

# ESTATUS Y CONSERVACIÓN DE AVES MARINAS

ECOGEOGRAFIA Y PLAN DE ACCION PARA EL MEDITERRANEO

# STATUS AND CONSERVATION OF SEABIRDS

ECOGEOGRAPHY AND MEDITERRANEAN ACTION PLAN

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# COMPARATIVE BREEDING BIOLOGY OF THE GULLS AND TERNS IN THE FOUR MAIN DELTAS OF THE NORTHERN MEDITERRANEAN

by

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## INTRODUCTION

The deltas of the rivers Ebro (Spain), Rhône (the Camargue - France), Po (Italy) and Evros (Greece), together with other areas, such as the Axios delta and the Alyki lagoon (north-western Greece), host the entire Mediterranean breeding populations of the Mediterranean Gull (*Larus melanocephalus*) [Black Sea population excluded], Lesser Black-backed Gull (*Larus fuscus*), Lesser Crested Tern (*Sterna bengalensis*) [Cyrenaica excluded] and Sandwich Tern (*Sterna sandvicensis*) [Black Sea excluded], a large proportion (10% to 50%) of the population of the Black-headed Gull (*Larus ridibundus*), Audouin's Gull (*Larus audouinii*), Gull-billed Tern (*Sterna nilotica*), Common Tern (*Sterna hirundo*) and Little Tern (*Sterna albifrons*), and a fair proportion (up to 10%) of Slender-billed Gull (*Larus genei*) as well as Yellow-legged Gull (*Larus cachinnans*). In the Nile delta, despite its large area, only Little Terns have populations of international significance (Meininger & Baha el Din, 1986).

Many breeding aspects of seabirds in these four deltas are not adequately documented, and our tentative comparison of their breeding biology aims only at producing some hypotheses concerning the geographical similarity or variability of the breeding habits, and to point out subjects that still need further study.

## RESULTS

### The environment of the deltas

Compared to mainland environments, all the deltas have relatively large natural areas, which have declined over the years owing to human activities. In the Camargue, the retaining dykes, constructed in 1868, now preclude any flooding from the river or from the sea. In the southern part of the Po delta, lagoons and marshes were reduced from 640 km<sup>2</sup> in 1872 to 180 km<sup>2</sup> in 1962 (Figure 1c). In the Evros delta, an undisturbed wetland until the 1950s, natural areas (less than one third) are continuously declining under human pressure. After 1950, the natural evolution of the estuarine ecosystem was affected by banking of the river and by draining of marshes for cultivation.

The main biotopes of the Ebro delta (Figure 1a, surfaces in Table I) are: sand dunes and zones of halophilous vegetation; salt pans; the river which branches into two affluents a few kilometres from the sea; irrigation canals; freshwater marshes, in patches bordering all the outskirts of the delta; cultivations which include orchards and large surfaces of rice fields (Maldonado, 1977; Camarasa *et al.*, 1977).

The Camargue (Figure 1b, surfaces in Table I), the largest of the four deltas, includes a wide alluvial plain located between the two branches of the Rhône and along the outer banks. The mainly brackish belt that borders the sea (Blondel & Isenmann, 1981; Lemaire *et al.*, 1987) includes: dunes; brackish ponds; salt pans. The freshwater belt includes: the river; large "étangs"

and other smaller ponds with open water and reedbeds; permanent and temporary marshes. Large areas are covered with *Salicornietum fruticosae*. Pastures with cattle and horses, and rice fields are widespread.

The area we consider to pertain to the Po delta (Figure 1c), includes the lagoons in the south, where many gulls and terns breed. The main biotopes are: sandy beaches; brackish biotopes, including the lagoons and the "valli", (ancient lagoons presently banked and managed for fishing and for hunting); salt pans; the river, divided into several branches, and irrigation canals; freshwater marshes, with reed beds; cultivations, including limited surfaces of paddies; urban areas and littoral woods.

The main biotopes of the Evros delta (Figure 1d, surfaces in Table I) are: permanently open saltwater lagoons; sand dunes; saltmarshes and salty grounds (areas affected directly by tidal flooding or indirectly by underground penetration, and areas with halophytic saltmarshes and unvegetated salt pans); temporary freshwater marshes with reedbeds; permanent freshwater (riverbed and small areas nearby); brackish zones; small forested areas, grasslands and cultivations (Britton *et al.*, 1978; Babalonas, 1980; Goutner, 1986, 1987). Over 10 000 cows and sheep overgraze the vegetation. No permanent human settlements exist within the delta.

### Distribution of the colonies

The colonies of gulls and terns are located in the three following types of environment (Figures 1a, b, c, d):

1. Beaches facing the sea, used by all the species (Evros), by Common and Little Terns (Ebro), by the Little Tern only (Po), and not utilized in the Camargue. Nesting on beaches is probably limited because of human disturbance. The beaches of the Evros, used by all the species, are on coastal islets and suffer from little disturbance. In the Po delta, Little Terns breed on the beaches, whereas Common Terns breed on islets amid the brackish ponds, a few kilometres from the sea; this spatial segregation is not strictly tied to the foraging areas preferred by the two terns (Common Terns forage mainly at sea but breed inland, while Little Terns forage mainly in the lagoons and in the ponds, and breed on the nearby seashore - Fasola *et al.*, 1988). Probably Common Terns breed on islets because they are more susceptible than Little Terns to human disturbance on the beaches.
2. Water bodies of the brackish belt (lagoons and salt pans), used in each delta by all the species, and exclusive nesting areas for Mediterranean Gulls, Black-headed Gulls, Slender-billed Gulls, Gull-billed Terns and Sandwich Terns in the Ebro, Rhône and Po deltas. The islets of these lagoons are highly suitable for seabirds because they are relatively undisturbed, and because they are located in the middle of a variety of foraging habitats exploited by the various species.
3. Terrestrial biotopes, used in some instances by Yellow-legged Gulls, whose colonies are located in the halophilous vegetation on islands in salinas near the sea (Camargue), or in cultivated fields (Po delta).

The siting of the colonies is presumably determined by the availability of foraging habitats within the flight range of the breeding adults, and by the amount of predation pressure and of human disturbance at the colony sites. It would be interesting to document shifts of colony sites in relation to changes in the foraging habitats or in the level of disturbance, as Erwin *et al.*, (1981) and Kotliar & Burger (1986) have attempted to analyse in other regions.

### Assemblages of gulls and terns

The same species of gulls and terns breed in each of the four deltas (Table I), with a few exceptions that can be explained by biogeographical considerations: the Black-headed Gull has the centre of its range in the European middle latitudes, and its absence from the south-eastern Evros delta is not surprising; the Mediterranean Gull has an eastern centre in its distributional range, and



therefore ignores the Ebro delta (where only one pair nested in 1988). The absence of Slender-billed Gulls from the Evros delta may be due to the reduced area of lagoons in this delta. The recent breeding of Audouin's Gulls and of Lesser Black-backed Gulls in the Ebro delta is a surprising expansion of their ranges.

The abundance of gulls and terns is loosely correlated with the entire surface of each delta (Figure 2), and it is strictly correlated with the surface of waters, including rice fields, that are used for foraging by the same gulls and terns in the Camargue and in the Ebro delta.

The differences in the abundance of particular species between the deltas cannot be directly related to the availability of particular biotopes; however, Common and Little Terns are more abundant in the two deltas (Ebro and Po), where the largest lagoons are found, a preferred foraging habitat for these species.

### **Population trends**

Censuses have been carried out repeatedly in each of the four deltas, and more frequently during the 1980s. The fluctuations of the number of nests could be due to large-scale trends affecting the entire Palearctic population (in which case changes occurring in the deltas are concurrent), or they may be due to variations in the local environment of the delta (in which case fluctuations in the deltas are independent). During the past three decades the Black-headed Gull, Slender-billed Gull, Yellow-legged Gull and the Sandwich Tern (Figure 3a and b) have colonized the deltas, and have increased markedly. In the Camargue, Yellow-legged Gulls have been culled since 1961, and this may be a limiting factor. No clear trend appears for Yellow-legged Gulls in the Ebro where, however, the censuses for this species have been inaccurate in some years (Martinez-Vilalta, 1988). For each of the above species, the increase approached a sigmoid trend, and occurred in a precise geographical sequence: Camargue - Ebro - Po - Evros, with a delay of a few years from one delta to the other. These patterns suggest the influence of some common factors, acting on a wide geographical scale. An increase of these species occurred throughout Europe, and was attributed to the surplus food provided in winter by human activities, to reduced persecution of gulls, and to improved availability of food for the Sandwich Tern (Cramp & Simmons, 1983; Cramp, 1985).

The Mediterranean Gull colonized two areas, and increased; it fluctuated widely in the Evros and in the other important breeding area in Greece, the Alyki lagoon (Goutner, 1986b).

The numbers of Gull-billed Terns and of Common Terns (Figure 3b) fluctuated, possibly with a slight decrease in the mid-1970s, following by a recent increase.

The Little Tern has fluctuated without a trend, but it has recently decreased in its main stronghold, the Po delta (Figure 3b).

Of the three species of terns whose populations have fluctuated, some cases suggest that different species in the same area tend to fluctuate accordingly (e.g. Common and Little Terns in the Evros, and Gull-billed and Common Terns in the Camargue), whereas the fluctuations of some species in different deltas are unrelated. These fluctuations may, therefore, be due to local factors.

However, more population data is necessary before we can test the significance of the above hypothesized correlations.

### **Structure of the colonies**

The number of colonies and the average number of nests per colony (Table II) are extremely variable between the deltas, and are presumably determined by the local environment, e.g. the Black-headed Gull and the Common Tern had comparable breeding populations in the zones and in the years considered in Table II, yet the number and the size of their colonies differed markedly. In other species (Mediterranean Gull, Slender-billed Gull, Sandwich Tern), larger

populations correspond to colonies of greater size, and the number of colonies is within the range of 1 to 3, both in large or small populations (Table II).

Associations among species (Table III) show that only the largest species (Yellow-legged Gull, 1 165 g on average) and the smallest one (Little Tern, 50 g) nest more frequently in monospecific colonies. These negative associations probably occur because the other gulls and terns tend to avoid the much larger Yellow-legged Gull, a predator of chicks. The remaining six species (whose average weights range from 129 g to 272 g) are all associated with each of the other species and they do not show any preference for specific colony-mates.

### **Breeding habitats**

Quantitative descriptions of the breeding habitats are available only for the Evros delta (Goutner, 1987) and for the Po delta (Fasola & Canova, this volume). Each species has a preferred micro-habitat for breeding. Mediterranean Gulls prefer patches with low vegetation (94% of cover on average in the Po delta and 50%-70% in the Evros delta); Sandwich Terns consistently prefer bare patches of sand, usually close to some low vegetation; Little Terns prefer areas with very low vegetation cover (8% in the Po delta, and 15% in the Evros delta, on average).

However, alternative habitats may be exploited by a species, e.g. Yellow-legged Gulls may nest both among dense herbaceous vegetation up to 1.5 m high, or on bare sand (in the Po and in the Evros deltas); Gull-billed Terns breed on bare sand in the coastal areas, and among vegetation in the saltmarshes of the Evros delta.

The characteristics of nest structure, of vegetation cover around the nests, and of distance from conspecifics, though adaptable to the local situation, seem to be specific traits that remain relatively constant in different areas.

### **Food and foraging**

Information on all the components of the trophic niche (prey, foraging habitats, and timing of foraging activities) has been published for the Po delta (Fasola *et al.*, 1989); data is available on foraging habitats in the Camargue (Isenmann, 1979); on diet and foraging in the Evros (Goutner, 1986a & b).

The above information suggests that each seabird retains a preference, from one region to another, for the same general prey types (e.g. Mediterranean Gull for terrestrial arthropods, Gull-billed Tern for terrestrial vertebrates and arthropods, Sandwich Tern exclusively for fish). There is no preference for particular prey species, within a given prey type; the species and families of prey may change completely from region to region; the prey are probably taken in proportion to their availability. Gulls and terns segregate as regards the size of the fish taken, more than as regards the species of fish. Gulls and terns show a consistent preference, from region to region, for specific general types of habitats (e.g. exclusively the sea in Sandwich Terns; the vegetated areas: marshes, natural grasslands and cultivations for Gull-billed Terns, and cultivations, grasslands and the sea for Mediterranean Gulls).

	Ebro Delta	Camargue	Po Delta	Evros
urban, wooded, and non-classified areas	35	183	81.1	-
cultivations, and natural herbaceous vegetation	72.3	592	897.2	139
rice fields	150.6	80	19.1	
brackish and freshwater ponds	34.7	361.1	150.8	0
rivers and canals	13.9	0	41.2	2.5
salt pans	5.6	209.5	1.2	0
lagoons and other salt-water areas	60.5		172.5	8.1
<i>Larus melanocephalus</i>	0.1	17	353	316
<i>Larus ridibundus</i>	438	7237	456	0
<i>Larus genei</i>	151	72	10	0
<i>Larus audouinii</i>	755	0	0	0
<i>Larus fuscus</i>	6	0	0	0
<i>Larus cachinnans</i>	411	2435	991	17
<i>Sterna nilotica</i>	123	232	94.1	52
<i>Sterna caspia</i>	0.1	0	0.1	0
<i>Sterna bengalensis</i>	1	0	0.4	0.1
<i>Sterna sandvicensis</i>	393	823	140	4
<i>Sterna hirundo</i>	3,876	1,472	2,674	190
<i>Sterna albifrons</i>	599	357.2	2,636	190

Table I: Biotopes of the four deltas, and breeding populations of gulls and terns. Surface data (km<sup>2</sup>) from Lemaire et al. (1987) for the Camargue, and measured directly on 1:10 000 - 50 000 scale maps for the other deltas. The data on populations (average number of nests for the 10 years 1979-1988, or for the years between 1979 and 1988 in which data were available) are from Goutner and Kattoulas (1984), Fasola (1986), Isenmann et al. (1986), Ferrer and Martínez-Vilalta (1986), Martínez-Vilalta (1988), and from unpublished data.

	no. colonies in the area				average				no. nests / colony (range)			
<i>Larus melanocephalus</i>	-	1	3-5	1-2	-	3	57	280	-	1-5	2-145	6-937
<i>Larus ridibundus</i>	10	7	14-22	-	110	419	27	-	1-339	2-934	2-128	-
<i>Larus genei</i>	2	1-2	1-5	-	215	12	4	-	94-310	1-26	1-4	-
<i>Larus cachinnans</i>	5	1-2	44	1	100	1	34	32	1-421	1-2	1-300	15-60
<i>Sterna nilotica</i>	3	1-4	2-4	1-2	71	86	35	45	1-185	1-246	1-78	5-69
<i>Sterna sandvicensis</i>	2	-	1-2	1-3	378	-	47	6	224-531	-	7-117	4-9
<i>Sterna hirundo</i>	18	7	86	2-7	305	58	37	66	1-1118	1-243	1-419	3-310
<i>Sterna albifrons</i>	9	1-2	17-24	1-11	72	38	202	49	1-351	4-66	25-2440	3-277

Table II: Parameters of colony structure. The four values, from left to right, are referred to the Ebro, Camargue, Po and Evros deltas, respectively. The figures for the Ebro (year 1988) were calculated from data in Martínez-Vilalta (1988); for the Camargue (only for the western region of the Salines d'Aigues Mortes, 1986 to 1988) were from unpublished data; for the Po delta (years 1982 to 1984) were from Fasola (1986); for the Evros (years 1981 to 1988) were from unpublished data.



L.melanocephalus L.ridibundus L. genei L. cachinnans S. nilotica S.sandvicensis S. hirundo

<u>Larus ridibundus</u>	-						
	-						
	+0.07						
	-						
<u>Larus genei</u>	-	+0.16					
	+0.34	-					
	+0.13	+0.07					
	-	-					
<u>Larus cachinnans</u>	-	-0.04	-0.09				
	-0.09	-	-				
	+0.17	+0.09	-0.10				
	0	-	-				
<u>Sterna nilotica</u>	-	+0.07	+0.25	-0.15			
	+0.06	-	-	-			
	+0.05	+0.07	+0.05	+0.30			
	+0.61	-	-	-			
<u>Sterna sandvicensis</u>	-	+0.15	+0.46	-0.09	+0.25		
	-	-	-	-	-		
	+0.13	+0.07	+0.45	+0.03	+0.05		
	-	-	-	-	-		
<u>Sterna hirundo</u>	-	+0.25	+0.08	-0.07	+0.11	+0.08	
	-	-	-	-	+0.13	-	
	+0.06	+0.22	+0.06	-0.16	+0.01	+0.06	
	+0.04	-	-	-	-	-	
<u>Sterna albifrons</u>	-	-0.27	-0.13	-0.24	-0.04	+0.02	+0.06
	-0.08	-	+0.17	+0.63	+0.30	-	-
	-0.02	-0.04	-0.02	-0.06	-0.01	-0.02	0
	-0.52	-	-	-	-0.20	-	-0.18

Table III: Indices of association of the breeding gulls and terns in the same colonies. The four values, from top to bottom, are referred to the Ebro, Camargue, Po and Evros deltas, respectively. The Index of Association is  $IA = ad - bc / (a+b)(c+d)(a+c)(b+d) / 2$ , where a = both species present in a colony; b = species 1 absent and species 2 present; c = species 1 present and species 2 absent; d = both species absent; this index ranges from -1 (complete avoidance) to +1 (complete association); values of 0 denote random association (Krebs 1972). Sources of data as in Table II.



◆ LITTLE TERN

■ COMMON TERN

▲ YELLOW-LEGGED GULL

● OTHER GULLS AND TERNS

5 km

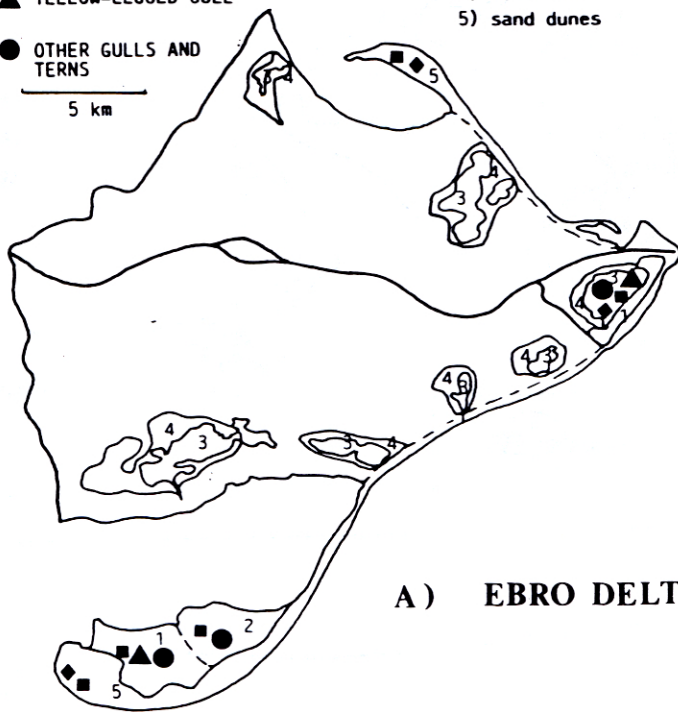
1) brackish and salt water

2) salt pan

3) freshwater

4) reed bed

5) sand dunes



A) EBRO DELTA

◆ LITTLE TERN

■ COMMON TERN

▲ YELLOW-LEGGED GULL

● OTHER GULLS AND TERNS

10 km

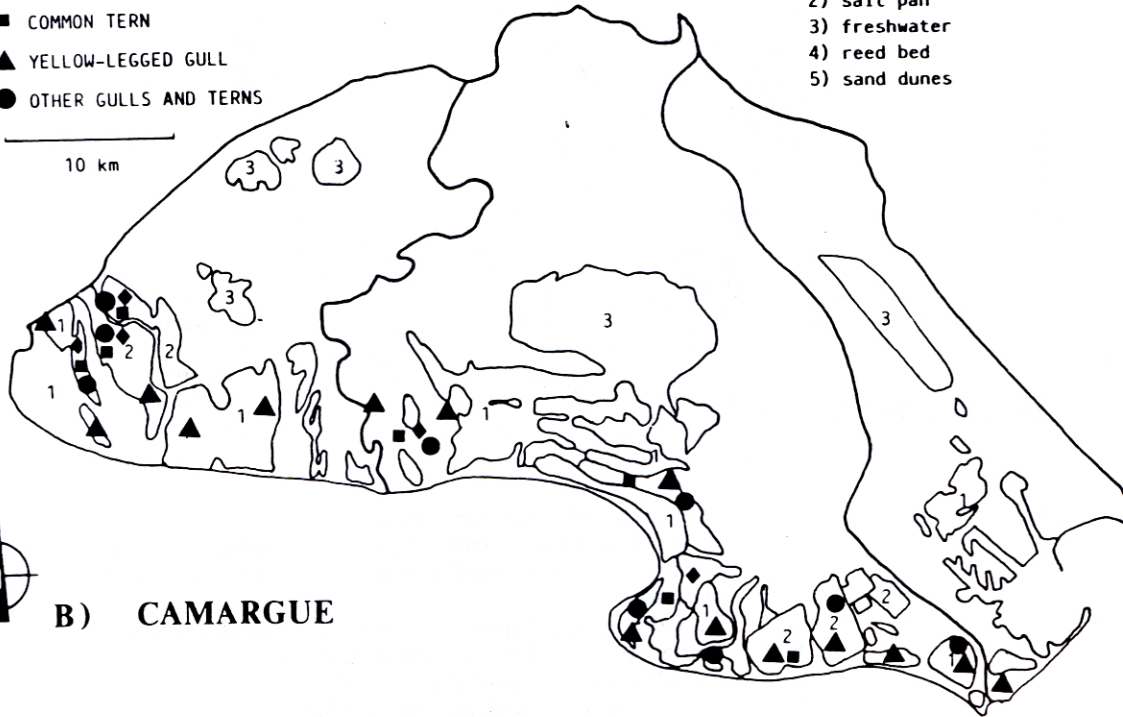
1) brackish and salt water

2) salt pan

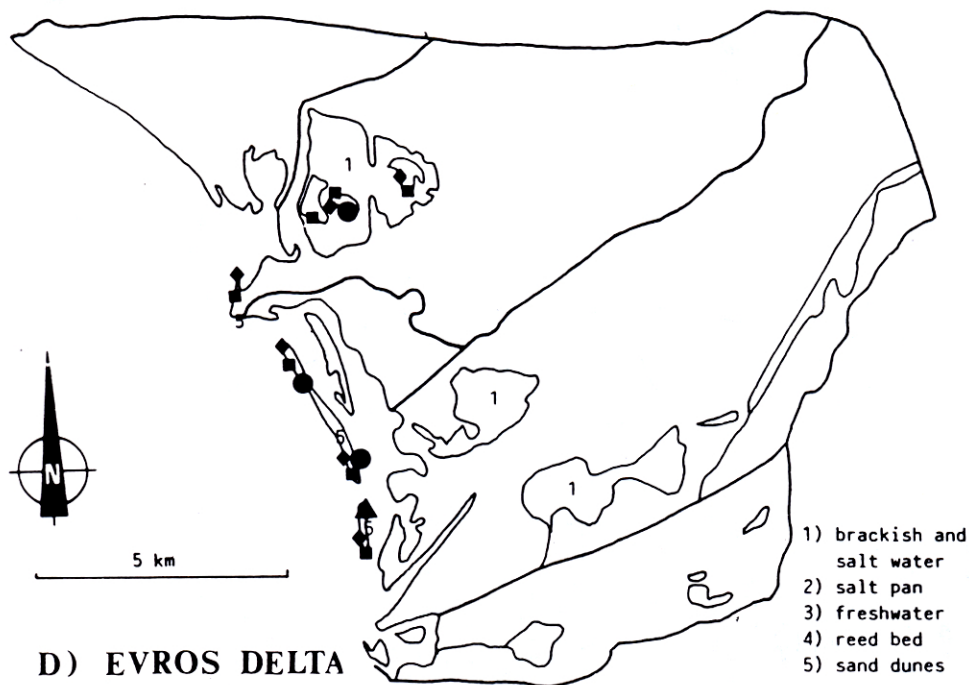
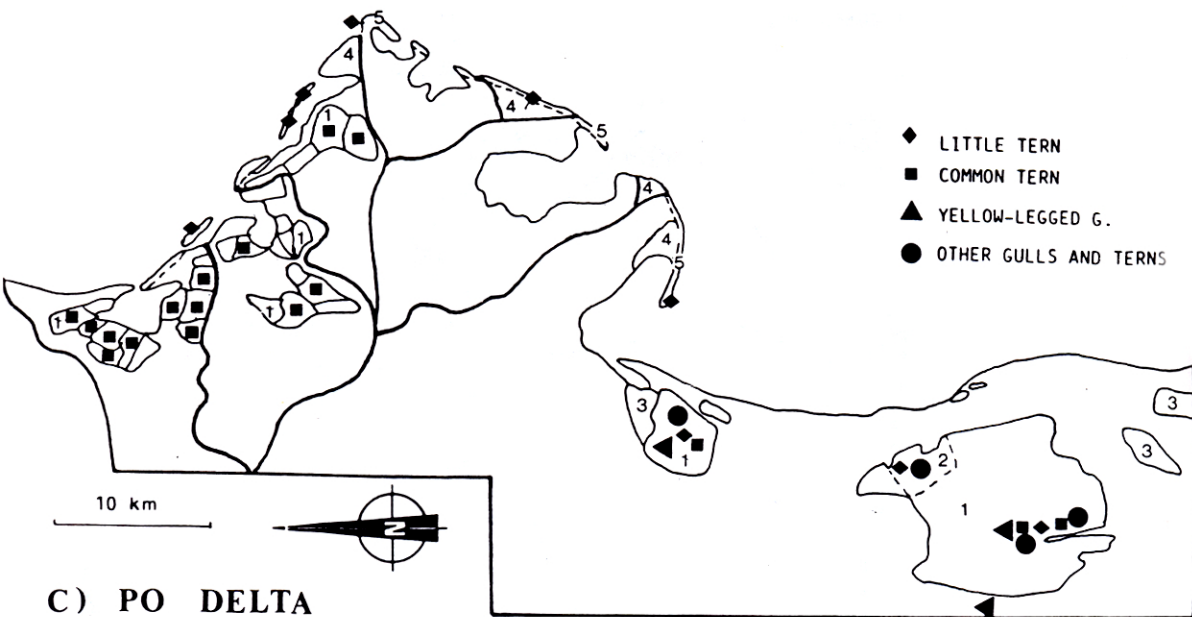
3) freshwater

4) reed bed

5) sand dunes



B) CAMARGUE



Figures 1 A), B), C) and D): The deltas and the areas considered in this study, their main biotopes and the distribution of the breeding sites of gulls and terns. Each symbol indicates either one or several neighbouring colonies.

- A) Ebro delta and colony sites in 1988 (Martínez-Vilalta, 1988).  
 B) Camargue, colonies from 1986 to 1988.  
 C) Po delta, colonies from 1982 to 1984.  
 D) Evros delta, colonies from 1985 to 1988.

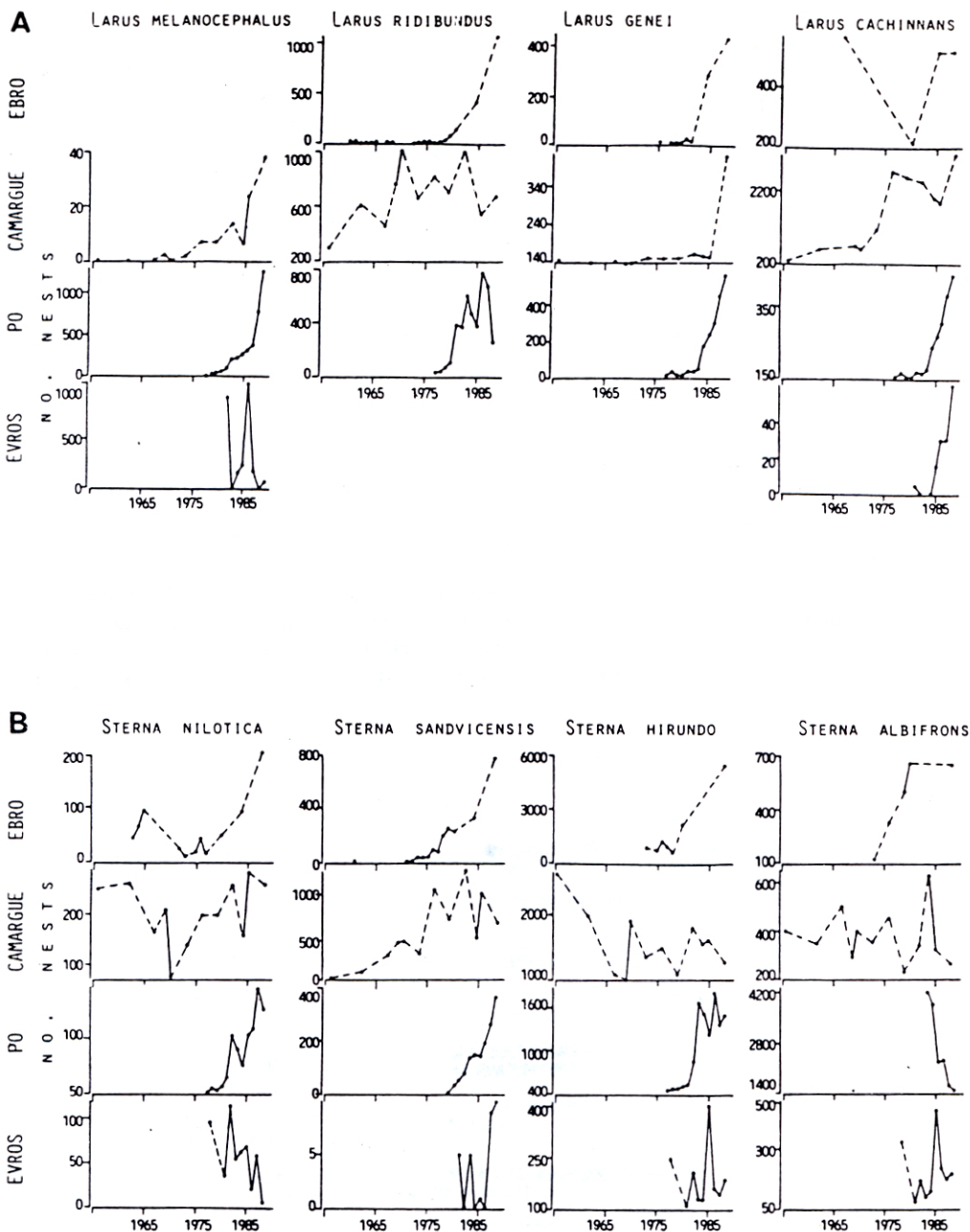


Figure 3 A and B:

Breeding populations in the deltas from 1956 to 1988, whenever data is available. The broken lines connect non-consecutive years fo census. For the Po delta, the populations are those breeding solely in the Valli di Comacchio, except for Mediterranean Gull and Little Tern whose populations are those breeding on the entire area. For the other three deltas, the data refers to the entire areas depicted in Figure 1. Data from Ferrer and Martínez-Vilalta (1986); Isenmann *et al.* (1986); Bricchetti and Foschi (1986); Martínez-Vilalta (1988), and from unpublished sources.

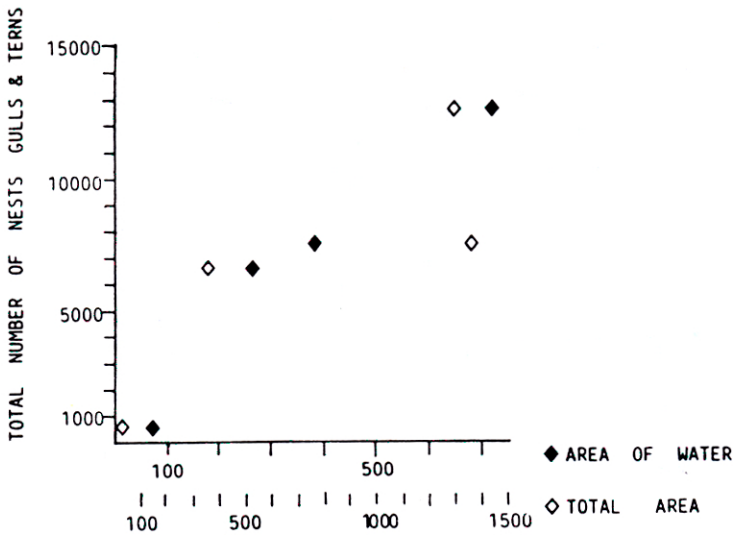


Figure 2: Abundance of gulls and terns in relation to the total surface, and surface of the aquatic biotopes (rivers, canals, rice fields, brackish and fresh water, marshes and salt pans) in the deltas (from bottom left to top right): Evros, Ebro, Po, Camargue. The correlation with the areas of water is significant ( $r=0.99$ ,  $P=0.01$ )

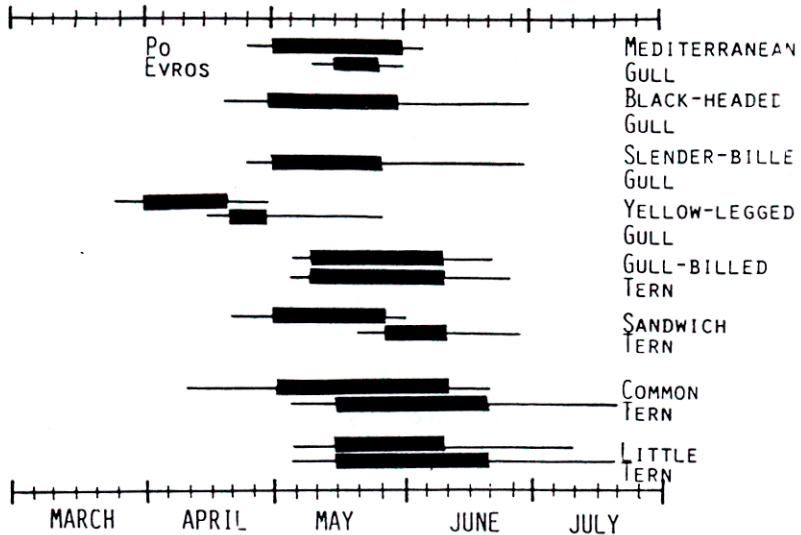


Figure 4: Dates of egg-laying by the gulls and terns in the Po delta (upper part of each graph) and in the Evros delta (lower part). The rectangles indicate the peak periods, the lines the extreme dates. Data referred to 1982-1984 for the Po, and to 1981-1988 for the Evros.



## Breeding habits

The breeding periods of the gulls and terns follow the same sequence in the Po and Evros deltas, with Yellow-legged Gulls breeding first, Little Terns last, and the other species overlapping in the middle of the breeding season (Figure 4). The timing of the peak breeding period in the same area may shift from 5 to 15 days from one year to another. In the Evros delta all the species seem to breed two weeks later than in the Po delta. No detailed data is available for the other deltas. In Mediterranean areas, Yellow-legged Gulls, Sandwich Terns, Common Terns and Little Terns breed 10-20 days earlier than in northern Europe (Figure 4 compared with data in Cramp & Simmons, 1983; Cramp, 1985). It is unclear whether late clutches are due to replacements of previous clutches, lost because of predation and of flooding, or whether they are laid by other birds, maybe younger birds breeding for the first time, as occurs with the Little Tern in North America (Massey & Atwood, 1984).

No study of breeding productivity has been conducted in the deltas; some data on clutch size is available for the Mediterranean, the Slender-billed and the Black-headed Gulls (Isenmann, 1975, 1976, 1977; Goutner, 1986a).

## CONCLUSION

### Conservation priorities

Nature reserves exist in the Camargue (only a core of 185 km<sup>2</sup> is protected) and in the Ebro delta (a natural park was created in 1983). The Po delta has recently (1988) been included in a large regional park. The Evros delta is still unprotected.

Only in the Ebro Park do breeding gulls and terns enjoy special protection through surveillance of the colonies. Management actions related to the breeding of gulls and terns carried out in the Camargue include:

- the limitation of the Yellow-legged Gull. The destruction of eggs, and the control of breeding adults, since the 1960s, seem to have stabilized the breeding population;
- applied research to reduce the conflict between breeding birds and the production of salt (see Walmsley, this volume).

In the Po delta, tourists regularly disturb colonies of Little Terns on the beaches. This may be responsible, in conjunction with sea storms, for the extensive breeding failures observed in Little Terns from 1985 to 1988.

Direct threats recorded in the Evros delta include: occasional disturbance and collection of eggs by fishermen, and trampling by grazing cows (e.g. on the Drana islets, Goutner, 1985); poisoning by pesticide residues may be responsible in 1988 for complete hatching failure of eggs of Mediterranean Gulls and Gull-billed Terns, two mainly insectivorous species (Goutner, 1986b). Some species (Slender-billed Gull, Sandwich Tern) which spend the winter in the area are also shot. Indirect threats in the Evros delta are: destruction of the breeding sites, e.g. the Drana lagoon, a breeding site for Mediterranean Gull, Gull-billed Tern, Common Tern and Little Tern, dried up in 1987 (Goutner & Jerrentrup, 1987); destruction of the foraging habitats, e.g. 400 hectares of natural habitat in the western part of the delta, used by Mediterranean Gull and by Gull-billed Tern, were reclaimed and cultivated despite the high salinity of the soil. This reclamation was partially financed by the E.E.C. through an Integrated Mediterranean Programme without any Environment Impact Assessment.

The following priority actions should be undertaken for the conservation of breeding gulls and terns:

- Po delta: prevent human disturbance by protecting breeding sites, particularly small islets in the Valli di Comacchio, and some parts of the beaches of the delta;
- Evros delta: protection of the coastal islets from development; control of development plans financed by the E.E.C. as Integrated Mediterranean Programmes; control of direct human disturbance and of grazing in the colonies; rehabilitation of the Drana lagoon.

FASOLA, M., GOUTNER, V. y WALMSLEY, J. Biología comparada de la reproducción de las gaviotas y charranes en los cuatro deltas principales del norte del Mediterráneo.

## RESUMEN

Los grandes deltas mediterráneos (Evros, Po, Ródano y Ebro) acogen a las más grandes colonias de aves marinas y la mayor diversidad de estas aves en la región. La composición de especies es similar en los cuatro deltas. Sus poblaciones son distintas y se corresponden a "grosso modo" con la superficie del hábitat de características naturales en cada delta.

Se resumen y comparan, cuando hay datos disponibles, las características relevantes de la cría de las cuatro especies de gaviotas y cuatro de charranes que se encuentran regularmente en estos deltas. Se dan: tendencias de población, fechas de cría, tamaño de la colonia, ubicación de la colonia, hábitats de cría y de alimentación.

## REFERENCES

Bablonas, D. (1980). Vegetationsienheiten und Vegetationskartierung in dem Mündungsgebiet des Flusses Ewros. *Feddes Repertorium*, 91 : 615-627.

Blondel, J. & Isenmann, P. (1981). Breeding ecology of Laridae and Sternidae in the Comacchio wetlands and recent population trends in MEDMARAVIS & Monbailliu, X. (eds.) *Mediterranean Marine Avifauna. Population Studies and Conservation*, Berlin, Springer Verlag.

Britton, R.H., Hafner, H., Morgan, N.C., Campredon, P., Tamisier, A., Lassère, G., Eggers, H., Muller, G. & Hallmann, B. (1978). Proposals for nature conservation in the Evros delta. Unpublished report, Min. Coord., Athens.

Camarassa, J.M., Folch, I., Guillen, R., Masalles, R.M., Velasco, I. & Batlle, E. (1977). El paisatge vegetal del delta de l'Ebre. *Treb. Inst. Cat. Hist. Nat.*, 8 : 47-67.

Cramp, S. & Simmons, K. (1984). *The Birds of the Western Palearctic*, Vol. III, Oxford, Oxford University Press.

Cramp, S. (1985). *The Birds of the Western Palearctic*. Vol. IV. Oxford, Oxford University Press.

Erwin, M., Galli, J. & Burger, J. (1981). Colony sites dynamics and habitat use in Atlantic coast seabirds. *Auk*, 98 : 500-561.

Fasola, M. (1986). Laridae et Sternidae breeding in Italy: report on the 1982-1984 census project in MEDMARAVIS & Monbailliu, X. (eds.) *Mediterranean Marine Avifauna. Population Studies and Conservation*, Berlin, Springer Verlag.

Fasola, M., Bogliani, G., Saino, N. & Canova, L. (1989). Foraging, feeding and time-activity niches of eight species of breeding seabirds in the coastal wetlands of the Adriatic Sea. *Boll. Zool.* (in press).

Fasola, M. & Canova, L. (1989). Nest habitat of the gulls and terns breeding in the Po Delta. *Second Mediterranean Seabird Symposium* (this volume).

Ferrer, X. & Martinez-Vilalta, A. (1986). Fluctuations of the gull and tern populations in the Ebro delta, North-East Spain (1960-1985) in MEDMARAVIS & Monbailliu, X. (eds.) *Mediterranean Marine Avifauna. Population Studies and Conservation*, Berlin, Springer Verlag.

Goutner, V. (1985). Breeding ecology of the Avocet (*Recurvirostra avosetta* L.) in the Evros delta (Greece). *Bonn. Zool. Beitr.*, 36 : 37-50.

Goutner, V. (1986a). The ecology of the first breeding of the Mediterranean Gull (*Larus melanocephalus*) Temminck 1820 in the Evros delta (Greece). *Okol. Vogel*, 8 : 189-197.

Goutner, V. (1986b). Distribution, status and conservation of the Mediterranean Gull (*Larus melanocephalus*) in Greece in MEDMARAVIS & Monbailliu, X. (eds.) *Mediterranean Marine Avifauna. Population Studies and Conservation*, Berlin, Springer Verlag.

Goutner, V. (1987). Vegetation preferences by colonies of Mediterranean Gulls *Larus melanocephalus* and Gull-billed Terns *Gelochelidon nilotica* in the Evros delta. *Seevogel*, 8 : 29-31.

Goutner, V. & Kattoulas, M. (1984). Breeding distribution of gulls and terns (*Laridae*, *Sternidae*) in the Evros delta (Greece). *Seevogel*, 5 : 40-41.

Goutner, V. & Jerrentrup, H. (1987). The destruction of the Drana lagoon in the Evros delta Ramsar wetland and its consequences for waterfowl. *WSG Bull.*, 50 : 18-19.

Isenmann, P. (1975). Contribution à l'étude de la biologie de reproduction et de l'écologie de la Mouette mélanocéphale *Larus melanocephalus*. *Nos Oiseaux*, 33 : 66-73.

Isenmann, P. (1976). Contribution à l'étude de la biologie de reproduction et de l'étho-écologie du Goéland railleur *Larus genei*. *Ardea*, 64 : 48-61.

Isenmann, P. (1977). Données sur la reproduction de la Mouette rieuse en Camargue. *Nos Oiseaux*, 34 : 143-154.

Isenmann, P., Johnson, A. & Walmsley, J. (1986). Fluctuations of the Laridae of the Rhône delta over the past 30 years (1956-1986) in MEDMARAVIS & Monbailliu, X. (eds.) *Mediterranean Marine Avifauna. Population Studies and Conservation*, Berlin, Springer Verlag.

Kotliar, N.B. & Burger, J. (1986). Colony site selection and abandonment by Least Terns *Sterna antillarum* in New Jersey, USA. *Biol. Conserv.*, 6 : 1-21.

Krebs, J.C. (1972). *Ecology. The Experimental Analysis of Distribution and Abundance*. New York, Harper.

Lemaire, S., Tamisier, A. & Gagnier, F. (1987). Surface, distribution et diversité des principaux milieux de Camargue: leur évolution de 1942 à 1984. *Terre et Vie*, Suppl. 4 : 47-56.

Martinez-Vilalta, A. (1989). Cens de gavines i xatracas nidificants al delta de l'Ebre. *Bull. Parc Nat. Delta de l'Ebre*, 3 : 36-39.

Massey, B.W. & Atwood, J.L. (1981). Second-wave nesting of the California Least Tern: age composition and reproductive success. *Auk*, 98 : 596-605.

Maldonado, A. (1977). Introducción geológica al delta del Ebro. *Treb. Inst. Cat. Hist. Nat.*, 8 : 7-45.

Meininger, P.L. & Baha el Din, S.M. (1986). Seabirds along the Mediterranean Sea coast of Egypt in MEDMARAVIS & Monbailliu, X. (eds.) *Mediterranean Marine Avifauna. Population Studies and Conservation*, Berlin, Springer Verlag.

Walmsley, J. & Duncan, P. 1989. Industrial salinas in the Calargue and the conservation of breeding seabird populations. *Second Mediterranean Seabird Symposium* (this volume).