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NOTES ON THE VEGETATION OF THE AUCKLAND ISLANDS

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The following observations on the vegetation of the Auckland Islands, made between 26 December 1962 and 20 January 1963, are additional to or amplify those of Hooker (1847), Cockayne (1904, 1909) and Moar (1958a, b).

ALTITUDINAL DISTRIBUTION

Hooker (1847: 2) made the following important note on the vegetation in the north of Auckland I. "It is especially towards the summits of these hills that the most striking plants

are found, vying in brightness of colour with the Arctic Flora, and unrivalled in beauty by those of any other Antarctic country. Such are the species of *Gentian*, and a *Veronica* with flowers of the intensest blue, several magnificent *Compositae*, a *Ranunculus*, a *Phyllachne* and a *Liliaceous* plant whose dense spikes of golden flowers are often so abundant as to attract the eye from a considerable distance."

Cockayne (1904) accepted this statement but in 1909 wrote as follows: "Although there is a well-marked zonal distribution of the vegetation, the majority of the species may occur at any altitude, from sea-level to the highest summits." And he italicised the following: "*It is the formations—i.e. the distinct physiognomic combinations—which mark the zones, and not the occurrence of special species for the first time.*" He mentions four exceptions to this statement, namely *Grammitis pumila*, *Plantago aucklandica* and *Marsippospermum gracilis* at higher altitudes, and *Ranunculus aucklandicus* near the shore. My observations confirm those of Hooker as the following field notes show.

> "28.12.62. We went from Ranui Cove via Meg's Hill as far as the base of Mount Eden. During this time we did not see *Bulbinella rossii*, *Celmisia vernicosa* or any *Pleurophyllum* species."
>
> "29.12.62. Suddenly, as we climbed above the scrub, we came upon many of the species that we had been seeking. We entered a New Zealand sub-antarctic species zone. Below this most of the plants had been mainland species, but now we found *Hebe benthamii*, *Celmisia vernicosa* and *Abrotanella spathulata*. However not until we reached the extensive rock outcrop which forms the summit of Mt. Eden did we at last see *Bulbinella rossii*, *Pleurophyllum hookeri*, *P. criniferum* and many other sub-antarctic endemics."

In my experience, there exists in the north of the Auckland Is. (if not throughout the whole group) a distinctive group of species characteristic of or confined to the higher altitudes, and these include many of the endemics of the New Zealand subantarctic islands.

I place at least 18 species in this category: *Abrotanella spathulata*, *Anisotome antipoda*, *Bulbinella rossii*, *Cardamine subcarnosa*, *Carpha alpina*, *Celmisia vernicosa*, *Gaimardia pallida* (a new record for the Auckland Is.), *Geum parviflorum* var. *albiflorum*, *Hebe benthamii*, *Helichrysum bellidioides*, *Marsippospermum gracilis*, *Plantago aucklandicus*, *P. hookeri*, *P. speciosum*, *Polystichum cystostegia*, *Ranunculus pinguis*, *Rostkovia magellanica*, and *Schizeilema reniforme*. (A larger list could be made of species confined to lower altitudes.)

As most visitors to the Auckland Is. do not go far from the coast these striking endemics are seldom seen and it is natural that their exceptional occurrence at a low altitude in an easily accessible position should become noted. Such a situation occurs at "Fairchild's Garden", on Adams I. at the western entrance to Carnley Harbour, described by Chapman (1891) as follows:

> "It extends from the strait at the north west end of the island along the shore to the first piece of bush, and thence up to and over the summit of the hill—in all perhaps 400 acres—one of the most wonderful natural gardens the extra-tropical world can show." This area of open ground can be clearly seen in Falla's figure 12 (1948). Presumably because of the exposed situation inimical to tree growth, the upland species have here been able to descend to sea-level.

These points are reinforced by a perusal of the list of plants collected by Moar (1958 b). Such striking endemics as *Anisotome antipoda*, *Celmisia vernicosa*, *Pleurophyllum criniferum*, *P. speciosum* and *Hebe benthamii* were not recorded from the northern coastal areas visited, and only one plant of *Bulbinella rossii* was observed. All these species were recorded however from "Adams Island", and the actual locality was Fairchild's Garden, as shown on the map given by Leamy and Blakemore (1960).

The northern slopes of Adams I. should be examined further, to see whether the situation at Fairchild's Garden is exceptional. The other striking occurrence at sea-level — that of *Bulbinella rossii* on Enderby I.—is discussed later.

LOWLAND SCRUB AND *Oreobolus* LANES

Lowland scrub quickly replaces coastal rata forest, which is usually no more than 50 yards in depth even on the valley floors at the heads of sheltered inlets. On the steep sides of the U-shaped valleys scrub is at its densest (Fig. 1) but on the long tongue of gradually rising land stretching inland from Ranui Cove towards Mt. Eden, the vegetation is a combination of two entirely different communities.

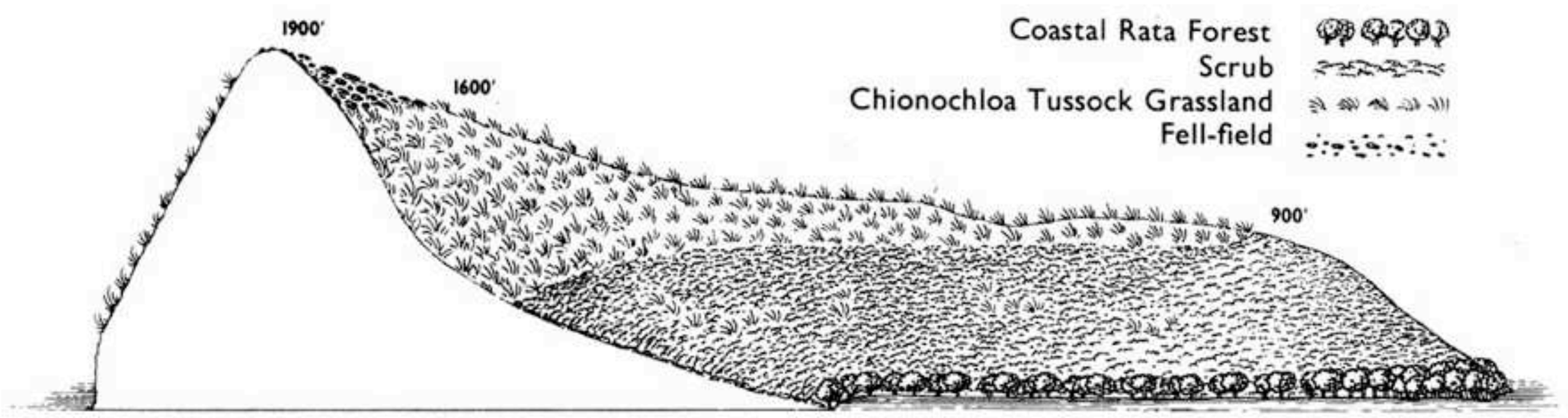

FIGURE 1. *Zonation of vegetation in the Chambres Inlet—Stony Peak sector, northern Auckland Island.*

(1) The scrub occurs in patches or in roughly parallel lines, often in an east-west direction. The predominant species are *Metrosideros umbellata*, *Dracophyllum longifolium* and *Myrsine divaricata*, while *Coprosma foetidissima*, *Cassinia vauvilliersii*, *Hebe odora* and *Neopanax simplex* are less important. In many places the pattern of the scrub has been determined by colonisation of sheltered hollows but patches of scrub also occur on convexities in the ground.

(2) Within the scrub are extensive areas of open ground in the form of lanes, covered with hard cushions of *Oreobolus pectinatus* in which grow *Cyathodes empetrifolia*, scattered gentians, orchids, and *Schizaea fistulosa*. Scattered tussocks of *Chionochloa antarctica* and stunted plants of the eight scrub species mentioned earlier also occur. Most of these species, whether in the scrub or in the *Oreobolus* lanes, are restricted to lower altitudes.

Viewed from the western high country a similar pattern of vegetation was seen to the south on both Twin Peaks and Musgraves Knob peninsulas. Cockayne (1909) described a similar situation above Carnley Harbour and suggested that the rows of woody plants result from the invasion of grassland by the tree species, and that the pattern results from mutual protection under the influence of strong prevailing winds. Du Rietz (in Oliver 1927) suggested however that the lanes were caused by local bog conditions. Future expeditions should check whether or not the trend is towards an expansion of the area under scrub.

A considerable amount of fossil wood is exposed in eroded *Chionochloa* tussock-grassland at 1450 ft. between Mt. Eden and Cloudy Peak. Stems or branches about 2 in. in diameter lie scattered about, approximately 10 in. below the present peat surface. Specimens are not yet identified.

UPLAND VEGETATION

Hitherto the only investigations at high levels have been those of Cockayne above Camp Cove, Carnley Harbour in the south. Here he described a *Pleurophyllum hookeri* association in "sopping wet through frequently stony ground." In the north, between Bivouac and Bleak Hill ($4\frac{1}{4}$ miles) the peat and its attendant grassland reaches to about 1600 ft. Above this is rock, or a brown mineral soil interspersed with rock fragments, extending to the western cliffs and the highest peaks. The following features were noted.

(a) Fell-field supporting a diversity of species is predominant, with *Pleurophyllum hookeri* one of the most prominent plants.

(b) On the summit of Bivouac, and half a mile north of Bleak Hill are flat poorly drained areas dominated by *Marsippospermum gracilis*.

(c) On the north side of Mt. Easton is a striking deep-green *Gaimardia pallida* bog.

(d) *Carpha alpina* predominates on some 15 acres of the north slope of Mt. Easton.

THE ROSS HARBOUR ISLANDS

The islands of Rose, Enderby and Ewing, lying so close together, yet with such interesting differences in vegetation, provide valuable opportunities for studying the effects of introduced animals and man on the original vegetation.

Rose Island (Fig. 2)

In my opinion the vegetation on Rose is the least modified of these islands. On the south side is scrub and rata forest, an eastern portion of which has been almost destroyed.

The greater part of the northern half of the island is *Poa litorosa* tussock-grassland with a sward grassland in the centre. Hitherto the only extensive grassland of *Poa litorosa* recorded for the Auckland Is. is on Disappointment I. (Cockayne 1909). Moar (1958 b: 471), who did not visit Rose, was told that *Bulbinella* was "abundant" there, but I could find none.

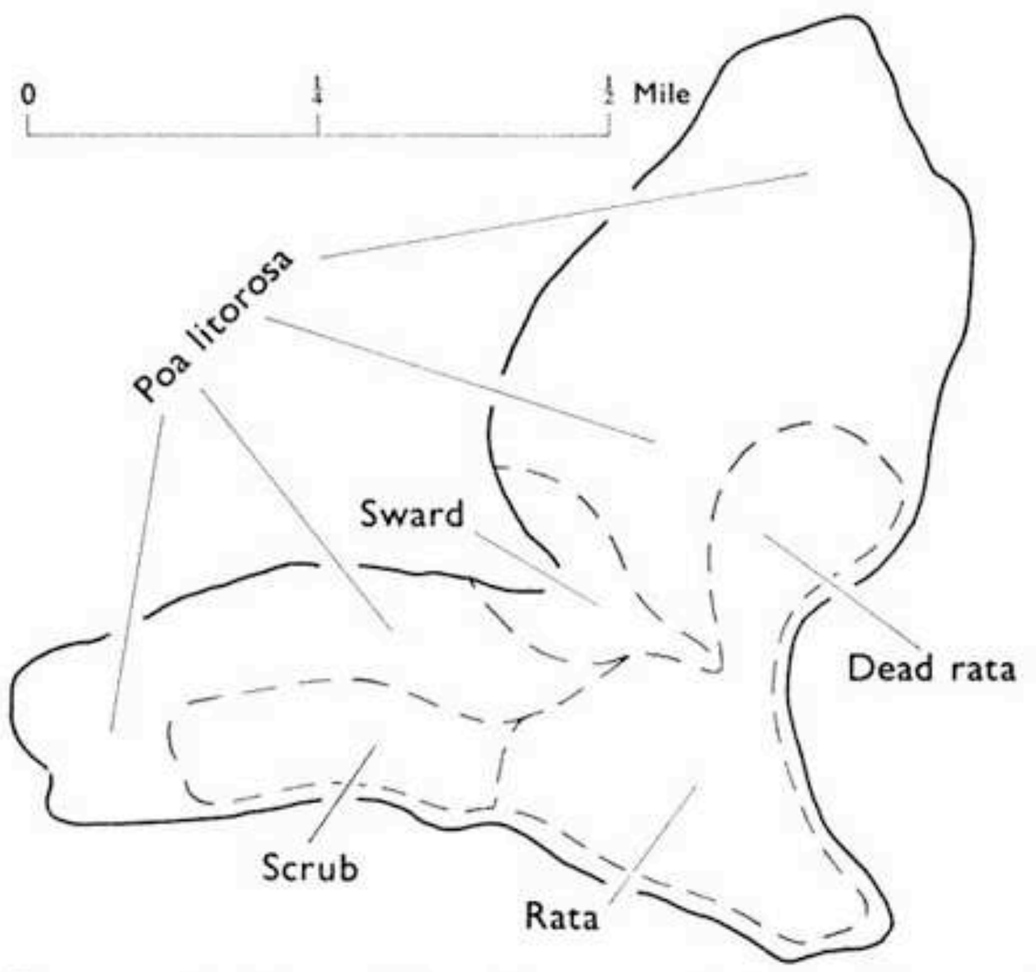

FIGURE 2. *Rose Island: general disposition of vegetation.*

Enderby Island (Fig. 3)

Cockayne (1904) has left the following useful records:

(a) "On Enderby Island there is a considerable quantity of rata forest and scrub which forms a somewhat narrow belt on the east and south sides, the whole of the west side of the island, according to Captain J. Bollons, being a tussock formation." (P. 244).

(b) "Proceeding through the forest to the north, the *Metrosideros* becomes less in quantity and more stunted, while *Cassinia vauvilliersii* makes its appearance, this shrub finally becoming dominant." (P. 244).

(c) ". . . on Enderby Island rata gives place on the windward side to *Cassinia* scrub, and this in its turn to tussock." (P. 254).

The rata belt and the *Cassinia* scrub still exist, but the remaining area is mainly covered by almost pure stands of *Bulbinella rossii* on the north and north-west or by a close-cropped sward on the very exposed western slopes, in which *Poa breviglumis* and *Agrostis magellanica* are prominent.

I suggest that the west and much of the north of Enderby I. was once under *Poa litorosa* grassland (as can still be seen on Rose I.) and that this has been modified to either a grassland sward or *Bulbinella*. The *Bulbinella* could have been derived from scattered plants along the cliff edges, and have invaded tussock, depleted by rabbits, cattle and burning. The facts that *Bulbinella* tends to die back to the ground in winter, and has numerous fleshy roots, make it less susceptible to the effects of burning than other plants, which it may gradually replace.

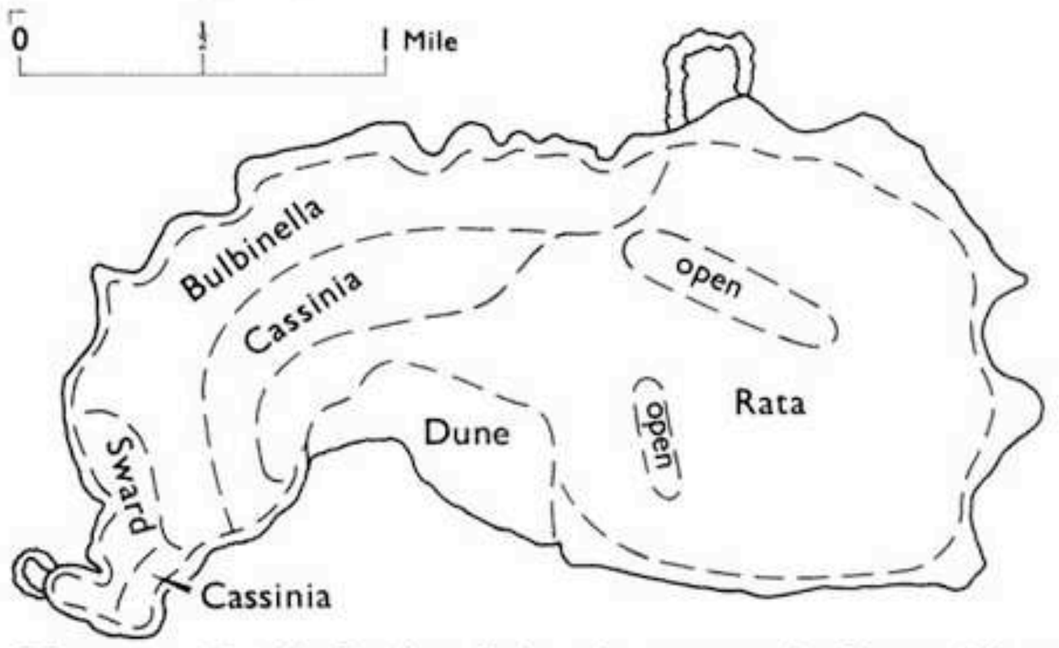

FIGURE 3. *Enderby Island: general disposition of vegetation.*

Ewing Island (Fig. 4)

Falla (1948) referred to the "dense *Olearia* forest which surrounds a core of rata forest" on Ewing I. The situation in 1964 is shown in Fig. 4, based on an aerial photograph.

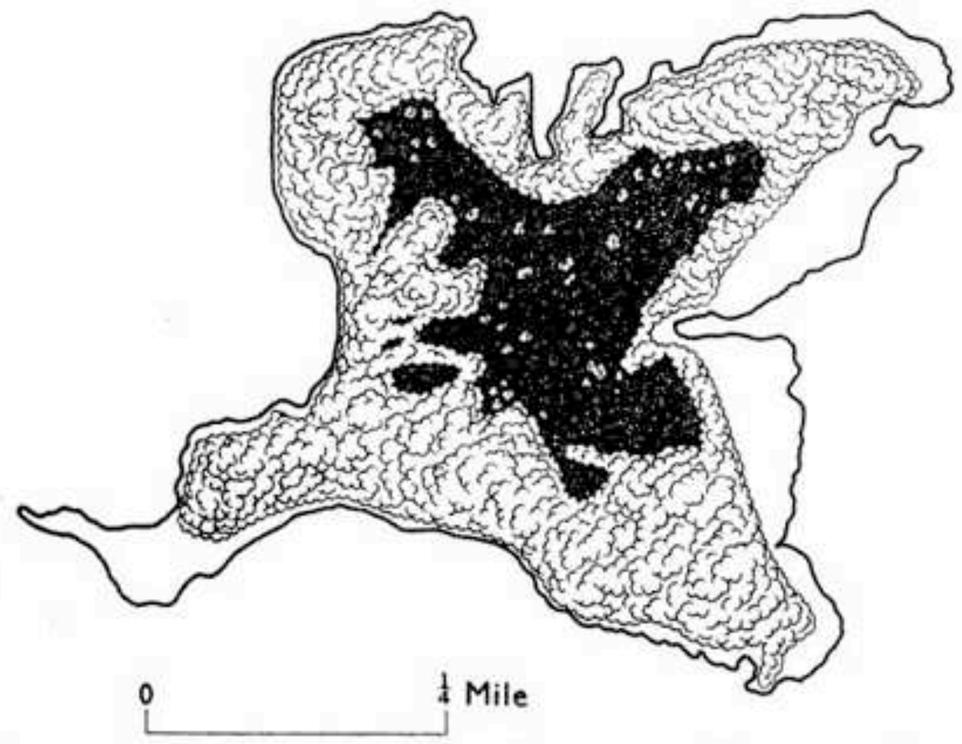

FIGURE 4. *Ewing Island: central rata forest surrounded by* Olearia lyallii; *rock platforms unshaded. Based on an aerial photograph, 1964.*

Olearia lyallii—A RECENT IMMIGRANT?

This striking tree-composite, with leaves amongst the largest in the New Zealand flora, is usually recognised as occurring only on the Snares Is., and at the northern extremity of the Auckland Is., where it is mainly concentrated at Erebus Cove and on Ewing I. Falla (1948, and in Moar 1958 b) pointed out that the area of *O. lyallii* on the headland at Erebus Cove had grown up in a man-made clearing; and he suggested that the same might have occurred on Ewing I. It is of interest to discuss whether *O. lyallii* may in fact be a recent immigrant and not, as Cockayne thought, a remnant of a primeval forest which has been ousted by changing conditions.

Ewing Island

In 1840 *O. lyallii* was rare in Ross Harbour. One specimen was brought from Ewing I. by Lyall, and Hooker described the plant thus: "a short stout trunk rises a few inches above the ground and then sends off horizontally patent branches which radiate as from a common centre for 10 or 12 feet on all sides a little above the surface of the earth." This description suggests a stunted plant in an exposed situation. Hooker continues: "It is a rare plant on the islands now under consideration and will probably be found to be a native of the southern extremity of New Zealand." M'Cormick (1884), who also landed on Ewing I. in 1840, does not mention the species. Bolton collected a specimen for Hooker in 1850 but Dr. R. Melville of Kew tells me that it is only labelled "Auckland Islands".

In 1890 Chapman recorded, "We walked for some hours over this flat island, among fairly grown rata trees, which occasionally bore bunches of glorious crimson flowers, finding magnificent *Olearias* on the sea-shore. Every now and then we stumbled upon huge sea-lions among the tussocks . . ." (Chapman 1891: 500).

In 1903 Cockayne observed that *O. lyallii* occupied only a narrow zone on the sheltered side of the island giving way to rata forest (Cockayne 1904: 254). In 1907 Cockayne again landed on Ewing I., with Dorrien-Smith (1908), but their records are contradictory. Dorrien-Smith wrote: "The chief interest among the plants was the forest of *Olearia lyallii* which covered the low island from one end to the other . . .", and that "the clear places on the island were occupied by *Poa litorosa* growing in large tussocks". Cockayne (1909), on the other hand, still wrote of O. *lyallii* that "this formation occupies a small portion of Ewing Island."

Oliver spent half an hour on Ewing I. in 1927, but only noted that "the scrub here is mainly tupari."

Whether *Olearia* on Ewing I. now grows on a man-made clearing, as tentatively suggested by Falla (1948), is by no means as certain as it is for Erebus Cove. The area now under *Olearia* on Ewing seems much larger than needed for the beaching of whale boats and for shore equipment, if this in fact occurred during the brief unsuccessful whaling period in 1850-52.

Recalling Chapman's and Dorrien-Smith's references to tussock on Ewing, and the present tussock-grassland on Rose I., it is possible that Ewing I. originally had a central stand of rata surrounded by *Poa litorosa* tussock-grassland. The grassland could have been invaded by *Olearia* which grew up in the shelter of the large tussocks.

Erebus Cove (Auckland Island)

O. lyallii was not seen here by Hooker in 1840 although his vessel was anchored at the Cove. Nor was the species seen by the French and American expeditions in the same year. During the Enderby settlement (1850-52) the forest was cleared behind the beach, across the base of the headland, and on the headland itself. It is on the headland that *O. lyallii* thrives today.

The scanty botanical records of the German Transit of Venus party (1874) give no relevant information. Nor did Chapman and Kirk, during their 1890 visit, record *O. lyallii* here. Chapman only notes (1891: 499): "All that remains of Governor Enderby's settlement is a piece of country which looks as if it had been cleared, with stumps sticking up here and there . . ." Cockayne in 1903 examined the regeneration and recorded: "The new formation consists of *Metrosideros lucida*, *Panax simplex*, *Coprosma foetidissima*, *Dracophyllum longifolium* and *Phormium tenax* the whole forming a most beautiful natural shrubbery in various hues of green" (Cockayne 1904: 303). He is presumably describing the area at the beach and across the base of the

headland (where the patch of *Phormium tenax* may still be seen). All that Cockayne notes in 1904 (other than his references to Ewing I.) is that *O. lyallii* occurs "perhaps to a very limited extent in one or two places on Auckland Island itself." After the 1907 visit Cockayne (1909) wrote more definitely that "There are a few trees in the neighbourhood of the Port Ross depot" (i.e. Erebus Cove); and Dorrien-Smith (1908) refers to "a small patch on the main island, at Port Ross." Photograph No. 63 of the 1907 expedition in the Canterbury Museum shows that *O. lyalli* was plentiful on the headland by that time, although the area appears slightly smaller than at present, and the trees appear thinner on the ground.

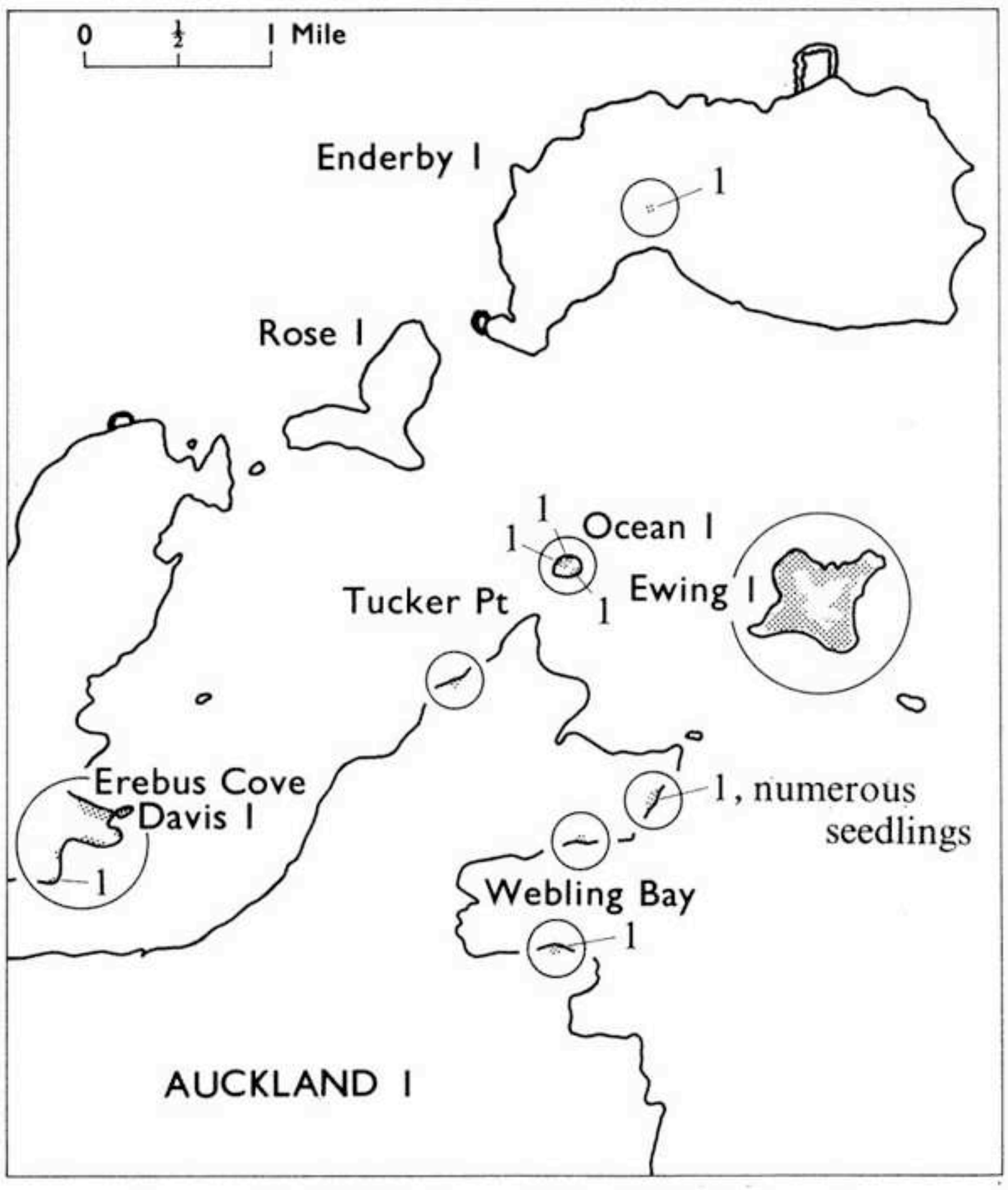

FIGURE 5. *Distribution of* Olearia lyallii *on the Auckland Islands: locations observed in 1962-63, with single plants marked. (Falla (in Moar 1958 b) refers to "A small patch at the head of Laurie Harbour on a site described by Ross (1847) as a clearing for huts of French whalers". Neither plants or reference was found.)*

General

The luxuriant growth of *O. lyallii*, and the large numbers of young plants, with germination even in cracks in the bark of prostrate trunks, have often been noted—for instance by Cockayne (1904) and Dorrien-Smith (1908). Although Cockayne could see no reason why it "should not be the dominant forest of the Southern Islands", *O. lyallii* has always been considered as fighting a losing battle in the Auckland Islands. To Dorrien-Smith (1908) it was swamped out by rata, "hence its disappearance from the main islands"; to Cockayne (1904) it was perhaps a relic of a former primeval forest, "ousted by a new formation as the conditions changed"; and he also considered "that the tree in question may have been a member of the now vanished and problematical forest of an ancient Antarctic continent" (Cockayne 1907; cf. also 1928: 174).

I suggest that *O. lyallii* is in fact increasing its area on the Auckland Islands, and that the present populations are derived from a relatively recent immigration, probably in the early 19th century, with Ewing I. as the point of entry. From here, it is suggested, the species moved east to points around Ross Harbour, and southwards along the coast (Fig. 5).

The source of *O. lyallii* would probably be the Snares, the only other locality where it is usually recognised as occurring. But when speculating on the history of this species it should be recalled that specimens from Milford Sound (Hooker 1867) and from Stewart Island and the Bluff (Cockayne 1927, 1928) have been considered similar to or identical with *O. lyallii*.

As Moar (1958 a) mentions the difficulty of distinguishing *O. lyallii* pollen from that of the *Pleurophyllums*, particularly *P. hookeri*, pollen analysis may not be fruitful in elucidating the history of this noble composite in the Auckland Islands.

ACKNOWLEDGEMENTS

I am very grateful to Dr. R. A. Falla for a vegetation map of Ewing Island on which Fig. 4 is based and for his interest in these problems; and to Mr. K. R. West for preparing the illustrations.

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BIRDS AND MAMMALS OF THE SUBANTARCTIC ISLANDS

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If comprehensive limits are allowed for a zone in the New Zealand area designated 'Subantarctic', it would include the outlyers of Stewart I., the Snares and the Chathams in the north, and Macquarie I. in the south. There is, however, a very mixed fauna in the northern zone with some derivative sub-antarctic elements only and this is clearly distinguishable from the middle zone which would include Auckland, Campbell, Antipodes and Bounty Is. The southern zone represented by Macquarie is distinguishable again, its