rhodeus sericeus	11	2.09	29	4-8cm, 1-7g
Pseudorasbora parva	83	15.8	399	5-9cm, 1-7g
Barbus barbus	2	0.38	16	7-12cm, 2-14g
Cobitis taenia	1	0.19	14	10cm, 4g

Table 2. The numerical abundance - Isalnita Lake (electric fishing).

Species	Number of specimens caught	Density sp/100m²	Biomass (g)	Measurements (lenght, weight)
Carassius auratus gibelio	12	2.4	1139	12-19.5cm, 38-109g
Silurus glanis	1	0.2	13	11cm, 13g
Squalius cephalus	25	5	775	11-21.5cm, 12-121g
Scardinius erythrophthalmus	5	1	61	8-12cm, 8-16g
Alburnus alburnus	21	4.2	141	6-12cm, 1-11g
Rhodeus sericeus	27	5.4	67	4-7cm, 1-5g
Pseudorasbora parva	30	6	109	4-10cm, 1-9g
Barbus barbus	2	0.4	30	7-14cm, 9-21g
Cobitis taenia	4	0.8	36	7.5-11.5cm, 6-12g
Esox lucius	1	0.2	122	24.5cm, 122g
Lepomis gibbosus	9	1.8	100	4-10cm, 5-20g

Table 3. The numerical abundance - Vadeni Lake (gill nets fishing).

Species	Number of specimens caught	Density sp/100m²	Biomass (g)	Measurements (lenght, weight)
Carassius auratus gibelio	2	1.33	338	19-23cm, 152-186g
Cyprinus carpio	1	0.66	321	27.5cm, 321g
Squalius cephalus	8	5.33	697	8.5-22cm, 8-102g
Alburnus alburnus	112	74.66	660	9-11cm, 5-7g
Rhodeus sericeus	121	80.66	217	5.5-7.7cm, 1-3g
Pseudorasbora parva	52	34.66	162	6-8.5cm, 2-5g
Perca fluviatilis	17	11.33	1405	15.5-25cm, 51-188g
Lepomis gibbosus	4	2.66	64	8-9.5cm, 15-19g
Gobio albipinnatus	36	24	355	9-12cm, 8-13g

Table 4. The numerical abundance - Turceni Lake (electric fishing)

Species	Number of Specimens caught	Density sp/100m²	Biomass (g)	Measurements (lenght, weight)
Carassius auratus gibelio	260	21.66	4001	9.5-23cm, 13-214g
Rutilus carpathorossicus	3	0.25	59	10.5-13.5cm, 13-26g
Squalius cephalus	14	1.16	634	9.5-21cm, 9-95g
Scardinius erythrophthalmus	3	0.25	11	5-8.5cm, 1-6g
Alburnus alburnus	63	5.25	319	7.5-12cm, 3-10g
Rhodeus sericeus	83	6.91	116	4.5-7cm, 1-3g
Pseudorasbora parva	24	2.0	65	5-8cm, 1-5g
Barbus barbus	1	0.08	20	13.5cm, 20g
Cobitis taenia	1	0.08	3	9cm, 3g
Esox lucius	2	0.16	92	13.5-22cm, 16-76g
Lepomis gibbosus	38	3.16	228	5.5-12cm,3-43g
Gobio albipinnatus	6	0.5	8	5-7cm, 1-3g

We can note the presence of a large number of Ciprinidae fish with different feeding regimes, either omnivores or detritivores or insectivores, and several predator like catfish, perch and pike. Although predators fish species have a low relative abundance (RA) (eg pike = 0.4% in Turceni or catfish = 0.87% to Isalnita), they probably have an important role in controlling species which they feed on in the accumulations. The presence of two exotic invasive species in all three lakes was also observed, stone moroko (Ar = 36.4% to Isalnita) and pumpkinseed (Ar = 7.63% at Turceni), which have developed numerical a lot, because the impact that the accumulation have through the phenomena of stagnation and clogging water suspension. The two invasive species have found here favorable conditions for feeding and breeding. The presence of these introduced species and the low abundance of river species was noted before as an indicator for anthropogenic effects (Araújo & Santos 2001).

The fishing effort (CPUE) (Navodaru 2008) was calculated for the two methods, index specific for quantitative characterization of fish populations in lakes, as follows: for gillnet fishing CPUE = 970.47 g/100mp and for electrical fishing CPUE = 518.6 g/100mp, on Isalnita Lake and for the accumulation Turceni CPUE = 463 g/100mp (electric fishing) and Vadeni CPUE = 2812.66 g/100mp (gillnet fishing).

In case of Isalnita accumulation for the Shannon-Wiener index has values of: H = 2.0 for electric fishing and H = 1.34 for gillnet fishing and for the Simpson index, D = 0.16 for electric fishing and D = 0.35 for gillnet fishing. In addition, two indexes were calculated for: accumulation Turceni H = 1.31, I = 0.32 and Vadeni accumulation H = 1.57, I = 0.25. In the case of Shannon-Wiener index it concluded that a higher value of 3 indicates a clear water, a value between 1 and 3 a moderately polluted water and a lower value of 1, a highly polluted water. While, in the Simpson index case, as the value obtained is higher (closer to 1) both species diversity is lower (1 means without diversity).

The ichthyofauna of Isalnita and Turceni reservoirs is still fit in barbel area, according with the ecological zoning (Banarescu 1964), although the fish zones were strongly affected once the lake was bilt. Instead the fish fauna results for Vadeni reservoir can be considered inconclusive because the lake was mostly dry with a few weeks before our study. However, it is noted that indigenous populations are in a progressive decline in all three lakes, the decline caused by conditions caused by hydraulic works, hydro morphological changes and breaking the longitudinal and lateral connectivity of the Jiu River.

The three lakes have at this time, a fishery production far below their economic potential. This could easily be increased by applying the monitor-

ing and management measures, including restocking of species characteristic of the area and/or naturalized species that can exploit the conditions in these lakes formed; restoration and conservation of spawning, water remediation.

CONCLUSIONS

We identified 17 fish species in the three dam lakes on the Jiu River course, 14 of which are native (*Cyprinus carpio*, *Silurus glanis*, *Squalius cephalus*, *Esox lucius*, *Perca fluviatilis*, *Scardinius erythrophthalmus*, *Rutilus carpathorossicus*, *Gobio gobio*, *Gobio albipinnatus*, *Alburnus alburnus*, *Rhodeus sericeus*, *Barbus barbus*, *Cobitis taenia*, *Misgurnus fossilis*) and three exotic (*Carassius auratus gibelio, Lepomis gibbosus*, *Pseudorasbora parva*). The differences among the ichthyofaunas of the three lakes and between the two utilized methods are small. This could be a consequence of the resemblance of the three lakes, formed on the same river, in regions with a similar altitude. However, negative transformations of the aquatic environment are noted as a result of water accumulation and the disappearance of the aquatic habitat typical for a river. Most species are Ciprinidae, which have a greater tolerance to the environment factors. The more sensitive fish species to changes such as the typical river ones are either absent or only found in ther areas where the river enters the lake. Alarming is the high abundance, in some lakes, of exoptic fish species that could be invasive. These could represent a real threat for native species in the future.

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