

Ornithological research on Marion Island, 1974-75

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Marion Island (46° 54' S, 37° 45' E) has a tundra-type biome, and the terrestrial ecosystem depends to a large extent on the productivity of the surrounding sub-Antarctic ocean. Seabirds are major transporters of essential plant nutrients to the nutrient-poor soils of the island. A long-term study of the nutrient and energy status of the biological communities on Marion Island was organized in 1972 by the South African Scientific Committee for Antarctic Research and sponsored financially by the South African Department of Transport (*van Zinderen Bakker*, 1973). The avian community is being studied by personnel of the Percy FitzPatrick Institute, University of Cape Town, under the direction of Professor W.R. Siegfried.

The aims of the ornithological research programme are to determine the mineral and energy contributions of birds to the terrestrial ecosystem of Marion Island, and to assess ecological adaptations and energy requirements of birds breeding in the maritime sub-Antarctic. This paper is a preliminary report on general progress made during the initial expedition (January 1974 - April 1975) to Marion Island.

Bird populations

Twenty-six species of birds breed on Marion Island. To begin with research concentrated on 13 species which are active diurnally and which breed above ground at sites readily accessible to observers from the base station and laboratory. These birds are among the largest and most prolific species, and together comprise more than half of the avian biomass on the island. The species are: King Penguin *Aptenodytes patagonica*, Gentoo Penguin *Pygoscelis papua*, Macaroni Penguin *Eudyptes chrysolophus*, Rockhopper Penguin *E. chrysocome*, Wandering Albatross *Diomedea exulans*, Sooty Albatross *Phoebastria fusca*, Light-mantled Sooty Albatross *P. palpebrata*, Northern Giant Petrel *Macronectes halli*, Southern Giant Petrel *M. giganteus*, King Shag *Phalacrocorax albiventer*, Great Skua *Stercorarius skua*, Kelp Gull *Larus dominicanus*, and Lesser Shearwater *Chionis minor*.

Almost all the surface-nesting birds on Marion Island are found at the coast and on the immediately adjacent vegetated flats. During January - March 1974

Table 1

Birds counts on Marion and Prince Edward Islands. The 1952 census covered only Marion Island (*Rand*, 1954), but *Van Zinderen Bakker's* (1971) figures for the 1965-66 census appear to be for both islands.

Species	1952	1965-66	1974	
			Marion	Prince Edward
<i>Sphenisciformes</i>				
King Penguin	—	2 million	—	5 000
Gentoo Penguin	—	2-3 000	1 603	318
Macaroni Penguin	—	2 million	—	—
Rockhopper Penguin	—	1 million	424 600	—
<i>Procellariiformes</i>				
Wandering Albatross	1 400	6 000	3 114	1 694
Grey-headed Albatross	82	300	4 406	1 756
Yellow-nosed Albatross	—	4 000	—	—
Sooty Albatross	—	2 000	2 253	480
Light-mantled Sooty Albatross	—	100	92	—
Northern Giant Petrel	—	500	130	28
Southern Giant Petrel	—	1 500	1 169	205
<i>Pelecaniformes</i>				
King Shag	400	—	647	119
<i>Charadriiformes</i>				
Skua	—	4 000	2 005	511
Kelp Gull	100	500	923	343
Lesser Shearwater	—	—	3 157	1 174

a census of these populations was attempted. Complete counts were obtained for the large and conspicuous Wandering and Grey-headed albatrosses but all other species were counted only along the western, northern and eastern coasts, or approximately 75 per cent of the island's coastline. The uncensused areas were the two inaccessible cliff areas of Triegaardt and Crawford Bay. In Table 1 the counts are presented and compared with previous data. No ground counts were made of the large King and Macaroni penguin colonies, since these had been photographed from the air during January.

In order to assess seasonal population fluctuations and to check the reliability of the main census, counts were repeated regularly through a complete year at areas close to the base. These local censuses showed that the main census was reliable for the Wandering Albatross, the King Shag and the Kelp Gull. For four species, Northern Giant Petrel, Sooty and Light-mantled Sooty albatrosses, and Gentoo Penguin, these regular counts revealed a higher number of breeding adults than recorded in the main census.

Prince Edward Island, 19 km north-west of Marion, was visited for only one brief period of unfavourable weather early in May 1974. Counts of birds were made along the entire eastern and north-eastern coasts (Table 1). The lack of beaches and the exposed nature of the rest of the island, compared with the area surveyed, suggest that the census accounted for over 50 per cent of the island's population of surface-nesting birds.

Data on egg-laying, eggs, incubation, parental care and development of young were obtained for 11 species. Water, fat, protein, mineral composition and calorific values are being determined for eggs, chicks at selected stages of growth, and adult birds. Food and guano samples were obtained from the chicks and adults of selected species. These samples will be analysed for energy and mineral contents. Nest and egg temperatures of Gentoo and Rockhopper penguins, Sooty Albatross, Southern Giant Petrel and Kelp Gull were monitored at different stages of incubation. The data for the Kelp Gull will be compared with those obtained for the same species in South Africa in order to compare the energy budget for populations in two very different environments.

Penguins renew their feathers on land and spend some 25 days fasting whilst moulting. Their energy requirements during the fast are met largely from stored body fat. Moulting Rockhopper and Macaroni penguins were kept in cages and weighed daily. At selected stages during the moult, guano samples were collected and individuals were killed for water, fat, protein and mineral and calorific analyses. Feathers and carcasses of 12 petrel species have been analysed similarly. These petrels form major items in the diets of the skuas and feral cats on Marion Island.

Conclusion

The 13 species studied show a diversity of ecological relationships (Table 2). The information and the materials gathered during the initial field expedition provide the foundation for a quantitative evaluation of these ecological relationships, and the roles of the birds in the major energy and nutrient webs within the ecosystem on Marion Island. Quantitative information on

Table 2
Ecological diversity of selected bird species breeding on Marion Island. Winter-breeding species are those whose egg laying or chick rearing occupies winter months (May-August inclusive). X: major; x minor.

	Foraging			Food							Breeding					
	Sea surface	Sea diving	Land and sea	Birds and eggs	Carriion	Fish	Cephalopods	Crustacea	Inter tidal organisms	Land organisms	Winter	Summer	Synchro nized	Unsynchro nized	Colonial	Solitary
King Penguin		X				X	X				X			X		
Gentoo Penguin		X				X	x	x			X		X	X		
Macaroni Penguin		X					x	X						X		
Rockhopper Penguin		X					x	X						X		
Wandering Albatross						X	X	X						X		X
Sooty Albatross							X	x						X		X
Light-mantled Sooty Albatross							X	x						X		X
Northern Giant Petrel			X			X	X							X		
Southern Giant Petrel			X			X	X							X		
King Shag		X				X		x						X		X
Skua			X													X
Kelp Gull			X						X							X
Lesser Shearbill			X						X							X

temporal and spatial changes in avian biomass and standing crops will be available, and also assessments of minerals contributed by way of guano, dead birds and eggs. Field work for this part of the ornithological research programme will be completed at the end of 1977. Thereafter, similar work will be undertaken for the nocturnal burrowing petrels, which feature importantly in the ecosystem on Marion Island.

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Bird ringing on Marion Island

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This paper summarizes bird ringing operations on Marion and Prince Edward islands between 1951 and 1975. During this period 2 535 birds of 19 species were ringed (Table 1). Ringing performed by seven individuals or groups of ringers is recorded in Table 2.

Thirty-four birds — 32 Wandering Albatrosses and two Southern Giant Petrels — were recovered or controlled (i.e. released alive) one year or more after ringing. One Wandering Albatross ringed as a chick was found breeding 20 years later.

Only 10 birds ringed on Marion Island have been recovered elsewhere (Table 3). Thirteen birds with foreign rings have been recovered on Marion and Prince Edward: five Wandering Albatrosses ringed off Australia, and four ringed on the Crozet islands, and

four King Penguins also ringed on the Crozets (Table 4).

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