

SHORT NOTE

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Foods of the South Polar skua *Catharacta maccormicki* at Ardery Island, Windmill Islands, Antarctica

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Abstract South Polar skuas (*Catharacta maccormicki*) breed on Ardery Island in the absence of a local breeding population of Adelie penguins (*Pygoscelis adeliae*). Assessment was made of the food remains in skua feeding territories in 1995/1996. The diet of South Polar skuas largely consisted of fulmarine petrel species which bred on Ardery Island. Southern fulmar (*Fulmarus glacialisoides*) remains were the predominant prey items found, and skuas appeared to feed preferentially on this species.

Introduction

Ardery Island occurs in the Ardery and Odbert Island Specially Protected Area, Windmill Island group, near Casey Station (66°22'S, 110°27'E), Antarctica. Ardery Island has breeding populations of South Polar skua (*Catharacta maccormicki*), Wilson's storm petrel (*Oceanites oceanicus*), and the fulmarine petrels, southern fulmar (*Fulmarus glacialisoides*), Antarctic petrel (*Thalassoica antarctica*), Cape petrel (*Daption capense*) and snow petrel (*Pagodroma nivea*). The distribution and size of bird populations on Ardery Island are detailed in Bonner and Lewis Smith (1985), van Franeker et al. (1990) and Barbraud and Baker (1998); different petrel species nest in discrete colonies. Adelie penguins (*Pygoscelis adeliae*) do not breed on Ardery Island; the closest colonies occur on Odbert Island, 2.5 km distant. The island consists of charnockite rock and the terrain

includes cliffs, both steep and gentle slopes, and areas of morainic boulder slopes.

In many other Antarctic areas, feeding during the breeding season by South Polar skuas, and hence their selection of breeding location, is largely dependent on Adelie penguin rookeries in combination with availability of food at sea (Young 1963; Müller-Schwarze and Müller-Schwarze 1973; Trillmich 1978; Hull et al. 1994; Norman et al. 1994). Ecklund (1961) estimated that at least 95% of skua nesting habitats in the Windmill Island group are close to Adelie penguin rookeries. The absence of breeding populations of Adelie penguins on Ardery Island allows investigation of skua feeding where other bird species are likely to be predominant in their diet. Other studies that have investigated the diet of skuas remote from Adelie penguin populations have found food items of importance to be snow petrels (Zipan and Norman 1993), southern fulmars and Antarctic petrels (Green 1986).

This study investigated the food of skuas on Ardery Island in the summer of 1995/1996 in relation to the proximity of skua nest sites and feeding territories to petrel colonies.

Materials and methods

The diet of South Polar skuas on Ardery Island was studied between 22 December 1995 and 29 February 1996. The location of skua nests, feeding territories of non-breeding skua pairs, and non-territorial feeding areas used by several skuas were identified and mapped (Fig. 1). Sampling locations were rated according to their proximity to breeding colonies of avian prey species.

Territories were visited regularly on at least a weekly basis. The remains from skua prey were recorded and then removed to avoid repeat records at subsequent visits. Items found included regurgitated pellets, egg shells, remains of adult birds, and chick remains. All items at first visit were included in the analysis. Pellets were sorted and the remains identified by comparison with material from known bird species. The species of bird and type of item (egg, adult or chick) were recorded for all remains found. Chi-squared tests (Steel and Torrie 1980) were used to test whether the counts of egg, adult and chick remains of each species

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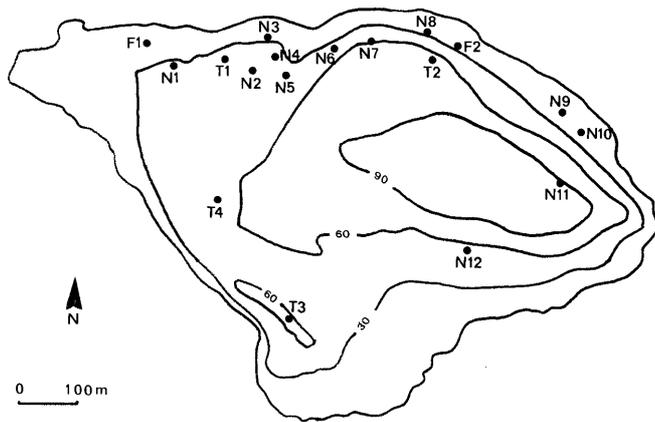


Fig. 1 Location of South Polar skua nests (N), territories of non-breeders (T) and feeding areas (F) on Ardery Island in 1995/1996

are in proportion to the populations of each species on Ardery Island.

The remains of adult birds were often detached from the body, e.g. head, wings, tarsii, or combinations of these. Any separated item of adult bird was recorded. Hence the possibility exists that more than one separated item from an individual bird was recorded; consequently, the percentages of adult birds of a prey species may be slightly exaggerated relative to egg and chick counts of the same and other species.

Results

A total of 594 food items was recorded from 18 South Polar skua feeding areas on Ardery Island (Table 1), of

Table 1 Comparison of egg, adult and chick remains between prey species of South Polar skua; counts, frequency of occurrence and the numbers of prey items relative to the prey species' population size

Prey species and population size on Ardery Island	Item	Count	Frequency (%)	Prey item/pair (%)
Southern fulmar 3860 pairs	Egg	267	44.9	6.9
	Adult	175	29.5	4.5
	Chick	69	11.6	1.8
	Total	511	86.0	13.2
Snow petrel 800 pairs	Egg	6	1.0	0.8
	Adult	33	5.6	4.1
	Chick	3	0.5	0.4
	Total	42	7.1	5.3
Cape petrel 550 pairs	Egg	9	1.5	1.6
	Adult	16	2.7	2.9
	Chick	0	0	0
	Total	25	4.2	4.5
Antarctic petrel 247 pairs	Egg	0	0	0
	Adult	2	0.3	0.8
	Chick	0	0	0
	Total	2	0.3	0.8
Adelie penguin 0 pairs	Egg	0	0	—
	Adult	14	2.4	—
	Chick	0	0	—
	Total	14	2.4	—

which 44 (7.4%) were found during the first visit. Southern fulmar material was by far the most numerous, constituting 86.0% of items found. Material from snow petrels (7.1%) and Cape petrels (4.2%) was much less abundant, and was concentrated at a few sites. Material from Adelie penguins (2.4%) and Antarctic petrels (0.3%) appeared very rarely in the skuas' diet.

No South Polar skua remains were found in the collection areas. However, observations on skua breeding success suggest that 12 skua eggs and 3 skua chicks were probably consumed during the observation period. Observation of Antarctic petrel colonies suggests that a low number of eggs and chicks may also have been consumed by skuas. No remains of Wilson's storm petrel were found at any of the study sites.

The incidence of egg, adult and chick remains (number of items) was compared to the population (pairs) of each prey species nesting on Ardery Island. Chi-squared tests found that the proportion of egg, adult and chick remains were different than would be expected from the population size of each species: egg $\chi^2 = 79.56$, $df = 3$, $P < 0.005$; adult $\chi^2 = 10.18$, $df = 3$, $P < 0.025$; chick $\chi^2 = 22.36$, $df = 3$, $P < 0.005$.

Comparison of the number of food items relative to the nesting populations (Table 1) suggests a disproportionately high number of southern fulmar eggs and chicks compared to those of other prey species. The number of southern fulmar adult remains was also higher than the other species; however, there were also a relatively high number of snow petrel adults while the number of Antarctic petrel adult items was disproportionately low.

Eight of the feeding sites provided sufficient material for comparison of diet (Table 2). Southern fulmar items were the most numerous at all sites, forming between

Table 2 Frequency of occurrence (%) of food items and approximate numbers of nest sites of prey species within respective territories (in parentheses) of eight South Polar skua feeding sites on Ardery Island

Skua site	Prey species				
	Southern fulmar	Snow petrel	Cape petrel	Adelie penguin	Antarctic petrel
N1	96.5 (> 500)	0.0 (50)	0.0 (50)	2.3 (0)	1.2 (30)
N3	94.7 (> 500)	0.0 (50)	5.3 (100)	0.0 (0)	0.0 (30)
N6	100.0 (> 500)	0.0 (50)	0.0 (100)	0.0 (0)	0.0 (0)
N7	91.2 (> 500)	2.9 (50)	0.0 (100)	5.9 (0)	0.0 (0)
N9	63.2 (> 500)	14.0 (100)	15.8 (50)	7.0 (0)	0.0 (0)
N10	88.1 (> 500)	8.9 (100)	0.0 (50)	3.0 (0)	0.0 (0)
N12	62.2 (150)	25.6 (200)	11.0 (50)	1.2 (0)	0.0 (0)
F2	94.0 (> 500)	1.2 (50)	3.6 (100)	0.0 (0)	1.2 (100)

62.2 and 100% of food remains found, and were the most abundant prey species within each feeding territory except N12.

Discussion

The results of this study suggest that Ardery Island supports a breeding population of South Polar skuas which is largely independent of Adelie penguins as a food source, with southern fulmars providing the bulk of their food. Our results support the concept of opportunistic feeding by South Polar skuas (Norman and Ward 1990), which states that skuas appear to largely depend on the most numerous and readily obtainable prey species for food. On Ardery Island, southern fulmar was the most numerous prey species and nests were more accessible to skuas than snow petrel and Wilson's storm petrel nests. In addition, snow and Cape petrel adults and chicks appeared more prone to spitting stomach oil in defence (S.C. Baker, personal observation) than either southern fulmars or Antarctic petrels.

The results suggest an apparent preference for southern fulmar adults and chicks compared to other prey species. The main Cape and Antarctic petrels' egg-laying periods were prior to commencement of this study. This is likely to bias the egg counts and would partially explain the disproportionately high numbers of southern fulmar eggs, although snow petrel eggs appear to be preyed upon much less frequently. Although the overall rates of predation of snow and Cape petrels are similar, there were a greater proportion of snow petrel adult remains but a lower proportion of chick remains compared to Cape petrels.

Adelie penguin remains were found very infrequently in the food remains of South Polar skuas. Leopard seal (*Hydrurga leptonyx*) faeces are also a source of Adelie penguin remains (Green 1986). Skuas were observed feeding on these on ice flows close to Ardery Island. Alternatively, skuas may have foraged on dead adult Adelie penguins from Odbert Island.

No items of marine foods, such as remains of fish, cephalopod or krill, were found in skua pellets. Skuas were never observed fishing, so it is likely that marine organisms were only consumed indirectly from feeding on the stomach contents of their prey. Moreover, marine prey are likely to be nearly completely digested by skuas, so that remains would be rare (Young 1990).

Ardery Island seems to be the only location in the Windmill Islands region where South Polar skuas are dependent on petrel species for food. Observations on Shirley, Holl, Odbert and Peterson Islands, all of which support Adelie penguin colonies, suggest that skuas are largely dependent on Adelie penguins as a food source.

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