

BIRDS AT LAURIE ISLAND, SOUTH ORKNEY ISLANDS, ANTARCTICA: BREEDING SPECIES AND THEIR DISTRIBUTION

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SUMMARY

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Bird communities of the ice-free areas of Laurie Island were surveyed during the breeding seasons of 1993/94 and 1994/95. Additional censuses of penguin colonies were made during the 2004/05 season. Twenty-nine seabird species were recorded, of which 15 were breeding. Adélie Penguins *Pygoscelis adeliae* bred at six localities, primarily on the south coast. This survey showed that the population of Adélie Penguins in the 2004/05 season was 32.3% lower than that found a previous study conducted during the 1983/84 season. Chinstrap Penguins *Pygoscelis antarctica* are the most numerous pygoscelid penguins in the area. Previous studies showed they had increased between 1948 and 1983 at many colonies. Since then, there was a slight increase in the population between 1983/84 and 1994/95 (from 141 950 to 143 792 breeding pairs, +1.3%). However, populations of Chinstrap Penguins in the Antarctic Peninsula showed different trends in the late 1980s. Because the censuses available from Laurie Island after 1994/95 season were incomplete, it is not possible to draw any conclusions about Chinstrap Penguin population trends. Population size and distribution of several other species breeding in the area are updated, and possible factors affecting short-term changes are discussed.

Key words: seabirds, Adélie Penguin, Chinstrap Penguin, breeding colonies, Laurie Island, Antarctica

INTRODUCTION

Because seabirds are considered excellent indicators of the state of pelagic marine ecosystems, they are often used to measure changes in marine environments. However, the use of birds as indicators of climate change may be difficult because of complex interactions in Antarctic ecosystems (Croxall *et al.* 2002) and the potential confounding effects of human impacts at local scales.

Many studies of penguin population trends have focused on the effects of climate variability (Trivelpiece and Fraser 1996, Croxall *et al.* 2002, Forcada *et al.* 2006). Others have attempted to separate the effects of environmental variability from those of human activities (Fraser & Patterson 1997, Micol & Jouventin 2001). In recent years, human activity in Antarctica has increased, mainly resulting from commercial fisheries (Nicol and Foster 2003), logistic operations and tourism (Enzenbacher 1992, 1994; Pfeiffer & Peter 2004). This has led to concern about the effects of human disturbance on bird populations.

To obtain reliable population estimates for management and conservation purposes, adequate information on the distribution and abundance of Antarctic seabirds is needed. Accordingly, the Scientific Committee for Antarctic Research (SCAR), through the Group of Experts on Birds (GEB), supports integration of all available data on the distribution and abundance of Antarctic seabirds. However, recent information on Southern Ocean seabird populations has become available only lately, through a number of published reviews (Woehler 1993, Croxall *et al.* 1995, Woehler

& Croxall 1997, van Franeker *et al.* 1999, Creuwels *et al.* 2007, Patterson *et al.* 2008).

The South Orkney Islands lie on the south side of the Scotia Sea about 600 km northeast of the Antarctic Peninsula. Coronation Island and Laurie Island are the two main islands of the South Orkney Islands group. Although they are an important breeding area for seabirds (Poncet & Poncet 1985, Rootes 1988, Woehler & Croxall 1997), the difficulties of access and the mountainous and glaciated terrain mean that information concerning the avifauna on some islands is still lacking.

Except for a few published studies (Ardley 1936, Choice 1947, Coria *et al.* 1996), data on abundance and location of breeding seabird colonies at Laurie Island are dispersed in the literature (e.g. Croxall & Kirkwood 1979, Poncet & Poncet 1985, Woehler 1993, Woehler & Croxall 1997) or accessible only through anecdotal reports from the Scottish National Antarctic Expedition of 1902–04 (Clarke 1906) and from Valette (1906).

Since the 1993/94 summer, an extensive study of the ecology of fulmarine petrels and South Georgia Shags *Phalacrocorax georgianus* at Laurie Island has been undertaken, including a survey of the distribution and number of breeding birds on the whole island during the summers of 1993/94 and 1994/95. The aim of this study was to assess the breeding population sizes and distribution of bird colonies at Laurie Island, South Orkney Islands. In addition, we also provide a brief summary of the occurrence of nonbreeding birds.

STUDY AREA AND METHODS

The survey was carried out on the ice-free shorelines of Laurie Island (60°45'S, 44°39'W) and other small offshore rocks and islands in their vicinity (Fig. 1), in 1993/94 and 1994/95. Additional censuses of various penguin colonies on Laurie Island were made in 2004/05. As part of a monitoring study of Adélie Penguin *Pygoscelis adeliae* colonies, birds occupying nests with eggs were counted annually from the 1995/96 to 2006/07 seasons at Point Martin (see Carlini *et al.* 2005). Furthermore, numbers of breeding pairs of shags were counted on surveys conducted in November of each year between 2002 and 2005.

Laurie Island is an irregularly shaped island, 22 km long in an east-west direction. The island is glaciated, with wide areas of uncovered rocks. The easternmost of the South Orkney Islands, it lies roughly 20 km east of Coronation Island, the largest island of the South Orkney Island group. A meteorological and research station was established on the island's isthmus in 1904 (Orcadas Base, Fig. 1).

Official site names and their latitudinal and longitudinal positions were obtained from the SCAR-MarBIN Portal (<http://www.scarmarbin.be/SearchGazetteer.php>). When no official names were available, positions of sites were determined with a global positioning system (GPS).

Groups of two or four observers worked methodically around the island counting breeding individuals. Large colonies of penguins (>200 pairs) were separated into 100-pair sections for counting, using features of the terrain. Totals for individual sections were summed

to obtain colony estimates. In smaller colonies, breeding pairs were counted individually. Incubating or brooding penguins were counted at each breeding colony with the use of 10 × binoculars. Colonies of penguins breeding on inaccessible cliff areas were estimated by scan counts from nearby promontories or from above or below the cliffs.

For South Georgia Shags *Phalacrocorax georgianus* and fulmarine petrels (Southern Giant Petrel *Macronectes giganteus*, Cape Petrel *Daption capense* and Snow Petrel *Pagodroma nivea*), censuses were made by direct counts of incubating or brooding birds for each breeding colony. Counts of storm-petrel species (Wilson's Storm-Petrel *Oceanites oceanicus* and Black-bellied Storm-Petrel *Fregetta tropica*) were limited to few locations owing to the characteristics of their nest sites, their nesting behaviour and, especially, the limited time available at each locality. Nevertheless, we recorded a number of nest sites of both species in some locations and noted the presence or absence of breeding birds at all localities surveyed.

Numbers of breeding pairs of Subantarctic Skua *Catharacta antarctica* and South Polar Skua *C. maccormicki* were estimated by counting active nests or by using mobbing behaviour to identify breeders when nests were not found. The number of active nests of Kelp Gull *Larus dominicanus*, Antarctic Tern *Sterna vittata* and Pale-faced Sheathbill *Chionis alba* was individually counted.

No counts of breeding seabirds were made at the Murray Islands, Saddle Island, the Weddell Islands, Bruce Island, Mabel Island and Nigg Rock because of the restricted time available. The accuracy of counts of each species was estimated following Woehler (1993).

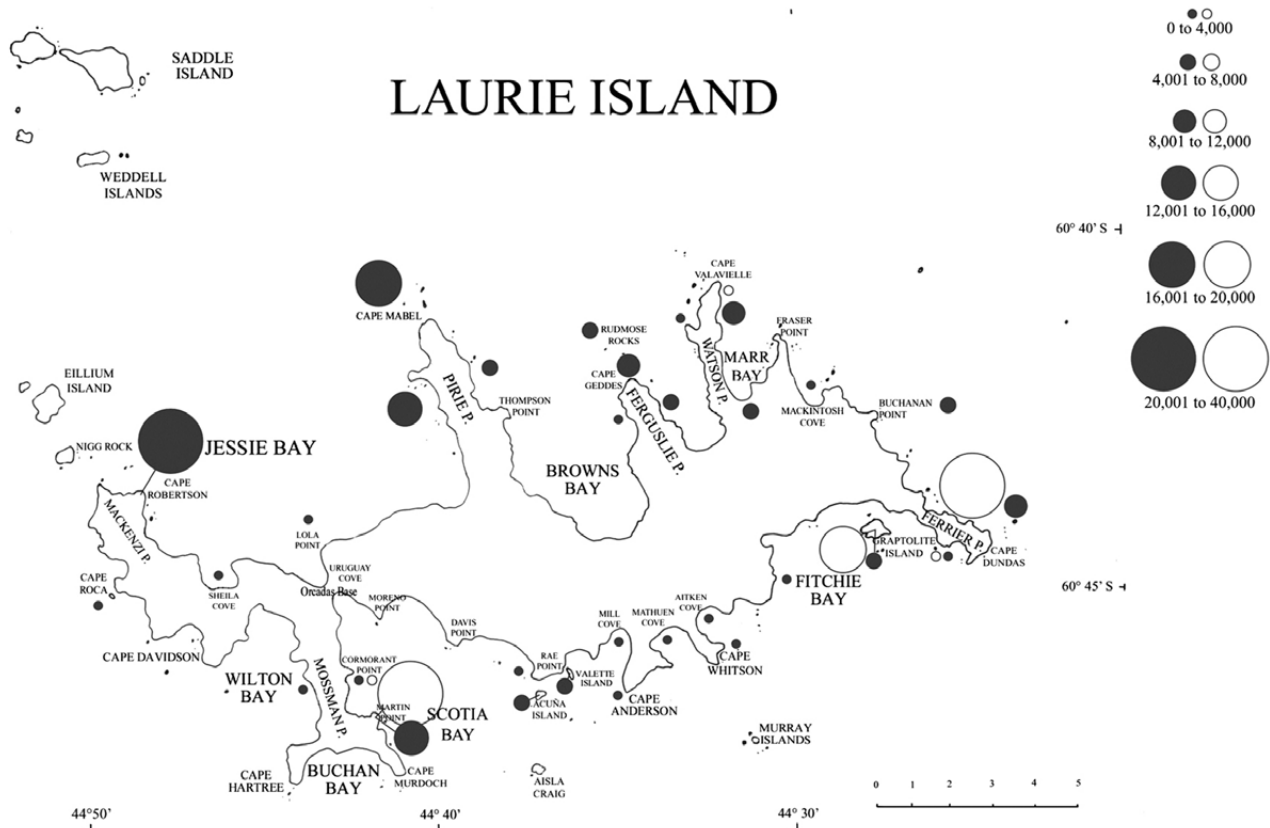


Fig.1. Laurie Island showing the locations of colonies of Adélie (open circles) and Chinstrap (grey circles) penguins.

With the counting methods used for penguin counts, accuracy was estimated at $\pm 5\%$ to 15% . However, accurate estimates of abundance of Cape and Snow Petrels were not possible because of limited access to breeding cliffs.

Since 1984 a register of nonbreeding species on Laurie Island has been kept by station personnel. In this paper we adopted the specific nomenclature following the revisions given in Marchant and Higgins (1990) and del Hoyo *et al.* (1992, 1996).

RESULTS

Breeding species

Adélie Penguin *Pygoscelis adeliae* — In 1993/94, this penguin was recorded breeding at six localities, primarily on the south coast (seven colonies), with only one colony on the north coast (Table 1, Fig. 1). Nearly 85 000 breeding pairs, all incubating, were counted from 25 October to 28 November 1994. The most important colonies were restricted to rocky promontories on Ferrier Peninsula, Mossman Peninsula (Point Martin) and Graptolite Island. (The number of breeding pairs for each locality are summarised in Table 1). Two new breeding localities were discovered during the 1993/94 season (Table 1). Adélie Penguin breeding populations decreased 31% between 1983/84 (Poncet & Poncet 1985) and 1993/94 (119 585 versus 85 102 breeding pairs, Table 1). From 1993/94 to 2004/05, the breeding population showed a further decrease of 5% (85 102 versus 80 976 nests with eggs), for a total decrease of 32.3%.

Chinstrap Penguin *Pygoscelis antarctica* — This is the most numerous pygoscelid penguin in the Laurie Island area. Eighty-eight breeding colonies were identified and counted at 26 localities, including seven new breeding localities (see Appendix 1, available on the Web site). Important colonies were observed on Nigg Rock, and Murray, Mabel, Weddell, Saddle and Eillium islands, but it was not possible to count these. The total population of Laurie Island,

considering only the 88 colonies for which the number of breeding pairs was available, was estimated as at least 143 800 pairs. At some locations only Chinstrap Penguins or Adélie Penguins occur, but at others both species nest. For example, in 1994/95, six mixed sites occupied by Adélie Penguins and later invaded by Chinstraps and two sites where only Adélie Penguins bred were found at Point Martin (Carlini *et al.* 2005). The breeding population showed a slight increase of 1.3% between 1983/84 (Poncet & Poncet 1985) and 1994/95 (141 950 versus 143 792 breeding pairs, Appendix 1). In 2004/05, when we censused 10 colonies, the resulting population trends were mixed: populations increased from 1994/95 in six colonies (Point Lola, 14%; Pirie Peninsula, 5.7%; Rudmose Rocks, 45.5%; Point Rae, 89.1%; Valette Island, 30.6%; and Acuña Island, 49.8%) and decreased in three colonies (Ferguslie Peninsula, 19.1%; Cape Geddes 25.4%; and Mill Cove, 6.7%).

Gentoo Penguin *Pygoscelis papua* and Macaroni Penguin *Eudyptes chrysolophus* — A total of 460 breeding pairs of Gentoo Penguins were recorded, the most important colony being located at Ferrier Peninsula (433 pairs). Several minor localities (Watson Peninsula, Point Martin, Acuña and Graptolite Islands) had scattered nests. Macaroni penguins were found in scattered nests, often mixed with Chinstrap colonies. Nine breeding pairs were observed at Point Martin, Acuña and Graptolite Islands.

Southern Giant Petrel *Macronectes giganteus* — The two largest colonies were located on snow-free areas on the north coast (see Appendix 2, available on the Web site). At Watson Peninsula, the count of incubating of giant petrels in 1994/95 (235 active nests) was similar to that in 1993/94 (230 active nests), but the number of incubating birds decreased at Cape Geddes, where 184 active nests were counted compared with 228 in 1993/94.

Cape Petrel *Daption capense* — An abundant species breeding in several colonies (Appendix 2), the total Cape Petrel population was estimated as at least 39 300 pairs. Although exact numbers at

TABLE 1
Variation in the size of the Adélie Penguin breeding populations at Laurie Island

Locality (number of colonies at site)	Year of study; count (accuracy expressed as percentage, following Woehler 1993)		
	1983/84 ^a	1993/94	2004/05
Watson Peninsula (1)	985 (10–15)	462 (<5)	392 (<5)
Ferrier Peninsula (2)			
North Coast (1)	60 000 (>50)	38 000 (10–15)	35 750 (10–15)
South Coast (1)	1000 (>50)	130 (<5)	108 (<5)
Total	61 000	38 130	35 858
South Coast (1)			
Fitchie Bay	3000 (>50)	NB ^b	NB
Acuña Island (1)	?	2008 (<5) ^c	1880 (<5)
Graptolite Island (1)	30 000 (>50)	18 500 (5–15)	16 300 (5–15)
Point Cormoran (1)	?	122 (<5) ^c	96 (<5)
Point Martin (2)	24 600 (25–50)	25 880 (5–10)	26 450 (5–10)

^a Poncet & Poncet 1985.

^b NB: Nonbreeding.

^c New colony.

Nigg Rock, and on Weddell, Saddle and Eillium islands could not be counted, several important colonies were observed there. The most numerous colonies were restricted to rocky outcrops along the coasts of Uruguay Cove, Pirie Peninsula, Mackintosh Cove and Ferrier Peninsula.

Snow Petrel *Pagodroma nivea* — Snow Petrels were found breeding in similar habitat as, and often close to, Cape Petrels. Their burrowing habit made it difficult to estimate numbers. A total of 1250 apparently occupied sites were recorded, with the most numerous colonies located on the cliffs of Buchan, Uruguay and Mackintosh Bays (Appendix 2).

Wilson's Storm-Petrels *Oceanites oceanicus* and Black-bellied *Fregetta tropica* Storm-Petrels — These Storm-Petrels were noted only after dark. Wilson's Storm-Petrel is widely distributed, nesting in all suitable rocky areas on Laurie Island. Sixteen nest sites were recorded, mainly on steep cliffs and scree slopes of Pirie Peninsula. Forty-one nests were found in three small colonies close to Orcadas Base; 24, on Point Lola; five, on Moreno Point; and 12, on Davis Point. Nine apparent nesting places of Black-bellied Storm-Petrel were found (Appendix 2). A total of 14 nests were counted in a small colony on Point Lola.

South Georgia Shag *Phalacrocorax georgianus* — Found breeding in seven colonies, totalling 668 breeding pairs (December 1994). Nesting was concentrated in rocky islets, mostly off the north and west coast, with the most numerous colonies at Pirie Peninsula, Wilton Bay and Watson Peninsula. Counts in 2005/06 suggested that the population had decreased since 1994: 80 occupied nests on the west coast of Pirie Peninsula (-31%); 85 on the east coast of Pirie Peninsula (Thomson Point, -26%); 181 at Cape Davidson (Cape Davidson count from 2003/04 only, -16%).

Pale-faced Sheathbill *Chionis alba* — Found in the whole study area, with 248 occupied nests in December 1994, mainly at three sites: Cape Robertson, Watson Peninsula and Ferrier Peninsula. Nests were located in rock holes near the sea and often associated with Chinstrap Penguins. Some pairs were found breeding close to Cape Petrels.

Subantarctic Skua *Catharacta antarctica* and South Polar Skua *C. maccormicki* — These two skuas as well as mixed pairs were found breeding at several sites throughout the study area. Two hundred pairs of Subantarctic Skuas were recorded, the most important concentrations being at Watson Peninsula, Ferrier Peninsula and Buchanan Point, in association with large numbers of Adélie Penguins, Chinstrap Penguins and Cape Petrels. Only one South Polar Skua breeding pair was found at Pirie Peninsula (1994/95), associated with colonies of Cape Petrels. In the same season, we recorded breeding of two mixed-species pairs. Five "clubs" of nonbreeding skuas were found scattered around the island, close to ponds or lakes, for a total of 210 nonbreeding skuas. The most important clubs were located at Cape Robertson (65) and Ferrier Peninsula (74).

Kelp Gull *Larus dominicanus* — Nests were found scattered around the island, either singly or in small breeding groups. A total of 339 pairs bred in 38 groups, ranging from one nest (Cape Geddes) to 40 nests (Point Davis). Most nests were placed evenly along the coastline, preferably on small rock outcrops. Few nests were located on pebble beaches. There were also some Kelp Gull roosting

"clubs." The most numerous "clubs" were at the ponds located along the coasts of Fitchie Bay.

Antarctic Tern *Sterna vittata* — This species was abundant and occurred in the whole study area. A total of 555 breeding pairs counted, with the densest colonies found at Watson Peninsula, Pirie Peninsula and Lola Point.

Nonbreeding species

Emperor Penguin *Aptenodytes forsteri* — Twenty-five (2 adults and 23 juveniles) seen on 13 occasions between 1994 and 2004.

King Penguin *Aptenodytes patagonicus* — Both adults and juveniles were seen in all years, on 10 dates between 6 December and 23 May, except that none were seen in 1997 and 1998.

Rockhopper Penguin *Eudyptes chrysocome* — On 23 January 1997 an adult was sighted in the Chinstrap Penguin colony on Mossman Peninsula.

Magellanic Penguin *Spheniscus magellanicus* — One was seen in February 1994 in the Chinstrap Penguin colony on Cormorant Point (Mossman Peninsula).

Black-browed Albatross *Thalassarche melanophrys* — This species was seen almost weekly from late March until late April, usually flying over Washington Strait and Jessie Bay.

Northern Giant Petrel *Macronectes halli* — One was seen flying over Jessie Bay on 15 January 1997.

Southern Fulmar *Fulmarus glacialisoides* — Singles and mixed flocks were regular visitors, seen on 27 occasions on 24 different dates between August and December covering all survey years.

Antarctic Petrel *Thalassoica antarctica* — These were seen between September and December in all years except 1987 and 1989, usually at least 2 km offshore, either alone or in flocks of Cape Petrels.

Antarctic Prion *Pachyptila desolata* — Small numbers were observed in all years, close to the Mossman Peninsula.

White-chinned Petrel *Procellaria aequinoctialis* — These petrels were seen offshore eight times during the summers of 1985, 1986 and 1987. During February 1985, they were seen feeding behind fishing vessels four times in Jessie Bay.

Black-necked Swan *Cygnus melanocorypha* — One was seen resting on a pond at Point Martin on 4 January 1992 and two were seen in flight on 3 February 1998 at Scotia Bay. Remains of at least four were found at Subantarctic Skua nests (Mossman Peninsula) on 22 and 24 December 1998.

Cattle Egret *Bubulcus ibis* — One was seen at Point Martin on 27 April 1992. A beached corpse, probably of the same bird, was found on 18 May 1992. On 12 January 1994 remains of at least three birds were founded close to Pale-faced Sheathbill nests at Mossman Peninsula.

White-rumped sandpiper *Calidris fuscicollis* — Five were seen at Point Martin on 22 and 23 December 1993 and observed again on

4 and 5 January 1994. Two were seen at Cape Geddes on 5 January 1997, and one was found dead at Cape Watson on 20 January 1997.

Arctic Tern *Sterna paradisaea* — Nine were seen on 8 May 1995 at Mossman Peninsula. Other groups occurred in Scotia Bay in March 1998 with Antarctic Terns.

DISCUSSION

A total of 29 seabird species were recorded on Laurie Island, comprising 15 breeders and 14 nonbreeders. These numbers are similar to those breeding at another extensive ice-free area, nearby Signy Island (16 species; Rootes 1988). The main difference between the two islands is the distribution of Antarctic Prions, which visit Laurie Island but have not been observed breeding, although large colonies occur on Signy and Coronation islands (Tickell 1962).

Distributions of Adélie and Chinstrap Penguins at Laurie Island resemble those observed at 25 de Mayo/King George Island (Trivelpiece & Fraser 1996), with colonies of Adélie Penguins established only on the south coast and the main Chinstrap colonies located on the north coast. Comparison of numbers of pygoscelid penguins presented in this study with earlier estimates of abundance from Laurie Island is made difficult by the sometimes poor documentation of previous surveys. Data on Adélie Penguin colonies at Laurie Island from 1983 (Poncet & Poncet 1985), in comparison with the current data (2004/05), suggest a 32.3% decrease in these pygoscelid populations. This is in agreement with previous observations made at Signy Island (Forcada *et al.* 2006). Counts over consecutive breeding seasons exist for only two colonies located at Point Martin. The censuses conducted from the 1995/96 breeding season onwards in these colonies show an increase, presumably related to breeding success (Carlini *et al.* 2009). Between 1993 and 2004, there has likely been a slow decrease in the numbers of Adélie Penguins at other colonies.

Previous censuses have shown a marked increase in numbers and breeding range of Chinstrap Penguins (Laws 1985, Poncet & Poncet 1987). At Signy Island, in particular, where a strong increase in Chinstrap population size was recorded for the period 1958–1978 (Croxall *et al.* 1981), there has been a remarkable decline since the early 1990s (Forcada *et al.* 2006). The population of Chinstrap Penguins at Laurie Island in 1947/48 was roughly estimated at 36 100 pairs by Robin (1948, in Croxall & Kirkwood 1979), whereas Poncet & Poncet (1987) recorded 174 650 breeding pairs for the 1983/84 breeding season. Thus, the Chinstrap population seemed to have increased between 1948 and 1983. Since then, a slow but steady increase seems to have been taking place in colonies located on the south coast, whereas the colonies established on the north coast remained stable (Appendix 1). Populations of Chinstrap Penguins in the Antarctic Peninsula region showed different trends in the late 1980s. Whereas populations in the Palmer area have increased since 1976, those on King George Island and Signy Island have decreased (Woehler *et al.* 2001). Because the censuses available from the Laurie Island after 1994/95 season are incomplete, it is not possible to reach any conclusions about Chinstrap population trends. An important finding from this work is the discovery of previously undescribed colonies of Adélie, Chinstrap (Table 1, Appendix 1) and Macaroni penguins. These discoveries are likely due to the more accurate surveys, with better coverage of colonies.

Comparison of numbers of seabirds other than penguins with earlier counts is very difficult because of the poor information from previous surveys (Clarke 1906, Valette 1906, Choice 1947, Ewer & Anderson 1947, Coria *et al.* 1996). Among fulmarine petrels breeding at Laurie Island, Cape Petrels were the most numerous (Appendix 2). However, it is not possible to estimate the population size because of the lack of precise census data which, in turn, is due to the inaccessibility of many breeding localities, making it difficult to count nests at these places. Of the Cape Petrel colonies reported here, population estimates are available for only 32, with a minimum total of 39 000 pairs (Appendix 2). Similarly, for the Snow Petrel, the minimum total of breeding pairs was 1250 scattered in 28 colonies.

The colonies of Southern Giant Petrels at Laurie Island, with 419 breeding pairs in 1995, represent over 12% of the total breeding population in the South Orkney Islands (3400 pairs, Patterson *et al.* 2008). A comparison of the Giant Petrel breeding populations at Cape Geddes, from this study and earlier counts (Coria *et al.* 1996), shows that from 1985/86 to 1993/94, the breeding population increased by about 43%, with a slight decrease between 1993/94 and 1994/95. For the other colony (Watson Peninsula) studied, the available data show no clear trends.

Several Antarctic localities where shags have been recorded breeding lack any recent population counts. Most of what is known about the population status of these birds is thus based on data from a few places in the Southern Ocean. The population of South Georgia Shags in South Orkney Islands has been estimated at 2000 breeding pairs (N. Cogley, unpublished work, quoted in Rootes 1988). Even if this figure is an underestimate, a steady decline in the number of pairs of these shags was observed in this study. Casaux & Ramón (2002) provided information on the diet of the South Georgia shag obtained during five consecutive years at Laurie Island. These authors suggested that the differences in the diet of the shag were related to a change in the abundance of some notothenioid species. This may explain the gradual decrease of these birds. Population decreases in colonies of other shags (*P. melanogenis* and *P. bransfieldensis* at Marion and South Shetland Islands, respectively) are well documented (Crawford *et al.* 2003, Casaux & Barrera Oro 2006). These decreases support the idea that these species are affected by changes in the availability of prey.

There is very scarce information on the breeding localities of Charadriiformes on Laurie Island. Indeed, we are unaware of any published reports since those of Clarke (1906). Owing to insufficient data, the situation for these birds remains unclear. New estimates are needed for Pale-faced Shearwater, skuas, Kelp Gull and Antarctic Tern populations to monitor future population trends on Laurie Island.

Nonbreeding species

Our list of nonbreeding species at Laurie island is similar to those from previous studies from South Orkney Islands. Four of the 14 species recorded were penguins, the most regular and numerous being Emperor Penguins, which have been recorded previously as winter visitors at Signy Island (Rootes 1988) and South Shetland Islands (Trivelpiece *et al.* 1987, Peter *et al.* 1988, Lumpe & Weidinger 2000). According to Coria *et al.* (2000), many of the Emperor Penguin sightings at Laurie Island may be from the Snow Hill colony, rather than from the colonies located on the east of Weddell Sea, as has been suggested in the past (Rootes 1988).

Antarctic Fulmars are common visitors to Laurie Island. They breed in some localities on South Orkney Islands (Creuwels *et al.* 2007), the nearest being Powell Island (approximately 15 km northwest of Laurie Island), but, surprisingly, they are absent from Laurie Island.

Black-necked Swan, Cattle Egret and White-rumped Sandpiper presumably originated from north of Laurie Island. The most frequent explanation for such vagrancy is unusual weather conditions that force birds to move out of their usual distribution. Such an explanation probably accounts for their occurrence at Laurie Island.

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