

ASPECTS OF THE SEASONAL DYNAMICS OF BIRDS IN PRE-DELTAIC WETLANDS FROM ISACCEA AREA (ROMANIA)

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Abstract. Our study began in the spring of 2012 and followed the diversity of bird fauna but also the seasonal dynamics of birds in the perimeter of four natural lakes situated in the pre-deltaic area of the Danube Delta Biosphere Reserve, one of them – Rotundu Lake being strictly protected area (228 hectares). Our list of bird fauna includes 129 species, 91 being regular breeding species while another 8 species being recorded like irregular or probably breeding species in the area. Between these, we notice the breeding presence of three globally threatened species (*Aythya nyroca* – about 30 pairs, *Microcarbo pygmeus* – with no more than 10 pairs and *Haliaeetus albicilla* – we identified two nests in the north-eastern part of area). Other 23 regular breeding and two probably breeding bird species appear in the Annex-1 of Birds Directive. In the second part of the breeding season and during the migration time, the birds diversity and their populations increase significantly, the birds finding here suitable feeding territories and secured refuge sites. We mention the appearance of three globally threatened species that use to stopover for feeding (*Pelecanus crispus* and *Circus macrourus*) or are wintering presence (*Branta ruficollis*) in the perimeter of these lakes.

Keywords: bird fauna, Danube Delta Biosphere Reserve, breeding season, migration.

Rezumat. Aspecte ale dinamicii sezoniere a avifaunei în zone umede pre-deltaice de lângă Isaccea (România).

Studiul nostru a început în primăvara anului 2012, urmărind diversitatea avifaunei, dar și dinamica sezonieră a păsărilor în perimetrul a patru lacuri naturale situate în zona pre-deltaică a Rezervației Biosferei Delta Dunării, Lacul Rotundu (228 hectare) având statut de zonă strict protejată. Lista avifaunistică a acestui teritoriu cuprinde 129 de specii, dintre care 91 sunt specii regulat clocitoare, alte 8 specii fiind înregistrate ca probabil sau neregulat clocitoare în acest perimetru. Printre acestea, menționăm prezența ca specii clocitoare a trei specii de păsări cu statut de protecție pe întregul areal de răspândire (*Aythya nyroca* – circa 30 perechi, *Microcarbo pygmeus* – cu un efectiv de cel mult 10 perechi și *Haliaeetus albicilla* – am identificat două cuiburi în sectorul nord-estic al zonei studiate). Alte 23 de specii regulat clocitoare și două specii probabil clocitoare sunt specii incluse în Anexa 1 a Directivei Păsări. În a doua parte a sezonului de reproducere și pe durata migrației, diversitatea păsărilor și efectivele acestora înregistrează creșteri semnificative, păsările găsind aici resurse trofice abundente și teritorii favorabile refugiului. Subliniem prezența altor trei specii protejate pe întregul areal de răspândire ce apar în perioada migrației (*Pelecanus crispus* și *Circus macrourus*) sau a iernii (*Branta ruficollis*) în perimetrul lacurilor investigate.

Cuvinte cheie: avifaună, Rezervația Biosferei Delta Dunării, cuibărit, migrație.

INTRODUCTION

Isaccea city is situated in the south-eastern Romania, on the territory of Tulcea County, on the right side of the Danube River. It represents a border locality (with Ukraine) in the northern limit of Niculițel Plateau.

The investigated territory is formed by the perimeter of four natural lakes Telincea, Saon, Rotundu and Gâsca, with the geographic coordinates 45°16'11" northern latitude and 28°27'35" eastern longitude. There exists one pre-deltaic area represented by a system of natural wetlands, lakes and marshes, sheltering a rich aquatic vegetation and fauna in the immediate vicinity of the floodplain of the Danube River (RĂDULESCU & VLADIMIROV, 2007; GĂȘTESCU, 2012).

All the investigated four lakes are typical natural lakes in the area liable to flooding of the Danube River, without any technical arrangements and present connections through a system of canals. The general aspect of the ecosystems is one of mosaic comprising open waters and canals, reed beds and meadows forests formed by willows and some poplars. The compact reed beds cover about 65% of the whole perimeter, while the open water surfaces and canals represent about 30%. We mention the presence of some clumps of very old willows (*Salix* sp.) in the immediate vicinity of the Danube River, on the northern limit of the investigated lakes. Rotundu Lake covers a surface about 228 hectares, representing a strictly protected area like part of the Danube Delta Biosphere Reserve (GĂȘTESCU & BABOIANU, 2011). This lake is a representative area for the study and preservation of natural biocoenosis adapted to high levels and amplitudes of flooding phenomenon, being an important reproduction territory for cyprinid group of fish.

The total area of the Danube Delta Biosphere Reserve is of about 5,800 km². From this, the surface of 3,510 km² belongs to the territory commonly called "Danube Delta", while the remaining area is shared between the upstream Danube floodplain (Isaccea - Tulcea sector, about 102 km²) and the Danube River valley between the village Cotu Pisicii and Isaccea town (13 km²), these two together representing the pre-deltaic area, respectively, the Razim-Sinoie lagoon complex (1,145 km²) and the neighbouring strip from the Black Sea (1,030 km²) up to the 20 m isobaths (GĂȘTESCU & ȘTIUCĂ, 2008).

The climate is temperate-continental, winter being long and very cold, while summers are hot and dry. The average annual temperature is 11⁰ C and the average annual rainfalls are about 500 millimetres. The dominant winds from the south – south-eastern directions bring rainfalls, while the western wind is very dry and hot, favouring the occurrence of droughts (RĂDULESCU & VLADIMIROV, 2007).

METHODS AND PERIOD OF STUDY

Our field investigations on the birds presence in the pre-deltaic region of Isaccea began in the early spring of 2012 and in this study we present the results of three years of field working in the perimeter of the lakes Saon, Rotundu, Telincea and Gâsca. The monitoring of birds was done using the methods of transect and fixed points (Fig. 1), allowing us to identify the birds through direct observation by binoculars and telescope (BRUUN et al., 1999), but also to estimate their populations. For this, we counted each bird from the small groups and used the quantitative evaluation in band for the groups or flocks larger than 200 individuals.



Figure 1. Transects for bird fauna monitoring in the pre-deltaic area Isaccea (2012 - 2015) (modified from <https://maps.google.com/>, 03.04.2015).

We used the calling activity in order to identify and estimate the populations of passerines from the reed beds, the crepuscular and nocturne bird species. 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 wetlands from the pre-deltaic area Isaccea offer suitable habitats and rich feeding territories for the birds through the richness and diversity of vegetation and fauna (CIOCHIA, 2000), presenting a great similarity with the existing habitats inside the territory of the Danube Delta (GÂȘTESCU & ȘTIUCĂ, 2008). Looking for the covering of habitats (Fig. 2), we notice that the cultivated lands are dominant reaching the limits of the investigated wetlands that cover significant surfaces, parallel with the Danube River, in the northern, north-eastern and eastern sides of Isaccea town. The meadow forests are present on small areas in the north-eastern side and the dry or humid meadows with shrubs and bushes appear in the immediate vicinity of the lakes.

During the period of study, we recorded 129 bird species (Table 1) that find suitable habitats for the breeding season, migration time or wintering period in the perimeter of the four lakes situated in the pre-deltaic Isaccea region: Saon, Rotundu, Telincea and Gâsca. The passerines (Passeriformes) present the greatest diversity, with 47 bird species, representing 36.43% from the recorded bird fauna. It is not a very rich bird-fauna if we compare the birds diversity from the investigated area with the total diversity of the bird fauna in Romania – 375 bird species (http://milvus.ro/wp-content/uploads/2008/02/RO_HU, 8.05.2015), representing just 34.4% from the Romanian bird fauna, respectively just 39.69% if we report it to the list of bird species from the Danube Delta Biosphere Reserve – 325 bird species (MUNTEANU, 2004).

Analysing the phenological status of the recorded bird species in the area, the summer visitors are dominant (69 species), followed by the sedentary species (29) and passage species (16), while the partial migratory and wintering visitors present the lowest diversity: 8, respectively, 7 species.

During the wintering period, the lakes Saon, Rotundu, Telincea and Gâsca are completely frozen. The ice bed appears in the middle December and it melts completely just in early, sometime, in middle March. For this reason, the wintering bird fauna is not rich (61 species), comprising the sedentary species, the partial migratory species and just seven typical wintering visitors like *Branta ruficollis* Pallas 1769 (15 – 20 individuals), *Anser albifrons* Scopoli 1769 (800 – 1,000 individuals), *Lanius excubitor* Linnaeus 1758 (5 – 10 individuals), *Buteo lagopus* Pontoppidan 1763 (7 – 9 individuals) and *Circus cyaneus* Linnaeus 1766 (5 – 10 individuals). The typical bird species for wetland habitats are present just during November and early November, some of them with effectives of hundreds or thousands of individuals – for example, on the 19th of December 2014, we counted about 1,000 individuals of *Anser albifrons* and one small group of seven individuals of *Branta ruficollis*. In winter, the greatest bird diversity was recorded on the dry meadows with shrubs and bushes (31 species) and in the perimeter of the cultivated lands (27 species).

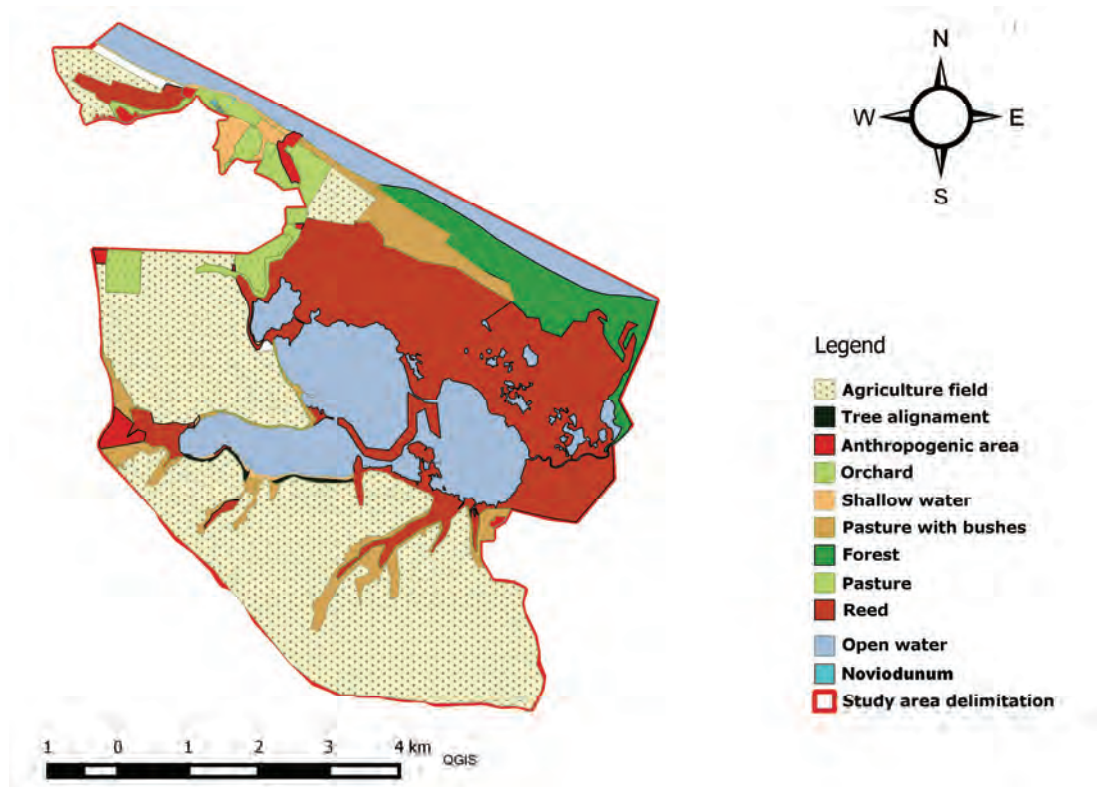


Figure 2. The habitats and land use in the pre-deltaic Isaccea region - vectorized map using <https://maps.google.com/>, 03.04.2015 and personal field observations.

Table 1. List of recorded bird species on the lakes from Isaccea area: effectives and conservation status.

No.	Species	Presence & effectives			IBA Criteria	Birds Directive Annex 1	Romanian Red Book of Vertebrates	IUCN Red List of Threatened Species
		Breeding (pairs)	Migration (individuals)	Wintering (individuals)				
1.	<i>Perdix perdix</i>	20 - 30	x	x	B2	-	-	-
2.	<i>Coturnix coturnix</i>	25 - 32	x	-	B2	-	-	-
3.	<i>Phasianus colchicus</i>	30 - 35	x	x	-	-	-	-
4.	<i>Cygnus olor</i>	15 - 20	300 - 500	5 - 10	A4/B1	-	-	-
5.	<i>Anser albifrons</i>	-	-	800 - 1000	A4/B1	-	-	-
6.	<i>Anser anser</i>	18 - 21	42 - 46	7 - 12	A4/B1	-	-	-
7.	<i>Branta ruficollis</i>	-	-	15 - 20	A1, A4/B1, B2	*	T	VU
8.	<i>Anas platyrhynchos</i>	50 - 55	600 - 750	55 - 65	A4/B1	-	-	-
9.	<i>Anas strepera</i>	20 - 22	120 - 170	5 - 8	A4/B1, B2	-	-	-
10.	<i>Anas clypeata</i>	-	3 - 5	-	A4/B1	-	-	-
11.	<i>Anas penelope</i>	-	32 - 36	-	A4/B1	-	-	-
12.	<i>Anas crecca</i>	-	5 - 10	-	A4/B1	-	-	-
13.	<i>Anas querquedula</i>	40 - 50	150 - 200	2 - 4	A4/B1, B2	-	-	-
14.	<i>Aythya fuligula</i>	-	2 - 4	-	A4/B1	-	-	-
15.	<i>Netta rufina</i>	-	5 - 10	-	A4/B1, B2	-	T	-
16.	<i>Aythya nyroca</i>	25 - 30	124 - 2000	-	A1, A4/B1, B2	*	V	NT
17.	<i>Aythya ferina</i>	42 - 48	250 - 300	-	A4/B1, B3	-	-	VU
18.	<i>Phalacrocorax carbo</i>	-	300 - 350	70 - 100	A4/B1	-	-	-
19.	<i>Microcarbo pygmeus</i>	5 - 10	50 - 100	-	A1, A4/B1, B2	*	V	-
20.	<i>Plegadis falcinellus</i>	-	72 - 113	-	A4/B1, B2	*	V	-

21.	<i>Platalea leucorodia</i>	-	5 - 20	-	A4/B1, B2	*	T	-
22.	<i>Botaurus stellaris</i>	5 - 10	x	-	B2	*	-	-
23.	<i>Ixobrychus minutus</i>	16 - 22	40 - 50	-	B2	*	-	-
24.	<i>Nycticorax nycticorax</i>	18 - 20	50 - 55	-	A4/B1, B2	*	V	-
25.	<i>Ardeola ralloides</i>	31 - 35	62 - 74	-	A4/B1, B2	*	V	-
26.	<i>Egretta garzetta</i>	24 - 32	37 - 71	-	A4/B1	*	T	-
27.	<i>Ardea alba</i>	15 - 20	60 - 120	4 - 9	A4/B1	*	T	-
28.	<i>Ardea cinerea</i>	17 - 21	57 - 89	5 - 10	A4/B1	-	-	-
29.	<i>Ardea purpurea</i>	5 - 15	30 - 40	-	B2	*	T	-
30.	<i>Pelecanus onocrotalus</i>	-	250 - 1,000	-	A4/B1, B2	*	V	-
31.	<i>Pelecanus crispus</i>	-	40 - 50	21 - 25	A1, A4/B1, B2	*	CT	VU
32.	<i>Ciconia nigra</i>	-	1 - 2	-	A1, A4/B1, B2	*	V	-
33.	<i>Ciconia ciconia</i>	10 - 12	85 - 120	-	A1, A4/B1, B2	*	V	-
34.	<i>Haliaeetus albicilla</i>	1 - 2	5 - 7	2 - 3	A1, A4/B1, B2	*	CT	-
35.	<i>Pandion haliaetus</i>	-	1 - 2	-	A1, A4/B1, B2	*	V	-
36.	<i>Clanga pomarina</i>	-	2 - 3	-	A1, A4/B1, B2	*	V	-
37.	<i>Milvus migrans</i>	2?	2 - 4	-	A1, A4/B1, B2	*	CT	-
38.	<i>Circus aeruginosus</i>	11 - 13	31 - 35	-	A4/B1	*	-	-
39.	<i>Circus cyaneus</i>	-	-	5 - 10	A4/B1	*	-	-
40.	<i>Circus pygargus</i>	-	6 - 10	-	A1, A4/B1, B2	*	T	-
41.	<i>Circus macrourus</i>	-	2 - 4	-	A1, A4/B1, B2	*	T	NT
42.	<i>Buteo rufinus</i>	-	3 - 12	4 - 6	A1, A4/B1, B2	*	V	-
43.	<i>Buteo buteo</i>	4 - 6	20 - 30	10 - 15	A4/B1	-	-	-
44.	<i>Buteo lagopus</i>	-	-	7 - 9	A4/B1	*	-	-
45.	<i>Pernis apivorus</i>	-	5 - 10	-	A1, A4/B1, B2	*	V	-
46.	<i>Accipiter nisus</i>	x	6 - 12	5 - 10	A4/B1	-	-	-
47.	<i>Accipiter gentilis</i>	x	4 - 7	3 - 5	A4/B1	-	-	-
48.	<i>Falco tinnunculus</i>	10 - 13	21 - 28	6 - 10	A4/B1	-	-	-
49.	<i>Falco vespertinus</i>	1 - 2	6 - 7	-	A1, A4/B1, B2	*	V	NT
50.	<i>Falco subbuteo</i>	-	13 - 15	-	A4/B1	-	-	-
51.	<i>Rallus aquaticus</i>	3 - 5?	x	-	A4/B1	-	-	-
52.	<i>Porzana porzana</i>	2 - 3?	x	-	A4/B1, B3	*	-	-
53.	<i>Gallinula chloropus</i>	43 - 58	125 - 250	-	A4/B1	-	-	-
54.	<i>Fulica atra</i>	25 - 40	460 - 780	-	A4/B1	-	-	-
55.	<i>Vanellus vanellus</i>	5 - 7	50 - 60	-	A4/B1	-	-	NT
56.	<i>Limosa limosa</i>	-	5 - 8	-	A4/B1, B2	-	-	NT
57.	<i>Tringa ochropus</i>	-	5 - 10	-	A4/B1	-	-	-
58.	<i>Tringa stagnatilis</i>	-	6 - 15	-	A4/B1	-	-	-
59.	<i>Tringa totanus</i>	-	36 - 54	-	A4/B1	-	-	-
60.	<i>Gallinago gallinago</i>	-	3 - 5	-	A4/B1	-	-	-
61.	<i>Chroicocephalus ridibundus</i>	x	650 - 900	-	A4/B1	-	-	-
62.	<i>Larus cachinnans</i>	x	150 - 200	-	A4/B1	-	-	-
63.	<i>Chlidonias niger</i>	5 - 7	25 - 30	-	A4/B1, B2	*	-	-
64.	<i>Chlidonias hybrida</i>	41 - 43	150 - 250	-	A4/B1, B2	*	-	-
65.	<i>Sterna hirundo</i>	38 - 72	250 - 400	-	A4/B1, B2	*	-	-
66.	<i>Tachybaptus ruficollis</i>	12 - 14	44 - 52	-	A4/B1	-	-	-
67.	<i>Podiceps cristatus</i>	21 - 23	72 - 88	-	A4/B1	-	-	-
68.	<i>Podiceps grisegena</i>	2 - 4	8 - 14	-	A4/B1	-	-	-
69.	<i>Podiceps nigricollis</i>	1 - 3	10 - 12	-	A4/B1	-	-	-
70.	<i>Columba palumbus</i>	20 - 25	55 - 78	-	A4/B1	-	-	-
71.	<i>Streptopelia decaocto</i>	x	x	x	A4/B1	-	-	-
72.	<i>Cuculus canorus</i>	x	x	-	A4/B1	-	-	-
73.	<i>Strix aluco</i>	1 - 2?	x	x	B2	-	-	-
74.	<i>Athene noctua</i>	7 - 9	x	x	B2	-	-	-
75.	<i>Alcedo atthis</i>	6 - 8	x	-	B2	*	-	-
76.	<i>Merops apiaster</i>	21 - 24	58 - 78	-	A4/B1, B2	-	-	-
77.	<i>Coracias garrulus</i>	8 - 12	32 - 52	-	B2	*	-	-
78.	<i>Upupa epops</i>	x	x	-	B2	-	V	-
79.	<i>Dendrocopos major</i>	x	x	x	B2	-	-	-
80.	<i>Dendrocopos syriacus</i>	x	x	x	B3	*	-	-
81.	<i>Dendrocopos minor</i>	x	x	x	B2	-	-	-
82.	<i>Picus canus</i>	x	x	x	B2	*	-	-
83.	<i>Galerida cristata</i>	x	x	x	B2	-	-	-
84.	<i>Alauda arvensis</i>	24 - 28	56 - 73	-	B2	-	-	-
85.	<i>Riparia riparia</i>	18 - 24	146 - 184	-	A4/B1, B2	-	-	-
86.	<i>Hirundo rustica</i>	x	x	-	B2	-	-	-
87.	<i>Delichon urbicum</i>	x	x	-	B2	-	-	-
88.	<i>Anthus campestris</i>	13 - 15	42 - 48	-	B2	*	-	-
89.	<i>Motacilla flava</i>	10 - 12	34 - 42	-	B2	-	-	-
90.	<i>Motacilla alba</i>	15 - 17	50 - 65	-	B2	-	-	-
91.	<i>Erithacus rubecula</i>	x	x	-	B3	-	-	-
92.	<i>Saxicola rubetra</i>	x	x	-	B3	-	-	-

93.	<i>Saxicola rubicola</i>	x	x	-	B2	-	-	-
94.	<i>Oenanthe pleschanka</i>	x	x	-	B2	*	V	-
95.	<i>Turdus pilaris</i>	-	-	120 - 130	B3	-	-	-
96.	<i>Turdus merula</i>	x	x	x	B3	-	-	-
97.	<i>Sylvia curruca</i>	x	x	-	B3	-	-	-
98.	<i>Sylvia communis</i>	x	x	-	B3	-	-	-
99.	<i>Acrocephalus schoenobaenus</i>	x	x	-	B3	-	-	-
100.	<i>Acrocephalus palustris</i>	x	x	-	B3	-	-	-
101.	<i>Acrocephalus scirpaceus</i>	x	x	-	B3	-	-	-
102.	<i>Acrocephalus arundinaceus</i>	x	x	-	B3	-	-	-
103.	<i>Hippolais icterina</i>	x	x	-	B3	-	-	-
104.	<i>Muscicapa striata</i>	x	x	-	B2	-	-	-
105.	<i>Phylloscopus collybita</i>	x	x	-	B3	-	-	-
106.	<i>Troglodytes troglodytes</i>	x	x	x	B3	-	-	-
107.	<i>Parus major</i>	x	x	x	-	-	-	-
108.	<i>Cyanistes caeruleus</i>	x	x	x	-	-	-	-
109.	<i>Panurus biarmicus</i>	x	x	-	-	-	-	-
110.	<i>Remiz pendulinus</i>	x	x	-	-	-	-	-
111.	<i>Lanius excubitor</i>	-	-	5 - 10	B2	*	-	-
112.	<i>Lanius collurio</i>	30 - 50	x	-	B2	*	-	-
113.	<i>Lanius minor</i>	22 - 32	x	-	B2	*	-	-
114.	<i>Pica pica</i>	x	x	x	-	-	-	-
115.	<i>Corvus monedula</i>	x	x	x	-	-	-	-
116.	<i>Corvus frugilegus</i>	x	x	x	-	-	-	-
117.	<i>Corvu cornix</i>	x	x	x	-	-	-	-
118.	<i>Corvus corax</i>	x	x	x	B3	-	-	-
119.	<i>Sturnus vulgaris</i>	x	x	x	-	-	-	-
120.	<i>Oriolus oriolus</i>	x	x	-	-	-	-	-
121.	<i>Passer domesticus</i>	x	x	x	-	-	-	-
122.	<i>Passer hispaniolensis</i>	5 - 7	x	-	B3	-	-	-
123.	<i>Passer montanus</i>	x	x	x	-	-	-	-
124.	<i>Carduelis cannabina</i>	-	x	-	B3	-	-	-
125.	<i>Chloris chloris</i>	x	x	x	B3	-	-	-
126.	<i>Carduelis carduelis</i>	x	x	x	B3	-	-	-
127.	<i>Emberiza schoeniclus</i>	x	x	x	-	-	-	-
128.	<i>Emberiza calandra</i>	x	x	-	B3	-	-	-
129.	<i>Emberiza citrinella</i>	x	x	x	B3	-	-	-

Legend:

Effectives: 2? – probably or possibly breeding effectives in the area; x – uncertainly data.

IBA Criteria: A1 – globally threatened species; A3 – species of restrictive biome; A4/B1 – bird species forming great agglomerations in different periods of the year (breeding season, migration, wintering time). B2 – species with unfavourable conservation status in Europe; B3 – species with favourable conservation status in Europe.

Romanian Red Book of Vertebrates: V – vulnerable species; T – threatened species; CT – critically threatened species.

IUCN - Red List of Threatened Species: VU – vulnerable species; NT – near threatened.

The greatest diversity of bird fauna was recorded during the spring migration time – 124 bird species (Fig. 3), the investigated territory being situated in the most important area for the birds migration on the Romanian territory (CIOCHIA & NEGRUȚIU, 1998): the flyways that follow the valleys of the Siret and the Prut rivers, crossing the Danube River and those that cross the area of the Danube Delta going to the south – south-eastern direction parallel with the Black Sea coastline to the Balkans wintering areas or towards the Bosphorus Strait.

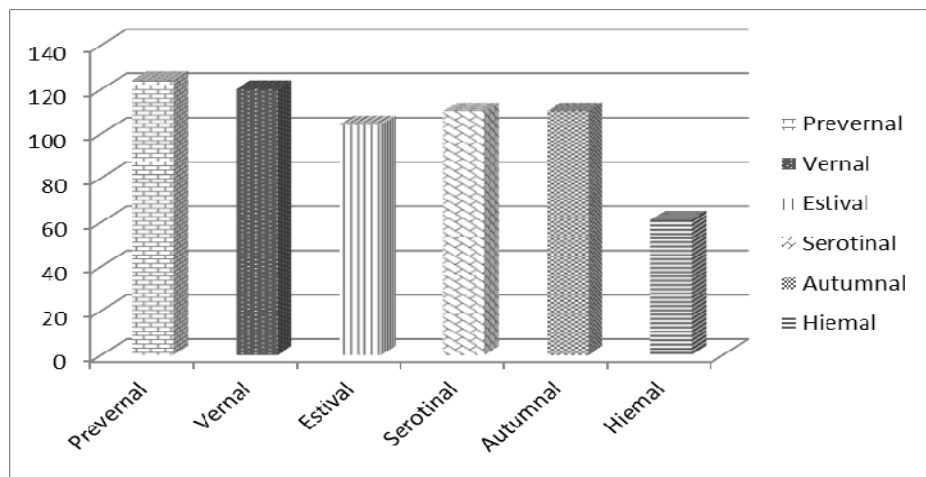


Figure 3. The seasonal dynamics of bird fauna in the pre-deltaic Isaccea region.

During this period, especially in March – April, the level of waters increases in the investigated perimeter, so, the grasslands, marshes and, sometimes, the cultivated lands from the vicinity of the lakes are flooded – especially on the western shores of Teleanca Lake. The whole territory becomes an extensive and very rich feeding site for the waterfowls, herons and waders that use the area for one short stop-over during their flight to the northern breeding territories. Despite the near constant effectives of geese and ducks, the specific composition of these large groups changes, sometimes, from one day to the next day. This is the time when we recorded not only the greatest diversity, but also significant effectives for the aquatic and semi-aquatic bird species.

The raptor groups (Accipitriformes and Falconiformes) are represented by 16 species during the spring migration, some of them being rare and protected species in Romania – for example, *Clanga pomarina* Brehm 1831 (2 – 3 individuals), *Pandion haliaetus* Boddaert 1783 (1 – 2 individuals) or *Milvus migrans* Linnaeus 1758 (2 – 4 individuals). We could survey, including the moment of intense migration of the raptor birds, counting tens soaring individuals that come from the south and fly to the north – north-eastern directions, part of them leaving the wintering territory (*Buteo lagopus* – 7 to 9 individuals, *B. rufinus* Cretzschmar 1829 – 4 to 6 individuals or *Circus cyaneus* – 5 to 10 individuals), while other just cross the territory being passage species – *C. macrourus* Gmelin 1770 (2 – 4 individuals) and *C. pygargus* Linnaeus 1758 (6 – 10 individuals).

In late March - early April, during the monitoring of spring migration, we observed also the first mating display between the waterfowls (Anseriformes) and grebes (Podicipediformes). During summer, we recorded 104 bird species in the area, but the breeding bird fauna in the pre-deltaic Isaccea region includes 91 regular breeding species and other 8 irregular or, at least, probably breeding species using a high variety of suitable nesting habitats (trees, hollows and shrubs in the meadow forests, reed beds, humid and dry grasslands, steep clay banks).

Well-represented in the area, herons form monospecific or mixed colonies (*Egretta garzetta* Linnaeus 1766: 24 – 32 pairs, *Ardeola ralloides* : 31 – 35 pairs, *Nycticorax nycticorax* Linnaeus 1758: 18 – 20 pairs and *Ardea alba* Linnaeus 1758: 15 – 20 pairs) or are breeding individuals (*Ixobrychus minutus* Linnaeus 1766, with 16 – 22 pairs, *Botaurus stellaris* Linnaeus 1758, with 5 – 10 pairs or *Ardea purpurea* Linnaeus 1766: 5 – 15 pairs) in the compact reed beds and in the old willow forests, where the access is very difficult for fishermen or other people.

The terns (Sternidae) and the grebes (Podicipedidae) also form breeding colonies, usual mixed colonies in the area, where they build their nests on small islands formed by depositing silts and embedding plants debris (especially old reed beds and bushes). Terns are dominants with effectives of hundreds pairs, but we must notice the presence of *Chlidonias niger* Linnaeus 1758 (about 30 pairs) that presents a negative trend during the last decades in Romania. At the same time, it is important to mention the presence of all four breeding species of grebes included in the Romanian bird fauna, especially *Podiceps nigricollis* Brehm 1831 and *P. grisegena* Boddaert 1783, which are not frequent breeding species in other wetlands from the country.

From the group of waterfowls, the breeding presence of *Anser anser* Linnaeus 1758 with 18 to 21 pairs in the investigated area is the best indicator of one very low level of the anthropogenic impact in these wetlands. Between the duck species, we recorded about 25 – 30 pairs of ferruginous duck (*Aythya nyroca* Gldenstdt 1770), a globally threatened species, respectively, 42 – 48 pairs of common pochard (*A. ferina* Linnaeus 1758).

The pygmy cormorant (*Microcarbo pygmeus* Pallas 1773) breeds in the pre-deltaic Isaccea region with no more than ten pairs, forming a small colony in some old willows on the right bank of the Danube River. But in the middle summer, we observed flocks of about tens individuals visiting daily the area used like feeding territory.

The great cormorants (*Phalacrocorax carbo* Linnaeus 1758), pelicans (*Pelecanus onocrotalus* Linnaeus 1758 and *P. crispus* Bruch 1832), glossy ibis (*Plegadis falcinellus* Linnaeus 1766) and spoonbills (*Platalea leucorodia* Linnaeus 1758) are constant presence during summer, but they do not breed in the area, coming here just to feed.

We paid a special attention to the census of the nests occupied by the white storks (*Ciconia cinonia* Linnaeus 1758) in the area. The species presented a positive trend during the years: if in 2012, there were seven occupied nests, in 2014 nine pairs of white stork had 2 – 4 flying juveniles and one nest was occupied by two adults, but they had not any chicks.

During the period of our study, we recorded 6 to 8 pairs of kingfisher (*Alcedo atthis* Linnaeus 1758) in the perimeter of the four investigated lakes, that representing one indicator of the high quality of the waters in the area. We mention, also, the existence of one special breeding colony that bring together different bird species that use burrows dug in high clay banks situated at a distance of about 3 kilometres of Gasca Lake. There are present species that use to dig their nest-tunnels (*Merops apiaster* Linnaeus 1758 with 21 – 24 pairs, *Coracias garrulus* Linnaeus 1758 with 8 – 12 pairs and *Riparia riparia* Linnaeus 1758 with 18 – 24 pairs), but also species that use to occupy old nests of this kind (*Passer domesticus* Linnaeus 1758 with 10 – 13 pairs and *P. montanus* Linnaeus 1758 with 8 – 9 pairs); one unusual presence in this colony is that of one pair of *Athene noctua* Scopoli 1769.

In the pre-deltaic Isaccea region, there are present some breeding raptor species (Accipitriformes and Falconiformes), most of them with small effectives in the area due to the small surfaces covered by suitable habitats, excepting the Eurasian marsh harrier (*Circus aeruginosus* Linnaeus 1758) that is present with up to 13 breeding pairs in the compact reed beds. From this group, we consider very important the breeding presence of *Falco vespertinus* Linnaeus 1766 (1 – 2 pairs) and the probably breeding presence of *Milvus migrans* (2 pairs, two or three adults being regularly observed in the area during the breeding season and we met juveniles birds, too). The breeding presence of two pairs of white-tailed eagle (*Haliaeetus albicilla* Linnaeus 1758) in the old meadow forest situated between the Danube River and the perimeter of the lakes represents one hot spot for the conservation measures in the area, being one strictly and critically threatened species in

Romania; there are just very few known nests outside the Danube Delta territory. The investigated area is situated in the vicinity of Măcin Mountains Park (PAPP & FÂNTÂNĂ, 2008), so, numerous raptor birds seem to use the open grasslands and cultivated lands like hunting territories in the breeding season.

The passerines present the greatest specific diversity and breed in very different habitats occupying the compact reed beds (warblers – *Acrocephalus* sp., *Panurus biarmicus* Linnaeus 1758 or *Emberiza schoeniclus* Linnaeus 1758), the willows from the shores (*Remiz pendulinus* Linnaeus 1758), the surrounding dry and humid grasslands (*Motacilla alba* Linnaeus 1758, *M. flava* Linnaeus 1758, *Anthus campestris* Linnaeus 1758, *Alauda arvensis* Linnaeus 1758 etc.), the shrubs (*Lanius collurio* Linnaeus 1758 or *L. minor* Gmelin 1788), inside the localities (*Hirundo rustica* Linnaeus 1758 or *Delichon urbicum* Linnaeus 1758).

The autumn migration is initiated in the area beginning with late July, being obviously slowly than the spring migration. The richness and variety of food resources transform the perimeter of the pre-deltaic natural lakes Saon, Rotundu, Telincea and Gâsca in one very suitable stop-over and feeding territory for the migratory birds. During the whole period of autumn migration in the area (late July – late October), we recorded the same diversity of birds: 110 species. We notice that it is close to the diversity from spring migration time, but the effectives are obviously bigger. This is the time when we recorded the greatest effectives of aquatic birds – for example, 300 – 500 individuals of *Cygnus olor* Linnaeus 1758, up to 2,000 individuals of *Aythya nyroca* (the 25th of September 2012, on Saon Lake) or 460 – 780 individuals of coot (*Fulica atra* Linnaeus 1758). The only appearance of osprey (*Pandion haliaetus* Linnaeus 1758) in the investigated area was recorded during the autumn migration, on the 22nd of September 2014, sitting on a wooden stump from the southern bank of Rotundu Lake.

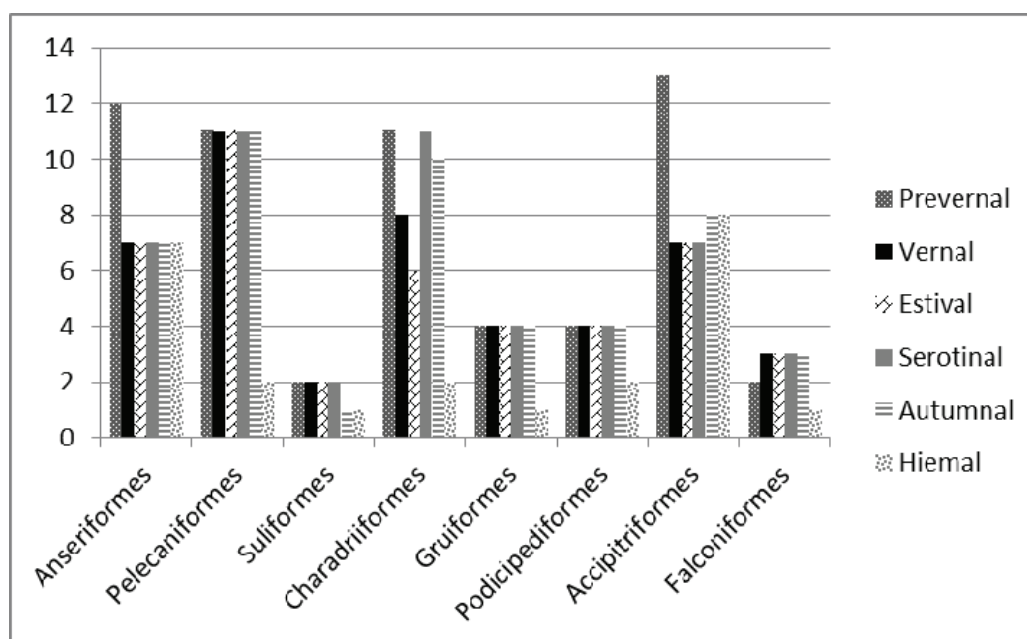


Figure 4. The seasonal dynamics of the specific diversity for the main groups of birds in the pre-deltaic region Isaccea.

If we look for the specific diversity of the main groups of birds recorded in the pre-deltaic Isaccea region from one phenological aspect to other (Fig. 4), the waterfowls (Anseriformes) and the raptor birds (Accipitriformes) present the greatest diversity during the migration time, especially, in March – April (prevernal aspect), while the waders (Charadriiformes) are represented by similar number of species during the first part of spring and autumn migration (March – April, respectively, July - August). Four groups of aquatic birds present a linear diversity starting from the prevernal aspect to the serotinal aspect – herons (Ardeidae - Pelecaniformes), cormorants (Suliformes), rails (Gruiformes) and grebes (Podicipediformes).

Analysing the conservation status of bird species recorded in the investigated area, during our study, we identified 6 globally threatened bird species; three are breeding species in the area (*Aythya nyroca*, *Microcarbo pygmeus* and *Haliaeetus albicilla*), two species appear just in passage (*Pelecanus crispus* and *Circus macrourus*) and one like winter visitor (*Branta ruficollis*). From the IUCN Red List, there are present three vulnerable species – one like breeding species (*Aythya ferina*), one using this area as feeding territory (*Pelecanus crispus*) and one during the wintering time (*Branta ruficollis*); other five have status of near threatened species, three being breeding species in the area (*Aythya nyroca*, *Falco vespertinus* and *Vanellus vanellus* Linnaeus 1758), while the two others are only passage species (*Circus macrourus* and *Limosa limosa* Linnaeus 1758).

From our list of bird fauna, 41 bird species appear in Annex 1 of 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. From these, 25 are breeding species in the area, some of them with tens pairs (for example,

Botaurus stellaris, *Ixobrychus minutus*, *Nycticorax nycticorax*, *Ardeola ralloides*, *Egretta garzetta*, *Ardea alba*, *A. purpurea*, *Aythya nyroca*, *Sterna hirundo* Linnaeus 1758, *Chlidonias hybrid* Pallas 1811, *C. niger*, etc.).

We must mention that, from our list, 26 bird species are included in the Red Book of Vertebrates from Romania (BOTNARIUC & TATOLE, 2005) with three different threatening statuses: 3 critically threatened species (one breeding species – *Haliaeetus albicilla*, respectively, *Milvus migrans* probably breeding species in the vicinity of the investigated territory), 8 threatened species (three of them being breeding species – *Egretta garzetta*, *Ardea alba* and *A. purpurea*) and 15 vulnerable species (we mention the non-breeding species – *Plegadis falcinellus*, *Pelecanus onocrotalus*, *Ciconia nigra* Linnaeus 1758, *Clanga pomarina*, *Pandion haliaetus*, *Buteo rufinus* and *Pernis apivorus* Linnaeus 1758).

CONCLUSIONS

During our study, we recorded 129 bird species in the pre-deltaic Isaccea area in the perimeters of four lakes: Saon, Rotundu, Telincea and Gâsca.

The greatest diversity was recorded during the migration time – 122 bird species, while in the breeding season, there are present 91 certainly breeding species, the other 8 being probably or irregular breeding species.

During our study in the area, we identified 6 globally threatened bird species (*Branta ruficollis*, *Aythya nyroca*, *Microcarbo pygmeus*, *Pelecanus crispus*, *Haliaeetus albicilla* and *Circus macrourus*).

From the IUCN Red List, there are present three vulnerable species (*Branta ruficollis*, *Aythya ferina* and *Pelecanus crispus*) and five near threatened species (*Aythya nyroca*, *Circus macrourus*, *Falco vespertinus*, *Vanellus vanellus* and *Limosa limosa*).

In our list of bird fauna, we mention 41 bird species which appear in Annex 1 of Birds Directive, respectively, 26 bird species that are included in the Red Book of Vertebrates from Romania with three different threatening statuses: 3 critically threatened species, 8 threatened species and 15 vulnerable species.

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