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Recent trends in sub-Antarctic ornithology

by John Warham

In this review the sub-Antarctic is considered to be the region of the Southern Ocean between the sub-Tropical and Antarctic Convergences (Figure 1). Various island groups within this zone provide important breeding sites for large numbers of seabirds. Smaller numbers of landbirds are also resident, some of endemic status.

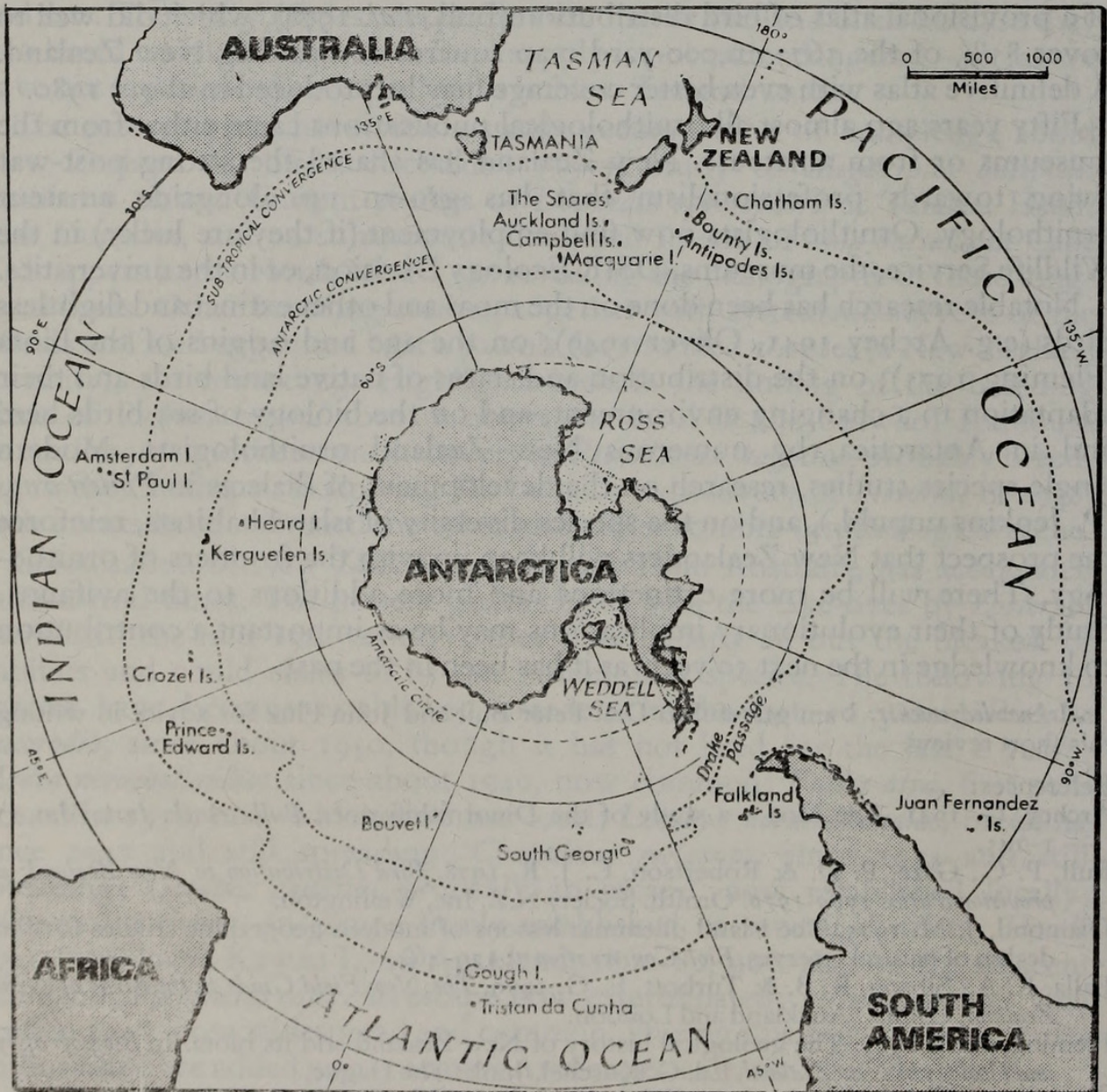


Fig. 1. The Southern Ocean showing mean positions of Sub-Tropical and Antarctic Convergences.

Up to World War II, sub-Antarctic ornithologists were mainly concerned with the numbers and distribution of species and with the collection of specimens. These activities have continued up to the present time and we are still counting, mapping, preparing inventories and unravelling the main strands of life histories. Little experimental work has been attempted, less indeed than in the Antarctic, for, paradoxically, the latter region is more accessible than are most islands of the sub-Antarctic zone. Much of the work on birds has been directly or indirectly supported by interested governments and this seems likely to continue following declarations of exclusive economic zones (E.E.Z.). New Zealand, for example, has declared an E.E.Z. embracing all her southern islands – the fifth largest zone in the world.

The birds of these southern islands have evolved in the absence of placental mammals and are very vulnerable to alien introductions. Only recently have efforts been made to collect firm data on these effects. At Kerguelen, Lesel & Derenne (1975) and at Macquarie Island, Jones (1977) examined cat predation and Challies (1975) at Auckland Island that of feral pigs. From analyses of stomachs and faeces Jones estimated that Macquarie's 375 cats eat 47,000 of the prion *Pachyptila desolata* and 11,000 White-headed Petrels *Pterodroma lessoni* annually.

The French have made a major contribution to sub-Antarctic ornithology. They have continued the descriptive work but have also done some physiological and experimental studies such as those on thermo-regulation in penguins. Mougin (1972, 1974), for instance, found that while deep body temperatures are very constant, foot and flipper temperatures vary in accordance with their role as heat radiators, and that fairly high internal temperatures (39.1°C) are powered by burning fat reserves which, in the King Penguin *Aptenodytes patagonica* involves a loss of 1.7% of body weight per day, and an even greater loss in smaller species.

French studies of seabirds are notable for the emphasis placed on macro- and micro-climates of colony- and nest-sites. Many population estimates and distribution maps have been produced, not only for colonial species but for territorial ones like Southern Skuas *Catharacta skua lonnbergi*. Nesting success has been determined by recording losses at various stages of the breeding cycles and data collected on the attainment of homeothermy by chicks. Some syntheses have also been presented, notably on the ecology of the Procelariidae by Mougin (1975) and by Barrat & Mougin (1974) on the zoogeography of Southern Ocean seabirds. Little has been done on behaviour but Jouventin (1978) examined the comparative ethology of penguins, his work complementing that of Warham (1975) and of Smith (1974), who made an ethological analysis of the Royal Penguin *Eudyptes chrysolophus schlegeli*.

The large Kerguelen Archipelago has been inhabited since 1950, but reports on the birds have been few since the early accounts of Milon & Jouanin (1953) and the very comprehensive study of Paulian (1953), then the most detailed for any sub-Antarctic island. These have been brought up to date by Derenne *et al.* (1974). Perhaps their most interesting finding is the inter-breeding of the Kerguelen Shag *Phalacrocorax verrucosus* and the King Shag *P. albiventer*, indicating that these should be regarded as conspecifics.

In warmer seas the avifaunas of the islands of St. Paul and New Amsterdam were virtually unknown until Segonzac's paper (1972). He found small numbers of Yellow-nosed Mollymawks *Diomedea chlororhynchos* breeding on

St. Paul whereas the Amsterdam Island's 15,000 pairs is evidently the largest known of this species. Segonzac also confirmed the nesting at St. Paul of the Fleshly-footed Shearwater *Puffinus carneipes*, whose timetable appears to be similar to that of the Western Australian population.

In recent years the main thrust of the French sub-Antarctic research in our field has been in the Crozet Archipelago. The birds of Ile des Cochons, Ile de l'Est and Ile de la Possession have been described. Some smaller islands have still to be examined. This group is very important for seabirds, supporting populations of Rockhopper and Macaroni Penguins *E. chrysocome* and *E. c. chrysolophus* of around 940,000 pairs (Derenne *et al.* 1976). Albatrosses also flourish there with some 7000 *Diomedea exulans* breeding on Ile des Cochons alone (Mougin 1970a). Among other petrels there are large populations of prions *Pachyptila* spp. and other burrowers. Sheathbills *Chionis major* also occur, as do also small numbers of the relict duck *Anas eatoni*.

Mougin's (1970b) work on the sibling sooty albatrosses *Phoebastria fusca* and *P. palpebrata* which nest sympatrically on Possession Island, established that they occupied distinct colonies without inter-breeding and with *fusca* laying about 14 days earlier than *palpebrata*. He also undertook an ecological study of the Kerguelen Petrel *Pterodroma brevirostris* which threw light on what had been one of the world's least known seabirds (Mougin 1969). Data on the Crozet Island King Penguins add to Stonehouse's earlier long-term study at South Georgia. Barrat (1976) found that the Crozet Island chicks have the same winter decline in weight but that successful pairs may possibly breed every 2 years instead of every 3 as at South Georgia. Southern Skua studies by Barre (1976) provide new data on measurements and breeding ecology of this familiar but rather neglected bird. Derenne *et al.* (1976) also mapped the King Shag colonies around all 3 of the larger islands. Their paper gives new data on body weights and other measurements, on the climatic conditions at the colony sites and on the annual cycles.

The British effort in Southern Ocean ornithology has been concentrated mainly at Signy Island and South Georgia, both in the Antarctic Zone and hence beyond the scope of this review. Further north, at Gough Island and Tristan da Cunha rather little research has appeared since the base-line papers of Elliott (1957) and of Swales (1965). The interesting endemics – flightless moorhen, rail and the finches – have evidently not been studied in detail in the field although *Gallinula nesiotis* has been widely bred in captivity. The giant petrels of Gough Island are not numerous. They are presumably *M. balli* but good descriptions of their plumage and soft parts are badly needed. The same is true of those from the Falkland Islands.

The Falkland's birds include some endemics, e.g. the Flightless Steamer Duck *Tachyeres brachypterus*, and many endemic sub-species, but little detailed work has been published since Cawkell & Hamilton's annotated list (1961). Much ringing of Black-browed Mollymawks *D. melanophrys* has been done in this group and many recoveries made. The handbook by Woods (1975) provides a useful summary of present knowledge. Some changes have been recorded, e.g. the establishment of Sooty and Greater Shearwaters *Puffinus griseus* and *P. gravis* and Macaroni Penguins as breeders. The fate of these latter krill-eaters will be interesting following the decline in whale stocks and the development of a krill-harvesting industry. From the one brief description,

the 400-acre Beauchene Island, well to the south of the main group, appears to be a major seabird sanctuary (Strange 1965).

Macquarie Island, politically part of Tasmania, has been occupied continually since 1948. Initially bird studies mostly involved the ringing of albatrosses and giant petrels. More detailed work started in the 1960's, including the major long-term study of a sub-Antarctic bird, the Royal Penguin, 19,097 of which were flipper-banded. Carrick (1972) followed the life histories of individual birds and found, *inter alia*, that the minimum weight of a newly arrived male had to be 4.6 kg for it to hold a nest, while for a female to lay she had to scale 4.8 kg on arrival, the weight of the fledgling being significantly related to that of its female parent on landing. Carrick placed great emphasis on social status as a factor in the regulation of the population.

Other birds investigated at this island include the White-headed Petrel and the giant petrels (Warham 1967, 1962). The discovery that *Macronectes* consists of 2 sibling species, *giganteus* of the maritime Antarctic and *balli* of the sub-Antarctic, arose from the latter work. Both species breed in different places at different times at Macquarie Island (Bourne & Warham 1966). Subsequent Australian, French and South African investigations have confirmed these findings and at Crozet (Voisin 1976) and Marion Island (Zinderen Bakker 1971a) and even at South Georgia both also breed sympatrically. A long-term study of the biennial breeding albatross *Phoebastria palpebrata* by E. Kerry is in preparation. Other specialised papers include Shaughnessy's (1975, 1970) work on the phenotypes of the Royal Penguin and of the genetics of the Southern Giant Petrel, but no up-to-date account of the Macquarie Island birds as a whole has appeared and in recent years ornithological research there has been reduced.

New Zealand has care of many sub-Antarctic islands but only the Chathams are inhabited. Most post-war research arose from privately-financed and university expeditions such as the Denver Museum's to Campbell Island (Bailey & Sorensen 1962) and a series organised from the University of Canterbury to the Snares (1961-1977) and to Antipodes Island in 1969. Recently government departments have organised comprehensive summer-time visits to the Auckland Islands (1972-73) and to the Bounties and Antipodes Island (1978) with many to the Chatham Islands. A notable effort has been D. Crockett's privately-financed searches for the Chatham Island Taiko, probably *Pterodroma magentae*. He rediscovered the bird in 1978 and more specimens were seen and handled, without nests being discovered, in 1979.

From the Snares Islands data on nest site and mate tenacity in Buller's Mollymawk *D. bulleri* have been presented by Richard & Warham (1973). Some of the birds have bred for at least 29 years. General studies of seabirds on the Snares include work on the Mottled Petrel *Pterodroma inexpectata* (Warham *et al.* 1977), on the Cape Petrel *Daption capense* (Sagar 1979) and on the Antarctic Tern *Sterna vittata* (Sagar 1978). The breeding biology of the Snares Penguin *Eudyptes robustus* was studied over several years by Warham (1974) and, together with similar work on other eudyptids, *E. c. schlegeli*, *E. chrysocome* and *E. sclateri* elsewhere in the sub-Antarctic (Warham 1971, 1963, 1972b), provide a useful basis for further work. The most widespread of these crested penguins, the Rockhopper, breeds between 36° and 53°S and the

laying dates correlate well with annual sea temperature, those at Tristan da Cunha and Gough Island (15°C) laying about 10 weeks earlier than those at Kerguelen (2.5°C) (Warham 1972a). Warham (1975) has also summarised the Crested Penguin work and described some vocalisations.

A major discovery of the 1972-73 Auckland Islands Expedition was an estimated 7000 pairs of Wandering Albatrosses breeding there annually, making this the major breeding concentration with some 37% of the world population (Robertson 1975). These birds are also abundant at Antipodes Island with perhaps 900 breeding pairs each year (Warham & Bell, 1979), but these and the few at Campbell Island have much darker breeding plumage than those elsewhere. These, and the Auckland Island birds are also smaller than those of high-latitudes, but the Auckland Wanderers are not dark plumaged, so that even within the New Zealand region there appear to be several distinct populations.

Research from this part of the sub-Antarctic includes some specialised studies like that of Imber & Russ (1975) on the foods of albatrosses based on the identifications of squid beaks and the comparative ecological work of Taylor (1975 and in prep.) on the parrots *Cyanorhamphus unicolor* and *C. novaeseelandiae* breeding at Antipodes Island where both appear to thrive despite the very restricted resources of a mere 2000 ha. Other recent work has been on the Auckland Island Teal *Anas aucklandica* (Weller 1975) who has also written (1972) accounts of some wildfowl from the Falklands.

A major finding of the South Africans in the sub-Antarctic was the existence of a substantial number of Yellow-nosed Mollymawks at Prince Edward Island (Zinderen Bakker 1971b). Among other published work from Marion and Prince Edward Islands is a study of the body composition and energy metabolism of moulting crested penguins by Williams *et al.* (1977) and a survey of behaviour in the Gentoo Penguin *Pygoscelis papua* (Zinderen Bakker 1971c).

Continuing programmes will no doubt increase the accuracy of species lists and throw up surprises like the Soft-plumaged Petrels *Pterodroma mollis* at Antipodes Island (Warham & Bell 1979) and the discovery of breeding South Georgian Diving Petrels *Pelecanoides georgicus* on Codfish Island near Stewart Island (Imber, pers. comm.). The prognosis for further research in the sub-Antarctic seems good, partly because of the need to police economic zones, so that more transport may be available. Hopefully there will be attempts to find out more about seabirds at sea, for although many transects have been published, these are difficult to evaluate and standardisation of methods seems essential. Recent examples are those of Johnstone (1974) and Johnstone & Kerry (1976) whose findings included that the 2 sibling giant petrels do tend to segregate in summer as predicted by Bourne & Warham (1966), *giganteus* being commonest south of the Antarctic Convergence, *halli* to the north, but non-breeders of both species shift north in the winter.

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The present status of Antarctic ornithology

by E. C. Young

INTRODUCTION

The three essential features of the antarctic continent critical to an understanding of antarctic ornithology are its position almost exactly centred on the South Pole, with most of its land mass below latitude 70°S; its permanent cover of ice and snow with much of its periphery at sea level girdled with glaciers or fast ice; and its great isolation from other substantial land masses across notoriously desolate ocean spaces, enhanced by the circumpolar air and water circulation patterns.

Climate similarity and biogeographical links suggest that the most useful regional area for a review of Antarctica is one extending out to about the Antarctic Convergence. The Antarctic Convergence, however, falls within the circle of westerly wind patterns and related water flow, countered in a narrow band around the continent by an easterly flow. The climate of the westerly wind zones is characterized by high, steady winds, high precipitation and predominantly cloudy weather. The weather in the easterly wind zone is generally better; drier with fewer cloudy days and lighter winds,



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