

ASPECTS ON THE DIVERSITY OF BIRD FAUNA DURING THE MIGRATION TIME IN THE ROSPA0063 RESERVOIRS BUHUȘI – BACĂU - BEREȘTI (ROMANIA)

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Abstract. Our ornithological study presents data on the diversity of bird species recorded during the migration time on the territory of ROSPA0063 Reservoirs Buhuși - Bacău – Berești, starting from May 2011 until May 2020. We identified 172 bird species, part of them being vagrant species with only one or two observations in the area during our study. We also present quantitative data for the observed bird species. The typical forest species are dominant by diversity but the aquatic birds present significant populations. We notice the relevance of this territory for the migration of diurnal raptor bird species, white stork (*Ciconia ciconia*), terns (*Chlidonias* sp.) and some waterfowl species in the Eastern Romania. We identified 45 bird species that appear in Annex 1 to the Birds Directive in the perimeter of Natura 2000 site. We mention the presence of 31 bird species included in the Romanian Red Book of Vertebrates, including four critically endangered species: *Pelecanus crispus*, *Haliaeetus albicilla*, *Milvus migrans* and *Sternula albifrons*.

Keywords: bird fauna, migration time, Natura 2000 network, Siret River.

Rezumat. Aspecte ale diversității ornitofaunei în perioada migrației în ROSPA0063 Lacurile de acumulare Buhuși – Bacău - Berești (România). Studiul nostru ornitologic prezintă informații privind diversitatea avifaunei în timpul perioadei de migrație pe teritoriul ROSPA0063 Lacurile de acumulare Buhuși – Bacău – Berești pentru intervalul de timp cuprins între mai 2011 și mai 2020. Au fost identificate 172 de specii de păsări, unele fiind specii accidentale, cu doar una sau două semnalări în acest teritoriu de-a lungul perioadei de studiu. De asemenea, prezentăm și date cantitative pentru speciile de păsări inventariate. Ca diversitate, speciile tipice pentru ecosistemul forestier sunt dominante, dar păsările acvatice prezintă cele mai importante efective. Subliniem importanța acestui teritoriu pentru migrația păsărilor răpitoare diurne, a berzei albe (*Ciconia ciconia*), a chirighițelor (*Chlidonias* sp.) și a unor specii de păsări acvatice în estul României. Au fost identificate 45 de specii incluse în Anexa 1 a Directivei Păsări pe teritoriul acestui sit Natura 2000. Menționăm prezența a 31 de specii de păsări incluse în Cartea Roșie a Vertebratelor din România, între care patru specii critic periclitare: *Pelecanus crispus*, *Haliaeetus albicilla*, *Milvus migrans* și *Sternula albifrons*.

Cuvinte cheie: avifaună, migrație, rețea Natura 2000, Siret.

INTRODUCTION

The ROSPA0063 Reservoirs Buhuși - Bacău - Berești is part of Natura 2000 network (HG no. 1284/2007), covering a surface of about 5575.5 hectares on the territory of the Bacău county, in the north and south of the Bacău city with an islands chain configuration (Fig. 1). The site presents the geographic coordinates 46°14'50'' northern latitude and 27°7'12'' eastern longitude and, it includes five reservoirs located along the Bistrița and Siret Rivers in the area of their confluence: Lilieci (338.8 hectares) and Bacău (216.9 hectares) on the Bistrița River, respectively, Galbeni (1063.8 hectares), Răcăciuni (1702.4 hectares) and Berești (2253.7 hectares) on the Siret River. The reservoirs also collect the water of some tributaries from the area such as Răcățău, Marvila, Rogoaza and Racova. The initial proposal for designation as Natura 2000 site included other two reservoirs from the Bistrița River, Buhuși and Gârleni; the final decision removed them both, following the decommissioning of Buhuși reservoir, despite the relevance of the Gârleni reservoir for the bird fauna in this region as we could prove by the monitoring activity starting from 2015 (GACHE, 2017, 2018).

In the perimeter of the ROSPA0063 Reservoirs Buhuși - Bacău - Berești, the open waters represent the dominant habitat, with compact reed beds and some surfaces covered by natural meadow forests with willows (*Salix* sp.) and poplars (*Populus alba*), but the general aspect is different from one reservoir to other. The left bank of near entirely Lilieci and Răcăciuni reservoirs, respectively in the north-eastern sector of Berești reservoir, is high and steep, partially covered by trees and bushes or even a deciduous forest in the north-eastern side of Răcăciuni reservoir. In the northern sector of all five reservoirs, the vegetation is as a mosaic of habitats comprising open waters and canals, large compact reed beds with sedges (*Carex* sp.), rushes (*Schoenoplectus lacustris* and *Juncus* sp.), willows and osiers (*Salix* sp.), small islands formed by pebble, grasslands with bushes. One large island is present in the edge area of Lilieci and Bacău reservoirs, covered by a meadow forest with old willow and poplar trees, with shrubs and reed beds around. On the western side of the site, excepting the area of Bacău reservoir surrounded by the city's buildings and facilities, the agricultural lands form a mosaic of vegetation comprising cultivated surfaces, grasslands with bushes and clusters of trees. A similar habitat is present in the eastern part of the southern sector of the Galbeni reservoir.

The climate is temperate-continental, with eastern and Arctic influences. Usual, the winters are long and very cold while summers are hot and dry, but in the last decade - in the context of the global climate change - the winters became strong in middle January, while the snow and ice-bed disappear only in the middle or even in the last decade of March. The average annual temperature is 9 °C; the average annual rainfalls are about 500 - 550 millimetres. The dominant winds come from the south-eastern, north-western and north-eastern directions. We notice the high incidence of the flooding phenomenon in early summer, especially in May-June and the severe drought starting from the late July until middle October.

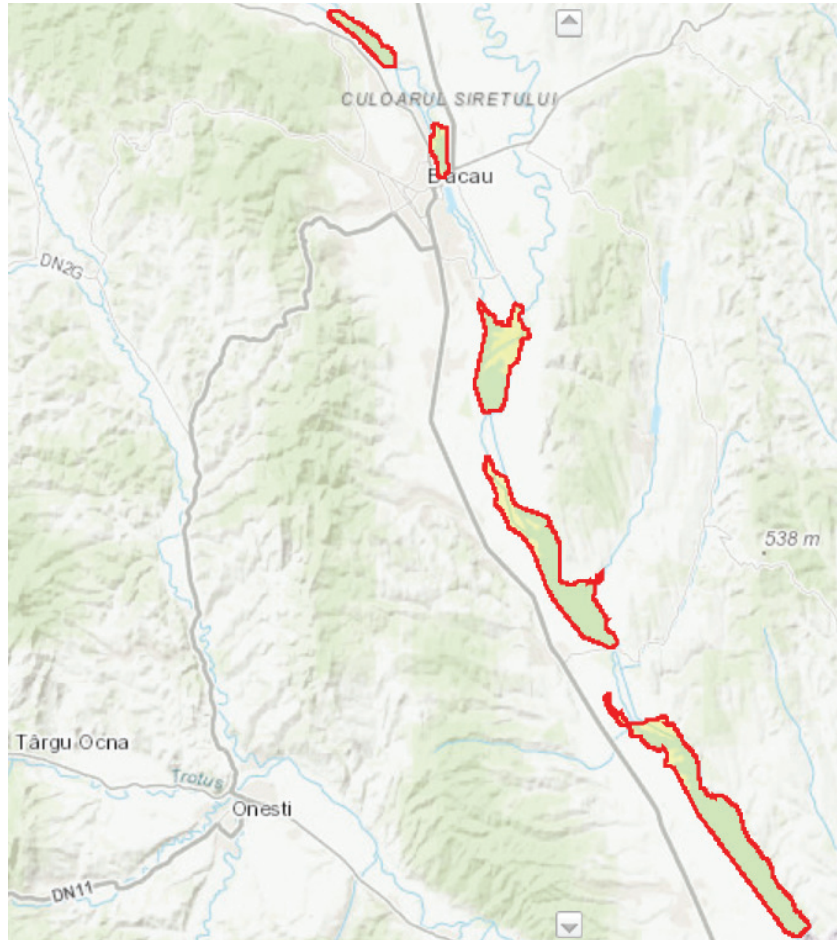


Figure 1. ROSPA0063 Reservoirs Buhuși – Bacău - Berești: red – limits of site, respectively from the north to the south, reservoirs Lilieci, Bacău, Galbeni, Răcăciuni and Berești (<https://natura2000.eea.europa.eu/Natura2000/SDF.aspx?site=ROSPA0063#7>).

Developed between 1966 and 1985, all these reservoirs are subject to a high risk of silting and present a very high dynamic of the habitats. For example, in the late '90s, the Răcăciuni reservoir was a large open water surface without suitable vegetation for birds (FENERU, 2002), but the situation changed completely during the last two decades. The surfaces of compact reed beds, willows and osiers, swampy and not deep water areas cover more than the double of this reservoir after about seven-eight years (Figs. 2, 3). The reservoirs of Bacău and Galbeni were subjected to the last hydro-technique rearrangements during the first decade of this century, for the second one for about six years (2006 - 2011); the flooding of both perimeters began in the late October 2011. During our study, we recorded at least three major floods in this area, aggravating the clogging phenomenon of the investigated reservoirs.

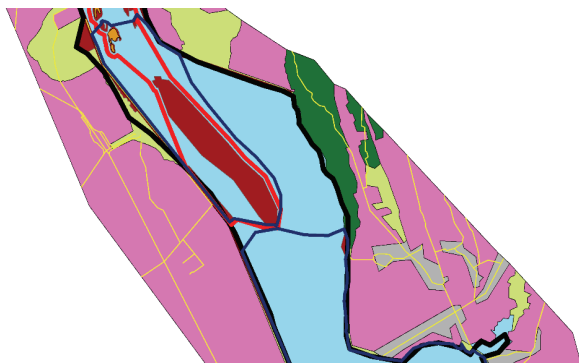


Figure 2. Răcăciuni reservoir, part of ROSPA0063 Reservoirs Buhuși – Bacău - Berești: dark red – the limits of reed beds in 2009 - 2011 (from *The Management Plan of ROSPA0063 Reservoirs Buhuși – Bacău – Berești*, 2012).



Figure 3. Răcăciuni reservoir, part of ROSPA0063 Reservoirs Buhuși – Bacău - Berești: dark green – the limits of suitable vegetation for birds in 2018 (satellite image 2018, Google Earth).

Ornithological qualitative data are available starting from the '60s (RANG, 1968, 1971, 2002). One comprehensive ornithological study focused on the aquatic and wetlands related bird fauna recorded on the territory of all reservoirs around the confluence of the Bistrița and Siret Rivers, which was performed starting from 1995 until early 2002, presenting the first quantitative analyses for the most important aquatic and semi-aquatic bird species for this area (FENERU, 2002). The ornithological importance of the area appears mentioned in some synthesis works (MUNTEANU, 2004; MÜLLER et al., 2005; PAPP & FĂNTĂNĂ, 2008). We also mention the results of recent monitoring activity of the bird fauna from this territory performed by GACHE (2012, 2017, 2018, 2019).

The initial official standard form from the moment of the designation of ROSPA0063 Reservoirs Buhuși - Bacău – Berești (2007) mentions the presence of 12 bird species included in Annex 1 of Birds' Directive. The present standard form of the Natura 2000 site (HG 971/2011, updated in 2016) includes 51 bird species, 22 of them from the mentioned annex to the Birds Directive.

The ROSPA0063 Reservoirs Buhuși – Bacău - Berești has a management plan (OMMMP no. 2681/2012), as the result of one monitoring study done during the period 2009 - 2011. Until December 2018, the Regional Centre of Ecology Bacău (CRE Bacău) was the custodian of the site. Now, the administration of the site is under the management of the National Agency for Natural Protected Areas that is in an on-going process of organization. We carried all the field investigation work with the large logistical support of the mentioned custodian, as part of the bird species' monitoring activities in the management plan.

METHODS AND PERIOD OF STUDY

Our on-going field investigations on the birds' fauna from the ROSPA0063 Reservoirs Buhuși - Bacău - Berești began during May 2011 in the perimeter of Bacău, Galbeni and Răcăciuni lakes, but starting from January 2012, we included the whole territory of the Natura 2000 site in our study. Beginning with January 2015, we also included the Gârleni reservoir in our field investigation.

The monitoring of birds was done using the methods of transect and fixed points, following the western and northern bank for the Lilieci, Bacău, Galbeni, Răcăciuni and Berești reservoirs, respectively, the eastern bank for the Bacău reservoir, while for the Gârleni reservoir, our transect followed the northern and eastern banks. Our monitoring study included the presence of birds on the sectors of rivers between the reservoirs, too. These are not part of Natura 2000 site's perimeter, but the birds swing between these sectors used as feeding territories and the reservoirs' area, used as resting territory.

We identify the birds (BRUUN et al., 1999; SVENSSON et al., 2017) through direct observation by binoculars (Olympus 8-16x40 and Nikon Akulon 8 – 24x) and telescope (HAKUBA 40x70, Swarowski 20 – 60x). We used the males' calling activity in order to identify and estimate the populations of passerines from the reed beds and woodlands, the crepuscular and nocturnal bird species. We aimed at estimating the bird populations, too, by counting each bird from the small groups and used a quantitative evaluation in band for the groups or flocks larger than 200 individuals. In the analysis of our results, we are using SIBLEY & AHLQUIST taxonomic system (1995) with subsequent additions and modifications (<http://avibase.bsc-eoc.org/>).

RESULTS AND DISCUSSIONS

The ROSPA0063 Reservoirs Buhuși - Bacău - Berești presents ornithological significance especially in the migration and wintering period, sheltering thousands of waterfowls and hundreds waders on its territory (FENERU, 2002; GACHE, 2012, 2017). During the period of our study, we recorded 172 bird species (Table 1) on the investigated territory in the migration time (March – first decade of May for spring migration, respectively, middle August – middle November for autumn migration). The mentioned values for the birds' population represent the total number of counted birds during one visit in the whole territory.

Previous studies include valued qualitative ornithological data, including the Plan of management for the Natura 2000 site ROSPA0063 Reservoirs Buhuși - Bacău – Berești. We found quantitative data about the bird population allowing us to assess the dynamic of birds' fauna in the area only in FENERU, 2002 and in the standard forms of the site. After one decade of monitoring the bird fauna in the area, we notice an underestimated population for some bird species and a high super-estimation of other ones in the standard forms of the site, both these situations being not appropriate to the conservation goals of the bird fauna.

As we can see in table 1, during the migration time, bird species which are typical or related to the woodland present the highest diversity on the territory of ROSPA0063 Reservoirs Buhuși - Bacău – Berești (52.32% from the recorded bird fauna) due to the large surfaces covered by forests inside and near the site's area. Only a few of these bird species are not leaving the forest's perimeter while most of them search for food around the shrubs and bushes, grasslands and cultivated lands. In the present analysis, we focus on the aquatic, semi-aquatic and raptor bird species characteristic for the dominant habitats during the migration time in the perimeter of investigated reservoirs, represented by key-species to designate this area as a Natura 2000 site.

Table 1. Diversity of the bird fauna during the migration on the territory of ROSPA0063 Reservoirs Buhuși – Bacău – Berești.

No.	Species	Lilieci (individuals)	Bacău (individuals)	Galbeni (individuals)	Răcăciuni (individuals)	Berești (individuals)	Birds Directive Annex 1	Romanian Red Book of Vertebrates
1.	<i>Perdix perdix</i>	10 - 22	-	8 - 14	14 - 28	0 - 8	Annex 2	-
2.	<i>Coturnix coturnix</i>	2 - 16	-	0 - 8	4 - 6	0 - 9	Annex 2	-
3.	<i>Phasianus colchicus</i>	1 - 7	0 - 1	1 - 3	1 - 4	0 - 2	Annex 2	-
4.	<i>Cygnus olor</i>	14 - 198	7 - 42	8 - 34	25 - 97	32 - 132	Annex 2	-
5.	<i>Cygnus cygnus</i>	106 - 146	4 - 40	-	12 - 114	0 - 12	Annex 1	-
6.	<i>Anser anser</i>	0 - 18	0 - 24	0 - 148	0 - 430	-	Annex 2	-
7.	<i>Anser albifrons</i>	25 - 72	0 - 120	0 - 320	0 - 680	-	Annex 2	-
8.	<i>Anas platyrhynchos</i>	64 - 3200	24 - 2300	126 - 4200	80 - 5230	72 - 520	Annex 2	-
9.	<i>Anas acuta</i>	4 - 22	0 - 5	2 - 18	4 - 24	-	Annex 2	-
10.	<i>Anas crecca</i>	12 - 720	24 - 220	86 - 400	218 - 1120	76 - 126	Annex 2	-
11.	<i>Anas querquedula</i>	34 - 370	-	68 - 335	48 - 218	32 - 148	Annex 2	-
12.	<i>Spathula clypeata</i>	8 - 124	0 - 18	12 - 94	28 - 98	4 - 32	Annex 2	-
13.	<i>Mareca strepera</i>	56 - 480	14 - 36	14 - 214	56 - 646	16 - 86	Annex 2	-
14.	<i>Mareca penelope</i>	36 - 268	42 - 88	24 - 176	86 - 325	28 - 134	Annex 2	-
15.	<i>Tadorna tadorna</i>	0 - 8	-	-	1 - 18	0 - 5	-	V
16.	<i>Netta rufina</i>	-	-	-	0 - 1	-	Annex 2	E
17.	<i>Aythya marila</i>	6 - 20	4 - 16	-	8 - 46	-	Annex 2	-
18.	<i>Aythya fuligula</i>	38 - 352	6 - 154	6 - 182	56 - 324	21 - 64	Annex 2	-
19.	<i>Aythya ferina</i>	48 - 680	18 - 214	18 - 402	154 - 1320	56 - 340	Annex 2	-
20.	<i>Aythya nyroca</i>	8 - 156	8 - 32	8 - 330	28 - 246	18 - 92	Annex 1	V
21.	<i>Bucephala clangula</i>	22 - 98	-	-	16 - 172	8 - 20	Annex 2	V
22.	<i>Somateria mollissima</i>	-	0 - 1	-	-	-	Annex 2	-
23.	<i>Mergus merganser</i>	-	-	-	4 - 34	2 - 48	Annex 2	-
24.	<i>Mergellus albellus</i>	-	-	-	4 - 18	0 - 6	Annex 1	V
25.	<i>Gavia arctica</i>	-	-	0 - 22	0 - 3	-	Annex 1	-
26.	<i>Phalacrocorax carbo</i>	26 - 110	7 - 110	17 - 130	32 - 1400	16 - 40	-	-
27.	<i>Microcarbo pygmeus</i>	-	0 - 28	0 - 52	0 - 70	-	Annex 1	V
28.	<i>Pelecanus crispus</i>	-	-	0 - 1	0 - 3	-	Annex 1	CE
29.	<i>Botaurus stellaris</i>	1 - 3	-	8 - 12	2 - 9	1 - 7	Annex 1	-
30.	<i>Ardeola ralloides</i>	1 - 5	0 - 2	4 - 8	2 - 6	2 - 4	Annex 1	V
31.	<i>Ixobrychus minutus</i>	3 - 7	2 - 8	5 - 16	4 - 16	2 - 9	Annex 1	-
32.	<i>Nycticorax nycticorax</i>	0 - 12	0 - 14	0 - 28	10 - 82	0 - 62	Annex 1	V
33.	<i>Egretta garzetta</i>	8 - 32	1 - 12	12 - 34	8 - 120	5 - 16	Annex 1	E
34.	<i>Ardea alba</i>	4 - 42	2 - 24	5 - 21	2 - 90	12 - 34	Annex 1	E
35.	<i>Ardea cinerea</i>	4 - 37	4 - 21	8 - 32	4 - 72	13 - 24	-	-
36.	<i>Ardea purpurea</i>	3 - 8	-	3 - 7	7 - 12	3 - 7	Annex 1	E
37.	<i>Plegadis falcinellus</i>	0 - 1	-	-	0 - 3	-	Annex 1	V
38.	<i>Platalea leucorodia</i>	-	-	-	12 - 78	-	Annex 1	E
39.	<i>Ciconia ciconia</i>	42 - 520	130 - 2050	12 - 8100	10 - 2750	5 - 670	Annex 1	V
40.	<i>Ciconia nigra</i>	-	-	0 - 1	-	-	Annex 1	V
41.	<i>Haliaeetus albicilla</i>	-	0 - 1	0 - 1	0 - 2	-	Annex 1	CE
42.	<i>Clanga pomarina</i>	8 - 27	12 - 75	0 - 6	2 - 12	-	Annex 1	V
43.	<i>Hieraaetus pennatus</i>	-	0 - 7	1 - 7	0 - 3	-	Annex 1	E
44.	<i>Circaetus gallicus</i>	-	-	-	0 - 1	-	Annex 1	V
45.	<i>Buteo buteo</i>	1 - 5	2 - 14	2 - 7	1 - 8	1 - 4	-	-
46.	<i>Buteo lagopus</i>	0 - 2	0 - 3	1 - 3	2 - 5	0 - 1	-	-
47.	<i>Pernis apivorus</i>	0 - 1	1 - 6	0 - 3	1 - 3	-	Annex 1	V
48.	<i>Accipiter gentilis</i>	1 - 3	-	0 - 2	0 - 2	-	-	-
49.	<i>Accipiter nisus</i>	0 - 2	-	0 - 1	0 - 2	-	-	-
50.	<i>Milvus milvus</i>	0 - 1	-	-	-	-	Annex 1	E
51.	<i>Milvus migrans</i>	0 - 1	-	-	0 - 3	0 - 1	Annex 1	CE
52.	<i>Circus aeruginosus</i>	1 - 3	0 - 2	2 - 4	1 - 5	2 - 3	Annex 1	-
53.	<i>Circus pygargus</i>	-	-	-	-	0 - 1	Annex 1	E
54.	<i>Circus cyaneus</i>	-	-	0 - 1	-	-	Annex 1	-
55.	<i>Falco subbuteo</i>	0 - 5	0 - 2	1 - 5	1 - 4	-	-	-
56.	<i>Falco tinnunculus</i>	2 - 6	0 - 5	1 - 8	1 - 4	1 - 5	-	-
57.	<i>Porzana parva</i>	x	-	-	x	x	Annex 1	-
58.	<i>Gallinula chloropus</i>	5 - 26	2 - 7	12 - 25	12 - 20	1 - 5	Annex 2	-
59.	<i>Fulica atra</i>	42 - 2100	86 - 1000	86 - 390	126 - 6800	26 - 210	Annex 2	-
60.	<i>Vanellus vanellus</i>	12 - 56	-	12 - 184	28 - 470	24 - 38	Annex 2	-
61.	<i>Haematopus ostralegus</i>	-	-	0 - 1	-	0 - 3	Annex 2	V

62.	<i>Charadrius dubius</i>	0 - 6	2 - 8	2 - 12	4 - 14	0 - 10	-	-
63.	<i>Calidris pugnax</i>	-	0 - 420	0 - 74	54 - 420	0 - 18	Annex 1, Annex 2	-
64.	<i>Calidris alpina</i>	-	-	0 - 18	36 - 132	-	-	-
65.	<i>Calidris alba</i>	-	-	0 - 14	0 - 56	-	-	-
66.	<i>Calidris temminckii</i>	-	-	0 - 32	18 - 78	0 - 2	-	-
67.	<i>Limicola falcinellus</i>	-	-	-	0 - 32	-	-	-
68.	<i>Gallinago gallinago</i>	-	0 - 18	0 - 6	4 - 26	-	Annex 2	-
69.	<i>Lymnocyptes minimus</i>	-	0 - 14	2 - 8	6 - 32	-	Annex 2	-
70.	<i>Numenius arquata</i>	0 - 24	-	-	72 - 118	-	Annex 2	-
71.	<i>Limosa limosa</i>	12 - 83	-	32 - 320	54 - 860	-	Annex 2	-
72.	<i>Actitis hypoleucos</i>	-	0 - 40	6 - 18	2 - 23	-	-	-
73.	<i>Tringa ochropus</i>	-	0 - 62	6 - 39	2 - 60	0 - 8	-	-
74.	<i>Tringa glareola</i>	-	0 - 160	8 - 23	62 - 110	0 - 6	Annex 1	-
75.	<i>Tringa nebularia</i>	-	-	12 - 52	2 - 28	-	Annex 2	-
76.	<i>Tringa stagnatilis</i>	-	0 - 46	0 - 17	0 - 115	0 - 18	-	-
77.	<i>Tringa totanus</i>	-	0 - 310	0 - 12	72 - 430	16 - 52	Annex 2	-
78.	<i>Tringa erythropus</i>	-	0 - 280	-	162 - 320	12 - 64	Annex 2	-
79.	<i>Xenus cinereus</i>	0 - 1	-	-	-	-	Annex 1	-
80.	<i>Recurvirostra avosetta</i>	-	0 - 22	0 - 2	0 - 12	0 - 2	Annex 1	V
81.	<i>Himantopus himantopus</i>	-	-	2 - 8	2 - 6	2 - 8	Annex 1	E
82.	<i>Larus marinus</i>	-	-	0 - 12	-	-	Annex 2	-
83.	<i>Larus fuscus</i>	-	0 - 16	0 - 28	0 - 42	-	Annex 2	-
84.	<i>Larus cachinnans</i>	32 - 252	2 - 320	108 - 306	8 - 880	14 - 170	Annex 2	-
85.	<i>Larus canus</i>	-	-	2 - 7	0 - 12	-	Annex 2	-
86.	<i>Chroicocephalus ridibundus</i>	48 - 374	56 - 560	88 - 678	44 - 1400	18 - 208	Annex 2	-
87.	<i>Hydrocoleus minutus</i>	-	-	2 - 18	0 - 36	-	Annex 1	-
88.	<i>Chlidonias hybrida</i>	52 - 210	28 - 113	43 - 282	16 - 256	22 - 118	Annex 1	-
89.	<i>Chlidonias niger</i>	0 - 82	0 - 4	12 - 42	7 - 98	2 - 30	Annex 1	-
90.	<i>Chlidonias leucopterus</i>	24 - 56	12 - 44	6 - 116	4 - 32	7 - 62	-	-
91.	<i>Sterna hirundo</i>	8 - 46	12 - 118	38 - 114	32 - 182	22 - 228	Annex 1	-
92.	<i>Sterna albifrons</i>	-	-	-	-	0 - 1	Annex 1	CE
93.	<i>Podiceps cristatus</i>	18 - 32	12 - 46	4 - 52	16 - 52	18 - 24	-	-
94.	<i>Podiceps grisegena</i>	4 - 18	2 - 6	2 - 6	2 - 14	-	-	-
95.	<i>Podiceps nigricollis</i>	0 - 4	0 - 4	2 - 12	0 - 20	-	-	-
96.	<i>Tachybaptus ruficollis</i>	8 - 52	6 - 16	10 - 32	12 - 32	3 - 22	-	-
97.	<i>Columba oenas</i>	0 - 11	-	0 - 7	12 - 82	0 - 5	Annex 2	-
98.	<i>Columba palumbus</i>	2 - 18	2 - 8	2 - 21	6 - 56	1 - 18	Annex 2	-
99.	<i>Streptopelia turtur</i>	2 - 8	4 - 26	8 - 18	10 - 32	2 - 7	Annex 2	V
100.	<i>Streptopelia decaocto</i>	4 - 32	9 - 32	6 - 28	6 - 21	4 - 21	Annex 2	-
101.	<i>Cuculus canorus</i>	3 - 13	8 - 12	5 - 18	8 - 19	18 - 22	-	-
102.	<i>Coracias garrulus</i>	-	-	-	-	0 - 5	Annex 1	-
103.	<i>Alcedo atthis</i>	-	0 - 2	-	-	0 - 3	Annex 1	-
104.	<i>Merops apiaster</i>	24 - 72	-	16 - 134	26 - 118	30 - 45	-	-
105.	<i>Upupa epops</i>	1 - 8	1 - 2	2 - 16	3 - 22	0 - 3	-	V
106.	<i>Picus viridis</i>	x	x	x	x	x	-	-
107.	<i>Dendrocopos major</i>	x	x	x	x	-	-	-
108.	<i>Dendrocopos syriacus</i>	x	x	x	x	x	Annex 1	-
109.	<i>Oriolus oriolus</i>	2 - 7	4 - 11	6 - 13	12 - 28	3 - 8	-	-
110.	<i>Lanius collurio</i>	9 - 17	2 - 7	1 - 11	4 - 26	3 - 14	Annex 1	-
111.	<i>Lanius minor</i>	3 - 8	0 - 2	2 - 10	3 - 12	0 - 3	Annex 1	-
112.	<i>Lanius excubitor</i>	3 - 5	0 - 2	0 - 4	3 - 6	0 - 3	-	-
113.	<i>Pica pica</i>	14 - 62	12 - 26	6 - 21	7 - 18	8 - 18	Annex 2	-
114.	<i>Garrulus glandarius</i>	2 - 8	0 - 4	3 - 6	2 - 22	-	Annex 2	-
115.	<i>Corvus monedula</i>	8 - 26	8 - 14	4 - 18	4 - 32	3 - 14	Annex 2	-
116.	<i>Corvus frugilegus</i>	32 - 136	18 - 92	18 - 320	18 - 328	14 - 172	Annex 2	-
117.	<i>Corvus cornix</i>	12 - 26	3 - 16	4 - 42	6 - 21	12 - 16	-	-
118.	<i>Corvus corax</i>	2 - 4	3 - 5	0 - 3	2 - 4	-	-	E
119.	<i>Galerida cristata</i>	5 - 18	2 - 7	2 - 16	4 - 11	6 - 14	-	-
120.	<i>Alauda arvensis</i>	18 - 32	3 - 12	14 - 22	8 - 43	21 - 32	Annex 2	-
121.	<i>Hirundo rustica</i>	64 - 280	48 - 170	90 - 320	320 - 540	128 - 320	-	-
122.	<i>Delichon urbicum</i>	32 - 72	24 - 48	62 - 210	26 - 220	12 - 46	-	-
123.	<i>Riparia riparia</i>	12 - 540	14 - 270	54 - 280	170 - 320	72 - 118	-	-
124.	<i>Phylloscopus collybita</i>	x	x	x	x	x	-	-
125.	<i>Phylloscopus trochilus</i>	x	x	x	x	x	-	-

126.	<i>Phylloscopus sibilatrix</i>	x	x	x	x	x	-	-
127.	<i>Locustella luscinioides</i>	x	x	x	x	x	-	-
128.	<i>Acrocephalus scirpaceus</i>	x	x	x	x	x	-	-
129.	<i>Acrocephalus arundinaceus</i>	x	x	x	x	x	-	-
130.	<i>Acrocephalus schoenobaenus</i>	x	x	x	x	x	-	-
131.	<i>Hippolais icterina</i>	3 - 8	1 - 6	4 - 6	3 - 8	4 - 5	-	-
132.	<i>Sylvia curruca</i>	2 - 5	2 - 4	3 - 8	5 - 10	2 - 5	-	-
133.	<i>Sylvia atricapilla</i>	2 - 7	0 - 4	2 - 7	3 - 11	0 - 4	-	-
134.	<i>Sylvia borin</i>	3 - 8	1 - 4	3 - 7	5 - 14	3 - 9	-	-
135.	<i>Sylvia communis</i>	3 - 13	2 - 7	3 - 15	6 - 19	3 - 12	-	-
136.	<i>Panurus biarmicus</i>	x	x	x	x	x	-	-
137.	<i>Muscicapa striata</i>	2 - 5	0 - 3	1 - 5	2 - 7	0 - 3	-	-
138.	<i>Ficedula albicollis</i>	4 - 7	-	0 - 5	2 - 11	0 - 5	Annex 1	-
139.	<i>Oenanthe oenanthe</i>	10 - 14	-	2 - 9	3 - 11	5 - 14	-	-
140.	<i>Saxicola rubetra</i>	3 - 9	2 - 6	2 - 7	2 - 13	2 - 7	-	-
141.	<i>Saxicola torquata</i>	2 - 4	0 - 3	5 - 7	2 - 9	4 - 7	-	-
142.	<i>Phoenicurus phoenicurus</i>	1 - 5	0 - 4	1 - 3	4 - 12	0 - 5	-	-
143.	<i>Phoenicurus ochruros</i>	1 - 7	1 - 7	2 - 7	3 - 14	3 - 7	-	-
144.	<i>Erithacus rubecula</i>	3 - 11	2 - 4	3 - 11	4 - 18	1 - 8	-	-
145.	<i>Luscinia luscinia</i>	4 - 7	2 - 5	5 - 9	5 - 16	3 - 6	-	-
146.	<i>Turdus merula</i>	5 - 19	3 - 7	6 - 21	5 - 26	4 - 9	Annex 2	-
147.	<i>Turdus torquatus</i>	0 - 4	-	1 - 5	0 - 7	-	-	-
148.	<i>Turdus philomelos</i>	8 - 24	5 - 14	7 - 35	6 - 32	2 - 17	Annex 2	-
149.	<i>Turdus iliacus</i>	52 - 72	-	62 - 118	140 - 210	86 - 132	Annex 2	-
150.	<i>Turdus pilaris</i>	160 - 210	4 - 142	72 - 210	28 - 320	126 - 158	Annex 2	-
151.	<i>Sturnus vulgaris</i>	118 - 470	62 - 480	32 - 1800	18 - 8500	150 - 12000	Annex 2	-
152.	<i>Sitta europaea</i>	x	x	x	x	-	-	-
153.	<i>Troglodytes troglodytes</i>	x	x	x	x	4 - 12	-	-
154.	<i>Parus major</i>	6 - 18	10 - 18	4 - 28	6 - 38	3 - 7	-	-
155.	<i>Cyanistes coeruleus</i>	2 - 7	1 - 5	2 - 7	2 - 15	0 - 5	-	-
156.	<i>Remiz pendulinus</i>	4 - 11	3 - 9	5 - 8	2 - 7	5 - 9	-	-
157.	<i>Passer domesticus</i>	62 - 198	18 - 173	56 - 230	140 - 320	180 - 240	-	-
158.	<i>Passer montanus</i>	24 - 92	6 - 42	48 - 112	38 - 120	52 - 98	-	-
159.	<i>Anthus campestris</i>	8 - 16	3 - 6	3 - 16	5 - 18	5 - 22	Annex 1	-
160.	<i>Motacilla flava</i>	4 - 28	0 - 7	7 - 21	8 - 26	4 - 32	-	-
161.	Motacilla alba	8 - 31	4 - 9	12 - 46	4 - 32	6 - 35	-	-
162.	<i>Fringilla coelebs</i>	8 - 26	2 - 21	15 - 48	22 - 42	8 - 12	-	-
163.	<i>Fringilla montifringilla</i>	18 - 340	9 - 28	12 - 32	24 - 190	94 - 118	-	-
164.	<i>Coccothraustes coccothraustes</i>	4 - 28	8 - 10	6 - 14	6 - 32	-	-	-
165.	<i>Serinus serinus</i>	12 - 18	-	8 - 14	14 - 24	-	-	-
166.	<i>Carduelis spinus</i>	18 - 52	8 - 18	-	18 - 76	14 - 21	-	-
167.	<i>Carduelis chloris</i>	7 - 19	5 - 18	3 - 14	7 - 23	3 - 9	-	-
168.	<i>Carduelis carduelis</i>	18 - 172	12 - 72	10 - 198	18 - 254	-	-	-
169.	<i>Linaria cannabina</i>	0 - 5	-	2 - 16	3 - 12	-	-	-
170.	<i>Emberiza calandra</i>	2 - 17	3 - 5	4 - 18	6 - 21	7 - 15	-	-
171.	<i>Emberiza schoeniclus</i>	x	x	x	x	x	-	-
172.	<i>Emberiza citrinella</i>	3 - 13	1 - 6	2 - 15	8 - 14	1 - 7	-	-

Legend: bold-font written species – bird species included in the standard forms of the Natura 2000 site; x – non-estimated population; *Romanian Red Book of Vertebrates*: CE – critically endangered species, E – endangered species, V – vulnerable species.

We notice some bird species as vagrant species on the territory of ROSPA0063 Reservoirs Buhuși - Bacău – Berești; some are vagrant in Romania, too and we met others only one or two times during our study. In the first group, we mention three species that we observed once during our field trips. The first one is *Somateria mollissima* present as one male inside a group of white-fronted geese – *Anser albifrons*, on the 13th November 2011, on the Bacău reservoir. The second one is *Xenus cinereus* (one individual, on the edge of the Lilieci reservoir, on the 20th May 2018), a species mentioned before for the autumn migration (FENERU, 2002). The last vagrant species is *Larus marinus*, recorded with twelve individuals on the edge of Galbeni reservoir on the 13th April 2013. During the spring migration, we recorded one male of *Netta rufina* and one flying adult of *Circaetus gallicus* in the perimeter of the Răcăciuni reservoir, on the 7th April 2019, while we met one adult of *Sternula albifrons* feeding in the edge area of Berești reservoir, on the 17th May 2020. The Dalmatian pelican (*Pelecanus crispus*) appears in our list due to the one flying adult individual observed in the perimeter of Galbeni reservoir in June 2016. We have only two observations for the glossy ibis (*Plegadis falcinellus*): one individual in the perimeter of Lilieci reservoir (6th April 2019), respectively, three individuals in

nuptial plumage feeding in the perimeter of Răcăciuni reservoir (17th May 2020). We include in the group of rare bird species in this area the black-throated loon (*Gavia arctica*) and the pygmy cormorant (*Microcarbo pygmeus*) that we not met every year even if we recorded dozens of individuals at some point. We observed the largest group of loons on the 15th October 2013: 22 individuals were feeding in the area where the Siret River flows into the Galbeni reservoir. During the first part of our study, we recorded up to 70 pygmy cormorants on the Răcăciuni reservoir on the 8th May 2011, obviously lower than the population given in the standard forms of the site (200 – 400 individuals). This species has not appeared in the subsequent years until the spring of 2020 when we met three individuals in the trees from the island in the perimeter of Bacău reservoir (16th May 2020) and one individual in the area of the Galbeni reservoir (17th May 2020). We notice that the pygmy cormorant (*Microcarbo pygmeus*) became a rare species in the Siret and Prut Rivers basins during the last two decades.

Numerous bird species related to the aquatic and wetlands' habitats – as *Cygnus olor*, *Spathula clypeata*, *Mareca penelope*, *M. strepera*, *Acrocephalus* sp. or *Emberiza schoeniclus* – were not present in this region before or immediately after the appearance of these reservoirs (RANG, 1968 and 1971) while they present important populations nowadays. A common species today presenting flocks about of thousands of individuals during the migration time on the territory of the site, the coot (*Fulica atra*), was present only for the perimeter of the Bacău reservoir during the period 1963 – 1970 (RANG, 1971). The tufted duck (*Aythya fuligula*) – mentioned only as a winter visitor in the same period – appeared as a breeding species (on the Lileci reservoir), a passer-by and winter visitor in the late '90s for this area (FENERU, 2002), nowadays presenting the largest population during the autumn migration (we counted about 1000 individuals on the whole territory during one day of monitoring).

Our recorded data supports the basis of designation this territory as part of the Natura 2000 network: the perimeter ROSPA0063 Reservoirs Buhuși - Bacău – Berești overlaps important flyways for the migration of bird species in Eastern Romania, but we recorded significant different populations for some species as they appear in the standard forms of the site.

Between the typical aquatic bird species, the anseriforms are dominant in terms of diversity (21 species) and populations being recorded with 15000 – 26000 individuals during one day of monitoring on the whole territory of the site, but we notice some differences between our recordings and the standard forms of the site. From the geese group, the largest population of white-fronted goose (*Anser albifrons*) was about 1200 individuals during the early November, while the standard forms give a population of 2000 – 5000 individuals. The ducks, especially the dabbling species, present large populations during the passage time but we met more than twice higher values as in the standard forms for the gadwall (*Mareca strepera*), while for three species (*Anas acuta*, *A. crecca* and *Spathula clypeata*) we recorded significantly smaller populations (less or even more than half mentioned there). During our study, three species of diving ducks appeared with increased populations about twice (*Aythya fuligula*) or even three times (*A. marila* and *A. nyroca*). For the smew (*Mergellus albellus*) and goosander (*M. merganser*), we found a significantly smaller population than appears in the standard forms.

From the gulls, except for the Caspian gull (*Larus cachinnans*), which presents similar values, we recorded tens of individuals and not hundreds (for the little gull - *Hydrocoleus minutus*) or even thousands (for the common gull – *Larus canus* or black-headed gull – *Chroicocephalus ridibundus*) as appears in the standard forms, and our recordings are similar to the previously published data (FENERU, 2002). We notice a significant population of terns (*Chlidonias* sp.) crossing the area during the first decade of May; we counted up to 850 individuals of *C. hybrida*, about 250 individuals of *C. niger* and up to 300 individuals of *C. leucopterus* on the whole territory of the site during one day of monitoring. The recorded populations are higher than those mentioned in the standard forms of the site or for the Prut River basin (GACHE, 2002; CAZACU, 2007).

The great crested grebe (*Podiceps cristatus*) and the little grebe (*Tachybaptus ruficollis*) represent the group of grebes in the standard forms of the ROSPA0063 Reservoirs Buhuși - Bacău – Berești with 200 – 300, respectively 100 – 150 individuals in the migration time but, we recorded significantly smaller population for the great crested grebe. The other two grebe species (*Podiceps nigricollis* and *P. grisegena*) appear with populations higher than two decades ago (FENERU, 2002).

Regarding the semi-aquatic bird species, we recorded similar passage populations for the herons and egret species as in FENERU (2002) in the standard forms of the site as well, aside from the grey-heron (*Ardea cinerea*) met with smaller values. The white stork (*Ciconia ciconia*) appears with flocks up to 380 individuals during the spring migration (late March) in this area; in August, thousands of white storks are crossing to the south - south-eastern direction. On the 20th August 2013, we were able to catch the peak of the autumn migration of the white storks, counting about 13430 individuals soaring over the Natura 2000 site, while in the Prut River basin, this species appears with no more than 500-600 individuals in the same period (GACHE, 2002). In opposite, the black stork (*Ciconia nigra*) appears as individuals in April, respectively, in early October in the area, while we recorded up to 200 individuals during the first decade of October in the Prut River basin (GACHE, 2002).

The waders need wetlands habitats like the swampy areas, shallow waters or the islands and stripes of pebble, sand and clay that cover small surfaces in the edge of Lileci, Galbeni, Răcăciuni and Berești reservoirs. In the perimeter of the Bacău reservoir, we recorded the highest values for the waders' population during the temporarily emptying of the basin for the hydro-technical arrangements in 2011, concentrated in the shallow waters and swampy surfaces from the southern part, and along the eastern bank to the edge area. Subsequently to the refilling the perimeter

of reservoir, the appearance of this group was incidentally, through individual birds. Starting from late July, during the autumn migration, one suitable area for the waders' feeding and resting appears in the southern limit of the compact reed beds from the Răcăciuni reservoir; there, we met the highest diversity and the largest concentration of birds related to this group. Usually, in late August, we counted more than 2000 individuals of waders during one day of monitoring in this area of the site. We notice that the populations are significantly smaller than they appear in the standard forms: hundreds of individuals for species like the black-winged stilt (*Himantopus himantopus*) and pied avocet (*Recurvirostra avosetta*), respectively, thousands of individuals in the case of the lapwing (*Vanellus vanellus*), ruff (*Calidris pugnax*), wood sandpiper (*Tringa glareola*) and spotted redshank (*T. erythropus*).

In middle September, we caught a significant autumn passage of the diurnal raptors overlapping this territory, tens individuals soaring over the area. The first time, on the 16th September 2016, we recorded about one hundred of soaring raptors during about 30 minutes: 75 lesser-spotted eagles (*Clanga pomarina*), seven booted eagles (*Hieraeetus pennatus*), 14 common buzzards (*Buteo buteo*) and six honey buzzards (*Pernis apivorus*). We could confirm this passage along the Valley of the Siret River during the same period on the nearest territory of ROSPA0072 Siret Middle Floodplain in 2016 and 2017. We intend to visit the area and extend the field days activity in the future to assess the amplitude of this autumn passage of the diurnal raptors (birds' diversity and population) in middle September.

The standard forms of ROSPA0063 Buhuși - Bacău - Berești include 51 bird species, and we met 47 of them during the migration time (bold-font written species in the Table 1). For the other four species, we must mention that one of them – *Curruca (Sylvia) nisoria* – appears as a breeding species in the Natura 2000 perimeter with 5 – 10 pairs, but we could not find this in any references related to the area (RANG, 1968, 1971 and 2002; FENERU, 2002). We did not identify the other two species, both being rare species in the area. The common crane (*Grus grus*), mentioned with 10 – 40 individuals in the passage on this territory in the standard forms, appeared only once in the area, during the autumn migration in November 1974 (RANG, 2002). The plovers represent rare appearances in this territory (FENERU, 2002); we cannot confirm the presence and the values of 80 – 120 individuals of grey plovers (*Pluvialis squatarola*), respectively, 200 – 300 individuals for the golden plover (*P. apricaria*) mentioned in the standard forms.

In the list of bird fauna identified during the migration time on the territory of ROSPA0063 Buhuși - Bacău - Berești, 45 bird species appear in Annex 1 to the Birds Directive (2009/147/EC), being species that need special conservation measures concerning their habitats in order to ensure their survival and the reproduction in their distribution range. During the migration time, we met 25 bird species included in Annex 1 to the Birds Directive, but that are not appearing in the standard forms of the site. Some of them are rare species in the area like *Pelecanus crispus*, *Circaetus gallicus*, *Xenus cinereus* or *Sternula albifrons*, respectively they appear as solitary birds or groups up to ten individuals in this perimeter – for example *Ciconia nigra*, *Circus pygargus*, *Milvus milvus*, *M. migrans* or *Coracias garrulus*. Other species appear to be regular, but maybe we cannot regard them as representative for the Natura 2000 site, like the Syrian woodpecker (*Dendrocopos syriacus*), shrikes (*Lanius collurio*, *L. minor*), collared flycatcher (*Ficedula albicollis*) or tawny pipit (*Anthus campestris*). However, at least the absence of the white stork (*Ciconia ciconia*) and lesser-spotted eagle (*Clanga pomarina*) from the standard forms requires its updating. A regular update of the standard forms is necessary, analysing the results of our monitoring activity and the dynamic of habitats that changes the suitable conditions for different bird species on the territory of this Natura 2000 site.

During the spring and autumn passage, we met also 51 bird species included in Annex 2 of Birds Directive (2009/147/EC) as hunting species under the national laws without jeopardising conservation efforts in their distribution area. Most of them represent waterfowl species (Anseriformes), wader species (Charadriiformes), passerines (Passeriformes) and doves (Columbiformes). Some of them do not appear in the standard forms of this Natura 2000 site but represent important gamefowl species (Galliformes, Columbiformes, respectively larks and thrushes – Passeriformes) in one territory where the hunting games present a high level.

During the migration time, we notice the presence of 31 bird species included in the Red Book of Vertebrates from Romania (BOTNARIUC & TATOLE, 2005). Four of them are critically endangered bird species; two of them are a constant presence in the area with a small population (*Haliaeetus albicilla* and *Milvus migrans*) and other two represent an irregular appearance in this territory (*Pelecanus crispus* and *Sternula albifrons*). Another ten are endangered species. One of them – *Netta rufina* – appears as a passer-by and winter visitor, while other three species – *Hieraeetus pennatus* and *Milvus milvus* and *Circus pygargus* – are only passage bird species on the territory of ROSPA0063 Buhuși - Bacău - Berești. The other ones (*Egretta garzetta*, *Ardea alba*, *A. purpurea*, *Platalea leucorodia* and *Himantopus himantopus*) are regular or irregular migratory breeding species in the area, most of them recorded with larger populations during the passage and only the raven (*Corvus corax*) is a sedentary bird in this perimeter. Seventeen represent a group of vulnerable species, most of them appearing only during the migration time in the area (*Microcarbo pygmeus*, *Plegadis facinellus*, *Ciconia nigra*, *Clanga pomarina*, *Circaetus gallicus*, *Pernis apivorus*, *Haematopus ostralegus* and *Recurvirostra avosetta*). The second group represents the passage and summer visitors, breeding or irregular breeding bird species on the territory of the Natura 2000 site (*Aythya nyroca*, *Ardeola ralloides*, *Nycticorax nycticorax*, *Ciconia ciconia*, *Streptopelia turtur* and *Upupa epops*). The other three species – *Tadorna tadorna*, *Bucephala clangula* and *Mergellus albellus* – are winter visitors and passage species in the investigated perimeter.

The anthropogenic activities with significant impact on the bird fauna from the territory of ROSPA0063 Buhuși - Bacău - Berești are the fishing activity, the extraction of osier and the hunting games outside but near the site,

the first one having a visible influence on the birds during the migration time. The fishing activity has two compounds: sport fishing and poaching fishing, both presenting high levels in the southern part of the site. During one suitable day for the sport fishing activity, dozens of boats cross the canals and the surfaces of reservoirs, disturbing the birds that search for food and resting places in the area. On the banks, we met up to 130 sport anglers, ones of them with ten to fifteen fishing rods. The poachers use to fix fishing nets under the water and abandon part of it in the area, placing the diving bird species (as the loons – *Gavia* sp. or diving ducks – *Aythya* sp.) at risk of death: caught in the immersed fishing nets, these birds swim to exhaustion and drowning. The hunting games have a high impact on the birds' presence in the perimeter of Răcăciuni reservoir. The waterfowls present an extremely cautious behaviour flying away when a car stops in the edge area and along the dam, which forms the western bank of this reservoir. The previous custodian collected thousands of cartridge tubes along with this sector of the reservoir.

CONCLUSIONS

During our study, we recorded 172 bird species during the spring and autumn migration on the territory of the Natura 2000 site ROSPA0063 Reservoirs Buhuși – Bacău – Berești. The perimeter of Răcăciuni reservoir shelters the highest diversity (161 bird species) and the largest population of aquatic and semi-aquatic bird species (15000 – 25000 individuals recorded in one-day field trip) during the migration time on the territory of the Natura 2000 site.

The diversity of bird fauna presents a positive trend in this territory. The waterfowls and wader species were present with the largest populations during the migration time. The population trends are constant for some species, but we recorded significant increases or reductions for more than half of them, comparatively with two decades ago. We consider this is natural dynamics in the context of the environmental changes in the area during the last thirty – forty years: expansion of compact reed beds and meadow vegetation, the silting phenomenon in the perimeter of all five reservoirs, long periods of drought and severe flooding phenomenon.

The territory of ROSPA0063 Buhuși - Bacău – Berești overlaps with important flyways in the Eastern Romania. We recorded a significant population during the migration time for species like swans and ducks (Anseriformes), coot (*Fulica atra*), gulls and waders (Charadriiformes), but for the white stork (*Ciconia ciconia*), terns (*Chlidonias* sp.) and diurnal raptors (Accipitriformes), too. We cannot confirm a significant passage of geese (*Anser anser* and *A. albifrons*) in the perimeter of these reservoirs.

During the migration time, we identified 45 bird species that appear in Annex 1 to the Bird Directive; 25 of them do not appear in the official standard presentation of ROSPA0063 Buhuși - Bacău – Berești. At the same time, we observed 51 bird species included in Annex 2 of the same directive, 29 of them not included in the official standard form presentation of the site. A periodical update of the standard forms of this Natura 2000 site is necessary related to the list of characteristic bird species, their status (breeding, passage or wintering visitors) and their population.

We met four critically endangered species, ten endangered bird species and seventeen vulnerable bird species included in the Red Book of Vertebrates from Romania during the migration on the territory of ROSPA0063 Buhuși - Bacău – Berești. The official standard forms of the site not mention 22 of them, including three of the critically endangered species – one with regular appearance (*Milvus migrans*) and other two rare species in the area (*Pelecanus crispus* and *Sternula albifrons*).

Among the anthropogenic activities, the sport fishing and the poaching fishing present a high level of impact on the bird fauna during the migration time in the area, disturbing the bird species inside the feeding and resting territories. The immersed fishing nets expose the diving birds to the risk of death. In the southern part, the hunting games have a significant impact on the birds' presence. A regular control activity in the area could decrease the level of this impact in the conditions created by the withdrawal of the active presence of the previous custodian on the territory of the Natura 2000 site.

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