

A SURVEY OF PENGUIN BREEDING POPULATIONS AT THE SOUTH ORKNEY ISLANDS

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ABSTRACT. In 1983–4, the numbers of breeding pairs of penguins were estimated or counted at all the breeding colonies on the South Orkney Islands, except for Signy, Weddell, Saddle, Bruce and Inaccessible islands and a few sites on Coronation Island. Counts and estimates of colony area were made mainly from a small sailing vessel close inshore, complemented by regular counts of nests ashore. Several unreported colonies (mainly of chinstrap penguins) were discovered and many more were surveyed for the first time. Total estimated breeding populations were about 413 300 pairs of chinstrap penguins, 126 100 pairs of Adélie penguins, 3825 pairs of gentoo penguins and six pairs of macaroni penguins. At the two sites where comparative data exist, Adélie penguin populations had increased by 5 and 11% per annum (over 25–30 years) and chinstrap penguin populations by 7 and 15% per annum (over 20–37 years); a third colony showed no change.

INTRODUCTION

Although penguins may comprise over one-half the bird biomass of many areas of the Southern Ocean (Mougin and Prévost, 1980) and perhaps be responsible for 75% of the food consumption by birds (Croxall, 1984), the quantitative information on which the population estimates are based is very patchy. As Wilson (1983) noted, 'Accurate estimates of abundance cannot be made for any single species or for any geographical area. The locations of many colonies have been only vaguely pinpointed and only at a few places have individual colonies been mapped and censused.'

The southern Scotia Sea is one of the better-known areas of the Antarctic and all data then available on the distribution and abundance of penguin breeding populations were summarized in detail by Croxall and Kirkwood (1979). The populations of the South Orkney Islands were little known but were believed to be of considerable size. Only on Signy Island, the site of the British Antarctic Survey station, have recent detailed surveys been carried out (Croxall and others, 1981). For Laurie Island, the only quantitative data were from 1945 (Ewer and Anderson, 1948) and, for most colonies, the only information on breeding population size was anecdotal statements the reports of the *Scotia* expedition of 1902–4 (Clarke, 1906, 1915; Wilton and others, 1908).

The present survey was designed to locate penguin colonies in the South Orkney Islands and to assess the breeding population size of as many colonies as time permitted. The results of this survey are presented here and compared, where possible, with the limited previous information.

METHODS

Surveys took place during two weeks in late December 1983 and early January 1984. At this time of the year chinstrap penguins are usually half way through incubation (mean hatching date 13 January) and Adélie penguins have young chicks, either still

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being guarded at the nest site or having recently formed crèches (mean hatching date 9–10 December; mean date of crèche formation *c.* 26–29 December), based on data from Signy Island (Lishman, 1985).

Most of the work was carried out from the *Damien II*, a 15-metre steel schooner with a beam of 4.4 m and a draught varying between one and three metres. The normal procedure was as follows. The colony was photographed from about 100 m offshore and its shape and location marked on a map. At Laurie Island and a few other places, available maps were insufficiently accurate and more detailed outlines of the coastline were prepared. The number of breeding pairs was then estimated using $\times 8$ binoculars. Except for very small colonies, we counted 50 occupied nests or 50 chicks (depending on the stage of the breeding cycle) and, by careful scanning, estimated how many additional units of similar size were present. Direct ground counts of nests in some colonies suggested that the boat counts were accurate to within 15–25%, i.e. category 3/4 of Croxall and Kirkwood (1979). Occasionally, counts were made from further away; these were necessarily less accurate and we regarded them as usually of category 4 (25–50% error). We could only guess at the size of a few colonies (category 5). Full details of the complete survey, including the maps and estimates of the size of each colony, are deposited in the archives of the British Antarctic Survey.

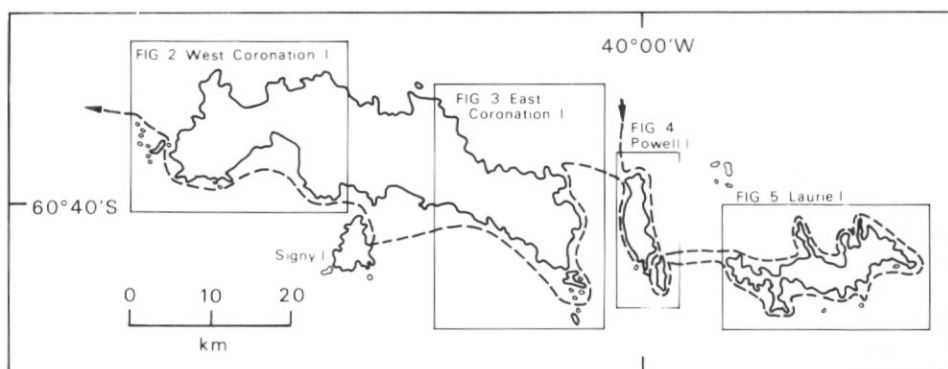


Fig. 1. South Orkney Islands, showing the track of the ship while engaged in the penguin survey.

RESULTS

The South Orkney Island group and the track of the boat while engaged in the survey are shown in Fig. 1. The results of the counts of each of the areas shown therein are given in Tables I–V and the location of the corresponding colonies is shown in Figs. 2–5.

The totals recorded in this survey were as follows: Adélie penguin – 126 000 pairs and 58 500 chicks in 17 colonies; chinstrap penguin – 413 000 pairs in 241 colonies; gentoo penguin – 3800 pairs in four colonies; macaroni penguin – six pairs at one site.

DISCUSSION

Comparison with previous data

Earlier counts of nests or pairs are available only for two Adélie and three chinstrap penguin colonies (Table VI). The Adélie colonies had increased by an average of 5–11% per annum over the last 25 or so years, rather faster than the 3–4% increases

Table I. Penguin breeding population estimates, west Coronation Island, 2-6 January 1984.

Locality	Chinstrap		Adélie		Gentoo	
	Category ¹	Pairs or nests (N) ²	Category	Pairs or chicks	Category	Nests
Larsen Is.	P5	10000 (3)	—	—	—	—
Monroe I. and Spine I.	P4 and P5	28000 (13)	—	—	—	—
Moreton Pt.	P5	23000 (2)	—	—	—	—
Coast north of Moreton Pt.	P5	1200 (3)	—	—	—	—
Return Pt.	P3/4	15600 (8)	—	—	—	—
Cheal Pt.	P3/4	22500 (9)	—	—	—	—
Gosling Is.	N1 and N3	9764 (6)	C3	8523 (1)	N1	874(1)
Coast and island west of Gosling Is.	P3/4	1000 (2)	—	—	—	—
Islands in Norway Bight	P3/4	180 (4)	—	—	—	—
Mansfield Pt.	P3/4	20 (1)	—	—	—	—
Gerd I.	P3/4	20 (1)	—	—	—	—
Stene Pt.	P3/4	1000 (1)	P3/4	1500 (1)	—	—
Total	—	112284 (53)	P C	1500 (2) 8523	—	874

¹ N: nests; P: pairs; C: chicks. Numbers refer to probable accuracy of counts, as defined by Croxall and Kirkwood (1979).

² Figures in parentheses refer to the number of colonies at each locality.

Table II. Penguin breeding population estimates, east Coronation Island, 31 December 1983.

Locality	Chinstrap		Adélie	
	Category ¹	Pairs ²	Category	Pairs
Purdy Pt.	P5	5000 (1)	—	—
Crown Head	P5	2000 (1)	—	—
Coast east of Crown Head	P4/5	2200 (2)	—	—
Cape Bennett	P3/4	7250 (8)	—	—
East Cape	P3/4	1800 (2)	—	—
Rayner Pt.	P3/4	9000 (1)	—	—
Gibbon Bay	P3/4	60 (2)	—	—
The Turret	P3/4	4150 (5)	—	—
Spence Harbour and unnamed island	P3/4	950 (3)	—	—
Matthews I.	P3/4	14750 (15)	—	—
Coffer I.	P3/4	2100 (2)	—	—
Two unnamed islands south of Matthew I.	P3/4	11500 (3)	—	—
Steeppholm Is.	P3/4	20 (1)	—	—
Skilling I. north coast	P3/4	6500 (3)	—	—
Amphibolite Pt.	P3/4	4000 (1)	P3/4	5000 (1)
Total	—	71280 (50)	—	5000 (1)

¹ P: pairs. Numbers refer to probable accuracy of counts as defined by Croxall and Kirkwood (1979).

² Figures in parentheses refer to the number of colonies at each locality.

Table III. Penguin breeding population estimates, Powell I., Michelsen I., Christoffersen I., Grey I. and Fredriksen I., 24–30 December 1983.

Locality	<i>Chinstrap</i>		<i>Adélie</i>		<i>Gentoo</i>		<i>Macaroni</i>	
	Category ¹	Pairs or nests ²	Category	Chicks	Category	Nests	Category	Nests
North, west and east coasts of Powell I.	P3 and P3/4	7608	—	—	—	—	—	—
South coast of Powell I. and Michelsen I.	N1	574 (1)	C1 and C3	11300 (1)	N1	1729 (1)	—	—
Christoffersen I.	N1 and N3	3861	C3	13260	N1	870	N1	6 (1)
Grey I.	—	—	C1 and C3	378 (1)	N1	324 (1)	—	—
Fredriksen I.	N3	2350 (1)	—	—	—	—	—	—
Total	P3/4	40820 (16)	—	—	—	—	—	—
	—	55213 (28)	—	49 938 (2)	—	2923 (2)	—	6 (1)

¹ N: nests; P: pairs; C: chicks. Numbers refer to probable accuracy of counts, as defined by Croxall and Kirkwood (1979).² Figures in parentheses refer to the number of colonies at each locality.

Table IV. Penguin breeding population estimates, west Laurie Island, 27-29 December 1983.

Locality	Chinstrap		Adélie		Gentoo
	Category ¹	Pairs ²	Category	Pairs	
Eillium I.	P4	21 400 (5)	—	—	—
Cape Robertson	P4	32 000 (1)	—	—	—
Mabel I.	P4/5	400 (4)	—	—	—
West coast of Pirie Pen.	P3/4	13 280 (14)	—	—	—
East coast of Pirie Pen.	P3/4	3 650 (7)	—	—	—
West coast of Mossman Pen.	P3/4	600 (2)	—	—	—
East coast of Mossman Pen. (Port Martin)	P3/4 and P5	10 000 (5)	P4	24 600 (6)	Bred 1903
Coast north of Cape Roca	P3/4	1 300 (1)	—	—	—
Cape Roca	P3/4	1 900 (1)	—	—	—
Coast south of Cape Roca	P3/4	1 000 (1)	—	—	—
Total	—	85 530 (38)	—	24 600 (6)	—

¹ P: pairs. Numbers refer to probable accuracy of counts, as defined by Croxall and Kirkwood (1979).

² Figures in parentheses refer to the number of colonies at each locality.

estimated from similar data for Signy Island (Croxall and others, 1981). The average annual increase of 7 and 15% at two chinstrap colonies was similar to values of 7-10% estimated for Signy Island populations (Croxall and others, 1981); the third colony showed no change.

Counts for a number of other populations in the South Orkney Islands were given in Croxall and Kirkwood (1979). These counts were invariably of adults, usually made late in the breeding season and of low accuracy (categories 4 and 5). Because counts of adults may be a rather poor index of breeding populations (see Croxall and Kirkwood (1979) for a more detailed discussion) we have not used them for detailed comparative purposes here, but if these counts were accepted at their face value, most indicate substantial population increases.

South Orkney Island penguin breeding populations

Our counts probably underestimate the true breeding population. For Adélie and chinstrap penguins, this will chiefly be because some pairs would have lost eggs or chicks before the census. Gentoo penguins occurred in small scattered colonies, sometimes mixed with other species, and it was often difficult to recognize and estimate the size of the colonies from the sea; thus, their populations will be further underestimated by an unknown amount.

Hatching success of Adélie penguins at Signy Island averages 82% and fledging success 75%, with about one-third of the failures occurring by the end of the creche period (Lishman, 1985). Approximately 25% of Adélie penguins were likely to have failed by the time of the survey and counts of pairs should therefore be increased by 33% to estimate the number that actually bred. The number of chicks surviving per pair at the survey date is about 1.5 (Lishman, 1985), and the chick counts can be divided by this figure to estimate the number of pairs that originally laid. The total

Table V. Penguin breeding population estimates, east Laurie Island, 28–29 December 1983.

	<i>Chinstrap</i>		<i>Adélie</i>		<i>Gentoo</i>	
	<i>Category</i> ¹	<i>Pairs</i> ²	<i>Category</i>	<i>Nests or pairs</i>	<i>Category</i>	<i>Nests</i>
Rudmose Rocks	P3/4	4200 (3)	—	—	—	—
Cape Geddes	P3/4	5000 (1)	—	—	—	—
East coast of Ferguslie Pen.	P3/4	7420 (6)	—	—	—	—
West coast of Watson Pen.	P3/4	2750 (13)	—	—	—	—
East coast of Watson Pen.	P3/4	11250 (10)	N3	985 (1)	N1	28 (1)
East coast of Marr Bay	P3/4	11200 (5)	—	—	—	—
East coast of Mackintosh Cove	P4	3800 (4)	—	—	—	—
Buchanan Pt.	P3/4	6 500 (1)	—	—	—	—
North coast of Ferrier Pen.	P3/4 and P4/5	10000 (6)	P4/5	60000 (1)	Recorded 1947	
South coast of Ferrier Pen.	P4/5	4200 (6)	P4/5	1000 (1)	Recorded 1947	
Graptolite I.	Recorded 1947		P4/5	30000 (1)	—	—
Fitchie Bay	P4	1200 (1)	P4/5	3000 (2)	—	—
Murray Is.	P3/4	1100 (3)	—	—	—	—
Aitken Cove	P4	3300 (3)	—	—	—	—
Methuen Cove	P4	2100 (3)	—	—	—	—
Point Rae	P3/4	400 (2)	Recorded 1903		—	—
Cape Anderson	P3/4	100 (1)	—	—	—	—
Valette I.	P3/4	4000 (1)	—	—	—	—
Acuna I.	P4	4000 (1)	Recorded 1903		—	—
Florence Rock	P4	500 (1)	—	—	—	—
Ailsa Craig	P4/5	6000 (1)	—	—	—	—
Total	—	89 020 (72)	—	94 985 (6)	—	28 (1)

¹ N: nests; P: pairs. Numbers refer to probable accuracy of counts, as defined by Croxall and Kirkwood (1979).

² Figures in parentheses refer to the number of colonies at each locality.

counts of 126085 pairs and 58460 chicks therefore represent 168113 and 38973 pairs originally, a grand total of 207086. Three areas where Adélie penguins breed were not visited in the survey: Signy Island, which had a total breeding population of 37000 pairs in 1978 (Croxall and others, 1981), and Cape Hansen and Shingle Cove on Coronation Island (together 13000 pairs in 1978; Croxall and Kirkwood, 1979). The Adélie penguin breeding population of the South Orkney Islands is thus in the region of 257000 pairs, or, given the accuracy of some of the estimates, best put between 200000 and 300000 pairs.

About 70% of chinstrap penguin eggs hatch, and by mid-to-late incubation about 10–20% of pairs are likely to have failed (Lishman, 1985). Correcting the count of 413327 pairs for 15% failure by census date gives a total of 486267 pairs. Four chinstrap penguin breeding areas were not visited during the survey: Signy Island (80000 pairs in 1978; Croxall and others, 1981), Cape Vix, Coronation Island (8000 pairs in 1964; Croxall and Kirkwood, 1979), Saddle Island (50000 birds, perhaps representing 25000 pairs, in 1903; Clarke, 1915) and Weddell Islands (no estimates

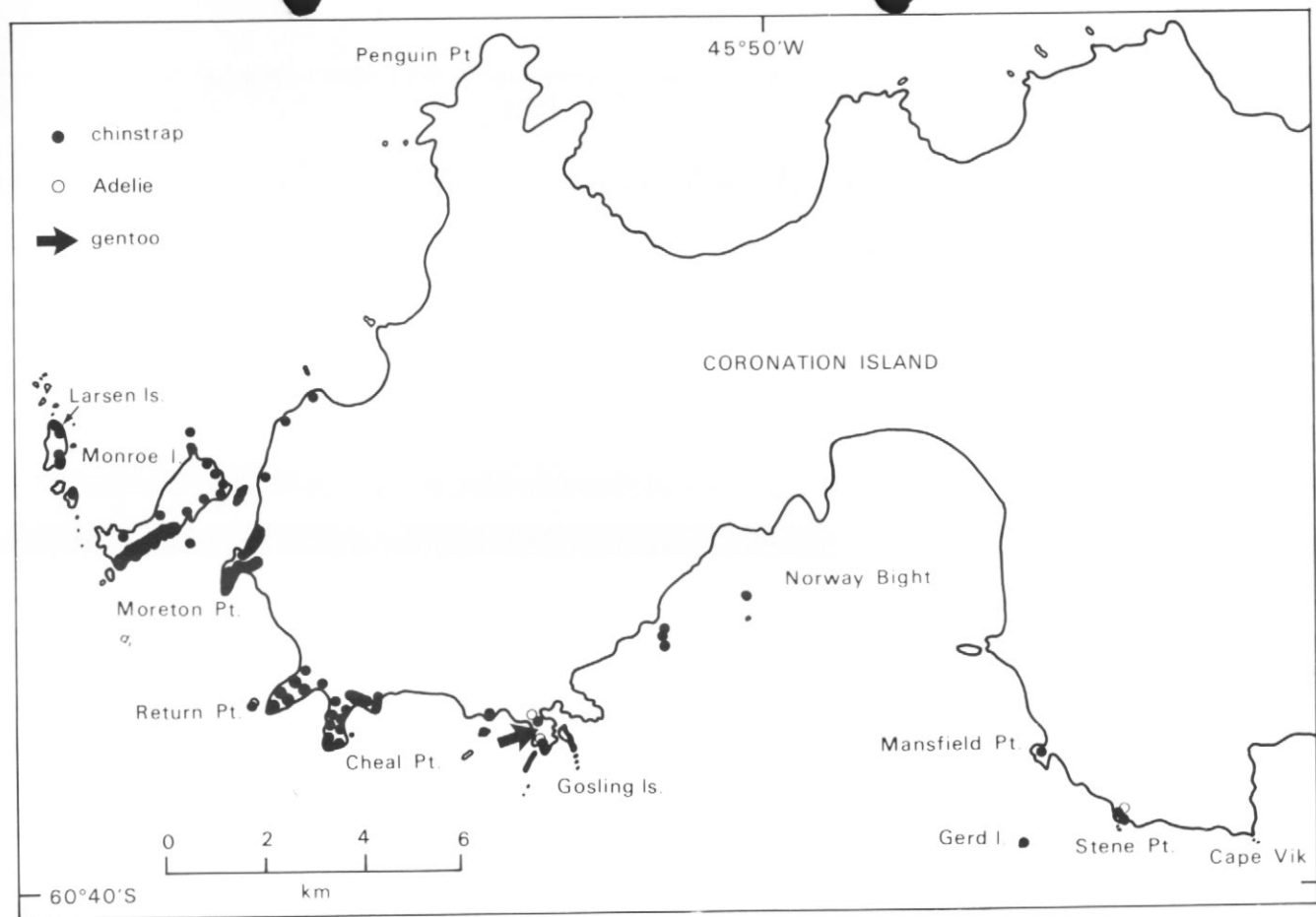


Fig. 2. Distribution of penguin colonies, west Coronation Island.

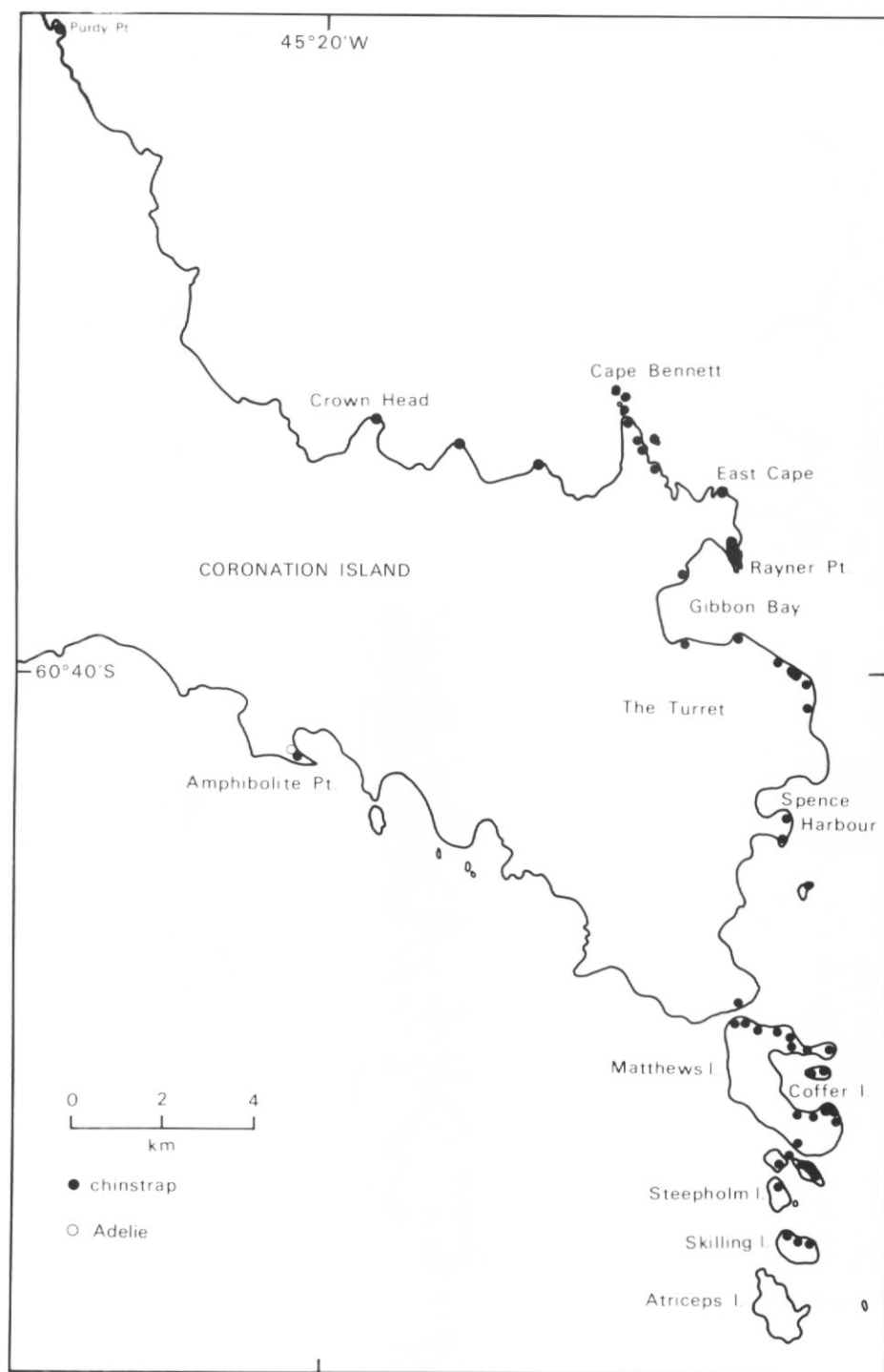


Fig. 3. Distribution of penguin colonies, east Coronation Island.

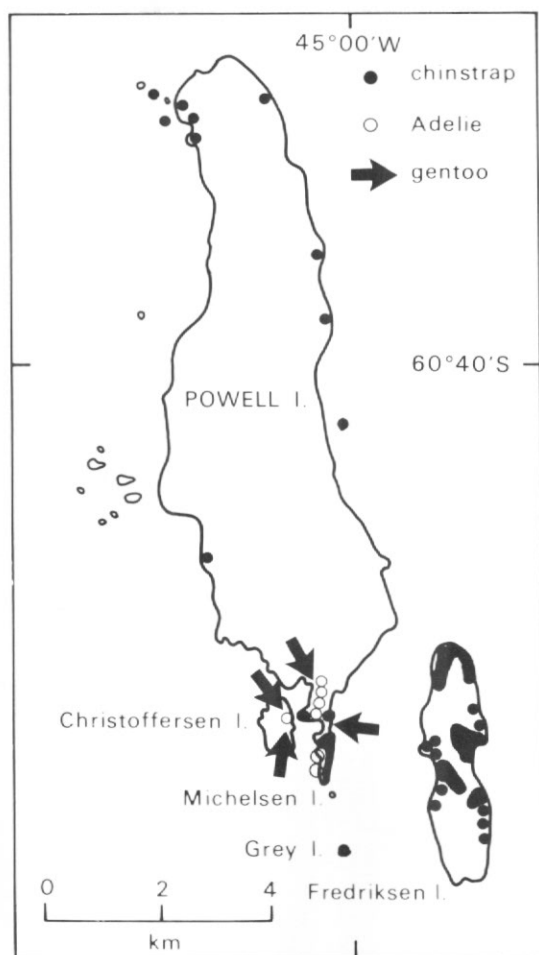


Fig. 4. Distribution of penguin colonies, Powell Island and adjacent islands.

available). The total breeding population of chinstrap penguins in the South Orkney Islands is probably of the order of at least 600 000 pairs.

Previous estimates of gentoo penguins breeding in the South Orkney Islands total some 1700 pairs (Croxall and Kirkwood, 1979). Our count was 3852 nests, and this did not include some known breeding areas. At the time of the survey gentoo penguin chicks were about to form creches, and approximately 40% of pairs have usually failed by this time (J. P. Croxall, personal communication). This indicates an original breeding population of 6800 pairs, and we suggest that the breeding population of the South Orkney Islands was in the range 5000–10000 pairs. Breeding pairs of macaroni penguins were scattered in ones and twos throughout the group. The total population is most unlikely to exceed 50 pairs.

Chinstrap penguins, with colonies scattered along the coastline of nearly every island in the South Orkneys group, are by far the most numerous species of breeding penguin. Adélie penguins breed at a dozen major localities, nearly always in association with the chinstraps; gentoos breed at about six localities, always in

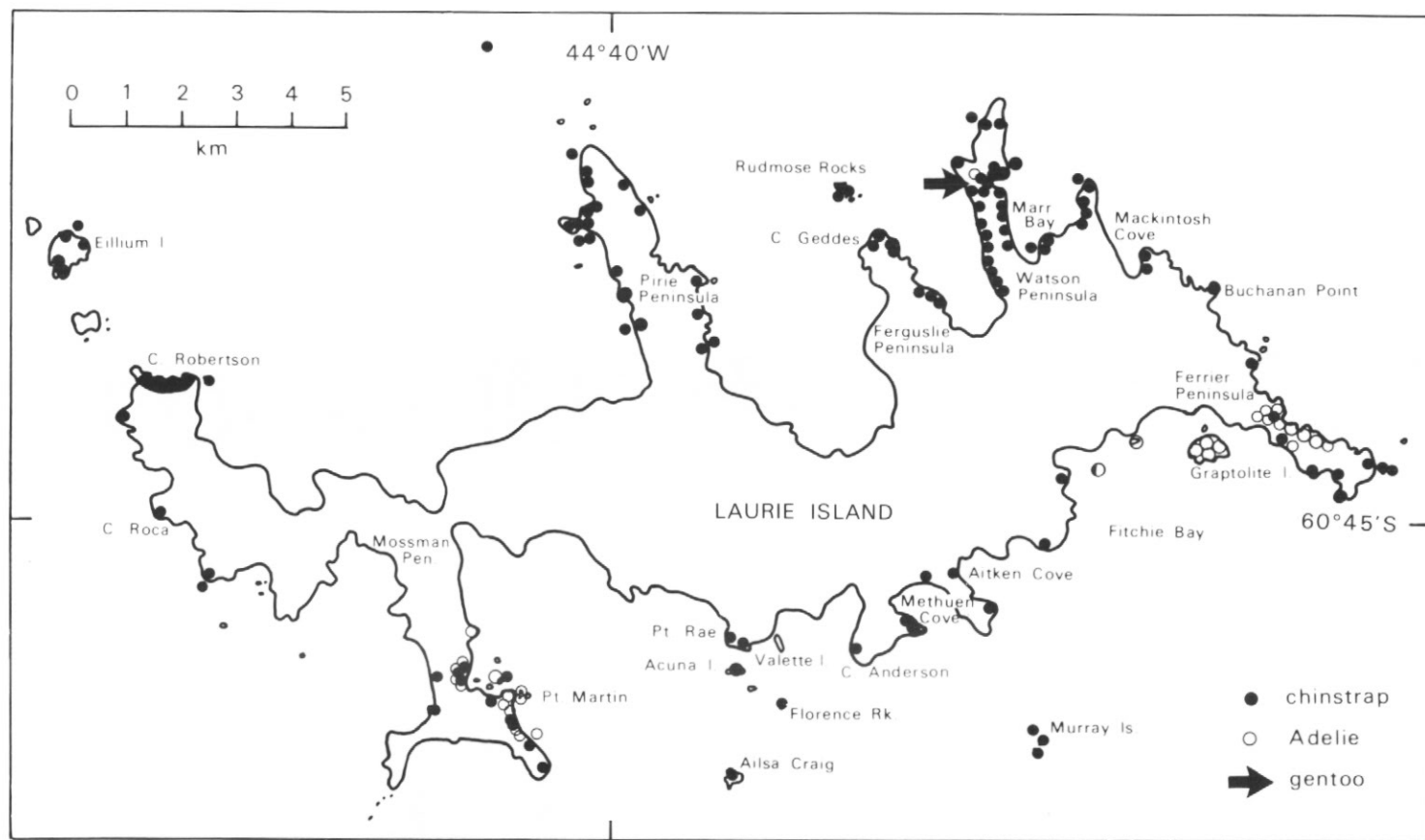


Fig. 5. Distribution of penguin colonies, Laurie Island.

Table VI. Comparison of present and previous counts of breeding penguin populations in the South Orkney Islands.

Species	Locality	Previous count		Present count (breeding pairs)	Mean annual increase (%)
		Date	Breeding pairs ¹		
Adélie	Gosling Is.	1955-6	c. 500	8 523	10.7
	Powell I./Michelsen I.	1957-8	14 650	49 560	4.8
Chinstrap	Cheal Pt, Coronation I.	1964-5	c. 6000	22 500	7.2
	Amphibolite Pt, Coronation I.	1964-5	5000	4000	0
	Cape Geddes, Laurie I.	1945-6	25	5000	15.0

¹ Data sources in Croxall and Kirkwood (1979).

association with the Adélies, both species avoiding the steeper terrain often preferred by chinstraps. In order to complete the penguin census of the South Orkneys, precise counts are needed for the large colonies of Adélies, chinstraps, and gentoos at Port Martin and Ferrier Peninsula on Laurie Island, together with a survey of the north coast of Coronation Island from Cape Bennett to Monroe Island and the small Weddell, Bruce, Saddle and Inaccessible islands.

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