

THE ECOLOGICAL DISTRIBUTION OF THE BIRDS FROM THE AREA OF THE INTERNATIONAL AIRPORT CRAIOVA (0–13 KM) AND THE RISK DEGREE THAT BIRDS MAY REPRESENT FOR AIR TRAFFIC

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Abstract. In our study, we present an image of the avifauna reported within the perimeter of the I. A. C. and its adjacent surroundings (0-13 km), including the distribution of the bird species on types of habitats/biotopes identified within the analysed perimeter, their relation to the living environment, as well as the risk degree birds may represent for air traffic. On the whole, we identified 138 species belonging to 18 systematic orders; according to their specific biotope, they are distributed as it follows: 9 species are typical of grasslands and agroecosystems, 71 species are typical of forest areas (forests and shrubs), 51 species are typical of aquatic areas, 3 species are synanthropic (depending on human settlements) and 4 species are eurytopic, relatively similarly distributed in many biotopes. The highest risk factor for air traffic is represented by the bird species characteristic of forests and shrubs (*Phasianus colchicus*, *Buteo buteo*, *Columba palumbus*, *Sturnus vulgaris*, *Corvus frugilegus*, *C. monedula*, etc.), followed by the aquatic bird species (*Ardea cinerea*, *Anas platyrhynchos*, *Larus* sp. ș.a.) and the synanthropic ones (*Columba livia domestica*, *Hirundo rustica*, *Delichon urbicum*).

Keywords: bird fauna, biotopes, International Airport Craiova (I. A. C.).

Rezumat. Distribuția ecologică a păsărilor din zona Aeroportului Internațional din Craiova (0–13 km) și gradul de risc pe care păsările îl ridică pentru traficul aerian. În studiul nostru prezentăm un tablou al avifaunei semnalate în perimetrul A. I. C. și în zonele adiacente acestuia (0-13 km), cuprinzând distribuția speciilor de păsări în tipurile de habitate/biotopuri din arealul analizat, relația acestora cu mediile de trai, precum și gradul de risc pe care păsările îl ridică pentru traficul aerian. În ansamblu am consemnat un număr de 138 de specii încadrate în 18 ordine sistematice și repartizate, după apartenența la biotopul specific, astfel: 9 specii sunt tipice pentru habitatele de pajiști și agroecosisteme, 71 de specii sunt tipice suprafețelor forestiere (păduri și tufărișuri), 51 de specii sunt tipice zonelor acvatice, 3 specii sunt sinantropice (dependente de așezările omenești), iar 4 specii sunt euritope, cu răspândire relativ egală în mai multe biotopuri. Cele mai multe amenințări legate de traficul aerian provin din partea speciilor de păsări tipice pentru pădure și tufărișuri (*Phasianus colchicus*, *Buteo buteo*, *Columba palumbus*, *Sturnus vulgaris*, *Corvus frugilegus*, *C. monedula* etc.), urmate de speciile de păsări acvatice (*Ardea cinerea*, *Anas platyrhynchos*, *Larus* sp. ș.a.) și cele sinantropice (*Columba livia domestica*, *Hirundo rustica*, *Delichon urbicum*).

Cuvinte cheie: avifauna, biotopuri, Aeroportul Internațional Craiova. (A. I. C.).

INTRODUCTION

Craiova municipality is located within the Romanian Plain, respectively Oltenia Plain, on the left bank of the Jiu River and represents the largest and the most important urban settlement from south-western Romania. The city is 227 km away from the country capital, Bucharest, and 68 km from the Danube.

The International Airport Craiova (I. A. C.) is situated in the eastern part of Craiova, 7 km from the city centre, at an altitude of 191 m above the sea level (<http://ro.wikipedia.org/wiki/Craiova#cite>) – Fig. 1. The adjacent area of the I.A.C. is located in the Teslui hydrographical basin, in the eastern and north-eastern part, while its western and south-western part belongs to the Jiu hydrographical basin.

The Teslui River has a tributary, namely the Ghercești Valley, which springs from the immediate proximity, north of the Airplane Factory (located in the western part of I. A. C.) and flows into the Teslui at the southern limit of the settlement with the same name. A quite large retention pond was built on this tributary. Immediately south of Craiova – Balș – Slatina highroad, starting from the eastern end of the main track of the airport, there appears a torrential valley that goes eastwards. This valley intersects many furrows with intermittent water that get dry during summer.

In the Jiu basin, west of the airport, there are located some torrential valleys (they spring from the high part of the plain and cross the river terraces) and Doctorului Lake (Doctor's Lake) (located on the high terrace), while in the southwest, the main torrential valleys that cross the Jiu terraces are: Fetei Valley (Girl's Valley), Bătrână Valley (Old Valley), Izvorului Valley (Spring Valley); along this last valley, there are 11 reservoirs that are known as Preajba-Făcăi lacustrine complex.

Being located at the southern limit of Olteț Piedmont and the northern limit of Leu – Rotunda high plain, the I. A. C. and its adjacent area presents mainly typical luvisols and some small areas with preluvisols. On the high terrace of the Jiu, located in the western part of the airport, psamosols predominate (BADEA et al., 2011).

The climate is temperate continental, specific to plain areas, with sub-Mediterranean influences. Due to its location in the south-west of the country, Craiova area undergoes the influence of the baric centres situated over the Mediterranean Sea, while in winter, there is also present the influence of the East-European Anticyclone (MARINICĂ, 2006).

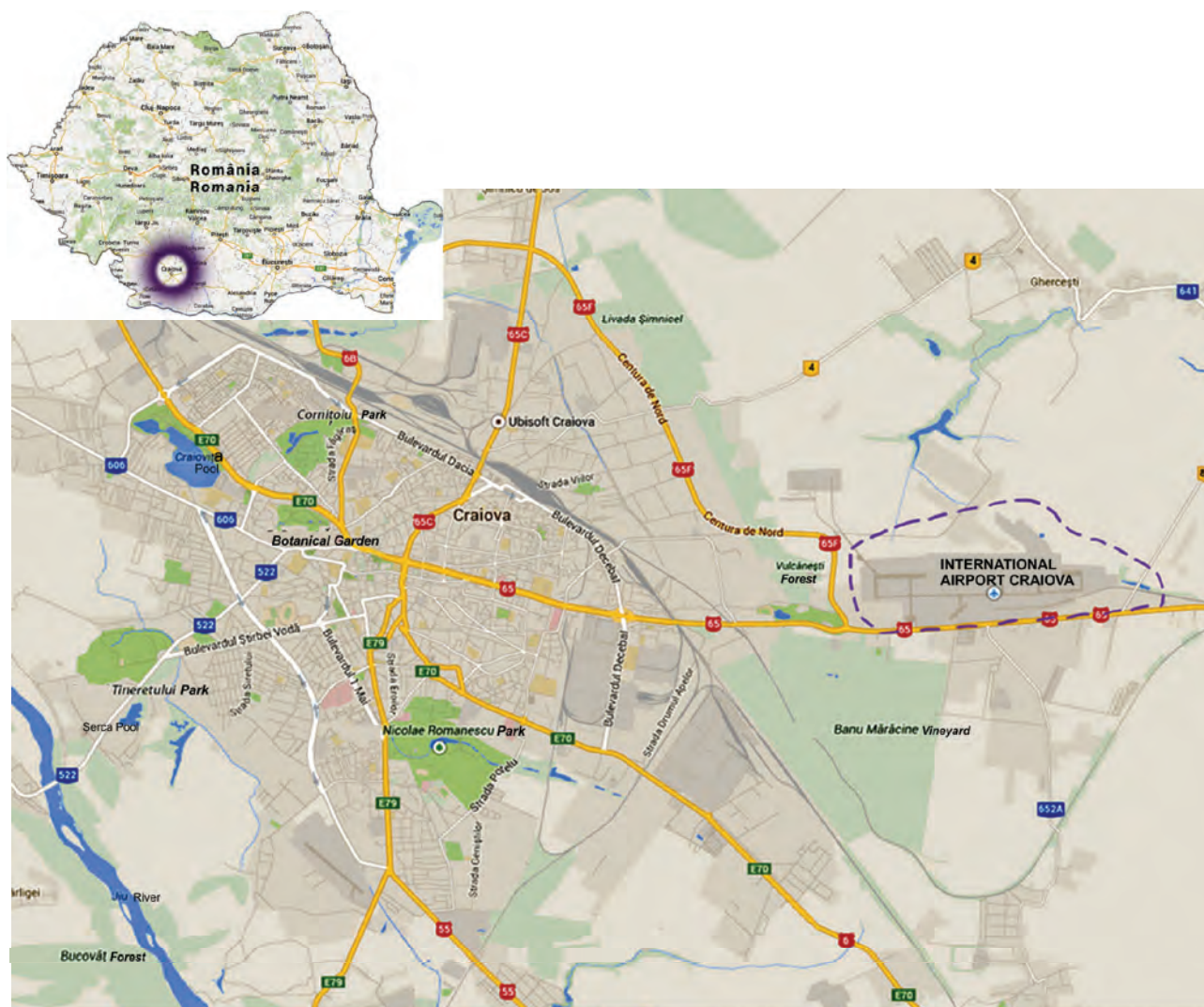


Figure 1. Location of the I. A. C. (<https://www.google.ro/maps>).

The physical-geographical characteristics of the territory the I. A. C. is located within, as well as the anthropogenic interventions that led to the development of the urban area of Craiova and, implicitly, of this objective, generated specific types of habitats/biotopes, which, on a distance of 13 km adjacent to the airport, are mainly components of artificial ecosystems: agroecosystems and urban ecosystems. However, within the analysed area, there still can be found some natural/semi-natural biotopes, some forested fields or aquatic and semi-aquatic surfaces represented by the green areas located in the city, such as "Nicolae Romanescu" Park, "Tineretului" Park, "Cornitoiu" Park, the Botanical Garden "Al. Buia" or in its proximity – the forests of the suburban area from Pârșani, Șimnicu de Sus, Șimnicu de Jos, Preajba – Făcăi lacustrine complex, the floodplain of the Jiu, etc. All the aforementioned areas are at a distance of 5-7 km from the I. A. C.

Although intensely anthropized, we considered the analysed territory should be studied from the avifauna viewpoint as it is populated by a high number of birds the activity of which may influence the safety of airplanes landing or taking off from the airport. As air traffic becomes more intense, the issue of the risks birds may generate is of general interest (THORPE, 1990) and it has already been approached by other specialists from our country (PETRESCU, 2002).

MATERIAL AND METHODS

As field research materials we used binoculars (Zeiss Jena 10x50 and Bushnell 12x40), bird guide (BRUUN et al., 1999) and a photo camera (Sony 15 x); for the scientific processing of the obtained data (systematic, ecological, phenological affiliation) we used the specialized literature: SZABÓ-SZELEY & BACZÓ, 2006; CĂTUNEANU et al., 1978; MUNTEANU et al., 2002; MUNTEANU, 2012. In order to render an adequate general image of the avifauna in the area we used the data obtained from direct observations, as well as the data mentioned in specialized literature (BĂLESCU, 2000, 2002, 2013; BĂLESCU & RIDICHE, 2001; RIDICHE, 2011).

The avifauna investigation methods were the direct observations made in fixed points (observation points were chosen so as to cover much of the I. A. C. area and surroundings) or in movement, on predetermined transects, by

walking. All the species recorded visually or auditory along the transect were noted in the observation file. The observations were made from mid-January to December 2014 (one to two monthly trips at various points); we also made intensive observations on the nesting bird species in April, May, June.

RESULTS AND DISCUSSIONS

Within the research area (perimeter of the I. A. C. and its surroundings on a distance of 13 km) we identified the following types of biotopes/habitats: grasslands and agroecosystems/cultivated lands, woodlands with trees and shrubs/bushes, wetlands (pools, flooded meadows, swampy terrains, fens, canals, watercourses: brooks, rivers, floodplains, etc.) and human settlements. Each of these habitats is populated by a diversified avifauna represented by 3 categories of bird species: typical species (dependent on the respective biotope through food and reproduction needs), accessory species (they only use the trophic resources of the respective biotope, have a short, temporary presence in the area) and eurytopic species, largely spread, present in many types of biotopes where they satisfy their feeding and nesting needs.

There was identified a total number of 138 species belonging to 18 systematic orders (Table 1). According to the biotope that better corresponds to the morphological adaptations and vital needs (food and reproduction), the main avifauna communities are grouped as it follows:

1. Avifauna characteristic of grasslands and agroecosystems;
2. Avifauna characteristic of woodlands (forest and shrub birds);
3. Avifauna characteristic of wetlands (aquatic avifauna);
4. Avifauna characteristic of human settlements (synanthropic avifauna).

Table 1. Overview for the avifauna of the perimeter of the International Airport Craiova (I.A.C.) and its adjacent areas (0-13 km).

No.	SPECIES	Observations			Biotope				Phenological type					Risk for air traffic
		Perimeter of I.A.C.	0-3 km	3-13 km	I	II	III	IV	R	PM	SV	WV	P	
I	ORD. PODICIPEDIFORMES													
1	<i>Tachybaptus ruficollis</i>	-	-	x	-	-	t	-			*	*		
2	<i>Podiceps cristatus</i>	-	-	x	-	-	t	-			*		*	
3	<i>Podiceps nigricollis</i>	-	-	x	-	-	t	-			*		*	
II	ORD. PELECANIFORMES													
4	<i>Phalacrocorax carbo</i>	-	-	x	-	-	t	-			*	*	*	(XXX)
5	<i>Phalacrocorax pygmaeus</i>	-	-	x	-	-	t	-			*		*	(XXX)
III	ORD. CICONIIFORMES													
6	<i>Botaurus stellaris</i>	-	-	x	-	-	t	-			*			
7	<i>Ixobrychus minutus</i>	-	-	x	-	-	t	-			*			
8	<i>Nycticorax nycticorax</i>	-	-	x	-	-	t	-			*			
9	<i>Ardeola ralloides</i>	-	-	x	-	-	t	-			*			
10	<i>Egretta garzetta</i>	-	x	x	-	-	t	-			*			X
11	<i>Ardea alba</i>	-	-	x	-	-	t	-			*		*	
12	<i>Ardea cinerea</i>	x	x	x	+	-	t	-			*		*	X
13	<i>Ardea purpurea</i>	-	-	x	-	-	t	-			*			
14	<i>Ciconia nigra</i>	-	-	-	-	t	+	-			*		*	(X)
15	<i>Ciconia ciconia</i>	-	x	x	+	-	t	+			*			X, XXX
IV	ORD. ANSERIFORMES													
16	<i>Cygnus olor</i>	-	-	x	-	-	t	-			*			(X, XXX)
17	<i>Anser anser</i>	-	-	x	+	-	t	-			*			(X, XXX)
18	<i>Anas crecca</i>	-	-	x	-	-	t	-				*	*	(XX)
19	<i>Anas platyrhynchos</i>	-	x	x	-	-	t	-			*	*	*	XXX
20	<i>Anas acuta</i>	-	-	x	-	-	t	-					*	(XXX)
21	<i>Anas querquedula</i>	-	-	x	-	-	t	-			*		*	(XX)
22	<i>Anas clypeata</i>	-	-	x	-	-	t	-					*	(XXX)
23	<i>Aythya ferina</i>	-	-	x	-	-	t	-			*	*	*	(XXX)
24	<i>Aythya nyroca</i>	-	-	x	-	-	t	-			*		*	(XXX)
25	<i>Aythya fuligula</i>				-	-	t	-				*	*	(XXX)
26	<i>Mergus albellus</i>	-	-	x	-	-	t	-				*		(XXX)
V	ORD. ACCIPITRIFORMES													
27	<i>Circus aeruginosus</i>	-	-	x	+	-	t	-			*		*	(X)
28	<i>Accipiter gentilis</i>	-	-	x	+	t	+	-	*				*	(X)
29	<i>Accipiter nisus</i>	-	x	x	+	t	+	-				*	*	
30	<i>Accipiter brevipes</i>	-	-	x	+	t	+	-			*		*	
31	<i>Buteo buteo</i>	-	x	x	+	t	+	-	*			*	*	X
32	<i>Buteo rufinus</i>	-	-	x	t	-	-	-			*		*	(X)
VI	ORD. FALCONIFORMES													
33	<i>Falco tinnunculus</i>	x	x	x	+	+	+	+			*		*	XX
34	<i>Falco vespertinus</i>	-	-	x	+	t	+	-				*		
35	<i>Falco subbuteo</i>	-	?	x	+	t	+	-				*		
36	<i>Falco peregrinus</i>	-	-	x	+	t	+	-	*			*	*	(X)

VII	ORD. GALLIFORMES																	
37	<i>Perdix perdix</i>	?	x	x	t	-	-	-	*									XXX
38	<i>Coturnix coturnix</i>	-	x	x	t	-	-	-			*							
39	<i>Phasianus colchicus</i>	x	x	x	+	t	-	-	*									X
VIII	ORD. GRUIFORMES																	
40	<i>Rallus aquaticus</i>	-	-	x	-	-	t	-			*							
41	<i>Gallinula chloropus</i>	-	-	x	-	-	t	-		*		*	*					
42	<i>Fulica atra</i>	-	x	x	-	-	t	-		*		*	*					
IX	ORD. CHARADRIIFORMES																	
43	<i>Himantopus himantopus</i>	-	-	x	-	-	t	-			*							
44	<i>Recurvirostra avosetta</i>	-	-	x	-	-	t	-			*							
45	<i>Charadrius dubius</i>	-	-	x	-	-	t	-			*		*					
46	<i>Vanellus vanellus</i>	-	x	x	-	-	t	-			*		*					XX
47	<i>Calidris minuta</i>	-	-	x	-	-	t	-					*					
48	<i>Scolopax rusticola</i>	-	-	x	-	+	t	-					*					
49	<i>Philomachus pugnax</i>	-	-	x	-	-	t	-					*					
50	<i>Tringa ochropus</i>	-	-	x	-	-	t	-					*					
51	<i>Larus ridibundus</i>	-	x	x	-	-	t	+		*		*	*					
52	<i>Larus cachimans</i>	-	x	x	-	-	t	+	*				*					
53	<i>Larus canus</i>	-	-	x	-	-	t	-					*					
54	<i>Sterna caspia</i>	-	-	x	-	-	t	-					*					
55	<i>Chlidonias hybrida</i>	-	x	x	-	-	t	-			*		*					XX
56	<i>Chlidonias niger</i>	-	-	x	-	-	t	-			*		*					
57	<i>Chlidonias leucopterus</i>	-	-	x	-	-	t	-			*		*					
X	ORD. COLUMBIFORMES																	
58	<i>Columba livia domestica</i>	x	x	x	+	-	-	t	*				*					XXX
59	<i>Columba palumbus</i>	-	x	x	-	-	t	+					*					X, XXX
60	<i>Streptopelia decaocto</i>	x	x	x	+	+	t	-	*				*					X, XXX
61	<i>Streptopelia turtur</i>	-	-	x	+	+	t	-					*					
XI	ORD. CUCULIFORMES																	
62	<i>Cuculus canorus</i>	-	x	x	+	+	+	-			*							
XII	ORD. STRIGIFORMES																	
63	<i>Tyto alba</i>	-	-	x	+	t	-	+	*									
64	<i>Athene noctua</i>	-	x	x	+	t	-	+	*									
65	<i>Asio otus</i>	-	-	x	+	t	-	+	*									
66	<i>Strix aluco</i>	-	-	x	+	t	-	+	*									
XIII	ORD. CORACIIFORMES																	
67	<i>Alcedo atthis</i>	-	-	x	+	+	t	-		*		*						
68	<i>Coracias garrulus</i>	-	x	x	+	t	-	-			*							
69	<i>Merops apiaster</i>	-	-	x	+	t	-	-			*							
70	<i>Upupa epops</i>	x	x	x	+	t	-	-			*							
XIV	ORD. PICIFORMES																	
71	<i>Picus canus</i>	-	-	x	-	t	-	-	*									
72	<i>Picus viridis</i>	-	-	x	-	t	-	-	*									
73	<i>Dryocopus martius</i>	-	-	x	-	t	-	-	*									
74	<i>Dendrocopus major</i>	-	x	x	-	t	-	+	*									
75	<i>Dendrocopos syriacus</i>	-	x	x	-	t	-	+	*									
XV	ORD. PASSERIFORMES																	
76	<i>Galerida cristata</i>	-	x	x	t	-	-	-	*									
77	<i>Alauda arvensis</i>	-	x	x	t	-	-	-		*								
78	<i>Hirundo rustica</i>	x	x	x	+	+	+	t			*							XX
79	<i>Riparia riparia</i>	-	-	x	+	+	-	-			*							
80	<i>Delichon urbicum</i>	x	x	x	+	+	-	t			*							XX
81	<i>Anthus campestris</i>	x	x	x	t	-	-	-			*							
82	<i>Motacilla flava</i>	-	x	x	t	-	+	-			*							
83	<i>Motacilla alba</i>	-	x	x	+	+	+	+			*							
84	<i>Bombycilla garrulus</i>	-	-	x	-	t	-	-					*					
85	<i>Troglodytes troglodytes</i>	-	x	x	-	t	-	-		*			*					
86	<i>Prunella modularis</i>	-	-	x	-	t	-	-	*									
87	<i>Erithacus rubecula</i>	-	-	x	+	t	-	+			*		*					
88	<i>Luscinia luscinia</i>	-	x	x	+	t		+			*							
89	<i>Luscinia megarhynchos</i>	-	-	x	+	t		+			*							
90	<i>Phoenicurus phoenicurus</i>	-	-	x	-	t	-	+			*							
91	<i>Turdus merula</i>	-	x	x	+	t	-	+		*								
92	<i>Turdus pilaris</i>	-	x	x	-	t	-	+					*					XX
93	<i>Turdus philomelos</i>	-	-	-	+	t	-	-			*							
94	<i>Turdus viscivorus</i>	-	-	x	-	t	-	-		*								
95	<i>Locustella luscinioides</i>	-	-	x	+	-	t	-			*							
96	<i>Acrocephalus schoenobaenus</i>	-	-	x	+	-	t	-			*							
97	<i>Acrocephalus palustris</i>	-	-	x	+	-	t	-			*							
98	<i>Acrocephalus scirpaceus</i>	-	-	x	+	-	t	-			*							

99	<i>Acrocephalus arundinaceus</i>	-	-	x	+	-	t	-			*			
100	<i>Hippolais icterina</i>	-	x	x	+	t	-	+			*			
101	<i>Sylvia curruca</i>	-	-	x	+	t	-	+			*			
102	<i>Sylvia communis</i>	-	x	x	+	t	-	-			*			
103	<i>Sylvia borin</i>	-	-	x	+	t	-	-			*			
104	<i>Sylvia atricapilla</i>	-	-	x	+	t	-	-			*			
105	<i>Phylloscopus collybita</i>	-	x	x	+	t	-	-			*		*	
106	<i>Phylloscopus trochilus</i>	-	x	x	+	t	-	-			*			
107	<i>Muscicapa striata</i>	-	-	x	+	t	-	-			*			
108	<i>Ficedula albicollis</i>	-	-	x	-	t	-	-			*			
109	<i>Parus lugubris</i>	-	-	x	-	t	-	+	*					
110	<i>Parus ater</i>	-	-	x	-	t	-	+	*					
111	<i>Parus caeruleus</i>	-	x	x	-	t	-	+	*					
112	<i>Parus major</i>	x	x	x	+	t	-	+	*					
113	<i>Sitta europaea</i>	-	-	x	-	t	-	-	*					
114	<i>Certhia sp.</i>	-	-	x	-	t	-	-	*					
115	<i>Oriolus oriolus</i>	-	x	x	+	t	-	-			*			
116	<i>Lanius collurio</i>	x	x	x	+	t	-	-			*			
117	<i>Lanius minor</i>	x	x	x	+	t	-	-			*			
118	<i>Garrulus glandarius</i>	-	x	x	+	t	-	+	*					
119	<i>Pica pica</i>	x	x	x	+	t	-	+	*					X
120	<i>Corvus monedula</i>	x	x	x	+	t	-	+	*					XX
121	<i>Corvus frugilegus</i>	x	x	x	+	t	-	+	*					XXX
122	<i>Corvus cornix</i>	-	x	x	+	t	-	-	*					X
123	<i>Sturnus vulgaris</i>	x	x	x	+	t	-	+	*		*		*	XX
124	<i>Passer domesticus</i>	x	x	x	+	t	-	+	*					XX
125	<i>Passer hispaniolensis</i>	-	-	x	+	t	-	-			*			
126	<i>Passer montanus</i>	x	x	x	+	t	-	+	*					XX
127	<i>Fringilla montifringilla</i>	-	x	x	+	t	-	+					*	XX
128	<i>Fringilla coelebs</i>	-	x	x	+	t	-	+	*		*			XX
129	<i>Carduelis chloris</i>	-	x	x	+	t	-	+	*					XX
130	<i>Carduelis carduelis</i>	-	x	x	+	t	-	+	*					XX
131	<i>Carduelis spinus</i>	-	-	x	-	t	-	+					*	
132	<i>Carduelis cannabina</i>	-	-	x	-	t	-	-	*					
133	<i>Pyrrhula pyrrhula</i>	-	-	x	-	t	-	-					*	
134	<i>Coccothraustes coccothraustes</i>	-	-	x	-	t	-	-	*					
135	<i>Emberiza citrinella</i>	-	-	x	+	t	-	-	*					
136	<i>Emberiza hortulana</i>	-	-	x	t	+	-	-			*			
137	<i>Emberiza schoeniclus</i>	-	-	x	-	-	t	-			*		*	
138	<i>Emberiza calandra</i>	x	x	x	t	-	-	-	*					X

Legend:

Biotope/habitat I – The avifauna of grasslands and agroecosystems, **II** – The avifauna of woodlands (forests and shrubs), **III** – The avifauna of wetlands (aquatic avifauna), **IV** – The avifauna of the human settlements (synanthropic/anthropophilic); **t** = typical species (addicted to a type of biotope/habitat, through the feeding and nesting needs); + = accessory species (which use only the trophic resources given by the respective biotope, having a short, temporary presence).

Phenological type: R – resident; PM – partially; SV – summer visitors; WV – winter visitors; P – passage visitors.

Risk for traffic: X – large and/or medium-sized birds flying solitary or in small groups (2 - 5 individuals); XX – small or medium-sized birds flying in flocks (tens/hundreds of individuals); XXX – large or medium-sized birds flying in flocks, (...) – potential risk if airplanes fly at low altitude.

A synoptic picture of the avifauna groups identified by us in the biotopes within and in the proximity of the I. A. C., as well as the number of the species that may represent a risk factor for air traffic for each biotope is rendered in Fig. 2:

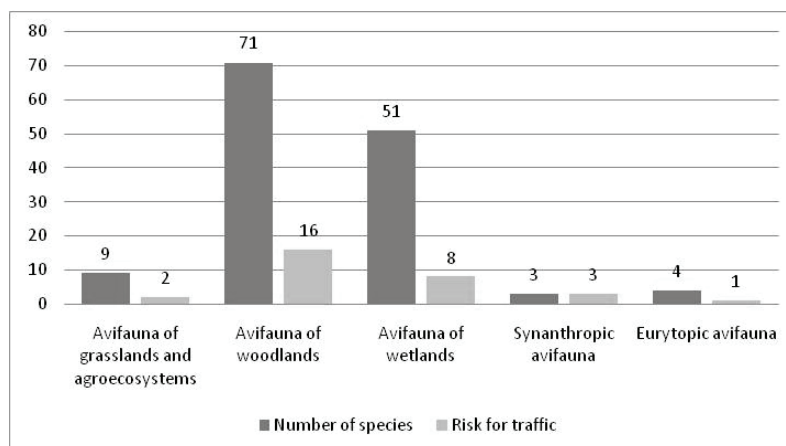


Figure 2. Graphic distribution of the bird species within the area of the I. A. C. (0-13 km), according to the habitat type and risk factor for air traffic.

It can be easily noticed that the best representation within the territory is held by the bird communities characteristic to forest biotopes (71 species), followed by aquatic and semiaquatic species (51 species) and by the ones specific to agroecosystems and seminatural or artificial grasslands (9 species); the most numerous threats related to air traffic come from the bird species typical of forests and shrubs, followed by aquatic and synanthropic species.

Details regarding the ecological situation of the aforementioned bird communities and their impact upon air traffic are further rendered.

1. Avifauna characteristic of agroecosystems and grasslands.

This avifauna is met either on the plots covered by agricultural crops or a rare and poor vegetation (xerophilic and xeromesophilic grasslands) with shrubs of dog-rose (*Rosa canina*), blackthorn (*Prunus spinosa*), European dewberry (*Rubus caesius*), etc. Such habitats can be found within the perimeter of the I.A.C. as well as in its adjacent surroundings and they have the greatest share within the studied territory. The avifauna specific to these habitats comprises 34 species, 9 of which are typical species and 25 are accessory species. Two of the typical species (*Anthus campestris* and *Emberiza calandra*) were signalled within the perimeter of the I. A. C; these and another 5 species (*Perdix perdix*, *Coturnix coturnix*, *Galerida cristata*, *Alauda arvensis* and *Motacilla flava*) were noticed in the immediate proximity of the airport (0-3 km), and another 2 species (*Buteo rufinus* and *Emberiza hortulana*) were reported only at a distance of over 5 km (Fig. 3).

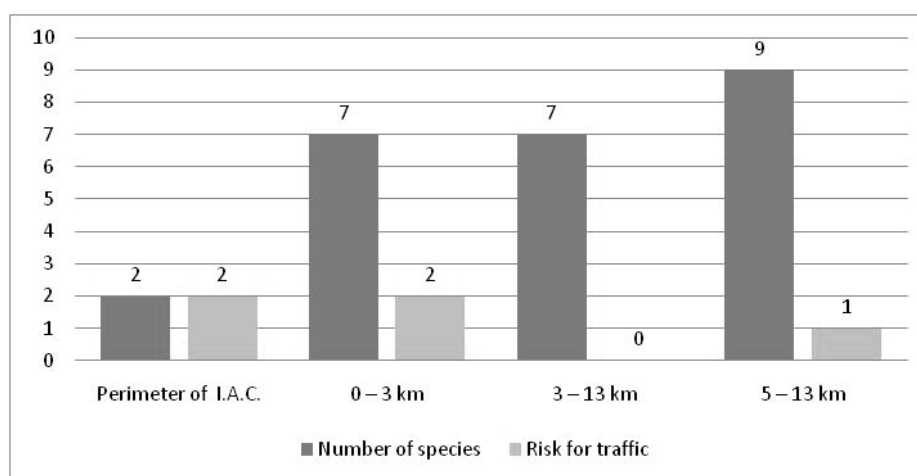


Figure 3. Graphical distribution of the bird species typical of the agroecosystems and grasslands from the area of the I. A. C. (0-13 km).

Of the 9 species typical of agroecosystems and semi-natural or artificial grasslands, *Perdix perdix* and *Emberiza calandra* pose a risk to aircraft due to the gregarious behaviour they manifest from autumn until spring, when they start breeding and flocks break up; if the altitude at which aircrafts flying at over 5 km from the I.A.C. is lower (i.e. approximately 500-1,000 m), *Buteo rufinus* represents a potential risk of collision due to the great flying height.

Most of the accessory species comes from the forest and shrub biotopes located in the areas adjacent to the I. A. C.; three are characteristic to the aquatic biotopes (*Ardea cinerea*, *Ciconia ciconia*, *Vanellus vanellus*) and one species (*Falco tinnunculus*) is eurytopic.

2. Avifauna characteristic of woodlands.

Within the analysed territory, the most important surfaces covered by forest vegetation, both as area and floristic value, are represented by the forests located in the suburbs of Craiova (Pîrșani, Șimnicu de Sus, Șimnicu de Jos, etc.) and the so-called "green spaces" from the urban area – "Nicolae Romanescu" Park (about 96 ha), "Tineretului" Park (about 51 ha), "Cornițoiu" Park (about 25 ha), the Botanical Garden "Al. Buia" (about 17 ha) - CIOBOTEA et al., 1999. The distance between these forested surfaces and the I. A. C. is over 5-7 km.

The closest areas covered by woody vegetation are the ones located in the western and south-western vicinity of the airport track, respectively inside the former military unit, and, little westwards, the recreation area "Hanul Doctorului" (Doctor's Inn). The vegetal associations present in these areas (trees and spontaneous or acclimatized shrubs, unmowed vegetation) developed and extended sufficiently enough to attract a quite varied specific fauna. The vegetal formations from the forests are vertically arranged (trees with a rich canopy, shrubs and herbaceous layer), so that, within forest ecosystems, birds have a wider variety of habitats, and, consequently, greater possibilities of feeding and nesting, as it follows:

- forest preferred by different species, such as: *Buteo buteo*, *Falco* sp., *Asio otus*, *Columba palumbus*, *Dendrocopos* sp., *Picus* sp., *Upupa epops*, *Certhia* sp., *Sitta europaea*, *Garrulus glandarius*, *Pica pica*, *Corvus frugilegus*, etc.;
- deciduous forest undergrowth, clearings, forest edges, orchards, coppices are nesting sites for many Passeriformes: *Erithacus rubecula*, *Luscinia* sp., *Sylvia* sp., *Hippolais* sp., *Ficedula* sp., *Muscicapa striata*, *Emberiza citrinella*, etc.
- bushes and isolated trees represent nesting places for *Lanius* sp., *Corvus cornix*, etc.

Consequently, the structure of the forest and shrub avifauna is a more complex one both as number of typical species and number of individuals, which is higher than in other biotopes. On the whole, within the forest areas studied by us, we identified 78 species, 71 of them being typical, while the rest comes from the avifauna of the other biotopes.

From the phenological point of view, in the community of forest and shrub birds, there is an almost equal rapport between sedentary/sedentary-migratory species and migratory species (summer visitors). There are 5 species that nest in the forests from higher altitudes (mountain forests) and populate the forested surfaces from our study area as winter visitors (*Accipiter nisus*, *Bombycilla garrulus*, *Turdus pilaris*, *Fringilla montifringilla*, *Carduelis spinus*). Although they have a temporary presence induced by the search for food resources during the cold season, we shall not consider them as accessory species to the forest and shrub biotopes from the areas adjacent to the I. A. C, but we shall analyse them as typical species having the same morphological and physiological adaptations.

Of the 71 species specific to the forest surfaces from the adjacent area of the I. A. C., it can be noticed that 12 bird species (*Phasianus colchicus*, *Streptopelia decaocto*, *Upupa epops*, *Parus major*, *Lanius collurio*, *L. minor*, *Pica pica*, *Corvus frugilegus*, *C. monedula*, *Sturnus vulgaris*, *Passer montanus*, *P. domesticus*) were reported within the perimeter of the airport, where they were in search for food. The same species together with other 23 species were reported in the area located in the immediate proximity of the airport (0-3 km), while the rest of the species appeared at more than 3 km away from the airport (Fig. 4).

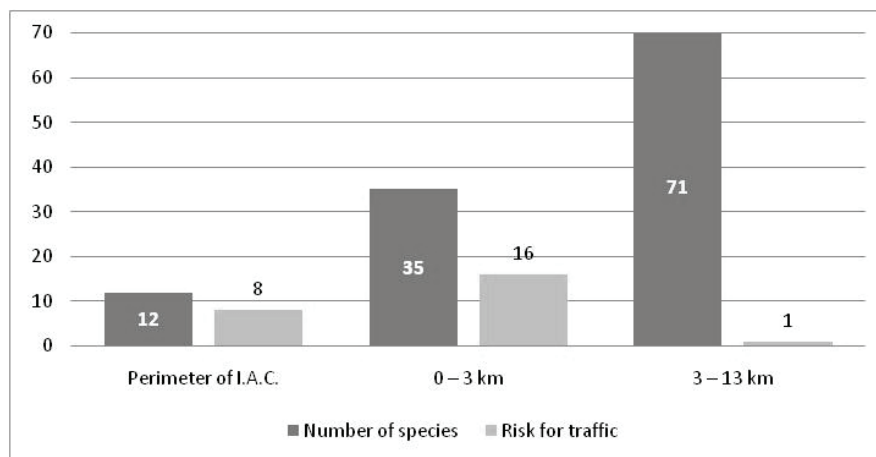


Figure 4. Graphical distribution of the bird species typical of the woodland ecosystems (forests and shrubs) from the area of the I. A. C. (0-13 km).

With regard to the risk for air traffic, we estimate that maximum 16 of the species characteristic to studied forest areas may represent a threat to the aircraft safety. It is about the large-sized species that fly high or the species with gregarious behaviour that live within or in the immediate proximity of the airport (0-3 km): *Phasianus colchicus*, *Buteo buteo*, *Columba palumbus*, *Streptopelia decaocto*, *Turdus pilaris*, *Pica pica*, *Corvus frugilegus*, *C. cornix*, *C. monedula*, *Sturnus vulgaris*, *Passer montanus*, *P. domesticus*, *Fringilla montifringilla*, *F. coelebs*, *Carduelis chloris*, *C. carduelis*.

Another 3 species, such as *Ciconia nigra*, *Accipiter gentilis* and *Falco peregrinus* may represent a potential risk factor because they soar at great height, even if they were reported rarely and at great distance from the I. A. C. This risk appears only if airplanes fly at low altitude (below 500-1,000 m) for more than 5 km from the airport.

The accessory species that use the trophic resources offered by the surfaces covered by a rich forest vegetation in the study area belong to many ecological categories: three species are eurytopic (*Falco tinnunculus*, *Cuculus canorus*, *Motacilla alba*), two come from the anthropogenic biotope (*Hirundo rustica* and *Delichon urbicum*), one species belong to greenswards (*Emberiza hortulana*) and another one is an aquatic species (*Alcedo atthis*).

3. Aquatic avifauna from the areas adjacent to the I. A. C. (0-13 km.).

The most significant and attractive wetlands for avifauna are located outside the municipality of Craiova: Preajba – Făcăi Lacustrine Complex (5-7.5 km south-south-west of the I. A. C.), the Jiu River and floodplain (9-11 km and 11-13 km south-west of the I. A. C.); there are also some wetlands inside the city: Craiovița Pool (5-7 km south-west of I. A. C.), Șerca Pool from "Tineretului" Park (7-9 km west of I. A. C.).

In the areas located in the proximity of the I. A. C., less than 3-5 km, there are other permanent or temporary aquatic surfaces (pools, brooks, swampy and/or flooded areas), but their surface or avifaunistic value is insignificant i.e. Ghercești Pool/Valley, Cârcea Pool.

The main biotopes/habitats from wetlands are:

- paludous aquatic vegetation (bulrush, reed), populated by water rail, rail and moorhen (Ord. Gruiformes.), some species of Passeriformes (warblers - *Acrocephalus* sp., common reed bunting - *Emberiza schoeniclus*), and among the birds of prey, we mention the marsh harrier - *Circus aeruginosus*;
- the shore and bank areas, preferred by limicolous species (Ord. Charadriiformes), are often visited by herons and egrets (Ord. Ciconiiformes) and by the white wagtail (*Motacilla alba*) belonging to Passeriformes;

- the water surface / the proper aquatic environment, populated by grebes (*Podiceps*), ducks (*Anas*, *Aythya*), gulls (*Larus*), terns (*Sterna*) and marsh terns (*Chlidonias*);
- the swampy fields and hydrophilous meadows, populated by certain waders species (*Vanellus vanellus*), greylag goose (*Anser anser*), some ducks (*Anas*), etc.;
- the coppices, preferred by the woodcock (*Scolopax rusticola*);
- the steep shore, nesting places for the common kingfisher (*Alcedo atthis*) and the sand martin (*Riparia riparia*).

The composition of the aquatic avifauna identified by us is very different according to the season; consequently, we shall take into account both nesting and possible nesting aquatic species (sedentary, partially migratory species and summer visitors) and the non-breeding aquatic species (passage species and/or winter visitors). In case of the last ones, even if they have a temporary presence induced by feeding needs during the spring-autumn migrations or in winter, we shall not consider them as accessory species, but they will be analysed as typical species having the same morphological and physiological adaptations. The total number of species reported within the wetlands from the studied perimeter is 65, 51 of them being typical aquatic species and 14 accessory species.

From the phenological point of view, within the community of aquatic nesting birds, there predominate the summer visitors, followed by the partially migratory species and, then, sedentary species.

With regard to the distribution, it can be noticed that only one aquatic species was reported within the perimeter of the I. A. C., namely *Ardea cinerea*. This species together with 7 other species (*Egretta garzetta*, *Ciconia ciconia*, *Anas platyrhynchos*, *Vanellus vanellus*, *Larus ridibundus*, *L. cachinnans*, *Chlidonias hybrida*) were reported in the area located in the immediate proximity of the airport (0-3 km), while the rest of the species were reported at more than 3 km from the airport (Fig. 5).

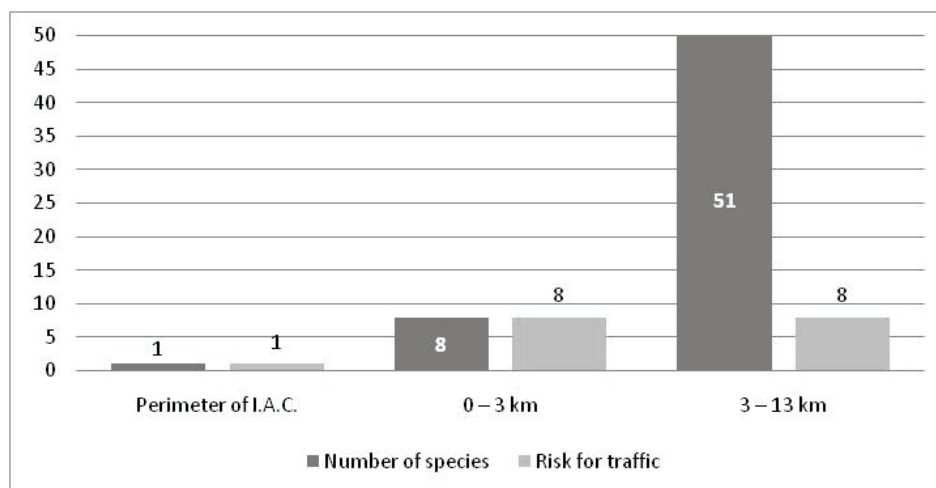


Figure 5. Graphical distribution of the bird species typical of the wetlands from the area of the I. A. C. (0-13 km).

All the species reported in the neighbourhood of the I. A. C. may represent a risk factor for air traffic as they are mostly large-sized species or manifest a gregarious behaviour, flying in flocks that may put in danger the safety of airplanes that take off or land.

The species *Cygnus olor*, *Anser anser*, *Circus aeruginosus*, *Phalacrocorax* sp., different anserine species (*Anas* sp., *Aythya* sp., *Mergus* sp.), as well as other non-nesting aquatic species, mostly distributed in wetlands located at more than 5-7 km from the airport, may also represent a risk factor as they fly in flocks at great height, but only in case the airplanes getting close to the airport, less than 5 km, fly at low altitude, below 1,000-2,000 m.

The accessory species that visit the wetland biotopes are mostly woodland species (*Ciconia nigra*, *Accipiter* sp., *Buteo buteo*, *Falco* sp.), some are eurytopic species and only one species is synanthropic.

4. Synanthropic/strictly anthropophilic avifauna

Human settlements (rural and urban) are spaces entirely modified by people. From the avifauna viewpoint, these habitats are heterogeneous being populated less by synanthropic species, dependent on the anthropogenic environment through their nesting needs, and more by numerous species that come from other biotopes (accessory species). The factors that trigger the composition of the anthropophilic avifauna are: optimum nesting places; diversity and availability of the trophic resources; safety from predators.

All strictly synanthropic species that populate the perimeter of the I. A. C. and its immediate proximities (*Columba livia domestica*, *Hirundo rustica*, *Delichon urbicum*) may represent a risk factor for air traffic as they fly rapidly during daytime, in flocks that may put in danger the safety of the airplanes that take off or land (Fig. 6).

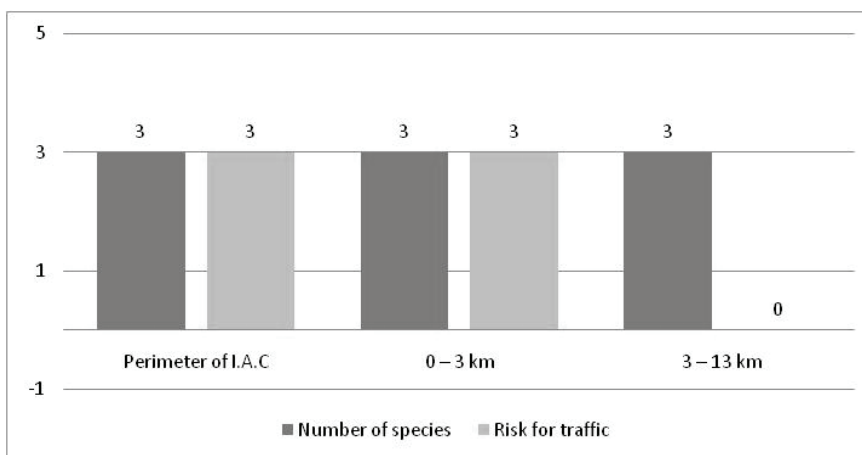


Figure 6. Graphical distribution of the synanthropic bird species from the area of the I. A. C. (0-13 km).

Most of the accessory species from the anthropogenic environment are forest species, two of them are aquatic species (*Ciconia ciconia* and *Larus cachinnans*) and one species is eurytopic (*Falco tinnunculus*). These accessory species became synanthropic as they easily adapted to living within human settlements; they build their nest in different locations, such as: constructions (high voltage pylons, bridges, eaves, cracks in walls) and trees located in the vicinity of human settlements and, sometimes, they even use the trophic resources resulted from human activities.

5. **Eurytopic avifauna includes widespread species**, nesting in diverse biotopes, at different distances from the airport: *Falco tinnunculus*, *Cuculus canorus*, *Motacilla alba*, *Riparia riparia*. The only eurytopic species that may represent a risk factor for air traffic is the common kestrel that soars and uses warm air currents, rising with them at a great distance from the ground. It was often seen while searching the open lands from a viewpoint (i.e. pillars of the fences surrounding the airport) or when overflying the ground, at heights of 10-20 m, executing episodic stationary observation flights for identifying potential prey.

CONCLUSIONS

Within the studied biotopes, located in the proximity of the I. A. C., up to a distance of 13 km, we identified 138 bird species belonging to 18 systematic orders and distributed, according to the specific biotopes, as it follows: 9 species are typical of grassland and agroecosystem habitats, 71 species are typical of woodlands (forest and shrubs), 51 species are typical of aquatic areas, 3 species are synanthropic (dependent on human settlements) and 4 species are eurytopic, relatively uniformly distributed in many biotopes.

- Of the 9 species typical of grassland and agroecosystem habitats, two species may represent a risk factor for air traffic, namely *Perdix perdix* and *Emberiza calandra* because of their gregarious behaviour manifested from autumn until spring; *Buteo rufinus*, reported at a great distance from the airport (more than 5 km) may also trigger a potential risk of collision as it soars at great height.
- Of the 71 species typical of woodlands (forests and shrubs), maximum 16 may represent a danger for aircraft safety. It is about the large-sized species that fly high or about the species characterized by a gregarious behaviour that permanently live within the airport or in immediate proximity (0-3 km): *Phasianus colchicus*, *Buteo buteo*, *Columba palumbus*, *Streptopelia decaocto*, *Turdus pilaris*, *Pica pica*, *Corvus frugilegus*, *C. cornix*, *C. monedula*, *Sturnus vulgaris*, *Passer montanus*, *P. domesticus*, *Fringilla montifringilla*, *F. coelebs*, *Carduelis chloris*, *C. carduelis*. Other 3 species, such as *Ciconia nigra*, *Accipiter gentilis* and *Falco peregrinus* may represent a potential risk as they soar at great height, even if they were reported at a greater distance from the I. A. C. (more than 3-5 km). This risk appears only if the airplanes getting close to the airport, less than 5 km, fly at low altitude, below 500 m-1,000 m.
- Of the 51 species typical of wetlands, 8 species (*Egretta garzetta*, *Ardea cinerea*, *Ciconia ciconia*, *Anas platyrhynchos*, *Vanellus vanellus*, *Larus ridibundus*, *L. cachinnans*, *Chlidonias hybrida*) reported in the area located in the immediate proximity of the airport (0-3 km) may represent a risk factor for the aircraft safety as they are mostly large-sized birds that fly at great height or manifest a gregarious behaviour, flying in flocks, putting in danger the safety of the airplanes that take off or land. Other 14 species, such as *Cygnus olor*, *Anser anser*, *Circus aeruginosus*, *Phalacrocorax* sp., different duck species (*Anas* sp., *Aythya* sp.) may represent a risk factor because they fly at great height, even if they were reported at greater distance from the airport (more than 5-7 km). This risk appears only if the airplanes getting close to the airport, less than 5 km, fly at low altitude, below 1,000 m-2,000 m.
- All the 3 strictly synanthropic species (*Columba livia domestica*, *Hirundo rustica*, *Delichon urbicum*) that populate the perimeter of the I. A. C. and its neighbourhoods may threaten the safety of aircraft that take off or land as they fly rapidly, in flocks during daytime.
- Of the eurytopic species, only one (*Falco tinnunculus*) may represent a risk factor for airplanes as it soars and uses warm air currents, rising with them at a great distance from the ground.

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