

Biogeography of Cook Strait Seabirds

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Murphy's pioneer studies of Southern Ocean seabirds led to the idea of circumpolar zonal distribution patterns correlated with the surface water masses. Thus many pelagic seabirds are completely or partially circumpolar in distribution, with northern and southern limits coinciding with, or at least paralleling in a rough way the oceanographic zones. The radial subdivisions of Southern Hemisphere land and sea have been more important than the concentric zones in controlling the distribution of some groups of birds, but even these have zonal limits within their own sectors.

New Zealand straddles the boundary between subtropical and subantarctic zones of surface water, the coasts of Auckland being subtropical and those of Otago/Southland subantarctic. Intermediate areas, including Cook Strait, fall in a convergence belt, where conditions may fluctuate markedly and show effects of both subantarctic and subtropical influence, emphasized by longitudinal currents, and where mixing of different water masses may blur the distinctness of the convergence.

During the breeding season seabird distribution is generally more critically defined than at other times and breeding stations are therefore used to define distribution areas. As, however, seabird breeding places are restricted by the availability of islands, we must expect long-ranging birds to nest on some islands outside their normal (zonal) feeding range. Geological evidence shows that climatic and oceanographic zones have shifted with changing climate. Interpreting recent distributions, we can either assume that the birds moved with the shifting zones, remaining "in phase" with their environment, or that they became stranded, adapting themselves to new conditions in "relict" distribution areas. Probably both assumptions are valid in different cases.

The subtropical waters of Auckland support several stenozoneal petrels of subtropical affinity (such as Buller's Shearwater and

the Blackwinged Petrel) and stenozoneal subantarctic forms dominate the breeding seabirds south of Canterbury and Westland (Royal Albatross, Buller's Mollymawk, *Eudyptes* penguins, Broad-billed Prion, etc.). The middle zone, convergence belt, or belt of mixed waters, supports a scantier fauna, chiefly of birds that are not strictly limited to zones (euryzoneal). The breeding pelagic seabirds of Cook Strait are all in this category.

Blue Penguin: Australasian only, chiefly in subtropical water with southern limits at Stewart Island. Subantarctic in origin, this penguin was perhaps stranded in subtropical water at a fairly remote date, and its range subsequently divided by a later northward movement of subantarctic water, so that it straddles the convergence zone and has formed subspecies on either side of it.

Fiordland Crested Penguin: A convergence-subantarctic zonal form which has rarely attempted to nest in Cook Strait.

Diving Petrel: Circumpolar, chiefly subantarctic, but ranging north to Auckland, perhaps as a relic of former subantarctic conditions there.

Whitefaced Storm Petrel: Almost cosmopolitan, with no narrow zonal affiliations; history therefore uncertain.

Fairy Prion: Subantarctic origin, now ranging into subtropical water, like the Diving Petrel, and thus perhaps with similar history.

Black Petrel (perhaps locally extinct): Endemic to New Zealand; range Auckland to Stewart Island; affinities with subantarctic zonal species. Probably a subantarctic form originally left as a relic in subtropical seas.

Mottled Petrel (perhaps locally extinct): Endemic to New Zealand; range from Auckland to Auckland Islands; affinities with an almost cosmopolitan group without zonal affiliation, cf. Whitefaced Storm Petrel.

Sooty Shearwater: Breeding Range N.S.W. to Macquarrie Island and Chile to Falkland

Islands; dominantly subantarctic with small (perhaps relict) subtropical populations.

Fluttering Shearwater: Range N. Auckland to Cook Strait; now classed as member of almost cosmopolitan species group.

Spotted Shag: Range N. Auckland to Otago; subspecies Stewart and Chatham Islands; related species in Chile; thus weakly zonal near subtropical convergence.

Marlborough King Shag: Northernmost race of a subantarctic New Zealand species, in a group which is circumpolar and strongly zonal in subantarctic seas; Cook Strait population probably relict.

Red-billed Gull: Race of wide-ranging African-Australasian species, northern in remote origin, spanning subtropical and subantarctic zones.

Black-backed Gull: Northern in remote origin, now circumpolar and subantarctic, but entering subtropical zone; not typically pelagic in ecology.

White-fronted tern: Endemic to New Zealand (migrating to Australia), ranging from Auckland to Auckland Islands. Affinities and origin not clear.

In summary, of 13 breeding seabirds in Cook Strait, seven (Blue Penguin, Diving Petrel, Black Petrel, Sooty Shearwater, Marlborough Shag and Black-backed Gull) seem clearly derived from subantarctic stock at some time in the past, two (Spotted Shag, Red-billed Gull) are weakly zonal but of uncertain derivation and four (Storm Petrel, Mottled Petrel, Fluttering Shearwater, White-fronted tern) belong to more or less cosmopolitan groups, lacking obvious zonal affiliations. All 13 species range north into

subtropical breeding waters. No Cook Strait species shows strong subtropical affinities, and the aberrant attempt of Fiordland crested Penguins to nest at Palliser Bay underlines the dominance of subantarctic influences.

In an analysis of the bird fauna present in Cook Strait at any one time, the presence of migrants and seasonal wanderers has also some slight significance, e.g., one of the subantarctic penguins, the Erect-crested (*Eudyptes slateri*) with a breeding range south of the convergence, is found in winter frequenting surface water to the south-east of Cook Strait and normally 60-70 miles off shore. However, in some years substantial numbers are reported in western Cook Strait, usually in August. Circumpolar wanderers of such species as the Giant Petrel (*Macronectes*) regularly congregate in the Straits area, although it may be assumed that the length of their stay is determined rather by adventitious food supply at whaling stations, on fishing grounds and in harbours rather than any attraction of free pelagic food supply. Most of the Southern Hemisphere smaller albatrosses or mollymawks have been recorded at one time or another from the Cape Palliser area. Some mention might also be made of the ready availability of food supply in current rips such as occur off Cape Jackson, Cape Terawhiti and elsewhere. Such a concentration of food in disturbed water is an invariable attraction to oceanic birds, resulting in spectacular congregations which undoubtedly draw in nomads and wanderers, and perhaps help to determine a regular pattern of seasonal movement. Birds listed in the above categories are again, in the main, of subantarctic origin.

Discussion

Commenting on the significance of the papers read during the morning PROF. L. R. RICHARDSON said that 15 years ago there was very little information available in regard to Cook Strait of the kind with which the meeting had been presented. It could be seen from the information contained in the papers that knowledge was rapidly advancing, and that the Cook Strait area would

in future become one of the most "researched" in the world. He asked on how many stations the present knowledge of the geology and physical oceanography of the Strait was based.

MR. GARNER said there had been no specific investigation into the physical oceanography of the Strait. It was an area of intermixing of a large number of different