

## SHORT COMMUNICATION

# NOCTURNAL FORAGING BY CHATHAM ISLAND SKUAS

**Summary:** Study of the cooperative breeding of southern great skuas (*Stercorarius skua lonnbergi*) on the Chatham Islands has identified differences in food availability among territories. Skuas here feed substantially on breeding petrels. Transmitters were placed on 10 birds of pairs and cooperatively breeding groups to monitor their movements on dark nights. Birds on territories containing petrel burrows remained within the territory, and fed on petrels caught on the ground. The territory of one pair on a rocky point lacked breeding petrels. The male was tracked at night away from the territory to an inland site. No birds left the island at night or followed flying petrels. No differences were found in the nocturnal behaviour of the individual birds of cooperative groups. The evidence obtained that skuas may feed both within and outside territories has implications for theories of territoriality and cooperative breeding based on resource defence.

**Keywords:** transmitters; skuas; *Stercorarius skua lonnbergi*; southern great skuas; Chatham Islands; nocturnal foraging.

## Introduction

This study of foraging is part of a long-term investigation of cooperative breeding of southern great skuas (*Stercorarius skua lonnbergi*) on the Chatham Islands. It was carried out on breeding territories on the northern coast of South East Island (44°22'S, 176°11'W) during December 1980. The island and the general biology of the skuas there have been described by Young (1978).

Chatham skuas feed substantially on broad-billed prions (*Pachyptila vittata*) and white-faced storm petrels (*Pelagodroma marina*) which are mainly taken at night. It was not known whether these prey were being taken from within the territory, from elsewhere on the island, or at sea. We suspected that at least some breeding groups were hunting exclusively within their territories. By contrast, other groups on barren sites must have been feeding away from their territories. The skuas might also have been feeding on fish. Experience with antarctic skuas (*Stercorarius maccormicki*) showed that it was easy to overlook feeding at sea, and to suppose that the birds were feeding exclusively in their territories (Young, 1963).

Direct observation of the skuas by day recorded little feeding of any sort and showed that there were very few occasions when they could have been at sea. Observations of skua behaviour at night showed two distinct patterns. During moon-lit nights skuas fly actively and behave much as during the day. On dark nights skuas are very hard to locate. They are reluctant to fly, they fail to see intruders and they seldom give alarm calls. Unless the birds are found on the nest, or by chance when searching among the vegetation, the territories appear to be deserted.

Uncertainty about the food source for these birds has hindered research on the evolution of their territorial behaviour and cooperative breeding. None of the resource-based models for these behaviours, for example, the ecological constraints model of Emlen (1982) for cooperative breeding, could be supported if the major part of the food used by the breeding birds was obtained outside the territory.

One way to check where the skuas were feeding at night was to use radio transmitters. It was hoped that radio-tracking skuas at night would answer several questions:

- (1) Could skuas capture petrels on the island on dark nights?
- (2) Do skuas remain on the territories throughout the night?
- (3) Can the territory provide all the food needed for the pair or cooperatively breeding group?
- (4) Are there differences in roles of the individual skuas of pairs and cooperatively breeding trios?

## Methods

The transmitters were packaged within an epoxy compound and inserted within a leather case which was attached to a nylon and wire harness forming a back pack. The full package measured 45 x 35 mm and weighed 35g. The skuas were apparently little affected by the radio package, which was soon preened into the feathers where it was scarcely visible to observers. The whip aerial of 250 mm extended slightly beyond the tail. The transmitters operated at 160 MHz, with a power output of 0.5 watts. The signals from the transmitters were monitored on two 12 channel/4 band receivers (AVM Instrument Co.,

Model LA-12, Illinois, USA). A six element, directional, high-gain antenna was erected at each receiving site. Each antenna was mounted on a central shaft passing through the roof of a hide. A needle mounted above a pelorus (aligned with true north) showed aerial direction. Signal strength, reflecting antenna orientation to the transmitter, was monitored using a signal-strength meter supplemented by an audio signal.

The two receivers were located near sea level at the northern tip of the island in territory 3 (A) (see Fig. 1) and on a 90 m high point midway along the west coast (B). The receiver points allowed skua movements to be monitored over most of the northern half of the island (where tens of thousands of petrels bred), the shore platform and shore line, and a wide sector of ocean to the north and west. Pitt Island, which is farmed and where some skuas scavenged, was also within range from the two receiving stations.

The transmitter/receiver system was checked against direct observations of skua movement by day, and shown to be sufficiently sensitive to record movements both within and away from the territories. Individual roost and loafing areas could often be distinguished.

Flights showed up immediately because the signals were stronger when the birds were in the air. Flights by birds around the territory perimeter (a regular feature of skua behaviour) were distinguishable from those in a fixed direction by a regularly varying signal strength as the aerial direction on the transmitter changed with the bird's flight. Flights over the sea were stronger than those over land and gave a steady signal. Any flights to sea were readily detected. During the day skuas flew from South East Island across to a freshwater lagoon on Pitt Island to bathe and those carrying transmitters were easily followed by telemetry throughout the 5 km flight.

The ability to distinguish steady-direction flights from circling and hovering was important. Direct observation of antarctic skuas foraging at sea showed that they invariably began circling when they started hunting (Young, 1963).

Observations began at dusk each night (at 2200 h) and continued throughout the night until first light (at 0500 h) to give seven hours' coverage. Readings were taken at each receiver at 10 minute intervals. The two stations were linked by radio telephone so that observations could be coordinated and checked. All birds were checked during each sweep and birds in flight were also monitored in the intervening period.

Observations from the two static receivers were supplemented by using hand-held, tracking receivers

which allowed individual birds to be found on or near the territory. Searches by torchlight were used as an additional check as all birds with transmitters were individually colour-banded. Birds found in the territories without transmitters were also noted, and territories were checked each morning for prey taken overnight.

The skuas selected for this study were all on territories in the north of the island. Comparisons were made between pairs and trios, and between skuas on territories with numerous petrel burrows and skuas with territories lacking burrows. Only pair 3 territory in this part of the island lacked burrows so that the second comparison was somewhat unbalanced for numbers in each group. Territory 3 was located on a rocky point which was sometimes cut off as an island during high tides. It had almost no soil and had little vegetation. The remaining territories were all coastal, reaching from the shore platform across the grass and herb slopes into the forest. The upper parts of these territories were densely burrowed by petrels.

The status of the skuas monitored during this study was as follows (chick weights are for 4 December): Territories with petrel burrows:

Trio 2 Pair plus supplementary male. Single fledgling (1600g).

Trio 6A Pair plus supplementary male. Two fledglings (1750g, 1650g).

Pair 4 Pair. Two fledglings (1600g, 1500g).

Pair 8 Pair. Single fledgling (1750g).

Territories lacking burrows:

Pair 3 Pair. Incubating two eggs throughout the study period.

One pair (4) and the two trios (2 and 6A) had transmitters on all adults. In pairs 3 and 8 only the male carried a transmitter.

Observations were made through six nights providing 420 hours of records. Records were obtained from all 10 skuas with transmitters on each night except for the last two nights when the transmitter failed on the pair 3 bird.

## Results

The records have been summarised in Fig. 1, giving arcs of receiver angles for each transmitter superimposed on a map of the territories of each skua breeding group. There were only intermittent records of 6A from receiver A, and of 2 from receiver B, because of the hills around these territories. These angles have been omitted from the figure. However, good records were obtained from both stations when

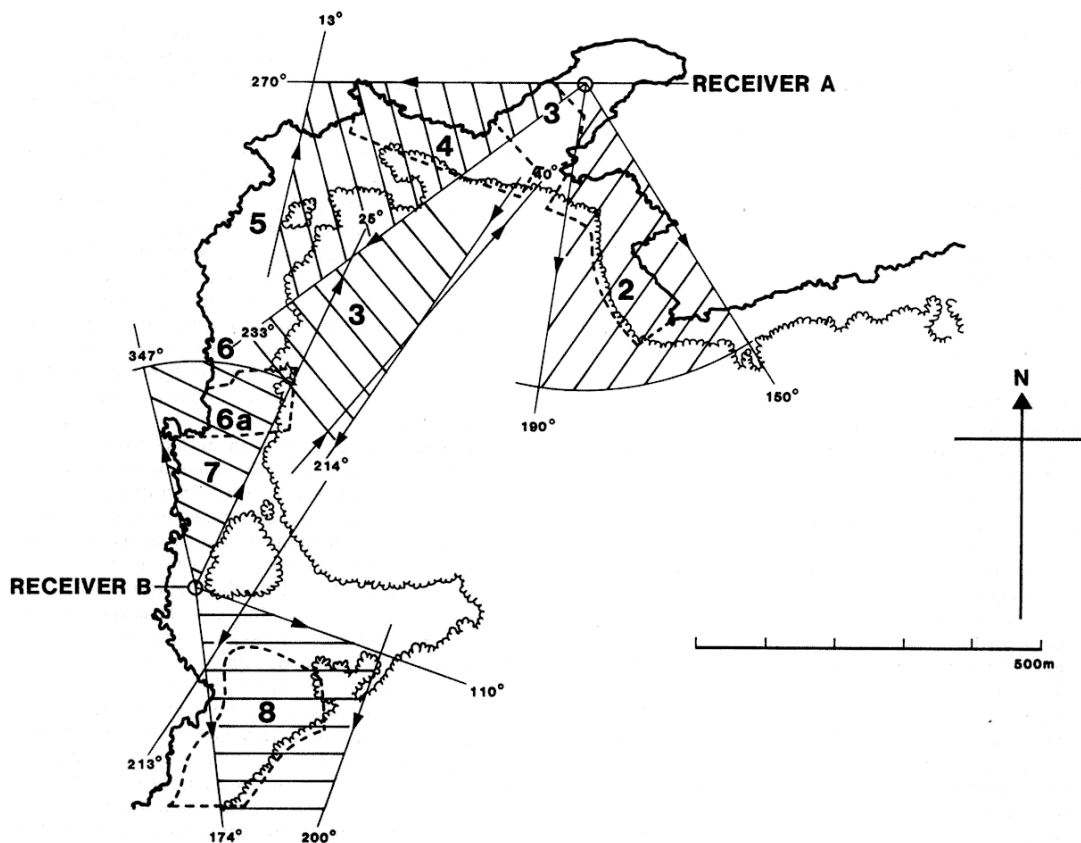


Figure 1: The nocturnal ranges of territorial southern great skuas on South East Island. The arcs of receiver angles for each station are plotted on a map of the northern part of the island showing the bush edge along the coast and the birds' territories. The receiver angles shown are the maximum range recorded for each breeding group carrying transmitters.

these skuas were flying, so that they could not have left their territories undetected.

With the single exception of pair 3 male, all other skuas were located within their territories at all times. No plots fell significantly outside the well known territorial limits. No skuas left the island on any night.

Compared with all the other birds with transmitters, the pair 3 male behaved differently. On each of the four nights the transmitter was working, this bird was tracked from its territory at dusk across the island to the forest margin along the inland edge of territories 6

and 6A. In the early morning, at about first light, it was tracked back to the territory, where it remained for the rest of the day. The female incubated the eggs throughout the night. To confirm the exact position of this skua, which appeared to be foraging very near defended territories, it was searched for during the night of 10 December with a portable aerial and receiver. When found it was positively identified from its signal and leg bands. The bird was foraging among broad-billed prion burrows beneath a dense canopy of the coastal *Olearia traversi*. Inspection of the records for each trio showed no clear differences in

movements or roosting sites of the individual skuas. For long periods identical plots were obtained for each breeding group suggesting that they were sitting closely together on the same roost. Apart from pair 3, which was incubating, the other skuas were all feeding large chicks at this date. At that stage of the breeding cycle the young do not need to be brooded or much protected, so that the territory lacks the focus of the earlier stages of nesting. The pair 3 skuas did show a clear division of nest attention with the male feeding away from the territory while the female remained at the nest.

Overall, there was little movement on the six nights of the study and few flights. Flights were intercepted during the set recording intervals on only 47 occasions during the entire period of observations. This was on average fewer than eight times per night. Most of these flights occurred in the early morning between 0400h and 0500h, at first light.

A more detailed watch of trio 6A was carried out from a bluff close to the inland edge of the territory on the night of 16/17 December to monitor the movements of individual skuas. Much of the territory, including the roosts and the place where the chicks hid, was in direct view. Receiver records were augmented by direct observation using a 'Zenoscope' light-enhancing night scope. The three skuas of this trio were together for much of the night and undertook short flights only from point to point on the territory. This flight pattern contrasted with that by day when long circling flights around the territory were common. From dusk (at 2000h) until 2240h, the birds were together on the roost above the nest site, except for two short flights by the alpha male and 25 minutes foraging among petrel burrows along the forest edge, without success, by the beta male. From 2240h until 0140h all three birds foraged for petrels in the long grass and shrubs of the upper territory, capturing at least three petrels, and making three flights back to the chicks with food. The alpha male fed the chicks twice, the beta male once. The skuas roosted again for the rest of the night, with a single flight by the beta male, until general flights about the territory began again at first light at 0420h.

Searches each morning recorded petrel remains (skeletons and wings) at middens of each study group except pair 3, which presumably ate their prey elsewhere.

## Discussion

This radio-tracking study, in conjunction with the records of prey found each morning, showed that the

skuas were able to catch adult petrels on the ground among vegetation, and under the forest canopy, in the dark. It also confirmed that little flight occurred at night. The skuas monitored in this study were all on coastal territories. These were not as dark as inland ones, especially those of the central valley inland from 6 and 6A where the grassy valley floor was surrounded by bush-clad slopes. This valley was very dark on moonless nights, but foraging, as judged from prey remains, appeared to occur with the same success here as in the coastal area. We suspect that skuas find petrels in the dark from the noise they make as they crash to the ground through the canopy and rustle through the grass. After many hours experience of skuas under different lighting conditions at night we think that they see about as well in the dark as humans.

The flight records using transmitters have established unequivocally that skuas on territories with petrel burrows remained on their territories throughout the night. As expected, the male of pair 3 defending the island territory, which lacked burrows, foraged away from the territory. The fact that it foraged along the defended inland margin of trio territories, where it was liable to be attacked, instead of in the very extensive areas of similar forest elsewhere on the island was unexpected.

No skuas left the island for the sea or for neighbouring Pitt Island and none attempted to follow incoming or departing petrels across the open coast. These petrels were the only food resource locally available to pair 3, but they were not exploited.

These records of territory occupation confirm that territories with petrels can supply the food needed by the breeding skuas at this time. They were therefore, both breeding and feeding areas - the type A territories of Hinde (1956) or the general purpose territories of Brown and Orians (1970). Territory 3 is unique for the northern side of the island in lacking breeding petrels. A large proportion of territories on the exposed flats on the southern side of the island also lack food. The skuas occupying these territories must also forage for petrels away from the territory. For these breeding groups the territory is simply a breeding area, the type B territory of Hinde (1956).

Neither the more general study of the five territories nor the close watch on territory 6A established characteristic patterns of movement or behaviour for the individual birds of the trios. During daylight watches it has been established that the beta adult shows reduced participation in incubation and in feeding young chicks, and consequently, appears to do

more than its share of territorial defence and foraging. The breeding season was too far advanced at the time of this study to be able to see whether such behaviour was maintained throughout the night.

Parmelee *et al.* (1978) were the first to demonstrate clearly the terrestrial feeding preference of this skua when breeding. In a comparative study of sympatric antarctic and southern skuas on the Antarctic Peninsula it was found that the former skuas fed at sea while the latter fed on land (on penguins). The present study provides additional evidence of preferred terrestrial feeding for southern great skuas in a very different environment with different food resources. Their feeding ecology during winter, or when away from the breeding areas, is not known.

### Acknowledgements

We are grateful for permission from the Department of Lands and Survey (now Department of Conservation) to work on these islands, and for help given in the Chathams by farmers and fishermen. The research was supported by funding from the University of Auckland Research Committee.

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