# ICHTHYOFAUNA ACTUAL STATE IN THE UPPER AND MID COURSE OF THE RIVER ARGES HYDROGRAPHICAL BASIN

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**Abstract.** Research was run in 2006 and aimed at the assessment of the ichthyofauna actual state in the upper and mid course of the River Argeş hydrographical basin. Biological material was sampled at 33 sites. A total number of 19 fish species (3 acclimatised) were identified. Various ecological indices were used in the evaluation of the ichthyocoenoses state. A zoning of the studied basin was achieved and the index of biological integrity was used in order to assess the quality of the researched aquatic ecosystem.

Keywords: fish stock, fish communities, biodiversity, index of biological integrity.

**Rezumat. Starea actuală a ihtiofaunei din cursul superior și mijlociu al bazinului hidrografic al râului Argeș.** Cercetările s-au desfășurat pe parcursul anului 2006 și s-a urmărit aprecierea stării actuale a ihtiofaunei din bazinul superior și mijlociu al râului Argeș. Materialul a fost colectat din 33 puncte de colectare. În total au fost identificate 19 specii de pești (3 aclimatizate). În aprecierea stării ihtiocenozelor au fost utilizați diferiți indici ecologici. S-a realizat zonarea bazinului investigat iar pe baza indicelui de integritate biologică a fost posibilă aprecierea calității ecosistemului acvatic investigat.

Cuvinte cheie: stoc, ihtiocenoze, biodiversitate, indice de integritate biologică.

### Introduction

Ichthyofauna prospective monitoring aims at investigation of the ichthyocoenoses specific structure using certain qualitative methods (specific structure assessment) and quantitative methods (numeric and gravimetric stock assessment, calculation of IBI and other ecological indices). Data used in the ichthyocoenoses state evaluation must be statistically assured.

River Argeş is a result of the confluence of the rivers Capra and Buda (which are at present flowing in the Lake Vidraru) and it is 339.6 km long while its basin covering area is of 12550 km<sup>2</sup>. The main tributaries of the River Argeş are: Vâlsan, River Doamnei, River Târgului (with the tributaries Bratia and Argeşel), Sabar and Dâmbovița (with the tributary Colentina) on the left hand and Neajlov (main tributary on the right hand) (Ujvári, 1972).

Research was run in the course of the year 2006.

#### **Material and Methods**

Biological sampling was achieved at 33 sites. The number of sampling sites is statistically assured and covers all the characteristic fish communities and even the changes in species spatial spreading (species spreading areas). In sampling sites fixing, the hydrotehnical arrangements from the River Argeş hydrographical basin were also considered.

Species identification was achieved based on certain morphological characters of the species sampled and on the description of the species in the scientific literature (P. Bănărescu, 1964).

The assessment of the fish numeric and gravimetric stock offers correct and comparable information regarding the number of individuals and biomass of each

population belonging to a certain species and from the entire ichthyocoenosis, at the sampling sites. At the same time, those indices also have a high value because they offer information of maximum importance in the case of ecological restoration.

Analytical (absolute abundance, constancy, dominance) and synthetic (ecological significance index) ecological indices were calculated in order to establish the structure and composition of the fish communities at the sampling sites. A special attention was granted to the ecological significance index (W) which gives information upon each species status within the community. Fish zones (and sub-zones) specific for a particular hydrographical basin can be established according to the characteristic species (Varvara *et al.*, 2001).

Determination of the biodiversity index allows the estimation of ichthyocoenoses biodiversity at the sampling points, the value of the index being an important indicator of the ecosystem state under anthropogenic impact. Diversity was calculated using the Shannon - Wiener index (Botnariuc & Vădineanu, 1982).

Determination of the index gives information regarding the degree of the ichthyocoenoses affectation due to anthropogenic impact and, by the means of the 15 parameters monitored; it is possible to know the ecosystem structural and functional changes. Biological integrity of the fish populations is calculated by the means of the biological integrity index (IBI), introduced by Karr & Dudley (Karr & Dudley, 1981) and modified by Miller (Miller *et al.*, 1988). This index uses fish as indicators of the aquatic ecosystems state and quality.

### **Results and Discussion**

Table 1 shows certain geographical and hydrochemical parameters at the 33 sampling points from the investigated hydrographical basin (Table 1).

	Sampling sites		Geo	Geographical Hydroche			nemical	
		No.	parameters		parameters			
No.		of species	Lat.	Long.	Alt. (m)	Temp. ( <sup>0</sup> C)	pН	Conduct. (µS/ cm)
1.	Argeş – upstream of Căpăţâneni (old riverbed of the Argeş)	2	45.20542	24.38155	638	10.3	7.5	149
2.	Argeș – locality Oești	3	45.15661	24.39216	518	13.8	7.7	800
3.	Argeș – upstream of the confluence with Brook Bănești, loc. Dobrotu	5	45.13129	24.39203	478	13.5	7.7	212
4.	Pârâul Bănești – the confluence with River Argeș, locality Dobrotu	6	45.13129	24.39203	478	16.9	7.7	382
5.	Brook Iaşului – upstream of the TBC hospital, locality Valea Iaşului	4	45.11258	24.42132	466	17.5	7.5	563
6.	Pârâul Iaşului – upstream of flow in Argeş, downstream of the bridge, locality Curtea de Argeş	3	45.09337	24.40341	443	18.5	7.3	603
7.	Vâlsan – upstream of Vâlsan reservoir	_	45.25176	24.42408	908	7.7	7	28
8.	Vâlsan – upstream of locality Brădetu	1	45.19224	24.45367	668	9.9	7.6	152
9.	Vâlsan – locality Muşătești	4	45.10431	24.47355	444	12.8	7.5	454
10.	Vâlsan – locality Bădiceni, commune Mălureni	3	45.03399	24.47272	380	11.8	7.6	490
11.	Vâlsan – upstream of the confluence with River Argeş (approx. 3 km)	5	44.59017	24.45274	341	19.2	7.4	430
12.	Bâscov – upstream of locality Drăganu	4	44.58733	24.40111	381	14.7	7.2	135
13.	Doamnei – upstream of the confluence with Cernat, upstream of locality Slatina (Bahna Rusului)	6	45.23457	24.48107	712	13	7.4	77
14.	Doamnei – locality Corbi	5	45.17389	24.48002	536	15.4	7.7	287
15.	Doamnei – locality Pietroșani	5	45.10721	24.51176	459	17.7	7.8	480
16.	Doamnei – locality Valea Nandrii	6	45.0116	24.53378	351	18.5	7.5	444

Table 1. Certain geographical and hydrochemical	parameters at the sampling points from the upper				
and mid basin of the River Arges.					

			Geographical parameters		Hydrochemical parameters			
No.	Sampling sites	of species	Lat.	Long.	Alt. (m)	Temp. ( <sup>0</sup> C)	pН	Conduct. (µS/ cm)
17.	Bratia – upstream of the confluence with Râuşor, downstream of the bridge	3	45.1596	24.56741	535	12.1	7.7	82
18.	Râușor – upstream of the hydrological station	3	45.16391	24.5558	619	12	7.5	64
19.	Bratia – downstream of the bridge, locality Coteasca	2	45.06575	24.55872	386	12.5	7.6	166
20.	Bratia – upstream of the confluence with River Târgului, downstream of the bridge, locality Băjești	4	45.01039	24.56491	348	12.5	7.5	195
21.	Târgului – Voina hut	-	45.26239	25.02934	926	5.6	7.2	36
22.	Târgului – downstream of the bridge, locality Schitu Golești	2	45.09	24.59717	409	10.3	7.6	156
23.	Târgului – upstream of the bridge Clucereasa, upstream of the flow in Doamnei	3	44.58295	24.55469	325	16.6	7.7	205
24.	Argeșel – downstream of the locality Gura Pravăț	2	45.1893	25.0754	776	9.8	7.4	95
25.	Argeşel – locality Hârțiești	5	45.09319	25.07085	505	13.5	7.8	429
26.	Argeşel – downstream of the bridge, locality Mioveni, upstream of the flow in Târgului	4	44.57759	24.55788	319	17.9	7.6	498
27.	Argeş – downstream of the Goleşti reservoir	9	44.48331	24.59858	250	15.6	7.5	345
28.	Dâmbovicioara – upstream of the locality Podu Dâmboviței	1	45.24854	25.12368	778	10.8	7.8	334
29.	Dâmbovița – downstream of the bridge, locality Podu Dâmboviței, the hydrological station	3	45.24405	25.12065	750	12.1	7.8	275
30.	Râușor – upstream of the locality Rucăr	1	45.2513	25.08115	799	10.6	9.5	154
31.	Dâmbovița – locality Valea Hotarului	4	45.19438	25.10089	627	11.3	7.6	243
32.	Dâmbovița – locality Valea Cetățuia	3	45.12972	25.12226	550	11.3	7.5	188
33.	Dâmbovița – locality Malu cu Flori	6	45.09396	25.12824	459	11	7.8	196

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In the upper and mid basin of the River Argeş were identified a total number of 19 fish species among which 16 native while 3 acclimatised (rainbow trout, topmouth gudgeon and pumpkinseed) (Table 2). Species scientific names correspond to the last revision performed by Nalbant (Nalbant, 2003).

	Scientific name		Ecological status			
No.		Common name	Bănărescu, 1964	2006		
				native	acclim.	
				species	species	
1	Salmo fario L., 1758	Trout	*	*		
2	Oncorhynchus mykiss Walbaum 1792	rainbow trout			*	
3	Thymallus thymallus L., 1758	Grayling	*			
4	Squalius cephalus L., 1758	Chub	*	*		
5	Phoxinus phoxinus L., 1758	Minnow	*	*		
6	Scardinius erythrophthalmus L., 1758	Rudd		*		
7	Aspius aspius L., 1758	Asp	*			
8	Alburnus alburnus L., 1758	Bleak	*	*		
9	Alburnoides bipunctatus Bloch, 1782	Schneider	*	*		
10	Chondrostoma nasus L., 1758	undermouth	*	*		
11	Gobio obtusirostris Valenciennes, 1844	Gudgeon	*	*		
12	Rheogobio uranoscopus Agassiz, 1828	longbarbel gudgeon	*	*		

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	Scientific name		Ecolog	ical status		
No.		Common name	Bănărescu, 1964	2006		
				native species	acclim. species	
13	<i>Romanogobio kessleri</i> Dybowski, 1862	Kessler's gudgeon	*			
14	Pseudorasbora parva Schlegel, 1842	topmouth gudgeon			*	
15	Barbus barbus L., 1758	Barbell	*			
16	Barbus petenyi Heckel, 1847	Afterbarbe	*	*		
17	Carassius gibelio Bloch, 1782	gold fish		*		
18	Orthrias barbatulus L., 1758	Loach	*	*		
19	Sabanejewia romanica Băcescu, 1943	Romanian spined loach	*	*		
20	Sabanejewia vallachica Nalbant, 1957	Vallachian spined loach	*	*		
21	Lepomis gibbosus L., 1758	pumpkinseed			*	
22	Perca fluviatilis L., 1758	Perch		*		
23	Romanichthys valsanicola Dumitrescu, Bănărescu & Stoica, 1957	Asprete	*			
24	Cottus gobio L., 1758	Bullhead	*	*		
TOTALS			18	19		

The species identified at the sampling sites from the upper and mid basin of the River Argeş are given in the figure 1. It may be noticed that the species repartition is characteristic to existent habitats, species number being conditioned by species size, but especially by the anthropogenic impact suffered, respectively by the hydrotechnical arrangements in the area and by the riparian population activity. It was observed that the species number progressively increases together with the distance from the springs and according as habitats become larger (Fig. 1).

Quantitative variation of the absolute abundance and biomass is very high and determined by the existent ecological conditions and anthropogenic impact. Numbers of the specimens per sampling site varied from 0 to 190 while the weight from 0 to 1625.7 g. At the 33 sampling sites, 1798 specimens were collected in all with a total weight of 19779.25 g.

In the upper and mid hydrographical basin of the River Argeş, the numeric stock varied from 0.37 specimens per 100 m<sup>2</sup> (Vâlsan, upstream of locality Brădetu) to 100.66 specimens per 100 m<sup>2</sup> (Bâscov, upstream of locality Drăganu) (Fig. 2).

The gravimetric stock had the lowest value on the course of the Brook Râuşor, upstream of the locality Rucăr (5.25 g per 100 m<sup>2</sup>) and the highest value on the course of the River Bâscov, upstream of locality Drăganu (491.6 g per 100 m<sup>2</sup>) (Fig. 2).

At two from the 33 sampling sites, the numeric stock and the gravimetric stock were zero due to the very low water conductivity (28  $\mu$ S cm<sup>-1</sup> on the River Vâlsan, upstream of the reservoir Vâlsan, respectively 36  $\mu$ S cm<sup>-1</sup> on the River Târgului, sampling site Voina hut).

Based on the ecological indices values and especially on the ecological significance index (W), fish communities characteristic to the upper and mid hydrographical basin of the River Argeş were identified.



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Figure 1. Species distribution in sampling sites



Figure 2. The numerical (ind./100 sqm) and weight (g/100 sqm) stock in the sampling sites

Communities characteristic to the classic fish zoning are kept, some with certain modifications. Modifications in the basin are due to the important hydrotehnical arrangements (the chain of reservoirs on the main course of the River Argeş) unlike other basins in which modifications in the fish communities structure are due to faecaloid-domestic pollution (Buzău) (Ureche *et al.*, 2004) or to a natural water contamination with salts and oil products (Trotuş) (Ureche *et al.*, 2006).

Thus, the mountain area of the River Argeş and its main tributaries belongs to the trout zone. Due to certain favourable conditions, on some of the River Argeş tributaries a minnow sub-zone appears (Argeşel, Bâscov).

Afterbarbe zone is the largest and comprises the main course of the River Argeş downstream of Vidraru reservoir and in the mid and lower courses of certain tributaries (Vâlsan, River Doamnei, Bratia, River Târgului) and in the mid course of the River Dâmbovița as well. Afterbarbe zone does not comprise the River Argeşel, its mid and lower course being comprised in the chub zone (Fig. 3).

The biodiversity and the biological integrity (IBI) indices showed the presence of certain relatively stable ichtyocoenoses though with a quite low number of native species, their affectation degree being less than the class V in the areas affected by the hydrotehnical arrangements at the sampling sites 3 (Argeş, upstream of the confluence with Băneşti, locality Dobrotu) and 27 (Argeş, downstream of the reservoir Goleşti) (Fig. 4).

Ichtyocoenoses stability state is in general good, being framed in the first two classes of evaluation excepting the sampling site 6 (Brook Iaşului, upstream of the flow in Argeş, downstream of the bridge, locality Curtea de Argeş) with the class of evaluation III, meaning a native genetic fund affected by the decreasing of the spreading area and by population numerical decreasing, without to affect its capacity of recovery. The cause is the pollution induced by the anthropogenic activities, the sampling site being placed downstream of locality Curtea de Argeş.

## Conclusions

Our research identified 19 species, among which 3 acclimatised (1798 specimens with 19779.25 g biomass), sampled by electric fishing at 33 points located on the main course of the River Argeş and on main tributaries. Compared to the '60s, some species were not found (asp, asprete) but certain new species (rainbow trout, rudd, topmouth gudgeon, gold fish, pumpkinseed, perch) were identified.

The numerical stock varied from 0.37 specimens per 100 m<sup>2</sup> to 100.66 specimens per 100 m<sup>2</sup> while the gravimetric one varied from 5.25 g per 100 m<sup>2</sup> to 491.6 g per 100 m<sup>2</sup>.

Number of species in the researched fish communities increased from 2-4 in the mountain area to 5-9 in the hilly area.

Communities were characteristic for a classical fish zoning. Thus, 3 zones: trout zone, afterbarbe zone and chub zone appeared. In the lower side of the trout zone, on certain tributaries of the River Argeş, a sub-zone of the minnow arose.

The indices of biodiversity and biological integrity (IBI) showed the presence of certain relatively stabile ichtyocoenoses in the large majority of the points though with quite few native species in some areas, their degree of affectation being below the class V.

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Figure 3. Fish regions



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Figure 4. Biological integrity in sampling sites

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