Interspecific kleptoparasitism in Audouin's Gull *Larus audouinii* at the Ebro Delta, northeast Spain: a behavioural response to low food availability

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Kleptoparasitism of Audouin's Gull *Larus audouinii* on other seabirds, a foraging behaviour previously unrecorded for the species, was studied in the Ebro Delta, northeast Spain, during 1992. The relationship between kleptoparasitism and trawler activity was assessed through changes in the availability of fish discards brought about by a trawling moratorium. When trawlers are not active, Audouin's Gulls use different feeding strategies, such as interspecific kleptoparasitism. Audouin's Gulls appeared to prefer to kleptoparasitize terns rather than gulls, but the success rate on gulls was higher. Most of the attacks were performed by single Audouin's Gulls, although success per attack improved with group size. During the trawling moratorium, the existence of large seabird colonies in the Ebro Delta acted as a buffer for Audouin's Gull through kleptoparasitism, compensating partly for the reduced food supply.

Until the establishment of a breeding colony in the Ebro Delta in 1981, Audouin's Gull *Larus audouinii* was considered threatened because of its small population size. Now, the total world population of Audouin's Gull has increased dramatically to c. 14,000 pairs, with more than 65% concentrated in the Ebro Delta colony (Oro & Martinez 1992), creating a new problem for the conservation of this species. Although some other gulls concentrate in fewer breeding sites (such as the Grey Gull *Larus modestus* or Heerman's Gull *L. heermanni* [Veermer et al. 1993]), few cases of a population explosion have been recorded restricted to a single place. The single outstanding characteristic of the Ebro Delta breeding site, as compared with other Audouin's Gull colonies, has been the remarkably high reproductive success and population growth (Oro & Martinez 1992), and this seems to be related to the birds feeding on trawler discards (Ruiz et al. 1996). Since 1991, a voluntary trawling moratorium has been established in the two provinces adjacent to the colony during 2 months each year and coinciding with the breeding season of Audouin's Gull. This moratorium has shown the importance of the fishing activity to the biology of the species, and several studies have recorded the ensuing changes (Oro & Martinez 1992, Paterson et al. 1992, Oro et al. 1995, Ruiz et al. 1996).

Interspecific kleptoparasitism by Audouin's Gull on other seabirds has not been recorded previously, and I assessed its relationship with trawler activity and the importance of this feeding strategy for the species in the Ebro Delta colony.

**METHODS**

The study was carried out in 1992 at the Ebro Delta, northeast Spain (Ebro Delta N.P., 40°37'N, 00°35'W). The colony held 6714 pairs in 1992 (D. Oro, unpubl. data), and its characteristics have been described by Oro and Martinez (1994a).

Other species breeding here are Gull-billed Tern *Gelochelidon nilotica*, Sandwich Tern *Sterna sandvicensis*, Common Tern *Sterna hirundo*, Little Tern *Sterna albifrons* and other species of gull such as Yellow-legged Gull *Larus cachinnans*, Black-headed Gull *Larus ridibundus*, Slender-billed Gull *Larus genei* and Lesser Black-backed Gull *Larus fuscus*.

Observations were conducted by the author during 23 days between the beginning of May (when all the breeding terns and gulls have already started the courtship feeding stage) and the end of June (when most Audouin's Gull chicks had fledged). The study was carried out between dawn and sunset by observing birds' behaviour as they crossed the observation point at the edge of the colony where most of the birds arrived from their foraging grounds. Observations were made for 207 h, and data for May (14 sample days; 126 h of observation) and June (nine sample days; 81 h of observation) were kept separate because the fishing moratorium was imposed on the local trawl fleet during April and May. In June, the fishing activity returned to normal (Monday to Friday), and 2 days of observation at weekends were included to compare the extent of kleptoparasitism when trawling activity had stopped for only 2 days.

Each set of observations recorded the number of kleptoparasitic attacks by Audouin's Gulls, the species parasitized, the number and age of the gulls involved in the attacks and the duration and outcome of the attacks. The criterion of success was dropping or regurgitation of food by the parasitized bird.

Chi-square test was used to compare number of hours with and without kleptoparasitic attacks with respect to trawling activity, and chi-square goodness-of-fit test was used to test if observed number of attacks agreed with the
**Table 1.** Numbers of terns and gulls (other than Audouin's Gull) breeding at the Ebro Delta, frequency of attacks by Audouin's Gull with no trawling and with trawling, success of attacks considering both periods of trawling moratorium and no trawling moratorium and attack rate per 10 h of observation

<table>
<thead>
<tr>
<th>Species</th>
<th>Breeding pairs</th>
<th>No trawling</th>
<th>Trawling</th>
<th>% of attacks successful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black-headed Gull</td>
<td>71</td>
<td>0</td>
<td>0</td>
<td>—</td>
</tr>
<tr>
<td>Slender-billed Gull</td>
<td>582</td>
<td>4</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Gull-billed Tern</td>
<td>24</td>
<td>0</td>
<td>0</td>
<td>—</td>
</tr>
<tr>
<td>Sandwich Tern</td>
<td>1220</td>
<td>19</td>
<td>1*</td>
<td>45</td>
</tr>
<tr>
<td>Common Tern</td>
<td>2198</td>
<td>29</td>
<td>1*</td>
<td>43</td>
</tr>
<tr>
<td>Little Tern</td>
<td>90</td>
<td>2</td>
<td>0</td>
<td>50</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>4185</td>
<td>54</td>
<td>2</td>
<td>50</td>
</tr>
</tbody>
</table>

Hours of observation: 126, 81
No. of attacks/10 h: 4.3, 0.2

* Count occurred during non-fishing, weekend period.

RESULTS

I recorded 56 attacks by Audouin’s Gulls on other seabirds, of which 54 (96%) were performed during the fishing moratorium (Table 1). Analysis showed a significantly higher proportion of attacks without trawling activity ($X^2 = 40.8$, $P < 0.001$). No more than two attacks were ever recorded in any hour. Further, the two attacks observed during the trawling activity period corresponded with each weekend census, when there was no commercial fishing activity. Although the sample size during fishing activity was small, the frequency of attacks was higher during the fishing moratorium than during the weekend cessation of fishing ($X^2 = 6.76$, $P < 0.03$).

Audouin’s Gulls kleptoparasited four seabird species (Table 1), and there were no differences in the frequency of attacks on these species ($X^2 = 2.70$, n.s.). However, Audouin’s Gulls strongly preferred to attack terns rather than gulls ($X^2 = 19.4$, $P < 0.0001$; Fig. 1), despite the success rate of attacks on gulls being higher.

Attacks performed by single Audouin’s Gulls (38 in total) were less successful than those carried out by groups of gulls (18 in total) ($X^2 = 18.9$, $P < 0.04$). Most of the attacks were performed by a single Audouin’s Gull, although robbing success per attack improved with group size (Fig. 2).

Of the 81 Audouin’s Gulls participating in the attacks, 80 were adults and only one was subadult. Considering that the proportion of adults in the colony was 94% (Ort & Martinez 1994b), the frequency of adults participating in the attacks was significantly higher than that expected by their proportion at the colony ($Z_{obs} = 7.74$, $P < 0.05$). Attacks were usually of short duration, and over 78% of them lasted less than 15 s (Fig. 3), whilst none lasted more than 30 s.

DISCUSSION

Audouin’s Gull was previously been described as a specialist in actively catching clupeids (sardines and anchovies), which...
contribute their main prey. Opportunistic behaviour, such as predation on migrant passerines, temporarily increased the diversity of their diet (Witt et al. 1981, Ruiz et al. 1996). The situation at the Ebro Delta colony followed the same pattern until the establishment of a trawling moratorium in the area, beginning in 1991. Then there was a marked decrease in breeding success (Oro & Martinez 1992, Oro et al. 1996). When trawlers were not fishing, Audouin’s Gulls showed an increase of their foraging niche width, feeding in rice fields and on dunes and shorelines (Ruiz et al. 1996). Further, the species switched to kleptoparasitism, apparently for the first time.

Rates of interspecific kleptoparasitism in Audouin’s Gull were low, especially when compared with parasitism by Yellow-legged Gull on Audouin’s Gulls at the same place (Oro & Martinez 1994a). Low rates of kleptoparasitism and the high success recorded for the attacks suggest a behaviour only performed by some specialized individuals (Brockman & Barnard 1979). Audouin’s Gull kleptoparasitic behaviour disappeared when the trawling moratorium stopped, probably because Audouin’s Gulls were forced to perform kleptoparasitism as a response to food shortage and not as an interspecific act of aggression involving competition (Thompson 1986). Lower rates of kleptoparasitism which reappeared when fishing activity stopped only for the weekend also support the idea that this behaviour was caused by food shortage.

Audouin’s Gulls seemed to prefer to kleptoparasitize terns rather than gulls, even though success on the Slender-billed Gull was highest, probably because Audouin’s Gulls tended to select hosts carrying visible food. Audouin’s Gulls did not form large groups of kleptoparasites, as Yellow-legged Gull did at the same colony (Oro & Martinez 1994a), and most attacks were performed by single gulls. As recorded in several papers, the robbing success per gull decreased when the number of gulls participating in the attack increased (Hatch 1975. Amat & Aguiler 1990). Thompson (1986) stated that one way to diminish the risk of being joined by another gull is through spacing, since in this way the attack of a gull joining in would be more expensive and consequently less profitable. In this study, it seems that Audouin’s Gulls diminished this risk by making fast attacks.

Just as the rice fields act as an accessory foraging ground in the Ebro Delta for the Audouin’s Gulls during the fishing moratorium (Oro et al. 1996, Ruiz et al. 1996), the existence of large seabird colonies also acted as a buffer during short food supply through kleptoparasitism. This has probably allowed the species to continue breeding successfully during the fishing moratorium, unlike the situation at the Columbretes Islands, 80 km from the Ebro Delta and 50 km off the coast, where Audouin’s Gulls experienced the same fishing moratorium situation but deserted the breeding colony when the moratorium started (Paterson et al. 1992, Oro et al. 1996).

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REFERENCES


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