indusia and undersides of laminae segments; A. viridescens is virtually only a glabrous form (glabrous laminae) of the hairy A. fulvum. There is some taxonomic inconsistency here in treating A. diaphanum as a polymorphic species and recognising A. fulvum and A. viridescens at specific rank. I wonder how rare the hairy form of A. cunninghamii is?

I thank the Department of Conservation, Northland Conservancy for permission to collect voucher specimens and Peter Bellingham for his comments.

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Flora and vegetation of an islet off Ponui Island, Hauraki Gulf, Auckland

E.K. Cameron & G.A.Taylor

The flora and vegetation of a small (0.6 ha) unnamed islet situated between Ponui and Rotoroa Islands in the Hauraki Gulf, Auckland was visited on separate trips by each of us. The islet lies 300 m off the north-east end of Ponui Island on the southern side of the Ruthe Passage (grid ref. NZMS 260 S11 072835) (Fig. 1). A large rocky reef extends out from its northern side. The long narrow islet is close to 200 m long by 20-50 m wide and reaches nearly 20 m asl at the western end. The islet is mainly a west-east ridge, lowest in the centre (5 m asl), with steep north and south facing slopes; there are few level areas. It is composed of Waipapa greywacke which is eroding rapidly along most of the northern slopes; the southern slopes are generally well clothed in low forest. The islet is within the Auckland Ecological Region and the Inner Gulf Islands Ecological District; it was visited for 1½ hours on 28 Oct. 1988 by GAT and 3 hours on 10 Nov. 1990 by EKC. It is Maori customary land.

VEGETATION

For convenience of description the islet can be divided into 5 zones (Fig. 1):

1. Bare - some three-quarters of the north-facing slope, from sea level to ridge top, is steep crumbling rock. The sparse vegetation is mainly grasses, occasional low patches of gorse (Ulex europaeus) or manuka (Leptospermum scoparium) and scattered seedlings of pohutukawa (Metrosideros excelsa). Scattered karo (Pittosporum crassifolium) and pohutukawa generally fringe the cliff-top. Two steep parts of the south-facing coast are similar.

2. Grassland-bracken - at the eastern end of islet the rock is not eroding and is covered in low vegetation of grasses, bracken (Pteridium esculentum), lichens (crusts and Cladina confusa, Parmotrema sp. and Ramalina sp.), mosses (mainly Thuidium sp.) and with the occasional karo

or pohutukawa.

3. Shrubland – the upper part of the western end of islet is a shrubland about 1 m tall and dominated by manuka, gorse, prickly mingimingi (Cyathodes juniperina), mingimingi (Leucopogon fasciculatus) and bracken. Karo, pohutukawa, needlebush (Hakea sericea), NZ broom (Carmichaelia aligera), Pomaderris rugosa, akepiro (Olearia furfuracea), akeake (Dodonaea viscosa), Astelia banksii and Coprosma rhamnoides are all present.

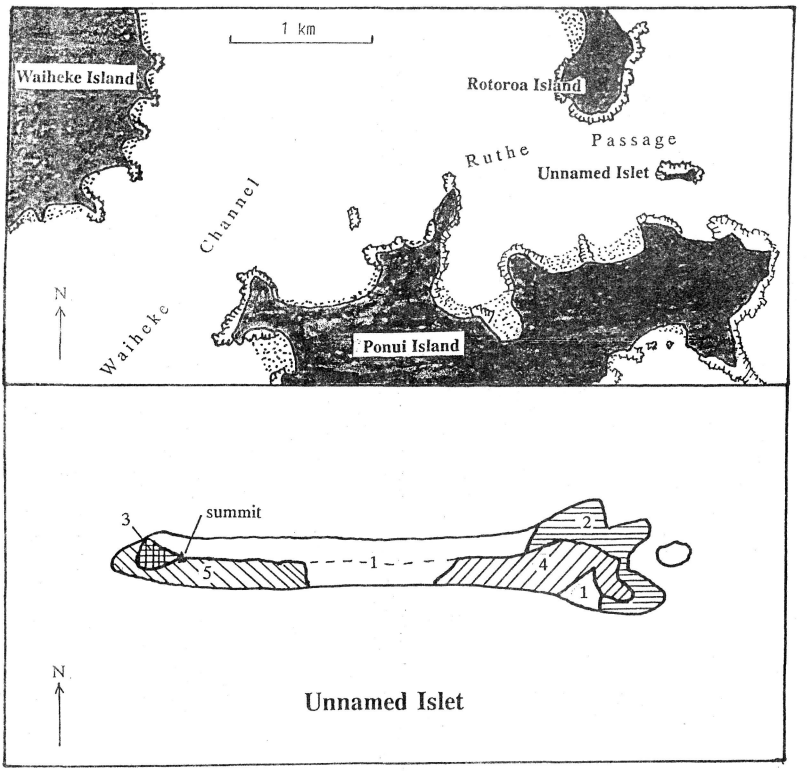

Fig. 1. Vegetation zones of Unnamed Islet (1 = bare; 2 = grassland-bracken; 3 = shrubland; 4 = shrubland-forest; 5 = forest) (not to scale); upper map shows location with respect to larger Hauraki Gulf Islands.

4. Shrubland-forest - steep, north-facing slope at eastern end of islet. A karo canopy with 6 m tall emergent pohutukawa with trunks up to 25.5 cm dbh. Astelia banksii is abundant on the ground with shrubs of mapou (Myrsine australis), akepiro, haupara (Pseudopanax lessonii) and koromiko (Hebe stricta). Bracken, hound's tongue (Phymatosorus diversifolius) and Asplenium haurakiense are also present. The coastal margin is grassy and open with Stipa stipoides, Isolepis nodosa, Poa anceps and numerous exotic grasses, e.g. Vulpia spp., Aira caryophyllea and Avena barbata. Taupata (Coprosma repens) and glasswort (Sarcocornia quinqueflora) are present, as well as Peperomea urvilleana and rengarenga (Arthropodium cirratum) in shady areas.

5. Forest - steep, south-facing slope at western end of islet. It contains the best forest with 8 m tall emergent pohutukawa up to 46.5 cm dbh, through a 3-4 m tall continuous canopy of karo and houpara. Mapou, coastal mahoe (Melicytus novae-zelandiae), hangehange (Geniostoma rupestre), Coprosma macrocarpa and kowhai (Sophora microphylla) up to 5 m tall and 27.7 dbh, are all present. Astelia banksii is the main ground cover and several fern species are common, e.g. Asplenium haurakiense, hound's tongue and shining spleenwort (Asplenium oblongifolium).

FLORA

A full vascular plant species list is appended which records 103 species and 2 hybrids; native species total 66 % of the flora. This is a large number of species for an islet less than 1 ha and includes a large number (68 spp.) of native species. Although small in size and modified the islet supports some interesting native species which are more a feature of the Outer Hauraki Gulf rather than the Inner Gulf, e.g. Asplenium haurakiense, Linum monogynum, coastal mahoe and Trisetum antarcticum. None of these were recorded by Brown (1979) in her botanical survey of Ponui Island.

The endemic NZ shrub, Pomaderris rugosa has a scattered geographical distribution: Northland, Silverdale (extinct?), Western Waikato, Waiheke Island, Ponui Island, Firth of Thames, and Coromandel and adjacent islands (Moore 1986). Its presence on the islet is not surprising as it occurs on the two large adjacent islands of Ponui and Waiheke.

Although all the Asplenium haurakiense was terrestrial with more or less erect fronds, there was variation in the length of the basal secondary pinna. Some plants had the typical elongated secondary basal pinna (AK 200596) and other plants with basal secondary pinnae not enlarged (AK 200586 and 200605) which is a feature of A. flaccidum s.s. Brown (1979) recorded only A. flaccidum s.s. for the adjacent Ponui Island. The islet is close to the Inner Gulf boundary for A. haurakiense and these plants without long basal secondary pinnae are possibly hybrids between A. flaccidum s.s. and A. haurakiense.

Hebe stricta var. stricta was the main type of koromiko on the islet (AK 200601), but one collection (AK 200602) had much shorter wider leaves close to Hebe sp. "m" (see Eagle 1986: 320) but the corolla tube was greater than sepals and therefore it appears to be an odd leaf form of H. stricta.

A single Clematis vine was seen in the south-west forest area on the islet, flowers were not observed. The plant had tri-foliate leaves twining petioles, lanceolate shaped leaflets c. 5 x 2 cm, and some scattered white lamina hairs. We could not match it with any known wild species in NZ.

The suspected hybrid specimen between Senecio hispidulus and S. glomeratus (AK 200587) is closest to S. hispidulus but possesses some cobwebby hairs on leaf undersides.

There are many weed species on the islet (35 spp.) but most are herbaceous and will not smother the native vegetation. The exceptions to this are boxthorn (Lycium ferocissimum), gorse, needlebush and sweet pea bush (Polygala myrtifolia). These are sun demanding species and they will continue to persist in the open areas.

FAUNA

In October 1988 a small colony of grey-faced petrels (Pterodroma macroptera) was present. At least 20 large burrows were found in the south-west forest and the skull, wing bones and egg of a grey-faced petrel were located. We both found several burrows of little blue penguins (Eudyptula minor) which were also nesting on the islet. A few pairs of southern black-backed gulls (Larus dominicanus) nest on the islet, mostly at the eastern end. In November 1990 there was one nest with 3 eggs and another nest with 2 eggs. In October 1988 a dead reef heron (Egretta sacra) on a crushed egg was found under forest at the eastern end. A few blackbirds (Turdus merula), chaffinches (Fringilla coelebs) and welcome swallows (Hirundo neoxena) were all noted on the islet.

Rodent signs were common on the islet. Numerous small holes were found and one of these had fresh rat droppings and fur at the burrow entrance. The droppings were the size typical of Norway rats (Rattus norvegicus). The small burrows were presumably dug by Norway rats. The reef heron had been scavenged by rats but whether it was killed by rats or some other predator was not discernable from the state of the remains. The islet is within the swimming range of rats from Ponui Island so presumably Norway rats have been present on the islet for a long time. The presence of a small depleted petrel colony would support this conclusion.

DISCUSSION

The contrast in vegetation between the bare north-side and the shrub-forest south-side of the islet is because of the different aspects, different exposure and past disturbances. The northern side is the most exposed and therefore more prone to wave erosion. The low stature of the vegetation reflects disturbance (fire?) in recent times. The drier north-side would be more prone to fire and would take longer to recover than the more shaded south-side.

The 23 native species recorded by us for the islet but not recorded for the adjacent Ponui Island by Brown (1979) (see Appendix) is not surprising as Ponui is an extremely large island (1795 ha) to survey in a week and most of it is grazed. The absence of flax (Phormium tenax) on such an islet is very surprising.

Many of the worst weeds frequent on Inner Hauraki Gulf Islands have not yet reached this islet, e.g. climbing asparagus (Asparagus scandens), pampas grasses (Cortaderia jubata and C. selloana) and bone-seed (Chrysanthemoides monilifera).

Although small, the islet is important botanically as the regenerating vegetation contains several native species more typical of Outer Haurkai Gulf Islands. Rats could quite easily be eradicated by poisoning which might allow the grey-faced petrel colony to expand. Because 300 m is near the normal, maximum swimming distance for Norway rats, after poisoning it would be interesting to monitor the islet once a year to

see how long rats would take to re-invade from adjacent Ponui Island. It may take many years.

ACKNOWLEDGEMENTS

To Malcolm Waller and the Wilson family for boat transport to the islet for GAT and EKC repectively; Alan Tennyson for field assistance to GAT and Jessica Beever for moss identification.

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APPENDIX

Species list for plants on islet north of Ponui Island

a = abundant
c = common
o = occasional
l = local
r = rare (less than 5 plants)
* = adventive species

P = also recorded for Ponui Id (Brown 1979)
AK = voucher in Auckland Museum herbarium
AKU = voucher in University of Auckland, Botany Department herbarium

Ferns (9)
Asplenium haurakiense c, AK 200596
A. haurakiense? x A. flaccidum s.s. c, AK 200586, 200605
A. oblongifolium o, P
A. polyodon r, P
Cyathea dealbata r (single sporeling), P
Pellaea rotundifolia r, AK 200597
Phymatosorus diversifolius c, P
Pteridium esculentum c, P
Pyrrosia eleagnifolia c, P

Gymnosperms (1)
Pinus radiata * r, P

Dicotyledons (68)
Anagallis arvensis var. arvensis * c, P
Apium prostratum s.s. l, P
Atriplex prostrata l, P
Avicennia marina var. resinifera r, P
Calystegia soldanella l
Carduus pycnocephalus/tenuiflorus * r, AK 200584
Carmichaelia aligera o, P, AK 200598
Centaurium erythraea * o
Cerastium glomeratum * o, AK 200604
Cirsium vulgare * o
Clematis sp. r, AKU 22036
Conyza albida * o, P
Coprosma macrocarpa lc, P
C. repens o, P

C. rhamnoides o, P
Cotula australis o
Crassula sieberiana lc, AK 200595
Cyathodes juniperina lc, P
Dichondra repens o, P
Disphyma australe o, P
Dodonaea viscosa lc, P, AK 200583
Einadia triandra o, AK 200592
E. trigonos s.s. r
Geniostoma rupestre ssp. ligustrifolium lc, P
Gnaphalium audax l
G. gymnocephalum l, AK 200585
Hakea sericea * l
Hebe stricta var. stricta o, P, AK 200601
Hypochoeris radicata * o
Leptospermum scoparium o, P
Leucopogon fasciculatus o, P
Linum monogynum l, AK 200581, AKU 22035
L. trigynum * c
Lotus pedunculatus * l
L. suaveolens * o
Lycium ferocissimum * o-lc, P
Melicytus novae-zelandiae s.s. c, AK 200588, AKU 22038
M. ramiflorus s.s. r, P
Metrosideros excelsa c, P
Muehlenbeckia complexa l, P
Myoporum laetum r, P, AK 200580
Myrsine australis lc, P
Olearia furfuracea o-c, P
Oxalis rubens o
Parietaria debilis l, AK 200599
Peperomia urvilleana o, P
Phytolacca octandra * r, P
Pimelea urvilleana c, AK 200579
Pittosporum crassifolium a, P
Plantago lanceolata * lc, P
Polycarpon tetraphyllum * c
Polygala myrtifolia * o
Pomaderris rugosa l, P, AK 200600, AKU 22037
Pseudopanax lessonii c, P
Sarcocornia quinqueflora s.s. o-lc, P
Senecio glomeratus r, AK 200589
S. hispidulus c, P
S. hispidulus ? x S. glomeratus r, AK 200587
S. lautus s.s.
Solanum americanum o, P, AK 200582
S. nigrum * r, P
Sonchus oleraceus * c, P
Sophora microphylla lc, P
Trifolium dubium * c, AK 200594
T. subterraneum * o
Ulex europaeus * lc, P
Wahlenbergia gracilis l-o, AK 200593
Weinmannia silvicola r, P, AK 200590

Monocotyledons (28)
Aira caryophyllea s.s. * la, AKU 22474
Anthoxanthum odoratum * o, P

Arthropodium cirratum lc, P
Astelia banksii a, P
Avena barbarta * c
Bromus arenarius * r, AKU 22033
B. diandrus * c
B. hordeaceus * o
Carex breviculmis o-lc, AK 200591
Deyeuxia billardierei o, P
Dianella nigra r, P
Dichelachne crinita o
Isolepis nodosa c, P
Lachnagrostis filiformis var. littoralis o, AKU 22478
Lolium rigidum * c, AKU 22034 22479
Microlaena stipoides l
Oplismenus hirtellus ssp. imbecillis o
Parapholis incurva * o, AKU 22475-77
Paspalum dilatatum * o
Poa anceps ssp. anceps c, P
P. annua * o
Rytidosperma racemosum * c, AKU 22472
Sporobolus africanus * o, P
Stipa stipoides lc, P
Thelymitra longifolia o, P
Trisetum antarcticum o, AKU 22032 & 22480
Vulpia bromoides * a, AK 200603, AKU 22039
V. myuros * c, AKU 22473

Bryophytes (2 - incomplete list)
Thuidium sp.
Triquetrella papillata AKU 72236

Vascular flora of Kawetoto Reef, Waikawau Bay, Coromandel Peninsula

E.K. Cameron

The rocky Kawetoto Reef is composed of dacite with an andesite dike intrusion of about mid Miocene age (Skinner 1976). It is located at the north end of the sandy Waikawau Bay, north-eastern Coromandel Peninsula (grid ref. NZMS 260 T10 366093) (Fig. 1). It is in the Colville Ecological District. The reef is attached to the mainland and runs into the sea from a rocky headland for some 200 m. Apart from one islet (c. 11 m asl) the reef is low (c. 2 m asl) and wave-washed or submerged. The islet is 50 m out from the mainland and is joined by the reef, more or less at high tide level, with channels across it which are dry only at low tide. Vascular plants on the reef are only present on this islet which is steep and not much wider than tall. Behind the rather open adjacent headland there is still a good cover of native forest. I visited the islet on 23 January 1991 for about 1 hour.

VEGETATION OF THE ISLET

Most of the islet is bare eroding rock, with about one quarter covered with vegetation, most of it being on the more sheltered western side.