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THE ANSERIFORMES FROM THE BASINS OF THE ARGEŞ RIVER BETWEEN VÂLCELE AND GOLEŞTI (ARGEŞ COUNTY, ROMANIA) IN FEBRUARY 2013 – JANUARY 2014

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Abstract
In this paper, the authors show the results of their research on the species of Anseriformes, performed on the dam lakes between Vâlcele and Goleşti from the Argeş River during February 2013 – January 2014. The Anseriformes was one of the two overdominant orders of the avifauna from the mentioned period. It numbered 15 species, which were represented by 49,335 individuals. There were 5 euconstant species (Cygnus olor, Anas platyrhynchos, Anas crecca, Aythya fuligula, and Aythya ferina), and 3 eudominant species (Anas platyrhynchos, Aythya fuligula, and Aythya ferina). The most individuals were observed in October – November and the number of species was the biggest in January – February. In the vernal and aestival seasons the numbers of species and individuals were very low. Anas platyrhynchos was the best represented (22,599 individuals, over 45% of whole number of individuals), followed by Aythya ferina. As result, these are the overdominant species. Function of the natural local conditions and anthropogenic pressure, the Goleşti Basin was the most attractive for the birds and the Bascov Basin, the least.

Keywords: Anseriformes, ecology, Argeş River, Romania.

1. INTRODUCTION

The ornithofauna of the dam lakes from the Argeş River was intensely studied. The researches have begun after the building of the reservoirs (Mătieş, 1969; Munteanu and Mătieş, 1983) and in the last 15 years they were almost continuous. They were focused mainly in the Vâlcele-Goleşti sector (Conete et al., 2008, 2011; Conete, 2011; Gava, 1997; Gava et al., 2004a,b, 2007, 2011; Mestecăneanu et al., 2004a, 2010, 2013, etc.).

The aim of this work is to show the some particular aspects of the ecology of the Anseriformes, the most important order in the area in respect of the strengths, chiefly in winter (Mestecăneanu and Gava, 2014a,b,c,d; Mestecăneanu and Gava, 2015a,b,c; Mestecăneanu and Gava, 2016a,b; Mestecăneanu et al., 2003, 2004b).

2. MATERIALS AND METHODS

The basins where the research-study was performed were constructed on the Argeş River starting in 1965 (Figure 1). They are part of the protected area ROSPA0062 Lacurile de acumulare de pe Argeş, component of the Nature 2000 network. Their surface is: 640 ha – Vâlcele, 643 ha – Budeasa, 140 ha – Bascov, 150 ha – Piteşti and 680 ha – Goleşti (cf. http://www.baraje.ro). The

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area is in the south of the Făgăraş and Iezer – Păpuşa Mountains in the Getic Piedmont and in the Piteşti High Plain (the southern division).

The vegetation is composed chiefly by reed bed, bulrush, alder, and willow and the climate is continental with hilly characteristics (Barco & Nedelcu, 1974).

As the field method, the itinerary method, combined to one of the fixed point of observations was used. 12 sessions of observations were carried out between 13-23 of each month during February 2013 – January 2014 (February 20, March 23, April 13, May 17, June 19, July 19, August 20, September 23, October 21, November 18, December 16, and January 14). The same track was followed every time and the birds of water were especially monitored. Binoculars, a spotting scope and a photo device were used.

The scientific nomenclature is in accordance to the Hamlin Guide (Bruun et al., 1999) and the data were laboured using the dedicated methods (Gomoiu and Skolka, 2001; Gache, 2002).

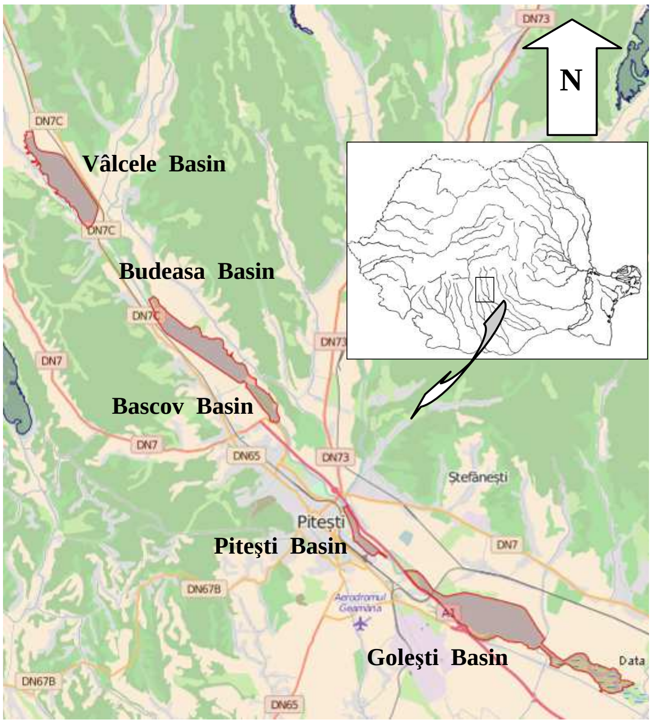

Figure 1. The map of the area. (by http://biodiversitate.mmediu.ro, modified)

3. RESULTS AND DISCUSSIONS

Between February 2013 and January 2014, in the area of study 15 species of Anseriformes were identified; they totalised 49,335 individuals. About genera, 2 species (13.33%) with 1,223 individuals (2.47%) are included in *Cygnus*, 1 species (6.66%) with 660 individuals (1.33%) is included in *Anser*, 6 species (40.00%) with 26,814 individuals (54.35%) are included in *Anas*, 1 species (6.66%) with 52 individuals (0.10%) is included in *Tadorna*, 3 species (20.00%) with 20,088 individuals (40.71%) are included in *Aythya*, 1 species (6.66%) with 490 individuals (0.99%) is included in *Bucephala* and 1 species (6.66%) with 8 individuals (0.01%) is included in *Mergus*. Three species (*Cygnus olor*, *Anas platyrhynchos* and *Aythya ferina*) were observed each month (Table 1). Together with *Anas crecca* and *Aythya fuligula*, they belong to the group of the euconstant species. No species was constant. 5 species were accessory and 5 species were occasional (Table 1, Figure 2).

Table 1. The occurrence of the birds along the year and some ecological indexes

No.	Species	Occurrence												Individuals	Ecological indexes		
		January	February	March	April	May	June	July	August	September	October	November	December		Constance category	Dominance category	Dzuba Index category
1	*Cygnus olor*	+	+	+	+	+	+	+	+	+	+	+	+	1,202	C4	D3	W3
2	*Cygnus cygnus*	+	+	-	-	-	-	-	-	-	-	-	-	21	C1	D1	W1

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3	*Anser albifrons*	-	+	-	-	-	-	-	-	-	-	-	+	660	C1	D2	W2
4	*Anas platyrhynchos*	+	+	+	+	+	+	+	+	+	+	+	+	22,599	C4	D5	W5
5	*Anas strepera*	+	+	-	-	-	-	-	-	-	-	-	-	22	C1	D1	W1
6	*Anas penelope*	+	+	+	+	-	-	-	-	-	-	+	+	208	C2	D1	W2
7	*Anas querquedula*	-	-	+	+	-	-	-	+	+	-	-	-	291	C2	D1	W2
8	*Anas crecca*	+	+	+	+	-	-	+	+	+	+	+	+	3,639	C4	D4	W4
9	*Anas clypeata*	+	-	-	+	-	+	-	+	+	+	-	-	55	C2	D1	W1
10	*Tadorna tadorna*	+	+	-	-	-	-	-	+	-	-	+	-	52	C2	D1	W1
11	*Aythya fuligula*	+	+	+	+	-	+	+	+	+	+	+	+	5,942	C4	D5	W5
12	*Aythya ferina*	+	+	+	+	+	+	+	+	+	+	+	+	14,140	C4	D5	W5
13	*Aythya nyroca*	-	-	-	-	-	-	+	+	-	-	-	-	6	C1	D1	W1
14	*Bucephala clangula*	+	+	+	-	-	-	-	-	-	-	+	+	490	C2	D1	W2
15	*Mergus albellus*	+	+	-	-	-	-	-	-	-	+	-	-	8	C1	D1	W1

Legend:
+ – presence; - – absence; C1 – occasional species, C2 – accessory species, C3 – constant species, C4 – euconstant species; D1, W1 – subrecedent species, D2, W2 – recedent species, D3, W3 – subdominant species, D4, W4 – dominant species, D5, W5 – eudominant species.

By dominance, 3 species were eudominant, 1 species was dominant, 1 species was subdominant, 1 species was recedent and 9 species were subrecedent (Table 1, Figure 3) and by Dzuba Index of ecological significance, 3 species were eudominant, 1 species were dominant, 1 species was subdominant, 4 species was recedent and 6 species were subrecedent (Table 1, Figure 4).

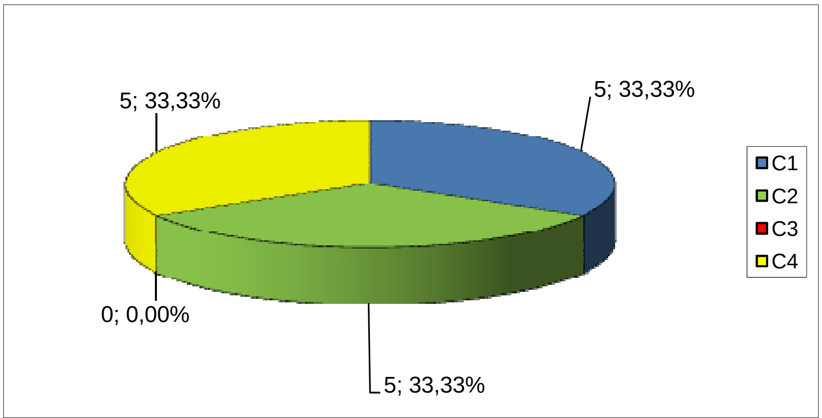

Figure 2. The distribution of the species by the category of constance
(C1 – occasional species, C2 – accessory species, C3 – constant species, C4 – euconstant species)

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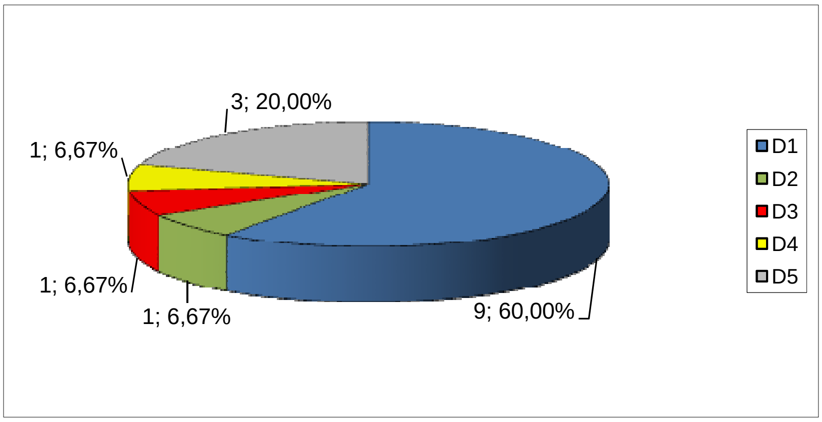

Figure 3. The distribution of the species by the category of dominance (D1 – subrecedent species, D2 – recedent species, D3 – subdominant species, D4 – dominant species, D5 – eudominant species)

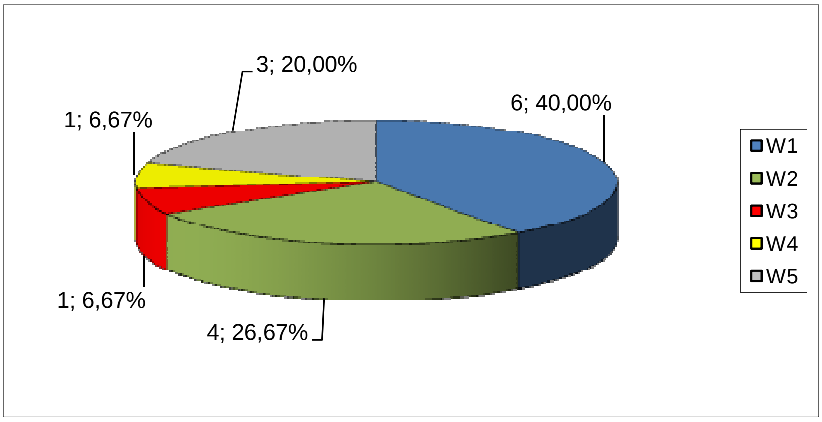

Figure 4. The distribution of the species by the category of Dzuba Index (W1 – subrecedent species, W2 – recedent species, W3 – subdominant species, W4 – dominant species, W5 – eudominant species)

Regarding the monthly dynamics of the individuals (Figure 5), we observe that there is a maximum in February and a noticeable peak in October-November, when the lakes hold birds in passage. In the middle of the winter, the number of individuals is smaller, because of the harder life conditions. The tip from August reflects both the addition of juveniles or migratory birds and the increase of the species number. Remarkable is that in April-July the number of birds is the least, the absolute minimum being in May. The number of species varies almost identically: the minimum is in May, respectively in June (due to the breeding species) and the maximum is in January – February (at the end of winter).

The correlation between the number of species and the surface of the basins was 0.32 (positive correlation with fair degree of linear relationship) and the correlation between the number of individuals and the surface of the basins was a 0.55 (positive correlation with moderately strong linear relationship). That means (by COLTON, 1974) that the number of species and, particularly, the number of the individuals grows as the surface of the reservoirs increases. However, other factors are involved in these equations, because of the low coefficient of determination (0.10, respectively 0.30).

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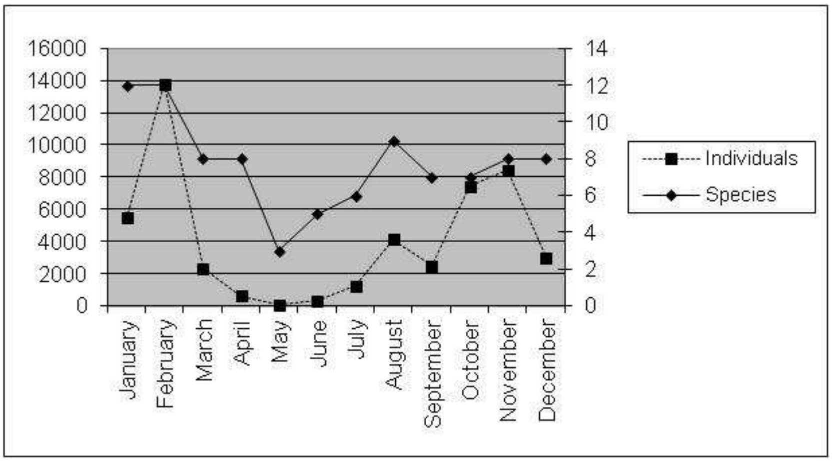

Figure 5. The monthly dynamics of the species number and individuals

The strength of all the species is determined by the strengths of the eudominant species. We observe that in the first part of the year *Anas platyrhynchos* (6,875 individuals) and *Aythya ferina* (3,820 individuals) were the best represented in February, while *Aythya fuligula* (1,122 individuals) was the best represented in March. In the last part of the year, *Anas platyrhynchos* had the peak of the strength in November, while *Aythya ferina* and *Aythya fuligula* had the maximum of the strengths in October. The general peak of the strengths from August is generated by the individuals of *Aythya ferina*, *Anas platyrhynchos* and *Anas crecca* (the last being exclusively passage species). The strengths of the other species are less significant, but they are generally bigger in February (Figure 6).
Other remarks: *Anas crecca*, *Cygnus olor*, *Anas strepera*, *Anas penelope*, *Mergus albellus* – maximum 1,035, 636, 16, 87, respectively 4 individuals in February, *Cygnus cygnus*, *Bucephala clangula* – maximum 12, respectively 318 individuals in January, *Anas querquedula, Anas clypeata* – maximum 200, respectively 15 individuals in August, *Tadorna tadorna* – maximum 45 individuals in November, *Aythya nyroca* – maximum 4 individuals in July.
Because they were present on the basins in May and/or June (Table 1), some species breed here: *Cygnus olor* – probable breeding, *Anas platyrhynchos* – confirmed breeding, *Anas clypeata* – possible breeding, *Aythya fuligula* – possible breeding and *Aythya ferina* – probable breeding.
Almost a half of the recorded individuals (45.80%) belong to *Anas platyrhynchos* and over a quart (28.66%) to *Aythya ferina*. They are the overdominant species by the index of relation. *Anas crecca* and *Aythya fuligula* are the dominant species and the others are the complementary species (Figure 7).
Anas platyrhynchos was overdominant every month, excepting March, when it was dominant, and July, when it was complementary. *Aythya ferina* was overdominant all months, excepting April and December, when it was dominant. *Aythya fuligula* was overdominant in March and April, respectively in October and November, on the background of the decrease of the *Anas platyrhynchos* and *Aythya ferina* strengths and *Anas crecca* was overdominant in August and September, in the passage period. The rest of the time, they were dominant or complementary (Figure 8). The other species were complementary each month. *Anser albifrons* is the exception: it was dominant in December, when 400 individuals were observed on the Goleşti Basin.

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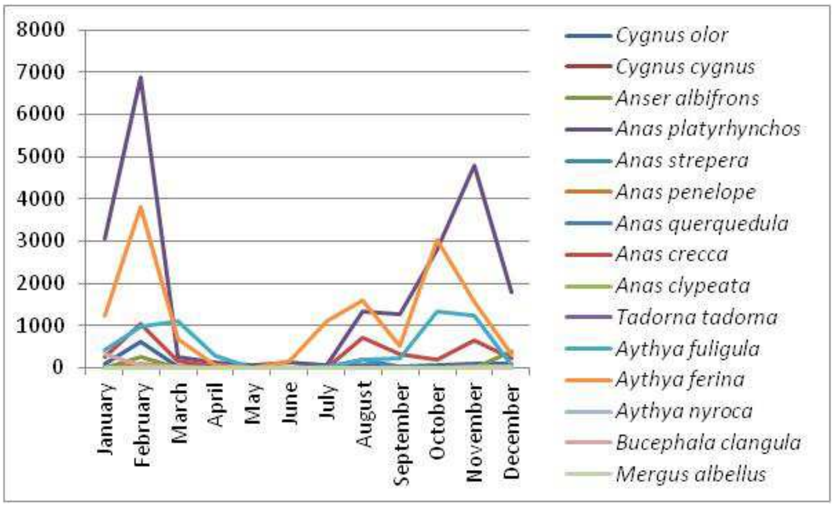

Figure 6. The monthly variation of the species strengths

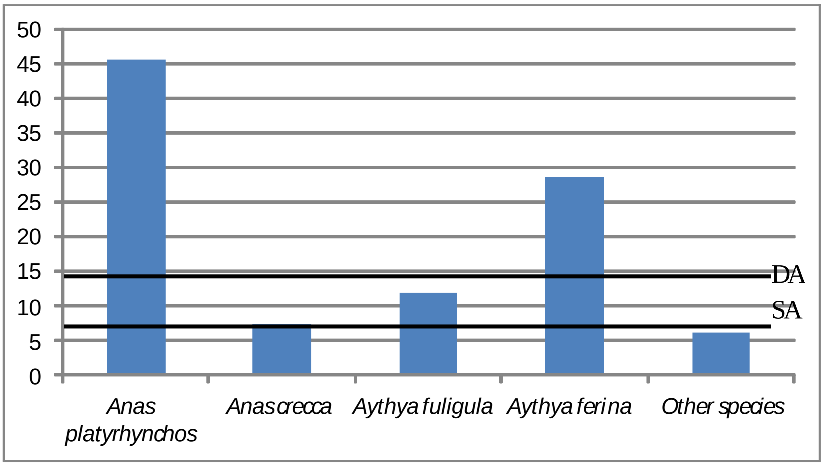

Figure 7. The global participation of the species to the Anseriformes coenose by the index of relation (DA – the dominance axis, SA – the static axis)

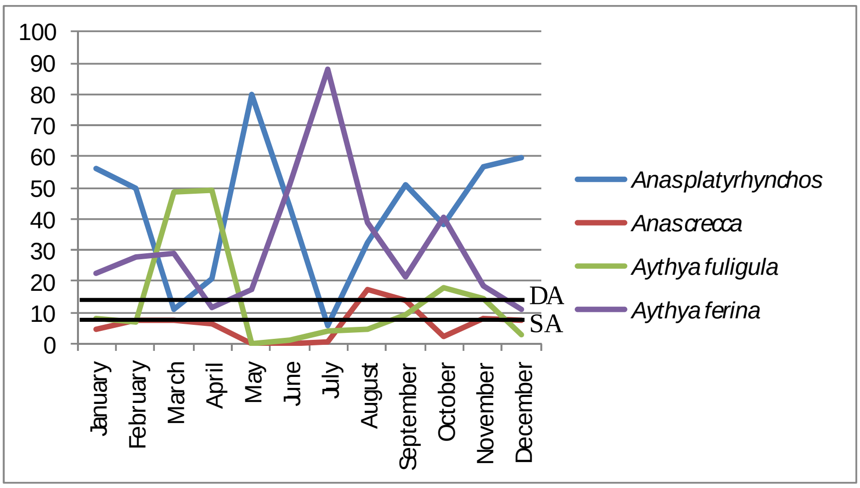

Figure 8. The monthly dynamics of the species by the index of relation (DA – the dominance axis, SA – the static axis).

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Anas platyrhynchos was overdominant every season, too, excepting the prevernal, when it was dominant. Instead, *Aythya ferina* was overdominant all the seasons. *Aythya fuligula* was overdominant in the prevernal and autumnal seasons and *Anas crecca* only in the serotinal. In the hiemal season it was dominant and in the vernal, aestival, and serotinal it was complementary (Figure 9). Regardless the interval, the other species were complementary.

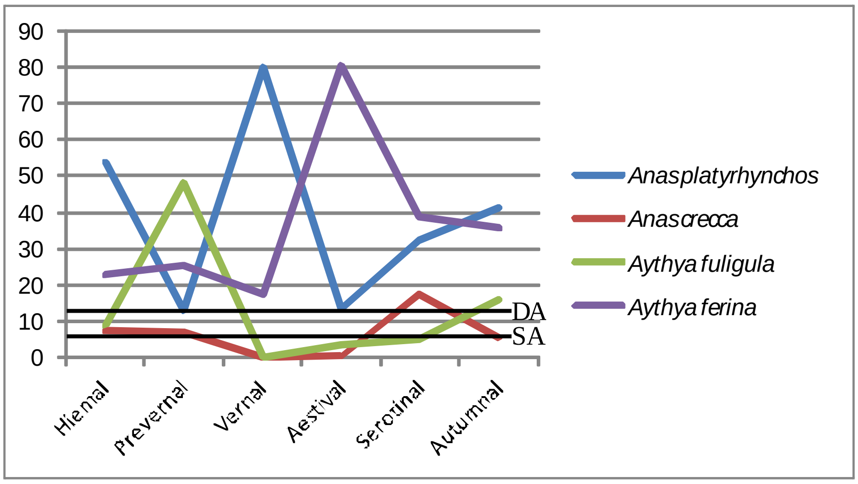

Figure 9. The seasonal dynamics of the species by the index of relation (DA – the dominance axis, SA – the static axis)

Concerning the similarity between the coenosis of Anseriformes from the reservoirs, by Bray–Curtis index (Table 2, Figure 10) the biggest similarity is between Piteşti and Budeasa (69.18%) and the lowest between Budeasa and Bascov (6.72%). By Jaccard index (Table 3, Figure 11), the highest similarity was between Piteşti and Goleşti (78.57%) and the lowest between Goleşti and Bascov (28.57%). The differences between the values represent the consequences of the fact that the Bray–Curtis index is based on the presence/absence of the species in the samples and on their number of individuals and the Jaccard index is based only on the presence/absence of the respective species in the samples.

Viewing the variation of strengths calculated on the basins, we state that *Anas platyrhynchos*, *Aythya ferina* (that were present on all the reservoirs), *Aythya fuligula* and *Anas crecca*, had the biggest strengths on the Goleşti Basin (13,812, 10,770, 5,209, respectively 2,002 individuals), followed by the Budeasa Basin. The last two species were not present on the Bascov Basin, where the first two registered the lowest values. *Cygnus olor* was also observed on all the basins, but their biggest number was recorded on the Piteşti Basin (609 individuals). *Anser albifrons* was observed only on the Goleşti Basin (660 individuals). *Bucephala clangula* was observed on the Vâlcele, Budeasa and Goleşti basins (the biggest strength, on Goleşti, 252 individuals), *Anas querquedula* was observed only on the Piteşti and Goleşti basins (the biggest strength, on Goleşti, 278 individuals), *Anas penelope* were not recorded on the Vâlcele Basin, but it was observed in the rest (the biggest strength, on Budeasa, 103 individuals), *Anas clypeata* were not recorded only on the Bascov Basin (the biggest strength, on Vâlcele, 22 individuals), *Tadorna tadorna* was registered on the Piteşti and Goleşti basins (the biggest strength, on Goleşti, 49 individuals), *Anas strepera* was observed on the Budeasa and Piteşti basins (the biggest strength, on Budeasa, 16 individuals), *Cygnus cygnus* was observed on the Piteşti and Goleşti basins (the biggest strength, on Piteşti, 12

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individuals), *Mergus albellus* was observed on the Budeasa and Bascov basins (the biggest strength, on Budeasa, 5 individuals) and *Aythya nyroca* was observed on the Piteşti and Goleşti basins (the biggest strength, on Piteşti, 4 individuals) (Table 4, Figure 12). Per total, 3,920 individuals (7.94%) were recorded on the Vâlcele Basin, 7,132 (14.45%) were recorded on the Budeasa Basin, 248 (0.50%) were recorded on the Bascov Basin, 4,750 (9.62%) were recorded on the Piteşti Basin and 33,285 individuals (67.46%) were recorded on the Goleşti Basin. Regarding the number of species, 7 (46.66%) were registered on the Vâlcele, 11 (73.33%) were registered on the Budeasa, 5 (33.33%) were registered on the Bascov, 12 (80.00%) were registered on the Piteşti and 13 (86.66%) were registered on the Goleşti Basin. It results that the Bascov Basin has the smallest importance for the birds from the Anseriformes order. The reason is the anthropogenic pressure, which is bigger here than on the others reservoirs, and that was largely discussed in other papers (Conete, 2011, Mestecăneanu & Gava, 2014a,b, etc.). On the other hand, the Goleşti basin is the most attractive (Conete, 2011, Conete et al., 2012, Mestecăneanu et al., 2005, Mestecăneanu & Gava, 2016a,b, etc.).

Table 2. The similarity matrix between the basins coenosis, by Bray-Curtis (single linkage)

Similarity matrix	**Vâlcele**	**Budeasa**	**Bascov**	**Piteşti**	**Goleşti**
Vâlcele	*	68.34	10.36	60.80	21.05
Budeasa	*	*	6.72	69.16	34.00
Bascov	*	*	*	9.68	1.46
Piteşti	*	*	*	*	22.62
Goleşti	*	*	*	*	*

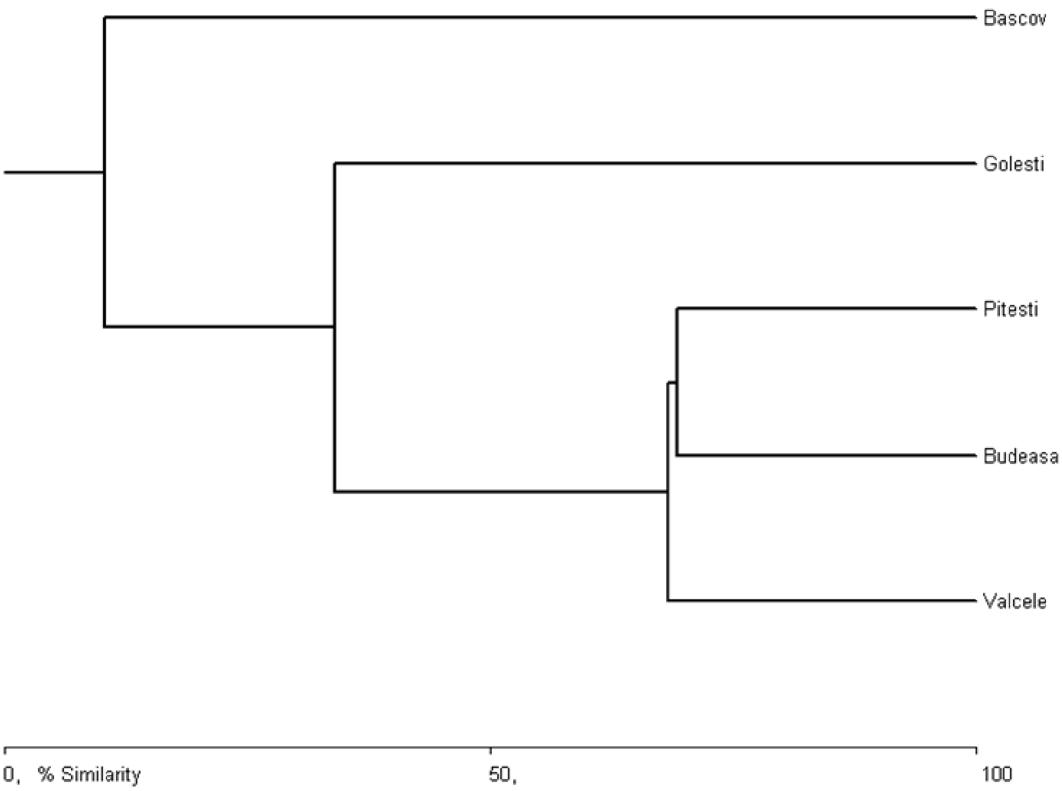

Figure 10. The Bray-Curtis cluster analysis (single link)

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Regarding the density for the whole area, the Anseriformes registered 1.82 individuals/ha/month. The Goleşti Basin has the biggest value (4.08); the lowest is on the Bascov Basin (0.15). On the seasons, the hiemal season is remarkable due to the biggest value (3.41) and the vernal season due to the lowest one (0.03). Obviously, the species with the biggest densities are the eudominant ones. They reach the biggest values on the Goleşti Basin (and Piteşti, for *Anas crecca*); the lowest densities are on the Bascov Basin (and Vâlcele, for *Aythya ferina*). From the point of view of the ecological seasons, *Anas platyrhynchos* has the biggest density in the hiemal season, *Anas crecca*, in the serotinal one, and *Aythya fuligula* and *Aythya ferina*, in the autumnal one. Regardless the species, the values reflect the phenology, the breeding, the frequency and abundance of each species and the natural conditions or the scale of human pressures at local or overall planes (Table 4).

Table 3. The similarity matrix between the basins coenosis, by Jaccard (single linkage)

Similarity matrix	**Vâlcele**	**Budeasa**	**Bascov**	**Piteşti**	**Goleşti**
Vâlcele	*	63.63	33.33	46.15	53.84
Budeasa	*	*	45.45	64.28	60.00
Bascov	*	*	*	30.76	28.57
Piteşti	*	*	*	*	78.57
Goleşti	*	*	*	*	*

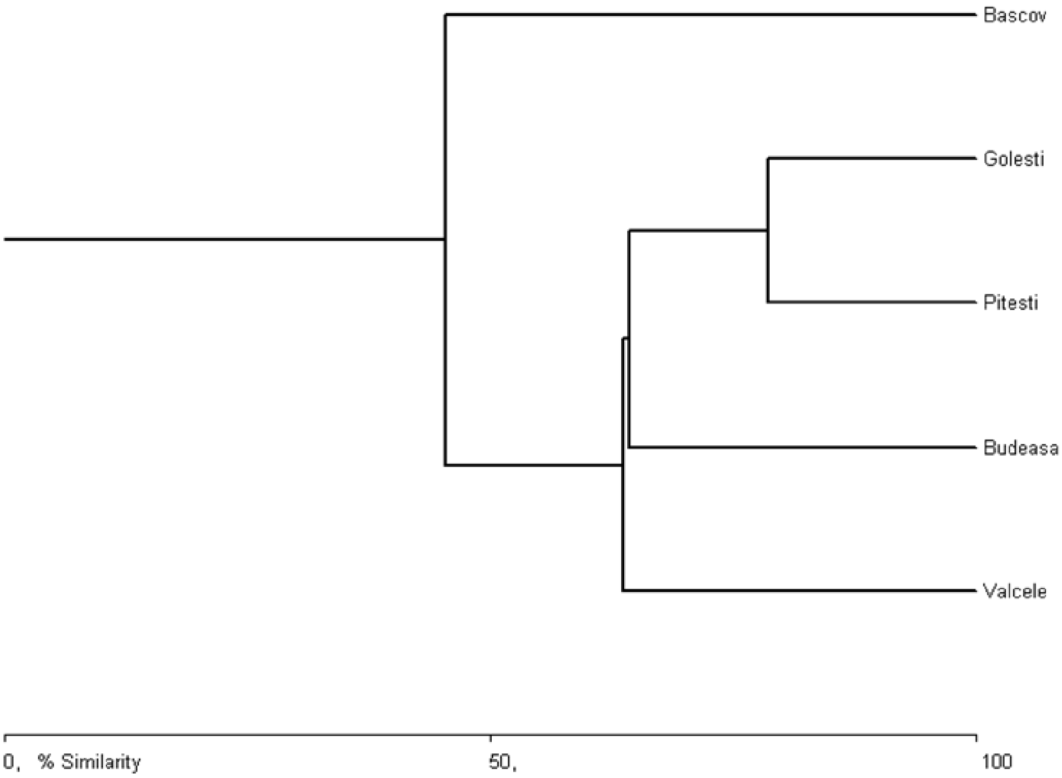

Figure 11. The Jaccard cluster analysis (single link)

The Shanon–Wiener ecological diversity is between 1.03 (for Vâlcele) and 1.43 (for Piteşti) and the Simpson ecological diversity was situated between 1.86 (for Vâlcele) and 3.46 (for Piteşti). Overall, it

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was 1.43, respectively 3.20. The smallest evenness was on the Vâlcele Basin (0.53), respectively on the Budeasa Basin (0.24) and the biggest was on the Bascov Basin (0.72, respectively 0.55). Overall, it was 0.53, respectively 0.21 (Table 5). These mean that on the Vâlcele Basin there is a relatively unstable coenose of Anseriformes, with a relatively low diversity, the opposite being on the Piteşti Basin. On the Budeasa Basin there are big differences between the strengths of the species, the smallest ones being on the Bascov Basin. The Goleşti Basin has a relatively stable coenose, with few dominant species, and a relatively big diversity, things that are valuable at general level, too.

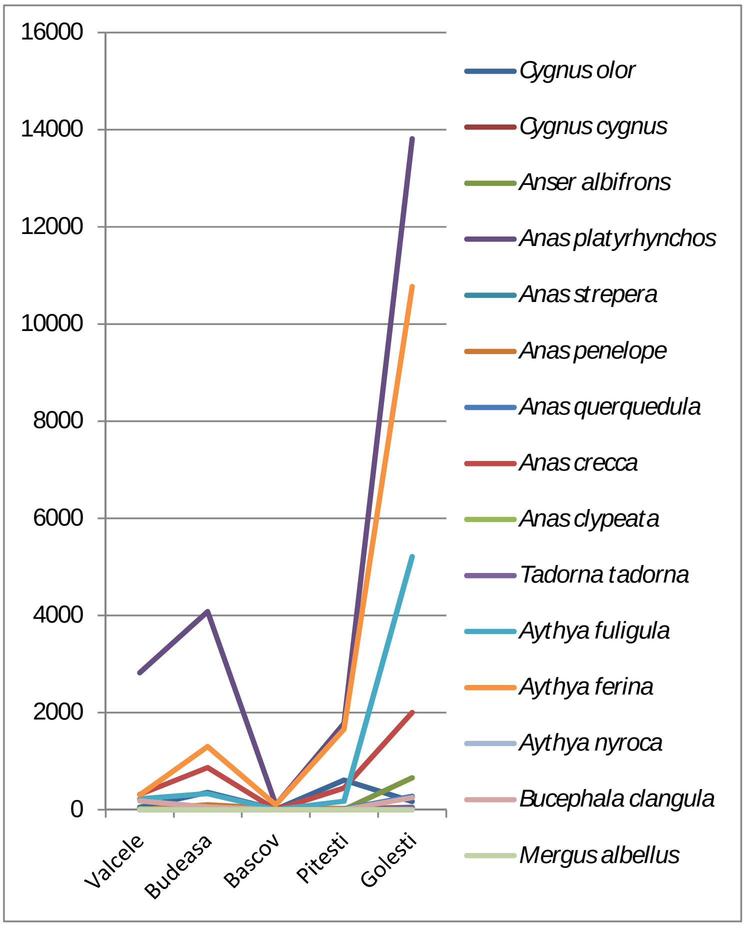

Figure 12. The variation of the species strengths on basins

With reference to the ecological seasons, the diversity is between 0.58 (in the vernal season) and 1.41 (in the prevernal and the serotinal seasons) for the Shanon–Wiener index and between 1.49 (in the aestival season) and 3.45 (in the serotinal season) for the Simpson index. The evenness varied between 0.34 (in the aestival season) and 0.64 (in the prevernal and the serotinal seasons), in the first case, and between 0.21 (in the aestival season) and 0.49 (in the vernal season), in the second case (Table 6). In other words, in the vernal season, and less in the aestival season, the coenose is the most unstable; the most stable it is in the prevernal and serotinal seasons. The hiemal and autumnal seasons have a medium stability. The lowest diversity is in vernal and aestival seasons, while good values are in the serotinal and prevernal seasons. In the autumnal and the hiemal seasons there is a medium diversity. The biggest differences between the strengths are in the aestival season.

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Table 4. The density of the species (individuals/ha/month).

No.	Species	Vâlcele	Budeasa	Bascov	Piteşti	Goleşti	Hiemal	Prevernal	Vernal	Aestival	Serotinal	Autumnal	Overall
1.	***Cygnus olor***	0.01	0.05	0.01	0.34	0.02	0.10	0.01	0.00	0.01	0.02	0.02	0.04
2.	***Cygnus cygnus***	-	-	-	0.01	0.00	0.00	-	-	-	-	-	0.00
3.	***Anser albifrons***	-	-	-	-	0.08	0.07	-	-	-	-	-	0.02
4.	***Anas platyrhynchos***	0.37	0.53	0.06	0.99	1.69	1.83	0.08	0.02	0.05	0.59	0.91	0.84
5.	***Anas strepera***	-	0.00	-	0.00	-	0.00	-	-	-	-	-	0.00
6.	***Anas penelope***	-	0.01	0.02	0.01	0.01	0.02	0.01	-	-	-	-	0.01
7.	***Anas querquedula***	-	-	-	0.01	0.03	-	0.01	-	-	0.09	0.01	0.01
8.	***Anas crecca***	0.04	0.11	-	0.25	0.25	0.24	0.05	-	0.00	0.32	0.12	0.13
9.	***Anas clypeata***	0.00	0.00	-	0.01	0.00	0.00	0.00	-	0.00	0.01	0.01	0.00
10.	***Tadorna tadorna***	-	0.00	-	0.00	0.01	0.01	-	-	-	0.00	-	0.00
11.	***Aythya fuligula***	0.03	0.04	-	0.10	0.64	0.30	0.32	-	0.01	0.09	0.35	0.22
12.	***Aythya ferina***	0.04	0.17	0.06	0.92	1.32	0.77	0.16	0.01	0.28	0.72	0.79	0.52
13.	***Aythya nyroca***	-	-	-	0.00	0.00	-	-	-	0.00	0.00	-	0.00
14.	***Bucephala clangula***	0.02	0.01	-	-	0.03	0.05	0.00	-	-	-	-	0.02
15.	***Mergus albellus***	-	0.00	0.00	-	-	0.00	-	-	-	-	0.00	0.00
Overall		0.51	0.92	0.15	2.64	4.08	3.41	0.65	0.03	0.35	1.83	2.20	1.82

Legend: - absence; 0.00 – a very small density.

Table 5. The ecological diversity and the evenness from the dam basins

Basin	Shanon Wiener index	Hsmax	Shanon Wiener eveness	Simpson index (1/λ)	S	Simpson eveness
Vâlcele	1.03	1.95	0.53	1.86	7.01	0.27
Budeasa	1.30	2.40	0.54	2.63	11.01	0.24
Bascov	1.15	1.61	0.72	2.77	5.08	0.55
Piteşti	1.43	2.48	0.58	3.46	12.02	0.29
Goleşti	1.40	2.56	0.54	3.27	13.00	0.25
Overall	1.43	2.71	0.53	3.20	15.00	0.21

Table 6. The seasonal ecological diversity and evenness

Season	Shanon Wiener index	Hsmax	Shanon Wiener eveness	Simpson index (1/λ)	S	Simpson eveness
Hiemal	1.38	2.56	0.54	2.81	13.00	0.22
Prevernal	1.41	2.20	0.64	3.11	9.02	0.34
Vernal	0.58	1.10	0.53	1.50	3.08	0.49
Aestival	0.67	1.95	0.34	1.49	7.02	0.21
Serotinal	1.41	2.20	0.64	3.45	9.01	0.38
Autumnal	1.27	2.08	0.61	3.06	8.00	0.38

4. CONCLUSIONS

In the period of study, Anseriformes, one of the two overdominant orders into the avicoenose of the dam lakes between Vâlcele and Goleşti from the Argeş River, was represented by 15 species. The

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most important among them was *Anas platyrhynchos*, species occurred each month and which summed almost a half of the recorded individuals. The area is a favourable place, too, mainly in the winter and in the passage times, for *Aythya ferina* and *Aythya fuligula* that individualised through their frequency and abundance. *Anas crecca* is another significant species, from August to February, but it has lower strengths. Mainly during the vernal period, and less in aestival one, the number of species and individuals was very low, fact that suggests that the basins are not very attractive for the birds in the breeding time. 5 species (*Cygnus olor*, *Anas platyrhynchos*, *Anas clypeata*, *Aythya fuligula*, and *Aythya ferina*) breed here, but only *Anas platyrhynchos* for sure. This and *Aythya ferina* are the overdominant species for the whole period, but not every month. While the first was overdominant every season, except the prevernal, the second was always overdominant. The birds occupied the basins according to their surface, the food resources, the shelter and the anthropogenic pressure that manifests differently on each of them. As a result, the biggest similarity was stated between the Piteşti and Budeasa basins or between the Piteşti and Goleşti basins, the last one being the most attractive of all the reservoirs. Instead, the Bascov basin is the least important, because of the accentuated human impact. The densities of the species confirm these. Generally, the coenose of Anseriformes is fairly stable and the diversity is relatively big, although there are few dominant species. Piteşti Basin has the biggest diversity and Vâlcele Basin the lowest. On the other hand, the vernal and aestival seasons are characterised by a low diversity and the prevernal and serotinal by a big one.

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