Former Faunal Areas: Some Sub-Fossil Evidence

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Any discussion of former faunal areas based on the distribution of fossil or sub-fossil bones is complicated when those bones are of various geological ages. Nevertheless, study of the regions in which the genera and species of moa are found makes possible some tentative conclusions.

The evidence is unevenly distributed because some areas—the best sources are caves, swamps and sandhills—are better suited to the preservation of bones, or have been better explored. The South Island *Megalapteryx didinus* (Owen) ranged down the west coast to Inangahua Junction, from Takaka to coastal Marlborough, down the East Coast to Southland and the Te Anau-Lake Wakatipu area. *Megalapteryx benhami* Archey is known only from the Nelson area.

Anomalopteryx didiformis (Owen) has virtually the same South Island distribution as *Megalapteryx*, but not as far west in Otago and Southland. In the North Island it is not uncommon in Wellington district, ranging up the east coast to Gisborne, is found at Coromandel Peninsula, Whangarei, up the west coast, and in southern Auckland. The smaller *Anomalopteryx oweni* (von Haast) is most common in North Auckland, but is known from Te Aute swamp (Hawkes Bay), Martinborough (Wellington) and around Wanganui. As *Euryapteryx* and *Zelornis* can only be separated if the skull is present, possibly some *Euryapteryx gravis* (Owen) records may be of *Zelornis haasti* (Rothschild), and some *Euryapteryx tane* Oliver may be of *Zelornis exilis* (Hutton).

In the South Island, *Euryapteryx gravis* predominates, from Takaka to Marlborough, down the eastern side of the Alps to Stewart Island, and westward to L. Wakatipu, and in the North Island, up the east coast to L. Waikaremoana. Bones from Papatowai, Southland, formerly classified as the North Is. *E. geranoides* (Owen) belong to an undescribed small *Euryapteryx* which I collected on Stewart Island in Nov. 1954. *Zelornis haasti* is known from Takaka, Canterbury, Otago and Southland.

In the North Island, four closely related small species, *Zelornis exilis*, *Euryapteryx curtus* (Owen), *E. tane*, and *E. geranoides* are recognised. The first three range from N. Auckland to Wanganui and Napier, and *geranoides* from Tom Bowling Bay, N. Auckland, to Takaka.

Emeus crassus (Owen) and *Emeus huttoni* (Owen) are known from Marlborough, and are common in Canterbury and Otago. *Pachyornis elephantopus* Owen ranged from Takaka to Marlborough and from Canterbury to Southland. *P. murihiku* Oliver was found near Invercargill, and *P. australis* Oliver in Southland and Nelson. The North Island *P. septentrionalis* Oliver ranges from Doubtless Bay (scarce) down the east coast to Conoor and Martinborough, and the west coast to Wanganui. *P. mappini* Archey is found in N. and S. Auckland, Coromandel Peninsula, Gisborne, New Plymouth, and the east and west coasts of Wellington.

Dinornis maximus von Haast is common in Canterbury, Otago and Southland. *D. robustus* Owen is found from Takaka to Marlborough, down the east coast to Southland, over to L. Wakatipu, and Jackson's Bay, west coast. *D. torosus* Hutton had a similar distribution to *robustus* and reached Rahu, west coast.

The North Island *D. giganteus* Owen is uncommon, found mainly from Poverty Bay southwards on the east coast, and from Wanganui southwards on the west, being most plentiful in the Wellington district. The Doubtless Bay records may be of *D. hercules* Oliver, also mainly found in southern North Island. *D. ingens* Owen, found throughout the North Is., is more common

in the southern part. South Island legbone records refer to *robustus*.

It now remains to discuss the significance of this distribution. Fleming's map (1949) of his interpretation of the paleogeography of New Zealand during the early Whanganui Period, shows a small strait flooding the Manakau lowlands, near Auckland, and a much larger Manawatu Strait running roughly along a line below New Plymouth to below Gisborne, and Cook Strait closed on the eastern side.

Moa origins are unknown. It is possible that the *Dinornis* group had a different ancestry from the other six genera. Probably before the Waitotaran stage *Dinornis* had diversified into three size groups, and during the existence of the Manawatu Strait the *maximus-giganteus* and *hercules, robustus-ingens, torosus-novaezelandiae* pairs developed.

Original *Euryapteryx* stock was probably small, but *E. gravis* and *Zelornis haasti* became dominant in the South Is., leaving marginal small forms in the south (Stewart Is. was then joined to the mainland) and in the North Is. *E. gravis* spread over the Cook Strait land bridge up the east of the North Is. Volcanic ash showers obscure the evidence in the central North Island, but *Zelornis exilis, Euryapteryx cortus* and *E. tane* came from north of the Manakau Strait, spreading southwards when it closed. *E. geranoides* probably originated as a species between the Manakau and Manawatu Straits, later spreading north and south.

Emeus, closely related to *Euryapteryx,* is confined to eastern South Island, and *Pachyornis elephantopus* to that area and Nelson-Takaka. *P. mappini* and *P. septentrionalis* originated either in North Auckland or mid-North Island. *Anomalopteryx didiformis* originated south of the Manakau Strait, (fragmentary *A. antiquus* Hutton from Timaru is very close to it). *A. oweni* became distinct north of Manakau Strait.

Thus the three main moa faunal areas (see map) are (A) North of Manakau Strait. (B) Central North Island. (C) South Island, mainly east of the Alps, from Takaka to Stewart Is., and, for *E. gravis,* Eastern North Island. The distribution of *D. maximus* is shown by the dotted line.

REFERENCE

FLEMING C. A., 1949: *Tuatara* 2(2): 72-90.

Discussion

THE CHAIRMAN opening the discussion said the problem was to try to establish some community of pattern in the various ecological and biological factors present in the areas propounded as natural and see to what extent it was possible to make broad delineations of these areas Various points had emerged from the papers: the apparent significance of the 38th parallel; the effect of Cook Strait, which is a barrier to certain reptiles and some of the birds, but not to worms.

MR. DELL, answering a question on the discontinuous distribution of snails, said that some could be partly explained on the geological evidence but the geologists' plans of the post-pliocene area in New Zealand were rather indefinite. If Wellman's theory of glaciation in New Zealand was accurate one had to envisage everything being pushed up from south to north by advancing ice, and subsequently the whole area being re-colonised and the forest advancing as the ice face disappeared and moved south; it was possible that some species found the only suitable conditions in the regenerating forest following on the disappearing ice sheet; certain of them perhaps stayed behind and adapted themselves and others carried on, following the retreating ice. For a long time it was believed that glaciation was the key to the distribution of *Paryphanta,* but if the geologists were right and the South Island was fairly devoid of this type of life it was a hard situation to envisage.

MR. SCARLETT said the survival of certain groups of opilionids in Fiordland suggested that high country there was not as severely glaciated as some geologists thought.

MISS L. B. MOORE commented that the effects of glaciation might have been over-emphasised and mentioned that earthworms

KEYS TO CLIMATE AND SOIL MAPS

MAIN CLIMATIC DISTRICTS

(See map)

A. Very warm humid summers, mild winters. Annual rainfall 45-60 inches with maximum in winter. Prevailing wind south-westerly but occasional strong gales and heavy rain from east or northeast from Auckland northwards and about Coromandel Peninsula.

A_2 Similar to type A but much wetter; rain-60-100 inches.

B. Sunny, rather sheltered areas which receive rains of very high intensity at times from the northeast and north. Very warm summers and mild winters. Annual rainfall 40-60 inches with maximum in winter.

C. Very warm summers, day temperatures occasionally above 90°F with dry Foehn NW wind blowing. Rainfall 40-60 inches per annum; marked decrease in amount and reliability of rain in spring and summer; moderate winter temperatures with maximum rainfall in this season.

C_0 Drier than type C—rainfall 25-35 inches. Very sunny.

C_2 Cooler and wetter hill climates. Very heavy rains at times from east or southeast; annual rainfall mainly 60-80 inches.

D. West to northwest winds prevail with relatively frequent gales. Mean annual rainfall 35-50 inches; rainfall reliable and evenly distributed through the year. Warm summers, mild winters.

D_2 Wetter than D—rainfall 50-80 inches.

E. Mild temperatures, high rainfall increasing rapidly inland with height, minimum rainfall in winter especially in the south. Prevailing winds SW but gales not frequent at low levels in spite of exposed coastline.

F. Low rainfall, 23-30 inches; in the south slightly more in summer than in other seasons. Warm summers with occasional hot Foehn northwesterlies giving temperatures above 90°F, cool winters with frequent frosts and occasional light snowfalls. Prevailing winds NE near the coast, NW inland.

F_2 Cooler and wetter hill climates. Rainfall 30-60 inches. NW winds prevail with occasional very strong gales specially along river courses. Snow may lie for several weeks in winter..

F_0 Semi-arid areas, rainfall 13-20 inches. Very warm, dry summers; cold winters.

G. Warm summers, cool winters. Rainfall 25-35 inches, evenly distributed except for slight falling off in winter.

G_2 Wetter and slightly cooler than G climates; rainfall 35-50 inches; in coastal districts cloudy, windy conditions and frequent showers.

M. High rainfall, mountain climate.

"NATURAL AREAS" OF NEW ZEALAND SOILS.

(Boundaries generalized from Soil Map of N.Z. 1948.)

SOILS IN WHICH THE ENVIRONMENT IS FULLY EXPRESSED:

1. Soils of the cool semi-arid zone, developed under tussock grasses.
2. Soils of the mild sub-humid zone developed mainly under tussock grasses.
3. Soils of the humid zone developed mainly under forest.

SOILS IN WHICH THE ENVIRONMENT IS NOT FULLY EXPRESSED, DUE TO THE DOMINANCE OF CERTAIN FACTORS:

4. Skeletal soils on steep slopes dominated by the topography factor.
5. Recent soils from alluvium or volcanic ash, dominated by their youth—the time factor.
6. Soils from old volcanic ash, dominated by their abnormal parent material.
7. Soils from younger volcanic ash, dominated by their youth and their abnormal parental material.

Excursion

On Saturday, May 12th, there was an excursion by bus from Wellington, over the Rimutaka Range, to the southern portion of the Wairarapa district.

During the excursion stops were made at the following places:

1. Summit of Rimutaka Range: Mr. A. L. Poole and Mr. A. P. Druce pointed out features of the vegetation, which consists of scrub (manuka and some sub-alpine species) and remnants of the red beech and silver beech forest which formerly covered the area.

2. Western Lake Forest Reserve: Beech forest here comes down to the edge of Lake Wairarapa. Mr. Poole and Mr. Druce explained some features of the forest.

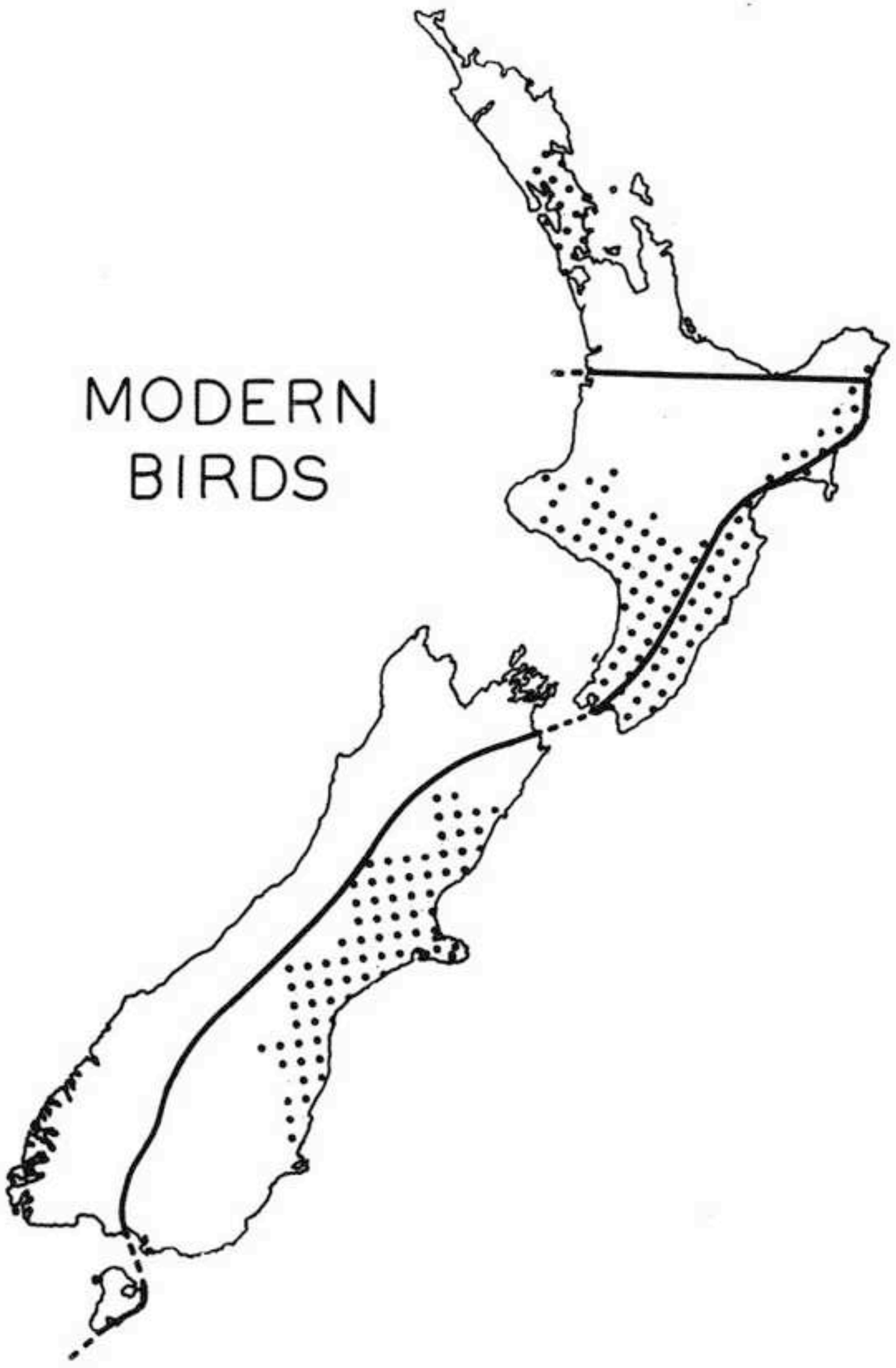
3. Lake Pounui: This is a small lake which is a bird sanctuary, and since the shooting season was in progress considerable numbers of waterfowl were seen. A stop was made at this point for lunch.

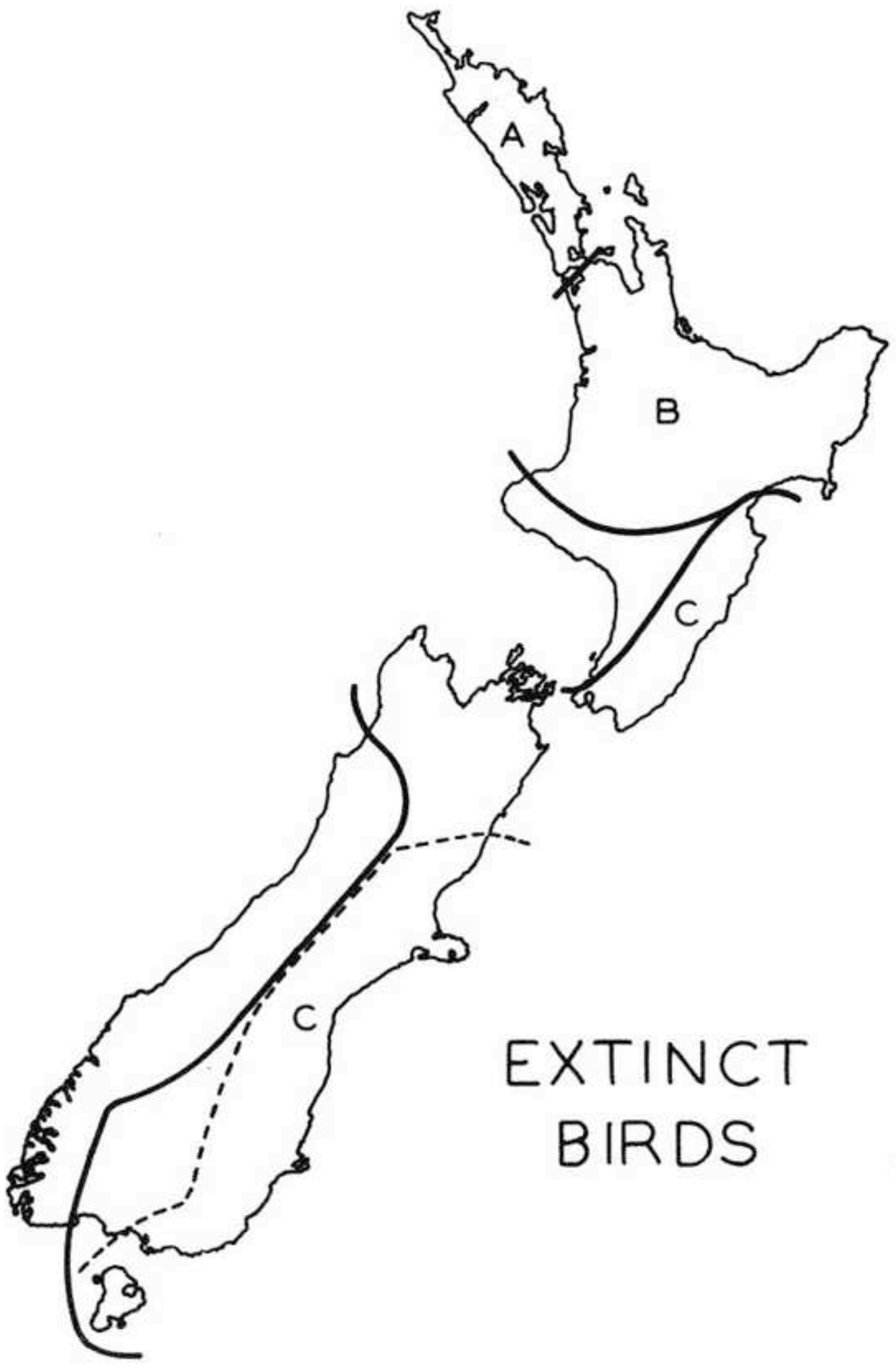
4. Top of hill above Lake Onoke: From this point an excellent view was obtained of Palliser Bay, Lake Onoke, which is separated from the sea by a long narrow shingle spit, Lake Wairarapa, and the southern portion of the Wairarapa district, bounded on the east by the Aorangi Range.

5. Lake Onoke: Most of those present walked along the narrow spit and examined contrasting conditions on the seaward and landward sides.

From Lake Onoke the bus returned to Wellington over the same route. Commentaries on points of interest near the road were given throughout the excursion by various members, using the loudspeaker system in the bus.

MODERN
BIRDS





EXTINCT
BIRDS