

The colony of the Audouin's Gull at the Ebro Delta

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Abstract — We describe the Audouin's Gull colony established in the Ebro Delta (NE Spain) since 1981. The amazing growth of this colony, which is now the largest in the world, with about the 60% of the species' world population, was favoured in our view both by the complete protection of the breeding areas from human interference since 1987, and by its high reproductive success (maximum 2.01 chicks/pair in 1988). This breeding success is the highest recorded in Audouin's Gull colonies studied to date, and it seems to be due to the high availability of feeding resources (demersal fish) from activities by the local fishing fleet. Moreover, disturbance by breeding Yellow-legged Gulls was low. Changes in these factors could break the colony stability, as happened with the moratorium on inshore fishing in 1991 and 1992. The fragility of the Audouin's Gull population is mainly due to its generalized low breeding success in the main colonies, and its concentration in a few large colonies.

Introduction

Although its colonies are quite widespread throughout the Mediterranean (Figure 1), most of the Audouin's Gull (*Larus audouinii*) population is concentrated in the Western Mediterranean (Bradley 1988, Troya *et al.* 1989). It seems that both availability and abundance of its main food resource, the clupeid fish, are much higher in the Western than in the Eastern zone (Witt *et al.* 1981) and this factor might limit the increase of the Eastern colonies.

Until the establishment of the colony at the Ebro Delta, Audouin's Gull was unique among gulls in being limited for breeding to a particular kind of habitat, rocky islands (Cramp and Simmons 1983). However, at the Ebro Delta the species for the first time occupied a totally different habitat on the

mainland coast. The habitat is a peninsula of 2500 ha. with a mosaic of salt marsh and psammophilous communities and a flat profile with small dunes (Càmarasa *et al.* 1977).

The growth of the Audouin's Gull colony in the Ebro Delta

The Ebro Delta colony was established within the Punta de la Banya peninsula (Ebro Delta Natural Park) in 1981, after an increase in the records of Audouin's Gulls during post-breeding periods in 1979 and 1980, especially immature and sub-adult birds (Martinez and Motis 1982). Since then, the colony has grown constantly to become the biggest in the world, reaching ca. 7000 pairs in the 1992 breeding season (Figure 2). This number represents



Figure 1. Distribution of Audouin's Gull colonies, and percentage of nests in relation to total world population in the three main colonies in 1991 (estimated world population 9.000 pairs).

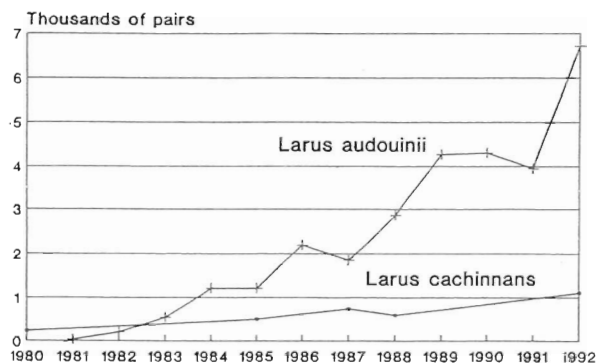


Figure 2. Growth of Audouin's Gull and Yellow-legged Gull population in the Ebro Delta.

approximately 60% of the species' world population.

Colony growth may have been favoured by the complete protection of breeding areas from human interference since 1987, which has guaranteed peace at the colony site.

Interactions with Yellow-legged Gulls

One of our aims was to check the pressure exerted by the Yellow-legged Gull (*Larus cachinnans*) on the Audouin's Gull at the Ebro Delta colony. Culling is practised in the Balearic and Chafarinas Islands to control the Yellow-legged Gull population, and the negative consequences of its presence on Audouin's Gull have been discussed in other colonies Sardinia (Monbailliu and Torre 1986), the Columbretes Islands (Catala *et al.* 1990). However, only the studies carried out in the Chafarinas Islands demonstrated the real damage caused by Yellow-legged Gulls, with quantitative data on aggression, predation and dominance, especially on eggs and chicks (Bradley 1988).

Nonetheless, at the Ebro Delta colony where Yellow-legged Gulls have bred for several decades, it is surprising that its population has remained fluctuating but stable until the 1992 breeding season, in which it increased in number (See Figure 2). It is a vast colony with scattered nests, occupying the most favourable sites on dunes, thus avoiding the risks of floods, which are very frequent in the area because of the strong winds in March and April. We have no evidence for the existence of habitat competition between Audouin's and Yellow-legged Gulls, though it is probably not high because of the large surface area of suitable habitat in the peninsula.

Moreover, only some pairs of Yellow-legged Gull breed in the middle of the Audouin's Gull colonies, and the interactions are minimal, as demonstrated

by data gathered on samples of animals joining or leaving the colony.

Behavioural observations were carried out during 21 days between the beginning of April and the end of June 1992 in a subcolony of 160 pairs, either by watching the colony, or by watching the gulls arriving at the colony. The observations began at day break and continued until after sunset watching the colony from an observation point far off 150 metres. We recorded the number of Audouin's Gulls arriving at the colony and the interspecific relationship observed with Yellow-legged Gull, divided into three categories: Kleptoparasitic, predation upon adult Audouin's and predation upon Audouin's nests; results are shown in Table 1.

Table 1. Predatory interactions by Yellow-legged Gulls on Audouin's Gulls.

	Kleptoparasitic interactions	Predation of adult Audouin's Gulls	Predation of Audouin's Gull nests (160 breeding pairs sub-colony)
No. of hours observation	563	563	563
No. of attacks	186	10	8
No. of attacks/1000 birds	2.58	—	—
Success (%)	35.9	70	20

Kleptoparasitic activities were regularly observed, especially at early and late hours of the day, when Audouin's Gulls come back from their feeding places. The predation on adult Audouin's Gulls is scarcer and also occurs at the same hours, when most of Audouin's Gulls move to and from the colony. These attacks probably begin with a kleptoparasitic fight, but if the number of the Yellow-legged Gulls involved is high and Audouin's Gulls do not regurgitate their prey, the attacks can turn into a direct predation if the Audouin's Gulls are unable to escape. Flocking during attacks confers Yellow-legged Gulls a high success rate, from 35 to 70 %, although the number of attacks per hour or per 1000 Audouin's Gulls censused is very low.

In contrast, the attacks performed in the Audouin's Gull colonies are made by single Yellow-legged Gulls, and their success rate drops to 25%, because these attempts are carried out after landing and this may favour the Audouin's Gull's defense behaviour. At the Ebro Delta colony the impact of Yellow-legged Gulls upon Audouin's Gulls is low. Further studies are needed, for example of habitat or food availability in order to evaluate this impact more precisely.

Breeding success

Breeding success was calculated as the number of fledglings per breeding pair. Breeding pairs were estimated by counting the total number of adult gulls in the colony during the second half of May, one or two weeks before main hatching period, and the figures obtained were corrected by counting the total number of nests in control areas. During 1992, 1988 and before 1983 full nest counts were made. Total number of fledglings were estimated by mark-recapture methods at the end of June or in the first days of July, just when the young birds begin to fledge; Chapman closed populations three-sample experiment in 1988, and Paterson closed populations two-sample experiment in 1991 and 1992 (Telleria 1986).

One of the factors that could have contributed to the amazing growth of the Ebro Delta colony is the exploitation of the feeding resources made available by the fishing activities of the local fleet. This benefit could explain the high breeding success registered at the Ebro Delta colony in the early years, whilst a voluntary moratorium on inshore fishing in the waters of the zone during the key months of May and June 1991 caused reproductive success to decrease greatly (Table 2). In 1991 Audouin's Gulls collected many prey from the paddy fields and adults regularly foraged far from the colony (Paterson *et al.* 1992); this supports the view that the usual prey were in short supply.

Table 2. Audouin's Gull breeding success at the most important colonies (Ebro Delta and Chafarinas). Data from Bradley (1988), Troya *et al.* (1989), Paterson *et al.* (1991), G. Alvarez (pers. comm.) and our study.

Place	Breeding success	Year
Ebro Delta	2.01	1988
Ebro Delta	0.84	1991
Ebro Delta	0.92	1992
Chafarinas Is.	0.31-0.44	1983
Chafarinas Is.	0.24-0.26	1984
Chafarinas Is.	≤0.15	1985
Chafarinas Is.	0.36	1987
Chafarinas Is.	0.57	1988
Chafarinas Is.	≈0.01	1989
Chafarinas Is.	0.42	1990
Chafarinas Is.	0.35-0.41	1991

It is important to note that the breeding success recorded in 1988 at the Ebro Delta colony was much higher than any other registered in any other colony. In the Chafarinas Islands, from which the best set of comparative data comes, breeding success has

always been very low (G. Alvarez, pers. comm.). Audouin's Gulls probably follow a conservative strategy and the adults, which have a long life expectancy, do not invest much energy in raising a high number of chicks in sub-optimum environmental conditions.

Current situation

One of the main problems for the species is the concentration of almost 80% of the total world population in two colonies in the Western Mediterranean: the Chafarinas Islands and the Ebro Delta, while 8.5% is in the Balearic Islands (Figure 1).

In 1988 a high mean clutch size combined with high breeding success resulted in a high productivity of the Ebro Delta breeding colony which may be estimated to have produced about 74% (ca. 6000 chicks) of the fledglings at Spanish colonies. Thus any incident affecting the stability of this colony site could endanger the future of the species, although for the moment the situation at the Ebro Delta seems steady.

Table 3. Audouin's Gull clutch size at the Ebro Delta (data from this study).

Clutch size	Sample (n)	Year
2.74	252	1988
2.40	30	1991
2.14	1269	1992

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