Romania – Republic of Moldova joint study concerning the fish fauna in Stânca-Costeşti reservoir

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Abstract. The paper presents some results of a fish fauna study in the Stânca Costesti reservoir on Prut River. The study was done during the years 2013 and 2014, by a joint team of the Zoolgy Institute of the Academy of the Republic of Moldova and the „Alexandru Ioan Cuza" University in Iasi, România. A total of 1726 specimens belonging to 29 species were captured. The data were processed and interpreted based on the statistical tools. The study concludes that the above mentioned reservoir has a major fishery potential and it is necesary to involve the authorities in the both countries in order to improve the management of the fish stocks for the better use and conservation of its biological potential.
Key Words: fish fauna, reservoir, ecological guilds.

Introduction. The Stânca-Costeşti reservoir, in use since 1976, was built as a collaborative project between Romania and Republic of Moldova (URSS at that time), and is situated on the Prut River, at 580 km before the conjunction with the Danube River. The lake is made up by a 47 m high and 740 m long dam. The main rivers making up the reservoir are: Prut, with a 81 $m^3 s^{-1}$ flow, on the right bank, Volovăţul, with a 0.1-0.2 $m^3 s^{-1}$ flow, on the left bank, Vilia, Lopatinca, Racovăţul and Ciugurul, which may provide a total flow of 1 $m^3 s^{-1}$. Stânca-Costesti reservoir (Figure 1) is 60 km long, and has a surface of 5900 ha, at a normal retention level (but may reach 9000 ha, when the filling coefficient is at its maximum) and a volume of around 1.4 billion m^3 of water (Vartolomei 2009.

Figure 1. Stânca- Costeşti Reservoir (wiew from the left bank).

The main functions of the reservoir lake are (Vartolomei 2009):

- protection from floods and regulation of the downstream;
- hydroelectric generation – total capacity of the plant = 32 MW (16 MW for each partner, Romania and Moldova);
- water supply for the city of Iaşi (Ţuţora input on the Prut River); the maximum capacity of supplied water is 6 $m^3 s^{-1}$;
- watering of 140000 ha, 70000 ha each for Romania and Moldova, respectively;
- fish production and leisure, game fishing, water sports.

Material and Method. In 2014, two sampling campaigns were organized in August and October, on both sides, and a supplemental one in June on the Moldovan bank. The fish material was collected in six different sites: on both shores at the upstream section of the lake, in the middle sector and near the dam (Figure 2).

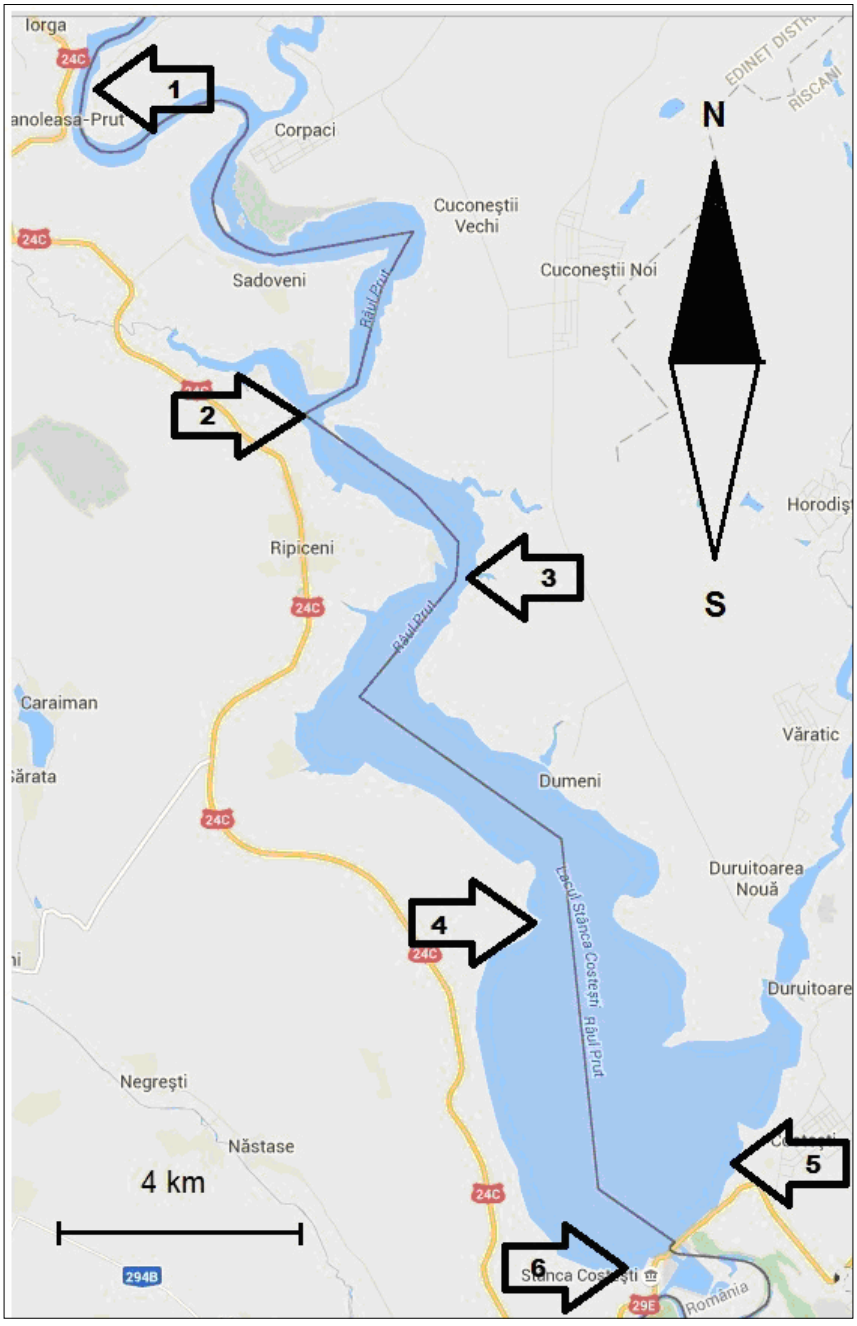

Figure 2. Map showing the samplings spots.

Several types of fishing tools have been used in Stînca reservoir, in order to limit the fishing selectivity. Fishing was done with 10 m long seine net with 5 mm mesh size, a Hans Grassl IG 4000 electrofisher and 10 gillnets of 24 m long and 2 m hight, as recommended in SR EN 14757 standard (Davideanu 2013). Electrofishing was performed by boat during day time on two 500 m length transects along the shore lines. On each site 10 gillnets (superficial and deep water) was randomly placed over night and the capture was inventorised in the morning. The 10 m long seine net with 10 mm size mesh was used to collect 3 samples (of 30 m each) on the beach (maximal water depth 1.2 m) during the first hours after sunset.

The structural changes at the level of ichtiocenoses are characterized by using some analytical ecological indices (abundance, dominance, constancy) and synthetic ones (the index of ecological significance) (Stan 1995).

Species abundance is the number of individuals per species, and relative abundance refers to the evenness of distribution of individuals among species in a community.

The dominance was calculated using the formula: D = 100*n/N, where: n - number of individuals of one species from one sample; N - total number of individuals of all species from one sample. The dominance classes for the identified mites were: eudominants = over 10% (D5); dominants = 5.1-10% (D4); subdominants = 2.1–5% (D3); recedents = 1.1-2% (D2) and subrecedents ≤ 1.1% (D1).

The constancy was calculated using the formula: C = 100*pA/P, where: pA = number of samples with species A; P = total number of samples. The mite species were classified in four constancy classes: euconstants = 75.1-100% (C4), constants = 50.1-75% (C3), accessory = 25.1-50% (C2) and accidental = 1-25% (C1).

Ecological significance index (W) is calculated with the formula: W = C*D/100, were C = constancy of one species and D = diversity of one species. Taking into account the value of this index the species can be grouped into the following categories: characteristic: W over 10% (W_5) and 5.1-10% (W_4); accessory: 0.1-1% (W_2) and 1.1-5% (W_3); accidental: under 0.1 (W_1).

Results and Discussion. In the fishing campaign from August and October 2014, 1726 fish belonging to 29 species were captured, which are classified in 9 families from 6 orders (Tables 1 and 2). Fish were identified according to the literature Kottelat & Freyhof 2007. There are some previous data about the fish fauna of the lake: Misaila & Matei (1990) indicated 10 species in the lake, Usatâi et al (1999) mentioned 26 species and Bulat et al (2014) mentioned 31 species (Table 1).

Subsequent to this fishing campaign, the list of fish species in the lake was supplemented with a new species of non-native origin, *O. mykiss,* which probably accidentally escaped from fishfarms during the major floods in 2008 and 2010. After discussions with commercial fishermen, we may conclude that this is not a single, isolated case, as the rainbow trout is also mentioned in their captures, as well as the sterlet - *Acipenser ruthenus*, which has not been previously reported.

According to the data comprised in Tables 2 and 3 and Figure 3, for Stânca reservoir, we notice 2 eudominant (class D_5) species, from the numerical point of view: *A. alburnus*, a eurytopic species with a short life span (D = 29.02%) and *P. fluviatilis,* (D = 22.36%), which, being an optional predator, adapts very well to the oscilating water levels of the reservoir, and has the tendency to remove valuable species by the roe and spawn consumption (in certain ecosystems, it may eliminate all other species). These two eudominant species are followed by a group of 3 dominating species (class D_4): *S. lucioperca* (D = 9.15%), a fish species of major economic importance, *R. rutilus (*D = 8.81%), an average size, tolerating, omnivorous and eurytopic species, and *A. brama* (D = 5.67%), a limno-rheophilic omnivorous species. The 5 above-mentioned species comprise a number of 1295 specimens, i.e. 75.01% of the number of captures from the reservoir lake.

The 4 subdominating species (D_3), *C. gibelio, N. fluviatilis, L. aspius* and *C. carpio*, and the 20 recedent and subrecedent species (D_2–D_1) *G. cernua, V. vimba, S. cephalus, B. barbus, R. amarus, H. molitrix, S. erythrophthalmus, P. parva, B. sapa, C. nasus, C.*

taenia, S. glanis, H. nobilis, P. platygaster, B. gymnotrachelus, E. lucius, G. obtusirostris, C. idella, P. glenii, O. mykiss, account for only 24.99% of captures, with dominance ranging from 0.05% (*O. mykiss*) to 1.68% (*C. gibelio*).

Table 1

List of fish species spotted in Stânca Costeşti Lake during previous studies

No.	Order	Family	Species	Author			
				Misaila & Matei (1990)	*Usatâi et al (1999)*	*Bulat et al (2014)*	*Present study*
1	Salmoniformes	Salmonidae	*Oncorhynchus mykiss*				X
2	Esociformes	Esocidae	*Esox lucius*	X	X	X	X
3	Cypriniformes	Cyprinidae	*Abramis brama*	X	X	X	X
4			*Alburnus alburnus*	X	X	X	X
5			*Ballerus sapa*		X	X	X
6			*Barbus barbus*	X		X	X
7			*Blicca bjoerkna*		X		
8			*Carassius gibelio*	X	X	X	X
9			*Chondrostoma nasus*		X	X	X
10			*Ctenopharyngodon idella*		X	X	X
11			*Cyprinus carpio*	X	X	X	X
12			*Gobio obtusirostris*		X	X	X
13			*Hypophthalmichthys molitrix*	X	X	X	X
14			*Hypophthalmichthys nobilis*	X	X	X	X
15			*Leucaspius delineatus*			X	
16			*Leuciscus aspius*	X	X	X	X
17			*Pseudorasbora parva*			X	X
18			*Rhodeus amarus*		X	X	X
19			*Rutilus rutilus*		X	X	X
20			*Scardinius erythrophthalmus*		X	X	X
21			*Squalius cephalus*		X	X	X
22			*Vimba vimba*		X	X	X
23		Cobitidae	*Cobitis taenia* sensu lato		X	X	X
24			*Misgurnus fossilis*			X	
25	Siluriformes	Siluridae	*Silurus glanis*		X	X	X
26	Gasterosteiformes	Gasterosteidae	*Pungitius platygaster*			X	X
27	Perciformes	Percidae	*Gymnocephalus cernua*		X	X	X
28			*Perca fluviatilis*		X	X	X
29			*Sander lucioperca*	X	X	X	X
30		Gobiidae	*Babka gymnotrachelus*			X	X
31			*Neogobius fluviatilis*		X	X	X
32			*Proterorhinus marmoratus*		X	X	
33			*Zosterisessor ophiocephalus*		X		
34		Odontobutidae	*Perccottus glenii*			X	X

The abundance of the *S. lucioperca* has been increased by the intervention of the Fish Population Service from the Republic of Moldova, which announced, in 2014, the insertion of nests containing 2 million embryo roe brought from Razelm Lake. The success of this re-population is also indicated by the increasing number from the 37 specimens captured in 2013 and to the 158 specimens captured in the fall of 2014 (Bulat et al 2014), most of them being of small dimensions and under 3 years old (age assessed based on their total length).

Based on the data supplied by governmental institutions (Fishery Inspection in Republic of Moldova, and National Agency for Fishery and Aquaculture in Romania), *A. brama* is the main species captured by commercial fishing in both countries, followed by *C. gibelio* in Romania and *R. rutilus* in the Republic of Moldova.

Table 2

Relative abundance of captures from Stânca-Costeşti Reservoir, according to the type of tool and the location of the sampling sites, 2014

No.	Species	Relative abundance of the fish species captured with various fishing tools in different collection sites on Stânca-Costeşti reservoir														
		Sampling spot 1 (Moldova)		Sampling spot 2 (Romania)			Sampling spot 3 (Moldova)		Sampling spot 4 (Romania)			Sampling spot 5 (Moldova)		Sampling spot 6 (Romania)		
		Gill net	Trammel	Gill net	Trammel	Electric	Gill net	Trammel	Gill net	Trammel	Electric	Gill net	Trammel	Gill net	Trammel	Electric
1	*A. alburnus*	8.7	25	62.15	11.4	30	15.58	29.66	17.44	15.97	28.4	3.77	30	22.78	39.47	59.09
2	*P. fluviatilis*	4.93	7.61	14.64	43.54	41.42	16.88	16.94	27.9	35.41	28.4	5.66	8.57	26.58	5.26	15.9
3	*S. lucioperca*	4.93	3.26	2.2	24.35	18.57	7.79	5.93	5.81	13.88	10.22	4.71	2.85	11.39		2.27
4	*R. rutilus*	7.4	6.52	5.8	0.7	4.28	12.98	6.77	12.79	7.63	12.5	13.2	20	21.51	34.21	11.36
5	*A. brama*	11.11	3.26	7.18			14.28	3.38	22.09		14.77	4.71	2.85	7.59		
6	*C. gibelio*	17.28	6.52	1.1			9.09	7.62	11.62			18.86	7.14	3.79		
7	*N. fluviatilis*		1.17		14.76			4.23		13.19			10			
8	*L. aspius*	4.93	3.26	0.82	1.1		3.89	5.08			2.27	12.26	8.57	3.79	21.05	11.36
9	*C. carpio*	6.17	1.08	1.1	3.69	5.71	5.19	0.84		6.25	2.27	8.49	5.71	1.26		
10	*G. cernua*	4.93	2.17	0.27	0.36		7.79	5.08		2.77		2.83	1.42	1.26		
11	*V. vimba*	2.46		0.82			1.29		1.16			10.37	2.85			
12	*S. cephalus*	6.17	3.26	0.55						3.47	1.13					
13	*B. barbus*	3.7	1.08	2.2				0.84		1.38						
14	*R. amarus*		10.86					4.23								
15	*H. molitrix*	4.93	1.08				1.29					6.6				
16	*S.erythrophthalmus*						2.59	3.38				2.83				
17	*P. parva*		5.43					2.54								
18	*B. sapa*	4.93	2.17													
19	*C. nasus*	2.46		1.1												
20	*C. taenia*		4.34					1.69								
21	*S. glanis*	3.7	1.08									0.94				
22	*H. nobilis*	1.23										2.83				
23	*P. platygaster*		3.26													
24	*B. gymnotrachelus*		3.26													
25	*E. lucius*		1.08				1.29									
26	*G. obtusirostris*							1.69								
27	*C. idella*											1.88				
28	*P. glenii*		2.17													
29	*O. mykiss*								1.16							
	No. of individuals	81	92	362	271	70	77	118	86	144	88	106	70	79	38	44
	No of species	17	22	13	8	5	13	16	7	9	8	15	11	9	4	5

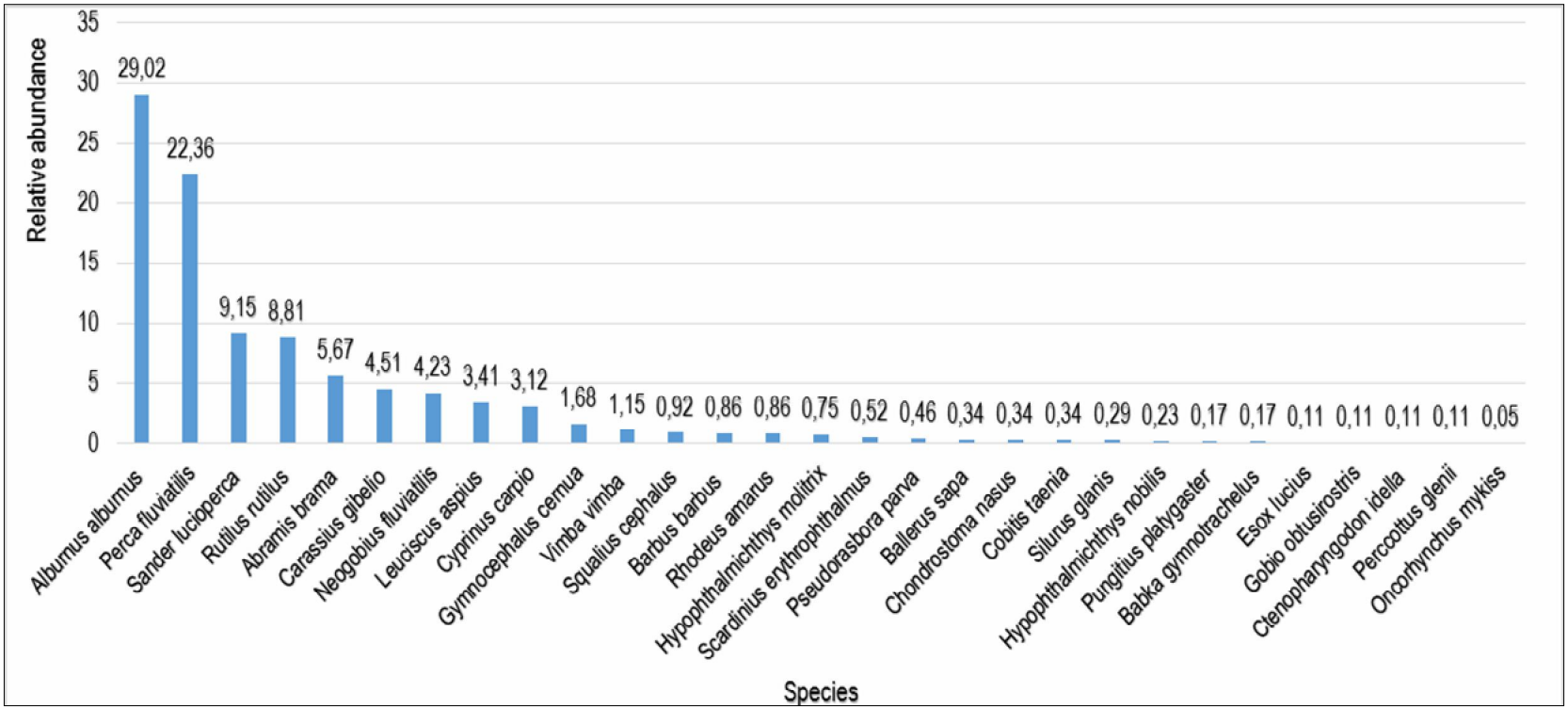

Figure 3. Dominance of species captured in Stânca Reservoir, 2014.

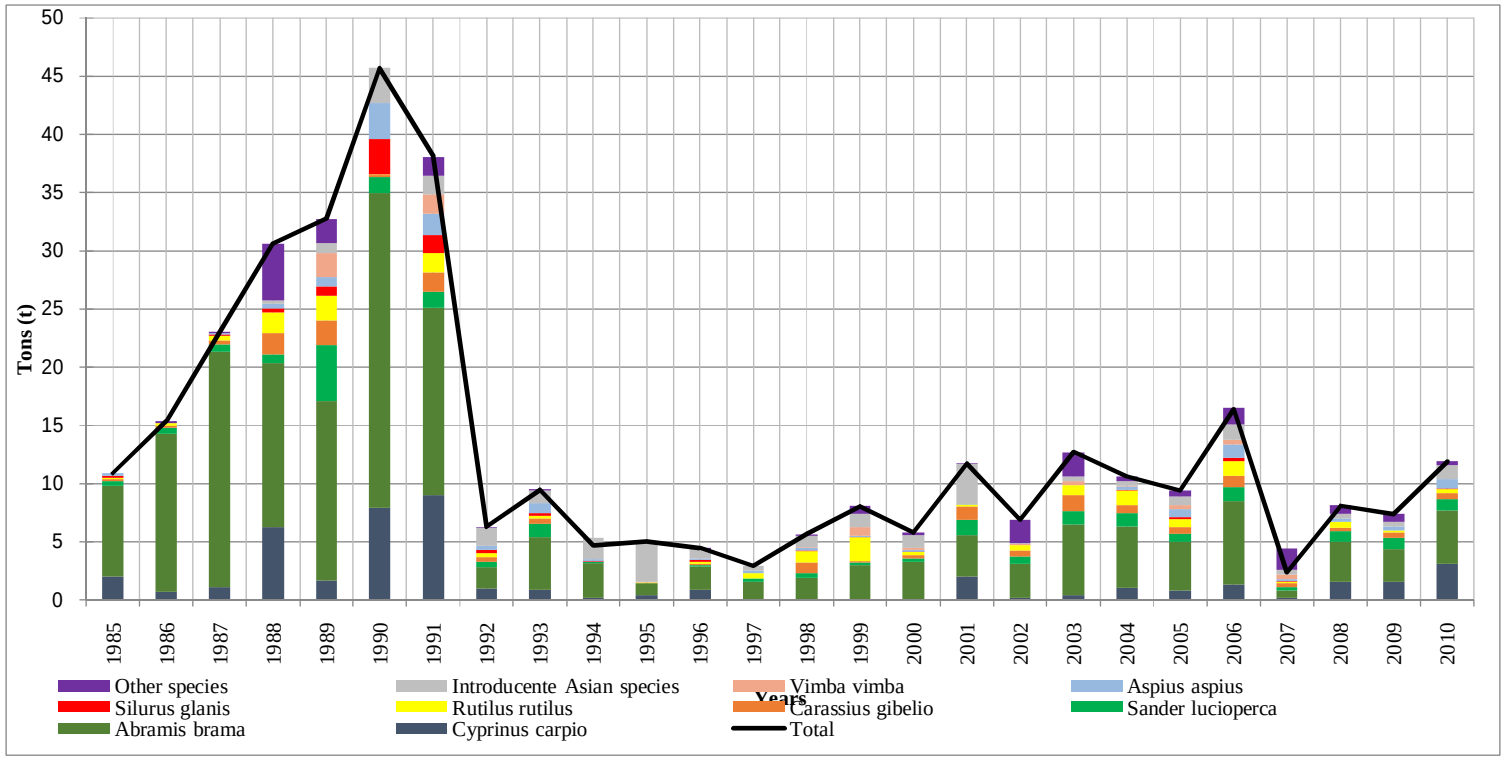

Figure 4. Dynamics of industrial fishing in the Costeşti-Stânca reservoir, within the Republic of Moldova territory boundaries (tons).

Table 3

Values of the analytical ecological indexes and the ecological significance index calculated for the samples captured in Stânca-Costeşti Reservoir, 2014

No.	Species	Index						
		Numerical abundance	Dominance		Constancy		Ecological significance index	
			%	Class	%	Class	%	Class
1	*Alburnus alburnus*	501	29.02	D5	100	C4	29.02	W5
2	*Perca fluviatilis*	386	22.36	D5	100	C4	22.36	W5
3	*Sander lucioperca*	158	9.15	D4	100	C4	9.15	W4
4	*Rutilus rutilus*	152	8.81	D4	100	C4	8.81	W4
5	*Abramis brama*	98	5.67	D4	100	C4	5.67	W4
6	*Carassius gibelio*	78	4.51	D3	100	C4	4.51	W3
7	*Neogobius fluviatilis*	73	4.23	D3	83	C4	3.51	W3
8	*Leuciscus aspius*	59	3.41	D3	100	C4	3.41	W3
9	*Cyprinus carpio*	54	3.12	D3	100	C4	3.12	W3
10	*Gymnocephalus cernua*	29	1.68	D2	100	C4	1.68	W3
11	*Vimba vimba*	20	1.15	D2	83	C4	0.95	W2
12	*Squalius cephalus*	16	0.92	D1	50	C2	0.46	W2
13	*Barbus barbus*	15	0.86	D1	66	C3	0.56	w2
14	*Rhodeus amarus*	15	0.86	D1	33	C2	0.28	W2
15	*Hypophthalmichthys molitrix*	13	0.75	D1	50	C2	0.37	W2
16	*Scardinius erythrophthalmus*	9	0.52	D1	33	C2	0.17	W2
17	*Pseudorasbora parva*	8	0.46	D1	33	C2	0.15	W2
18	*Ballerus sapa*	6	0.34	D1	16	C1	0.05	W2
19	*Chondrostoma nasus*	6	0.34	D1	33	C2	0.11	W2
20	*Cobitis taenia*	6	0.34	D1	33	C2	0.11	W2
21	*Silurus glanis*	5	0.29	D1	33	C2	0.09	W1
22	*Hypophthalmichthys nobilis*	4	0.23	D1	33	C2	0.07	W1
23	*Pungitius platygaster*	3	0.17	D1	16	C1	0.02	W1
24	*Babka gymnotrachelus*	3	0.17	D1	16	C1	0.02	W1
25	*Esox lucius*	2	0.11	D1	33	C1	0.03	W1
26	*Gobio obtusirostris*	2	0.11	D1	16	C1	0.01	W1
27	*Ctenopharyngodon idella*	2	0.11	D1	16	C1	0.01	W1
28	*Perccottus glenii*	2	0.11	D1	16	C1	0.01	W1
29	*Oncorhynchus mykiss*	1	0.05	D1	16	C1	0.01	W1
	No. of individuals	1726						

D1-subrecedent species (<1.1%); D2-recedent species (1.2-2%); D3-subdominant species (2.1-5%); D4-dominant species (5.1-10%); D5-eudominant species (>10%); C1-accidental species (1-25%);C2-accessory species (25.1-50%); C3-constant species (50.1-75%); C4-euconstant species (75.1-100%);W1-subrecedent species (accidental) (<0.1%); W2-recedent species (0.1-1%); W3-subdominant species (accessory) (1.1-5%); W4 - dominant species (5.1-10%); W5-eudominant species (characteristic) (>10%).

According to Alimov et al (2013), and Kitaev (2007) and also based on the lentic ecosystems classification from the fish population point of view and the multiannual records of industrial captures, we may state that the reservoir fits the bream type category, with the tendency of transformation into the bream-roach-perch type (Figure 4). From an economic point of view, the most important species are the dominating species (D_4), thanks to the significant size they may reach, becoming the main subject matter of commercial fishing: *S. lucioperca, A. brama, and R. rutilus.*

R. rutilus, lake nutrition type, shows an extremely high growing rhythm because the easily accessible and high caloric food provided by zebra shells *Dreissena* sp. (Figure 5). The prevailingly malocophagie of the species in this lake was proved (Bulat et al 2014). Upon assessing the maximal gravimetric theoretical values (by applying the Ford-Walford relation when describing the Bertalanffy function), as it was shown by Bulat et al (2014) we notice that, in the Costeşti-Stânca reservoir ecosystem, this species may reach significant standard length (36.255 cm) and weight (1125.11 g). This fact allows the capture of this species even with the nets permitted for industrial fishing in the Republic of Moldova (starting with the mesh size of 55 mm), increasing the value of the species as comercial fishery target.

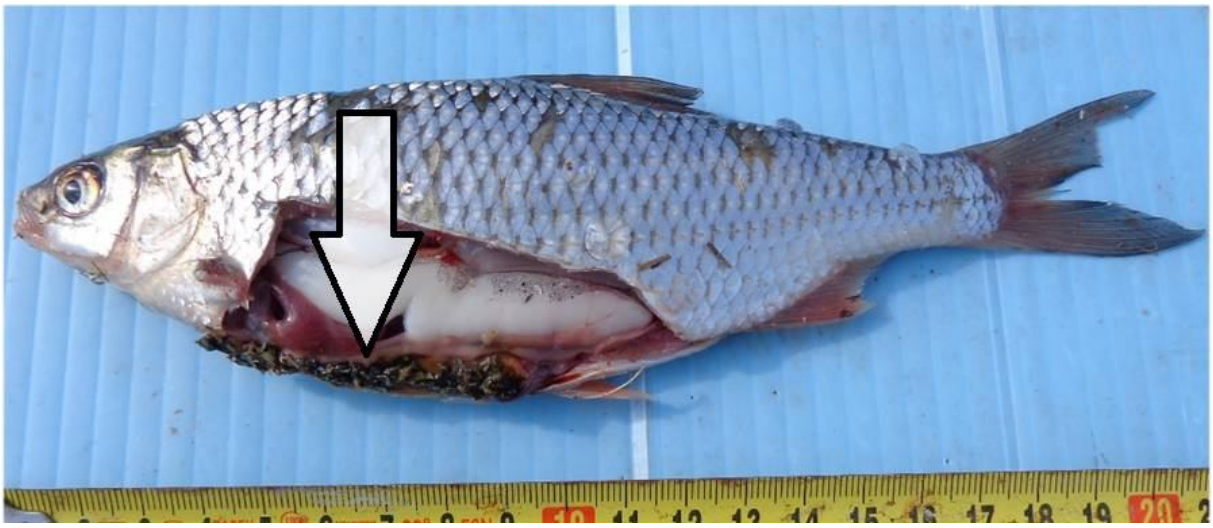

Figure 5. The dissection of *R. rutilus* showing the stomach completely filled with *Dreissena* sp.

Although numerically better represented, *A. alburnus* and *P. fluviatilis* are economically less important than *A. brama*, because of their relatively small size. *P. fluviatilis* forms numerous schools of seashore small ecophene in the lake. From the commercial point of view these ecophene are inefficient to capture, while from an ecological point of view it becomes an unwanted trophic competitor and active consumer of the offspring of other fish.

From the constancy point of view (Table 3, Figure 6), the euconstant species (C4), captured in all 6 sampling sites are: *A. alburnus*, *P. fluviatilis*, *S. lucioperca*, *R. rutilus*, *A. brama*, *C. gibelio*, *L. aspius*, *C. carpio*, *G. cernua*; other 2 species were captured in 5 out of the 6 stations: *N. fluviatilis* and *V. vimba*, and *B. barbus* was captured in 4 sites.

The structure of the fish population from Stânca reservoir is completed by a group of 9 accessory species: *S. cephalus*, *R. amarus*, *H. molitrix*, *S. erythrophthalmus*, *P. parva*, *C. nasus*, *C. taenia*, *S. glanis*, *H. nobilis* and 8 accidental species: *B. sapa*, *P. platygaster*, B*. gymnotrachelus*, *E. lucius*, *G. obtusirostris*, *C. idella*, *P. glenii*, *O. mykiss*.

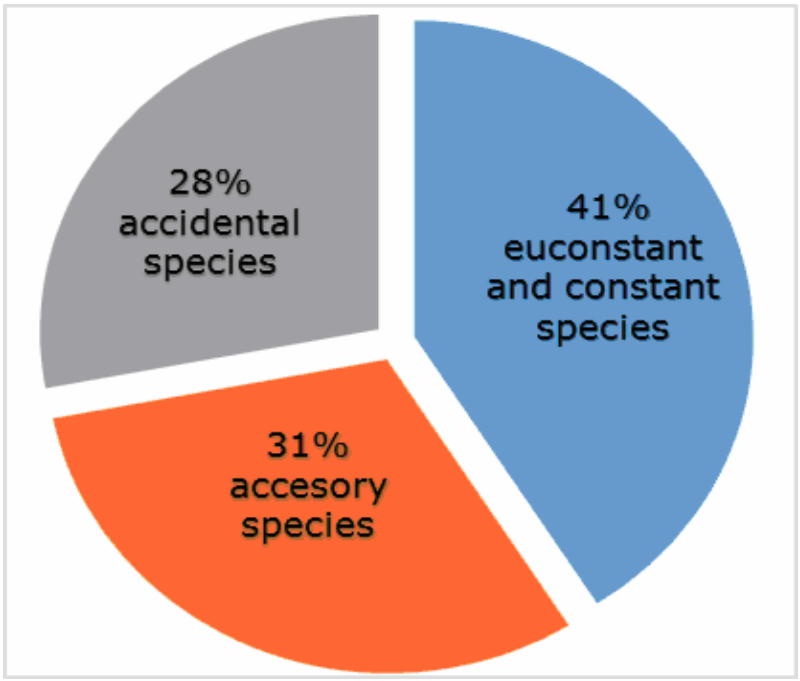

Figure 6. Species distribution in the samples captured in Stânca reservoir, according to the constancy index.

For the sake of example, in the Răcovăţ, Ciuhur and Dumeni bays area, *P. fluviatilis* weight considerably increases in the large area, and the representative species are the *H. molitrix* and *A. aspius*. In the upper sector, *C. nasus*, *R. rutilus*, *S. cephalus*, *V. vimba*, and *B. barbus* are more numerous; once temperature drops, their presence increases in all the lake sectors. In the sub-water layers, where the concentration of the *Dreissena* sp. colonies increases, there is also a significant increase of the presence of the *R. rutilus*, *C. carpio* and *A. brama*, as well as the presence of some predatory and sweeping species like *S. luciperca*, *P. fluviatilis*, *S. glanis*, *L. aspius,* which are lured by the abundance of the prey. The shoreline habitats are dominated by the *A. alburnus, G. fluviatilis* and the slow growth *P. fluviatilis*. We also find *E. lucius*, *S. erythropthalmus* and *H. molitrix* concentrated in low waters, rich in water vegetation.

In summertime, most fish species, irrespective of the age group, prefer less deep habitats, which are more abundant in fodder hydrobionts (being fished during the trophic and reproductive migrations from an area to another). In summertime, the spatial distribution of individuals is a bit more scattered, less dense in the lake area; in autumn, we notice an intensification of trophic migrations before the coming of the cold season.

Also, in any anthropic regulated water ecosystem, the deciding factor that influences the biocenosis structural and productive indicators is the hydrological regime (Butorin & Podubnii 1984). In its turn, it influences the intensity of the water change in the lake, namely the thermic and gas regimes, the accumulation and sedimentation processes, the fish's access to spawning grounds, all directly reflecting also on the fish production of the ecosystem.

Multiannual investigations show that, for Costeşti-Stânca Reservoir, it is recommended to keep a water level as high and constant as possible during the reproduction season (for the flooding of spawning grounds), to reduce it by 1 m in July and to repeat the water level diminish before the ice bridge establishment. This annual dynamics of the hydrological regime will secure the reproduction success of different fish species, the growth and development of the spawn under optimal conditions, the mineralization and disinfection of the reproductive substrate and the covering of spawning grounds with water vegetation, thus preparing them for the future reproduction year.

Analyzing the values of the ecological significance index (Table 3, Figure 7) we notice that the characteristic species (W_4-W_5) for Stânca-Costeşti Lake are *A. alburnus*, *P. fluviatilis, S. lucioperca, R. rutilus* and *A. brama*; the mentioned species occupy the first place both from the point of view of numerical dominance and their continuous presence in captures. The high values of this index with regard to the bleak and the perch are illustrative of the need to use the biomanipulation method more actively when regulating the stock, using the zander, the asp and the wells catfish as natural consumers, to this goal.

The predators serve as a biological regulator and allow the co-habitation of a great diversity of species as it was shown by Alimov et al (2013). We consider that using biomanipulation methods for enhancing the structure of fish species will further contribute to both the ecological and economical benefit of the lake.

The group of accessory species (W_3-W_2) is rich and diverse (15 species - 52%) out of these species, the following ones stand out because of their commercial value: *C. gibelio, L. aspius,* and *C. carpio.*

It becomes quite alarming that some invasive non-native species (*H. molitrix, P. parva* and the *C. idella*) and some intervening (Kolesnik et al 2007) species (*N. fluviatilis, B. gymnotrachelus*, *P. marmoratus* and *P. platygaster*) show a positive dynamics of the stock in time, which confirms the need to more efficiently use the applied trophology principles for the preservation of the reservoir's fish population.

The other accesory species, i.e. *V. vimba*, *S. cephalus, B. barbus, R. amarus, H. molitrix, S. erythrophthalmus, B. sapa, C. nasus, C. taenia* were captured in a relatively small number, although some of them, like the *H. nobilis, S. erythropthalmus*, have a great biological potential to provide consistent populations in the reservoir lakes, especially those that are actively subject to the eutrophication process. Rheophilic species captured in the lake, like *V. vimba, S. cephalus, B. barbus, R. rutilus* and *C.*

nasus, on one hand, indicate the beginning of active trophic migrations from upstream, with the coming of fall, and the cooling of water, and on the other hand they illustrate the still favorable ecological condition of this relatively young and unpolluted ecosystem.

Out of the 9 accidental species, it is worth mentioning once again *O. mykiss*, a species that tolerates a water temperature up to 24°C, which allows its survival in the lake, although it only feeds at temperatures under 18°C (Molony 2001).

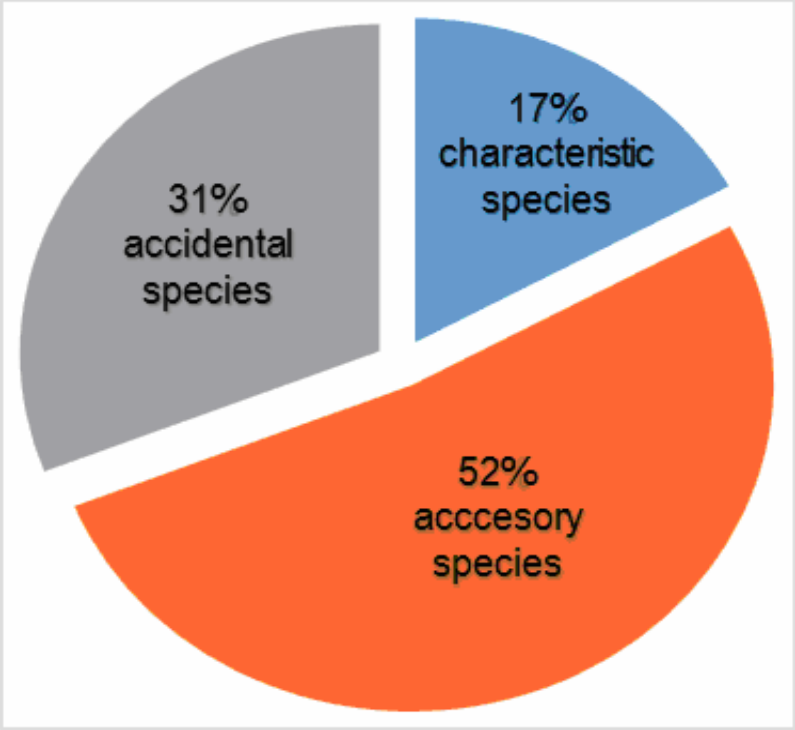

Figure 7. Species distribution in the samples captured in Stânca reservoir, according to the ecological significance index.

Previous studies carried out in 2013, indicate a grouping characteristic of Stânca Costeşti Lake, which is made up of the following species: *A. brama*, *R. rutilus*, *P. fluviatilis*, *L. aspius* with the difference that, in 2014 year captures, S. *lucioperca* joins this dominating group, exceeding *L. aspius,* much better represented in captures in 2013 (Bulat et al 2014). The differences between the outcome of the fishing done in 2014 and those in 2013 may be due to three factors: artificial introducing of S. *lucioperca* eggs from the spring of 2013, the differences between sampling season and tools used.

The analysis of the fish community structure in the lake, from the point of view of the species belonging to different functional-ecological categories (guilds) points out to the following aspects.

Most species are native species living in the river even prior to the accumulation: (*A. brama, P. fluviatilis, S. lucioperca, L. aspius, C. carpio, V. vimba, S. eythrophthalmus, S. cephalus, C. nasus, S. glanis*). There are also well adapted non-native species, which may cause major economic damages in their secondary spread areas (e.g. *C. idella* and *P. parva*). We have also recently discovered in the lake a non-native species with extremely high invasive potential, which is now in full geographical expansion - *P. glenii* as it was shown by Iacob & Petrescu-Mag (2008) and Bulat et al (2014).

The introduced species have been deliberately brought for commercial purposes, and their stock is maintained only by systematic repopulations of the lake (*H. nobilis, C. idella*), but which prove record individual growths in this ecosystem, as they benefit from optimal trophic conditions (Bulat et al 2014).

Stânca-Costeşti Reservoir is an artificial biotope, which is, at present, in the ecological stability succession stage, having a high bio-productive potential and a healthy

fish population structure. At this stage, the following tolerating and euritope species dominate: *Alburnus alburnus, Perca fluviatilis, Abramis brama* and *Rutilus rutilus*.

Spatial distribution of species at the lake level in August-October 2014 is relatively uniform; no significant differences have been identified among the three investigated sectors (Figure 8). A higher efficiency of the fishing done in the upper sector of the lake may be explained by more favorable fishing conditions, the river bed width and less deep waters in this sector.

Fish fauna protection. Stânca Costeşti ROSPA 0058 Nature 2000 protected area is a protected area of national interest, with a surface of 2161 ha, consistent with IV IUCN category (mixed natural reserve), situated in Botoşani, on the administrative territory of Stânca Ştefăneşti, Manoleasa and Ripiceni. This site is the most important winter quarters of aquatic birds in the Prut basin, where 178 species of birds have been identified, out of which 44 species are EU protected (http://www.mmediu.ro).

From the point of view of the fish populations, in Stânca reservoir we have identified 9 fish species protected by national and/or international laws, directives, conventions (Table 4). The national pieces of legislation from the Republic of Moldova (Law no. 149 of 08.06.2006 pertaining to the fish stock, fishery and aquaculture, published on 11.08.2006 in the Official Journal no. 126-130) and the bilateral agreement between the Romanian Government and the Moldovan Government concerning cooperation in the field of fish resources (as published in the Official Journal of Romania no. 756 on 29.1.2003) protect the fish species identified in the lake only in terms of regulating their fishing conditions, i.e. admissible minimal dimensions, fishing methods, and fished quantity.

Table 4

List of fish species of conservative interest, from Stânca Costesti reservoir

No.	*Order*	*Family*	*Species*	*Legislation*					
				OUG. 57/2007 Romania	*L. 13/1993*	*Bern Convention*	*Council Directive 92/43/ EEC Habitats Directive*		*IUCN 2011*
				3	*5*	*III*	*II*	*V*	
1	Cypriniformes	Cyprinidae	*L. aspius*	X		X	X	X	LC
2			*B. sapa*			X			LC
3			*V. vimba*			X			LC
4			*C. nasus*			X			LC
5			*R. amarus*	X		X	X		LC
6			*B. barbus*		X			X	LC
7		Cobitidae	*C. taenia*	X		X	X		LC
8		Siluridae	*S. glanis*			X			LC
9	Gasterosteiformes	Gasterosteidae	*P. platygaster*			X			LC

LC - category in IUCN classification translates as “low concern” from the conservation point of view; The numbers (arabic 3, 5 and latin III, II, V) indicate the annex of a certain directive or law that refers to the mentioned species.

The species *L. aspius*, *B. barbus*, and *S. glanis* are valuable species aimed by commercial fishermen. *V. vimba, C. nasus* and *R. rutilus* are caught in small quantities, being of little importance to commercial fishing, but represent a sure indicator of the ecosystem well-being. *R. amarus, C. taenia* and *P. platygaster* are far from being threatened, although they have a preservation value at the European level, within the Romania-Moldova inter-state boundaries, proving obvious biological progress in most ecosystems.

The measures related to the preservation of the fish stock from the lake comprise the observance of maximum quantities, assigned quotas, the compliance with the

prohibition periods and the minimum dimensions of the fishing mesh size. The water retention level provision during the reproduction period is very important for most species present in the lake (including protected species). The observance of the optimal water level in the lake becomes the determining factor for successfully providing the fish biomass durable growth rate.

Conclusions. Even if the fishery is the last on the uses list of Stânca-Costeşti Reservoir, given its natural productivity and dimensions, the lake has an obvious economic fishery potential. This is an important reservoir of the natural fish stock of the Prut River, and shelters representatives of some very valuable species both from the economic and preservation point of view.

Studies carried out in the past few years defines the following species group as characteristic of Stânca Costeşti Lake: *Alburnus alburnus*, *Perca fluviatilis*, *Sander lucioperca, Rutilus rutilus*, and *Abramis brama*, valuable species from an economic point of view, both directly and thanks to the secondary production they may generate through the predatory species, which are even more valuable, economically speaking.

It is necessary to develop a common strategy for planning, monitoring and management, including scientifically based bio-manipulation of the lake fish populations, to better capitalize its biological and economic potential.

Given its cross-border position, and the national and international jurisdictions, it is important to sort out, clarify and agree upon the specific tasks of the bodies in charge of the monitoring, preservation, management and wise use of the fish populations from Stânca Costeşti reservoir.

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