DISTRIBUTION, NUMBERS AND BREEDING OF BIRDS AT THE NORTHERN ICE-FREE AREAS OF NELSON ISLAND, SOUTH SHETLAND ISLANDS, ANTARCTICA, 1990–1992

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SUMMARY

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Bird populations were surveyed at the northern ice-free areas of Nelson Island (South Shetland Is.) from December 1990 to May 1992. Seasonal variation in abundance of individual species was evaluated by means of regular censuses along the coastline. The approximate number of breeding pairs for 10 species were: Chinstrap Penguin *Pygoscelis antarctica* (800), Southern Giant Petrel *Macronectes giganteus* (40), Pintado or Cape Petrel *Daption capense* (1300), Wilson's Storm Petrel *Oceanites oceanicus* (100–500), Black-bellied Storm Petrel *Fregetta tropica* (10), Greater Sheathbill *Chionis alba* (2), Subantarctic Skua *Catharacta antarctica* (12), South Polar Skua *C. maccormicki* (21), Kelp Gull *Larus dominicanus* (10), and Antarctic Tern *Sterna vittata* (100). Species composition of breeding birds has not changed since 1984/85, whereas the higher abundance of some species likely reflects an increased observer effort. Breeding of Antarctic Terns, Kelp Gulls and South Polar Skuas was delayed after the harsh winter of 1991. Compared to earlier studies, no differences were found in clutch size, egg size or breeding success. Thirteen non-breeding species were recorded.

INTRODUCTION

The southern part of King George Island, South Shetland Islands, represents an area where density of settlement and intensity of anthropogenic disturbance are among the highest in Antarctica (Headland & Keage 1985). Ornithological research conducted there over the past decade has documented declines in breeding numbers as well as breeding success of several bird species (Kaiser *et al*. 1988, Peter *et al*. 1989, Peter *et al*. 1991). Neighbouring Nelson Island does not support permanently occupied bases and the impact of direct human disturbance upon birds is likely to be lower. The bird fauna of the two more distant and probably less disturbed major breeding areas on Nelson Island have been surveyed on several occasions (Harmony Point – SSSI No. 14, Favero *et al*. 1991, Silva *et al*. 1998; Duthoit Point, Coria *et al.* 1995). On the other hand, only incomplete data (Peter *et al.* 1988a) are available for the northern ice-free areas of Nelson Island adjacent to Fildes Peninsula of King George Island, which are intermediate with regard to their location and level of disturbance. Here we present new data on distribution and numbers of all bird species in this area, with notes on breeding performance of species not yet reported elsewhere. Whereas most of the earlier surveys of birds concern the summer period, our 18-month study covers the complete annual cycle.

STUDY AREA AND METHODS

The study area includes three coastal ice-free oases (I–III) separated by glaciers (Fig. 1). The highest hills reach 98 m above sea level, while cliffs scattered along the coast are up to 50 m high. The coast is mostly formed by stony beaches and boulder slopes. Environmental conditions are similar to those on nearby Fildes Peninsula of King George Island (e.g. Kaiser *et al*. 1988). The weather was colder during the study period (1991 yearly mean temperature: –3.3°C, Lingen *et al*. 1993), when compared to the long-term mean (about –2.7°C) or the period of the previous comparable study (1984 yearly mean: –1.7°C, Peter *et al*. 1988a, Fig. 2). Investigations were conducted from 10 December 1990 to 18 May 1992, hence only the 1991/92 summer breeding season was completely under observations. During all this time we were resident at Oasis I (Fig 1.), and visits to the rest of the area were of short duration and mainly during summer. No other human activities took place in the area during the period of this study. Our research focused on the breeding biology of the Pintado or Cape Petrel *Daption capense* (Weidinger 1996a,b; 1997) and skuas *Catharacta* spp. (P. Lumpe unpubl. data). Data on occurrence and breeding biology of other species were obtained opportunistically throughout the year. Most results presented here concern data which were obtained at the time of nest searches or during a few additional visits. Egg volume was calculated as an index length × width^2, multiplied by a specific constant used in earlier studies (0.48 for Charadriiformes, 0.507 for Procellariiformes) to permit direct comparison of results. In order to quantify seasonal changes in abundance and dominance (of individual species), birds were counted along the coastline of the Oasis I (Fig. 1), at approximately 10-day intervals (in the middle of each decade) from 15 December 1990 to 6 May 1992. All these censuses were performed by the same observer (P.L.). All visible individuals were counted, attention being

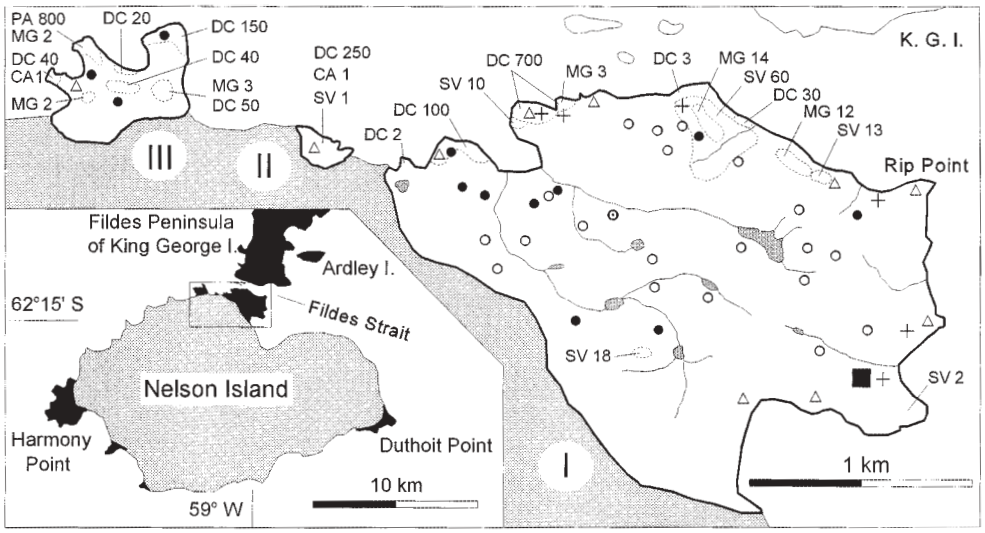


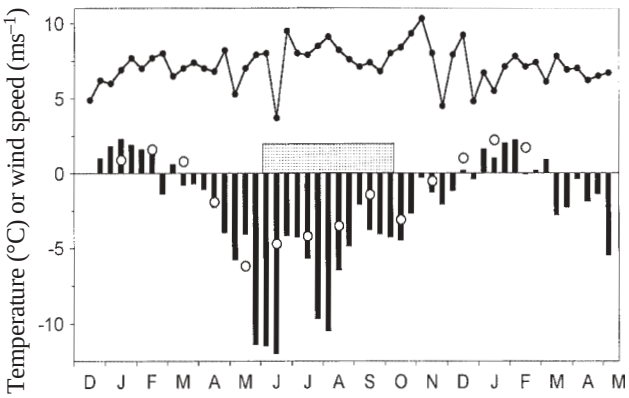
Fig. 1. *Nelson Island with surroundings and details of the three surveyed oases (I–III) showing an extent of glacier and position of lakes (shaded area) and position of the camp (■). Distribution of breeding bird species is marked as follows: Gentoo Penguin (PA), Southern Giant Petrel (MG), Pintado Petrel (DC), Black-bellied Storm Petrel (+), Greater Sheathbill (CA), Subantarctic Skua (●), South Polar Skua (○), mixed skua pair (⊙). Kelp Gull (△), Antarctic Tern (SV). Approximate extent of the breeding colonies is delimited by a dotted line, abundance is given as number of breeding pairs, markers refer to single occupied nests. Wilson's Storm Petrel (not shown) occurred in the whole area.*

paid to elimination of multiple records. In addition to abundance, seasonal changes in dominance of individual species are also presented. Numerical values in the text are presented as means ±SD.

SPECIES ACCOUNTS

Chinstrap Penguin *Pygoscelis antarctica*

The single breeding colony located at Oasis III contained *c*. 800 pairs in 1991/92. Only moulting adult birds attended the colony after the beginning of March. The number of birds visiting the coast of Oasis I increased during January after hatching of chicks. Winter absence lasted from 5 May to the end of October (Fig. 3). Estimated abundance as well as timing of breeding are similar to those in 1984/85 (*c*. 1000 pairs, Peter *et al*. 1988a).



December 1990–May 1992

Fig. 2. *Mean daily wind speed (solid line) and temperature (bars) during the period of this study (given are 10-day means; data from Lingen* et al. *1993). Duration of sea-ice is indicated by horizontal rectangle. Temperature during 1984/85 (monthly means; data from Peter* et al. *1988a) is shown by open circles.*

Southern Giant Petrel *Macronectes giganteus*

This species occurred in the area all year round (Fig. 3). Colonies were distributed along the coast, located mostly on exposed tops of isolated rock outcrops 5–15 m high (Fig. 1). Twenty-five occupied nests were counted at Oasis I on 24 December 1990. These nests contained eggs (6), addled eggs (1), pipped eggs (7) or young chicks (10) on 12 January (one nest not accessible) and 15 chicks on 10 March 1991. The first chick had fledged before 2 May, the last was still present on 22 May. Egg dimensions (n = 14) in 1990 were: length, 102.9±3.8 mm (range 96.7–109.3 mm); width, 66.5±2.4 mm (61.2–70.5 mm); volume, 231.6±21.3 ml (184.9–263.3 ml). Hence, egg size was intermediate with respect to values so far reported from King George Island (Jablonski 1986, Peter *et al*. 1988a). The first eggs in 1991 were found on 10 November and laying in 29 nests was completed before 22 November. Compared to the previous year a lower number (19) of nests survived until 26 December, but the same number (15–16) of chicks fledged after 3 May. The breeding success of about 52% as well as the timing of the breeding cycles, conform to the results of earlier local studies (Jablonski 1986, Peter *et al*. 1988a, Favero *et al*. 1991).

Pintado Petrel *Daption capense*

This was an abundant species breeding in the study area in several distinct colonies, although a few pairs bred solitarily (Fig. 1). Colonies distributed along the western part of Fildes Strait represent probably the greatest breeding aggregation on King George and Nelson Islands. Accurate estimates of abundance were not possible due to limited access to breeding cliffs. Reported values were estimated from proportion of accessible occupied nests in well visible plots, extrapolated to the total area of suitable nesting habitat within individual cliffs. Patterns

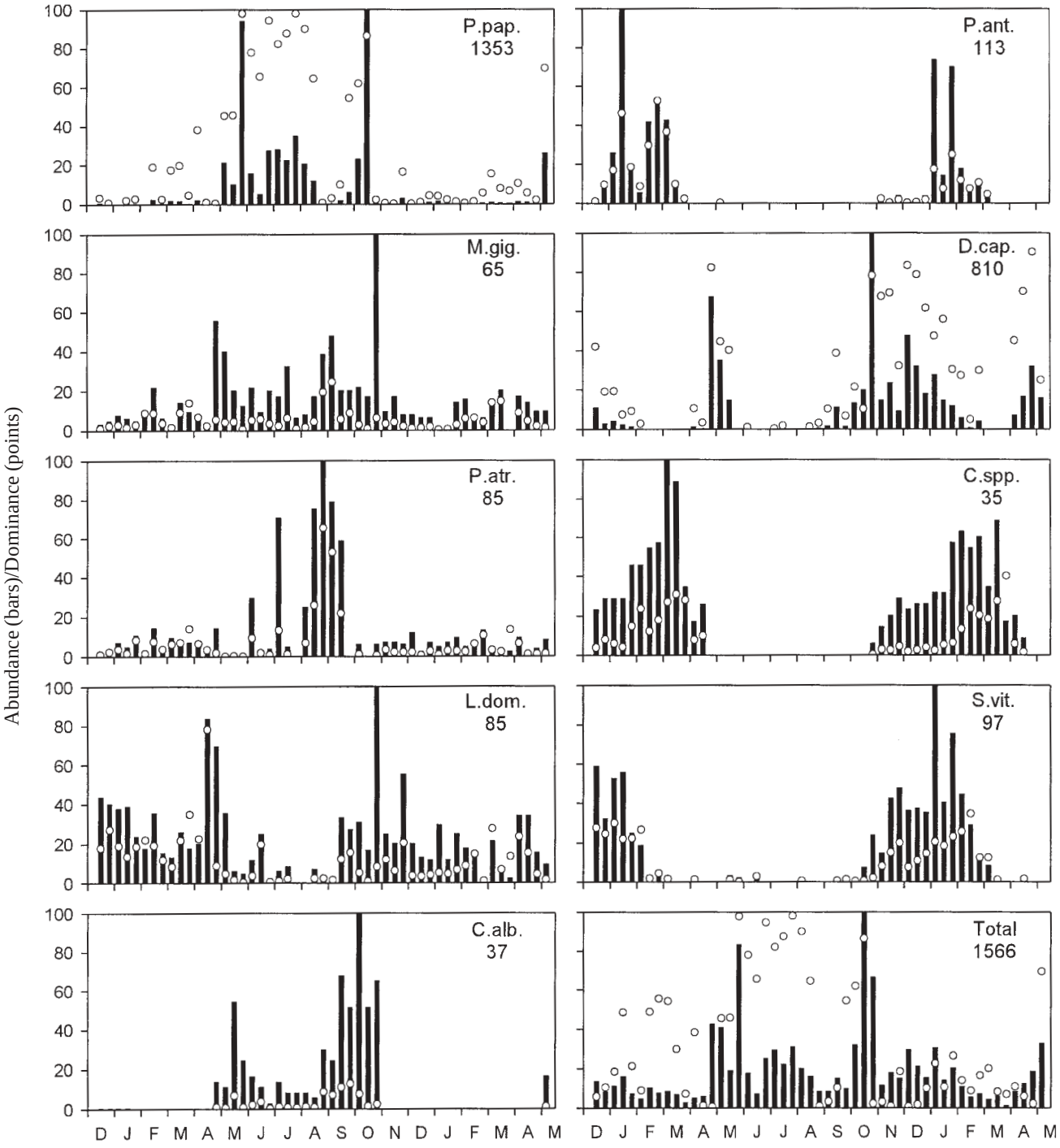


Fig. 3. *Results of coastline census of birds at Nelson Island. Abundance of individual species is expressed as a percentage of the maximum count (shown with abbreviated species name), dominance gives a percentage of the total abundance of all species (including those not shown separately). The lower right figure shows the total abundance of all species and dominance of penguins. Skuas* Catharacta *spp. are considered together.*

of colony attendance and various aspects of breeding biology have been described elsewhere (Weidinger 1996a,b, 1997).

Wilson's Storm Petrel *Oceanites oceanicus*

An abundant breeding species, inhabiting most of the area under study. Nesting was concentrated in boulder slopes along the coast, but nests were also found in rock crevices located high in the cliffs. Total abundance was roughly estimated as in the order of 100–500 breeding pairs, but conclusions on habitat preferences and breeding density obtained in Admiralty Bay, King George Island (Wasilewski 1986) seem to be applicable to Nelson Island as well. Winter absence in 1991 lasted from end of April until 7 November. Nests with eggs of unknown age were observed between 28 December and 10 March. A freshly hatched chick was found on 21 February, and the last flying bird was seen on 2 May 1992. The above dates are in good accordance with those from King George Island (Wasilewski 1986, Peter *et al.* 1988a).

TABLE 1

Estimated number of breeding pairs in the study area, Nelson Island, Antarctica, in 1991/92

Species	Oasis I	Oasis II	Oasis III
Chinstrap Penguin	–	–	800
Southern Giant Petrel	29	–	8
Pintado Petrel	800	250	300
Wilson's Storm Petrel[a]	100–500	–	10–50
Black-bellied Storm Petrel[a]	6–10	–	–
Subantarctic Skua	9	–	3
South Polar Skua	21[b]	–	–
Kelp Gull	8	–[c]	1
Antarctic Tern	100	1	–
Greater Sheathbill	–	1	1

[a] rough estimates.
[b] including one mixed species pair.
[c] one pair in 1990/91.

Black-bellied Storm Petrel *Fregetta tropica*

A species nesting in similar habitat, and often close to, Wilson's Storm Petrel nesting places. One nest was found in a crevice in a steep cliff about 15 m above sea level, one metre from an occupied nest of a Pintado Petrel (Fig. 1). The total abundance probably did not exceed 10 breeding pairs. Arrival after a winter absence was recorded on 20 November, a chick (<5 days old) was found on 17 February. The last observation on 29 April (one bird attacked by Kelp Gull) is much later than the date of departure recorded in 1985 (11 March, Peter *et al*. 1988a).

Greater Sheathbill *Chionis alba*

Two pairs were found breeding in the study area in both years, associated with colonies of Pintado Petrels (Fig. 1). Nests of both pairs were located in rock cavities near the sea. Laying started on 11 December 1991 and was finished by 25 December in both years. Completed clutches contained two eggs (n = 4). Egg dimensions (n = 6) were: length, 57.7±0.9 mm (56.6–59.1 mm); width, 38.5±0.3 mm (38.2–39.1 mm); volume, 43.4±1.4 ml (41.9–45.7 ml). Young chicks (<5 days old) were found on 15 January 1991 and 23 January 1992, and were still present near the nest on 8 March 1992. All four eggs hatched and one and two chicks fledged in two nesting attempts under regular observations. Wintering birds occurred on the coast of Oasis I from 15 April until the beginning of November 1991 (Fig. 3, cf. Peter *et al*. 1988b), during which time they accompanied groups of Gentoo Penguins *P. papua* and Weddell Seals *Leptonychotes weddelli* with pups. Occasional visits by single birds to Oasis I were also recorded during the breeding period 1990/91.

South Polar Skua *Catharacta maccormicki* and Subantarctic Skua *C. antarctica*

Both species of skuas occurred in the whole study area except for the winter period from 16 May to 25 October 1991 (Fig. 3). Winter absence from the Fildes Peninsula of King George Island was of shorter duration (26 May–16 October, based on irregular observations). The South Polar Skua was approximately twice as abundant as the Subantarctic Skua but bred only at Oasis I (Table 1, Fig. 1). We recorded breeding of one mixed species pair. The study area, in particular the Pintado Petrel colonies, was frequently visited by flocks of non-breeding birds from Fildes Peninsula searching for prey. Breeding biology and behaviour were the subject of detailed studies (P. Lumpe unpubl. data).

Kelp Gull *Larus dominicanus*

Breeding Kelp Gulls occurred in the area all year round (Fig. 3). Solitary nests were spaced nearly evenly along the coastline (Fig. 1) and placed preferably on small rock outcrops, similar to the nesting habitat of Southern Giant Petrels. One nest was located about two metres away from an occupied nest of a Pintado Petrel. All nests were built from lichens (cf. Pereira *et al*. 1990). Nest dimensions were (n = 15): cup depth 7±1 (5–9) cm, cup diameter 24±2 × 22±2 (19–30) cm, nest diameter 61±16 × 49±9 (35–85) cm. The first signs of courtship and territorial behaviour were observed on 27 October. All nest sites were already attended by pairs on 8 November and the first copulation was seen one day later. Egg laying began on 20 November and four other clutches were initiated during the next 10 days. Eggs were laid in one day (n = 2) or two day (n = 4) intervals. Completed clutches contained on average 2.6 (2–3, n = 20) eggs and the frequency of three-egg clutches did not differ between years. However, eggs were significantly smaller (*t*-test, $P < 0.001$ in all cases) in 1990 (n = 22) than in 1991 (n = 32): length, 70.2±3.1 vs 73.0±2.4 (65.0–76.9) mm; width, 48.2±1.8 vs 49.8±1.5 (44.0–53.1) mm; volume, 78.3±7.1 vs 87.1±7.3 (61.9–100.9) ml. The only comparable data are those from King George Island in 1978 (Jablonski 1986), when eggs were of similar size (volume = 86.7 ml) as in 1991. Egg size in this study was independent of clutch size. Pipping of the first-laid egg in a two-egg clutch was recorded 27 days after laying and the chick hatched one day later. The first hatching dates in 1991 (22–29 December) were later than those in 1990 (11 December) or in the earlier studies (11–24 December 1978, Jablonski 1986; end of November 1984, Peter *et al.* 1988a; but 28 December 1988, Favero *et al*. 1991). This suggests delayed breeding in 1991.

Antarctic Tern *Sterna vittata*

The Antarctic Tern was an abundant breeding species which occurred all year round but in small numbers from March to September (Fig. 3). Most pairs breed in loose colonies, dispersed along the coast as well as far inland (Fig. 1). Dense colonies (minimum inter-nest distance = 3 m) of up to 20 nests or solitary breeding also occurred. There was apparently no single preferred nesting habitat. Nests were placed on top of low rock outcrops (often close to nests of Kelp Gulls or Southern Giant Petrels), on slopes of fixed gravel, in wet areas on isolated boulders overgrown by moss as well as in dry lichened places. Nests located on fine earthy substratum consisted of a scrape whose depth was 2.0±0.7 cm and diameter 10.0±1.5 × 8.8±1.5 (6–13) cm. Most nests had a rim made up from small stones, the external diameter being 18.0±2.5 × 13.0±2.8 (7–23) cm (all n = 34). In 1991, the occupation of colonies and territorial behaviour commenced just before the period of mass occurrence (8 October, Fig. 3) and nearly all birds were paired one month later. Courtship feeding was seen on 14 November and the first clutches were found on 20 November. Not all one-egg clutches could be correctly classified as completed. Hence, the average clutch size was estimated separately at 1.51 eggs for completed clutches only (n = 74) and at 1.34 eggs for all nests found (n = 111). The

actual value should lie in between, but closer to the former estimate, which is similar to the mean values (1.47 and 1.45 eggs) reported from King George Island by Kaiser *et al*. (1988) and Jablonski (1995), respectively. The proportion of two-egg clutches did not differ significantly between years. Egg dimensions (n = 132) were: length, 45.1±1.5 mm (42.0–48.2 mm); width, 33.1±0.9 mm (30.0–34.9 mm); volume, 23.7±1.5 ml (18.8–27.2 ml). Egg size was independent of clutch size and did not differ between years at Nelson Island, being intermediate with respect to the mean values reported from King George Island (Kaiser *et al*. 1988, Jablonski 1995). The minimum length of incubation was 23 (n = 2) and 24 (n = 2) days (cf. mean 24 days, Jablonski 1995). The first hatchlings were found on 27 December (1990) and 9 January (1992), the last chick hatched on 6 February (1992). Hatching and breeding success could not be determined with reasonable accuracy due to infrequent nest checks. Available data suggest, however, that overall breeding success in both years fell within the range of published data and did not exceed the overall mean for King George Island (15%, Jablonski 1995). A minimum 16% (n = 127) of all clutches was already deserted when found, presumably due to inclement weather (eggs flooded or frozen). Deserted eggs were taken by predators usually within a few days, but heavy avian predation was also the major primary cause of nesting failures (cf. Kaiser *et al*. 1988). Although clutch size, egg size and probably also breeding success were similar, breeding was delayed for about one month and arrival for about two months in 1991, when compared to 1984 (Peter *et al.* 1988a).

Species breeding near the study area

Gentoo Penguins were observed in small numbers throughout the year, the two periods of mass occurrence correspond to the dates of formation and break-up of sea ice (Fig. 3). In between these dates, up to about 1000 birds wintered on the coast of the western part of Fildes Strait where the sea did not freeze over during the winter 1991. Visits by Adélie Penguins *P. adelie* (1–9 birds) were less frequent and restricted to the period from December to beginning of February, but one bird was observed several times (26 April–26 June 1991) together with wintering Gentoo Penguins. The nearest breeding place of the Gentoo and Adélie Penguins was Ardley Island (*c*. 4 km north-east from Oasis I). Individual Imperial Cormorants or Blue-eyed Shags *Phalacrocorax atriceps* were observed along the coast all year round. Regular breeding of this species was reported from Duthoit Point (Coria *et al*. 1995) and Harmony Point (Favero *et al*. 1991) on Nelson Island.

Non-breeding species

A King Penguin *Aptenodytes patagonicus*, an injured bird with a swollen left leg, stayed for two days (10–11 May 1992) on the western coast of Oasis I. An immature Emperor Penguin *A. forsteri* was observed on 1 July 1991 on the frozen sea near Rip Point. Black-browed Albatrosses *Thalassarche melanophrys* were seen flying over Fildes Strait and Maxwell Bay (one, 26 March 1991, 9 and 27 March 1992 and two, 5 April 1992). A Light-mantled Sooty Albatross *Phoebetria palpebrata* was seen flying repeatedly along the Pintado Petrel breeding cliffs (Oasis I) on 4, 14 and 24 January 1992. Groups of up to seven Antarctic Fulmars *Fulmarus glacialoides* were observed seven times during winter 1991 (14 May–28 October). One to three birds were seen six times during summer (28 November–18 December 1991) when flying along the Pintado Petrel breeding cliffs or feeding on the sea in flocks of the latter species. The largest group of 33 birds was observed on 15 March 1992. The first Antarctic Petrel *Thalassoica antarctica* arrived on 20 May 1991 in a mixed flock of Pintado and Snow Petrels. Thereafter, one to three birds were seen on five occasions between 10 July and 18 September 1991. A fresh corpse was found on 11 November 1991. Snow Petrels *Pagodroma nivea* occurred regularly throughout winter (15 April–25 October 1991), in greater numbers (up to 24 birds in one flock) after 20 May. Single birds were recorded once during summer 1990 (8 December) and four times in 1991 (10 November–17 December). A single Cattle Egret *Bubulcus ibis* was observed alive in Fildes Strait on 1 May 1991 and a skeleton was found one month earlier on the eastern coast of Oasis I. The beached corpse of an Antarctic Prion *Pachyptila desolata* was found in summer 1990/91. Away from Nelson Island, we twice observed a single White-rumped Sandpiper *Calidris fuscicollis* (Ardley Island, 26 December 1990; Fildes Peninsula, 8 February 1992). All the above species are more or less regular visitors to both King George and Nelson Islands (Peter *et al*. 1988a, Lange & Naumann 1990, Favero *et al*. 1991, Myrcha 1993, Silva *et al*. 1995). Notable was the much lower abundance of Snow Petrels in 1991 as compared to 1984 (Peter *et al.* 1988a).

CONCLUSIONS

In all, 10 breeding and 13 non-breeding species were found in the whole study area. Lower number of species (*Catharacta* spp. taken together) bred at the Oasis I (7) than at the two other extensive ice-free areas of Nelson Island (11 species in both cases; Favero *et al*. 1991, Coria *et al*. 1995) or at Fildes Peninsula of King George Island (nine species; Peter *et al*. 1988a). Nevertheless, the species composition of breeding birds has not changed there since 1984/85 (Peter *et al.* 1988a). Considerably higher abundance of breeding Pintado Petrels, Antarctic Terns and skuas during this study likely reflect an increased observer effort, rather than population increases (Weidinger 1996a). Breeding was delayed after the relatively harsh winter of 1991 (compared to the unusually mild winter 1984) in Antarctic Terns, Kelp Gulls and South Polar Skuas, whereas no such effect was found with Pintado Petrels (Weidinger 1997) and Southern Giant Petrels. Compared to earlier studies from this area, observed clutch size, egg size and breeding success did not differ in species for which data were available. It had been previously reported that Pintado Petrels laid significantly larger eggs in 1991 than in 1990 (Weidinger 1996b). A similar difference was found also in Kelp Gulls, but not in Antarctic Terns or skuas. The only difference in clutch size between the two years was the higher proportion of two-egg clutches in South Polar Skuas in 1991 (P. Lumpe unpubl. data).

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