

VASCULAR PLANTS OF THE MAIN NORTHERN MOKOHINAU ISLANDS, NORTH-EAST NEW ZEALAND

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SUMMARY

The flora of three highly modified islands and one undisturbed isle of the northern Mokohinau is updated. A vouchered species list is presented for the first time and plant remnants of the lighthouse keepers', now abandoned, gardens are included. Two hundred and fifty five vascular plant taxa are recorded for the northern Mokohinau of which 46 wild species are new records. The northern Mokohinau flora is compared with that of the less modified Fanal Island; the largest island in the Mokohinau Group.

INTRODUCTION

The Mokohinau Islands (lat. 35°55'S, long. 175°08'E) are the most remote group of islands in the Hauraki Gulf. They consist of c. 30 islands and islets; the northern Mokohinau which include Burgess (Pokohinau) Island and adjacent western islands, Fanal (Motukino) Island, and several isolated islets (Fig. 1).

Except for a small area of conglomerate behind Landing Bay on Burgess Island, the Mokohinau are composed of igneous rocks, mainly rhyolite (Fleming 1950). The mean annual rainfall is 1082 mm (means = January 73 mm, July 119 mm) and the mean annual temperature is 16.3°C (means = January 20.1°C, July 12.6°C) (NZ Meteorological Service 1983).

All the Mokohinau Islands are part of the Hauraki Gulf Maritime Park and are administered by the Department of Conservation. Burgess Island is a Lighthouse Reserve; all the others are Nature Reserves.

The history of all the main islands is reflected in the extent of modification of their vegetation. On Burgess Island forest has virtually been eliminated, whereas Fanal Island contains advanced regenerating forest. Archaeological evidence on Atihau (Trig), Hokoromea (Maori Bay), Burgess and Fanal Islands indicates they were probably occupied for only a short period of time (Moore 1986). The three main northern Mokohinau Islands have been burnt many times and Burgess Island has been grazed for over 60 years by livestock. Gillham (1960) records that in the early 1880's the vegetation on Burgess was quite open and from at least as early as 1920 the island was burnt about every three years to control tussocky sedges. McCallum (1986) refers to muttonbirders regularly burning the islands west of Burgess Island. The last fire on Atihau and Hokoromea Islands, appears to have been in 1932 (Gillham 1960). McCallum (1980) mentions a remnant fence on Atihau and that the island was grazed by goats during the early 1940's (McCallum 1986).

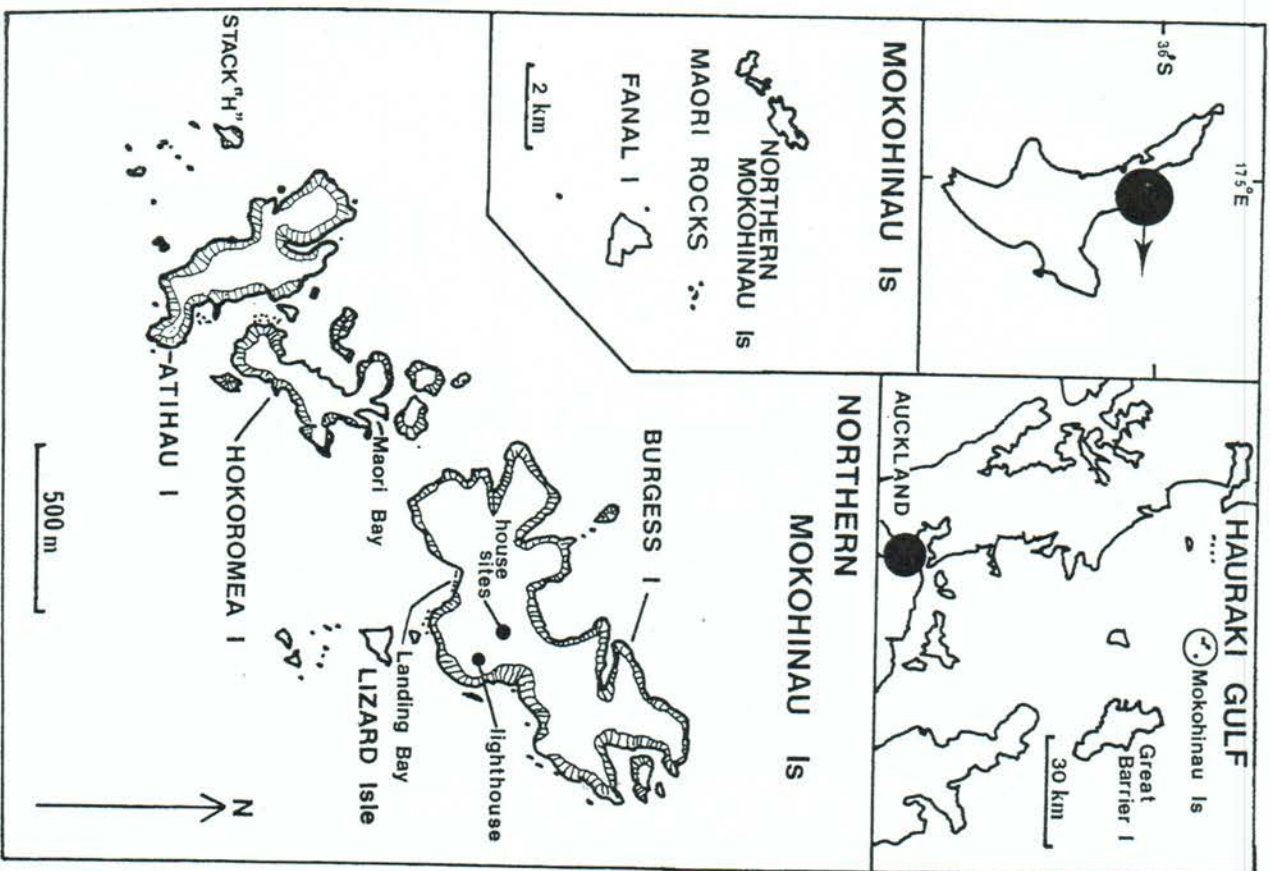


Fig. 1. Place names and location of Mokohinau Islands.

In an ornithological account, Sandager (1889) lists the principal northern Mokohinau plants as flax (*Phormium tenax*), grasses, bracken (*Pteridium esculentum*), *Adiantum aethiopicum*, sedges, New Zealand ice plant (*Disphyma australe*), *Hebe*, *Coprosma*, ngaio (*Myoporum laetum*), pohutukawa (*Metrosideros excelsa*), *Pittosporum*, *Carrichaelia* and *Olearia*. The last mentioned was exposed, stunted and scattered in distribution.

There are three botanical accounts on the Mokohinaus: Gillham (1960) surveyed the northern Mokohinaus in August 1957; Esler (1978) visited all the main Mokohinau Islands in February–March 1978; and Wright (1980) spent one week on Fanal Island in May 1979. In August 1965, G.I. Collett, while relieving at the lighthouse, collected 104 vascular plant specimens, presumably from Burgess Island although in a letter to Botany Division, Collett stated that he had access to two, small, goat-free islets as well.

This present account deals with the flora of the three main northern Mokohinau Islands (Burgess, Atihau, Hokoromea) and one islet (Lizard Isle). The survey was carried out during an Offshore Island Research Group scientific trip, 30 December 1983 to 7 January 1984. Most time was spent on Burgess Island where the camp was situated, but one-day visits were made to Atihau, Hokoromea and Fanal Islands. Additions to Fanal Island's flora are covered separately by Cameron and Wright (1987).

Kiore (*Rattus exulans*) are present on all the larger Mokohinau Islands; other rat species and mice (*Mus musculus*) are absent (Atkinson 1986).

ISLANDS STUDIED

Burgess (Pokohinau) Island

Burgess Island is the second largest island of the Mokohinaus and covers c. 50 ha and measures c. 1.2 x 0.4 km. Apart from the boulder beach in Landing Bay the coastline is steeply cliffed and dissected, although inland the slopes are fairly gentle. The topography is illustrated in a geological account by Fleming (1950). The lighthouse dominates the highest point on the island, Lighthouse Hill, at 112 m ASL.

A manned lighthouse began operating in 1883 and a workshop, wharf, tramway and three houses were associated with it. During World War II there was a Royal NZ Air Force Unit and radar station on the island. In 1980 the lighthouse was automated and two houses (Fig. 2) and the workshop were burnt. The other house was dismantled three years before. An A-frame building erected in c. 1967 still remains near the lighthouse.

Fire (Maori and European) and lighthouse keepers' livestock (cattle, goats, sheep, pigs, geese) have totally modified the vegetation. Gillham (1960) records that in 1957 Burgess Island supported c. 12 dairy cattle, c. 30 feral goats, a few pigs and that the sheep had just been removed. When Ray Waller moved to Burgess in 1973 all the cattle (52) were removed and new stock (5 cows, 1 bull, 2 steers, 3 sheep) were restricted to part of the island. The few pigs were penned. The last 13 goats were shot in 1973 (C. R. Veitch, pers. comm.). All livestock

and people were removed by March 1980.

About 30 pohutukawa were planted in the late 1960's between the houses and lighthouse. The single *Eucalyptus* near the houses, was planted in 1970 and thousands of jonquils (*Narcissus* sp.) grow close by. Though not seen by me, the jonquils are presumably still present. The Norfolk pine (*Araucaria heterophylla*) by the grave behind Landing Bay was planted in the late 1950's.

Although my observations were almost six years after Esler's visit, the vegetation has not appreciably altered since then, from the dominant cover of rank exotic pasture grasses, native sedges and bracken. The ledges on the coastal cliffs east and north-east of the lighthouse have been a refuge for small numbers of some native species e.g. *Hebe*, houpara (*Pseudopanax lessonii*) and wharangi (*Melicope ternata*). By the small cliff behind Landing Bay, the bush remnant and buffalo grass (*Stenotaphrum secundatum*) sward in front, still persist as recorded by Esler (1978) (Fig. 3). Pohutukawa on the slope closest to Hokoromea Island form the only sizeable 'forest' area on Burgess. The southern trees of this stand were killed by a fire in 1980, which spread from the burning of the dismantled landing shed near the wharf. Under the healthy pohutukawa canopy some native species are becoming established in low numbers e.g. mapou (*Myrsine australis*), *Coprosma rhannoides*, *Psidium* and *Asplenium polyodon*.

Apart from a few coastal seepages, streams are absent in the northern Mokohinaus and the only swamp was a small area with permanent water at the north-west end of Landing Bay. This was the only locality for *Carex virgata* and *Lilaeopsis*. *Eleocharis* was present only here and in a small well by the tramway on Lighthouse Hill. Several fern species (e.g. *Blechnum* 'capense', *Doodia squarrosa*, *Histiophris incisa*) were only in or by a deep, narrow ditch near the swamp. This ditch was dug for water collection by the lighthouse staff before the last war.

Two hundred and thirty seven taxa were recorded for Burgess Island.

Aitihau (Trig) Island (Figs. 4-8)

Aitihau Island covers c. 14 ha, reaches 72 m ASL at the northern end and measures c. 0.8 x 0.2 km. The island is surrounded by high cliffs but inland the slopes are gentle. This easy topography is covered in dense flax, 2-3 m tall, creating the most impenetrable vegetation that I have ever experienced. Ngaiti is the most common plant to be associated with the flax. In the more open areas and amongst the smaller flax plants toeoe (*Cortaderia splendens*) and bracken are common. On the northern third of the island, emergent pohutukawa are locally common, but are uncommon elsewhere. Several plants of parsley fern (*Botrychium australe*) were found growing under the margin of pohutukawa on the north-western end of the island. Only two plants of the *Hebe* were seen. The pale coloured near vertical cliffs are mainly bare except for herbaceous salt-tolerant herbs, taupata (*Coprosma repens*) and large tussocks of *Chionochloa bromoides*.

One hundred species were recorded for the island.

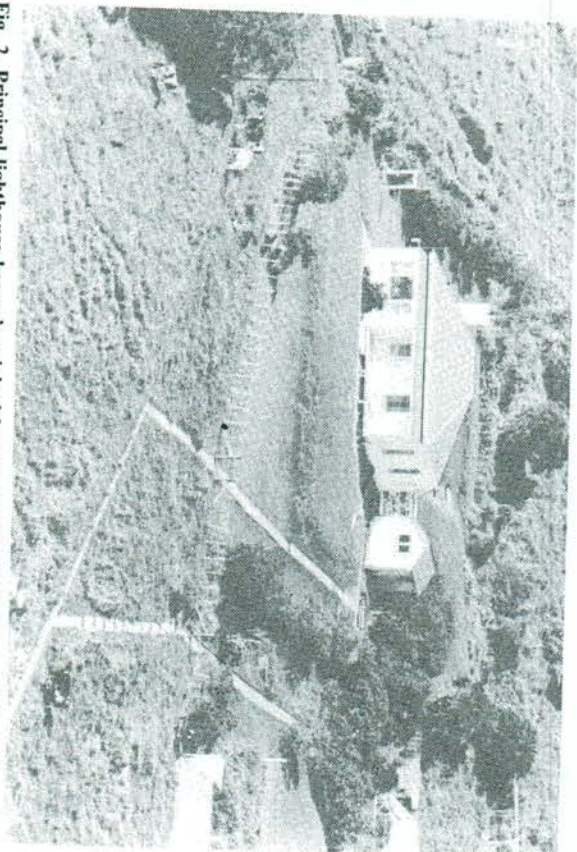


Fig. 2. Principal lighthouse keeper's original house, built in 1898. Photo: R.M. Walter, 1980.

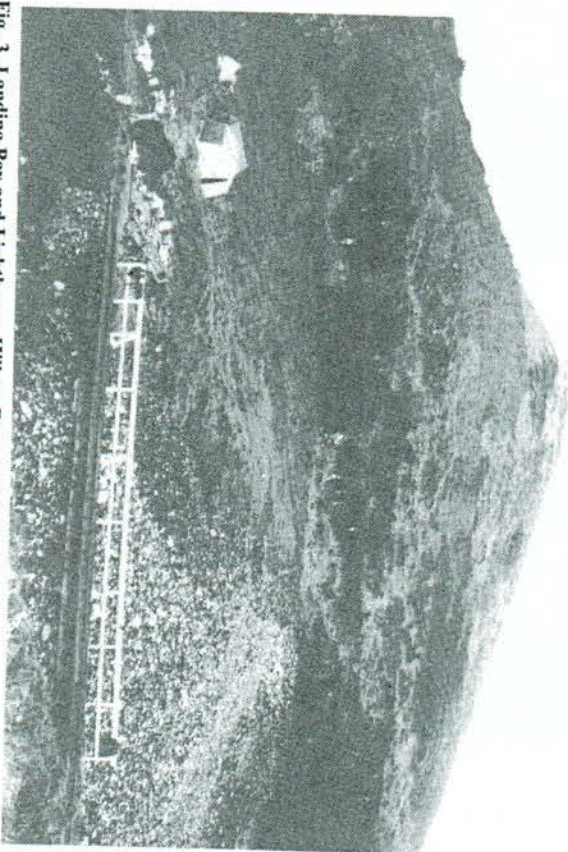


Fig. 3. Landing Bay and Lighthouse Hill on Burgess Island. Note bush remnant behind buffalo grass flat and remnant tramway (foreground). January 1984.

Hokoromea (Maori Bay) Island (Figs. 7, 8)

Hokoromea Island covers c. 10 ha and is not quite as high as Aihau. It is c. 0.5 km long, dissected, and like Aihau Island, is surrounded on most sides by tall, pale cliffs. The dominant vegetation is similar to that on Aihau but pohutukawa is more frequent. *Chionochoa bromioides* and *Scirpus nodosus* are also more common on Hokoromea Island and prostrate taupata dominates on some of the steep, but not vertical, faces.

The tallest pohutukawa was c. 10 m high with 50 cm dbh, and grew in the mid-eastern part of the island. All other pohutukawa were smaller and showed signs of rapid growth with *Leptocarpus similis* still persisting in many places underneath. Cook's scurvy grass (*Lepidium oleraceum*) was seen at only one locality, on the northern side of Maori Bay.

One hundred and four species were recorded for the island.

Lizard Isle (Fig. 9)

Lizard Isle covers c. 0.9 ha and is situated c. 100 m off the south coast of Burgess Island. It is a low, flat islet containing a shrubland 1-1.5 m tall of taupata and *Meliccytus novae-zelandiae* in the centre. Prostrate ngaio and taupata form the margin with *Scirpus nodosus* and *Leptocarpus similis* in places. On the predominantly bare edges, carpets of glasswort (*Sarcocornia quinqueflora*) and New Zealand ice plant grow. Twenty-six species were recorded for the islet, 88.5% were native.

Lizard Isle appears to be in its natural state, unmodified by man. McCallum (1986) records that it was rat-free up to 1977 when kiore reached the islet. Successful poisoning was carried out the following year.

FLORA OF THE MAIN NORTHERN MOKOHINAU ISLANDS

Species List

Two hundred and fifty-five vascular plant taxa are listed below for Burgess, Hokoromea, Aihau Islands and Lizard Isle.

Nomenclature of ferns and fern ally follows Brownsey *et al.* (1985) and angiosperms generally follow Allan (1961), Moore and Edgar (1970), Healy and Edgar (1980), Healy (1984), and Cheeseman (1925). Most of the adventive dicotyledons are also listed in a series of 'checklists' in the New Zealand Journal of Botany, beginning in 1978. Nomenclature changes relating to native plants are reviewed by Edgar (1971) and Edgar and Connor (1978, 1983); many of these are followed.

Where possible subsequent taxonomic and nomenclature changes have been incorporated when comparing the records of previous workers. The vouchered specimens were collected by the following people (the herbaria where they are lodged are in parentheses): E.K. Cameron (AKU), G.I. Collett (CHR), A.E. Esler (CHR), M.E. Gilham (CHR), B.S. Parris (AK) and A.E. Wright (AK). The CHR specimens were not examined by me, but dubious records were check-



Fig. 8. Oblique aerial of southern end of Hokoromea Island (right) and part of Aihau Island (left) from south-east. Photo: W.J. Ballantyne, November 1978.



Fig. 9. Oblique aerial of Lizard Isle from the east. Photo: W.J. Ballantyne, November 1978.

ed by Botany Division staff. Herbarium abbreviations follow Holmgren *et al.* (1981).

KEY TO SYMBOLS

Island

B = Burgess (Pohokina) I.
H = Hokoromea (Maori Bay) I.
A = Aihiau (Titi) I.
L = Lizard Isle

Frequency of species

a = abundant
c = common
o = occasional
f = rare
l = local
s = single plant

* = adventive
R = garden relic
+ = new record (excluding garden relics)
++ = new record from Collett herbarium specimens (1965) and also seen during present survey.

Records unsubstantiated by this survey

G = Gilliam (1960) assumed from Burgess, but island not specified
C = Collett from specimens collected in 1965
P = Parriss (1971)
E = Esler (1978)

SPECIES

Ferns and Fern Allies

<i>Adiantum aethiopicum</i>	c				AK 165103
<i>A. cunninghamii</i>	G,C	r+			CHR 184250 B
<i>A. hispidulum</i>	o				CHR 184249
<i>Asplenium bulbiferum</i>	p				
<i>A. flaccidum</i> ssp. <i>haurakiense</i>	c	o	o+		CHR 184237 B
<i>A. flacc.</i> ssp. <i>haur.</i> x <i>A. oblongifolium</i>	r+				AKU 16039
<i>A. oblongifolium</i>	c	o+	o+		AK 165091 B
<i>A. obtusatum</i> ssp. <i>northlandicum</i>	o	l+			AKU 16040 B
<i>A. polyodon</i>	r++				AKU 16074
<i>Blechnum norfolkianum</i>	o	r+			AK 165135 B
<i>B. sp.</i> (<i>B. capense</i> sensu Allan 1961)	r+				
<i>Botrychium australe</i>			l+		AKU 16053
<i>Cyathea dealbata</i>	o	r+			
<i>Dicksonia squarrosa</i>	r+	r+			
<i>Doodia media</i> ssp. <i>australis</i>	o	r	o+		CHR 111657 & 184252 B
<i>D. squarrosa</i>	r+				AKU 16061
<i>Histiopteris incisa</i>	r				CHR 184241
<i>Polystichum diversifolius</i>	r+				
<i>Polystichum richardii</i>	r+	o	o+		
<i>Psilotum nudum</i>	G				
<i>Pteridium esculentum</i>	r+				AKU 16075
<i>Pteris tremula</i>	a	a	a		CHR 184242 B
<i>Pyrrhosia serpens</i>	r				CHR 184240
	l	o+			CHR 184236 B

Gymnosperms

Arucaria heterophylla R
Cupressus macrocarpa R

s
r

*Pinus pinaster**

G

Dicotyledons

<i>Achillea millefolium</i> *	o+				AKU 16107
<i>Acacia novae-zelandiae</i>	l				CHR 184202
<i>Acmena smithii</i> R	s				
<i>Amananthus lividus</i> *	G,C,E				CHR 183361
<i>Anagallis arvensis</i> var. <i>arvensis</i> *	c	c	o+		CHR 184225 B, AK 165149 H
<i>Apium prostratum</i> ssp. <i>prostratum</i>	c	l	o+		CHR 166328 B, AK 165150 H
<i>Apтения cordifolia</i> *	o+				AKU 16062
<i>Aster subulatus</i> *	o				CHR 111653 & 184217
<i>Atriplex prostrata</i>	l				
<i>Banksia integrifolia</i> R	s				
<i>Bidens pilosa</i> *	l+				AKU 16096
<i>Borago officinalis</i> *	l+				AKU 16054
<i>Brassica napus</i> *	l+				AKU 16091
<i>B. oleracea</i> R	l+				AKU 16085 B, AKU 16059 A
<i>Calendula officinalis</i> R	l+				AKU 16140 B
<i>Callistemon ? citrinus</i> R	l+				AKU 16089
<i>Calyptegia sepium</i>	l				AKU 16083
<i>C. soldanella</i>	la	o			AKU 16135 B
<i>C. turgidum</i>	lc				
<i>Cardamine debilis</i>	G,C				CHR 111629 & 184233
<i>Carmichaelia aligera</i> (incl. <i>C. cunninghamii</i>)	C	r+			CHR 183340 B, AKU 16063 H
<i>Cassinia retorta</i>	o	c	o		CHR 184206 B, AKU 16048 A
<i>Centaureum erythraea</i> *	c	c	o		CHR 184218 B
<i>Centella uniflora</i>	o+	c	o+		
<i>Cerastium glomeratum</i> *	G				AKU 16078
<i>Chenopodium murale</i> *	G,E				
<i>Chrysanthemum frutescens</i> R	l				AKU 16088
<i>Cirsium vulgare</i> *	o	o	o+		
<i>Coryza albidia</i> *	c	o	o		AK 122795 B
<i>Coprosma macrocarpa</i>	o	o	o		AK 165096 B
<i>C. repens</i>	c	c	o	c	
<i>C. rhamnioides</i>	r++	s+			CHR 184211 B
<i>Coronopus didymus</i> *	o	o+			AKU 16042 B
<i>Cotula australis</i> *	r				CHR 184215
<i>C. coronopifolia</i> *	o	l+	o+		CHR 184219 B
<i>Crassula multicaeva</i> R	l				
<i>C. tetramera</i>	o	o+	l+		AK 165139 B
<i>Crepis capillaris</i> *	G				AKU 16057 A
<i>Dianthus caryophyllus</i> R	l				AKU 16092
<i>Dichondra repens</i>	lc	c	o	o	CHR 184229 B
<i>Displyma australe</i>	c	c	c	c	CHR 183356 B
<i>Eimadia trigonos</i> ssp. <i>trigonos</i>	c	o+	o+		AKU 16034 B, AKU 16047 A
<i>E. triandra</i>	r				AKU 16130
<i>Eucalyptus ? ficifolia</i> R	r				AKU 16100
<i>Euphorbia pepus</i> *	l				AKU 16144
<i>Ficus carica</i> R	l				
<i>Fumaria muralis</i> *	G				
<i>Gaillardia x grandiflora</i> R	l				AK 165145
<i>Galium aparine</i> *	G				
<i>Gazania rigens</i> R	l				AKU 16086

<i>Geniostoma rupestre</i> var.	0	0 + 0 +	
<i>Geranium dissectum</i> *	1		AKU 16037
<i>G. ? molle</i> *	C		CHR 183365
<i>G. solanderi</i> "coarse hairs" (see Gardner 1984)	0	0 + 0 +	AKU 16031
<i>Gnaphalium andax</i> ssp. <i>andax</i>			AKU 16049 A
<i>G. coarctatum</i> (G. <i>spicatum</i> sensu Healy 1984)	G,E	1 0 +	CHR 184220 B
<i>G. gymnocephalum</i>	E	r 0 +	AKU 16051 A
<i>G. simpliciale</i> *	C	0 +	AKU 16056
<i>Gonocarpus incanus</i>	1	0 + 0 +	CHR 183370
<i>Haloragis erecta</i>	1 + +	c r +	CHR 183369 B
<i>Hebe</i> sp. "V" (see Eagle 1982)	1		AKU 16132 B, AKU 16058 A
<i>Hydrangea ? rosa-sinensis</i> and hybrids R	1		
<i>Hypochoeris radicata</i> *	1	c 0	CHR 184223 B
<i>Kalanchoe daigremontiana</i> x <i>K. tubiflora</i> R (det. W.R. Sykes)	1 +		AKU 16084
<i>Lathyrus odoratus</i> *	0 + +		AKU 16142
<i>L. tingianus</i> *	1	0 + +	AKU 16082
<i>Lavatera arborea</i> *	1 +		AKU 16095
<i>Leontodon taraxacoides</i> *	1 +		AKU 16070
<i>Lepidium oleraceum</i>	r +		AKU 16069
<i>Leucopogon fasciculatus</i>	0 +		
<i>Lilaeopsis</i> sp.	1		
<i>Linum biene</i> *	0	0 0	CHR 183364
<i>Lobelia anceps</i>	0	0 0 +	AK 165137 B, AK 165158 L
<i>Lotus angustissimus</i> *	0	1 + 0 +	AK 165099 B
<i>L. pedunculatus</i> *	0		
<i>L. suaveolens</i> *	c 0	0	
<i>Lychnis coronaria</i> R	1		AKU 16093
<i>Lycium ferocissimum</i> *	1 +		
<i>Lycorepicon esculentum</i> *	1 +		AK 165148
<i>Macropiper excelsum</i> f. <i>psittacorum</i>	0	r + 0	AK 165092 B
<i>Malus domestica</i> R	s		AKU 16033
<i>Medicago lupulina</i> *	0 +		
<i>Melicope ternata</i>	r + +	r +	CHR 184208 B
<i>Melicypus novae-zelandiae</i> ssp. <i>novae-zelandiae</i>	0	0 + 0 c	CHR 183343 B
<i>Menha spicata</i> *	1		AKU 16138
<i>Metrosideros excelsa</i>	c	a c	
<i>Mitablis jadapa</i> R	1		AKU 16098
<i>Modiola caroliniana</i> *	1		CHR 183372
<i>Muehlenbeckia complexa</i>	c	0 0	CHR 183360 B
<i>Myoporum laetum</i>	c	c c c	CHR 184235 B, AK 165156 L
<i>Myrsine australis</i>	s +	1 + r +	
<i>Opuntia vulgaris</i> R	1		
<i>Orobanche minor</i> *	G		AKU 16087
<i>Osteospermum ecklonis</i> R	1 +		AKU 16137
<i>Oxalis articulata</i> *	c		
<i>O. corniculata</i> (red form)	E		
<i>O. exilis</i>	1	r + 1 +	AKU 16073 B
<i>O. rubens</i> (O. <i>stricta</i> sensu Allan 1961)	1	0 0 +	AKU 16076 & CHR 354435 B
<i>Parietaria debilis</i>	1	1 +	AKU 16127 B, AK 165115 A

<i>Parsonia capsularis</i>	0 +		AK 122829 & 165067
<i>Pelargonium x asperum</i> ? R	C		CHR 183366
<i>P. x hortorum</i> R	1		AKU 16097
<i>P. inodorum</i>	1	0 + 0 +	
<i>P. petalum</i> R	1		AKU 16090
<i>Peperomia urvilleana</i>	0	E 1 +	CHR 183339 B
<i>Physolacca octandra</i> *	0	0	CHR 183359 B
<i>Pteris hieracoides</i>	0	r + 0 +	AKU 16055 A
<i>Pimelea prostrata</i>	0	c 0 0	AK 165087 B, CHR 354444 A
<i>Pittosporum crassifolium</i>	1 +	1 + s +	
<i>Plantago coronopus</i> *	0		AKU 16043
<i>P. lanceolata</i> *	c	1 +	CHR 184226 B
<i>P. major</i> *	0		
<i>Polycarpon tetraphyllum</i> *	c	c + 0	CHR 183351 B
<i>Portulaca oleracea</i> *	E	E	
<i>Prunus persica</i> R	1	1 + 0	AKU 16104
<i>Pseudognaphalium luteoalbum</i>	c	1 + 0	AK 165079 B, AK 165113 A
<i>Pseudopanax lesssonii</i>	s +	1 + r +	
<i>Ranunculus parviflorus</i> *	0 +		AKU 16108, ? CHR 183337
<i>Rorippa gigantea</i>	1	1 +	AKU 16060
<i>Rubus idaeus</i> R	1		AK 165164
<i>Rumex acetosella</i> *	1c		CHR 183357
<i>R. conglomeratus</i> *	c		
<i>R. crispus</i> *	0		
<i>R. pulcher</i> *	E		
<i>Sagina procumbens</i> *	0		CHR 183347
<i>Salix caprea</i> R	r		
<i>Samolus repens</i>	0	0 + 0 + 0	CHR 184224 B
<i>Sarcocornia quinqueflora</i> ssp. <i>quinqueflora</i>	c	0 0 + c	CHR 183358 B
<i>Scleranthus biflorus</i>	1		CHR 183345 & 354433
<i>Selliera radicans</i>	E		
<i>Senecio bipinnatisectus</i> *	1 +	1 +	AKU 16071 H
<i>S. glomeratus</i>	0 +		AKU 16080 B, AKU 16143 L
<i>S. hispidulus</i>	c	1	AK 165086 B, AKU 16067 H
<i>S. laevis</i> ssp. <i>laevis</i>	c	c 0 0	AKU 16079 B, AK 165159 L
<i>S. laevis</i> cf. <i>Cuvier</i> form	1c +		AKU 16081 & 16105
<i>S. minimus</i>	1	1 +	AKU 16072
<i>Sicyos angulata</i>	1	1c	CHR 184231 B
<i>Silene gallica</i> *	0		CHR 183352
<i>Sisymbrium officinale</i> *	0		
<i>S. orientale</i> *	C		CHR 183341
<i>Solanum americanum</i>	c	0 0	AK 165160 L
<i>S. nigrum</i> *	1	1 +	CHR 184230 B
<i>Sonchus asper</i> *	r +		AKU 16066
<i>S. oleraceus</i> *	c	0 0	AKU 16136 B
<i>Spergularia media</i>	c	0 0	CHR 183349 B
<i>S. rubra</i> *	1	0 +	AKU 16036
<i>Stellaria media</i> *	0	0 +	AKU 16064 H
<i>S. parviflora</i>	0 + +	1 +	AKU 16038 B
<i>Symphylitum ? officinale</i> R	1		
<i>Tetragonia trigyna</i>	0	0 + 1 +	AK 165100 B
<i>Trifolium dubium</i> *	0	1 + 1 +	
<i>T. glomeratum</i> *	1 +		AKU 16102

<i>T. pratense</i> *	G,E		
<i>T. repens</i> *	G,E		
<i>T. subterraneum</i> *	I		AKU 16101
<i>Tropaeolum majus</i> R	I		AKU 16099
<i>Ulex europaeus</i> *	O		
<i>Veronica persica</i> *	E		
<i>Vicia sativa</i> *	C		
<i>Viola odorata</i> R	G		
<i>Wahlenbergia gracilis</i> agg.	O+		CHR 184227
Monocotyledons			
<i>Acianthus forficatus</i> var. <i>sinclairii</i>	G		
<i>Agave americana</i> * R	I		
<i>X. Agropogon litoralis</i> *	I		AKU 16134
<i>Agrostis capillaris</i> *	I		AKU 16129
<i>Aira caryophylla</i> *	C	I	C
<i>Amaryllis belladonna</i> R	I		
<i>Anthraxanthum odoratum</i> *	C	F	O+
<i>Arthropodium citratum</i>	Ic	O	O+
<i>Asclepias banksii</i>	O	I+	CHR 183330 B
<i>Avena barbata</i> *	O	O	CHR 193863 B
<i>Briza maxima</i> *	O	O	AK 165081 B
<i>B. minor</i> *	O	I	O+
<i>Bromus diandrus</i> *	O+	F+	O
<i>B. hordeaceus</i> *	C	C+	O
<i>B. willdenowii</i> *	C		
<i>Carex flagellifera</i>	C	O+	O+
<i>C. spinosistris</i>	I+	O	AKU 16065 H, CHR 354443 A
<i>C. testacea</i>	O+	O	AKU 16046 A
<i>C. virgata</i>	Ic		
<i>Chionochloa bromoides</i>	C	A	C
<i>Cordylone australis</i> x <i>C. banksii</i> R	S		CHR 183325 B
<i>Cortaderia splendens</i>	C	C	C
<i>Crocodynia x crocosmiflora</i> * R	I		CHR 192597 B
<i>Cyperus ustulatus</i>	C	C	C
<i>Dactylis glomerata</i> *	A	O	O
<i>Deyeuxia billardieri</i>	I	C	O
<i>Dianella nigra</i>	O+	O	AK 165093 B, AK 165151 H
<i>Dichelachne crinita</i>	O+	O	CHR 183331 B
<i>Eleocharis acuta</i>	I	F	O
<i>Elymus multiflorus</i>	O+	I+	
<i>Elyrigia repens</i> *	I+		
<i>Eragrostis browii</i> *	O		AKU 16103
<i>Festuca arundinacea</i> *	G	F	AK 165152
<i>F. rubra</i> *			
<i>Giladiolus</i> (modern hybrids) R	I		AKU 16133
<i>Holcus lanatus</i> *	A	F+	E
<i>Iris foetidissima</i> R	I		
<i>Juncus bufonius</i> *	I		
<i>Lachnagrostis filiformis</i> agg.	C	I	A
<i>Leptocarpus similis</i>	O	Ic+	C
<i>Lilium</i> ? <i>longiflorum</i> R	I		CHR 183326 B, CHR 354442 A
<i>Lolium perenne</i> *	O		CHR 183334 B
<i>Microtis unifolia</i>	O+	F+	O+
			AK 165066
			AK 165088 B, AKU 16050 A

<i>Narcissus</i> sp. or hybrids R	?		
<i>Opismenus imbecilis</i>	I		
<i>Paspalum dilatatum</i> *	A		CHR 183328 B
<i>P. orbiculare</i>	G		
<i>Phormium tenax</i>	C	A	A
<i>Poa anceps</i> ssp. <i>anceps</i>	C	C	C
<i>P. annua</i> *	O		
<i>P. pratensis</i> *	O		AK 165090 B
<i>Polygonum monspeliensis</i> *	O		AKU 16106
<i>Ripogonum scandens</i>	F+		AKU 16077
<i>Rytidosperma bianulata</i>	G		
<i>R. caespitosum</i> *	E	O+	AKU 21390
<i>R. pilosum</i> *	E	E	
<i>R. racemosum</i> *	O+	O+	AKU 16068, AKU 21391
<i>R. unarede</i>	C	E	AKU 16032 B
<i>Scirpus cernuus</i>	C+	O+	AKU 16035 B, AKU 16045 A
<i>S. nodosus</i>	O	I+	O+
<i>Sporobolus africanus</i> *	A	A	C
<i>Stenotaphrum secundatum</i> *	C	O+	O+
<i>Theymitra longifolia</i>	G	O+	O+
<i>Vulpia bromoides</i> *	C	I	O
<i>V. myuros</i> *	G	E	
<i>Watsonia bulbifera</i> * R	I		
<i>Zantedeschia aethiopica</i> *	O		

Dubious and excluded records

Acaena anserinifolia - Burgess (Gillham 1960), is misidentified *A. novae-zelandiae* (CHR 184202).
Coprosma robusta - Burgess (Gillham 1960), is misidentified *C. macrocarpa* (CHR 111648).
Eriodia (*Rhagodia*) *triandra* - Lizard Isle (Esler 1978), most likely misidentified *E. trigonos*.
Leptospermum ericoides and *L. scoparium* - Lizard Isle (Esler 1978), in error for Fanal Island column.
Matba rotundifolia? - Burgess (Gillham 1960), is misidentified *Modiola caroliniana* (CHR 183372).
Parsonsia heterophylla - Burgess (Gillham 1960 and most likely Esler 1978), is misidentified *P. capsularis* (CHR 111647).

The following Gillham (1960) records are presumed synonymous with plants in the present species list; the likely species is given in brackets:

Centaurium australe (*C. erythraea*)
Geranium dissectum var. *glabratum*? (*G. solanderi*)
G. microphyllum? (*G. molle*)
Hebe salicifolia (*H. sp.* "Y")
Mentha arvensis? (*M. spicata*)
Oxalis corniculata (*O. exilis*)
Pelargonium quercifolium? (*P. x asperum*)
Phormium colensoi (*P. tenax*)
Rumex obtusifolius (*R. conglomeratus*)

DISCUSSION

The three main northern Mokohinau Islands lack the diverse forest areas present on Fanal Island, and the low proportion of native species in the northern group (especially Burgess Island) compares poorly with the less recently

disturbed Fanal Island (Table 1). The severity of modification in this northern group is indicated by the scarcity or absence of hardy native tree and shrub species which are usually common on Hauraki Gulf Islands e.g. mahoe (*Melicope ramiflora*), kanuka (*Kunzea ericoides*), mapou, *Coprosma rhomboides* and houpara. This is further indicated by the fact that Fanal Island has 43 native species not present in the northern Mokohinaus.

Of the seven important, northern Mokohinau woody plants listed by Sander in 1889, *Olearia furfuracea* now appears extinct there - though still present on Fanal Island; *Hebe* and *Pittosporum* are local in their distribution; *Carmichaelia* occurs occasionally; and the other three species are still common. This further reduction in woody species was noted by Gillham (1960), but when compared with the present survey, *Pittosporum*, *Hebe* and *Carmichaelia* appear to have increased in frequency over the last 27 years in the northern Mokohinaus.

Although more modified, the northern Mokohinaus contain 17 native species unrecorded for Fanal Island. Of these, four were not seen by me and are unvouchered; *Asplenium bulbiferum*, *Paspalum orbiculare*, *Ripogonum scandens* and *Selliera radicans*. The absence of a beach or swampy area makes it unlikely for five of the 17 species (*Atriplex*, *Calystegia soldanella*, *Carex virgata*, *Eleocharis*, *Lilaopsis*) to occur on Fanal Island.

Conversely there are four adventive species on Fanal Island that have not been recorded for the northern Mokohinaus; pampas (*Cortaderia jubata*), selfheal (*Prunella vulgaris*), *Lactuca saligna* and *Gnaphalium ustulatum*. It is likely pampas with its wind-blown seed will reach the northern Mokohinaus before long. Because of the abundance of open sites there, it will have a major impact if it establishes.

In the present account 24 native and 22 adventive species are new to the northern Mokohinaus. Of these additions six native and 20 adventive species are new records for the total Mokohinau Group. Although the three main islands of the northern Mokohinaus are included in this paper, there are many smaller islands which have been omitted. These may contain a few additional species for the group e.g. *Linum monogynum* was on 'Stack H.' Other species will have remained undetected because they are present in very low numbers, persisting in marginal habitats due to the fires and grazing in the past. Such plants should now multiply, spread and become evident in the future.

Several of the exotic annuals, which require open sites, listed by Gillham and Esler for Burgess Island, were not recorded during the present survey. Many of these plants will be heading towards extinction on Burgess with the cessation of grazing.

Regeneration of the northern Mokohinaus will occur very slowly as the seed source for most native species is extremely limited. Also the dense swards of flax, bracken and exotic grasses will be difficult for many species to establish in. The frequent dry summers and exposure of virtually all sites will further hinder regeneration. Gillham (1960) noted that since the last fire on Aitahu

and Hokoromea Islands, 25 years regeneration produced flax with scattered shrubs. Now with over 51 years of regeneration, there is still predominantly flax, but with scattered, medium-sized pohutukawa as well.

Fanal Island may act as a seed source for several native plant species in the future. As forest develops on the northern Mokohinaus land bird travel between the islands should increase and thereby increase the dispersal of many plant species. Large-seeded plants such as karaka (*Corynocarpus levigatus*), puriri (*Vitex lucens*), kohokohe (*Dysoxylum spectabile*), tawapou (*Planchonella costata*) and perhaps *Nestegis apetala*, pigeonwood (*Hedycarya arborea*), nikau (*Rhoplostylis sapida*) will depend on the fruit-eating New Zealand pigeon (*Hemiphaga novaezealandiae*) for dispersal if they are to reach the northern Mokohinaus from Fanal Island. New Zealand pigeons are common on Fanal Island (Bellingham 1980) but have not been observed in the northern group (McCallum 1980).

It will be interesting to see which of the 41 garden remnant plants on Burgess Island will persist. Ten of these plants have already started to naturalise and four of these may be very successful in the future if not eradicated; *Agave*, *Crassula multicaeva*, *Crocosmia* and *Watsonia*.

Table 1. Floral statistics* of the four main Mokohinau Islands.

	Burgess Island	Hokoromea Island	Aitahu Island	Three islands combined	Fanal Island	TOTALS
Native ferns and fern ally	21	10	8	22	25	30
Native dicotyledons	53	41	43	61	78	86
Native monocotyledons	26	22	19	28	32	38
Adventive dicotyledons	72	17	19	77	22	80
Adventive monocotyledons	29	14	11	31	11	32
Adventive sub total	101	31	30	108	33	112
Native sub total	100	73	70	111	135	154
TOTALS	201	104	100	219	168	266
% native	49.8	70.2	70.0	50.7	80.4	57.9

* hybrids, non-naturalised garden remnants and two historical records (*Pinus* and *Cortylus terminalis*) are excluded.

*from Cameron and Wright (1990).

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REFERENCES

- Allan, H.H. 1961: Flora of New Zealand. Vol. I Government Printer, Wellington.
- Atkinson, I.A.E. 1986: Rodents on New Zealand's northern offshore islands: distribution, effects and precautions against further spread. In: The offshore islands of northern New Zealand, eds A.E. Wright and R.E. Beever. Department of Lands and Survey, Information Series 16: 41-45.
- Bellingham, P.J. 1980: Birds of Fanal Island, Mokohinau Islands, New Zealand. *Tane* 26: 63-67.
- Brownsey, P.J.; Given, D.R. & Lovis, J.D. 1985: A revised classification of New Zealand pteridophytes with a synonymic checklist of species. *New Zealand Journal of Botany* 23(3): 431-489.
- Cameron, E.K. & Wright, A.E. 1990: Additional vascular plant records for Fanal Island, Mokohinau Islands. *Tane* 32: 133-135.
- Cheeseman, T.F. 1925: Manual of the New Zealand flora. Ed. 2. Government Printer, Wellington.
- Eagle, A. 1982: Eagles trees and shrubs of New Zealand. 2nd series. Collins, Auckland.
- Edgar, E. 1971: Nomina nova plantarum Novae-Zelandiae 1960-1969. Gymnospermae, Angiospermae. *New Zealand Journal of Botany* 9 (2): 322-330.
- Edgar, E. & Connor, H.E. 1978: Nomina nova II, 1970-76. *New Zealand Journal of Botany* 16(1): 103-118.
- Edgar, E. & Connor, H.E. 1983. Nomina nova III, 1977-1982. *New Zealand Journal of Botany* 21(4): 421-441.
- Esler, A.E. 1978: Botanical features of the Mokohinau Islands. *Tane* 24: 187-197.
- Fleming, C.A. 1950: Geology of the Mokohinau Islands, North Auckland. *Transactions of the Royal Society of New Zealand* 78: 255-268.
- Gardner, R.O. 1984: *Geranium solanderi* and allies in New Zealand. *New Zealand Journal of Botany* 22(1): 127-134.
- Gillham, M.E. 1960: Plant communities of the Mokohinau Islands, northern New Zealand. *Transactions of the Royal Society of New Zealand* 8: 79-98.
- Healy, A.J. 1984: Standard common names for weeds in New Zealand. Ed. 2. New Zealand Weed and Pest Control Society, Hastings.
- Healy, A.J. & Edgar, E. 1980: Flora of New Zealand. Vol. III. Government Printer, Wellington.
- Holmgren, P.K.; Keuken, W. & Schofield, E.K. 1981: Index Herbariorum. *Regnum vegetabile* 106: 1-452.
- McCallum, J. 1980: The birds of the northern Mokohinau Group. *Tane* 26: 69-78.
- McCallum, J. 1986: Evidence of predation by kiore upon lizards from the Mokohinau Islands. *New Zealand Journal of Ecology* 9: 83-87.
- Moore, L.B. & Edgar E. 1970: Flora of New Zealand. Vol. II. Government Printer, Wellington.
- Moore, P.R. 1985-1986: Archaeological sites and obsidian deposits on the Mokohinau Islands, Hauraki Gulf. *Tane* 31: 75-84.
- New Zealand Meteorological Service 1983: Summaries of Climatological Observation to 1980. *New Zealand Meteorological Service Miscellaneous Publication* 177: 1-172.
- Parris, B.S. 1971: Miscellaneous plant records for northern offshore islands. *Tane* 17: 169-171.
- Sandager, F. 1889: Observations on the Mokohinau Islands and birds which visit them. *Transactions of the New Zealand Institute* 22: 286-294.
- Wright, A.E. 1980: Vegetation and flora of Fanal Island, Mokohinau Group. *Tane* 26: 25-43.