

PHILOPATRY, MATE AND NEST-SITE FIDELITY IN THE BROWN  
SKUAS OF ANVERS ISLAND, ANTARCTICA<sup>1</sup>DAVID F. PARMELEE AND PAMELA J. PIETZ<sup>2</sup>*Bell Museum, University of Minnesota, Minneapolis, MN 55455*

*Key words:* Antarctic Peninsula; Anvers Island; Brown Skua; *Catharacta lonnbergi*; philopatry; mate fidelity; nest-site fidelity; food source.

For nine austral summer seasons (October to March) from 1974-1975 through 1980-1981, and 1983-1984 through 1984-1985, the authors and others observed two skua species that breed sympatrically near U.S. Palmer Station (64°46'S, 64°03'W) on Anvers Island near the Antarctic Peninsula. South Polar Skuas (*Catharacta maccormicki*) nest here in the hundreds and forage primarily at sea. Brown Skuas (*C. lonnbergi*) nest in much smaller numbers and feed at Adélie Penguin (*Pygoscelis adeliae*) colonies. During the first seven seasons, our studies centered on behavioral and ecological relationships between the two species (Parmelee et al. 1978, 1979; Neilson 1983; Pietz 1984, 1985; Parmelee 1985; Pietz 1986, 1987). During the final two seasons every effort was made to locate previously banded adults and young within the principal study area and in outlying regions (Parmelee and Rimmer 1985, Parmelee et al. 1985). Because skuas may live over 30 years (Ainley 1981) and do not breed until several years old, long-term studies are essential for understanding their population biology. In this paper we summarize Brown Skua mate and nest-site fidelity over an 11-year period, and report returns of banded young to their natal areas.

## STUDY AREA AND METHODS

The principal study area (Fig. 1) included a number of small moss-and-lichen-covered peninsulas and off-shore islets that were mostly snow-free in summer and provided nesting grounds for skuas and other seabirds (Parmelee et al. 1977). Access to these sites was by outboard motor-driven rubber boats. Outlying areas were visited by means of larger vessels or helicopters.

In each season a concerted effort was made to identify Brown Skuas at 18 of the 19 nesting sites shown in Figure 1. Excluded were unbanded individuals that nested on Torgersen Island. Most adults were captured for banding in hand-held nets, and a few in cannon nets and baited traps. The majority were color-banded for convenient field identification.

Female Brown Skuas average larger in size and weight than males (Neilson 1983); thus, paired birds generally

were not difficult to sex. Nevertheless, we verified many of our designations through necropsies of banded individuals that died during the study. Knowing the sex of one paired bird allowed us to establish the sexes of former and subsequent mates of both pair members.

It was not possible to witness each fledging; therefore our "fledging" counts included birds that we believed had a good chance of fledging, judging by the advanced stage of an individual's juvenal plumage. These birds provided the basis for determining the percent of returns. In this study philopatry refers to the return of chicks to their natal grounds as prebreeders or breeders. Mate and nest-site fidelity refer to the return of adults to former mates and nest sites, respectively, whether or not on natal grounds.

## RESULTS

From 1974-1975 to 1984-1985 we banded 72 Brown Skua adults and 116 fledglings, including 64 adults and 94 fledglings within the study area. In nine seasons, a minimum of 50 Brown Skuas (29 males and 21 females) occupied 18 territories in the study area. In nine cases Brown Skua pairs occupied sites but apparently produced no eggs. Of 75 nestings in which eggs were found, one was artificially terminated and three produced chicks whose fates were unknown; the remaining 71 nestings produced 96 fledglings, or 1.35 fledglings/nest. One male and two female Brown Skuas from this sample were involved in mixed-species matings as well. Pairs were composed of South Polar Skua males and Brown Skua females in all but one case. Eleven of these pairings produced eggs, and 17 hybrid chicks fledged (1.5 fledglings/nest).

Except for a few of the adults that formed mixed pairs with South Polar Skuas, Brown Skuas invariably nested on islands occupied by Adélie Penguins (Fig. 1). On all other coasts of Anvers Island and throughout much of Palmer Archipelago, both Brown Skuas and Adélie Penguins were rare or absent. The only variance from this food link was noted on Brabant Island (64°08'S, 62°36'W) where, in the absence of penguins, a pair of nesting Brown Skuas fed on other species of seabirds (Parmelee and Rimmer 1985).

Within the study area, Brown Skua pairs numbered from six to 12 per season for the 9-year period. An average of 8.6 pairs per year produced eggs. Activity was concentrated within the triangle formed by Torgersen (Site T-1), Litchfield (Sites L-1 to L-11), and Humble (Sites H-1 to H-3) Islands (Fig. 1). Over nine seasons, the triangle accounted for more than 80% of all Brown Skua adults, 79% of their fledglings, and 77% of their nests. The triangle also contained 84% of the

<sup>1</sup> Received 5 November 1986. Final acceptance 1 June 1987.

<sup>2</sup> Present address: Northern Prairie Wildl. Res. Ct., P.O. Box 2096, Jamestown, ND 58402.

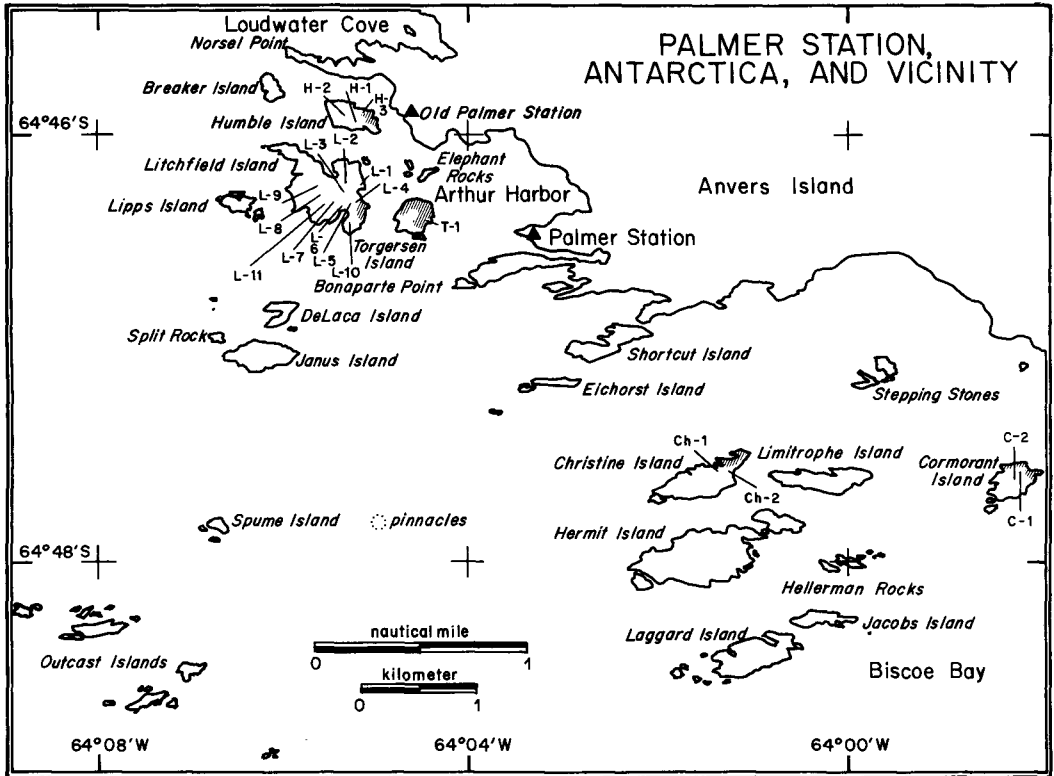


FIGURE 1. Palmer Study Area. Approximate nest sites of Brown Skuas are shown on Cormorant, Christine, Torgersen, Litchfield, and Humble Islands. Adélie Penguin colonies on these five islands are indicated by parallel lines.

nearly 13,800 penguin nests in the study area. Litchfield Island accommodated only about 580 penguin nests (8-year mean), yet it had 62% of all Brown Skua adults, 61% of all fledglings, and 65% of all nests. Litchfield's Brown Skuas hunted mostly on Torgersen Island where there were over 8,700 penguin nests (5-year mean) but few nesting skuas of either species.

The longest recorded continuous residency at one site by the same Brown Skua was 11 seasons, assuming this female was present during the two seasons not checked. The longest recorded continuous residency by the same pair was five and likely seven seasons, after which the pair was collected by a parasitologist (Hoberg 1984). Continuous residency by the same pair was 5 years at three sites when terminated by fowl cholera. The strength of site tenacity is reflected by the fact that individual Brown Skuas averaged only one territory during nine seasons (Table 1). Only five birds changed territories; two females and one male moved to different sites on the same island, and one female and one male moved to sites on adjacent islands.

In our sample each change of territory involved a change of mate. A total of 26 mate changes occurred (five involving South Polar Skuas), 21 without a territory change. Reproductive failure rarely preceded changes of sites or mates. In 12 of 15 cases a mate change occurred immediately following a year in which

a pair had successfully raised one or more fledglings. In at least eight instances, individuals returned to their previous mates despite reproductive failure in the preceding season.

It was not clear why some individuals changed mates or nest sites. According to Neilson (1983), different arrival times of the sexes from one season to the next likely have a disruptive influence on mate and site fidelity. A more common factor leading to mate and site changes was probably failure of the previous mate to return to the territory. Of 50 banded adult breeders, we know that 30% died (nine from fowl cholera and three as a result of collecting); another 40% failed to return to the breeding grounds. Inexplicably, twice as many males as females disappeared or were found dead.

Another disruptive influence on mate and site fidelity was what we call absenteeism; i.e., former breeders returned to the area but did not breed, or they were not seen in the area for one or more seasons and then returned. Two female Brown Skuas returned to breed at their former nest sites after absences of 1 and 2 years, respectively; a third returned to a different nest site after a 2- to 4-year absence. Two males were absent from the breeding grounds for 1 year, then returned but failed to breed again. Another eight males and seven females were present on the breeding grounds but failed to produce eggs for one to two seasons. Of

TABLE 1. Nine-year summary for nine male and 10 female Brown Skuas banded as breeding adults in 1974–1975.  $\bar{x} \pm SD$  is calculated per individual; ranges are given in parentheses.

|   | Males                  | Females                 |
|---|------------------------|-------------------------|
| No. years seen at Palmer:                             | 4.4 $\pm$ 1.3<br>(1–5) | 6.1 $\pm$ 3.0<br>(1–9)  |
| No. territories held:                                 | 1.1 $\pm$ 0.3<br>(1–2) | 1.3 $\pm$ 0.5<br>(1–2)  |
| Maximum no. years occupied same site:                 | 4.2 $\pm$ 1.3<br>(1–5) | 5.1 $\pm$ 2.6<br>(1–9)  |
| Minimum no. mates: <sup>a,b</sup>                     | 1.3 $\pm$ 0.5<br>(1–2) | 1.9 $\pm$ 0.9<br>(1–4)  |
| Maximum no. years paired with same mate: <sup>b</sup> | 3.4 $\pm$ 1.4<br>(1–5) | 3.6 $\pm$ 1.4<br>(1–5)  |
| No. seasons occupied a site with a mate: <sup>b</sup> | 4.0 $\pm$ 1.5<br>(1–5) | 5.5 $\pm$ 2.8<br>(1–9)  |
| No. seasons had eggs: <sup>b</sup>                    | 3.9 $\pm$ 1.5<br>(1–5) | 4.9 $\pm$ 2.2<br>(1–7)  |
| No. fledglings produced: <sup>b</sup>                 | 4.6 $\pm$ 2.2<br>(1–7) | 6.5 $\pm$ 3.4<br>(1–12) |

<sup>a</sup> Assumes unbanded mates of consecutive seasons were the same individual.

<sup>b</sup> Excludes matings with South Polar Skuas.

16 cases in which an adult was present but did not breed, 10 involved birds whose mates did not return (three known dead, seven never seen again), four involved two injured birds and their mates, and two involved birds whose former mates had formed new pairs. Of the 12 birds who had lost their previous seasons' mate, eight did not have mates for at least 1 year; four found new mates but produced no eggs.

Despite the number of mate changes observed, mate fidelity was strong. Of the nine males banded the first year of the study, 67% had only one mate during 9 years of observations, and the rest had two. Of 10 females banded the first year of the study, 30% had one and 50% had two mates in 9 years, probably reflecting the greater residence time of females at Palmer (Table 1). No male was seen in more than five breeding seasons, whereas four of 10 females were seen in all 9 years (median of distribution of number of years sighted was higher for females; Smirnov  $T_2 = 5$ ,  $P = 0.05$ ).

The sex difference in return rate affected site tenacity as well. The number of years a bird returned to the Palmer area obviously limited the number of years it could return to the same territory (Table 1). Of 50 banded Brown Skuas, 10 females returned to the same territories long enough to successively acquire second and, in two cases, third Brown Skua mates. Only five males acquired second mates while retaining their territories.

In February 1979 Brown Skuas at Palmer suffered a fowl cholera epidemic (Parmelee et al. 1979), which left several traditional nest sites vacant for one or more seasons. Three sites were empty at least two seasons. When next checked in 1983–1984, these sites were occupied by Brown or South Polar skuas, including new birds and survivors of the epidemic. One site was

occupied the season following the epidemic by the surviving female and a new mate, but the pair did not produce eggs until 1 year later. Another site was vacant for one season and then occupied by South Polar Skuas. In 1983 a parasitological collecting expedition (Hoberg 1984) removed a breeding pair that had occupied the same territory since 1976–1977. South Polar Skuas occupied the site during the following two seasons, while a new pair of Brown Skuas established a territory nearby. The site from which Hoberg removed a mixed pair remained vacant for at least two seasons. Clearly the recovery period at Palmer can be slow.

Three Brown Skuas banded as chicks later returned as nesting adults (Parmelee et al. 1985), two others returned as prebreeders. One of the breeding adults nested about 15 km from its natal site, another within 1 km, and one precisely at its natal nest scrape—an example of perfect philopatry. So far, all returnees have been female. The youngest breeding age recorded was 6 years.

Of 116 banded fledglings, only 4.3% returned during the study. This suggests a wide dispersal and/or a high mortality of young following fledging. Wide dispersal of young is not supported by our data. Although we searched numerous coastal areas (interiors ice-capped) throughout the Palmer Archipelago, we found no banded Brown Skuas. Furthermore, there have been no recoveries of our banded Brown Skuas at other skua nesting sites in the Antarctic or sub-Antarctic, or from more distant areas.

## DISCUSSION

Along the south coast of Anvers Island, Brown Skuas have established a breeding ground that is stable in numbers of nest sites and breeding pairs. By monopolizing the penguin colonies as a food source, Brown Skuas of Anvers Island compete successfully against the greater numbers of South Polar Skuas that nest close-by but forage almost exclusively at sea. Judging by the large numbers of Brown Skua fledglings produced on Litchfield and Humble Islands, and the fact that those islands had the region's largest concentration of nesting South Polar Skuas, we find little correlation between numbers of South Polar Skuas and fledging success in Brown Skuas. Trivelpiece et al. (1980) also witnessed high fledging success of Brown Skuas in the presence of South Polar Skuas, although the latter were not nearly so numerous in that study area.

During our study we observed the re-occupation of vacated territories following a severe epidemic that decimated the Brown Skuas but had little effect on South Polar Skuas. Young (1972) documented the way new skua pairs became established in a vacant area in a breeding colony. He concluded that the stability found in territory boundaries from year to year arises because territories becoming vacant are occupied by replacement pairs while neighbors are still inhibited from encroaching on them. Our observations indicate that under certain conditions the integrity of skua boundaries may persist for one or more seasons even when unoccupied.

As missing mates were replaced and vacant territories filled, the total number of Brown Skuas occupying established territories rose to 40% above the

minimum two birds per site (at least 50 adults at 18 sites in 9 years). The fact that new birds entering the area used previously established territories suggests that such sites are somehow advantageous. Incoming skuas may be attracted to these sites because their locations provide proximity to ample food and potential mates.

During one season at Chatham Islands, New Zealand, Young (1978) reported that five of 11 Brown Skua territories contained three birds (trios). The formation of trios was rare at Anvers Island (four instances, resulting in one fledgling in 9 years), as in other parts of the species range distant from the Chatham Islands (Young 1978). Because trios are common in the New Zealand area, one suspects that they are advantageous under certain conditions.

Male skuas generally arrive on the breeding grounds before females (Neilson 1983) suggesting that males establish territories to which they attract mates. However, in our study many females returned to and remained at a nest site even when they had lost their mates. Most of these females later bred at the same site with new mates, indicating that females can hold a territory and attract a male to it.

The low percent of returning Brown Skua chicks suggests a high mortality of young following fledging. Great Skuas (*C. skua*) also suffer high mortality in the first year (Furness 1978). Only additional observations will determine whether the current rate of returning birds is sufficient to maintain population stability at Palmer.

This study was financed by the National Science Foundation Grant DPP82-13688. For field assistance we are indebted to the following at or formerly from the University of Minnesota: N. P. Bernstein, W. R. Fraser, B. Glass, G.-A. D. Maxson, S. J. Maxson, D. R. Neilson, J. M. Parmelee, C. C. Rimmer; also M. Bergaas, S. Elvig, T. English, C. Franke, and R. Payne for office and technical assistance. We also are indebted to the referees for helpful suggestions and a critical review of the manuscript. M. Fuller, Patuxent Wildlife Research Center, and G. Jonkel, Chief Bird Banding Laboratory, Laurel, Maryland, provided invaluable assistance with the Antarctic banding program. Special thanks to G. A. Llano and F. Williamson, formerly of the National Science Foundation, who assisted us in various ways throughout the study.

#### LITERATURE CITED

- AINLEY, D. G. 1981. Population studies of South Polar Skuas. *Antarct. J. U.S.* 16(5):148.
- FURNESS, R. 1978. Movements and mortality rates of Great Skuas ringed in Scotland. *Bird Study* 25: 229-238.
- HOBERG, E. P. 1984. Trematode parasites of marine birds in Antarctica: the distribution of (*Gymno-phallus deliciosus* Olsson 1893). *Antarct. J. U.S.* 19(5):159-160.
- NEILSON, D. R. 1983. Ecological and behavioral aspects of the sympatric breeding of the South Polar Skua (*Catharacta maccormicki*) and the Brown Skua (*Catharacta lonnbergi*) near the Antarctic Peninsula. M.S. thesis, Univ. of Minnesota, Minneapolis-St. Paul.
- PARMELEE, D. F. 1985. Polar adaptations in the South Polar Skua (*Catharacta maccormicki*) and the Brown Skua (*Catharacta lonnbergi*) of Anvers Island, Antarctica. *Proc. XVIII Int. Ornithol. Congr.* (1982):520-529.
- PARMELEE, D. F., AND C. C. RIMMER. 1985. Ornithological observations at Brabant Island, Antarctica. *Br. Antarct. Surv. Bull.* 67:7-12.
- PARMELEE, D. F., N. BERNSTEIN, AND D. R. NEILSON. 1978. Impact of unfavorable ice conditions on bird productivity at Palmer Station during the 1977-78 field season. *Antarct. J. U.S.* 13(4):146-147.
- PARMELEE, D. F., W. R. FRASER, AND D. R. NEILSON. 1977. Birds of the Palmer Station area. *Antarct. J. U.S.* 12(1-2):14-21.
- PARMELEE, D. F., S. J. MAXSON, AND N. BERNSTEIN. 1979. Fowl cholera outbreak among Brown Skuas. *Antarct. J. U.S.* 14(5):168-169.
- PARMELEE, D. F., J. M. PARMELEE, AND M. FULLER. 1985. Ornithological investigations at Palmer Station: The first long-distance tracking of seabirds by satellites. *Antarct. J. U.S.* 19(5):162-163.
- PIETZ, P. J. 1984. Aspects of the behavioral ecology of sympatric South Polar and Brown skuas near Palmer Station, Antarctica. Ph.D. diss., University of Minnesota, Minneapolis-St. Paul.
- PIETZ, P. J. 1984. Long call displays of sympatric South Polar and Brown skuas. *Condor* 87:316-326.
- PIETZ, P. J. 1986. Daily activity patterns of South Polar and Brown skuas near Palmer Station, Antarctica. *Auk* 103:726-736.
- PIETZ, P. J. 1987. Feeding and nesting ecology of sympatric South Polar and Brown skuas. *Auk* 104: 617-627.
- TRIVELPIECE, W., AND N. J. VOLKMAN. 1982. Feeding strategies of sympatric South Polar Skuas *Catharacta maccormicki* and Brown Skuas *C. lonnbergi*. *Ibis* 124:50-54.
- TRIVELPIECE, W., R. G. BUTLER, AND N. J. VOLKMAN. 1980. Feeding territories of Brown Skuas *Catharacta lonnbergi*. *Auk* 97:669-676.
- YOUNG, E. C. 1972. Territory establishment and stability in McCormick's Skua. *Ibis* 114:234-244.
- YOUNG, E. C. 1978. Behavioural ecology of *lonnbergi* skuas in relation to environment at the Chatham Islands, New Zealand. *N.Z. J. Zool.* 5:401-416.