

EVALUATION OF THE ORNITHOLOGICAL IMPORTANCE OF THE WESTERN COASTAL REGION OF THE EVROS DELTA WITH SPECIAL REFERENCE TO THE ECOLOGY OF CHARADRIIFORMES (AVES)

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Introduction

The Evros delta is still today a wetland with special importance due to the uniqueness of its biotops (BRITTON et al. 1978, BABALONAS 1979) and to a very rich avifauna (BAUER MULLER 1969).

During the research which took place in the past and at the consequent propositions for the Evros delta conservation (BAUER BROSIUS 1965, HOFFMANN et al. 1971, BRITTON et al. 1978), it became clear that the western coastal region of the delta was not studied and its importance as a part of the Evros delta ecosystem was sorrowfully omitted.

After our first mention to this area in previous studies, which dealt mostly with the breeding season (GOUTNER 1983a, b), we shall present some new data collected from 1979-1983, also including winter field observations.

Study area

1. Coastal region

The study area extended at the western coastal region of the Evros delta from the lagoon «Laki» to the site «Karamanos». (Fig. 1). The region further western (at a distance of about 3 km) was of less importance so this was excluded from the present study.

Of special importance were the supralittoral and the midlittoral zones of the region. At these zones, the deposition of the material brought by the Evros river is evident. A result of this deposition is the shallowness of the sea and the formation of sand reefs (GOUTNER 1983a). The effect of the tidal cycle, though not strong, is characteristic due to the shallowness mentioned: at low waters,

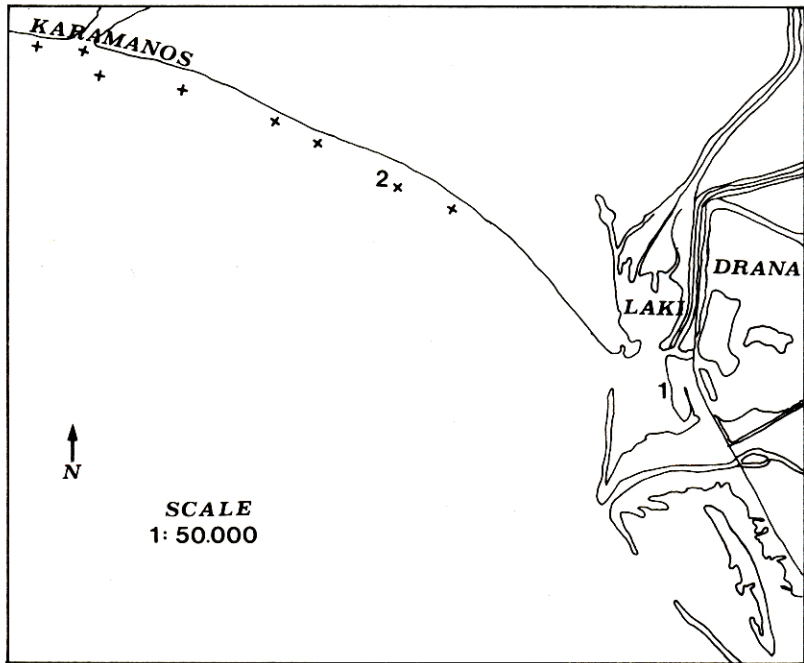


Fig. 1. Map of the western coastal region of the Evros delta. The position of the most important sand reefs is noted (+). 1 & 2: food sampling areas.

especially during N-NE winds, large parts of the midlittoral zone appear and sand reefs, as well. At high waters, especially when prevail S-SW winds, this zone is covered and only when the winds are not strong a few sand reefs remain uncovered. The position and extension of the sand reefs changed through years due to wave action. The largest ones are up to 100 m long and lie 50-300 m far from the coast.

The coast is sandy and level at its greatest part but close to «Laki», there are low sand dunes stabilized by ammophile plants like *Elymus giganteus ssp. sabulosus* (Tzvelev), *Agropyrum junceum ssp. mediterraneum* (Sim. & Guin.), *Phragmites communis* (Trin.) and *Tamarix spp.* At more muddy sites, there are species like *Salicornia europaea* (L.), *Cakile maritima* (Scop.), *Chenopodium album* (L.), *Suaeda spp.* etc, whereas *Juncus acutus* (L.) dominates at the upper parts of the coast (BABALONAS 1979, 1980).

2. Broader region

The plain extending northern of the coast is mainly covered by *Juncus spp.*

and various Poaceae and Fabaceae (BABALONAS 1979) thus constituting fields of intensive grazing by herds. However, even at a distance of 2-3 km far from the coast, there are extensive areas with very salty soil where only halophytes *Halocnemum strobilaceum* (Biedb.) exist. The salting of the ground at so long a distance from the coast is due to the entering of the sea water deeply in the mainland from the site «Karamanos». These areas are flooded in winter by rain water (evaporating in the summer) and form mudflats whose importance as feeding areas of the waders in delta has been already indicated (GOUTNER 1983a,b).

Detailed analysis of the plant associations of the study area is given in BABALONAS (1979, 1980, 1981).

Materials and Methods

To evaluate the use of the region by Charadriiformes, we made frequent visits at the area and counted the birds using binoculars and telescope, walking along the coast from W to E. For the birds of other taxa we simply noted their presence at each visit. Birds observed in the open sea (*Anas* spp., *Puffinus puffinus* Brün. etc), were not counted.

In December 1983, about 50 hours of observation were spent for checking the feeding activity patterns of the waders present: the birds were counted and the part of the population feeding noted. Feeding rates were measured according to GOSS-CUSTARD (1970, 1973) but only for oystercatchers (*Haematopus ostralegus* L.) because it was impossible to approach the other birds at appropriate observation distance due to the nature of the terrain and because the birds were very frightened by discriminate shooting by hunters.

The species composition of the organisms available to the birds were examined at intervals by substrate sampling at the feeding sites following methods described by GOSS-CUSTARD (1970) and HEPPLESTON (1971), details given in GOUNTER (1983a). For comparison of food availability between the feeding sites of the estuarine and study area, quantitative sampling took place in April 1980 at two representative feeding sites (1 and 2 in Fig. 1). Method is fully described in GOUTNER (1983a).

Results

1. Charadriiformes

a. Charadrii

(i) Numbers

Good numbers of waders were observed in winter and during migration (Table 1). Of the species stated, all but *Tringa glareola* (L.) were encountered

TABLE I
Maximum numbers of waders observed on the
sand reefs during migration

	Month	Year	N (max)	±
<i>Haematopus ostralegus</i>	December	1983	205*	5
<i>Pluvialis squatarola</i>	March	1981	300*	15
<i>Arenaria interpres</i>	May	1981	100	5
<i>Calidris alpina</i>	May	1982	300	20
<i>Calidris alba</i>	May	1982	250	15
<i>Philomachus pugnax</i>	March	1980	156	5
<i>Tringa glareola</i>	May	1983	215	10
<i>Limosa limosa</i>	March	1980	134	5
<i>Numenius arquata</i>	March	1980	200*	10

*Wintering.

mostly at the sand reefs. *Tringa glareola*—and frequently *Calidris spp.* and other *Tringa spp.*—gathered at the inland mudflats mentioned above. The preference of the sand reefs was due to their isolation providing important resting (Phot. 1) and feeding (see below) places for the birds. Never did we see waders resting at the main body of the coast where the disturbance by human activities (grazing, automobiles, hunters) is continuous.



Photograph 1. Part of an oystercatcher flock resting on a sand reef.

(ii) Feeding

In winter, the most abundant waders were oystercatchers (*Haematopus ostralegus* L.), curlews (*Numenius arquata* L.), grey plovers (*Pluvialis squatarola* L.), dunlins (*Calidris alpina* L.) and sanderlings (*Calidris alba* L.). The two *Calidris spp.* formed mixed flocks consisting of about 80% dunlins and 20% sanderlings. We included them in one category (*Calidris spp.*) for facilitation during counts. There were also other waders present like *Tringa totanus* (L.), *Limosa limosa* (L.) and *Charadrius alexandrinus* (L.), but their numbers were small in relation to the above mentioned species so no similar counts were made.

The data on feeding activities were separated in two periods (Table 2) ac-

TABLE 2
 Percentage of four wader species population feeding
 at the sand reef sites in December 1983.
 Data for all sites during the two
 periods compiled.

	Period 1*		Period 2*	
	Range	Mean	Range	Mean
<i>Haematopus ostralegus</i>	19.6–86.7	28.5	11.1–77.8	61.0
<i>Numenius arquata</i>	4.1–52.9	22.4	0.0–80.8	16.2
<i>Pluvialis squatarola</i>	9.8–77.4	35.7	15.4–58.5	40.5
<i>Calidris spp.</i>	12.3–83.5	39.5	13.5–89.2	60.2

*8.30–12.30.

**12.30–16.30

According to the tide periodicity. As the tide rises at about 12.30, a part of the feeding grounds becomes unavailable to the birds. The waders fed at the peripheries of the sand reefs in a water depth no more than their feet length. Lack of feeding on the main bodies of the sand reefs is rather attributed to unavailability of food (see Table 6, B-1). They also fed at the upper parts of the midlittoral zone in water of the depth mentioned above. According to the data (Table 2), an important part of the population fed during both periods (which covered the largest part of the daylight period). It was clear that, at least oystercatchers and *Calidris spp.*, fed more intensively during period 2 (also see Fig. 2), whereas similar feeding effort was displayed by grey plovers in both

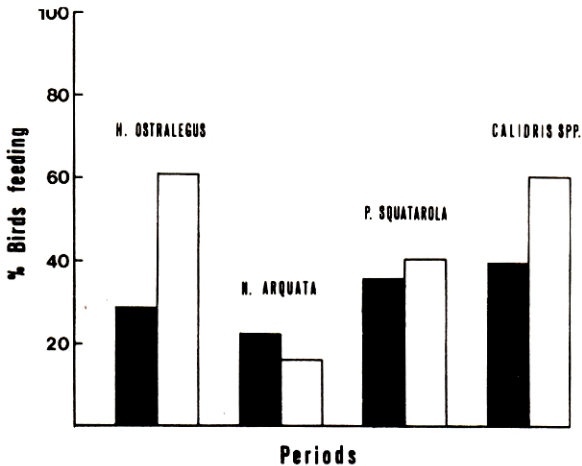


Fig. 2. Percentage mean values of four wader species population feeding at the sand reef sites during periods 08.30-12.30 (closed columns) and 12.30-16.30 (open columns).

periods. The curlew feeding patterns were rather irregular attributed to the frequent disturbance by hunters and consequent movements of these shy birds.

The rising of the tides did not appear to affect the bird feeding during the periods 2 but we must note that only a part of the sand reefs was covered during observation periods which were almost windless.

The study area appeared to have special importance for feeding of the waders mentioned, as they were excluded from the mudflats because of hunting. Measurement of feeding rate in oystercatchers indicated noticeable feeding effort although the feeding success was relatively small (Table 3). Of the foods received, annelids appeared to be prey of great importance (Tables 4

TABLE 3
Feeding rate of oystercatchers
(pecks/min) in December
1983 (n=26)

	Pecks	Successful pecks
\bar{x}	12.38	1.00
S.D.	7.17	0.83
Range	3-33	0-3
Total	322	26 (8.1%)

TABLE 4
Foods taken by oystercatchers
in winters of 1982 and 1983.
Data compiled

Prey taken	%on total received
Annelida	26.9
<i>Ensis</i> spp.	11.5
Other bivalves	7.7
Unidentified	53.9
Total items	260

TABLE 5
Fauna composition from substrate samples
at the sand reef sites

Annelida	Bivalvia
<i>Sigalion mathildae</i>	<i>Donax trunculus</i>
<i>Nephtys hombergii</i>	<i>Tellina tenuis</i>
<i>Glycera convoluta</i>	
<i>Aricia</i> spp.	
<i>Owenia</i> spp.	
Nemertina	

and 5), whereas *Ensis* spp. and «other bivalves» received (*Cerastoderma* spp., *Cardium* spp.) were in all cases dead and open, laid aside to the sand reefs by wave action. The use of dead prey by the birds may be an indication of small food availability, but the birds were unable to exploit the estuarine areas, where the food is more abundant (Table 6), because of shooting pressure. The uniden-

TABLE 6
Comparison of numbers of organisms, found in the samples,
between the estuarine region (A) and the sand reefs (B)
(April 1980)

	A			B		
	1	2	3	1	2	3
Bivalvia	71	32	35	—	37	30
Amphipoda	156	157	81	—	—	—
Decapoda	—	—	2	—	—	—
Annelida	71	69	108	—	5	6

1:: Samples taken away of the water. 2: Samples from the waterside, 3: Samples from water-depth about 10 cm. The numbers represent the total of organisms found in 30 sample cores.

tified prey might include the very small but abundant bivalves *Tellina tenuis* (Da Costa) (large axis measurements: $x = 14,0 \pm 2,3$ (S.D. mm $n=69$). No gut contents were examined in the present study to evaluate the importance of the last mentioned bivalve as food.

b. Lari

Large numbers of Lari were observed along the sand reefs mostly in winter and during migration. The species of gulls encountered were the herring gull (*Larus argentatus* Pont.), black-headed gull (*L. ridibundus* L.) little gull (*L. minutus* Pallas), mediterranean gull (*L. melanocephalus* Tem.) and slender-billed gull (*L. genei* Brème). Among these species, the herring gulls occasionally used parts of the coast for roosting in spring and summer, whereas all of the other species the whole region for feeding. Large congregations of the only wintering tern of the delta (sandwich tern, *Sterna sadvicensis* Latham), were observed at the most isolated sand reefs (Fig. 3). Flocks of the above mentioned species distributed further western at the region.

2. Other birds

The bird species encountered in the study area are in the Appendix. A total of 110 species and 9 more genus were identified and this list is to be further completed. Of these birds, 7 species are threatened with extinction from Greece and 29 from Europe (according to list by KANELIS 1977).

The study area appears to be very important for wintering of Passeriformes, and each of the mixed flocks of Fringillidae encountered, included up to 1000 birds. Consequently, the area is important hunting region for birds of prey, especially in winter.

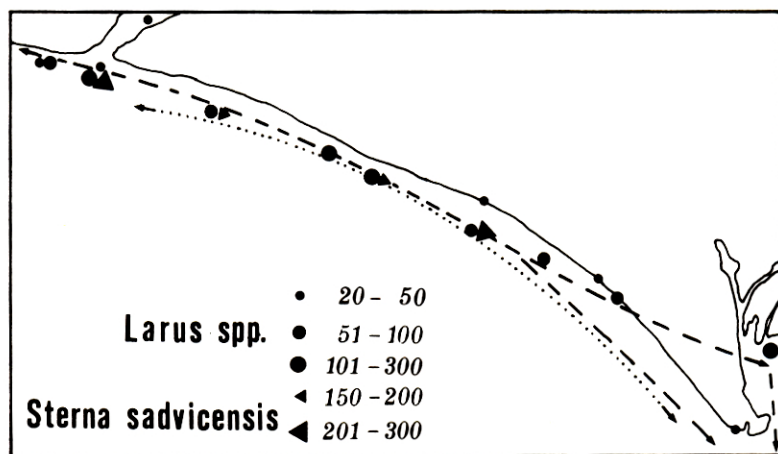


Fig. 3. Numbers and main sites of Lari congregations. Broken line: main routes of *Larus spp.* Stippled line: routes of *St. sadvicensis*.

Discussion

In previous study we indicated that good numbers and great species variety of waders prefer the western coastal region of the delta during migration and some of them are encountered there almost exclusively (GOUTNER 1983b). From the present study it appears that the region is of importance for the waders also during the winter, especially because of lack of sufficient feeding and resting sites due to disturbance by hunting. The only available resting sites for the wintering birds are the sanctuaries (Drana and Palukia), so the western coastal region is twice more important. The presence of undisturbed sites for the preservation of waterfowl at hunting areas in winter has been clearly indicated in LAMPIO (1980).

Although the data on the feeding patterns of the wintering waders of the region are still inconclusive, it appeared that the areas are important feeding sites during daylight, at least when the sand reefs remain uncovered by sea water.

Among the Lari observed at the region, *Larus melanocephalus*, *L. genei* and *Sterna sadvicensis* are threatened with extinction in Europe (KANELLIS 1977). Thus, it is clear the importance of preserving their populations at the wintering grounds. For the Evros delta, this is of special importance considering that *L. melanocephalus* started breeding successfully in recent years and also *St. sadvicensis* bred spatially (GOUTNER 1983c, GOUTNER KATTOULAS 1984).

Furthermore, the great variety of bird species encountered indicates that the region is an unseparated part of the Evros delta ecosystem and, at least the supralittoral and midlittoral zones, must be included in the nature reserve proposed, preserved against any kind of industrial activity.

Acknowledgements

Dr. A. Koukouras, H. Hindiroglou, K. Dounas, T. Kevrekidis and S. Galinou helped at the identification of the marine organisms. Sotiris Goutner helped very much at the field visits.

Dr. A. Koukouras and Dr. D. Babalonas made useful comments on the manuscript. We express our thanks to the above mentioned persons for their collaboration.

Summary

Important bird activity was observed at the western coastal region of the Evros delta. A total of 110 bird species and 9 more genus were identified (36 threatened).

The region was for special importance for Charadriiformes. Good numbers of 9 charadrii species (*Haematopus ostralegus*, *Pluvialis squatarola*, *Arenaria interpres*, *Calidris alpina*, *Calidris alba*, *Philomachus pugnax*, *Tringa glareola*, *Limosa limosa*, *Numenius arquata*) were observed during migration and/or wintering. The winter feeding activity of five of these species (*H. ostralegus*, *P. squatarola*, *Calidris spp.*, *N. arquata*), was almost continuous during daylight periods and did not appear to be affected by the weak tide action of the region. In winter, the oystercatchers fed mainly on annelid worms and bivalves which were the only available preys at the feeding grounds.

Large numbers of Lari were observed at the region. Five gull species (*Larus argentatus*, *L. ridibundus*, *L. minutus*, *L. melanocephalus*, and *L. genei*) and one tern species (*Sterna sadvicensis*) were observed, using the area for feeding and roosting, mainly in winter and during migration.

The higher activity of Charadriiformes was observed at the sand reef sites of the midlittoral zone and, at least this zone and also the supralittoral one, must be included in the nature reserve already proposed.

Περίληψη

Σημαντική δραστηριότητα πουλιών παρατηρήθηκε στα δυτικά παράλια του δέλτα του Έβρου. Συνολικά προσδιορίστηκαν 110 είδη και 9 γένη πουλιών από τα όποια τα 36 απειλούνται με άφανισμό.

Η περιοχή έχει ιδιαίτερη σημασία για τα πουλιά της τάξης Charadriiformes. Παρατηρήσαμε σημαντικούς αριθμούς πουλιών, που ανήκουν σε 9 είδη της υποτάξης Charadrii, κατά τη μετανάστευση και/ή το ξεχειμώνασμα: *Haematopus ostralegus*, *Pluvialis squatarola*, *Arenaria interpres*, *Calidris alpina*, *Calidris alba*, *Philomachus pugnax*, *Tringa glareola*, *Limosa limosa* και *Numenius arquata*.

Η τροφική δραστηριότητα, κατά το χειμώνα, σε πέντε απ' αυτά τα είδη (*H. ostralegus*, *P. squatarola*, *Calidris spp.* και *N. arquata*), ήταν σχεδόν συνεχής κατά τη διάρκεια της μέρας και δέ φάνηκε να επηρεάζεται από τις άσθενεις παλίρροιες της περιοχής. Κατά το χειμώνα οι στρειδοφάγοι τρέφονταν κυρίως με πολύχαιτους και δίθυρα που ήταν οι μόνες διαθέσιμες τροφές στις περιοχές διατροφής.

Μεγάλοι αριθμοί πουλιών της υποτάξης Larī παρατηρήθηκαν στην περιοχή. Πέντε είδη γλάρων (*Larus argentatus*, *L. ridibundus*, *L. minutus*, *L. melanocephalus* και *L. genei*) και ένα είδος γλαρονιού (*Sterna sadvicensis*) που χρησιμοποιούσαν την περιοχή, κυρίως κατά τη μετανάστευση και το ξεχειμώνασμα, για ανάπαυση και διατροφή.

Η σημαντικότερη δραστηριότητα των Charadriiformes παρατηρήθηκε στους άμμουφαλους (ξέρες) της μεσοπαράλιας ζώνης και, τουλάχιστο αυτή η ζώνη καθώς και η παραλιακή, πρέπει να περιληφτούν στην προστατευόμενη ζώνη που έχει ήδη προταθεί.

REFERENCES

- BABALONAS, D. 1979. Pflanzensoziologisches studium der vegetation des Ewros delta (Aenision delta). *Thesis. Univ. Thessaloniki, (Greece)*.
- BABALONAS, D. 1980. Vegetationseinheiten und vegetationskartierung in dem mündungsgebiet des fluesses Evros. *Feddes Repertorium*, **91**: 615-627.
- BABALONAS, D. 1981. Floristischer katalog des mündungsgebiets des Evros. *Candollea*, **36**: 251-269.
- BAUER, W. BROSIUS, F. 1965. The protection of nature and animals in Greece. *To Vouno*, **240/241**: 53-58 (in Greek).
- BAUER, W. MULLER, G. 1969. Zur avifauna des Ewros delta. *Beitr. Naturk. Forsch. Südwest. Dtl.*, **28**: 33-51.
- BRITTON, R.H., HAFNER, H., MORGAN, N.C., CAMPREDON, P., TAMISIER, A., LASSERRE, G., EGGERS, H., MULLER, G., HALLMANN, B. 1978. Proposals for nature conservation in the Evros delta. *Unpublished report, Min. of Coord. Athens*, 66 p.
- GOSS-CUSTARD, J.D. 1973. Current problems in studying the feeding ecology of estuarine birds. their prey. *J. Anim. Ecol.*, **39**: 91-113.
- GOSS-GUSTARD, J.D. 1973. Current problems in studying the feeding ecology of estuarine birds. *Coastal Ecol. Res. Pap.*, **4**: 1-33.
- GOUTNER, V. 1983a. Ecology of breeding of the avocet (*Recurvirostra avosetta L.*) and oystercatcher (*Haematopus ostralegus L.*) (AVES), in the Evros delta. *Thesis. Univ. Thessaloniki, (Greece)*.

- GOUTNER. V. 1983b. The distribution of waders (Charadrii) in the Evros delta (Greece), during the breeding season. *Sci. Annals Fac. Phys. & Math., Univ. Thessaloniki*, (in press).
- GOUTNER. V. 1983c. The ecology of the first breeding of the Mediterranean gull (*Larus melanocephalus* Temminck 1820) in the Evros delta. *Ökologie der Vögel*, (in press).
- GOUTNER. V. KATOULAS. M. 1984. Breeding distribution of Gulls and Terns (Laridae, Sternidae) in the Evros delta (Greece). *Seevögel* 5(3): 40-41.
- HEPPLESTON. P.B. 1971. The feeding ecology of oystercatcher (*Haematopus ostralegus* L.) in winter in northern Scotland *J. Anim. Ecol.*, 40: 651-672.
- HOFFMANN. L., BAUER. W. & MULLER. G. 1971. Proposals for conservation in Northern Greece. *I.U.C.N. occasional papers*, Nr. 1: 1-10.
- KANELIS. A. 1977. List of threatened birds. *Nature (Hel. Soc. Prot. Nat.)*, 9: 4-5.
- LAMPIO. T. 1980. Management of waterfowl populations. *Acta Orn.*, 17: 127-145.

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APPENDIX

List of birds observed at the western coastal region of the Evros delta. One asterisk: threatened with extinction from Greece. Two asterisks: threatened in all Europe.

Podicipediformes	Procellariiformes
<i>Podiceps cristatus</i>	<i>Puffinus puffinus</i> *
Pelecaniformes	Charadriiformes
<i>Pelecanus onocrotalus</i> **	<i>Haematopus ostralegus</i>
<i>Phalacrocorax carbo</i> **	<i>Charadrius hiaticula</i>
<i>Phalacrocorax pygmaeus</i> *	<i>Charadrius alexandrinus</i>
Ciconiiformes	<i>Pluvialis squatarola</i>
<i>Ixobrychus minutus</i> *	<i>Vanellus vanellus</i>
<i>Nycticorax nycticorax</i> **	<i>Vanellus spinosus</i> **
<i>Egretta alba</i> **	<i>Arenaria interpres</i>
<i>Egretta garzetta</i> **	<i>Calidris minuta</i>
<i>Ardea cinerea</i>	<i>Calidris alpina</i>
<i>Platalea leucorodia</i> **	<i>Calidris alba</i>
<i>Plegadis falcinellus</i> **	<i>Philomachus pugnax</i>
<i>Ciconia ciconia</i> **	<i>Tringa totanus</i>
<i>Ciconia nigra</i> **	<i>Tringa ochropus</i>
Anseriformes	<i>Tringa glareola</i>
<i>Cygnus olor</i>	<i>Limosa limosa</i>
<i>Tadorna tadorna</i> *	<i>Numenius arquata</i>
<i>Tadorna ferruginea</i> **	<i>Numenius tenuirostris</i>
<i>Anas platyrhynchos</i>	<i>Scolopax rusticola</i> *
<i>Anas penelope</i>	<i>Gallinago gallinago</i>
<i>Anas acuta</i>	<i>Himantopus himantopus</i> **
<i>Anas querquedula</i> *	<i>Recurvirostra avosetta</i> **
<i>Anas spp.</i>	<i>Burhinus oedipnemus</i> **
<i>Mergus serrator</i>	<i>Clareola pratincola</i>
	<i>Stercorarius parasiticus</i>
	<i>Larus melanocephalus</i> **
	<i>Larus minutus</i>

Falconiformes

*Milvus migrans****Accipiter spp.**Buteo buteo**Buteo rufinus****Aquila chrysaetos****Neophron percnopterus****Circus gallicus****Haliaeetus albicilla****Circus cyaneus**Circus macrourus****Falco columbarius**Falco tinnunculus*

Galliformes

Coturnix coturnix

Gruiformes

*Rallus aquaticus**Porzana spp.**Gallinula chloropus**Fulica atra*

Coraciiformes

*Merops apiaster**Upupa epops*

Passeriformes

*Hirundo rustica**Delichon urbica**Melanocorypha calandra**Galerida cristata**Calandrella cinerea**Alauda arvensis**Anthus spp.**Motacilla flava**Motacilla flava ssp. feldegg**Motacilla alba**Lanius collurio**Sturnus vulgaris**Pica pica**Corvus monedula**Corvus frugilegus***Corvus corone ssp. cornix**Corvus corax**Acrocephalus spp.**Sylvia communis**Sylvia spp.**Saxicola rubetra**Saxicola torquata**Oenanthe oenanthe**Luscinia megarhynchos**Turdus spp.**Passer domesticus**Passer hispaniolensis**Carduelis carduelis**Acanthis cannabina**Troglodytes troglodytes**Carduelis chloris**Emberiza calandra**Emberiza citrinella**Emberiza melanocephala**Emberiza spp.**Larus ridibundus**Larus gene****Larus argentatus**Chlidonias spp.****Gelochelidon nilotica****Hydroprogne tschegrava**Sterna sadvicensis****Sterna hirundo****Sterna olbifrons***

Columbiformes

Streptopelia turtur

Cuculiformes

Cuculus canorus

Strigiformes

*Asio flammeus***

Caprimulgiformes

Caprimulgus europaeus