Acta Œcologica
Œcol. Applic., 1989, Vol. 10, n° 4, p. 365-378

Evaluation of the relative importance of the zoning of the Evros Delta wetland (Greece) for bird groups of special conservation interest

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ABSTRACT

The use of the Evros Delta zones (coastal region, lower delta, upper delta) is evaluated for five bird groups (waders, waterfowl, raptors, shorebirds and larids) during a project from October 1987 to June 1988.

Within groups, apart from particular periods when the upper delta appeared of greater importance (in terms of population sizes and number of species), the other two zones concentrated the highest population and species richness. The trends of populations within groups varied depending on the stage of their life cycle – especially wintering and migration. Such changes are interpreted where possible.

Overall, the coastal region and lower delta were more important, the preference of birds however changing and depending on the relative dominance of particular groups.

The Species Equitability Index (H, Eveness) – reflecting the quality of the system – was notably reduced in the lower delta and coastal region in winter due to overcrowding, especially of waterfowl.

Proposed management measures aiming to improve the quality of the delta zones for bird conservation are the flooding of particular areas with freshwater, the ceasing of drainage, a restoration of the Drana lagoon, an extension of the non-hunting zone and strict control of hunting.

KEY-WORDS: Evros Delta, zoning evaluation, bird conservation, management measures.

RÉSUMÉ

L'utilisation des trois zones du delta de l'Evros en Grèce (zone côtière, bas delta, haut delta) a été évaluée pour cinq groupes d'oiseaux (Échassiers, Anatidés, Rapaces, Limicoles, Laridés) durant un projet mené d'octobre 1987 à juin 1988. Pour tous les groupes, mis à part des périodes particulières où le haut delta paraît de plus grande importance, les plus grands effectifs furent observés dans le bas delta et la zone côtière.

L'évolution des effectifs dans chaque groupe dépend de la phase du cycle biologique considérée (hivernage ou migration). Des explications de cette évolution sont proposées dans la mesure du possible. Dans l'ensemble le bas delta et la zone côtière sont les milieux les plus importants, mais les préférences apparentes des diverses espèces peuvent varier selon que tel ou tel groupe est localement dominant.

L'index d'équitabilité, qui reflète la qualité du système, peut être réduit de façon notable dans le bas delta et la zone littorale sous l'effet de la surpopulation, surtout pour les Anatidés. Les mesures de gestion proposées en vue d'améliorer la qualité de ce delta dans une optique de conservation des oiseaux sont : l'inondation d'aires particulières avec de l'eau douce, la cessation du drainage, la restauration de la lagune Drana, l'extension de la zone de chasse interdite et enfin le strict contrôle des activités cygénétiques.

MOTS-CLÉS : delta de l'Evros, zoraga, conservation des oiseaux, mesures d'aménagement.

Acta Œcologica/Œcologia Applicata, 0243-7678/89/04/365/14/$ 3.40/

INTRODUCTION

In Greece there are at least 124 wetlands (HELIOTIS, 1988) and many of them host great numbers of various bird species especially during migration and winter. Eleven of these wetlands are of international importance (HELIOTIS, 1988) but the avifauna has generally not been studied extensively in most of them. Due to the special importance of these wetlands for wintering waterfowl, most studies have been carried out within this period during relatively short field visits (JOENSEN & MADSEN, 1985; ATHANASIOU, 1987; JOENSEN *et al.*, 1987; HANDRINOS, in press for an overview of mid-winter counts).

Even less quantitative information is available for migration periods (especially autumn) and the data are widely scattered (ENGLEMOER & BLOKSMA, 1982; SZIJJ, 1982; GOUTNER, 1983*b*; WAN VESTRIENEN, 1988) although more detailed studies are in preparation (MEININGER, in prep.).

This paper aims to demonstrate the use of the Evros Delta wetland by important bird groups, especially during wintering and migration, and propose some management implications for bird conservation.

STUDY AREA

The Evros Delta is the easternmost Greek wetland (40°47'N, 26°05'E). Nowadays and due to various human interference during the last 40 years (especially drainage and herd grazing), the ecosystem has changed very much and it is far from being considered natural (MÜLLER, 1967; BAUER & MÜLLER, 1969; BRITTON & HAFNER, 1978; GOUTNER, 1983*a*, *b*).

In the delta, BRITTON & HAFNER (1978) distinguished 12 types of biotopes which in terms of phytosociological composition have been studied by BABALONAS (1979; 1980; 1981). Composition of benthic macrofauna has been studied by GOUVIS (1988) and KEVREKIDIS (1988) and breeding Charadriiformes by GOUTNER (1983*a*, *b*; 1985; 1986*a*, *b*; GOUTNER & KATTOULAS, 1984).

In this study, based on today's regime of habitat composition and management the Evros Delta is divided into three zones (fig. 1).

(1) Coastal region: includes the marine zone of the delta landwards from the isobath of 10 m (that is an area mostly used by birds of this zone) with open sea water, sand and sand-mud islets and bars, their exposure depending on the height of tides, and sandy beaches and sandy islets; vegetation is ammophilous and nitrophilous and secondarily halophytic (BABALONAS, 1979; GOUTNER, 1986*a*). The range of water salinity between islets and land is 4-25 ‰ (GOUVIS, 1988) but sea-wards is higher (unpubl. data). The most important human activities are fishing from boats and digging of fish baits (mainly *Solen* sp. and *Upogebia* sp.) from the substrate.

(2) Lower delta: this is the seaward terrestrial part of the delta directly or indirectly affected by sea water. Dominant habitats are lagoons, tidal and non-tidal saltmarshes with temporary brackish water, the extent of the latter depending mainly on yearly rainfall. During this study, rainfall in November and December was much more abundant than in previous years (table I) and thus a lot of habitat of this type was available in spring 1988. The dominant vegetation is halophytic (BRITTON & HAFNER, 1978; BABALONAS, 1979). The range of salinities is great: it varies from 6.3 ‰ in April, to 31.8 ‰ in July in non-tidal saltmarshes (GOUTNER, 1983*a*) and it reaches 40 ‰ in some lagoons in September due to evaporation (GOUVIS, 1988). The most important human activities are fishponds and the grazing of cattle.

(3) Upper delta: this is the inland part of the delta. Most of this area is cultivated and stripes of natural biotopes occur mainly along the two branches of the river Evros. There, the dominant vegetation is *Tamarix* sp., *Typha* sp. and *Populus* sp. (BABALONAS, 1979; pers. observ). Water salinity is much

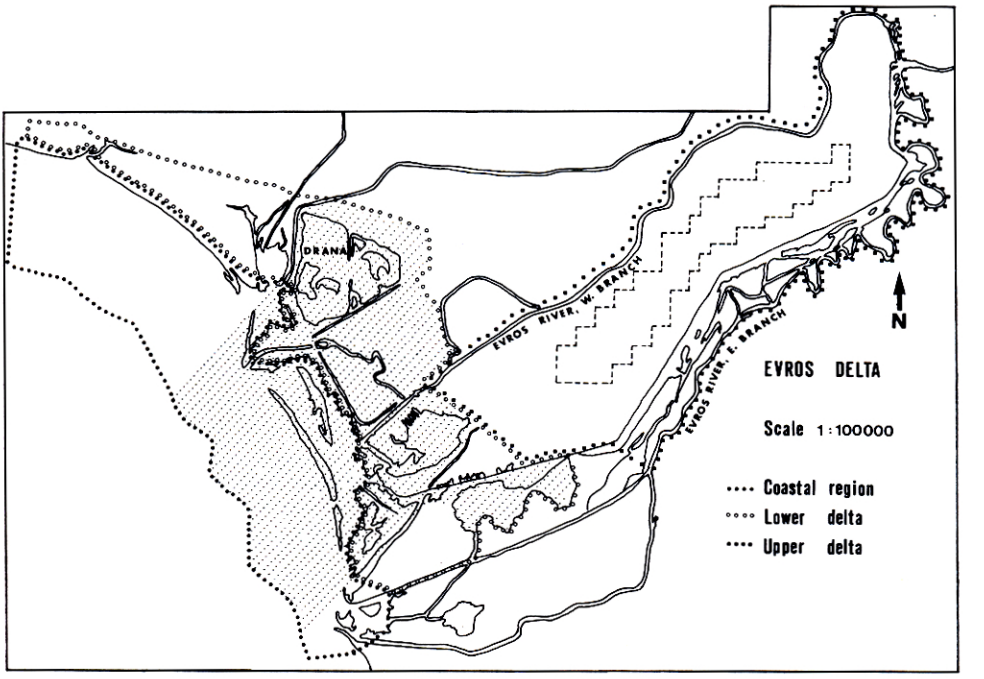

FIG. 1. – Map of the study area with zones considered. Stippled-lined quadrat at the Upper delta denotes area excluded from the analysis (*see* methods). The fine dotted area is the non-hunting zone. Names of sites are those used in the text.

lower than in the other two zones, being 2.5-6.5 °/₀₀ in the lower parts of this zone (GOUVIS, 1988) and less than 2 °/₀₀ further inland (unpubl. data). Besides agriculture, grazing is a major activity along river fields.

Part of the lower delta and coastal region is a non-hunting zone (fig. 1).

TABLE I. – *Total rainfall height (mm) in the Evros Delta.*

	J	F	M	A	M	J	J	A	S	O	N	D
1985	51.7	43.3	31.6	11.4	10.9	21.0	25.5	16.3	0.3	15.9	99.1	18.9
1986	60.3	90.2	10.0	49.6	7.7	30.3	6.8	4.4	1.0	23.7	17.7	0.0
1987	32.4	23.2	20.2	60.7	11.1	41.1	5.1	13.4	0.0	19.8	118.9	158.4
1988	41.5	61.7	67.0	31.1	40.4	48.4	15.0	0.0	7.9	9.4	n.d	n.d

n.d= no data

METHODS

We selected in each zone an area of equal extent which included the remaining natural biotopes of the delta. After the end of the study parts of these areas where no birds under study were seen were excluded from the analysis. Of course, this treatment was biased towards "areas appropriate for bird groups under study" but, in the other hand, it produced information for the most important areas for bird conservation in the delta.

An area close to the Greek-Turkish border was also excluded from analysis as regular visits were not possible there.

Finally, each area was 4,875 ha and the total studied area 14,625 ha (fig. 1).

Twenty field visits were made during the course of this project from 15 August 1987 to 15 June 1988. However due to various logistical problems and sometimes harsh weather conditions during visits,

APPENDIX

Populations and number of species (in parenthesis) of birds of the groups considered (all compiled) in the three delta zones during each visit. The number for each visit (1-15) *is used in figures. These counts were carried out during daylight periods.*

Number of visit	Date	Coastal region	Lower delta	Upper delta	Totals
1	10-11 Oct. 1987	5217 (28)	1890 (16)	124 (9)	7231 (53)
2	24-25 Oct.	9784 (46)	21057 (42)	251 (17)	31092 (105)
3	7-8 Nov.	4459 (25)	1745 (32)	319 (11)	6523 (68)
4	19-20 Nov.	2995 (23)	1355 (25)	193 (12)	4543 (60)
5	8-10 Jan. 1988	12068 (28)	32059 (31)	211 (13)	44338 (72)
6	20-21 Feb.	6184 (20)	9915 (25)	138 (16)	16237 (61)
7	26-28 Feb.	6485 (36)	44938 (42)	134 (14)	51557 (92)
8	4-6 Mar.	8825 (27)	11062 (32)	78 (11)	19965 (70)
9	19-20 Mar.	3843 (22)	8838 (44)	320 (20)	13001 (86)
10	25-27 Mar.	5606 (37)	7442 (49)	785 (29)	13833 (115)
11	3-4 Apr.	5479 (41)	6435 (45)	178 (19)	12092 (105)
12	12-15 Apr.	4970 (43)	11032 (53)	1531 (19)	17533 (115)
13	28-30 Apr.	6810 (51)	8815 (62)	1666 (32)	17291 (145)
14	7-9 May	3174 (36)	6043 (46)	481 (26)	9678 (108)
15	5-7 June	1815 (20)	305 (19)	144 (14)	2264 (53)

full cover of the study area was possible on only 15 visits (Appendix) and the other five were excluded from analysis.

Using binoculars and telescopes we counted all waterbird and raptorial bird species. Birds of other groups were not counted as their population would be greatly underestimated due to the nature of the area, especially of the upper delta. The location of birds was noted on 1 : 50,000 maps and then these data were transfered to similar maps with a grid system, where each quadrat represented 25 ha, Using further subdivisions we excluded the areas within the three zones where no birds were seen. It is noteworthy that all counts were carried out only during daylight. The activities of birds at night were not followed in this study and this might have consequences for the interpretation of the patterns observed in specific groups, like waterfowl (*see* further).

To facilitate comparison among zones we grouped the birds in five categories (see also BURGER *et al.*, 1982) each containing the following genera:

(*a*) Waders: *Egretta*, *Ardea*, *Ardeola*, *Nycticorax*, *Ixobrychus*, *Botaurus*, *Ciconia*, *Plegadis*, *Platalea*, *Phoenicopterus*.

(*b*) Waterfowl: *Cygnus*, *Anser*, *Tadorna*, *Anas*, *Phalacrocorax*, *Gavia*, *Podiceps*, *Tachybaptus*, *Pelecanus*, *Fulica*, *Mergus*, *Somateria*, *Bucephala*, *Aythya* and unidentified ducks.

(*c*) Raptors: *Pandion*, *Haliaetus*, *Milvus*, *Circaetus*, *Accipiter*, *Buteo*, *Pernis*, *Neophron*, *Aquila*, *Circus*, *Falco*, *Hieraetus*, *Athene*, *Otus*.

(4) Shorebirds: *Haematopus*, *Recurvirostra*, *Himantopus*, *Charadrius*, *Pluvialis*, *Arenaria*, *Vanellus*, *Gallinago*, *Numenius*, *Limosa*, *Tringa*, *Calidris*, *Philomachus*, *Burhinus*, *Glareola* and unidentified shorebirds.

(5) Larids: *Larus*, *Gelochelidon*, *Sterna*, *Chlidonias*.

To compare the abundances of these birds between the three zones we used the Equitability Index (Eveness) calculated for each zone and each visit by Pielou's (1966) formula:

$$H = \frac{H'}{\ln S}$$

where H' is the Shannon-Wienner index (SHANNON & WEAVER, 1963) and

$$H' = -\sum_{i=1}^{s} p_i . \ln p_i$$

with S being the number of bird species (in both formulas) and p_i is the proportion of the i-th bird species in each count; ln is the Neperian logarithm.

RESULTS AND DISCUSSION

USE OF ZONES BY BIRD GROUPS

Waders

Wading birds occurred in generally low proportions throughout the study, the highest observed not exceeding 4.5% of the total (fig. 2). (Numbers of bird populations and species in each visit are given in the Appendix.) The lower delta held the greater proportion of these populations and the upper delta the lowest, although the mean number of species in these zones was similar and differred only between coastal region and lower delta (fig. 3). In the lower delta, peak numbers were observed in early November and March (autumn and spring migration) and in mid-winter. This might be due to the fact that the most important feeding grounds (lagoons, temporary brackish water marshes) and non-hunting areas occurred within this zone.

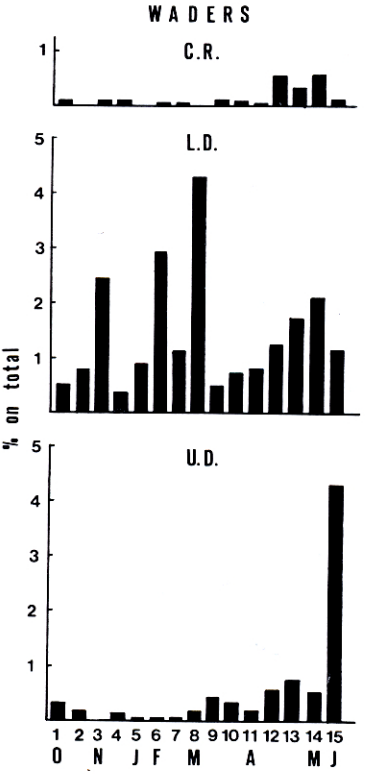

Fig. 2

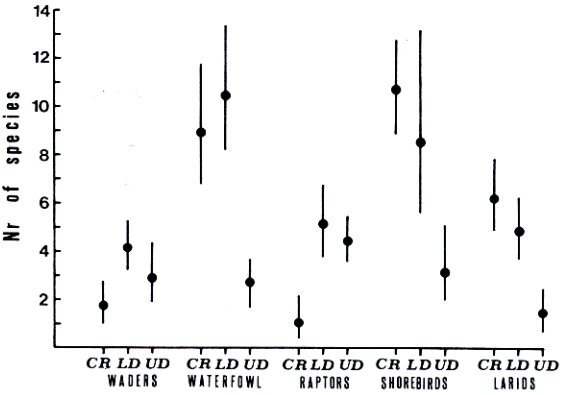

Fig. 3

FIG. 2. – Relative abundance of waders in the three Evros Delta zones. The values are percentages of the total number of birds counted in each visit (Appendix). The dates corresponding to the number of each visit are given in the Appendix. Letters at the lower histogram represent months. C.R.: Coastal region. L.D.: Lower delta. U.D.: Upper delta.

FIG. 3. – Mean number of species and 95%-confidence intervals per zone and per group. C.R.: Coastal region. L.D.: Lower delta. U.D.: Upper delta. Data were square root or log transformed where needed. They refer to $n = 15$ visits.

Many of the species of this group bred in the delta (BAUER & MÜLLER, 1969) but nowadays, due to habitat destruction, only a few pairs of several species breed there, namely *Ardea cinerea*, *A. purpurea*, *Ardeola ralloides* and *Ixobrychus minutus*. White Storks (*Ciconia ciconia*) nest at nearby villages. Other species, such as *Egretta garzetta* and *Nycticorax nycticorax*, may still breed in the Turkish part of the delta but visit the Greek side to feed (BRITTON & HAFNER, 1978). The slight population increase observed from mid-March until May may be attributed to this. Later in June, when most water in the lower delta temporary marshes evaporates, these birds used riverine fields in the upper delta, which provided a sudden preference for this zone (fig. 2).

Waterfowl

For waterfowl, the lower delta was by far the most important zone throughout this study. Their preference was much lower for the coastal region and negligible

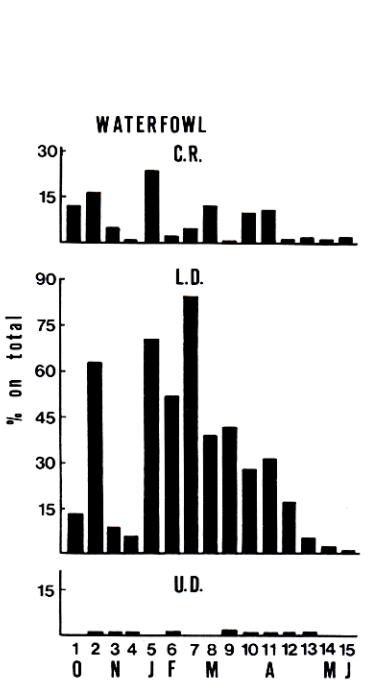

Fig. 4

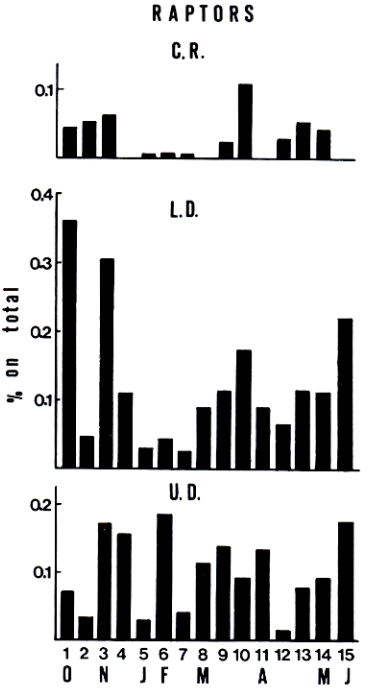

Fig. 5

FIG. 4. – Relative abundance of waterfowl in the three Evros Delta zones. Data presented like figure 2.

FIG. 5. – Relative abundance of raptors in the three Evros Delta zones. Data presented like figure 2.

for the upper delta (fig. 4), which also held a significantly smaller number of species than both the other zones, where means did not differ significantly (fig. 3).

The first increase of the lower delta population in October was due to the arrival of wintering populations. The most prominent increase occured in winter months with the populations rising up to 80% of the total bird populations.

The Evros Delta has been known as one of the best areas for wintering waterfowl in Europe. After 1973 the waterfowl populations suddenly decreased due to habitat destruction and hunting pressure (BAUER & MÜLLER, 1969; BRITTON & HAFNER, 1978; ATHANASIOU, 1987).

The preference for the lower delta of waterfowl is attributed both to the presence of lagoons in this area (fig. 1) and also to the fact that a major part of this zone has been included in the non-hunting sanctuary. As these birds are

subjected to special hunting pressure, they tended to congregate within the non-hunting areas (similarly see in CAMPREDON, 1982; JOENSEN & MADSEN, 1985; BREDIN *et al.*, 1986). However as illegal shooting takes place widely in the delta, the limits of this sanctuary are rather theoretical. Thus, disturbance frequently resulted in sudden movements of waterfowl to and from the coastal region and also to the Turkish part of the delta. Such conditions may have resulted in the irregularities we recorded in the autumn pattern of use of the coastal region and lower delta (fig. 4). These interpretations were based on the daylight patterns observed. Although our observations suggest that especially the lagoons of the delta constitute both feeding and resting areas for waterfowl, it is quite possible that waterfowl moved at night to feed or rest elsewhere (e. g. in another zone or in the Turkish part) and vice versa. This would give a different picture of the relative importance of each zone for these birds.

Raptors

The proportions of this group were the lowest of all, and never exceeded 0.35% of the total (fig. 5). The highest proportions were observed in the lower delta during the autumn migration. On some occasions, such as the end of November, in mid-winter and during part of March, the upper delta was of greater importance than the other two zones (fig. 5). In this group, the lowest number of species occurred in the coastal region, whereas in the other two zones it was higher but differed insignificantly between them (fig. 3). Raptors in June were rather breeders of the delta (*Circus aeruginosus*, *Milvus migrans*), or other breeding in the wider region and using the delta for feeding (HALLMANN, 1979).

Shorebirds

Generally, the delta held much higher numbers of shorebirds during the autumn and spring than during the winter period (fig. 6). Although of varying pattern of use through the study, both coastal region and lower delta were most important zones for shorebirds whereas the upper delta was of very limited use; only in May (late migration) did the proportions increase to between 5-10% of the total delta populations (fig. 6). This zone also held a significantly lower mean number of species, whereas in the other two zones the means did not differ significantly (fig. 3).

The differences in the patterns of use of each zone by shorebirds through this study may be explained by considering the relative abundance and distribution of the shorebird species present in the delta within each period. Thus, from October up to the end of November the dominant species were *Calidris alpina*, *Tringa totanus* and *Numenius arquata* with their summed population proportions ranging from 69.3 to 91.3% of the shorebirds present. From mid-April to mid-May, the same values were only 1.4 to 21.4%. Simultaneously the species composition changed with the arrival of other species like *Philomachus pugnax*, *Tringa erythropus*, *Calidris minuta* and *C. ferrugunea* where summed population proportions within the latter period dominated, varying from 64.4 to 78.4%. Of the first group, the shorebirds mainly used the coastal region, whereas those of the second mainly temporary brackish water marshes of the lower delta (and occasionally of the upper delta (GOUTNER *et al.*, in prep.). A similar separation in habitat use between these groups of shorebirds has been observed in the delta in the past (GOUTNER, 1983 *a*, *b*). Such separations are rather the result of different preferences

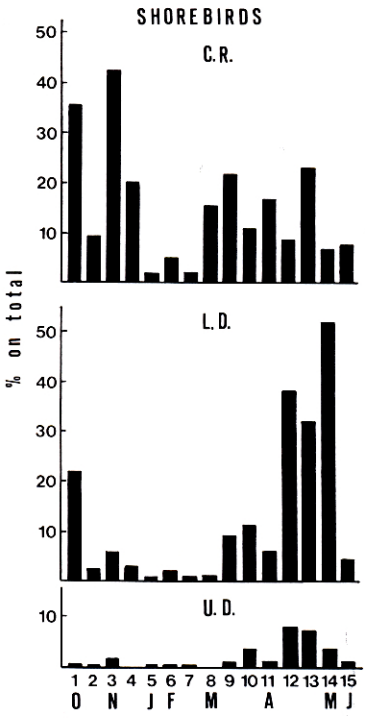

Fig. 6

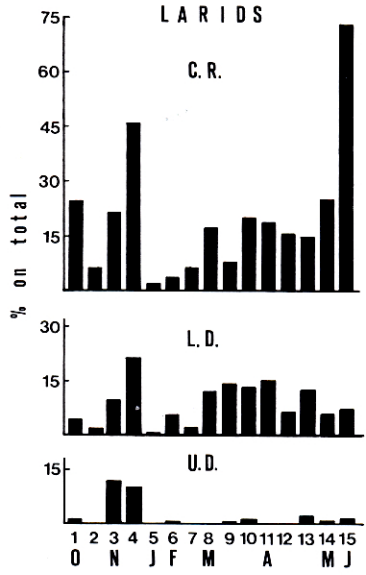

Fig. 7

FIG. 6. – Relative abundance of shorebirds in the three Evros Delta zones. Data presented like figure 2.

FIG. 7. – Relative abundance of larids in the three Evros Delta zones. Data presented like figure 2.

for food and different feeding methods applied (summary for each species is given in GLUTZ VON BLOTZHEIM & BAUER, 1982 and CRAMP & SIMMONS, 1983). Thus in the wintering and migrating grounds in Europe, despite changes found from site to site, the first group is attracted by tidal areas, feeding mainly on substrate dwelling animals, whereas the second group frequently uses less saline habitats and eats primarily insects (perhaps with the exception of *C. ferruginea*) (WOLFF, 1969; GOSS-CUSTARD & JONES, 1976; GOSS-CUSTARD *et al.*, 1977; GOUTNER, 1983 *b*; MARTINEZ-VILALTA, 1985; and others).

Larids

The highest proportions of larid populations were generally observed in the coastal region and the lowest in the upper delta (fig. 7). The mean number of species was insignificantly different in the coastal region and lower delta and significantly smaller than both in the upper delta (fig. 3).

In the coastal region, an important peak, accounting for about 45% of the total, was observed at the end of November (autumn migration), whilst in the

same period the relevant proportion in the lower delta did not exceed 20% (fig. 7). Within this period we observed the maximum proportions of the upper delta but they did not exceed 10% (fig. 7).

Low proportions of larids occurred in winter in both coastal region and lower delta and in spring, despite a relative increase, there were no spectacular changes. In June, due to the congregation of all breeding larids in the coastal islets of the delta, a high peak appeared in the coastal region. This zone, being one of the most important areas for breeding larids in the delta (GOUTNER & KATTOULAS, 1984) became the only breeding area of larids after the destruction of the Drana lagoon in May 1987 (GOUTNER & JERRENTRUP, 1987).

OVERALL USE OF ZONES

To evaluate the overall use of the three zones, the data for all bird groups were pooled for each zone and for each visit (fig. 8).

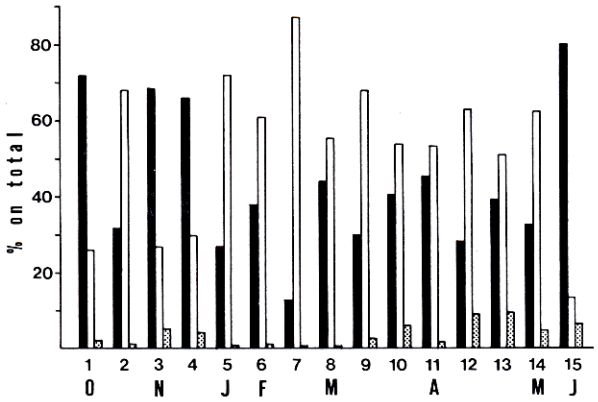

FIG. 8. – Relative use of the three delta zones by all bird groups considered (data combined). Population sizes and dates of visits are in the Appendix. Closed columns: Coastal region. Open columns: Lower delta. Dotted columns: Upper delta. Letters represent months.

The population proportions were in all visits lowest in the upper delta (less than 10% of the total). In the autumn migration period (except at the end of October), the use of the coastal region was the greatest though this changed in winter and spring migration periods in favour of the lower delta (fig. 8). The trend again changed after May when almost 80% of the population was found at the coastal region. It is evident that the general picture in each zone was the result of the relative dominance of one or more groups per visit or per period. However, as previously mentioned, such interpretation is based only on daylight counts and if there were available observations for night periods a different picture could appear.

The overall mean species richness in the upper delta (16.3, 20.1-13.3 95%-conf. limits) was significantly lower than the other two zones which were similar to each other (coastal region: 30.8, 36.5-25.9; lower delta: 35.2, 43.6-28.4). This did not however reflect the true picture within groups when treated separately. The general trend reflected that of waterfowl, shorebirds and larids but it was different for waders and raptors, for which the upper delta held similar (waders) or greater (raptors) number of species than the other zones (fig. 3).

Species equitability in the zones

The equitability index values varied through visits in all three zones (fig. 9). Overall, these changes differred significantly among zones ($F=5.13$, $P<0.05$, ANOVA, data log transformed).

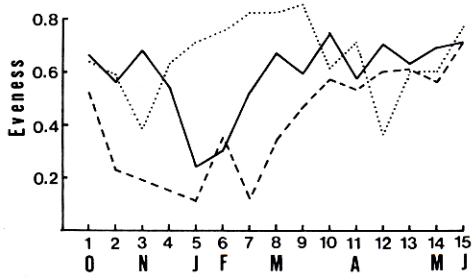

FIG. 9. – Trends of Equitability values (H, Eveness) in the three zones during study. Dates for numbers of visits are in the Appendix. Letters represent months. Solid Line: Coastal region. Broken line: Lower delta. Stippled line: Upper delta.

The most prominent changes in all zones took place in autumn and winter; a drop of *H* (apparent in the lower delta) occurred in all zones in the autumn. The minimum values of *H* were observed in the lower delta and coastal region during winter. It gradually increased in March, after which, despite relative changes, no dramatic peaks occurred. In contrast to these two zones, *H* in the upper delta increased in winter and, with the exception of a sudden drop in mid-April, the changes were similar in the other zones.

Such a reduction of *H* in the coastal region and lower delta in winter denotes the "crowding" of bird populations in these zones. Indeed, the highest population proportions at least in the lower delta were observed in this period (fig. 8). Additionally in the particular visits where minimum *H* was observed in these two zones, the dominant birds in numbers were waterfowl (fig. 4 and figs. 2, 5, 6, 7). Crowding of waterfowl in these zones, and especially in the lower delta, was due to their being relatively free of disturbance and containing feeding grounds. As these birds are wintering, as in other Mediterranean areas (e. g. MORGAN, 1982; JOENSEN & MADSEN, 1985; BREDIN *et al.*, 1986; VAN DIJK *et al.*, 1986; DIJKSEN & KONING, 1986) a degree of crowding might be expected. However an alarming reduction of available space for wintering waterfowl in the delta due to habitat destruction (like the Drana lagoon) and to a lack of adequate hunting control may well result in overcrowding of population in the remaining suitable sites. Overcrowding may lead to rapid reduction or even depletion of food stocks (REICHHOLF, 1973; ROBINSON, 1982), to competition among birds (PETERSEN, 1982) and between birds and fishes using the same prey items (ERICKSON, 1979; MACALLISTAIR EADIE & KEAST, 1982; BRITTON, 1982) and encourage spread of potential diseases (RYDER, 1982). Such conditions would reduce the importance of the delta for the birds of this group.

CONCLUSIONS AND MANAGEMENT IMPLICATIONS

The three zones of the Evros Delta were used in a different manner by bird groups throughout this study. Thus, each zone seems to play a particular role in the life cycle of these bird populations when they are in the delta. Generally, the coastal region and lower delta were the most important zones in terms of population sizes and number of species. The upper delta seemed to be more important for particular bird groups (especially waders and raptors) in particular periods.

The quality of the birds' environment may be reduced in the coastal region and lower delta especially in winter, due to crowding of waterfowl populations. This might result in a long term reduction of population attraction in these zones. Overcrowding of bird population in some areas and generally very big differences in the use of the delta zones have mainly resulted from mismanagement practices of the last 40 years leading to a serious imbalance of the Evros Delta wetland ecosystem.

To promote the conservation of bird groups studied, a better quality of the delta zones is needed for which the following management measures should be taken:

(1) To increase the use of the upper delta, a change in the water regime is needed with flooding of particular areas for attraction, especially of waterfowl and shorebirds. Extension of the non-hunting zone along the eastern branch of the river Evros and control of grazing there, are needed as well.

(2) As population of many species of shorebirds depends on available feeding habitats and consequently on yearly rainfall – which varies from year to year – water should be used from other sources (torrents, the river) for permanent flooding of particular non-tidal saltmarshes especially in spring and summer. These flooded marshes also favour waterfowl in winter. Drainage schemes in the lower delta should cease, too.

(3) To enhance a better balance in the use of wintering grounds of waterfowl, increase of available and suitable habitats is needed in the coastal region and especially lower delta. This can be promoted by the restoration of the Drana lagoon and a strict control of hunting. Restoration of Drana will again attract breeding Charadriiformes during spring and summer.

(4) This study concerns only the Greek part of the Evros Delta. Better management and conservation practices would arise if the Turkish part could also be appropriately monitored through collaboration between the two countries.

ACKNOWLEDGEMENTS

This paper was written within the framework of a joint project of the Hellenic Ornithological Society and the Royal Society for the Protection of Birds aiming for the conservation of the Slender-billed Curlew (*Numenius tenuirostris*) and the Lesser White-fronted Goose (*Anser erythropus*) in the Evros delta. This project was supported by the E.C. DG XI. We thank Mr. Alistair Gammel for encouragement, our H. O. S. friends for field participation and especially our project co-worker G. Handrinos who also drew some of the figures.

Special thanks to Dr. D. Petridis for statistical aid and data computation, Prof. A. Sinis for computing facilities. Dr. H. Hafner and Dr. J. D. Goss-Custard made useful comments on the manuscript and Prof. Alan Waugh did linguistic corrections.

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