Corella, 1994, 18(2): 37–40

ASPECTS OF BREEDING CHRONOLOGY AND SUCCESS OF THE ANTARCTIC SKUA *Catharacta maccormicki* AT MAGNETIC ISLAND, PRYDZ BAY, ANTARCTICA

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Received 23 December 1991

At Magnetic Island, an east Antarctic coastal site, the breeding timetable of Antarctic Skuas was similar to that reported from other sites. Breeding success ranged between 62 and 65 per cent over the three seasons 1986/87, 1989/90 and 1990/91. This is high compared with most previous studies and seems related to a high Adelie Penguin: Skua nesting number ratio and consequent high food availability. Most mortality was due to eggs being stolen by other skuas.

INTRODUCTION

Much work has been carried out on skuas, with particular attention being paid to the factors that influence breeding success (see Furness 1987). Breeding success has been correlated with timing of breeding (Wood 1971; Furness 1987; Pietz 1987), latitude (Young 1977; Hemmings 1984; Furness 1987), weather, particularly storms (Young 1963a; Spellerberg 1971; Ensor 1979), and abundance of food (Trillmich 1978). Food abundance appears to affect the degree of aggression inflicted upon the younger chick by the older (Wilson 1907). Sibling rivalry, presumably prompted by hunger, also predisposes the younger chick to starvation, exposure and predation by other birds (Young 1963a; Spellerberg 1971; Proctor 1975). This is probably an example of the classic brood reduction phenomenon where brood size tends to be adjusted to food availability by the starvation of the smaller, later-hatched siblings (Lack 1954). According to this theory, in years of greater than average food availability, the second skua chick is more likely to survive (see Parsons 1975).

This study aimed to assess the breeding success of the Antarctic Skua *Catharacta maccormicki* at Magnetic Island (68°30′S, 77°50′E), four kilometres offshore from Davis Station in Prydz Bay, Antarctica. Here, skuas usually nest in association with colonies of Adelie Penguins *Pygoscelis adeliae*. In Prydz Bay, Adelie Penguins provide an important food source for skuas throughout the penguins' breeding season (Green 1986; Norman and Ward 1990).

During summer, the island supports approximately 17 000 pairs of Adelie Penguins (Whitehead and Johnstone 1990), approximately 50 pairs of Cape Petrels *Daption capense*, 20–30 pairs of Snow Petrels *Pagodroma nivea*, and an unknown number of Wilson's Storm Petrels *Oceanites oceanicus*. Data on the timing of breeding, laying, hatching and chick survival were obtained to assess the factors influencing the breeding success of the Magnetic Island skuas, and to enable comparisons with studies from other sites.

METHODS

This study was carried out over three summers, 1986/87, 1989/90, and 1990/91 at Magnetic Island. During the 1986/87 summer (18.11.86–1.3.87), skua nests on Magnetic Island were monitored every three days. In the 1989/90 season one count of the number of pairs that nested, and later, a count of the chicks reared was made close to skua fledging (7.2.90). During the 1990/91 summer

(20.11.90–26.2.91), skua nests were monitored, on average, every two days. Details of laying dates, incubation periods, hatching dates and survival rates were recorded.

RESULTS

In the 1986/87 season, 13 nests were occupied, all pairs laying two eggs. Two pairs that failed, re-laid clutches of two eggs. Seventeen nests were active in the 1989/90 season with 34 eggs produced. In the 1990/91 season, 16 pairs each laid two eggs. The location of nest sites on Magnetic Island are shown in Figure 1.

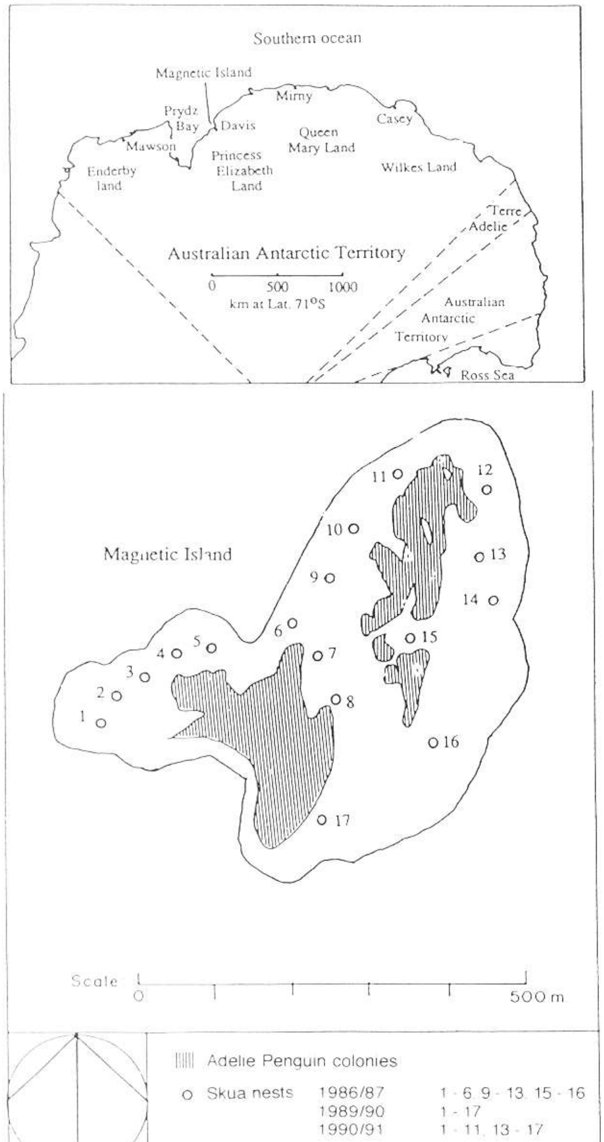

Figure 1. *Location of skua nests on Magnetic Island.*

Laying during the 1986/87 season occurred between 25 November and 5 December. Second clutches were laid 16 days after the initial ones. During the 1990/91 season, laying began in the last week of November and continued until 7 December. The interval between the laying of the first and second eggs at four nests averaged 2.8 ± 1.3 days.

In 1990/91, hatching occurred between 16 December and 4 January, the second clutch hatching on 17 January. Seven known incubation periods averaged 27.7 ± 1.1 days (range 27–30 days). The period from hatching to fledging was 60 days.

Overall breeding success varied little between the three years of this study, ranging between 62 and 65 per cent (Table 1). Most mortality events occurred during the incubation phase, when eggs were prone to being stolen by other skuas (Table 2).

DISCUSSION

During this study, the number of active nests varied from 13 to 17 across the years (Fig. 1). As in previous studies of the Antarctic Skua (Furness 1987), a maximum of two eggs were laid, apparently the most a skua can incubate effectively (Andersson 1976). The same nest sites were used in all three summers of this study. Re-laying in a new nest was within 20 m of the initial nest site.

The timing of laying was similar to Antarctic Skuas nesting at localities up to 10 degrees further south (Young 1963b; Young 1977). This conforms with the good correlation between laying date and latitude for the Subantarctic (Brown) Skua *C. lonnbergi* but not the Antarctic Skua (Young 1977). The observed plasticity in the Subantarctic Skua system probably reflects their more northern, less harsh environment. The range of the Antarctic Skua, however, offers little flexibility due to the limited breeding season imposed by the harsher climatic conditions at these latitudes (Young 1977), and laying dates are similar throughout its latitudinal range.

TABLE 1

The reproductive performance of Antarctic Skuas at Magnetic Island from 1986/87 to 1990/91.

	1986/87	1989/90	1990/91
Eggs laid	30	34	34
Eggs hatched	—	—	25
Hatching success (%)	—	—	74
Chicks fledged	19	22	21
Chick success (%)	—	—	84
Overall Breeding success (%)	63	65	62

The laying interval of 2.8 days between the two eggs is within the range of 2–3 days reported by Furness (1987) for skuas in general. Re-laying of clutches was recorded on three occasions during this study, in mid-December, late December and early January. This differs from Burton's (1968) report that the loss of only a single egg was replaced by re-laying one egg, and not a complete clutch. The incubation period of 28 days was similar to that found by Young (1963a), who noted that 93 per cent of chicks hatched after 29 or 30 days, and all between 29 and 32 days.

The survival of Antarctic Skua eggs during the 1990/91 season was 74 per cent. Previous authors have noted a range of 60–70 per cent, with losses due to predation, weather and food (Furness 1987). Hatching success in Great Skuas *Stercorarius skua skua* was 73 per cent, Subantarctic Skuas 71 per cent (Furness 1987) and another study of the Antarctic Skua reported 66 per cent success, the last being strongly affected by storms (Ensor 1979). Most mortality occurred during incubation, largely the result of predation by conspecifics. Young (1963a) and Spellerberg (1971) reported inclement weather to be the major contributory factor to egg loss.

TABLE 2

Details of mortality events at skua nests in the 1986/87 and 1990/91 seasons.

	Number	% of eggs laid	% of total mortality
1986/87:			
Egg loss	5	17	46
Egg/young chick	5	17	46
Chick eaten	1	3	9
1990/91:			
Eggs: stolen	7*	21	54
failed incubation	2†	6	15
Chicks: stolen	1*	3	8
causes unknown	2	6	15
Fledging:			
causes unknown	1	3	8

*presumably by skuas; †egg breakage.

Chicks at Magnetic Island fledged at 60 days of age although, as Burton (1968) also noted, they began short flights earlier than this. Young (1963a) noted the first flight of Antarctic Skua chicks at 49–59 days. Breeding success was similar to that reported for Pointe Geologie of comparable latitude, but considerably greater than at the more southerly Cape Bird and Cape Royds (Table 3).

The low chick mortality at Magnetic Island was due to intraspecific predation and weather. Sibling aggression may worsen this by exposing the second chick to adverse weather conditions (Proctor 1975; Young 1963b; Spellerberg 1971). Both the survival of chicks and the observed lack of sibling aggression on Magnetic Island contrasts with earlier findings (Wilson 1907; Young 1963b), that two chicks in a brood rarely survive to fledge, the older directly or indirectly causing the death of the younger. According to Young (1963b) and Proctor (1975) lack of food, or weight loss, in the older chick results in aggressive behaviour toward the younger sibling, whereas an abundant food supply allows greater attendance by parents,

TABLE 3

Breeding success of the Antarctic Skua.

Site	Latitude	Breeding success (%)	Reference
Windmill I.	66°20′	47	Eklund (1961)
Haswell I.	66°31′	45	Pryor (1968)
Pt. Geologie	66°40′	57	Jouventin and Guillotin (1979)
Pt. Geologie	"	63	Le Morvan *et al.* (1967)
Magnetic I.	68°33′	63	1986/87 this study
Magnetic I.	"	65	1989/90 this study
Magnetic I.	"	62	1990/91 this study
Cape Bird	77°15′	20	Ensor (1979)
Cape Royds	77°33′	33	Spellerberg (1971)
Cape Royds	"	24	Young (1963b)

reducing predation on chicks by conspecifics and the impact of the weather (Proctor 1975; Trillmich 1978).

The breeding success and lack of sibling aggression amongst the Magnetic Island skuas (reduced brood reduction) may be linked with an abundant food supply (Adelie Penguins). Penguins are a spatially and temporally predictable food source, unlike marine food sources whose access can be very dependent upon weather (Pietz 1987). This may reduce parental foraging time, allowing a greater degree of chick supervision.

Whitehead and Johnstone (1990) estimated the Adelie Penguin population of Magnetic Island to be about 17 000 pairs. This equates to a ratio of 1 062 penguin pairs per skua pair, compared to 350 at Cape Hallet (Maher 1966), 230 at Cape Royds (Young 1963a), and 150 at Cape Crozier (Wood 1971). This greater penguin:skua ratio at Magnetic Island may have an important bearing on the abundance of food and resultant parental attendance and sibling aggression.

Magnetic Island may be an unusual site, with its exceptionally low skua nesting density in relation to the available food resource, and the few vagrant non-breeders observed there. We propose that the high breeding success is probably a consequence of this low density and the resultant opportunity to feed on the abundant, predictable Adelie Penguin food resource. This would allow a great deal of parental attendance, thereby minimizing intraspecific predation, sibling infanticide and the effect of bad weather.

ACKNOWLEDGMENTS

Assistance with observations in the 1986/87 and 1989/90 seasons was kindly provided by Peter Osborne and Peter Hodum respectively. We would also like to thank Ian Norman and Mike Cullen for comments on earlier drafts. The advice of Durno Murray and the referees improved the manuscript.

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