

# ASPECTS OF THE BREEDING AND FEEDING OF KERGUELEN AND ANTARCTIC TERNS AT THE KERGUELEN ISLANDS

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## ABSTRACT

The breeding and feeding of Kerguelen Terns (*Sterna virgata*) and Antarctic Terns (*S. vittata*) were studied at the Kerguelen Islands in January-February 1985. The laying period was estimated to have ended during the third week of December for Kerguelen Terns and started during the last week of December for Antarctic Terns. Kerguelen Terns used a wide variety of feeding techniques and fed in marine, freshwater and terrestrial habitats. Marine crustaceans, fish and terrestrial invertebrates were the main prey. Antarctic Terns fed only in marine habitats, where crustaceans were the main prey. Even when feeding close together, the terns were seldom aggressive. Contrary to previous reports, Kerguelen Terns fed fish to chicks and fledglings despite the presence of Antarctic Terns. Frequent strong winds prevail at the subantarctic islands, and so wind speed is probably the most important factor affecting the ecology of Kerguelen and Antarctic terns.

## INTRODUCTION

Kerguelen Terns (*Sterna virgata*) and Antarctic Terns (*S. vittata*) occur together on the subantarctic archipelagos of Prince Edward, Crozet and Kerguelen in the Indian Ocean (Weimerskirch & Stahl 1988). However, whereas Kerguelen Terns are restricted to these islands, Antarctic Terns have a circumpolar distribution and breed on many subantarctic islands as well as mainland Antarctica (Watson 1975).

These two species of tern are similar in size, appearance and habits and the possibility of their competing on their breeding islands has been of interest since Falla (1937) found Antarctic Terns occupying all the nesting areas that Kerguelen Terns had vacated. Berruti & Harris (1976) and Stahl & Weimerskirch (1982) examined this aspect further. The breeding and feeding ecology of Kerguelen Terns at the Crozet Islands were described by Weimerskirch & Stahl (1988). They concluded that coexistence of the closely related Kerguelen and Antarctic Terns could have resulted in a parallel reduction of clutch size and a displacement of the laying period, with the result that competition for limited food resources is reduced. The only other information about Kerguelen Terns is in general papers (e.g. Paulian 1953, Despin *et al.* 1972, Thomas 1983).

The Kerguelen Islands have populations of about 1500-2000 breeding pairs of Kerguelen Terns and 1000-2000 breeding pairs of Antarctic Terns (Weimerskirch *et al.* 1989). The laying period of the sedentary Kerguelen Tern is from about the first week of November to mid-December, whereas that of the Antarctic Tern is from the last week of December to mid-February (Paulian 1953, Thomas 1983). The clutch of Kerguelen Terns is 1-2 eggs, whereas that of Antarctic Terns is 1 egg (Falla 1937, Paulian 1953, Thomas 1983).

Here I describe some aspects of the breeding and feeding of Kerguelen and Antarctic Terns at the Kerguelen Islands.

### METHODS

While on the Kerguelen Islands from 10 January to 11 February 1985, I visited the south coast of the Kerguelen mainland as far west as Baie Larose and several islands in the Golfe du Morbihan. Additional observations were made in the vicinity of the main base, Port-aux-Francais.

Whenever I encountered terns I recorded the species and the number, age, plumage, and behaviour of the birds. Following Stahl & Weimerskirch (1982), I considered terns with a greyish underwing to be Kerguelen and those with a white underwing and narrow black line along the trailing edge of the primaries to be Antarctic. The foraging activities of each bird in breeding plumage were timed for at least 2 minutes, during which I noted the bird's capture methods, capture rate, and prey.

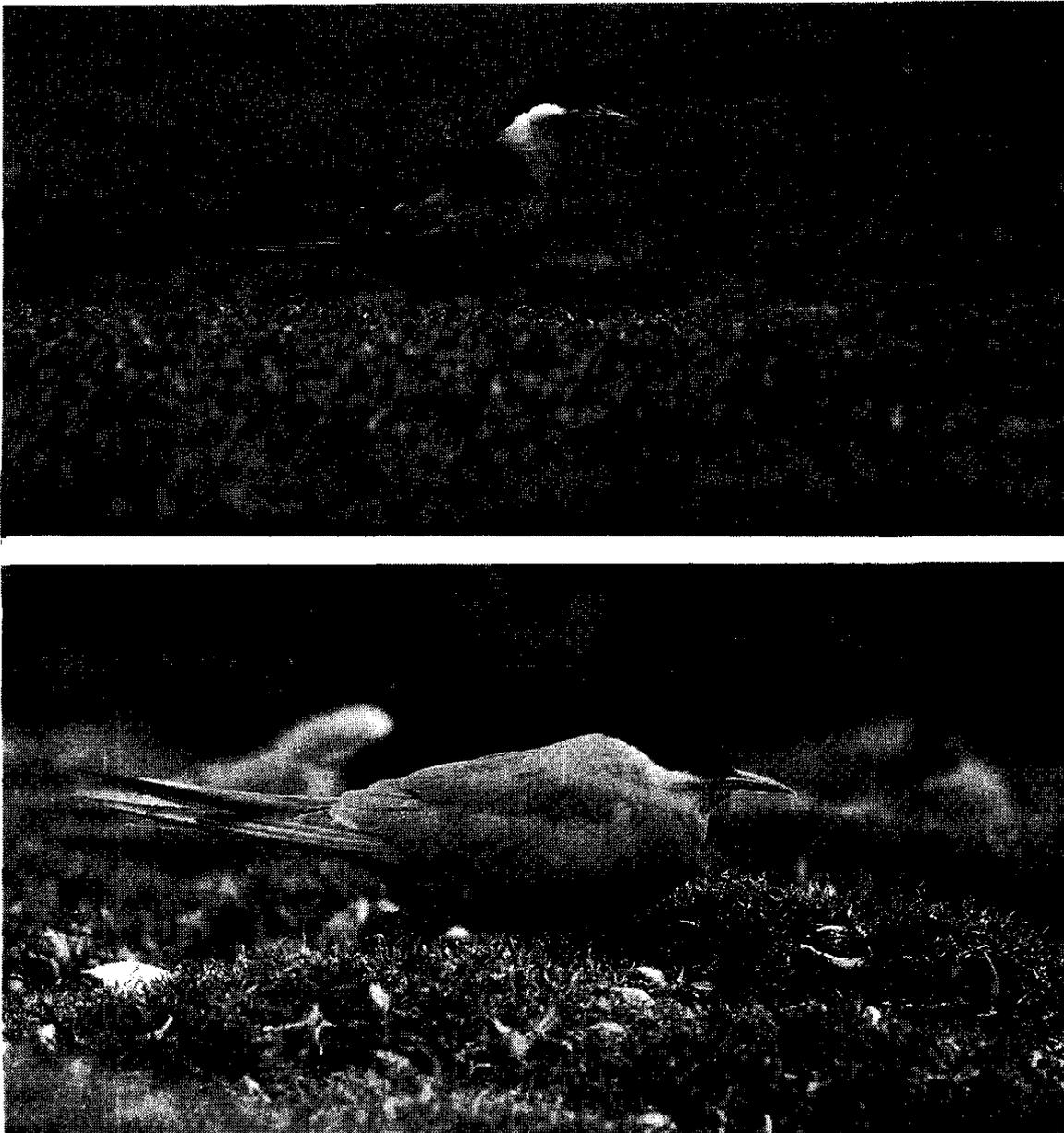


FIGURE 1 — Adult Kerguelen Terns in breeding plumage, Kerguelen, January 1985

## BREEDING

**Kerguelen Tern** (Figure 1)

All six Kerguelen Tern chicks found were among scree and sparse vegetation (*Acaena*, *Azorella*, *Poa*) on cliff tops (n = 4) or a river flat (n = 2). These sites were 2 - 100 m (mean = 25 m) above sea level and 50 - 1500 m (mean = 300 m) inland.



Figure 2 — Downy Kerguelen Tern chick, Kerguelen, January 1985



Figure 3 — Fledgling Kerguelen Tern, Kerguelen, January 1985

Three of the chicks were downy with the primaries erupting from their sheaths (Figure 2), while the other chicks were well-feathered (Figure 3) and within a few days of fledging. On the Crozet Islands, Weimerskirch & Stahl (1988) found that the duration of the fledging period depended on the chick's date of hatching; chicks hatching after mid-December taking up to 39 days to fledge, compared with 31 days for those hatching earlier. I estimated the downy chicks I found to be about 10 days old and the fully feathered chicks about 35 days old, and so they would have hatched from 6 to 15 January and 16 to 19 December respectively. With a 24-day incubation period (Weimerskirch & Stahl 1988), the estimated laying period would have extended until the third week in December, which is about a week later than that reported on Kerguelen by Paulian (1953) and Thomas (1983) and two weeks later than that on the Crozet Islands (Weimerskirch & Stahl 1988).

Recently fledged birds, in typical heavily barred plumage, were seen in the company of adults in most sheltered coastal areas and on islands of the Golfe du Morbihan.

### **Antarctic Tern**

Altogether, I found 29 breeding pairs. Nine pairs were nesting in isolation and the rest in small colonies of up to eight pairs. The minimum distance between nests was 3 m. These nests were on cliff-tops (12), on slight slopes (11), on beach ridges (5), and at a stream mouth (1). All were among rocks, most of which lacked vegetation or had a small amount of *Acaena* or *Azorella*, and were 1 - 20 m (mean = 6 m) above sea level and 1 - 200 m (mean = 32 m) inland.

Of the 29 nests located, 19 contained a single egg and 10 a single chick when first found. The eggs ranged in length from 44.0 to 50.5 mm ( $\bar{x}$  = 46.7  $\pm$  SD 1.87, n = 19) and in width from 31.3 to 34.6 mm ( $\bar{x}$   $\pm$  SD 0.94, n = 19). Back calculations from estimated hatching dates for the 10 chicks, allowing 24 days for the incubation period (Sagar 1978), give a laying period of 27 December to 15 January. This start of laying is similar to those estimated by Paulian (1953) and Thomas (1983), who reported the end of December and 20 December respectively.

## **FOOD AND FEEDING**

### **Kerguelen Tern**

Kerguelen Terns used a variety of feeding methods over a wide range of habitats. In marine habitats they fed in the surf zone, the extensive beds of the seaweed *Macrocystis* in the Golfe du Morbihan, pools left by the receding tide, and shallow water close to shore.

Flocks of up to eight Kerguelen Terns were seen feeding in the surf zone off a sandy beach along the south coast. Contact dipping (37%, n = 30) and full plunge diving (63%) from 3 to 4 m above the sea were used to catch crabs and fish. Each crab caught was carried to the beach, where the tern mandibulated it until the legs were removed; the body (estimated carapace width of 10-15 mm) was then swallowed. The fish were fed to chicks

and a fledgling. A 35 mm fish regurgitated by a downy chick was identified as a *Notothenia magellanica*.

The extensive beds of *Macrocystis* in the Golfe du Morbihan provided calmer water than areas without the seaweed in which the terns could feed. Flocks of up to 21 birds were seen feeding in this habitat, where they used full (60%, n = 148) and partial (40%) plunge diving to capture crustaceans and fish. Once, an adult caught crustaceans by walking on *Macrocystis* which was floating in the lee of a cliff. This bird captured 44 prey in about 7.5 minutes by pecking at the fronds of the seaweed.

TABLE 1 — Mean attempt rate, capture rate and percentage success ( $\pm 1$  SD) of Kerguelen Terns feeding in a variety of habitats

HABITAT	ATTEMPTS (min <sup>-1</sup> )	PREY (min <sup>-1</sup> )	SUCCESS (%)
Surf zone n = 3 birds	4.2 $\pm$ 2.5	1.5 $\pm$ 1.1	36.9 $\pm$ 11.3
<i>Macrocystis</i> n = 3 birds	7.1 $\pm$ 1.8	5.0 $\pm$ 1.6	69.3 $\pm$ 13.4
Wading in sea (n = 6 birds)	29.4 $\pm$ 7.1	20.3 $\pm$ 6.1	69.1 $\pm$ 4.0
Terrestrial vegetation (n = 48 birds)	3.4 $\pm$ 2.0	2.6 $\pm$ 1.7	74.2 $\pm$ 14.9

Three adults fed by wading in a pool left by the receding tide on a sandy beach. These fed rapidly (Table 1) on the many amphipods swimming in the pool. One bird paddled its feed for a few seconds and stirred up the sand and amphipods.

Kerguelen Terns which fed while walking on terrestrial vegetation — mainly close-cropped *Acaena*, *Cotula* and *Sagina* — were easy to observe; single birds and flocks of up to 53 birds were seen feeding in this way. Here the terns fed by pecking at the vegetation and the prey that could be identified before being swallowed were three each of annelids and spiders. Six pit-fall traps set for 24 hours in an area of *Acaena/Sagina* vegetation frequently used by feeding Kerguelen Terns collected a total of 15 Collembola, 10 Acari, 3 Arachnida, 13 Diptera, and 2 Coleoptera.

The highest feeding rates were by terns feeding on crustaceans (Table 1). This is not surprising, given the high densities of these crustaceans in the seaweed and shallow water of sheltered bays.

Kerguelen Terns seem to take similar food throughout their range. They fed on invertebrates in damp *Tillaea* meadows on Marion Island (Berruti & Harris 1976) and on the Crozet Islands the most numerous prey fed to chicks were (in descending order of abundance) terrestrial spiders and insects, fish, crustaceans, molluscs, and earthworms (Weimerskirch & Stahl 1988). Seasonal changes in diet on the Crozet and Kerguelen Islands are also similar, although terrestrial invertebrates appear to be more important in the diet

of terns on the Kerguelen than on the Crozet Islands. Also, on the Kerguelen, but not the Crozet Islands, freshwater fish are available in some of the rivers which flow into the Golfe du Morbihan, where salmonids have been introduced since 1955 (Davaine & Beall 1982).

Thus the main prey on both archipelagos during winter and into September are marine crustaceans, although on Kerguelen a small group of terns fed all winter on trout 60 - 100 mm long taken from one river (Thomas 1983, Weimerskirch & Stahl 1988).

On the Crozet Islands, marine fish were the main prey during incubation (November) and large numbers of terrestrial spiders were fed to chicks being brooded; after brooding, chicks were fed crustaceans and fish (Weimerskirch & Stahl 1988). Less information is available from the Kerguelen Islands, but chicks were fed fish and large numbers of insect larvae (Paulian 1953, this study). In November, Kerguelen Terns also fed all day along a stony shore for amphipods and abundant isopods. At dusk, the birds flew inland to feed on spiders and insects; insect larvae were well represented in the stomachs of birds collected (Falla 1937).

On the Crozet Islands, Kerguelen Terns also caught terrestrial arthropods by foraging in flight (Weimerskirch & Stahl 1988), a feeding technique not reported for this species on the Kerguelen Islands.

### **Antarctic Tern**

Antarctic Terns were seen to feed only close inshore over the sea. They fed alone or in flocks of up to five birds on crustaceans; none was seen to catch fish. When feeding over *Macrocystis* beds they averaged  $9.4 \pm \text{SD } 6.2$  attempts  $\text{min}^{-1}$  and  $6.7 \pm \text{SD } 4.7$  prey  $\text{min}^{-1}$  for  $68.0\% \pm \text{SD } 10.8\%$  success ( $n = 7$  birds). The feeding techniques used were full plunge (70%,  $n = 166$ ), partial plunge (26%) and dipping (4%).

A tern feeding over *Macrocystis* followed a Kerguelen Cormorant (*Phalacrocorax verrucosus*). Whenever the cormorant dived and surfaced the tern moved to hover 2-3 m above and just to one side of the cormorant. Presumably the tern fed on crustaceans disturbed by the cormorant, but this did not seem efficient because it made only four attempts at dipping in 6 minutes, with 50% success.

There are no reports of Antarctic Terns feeding on or over land, although on the Crozet Islands a chick regurgitated two weevil larvae (Stahl & Weimerskirch 1982). Perhaps the chick caught them, however, rather than receiving them from an adult. Thomas (1983) did not see them taking fish from the rivers.

### **AGGRESSIVE BEHAVIOUR**

Both species of tern fed alone and in single species flocks. Aggression was seen only between Kerguelen Terns. Once, an adult catching fish to feed a downy chick chased off another adult which had flown within 10 m of it. To do this the breeding bird flew towards the other, churring. Although Kerguelen Terns feeding on land sometimes fed to within 1 m of each other, usually they stayed further apart. Occasionally an adult tern feeding near

others on land would displace another by flying towards it, churring; the displaced bird usually flew 10 - 15 m and continued to feed. Once, however, an adult flew in and grabbed another adult by the nape; both birds then flew off.

Although I did not see mixed flocks of the two terns feeding, single birds or flocks of one species were seen to feed to within 2 - 3 m of the other species. This was usually over the *Macrocystis* beds and involved a flock of Kerguelen Terns feeding around a lone Antarctic Tern, which remained after the flock had passed by. Despite feeding so close, only twice was interspecific aggression recorded. In one, an adult Kerguelen Tern, which was feeding a fledgling at a roost of 12 adult and 2 fledgling Kerguelen Terns and 2 Antarctic Terns, swooped three times over the Antarctic Terns and chased them from the roost. In the other, an adult Antarctic Tern feeding over waves breaking on a rocky shore chased off a juvenile and a 1-year-old Kerguelen Tern by flying towards them, churring.

### MIGRATION

Kerguelen Terns are sedentary (Paulian 1953, Weimerskirch & Stahl 1988), but Antarctic Terns are migratory and are absent from Kerguelen from about the end of April to early December (Paulian 1953, Thomas 1983). Where these birds are during the non-breeding season has not been known, but on 6 February 1985 I caught a banded breeding adult Antarctic Tern on Ile du Chat, in the Golf du Morbihan. This bird had been banded as an adult at Dassen Island, southwestern Cape, South Africa, on 18 June 1983, some 4581 km from Kerguelen. More than 13 500 Antarctic Terns visit the coast of South Africa during the non-breeding season and birds which roost in the southwestern Cape start arriving in March, reach peak numbers in August, and most leave by the end of October (Brooke *et al.* 1988).

### CONCLUSIONS

The sedentary Kerguelen Terns use a wide variety of feeding techniques in marine, freshwater and terrestrial habitats. They have learnt to prey on salmonids, which were introduced to Kerguelen in 1955. Antarctic Terns, however, feed only in marine habitats and are present on the islands for just 5 months of each year. Therefore the two species of tern differ in their breeding schedule and food and feeding.

The ability of terns to feed at sea is reduced by increasing wind speed (Bengtson 1966, Dunn 1973, Taylor 1983, Sagar & Sagar 1989). Greater wind speed has also been shown to markedly slow the growth rate of tern chicks (e.g. Dunn 1975) and exceptionally windy conditions may explain the slower growth rates of late-hatched than early-hatched Kerguelen Tern chicks on the Crozet Islands in the 1980/81 breeding season. The mean laying date was much later that season than in the other two seasons of the study (Weimerskirch & Stahl 1988), which again indicates some effect of weather conditions or food supply. Kerguelen Terns sometimes lay two-egg clutches (Falla 1937), which may be a result of prolonged, relatively favourable wind conditions and food supply.

Strong winds prevail at the Kerguelen Islands, where winds of 57 km/h and above (11 and above on the Beaufort scale) occur, on average, 296 days each year (Duchene 1989). Although the *Macrocystis* beds have a calming influence on the sea and high steep cliffs provide some shelter from the wind, the terns did not feed during gales (8 on the Beaufort scale). Likewise, gale force winds on the Crozet Islands generally stopped the terns feeding (Weimerskirch & Stahl 1988). Consequently, the wind is probably the dominant factor in the breeding and feeding ecology of Kerguelen and Antarctic Terns on these islands.

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