Extension of Threatened Native Plant Garden coastal habitats. August 2006. (Pics: Jack Hobbs).

Threatened species will include NZ spinach (*Tetragonia tetragonioides*), *Leptinella tenella, Mimulus repens* and the Regionally threatened *Puccinellia stricta.*

Sand dune (foredune and stabilised dunes) / dune forest

The sand dune habitat will interpret the fragility of coastal dunes and explain the importance of its integrity in maintaining diverse coastal ecology. Coastal dune systems within the Auckland region are collapsing due to inappropriate recreational disturbance. Why do we continue to allow fragile coastal areas to be used for vehicular traffic? Interpretation will include solutions on how everyone can help protect these fragile ecosystems. The endemic, sand-binding plant pingao (*Desmoschoenus spiralis*) will be a feature plant of the replicated mobile dune together with *Spinifex sericeus*.

A stabilised dune system will be established showing the transition from mobile dune to dune forest. Species to be included: *Carmichaelia australis, Corynocarpus laevigatus, Dysoxylum spectabile, Leptospermum scoparium*, *Kunzea ericoides, Mida salicifolia* and the regionally threatened *Hebe diosmifolia, Pseudopanax ferox* and sand tussock (*Austrofestuca littoralis*).

Shell bank

The shell bank will feature transient species such as the NZ spinach (*Tetragonia tetragonioides*) now rarely found in the region and the closely related, commonly occurring native spinach (*Tetragonia implexicoma*). Cook's scurvy grass (*Lepidium oleraceum*) will also feature.

Now that this project is well under way my attention now turns to funding for the South Pacific pavilion, which has been planned for this garden since 1999. I trust that it won't take another five years to secure funds for this development! The pavilion will be of a contemporary design with overhead sailcloth, low-rammed earth walls and timber slatted seating. A place to ponder, rest, shelter and perform cultural performances such as harakeke weaving and storytelling.

Acknowledgements

Grateful thanks to Dr. Graham Robertson for his comments on this article and to Bec Stanley and Ewen Cameron for their letters of support to the Lottery Environment and Heritage Board (LEHB). A grant of $33,100 was awarded to the ARC by the LEHB for completion of this project together with $13,000 from the Friends of Auckland Botanic Gardens.

Vascular flora and fauna of twelve small northern New Zealand islands

Ewen K. Cameron

This article covers material from my talk to the Auckland Botanical Society, 5 April 2006 – with additional observations on two islands (Hikunui and Watchman).

This talk covers 12 islands and islets from the Three Kings Islands (34° 11′ S) in the north to Opoutere (37° 7' S) on the southeast coast of the Coromandel Peninsula (Fig. 1). Exploring and documenting the flora and vegetation of small northern islands has been an enjoyable activity often carried out in my holidays or weekends over the last 25 years. Islands' definite boundaries make them ideal study areas. Not knowing what may be present is what interests me the most. Physical difficulty of access is all part of the challenge which may involve quite an adventure to get ashore, or to reach cliff-vegetation, or to get off the island when the weather deteriorates. Unusual native plants or surprising weeds all help to indicate the wider picture: the status of the native flora and the spread of exotic species. Islands with large seabird populations and no rats make interesting

comparisons with those lacking seabird colonies and with rats. A geographical range of small islands in different states of disturbance and their biota is presented.

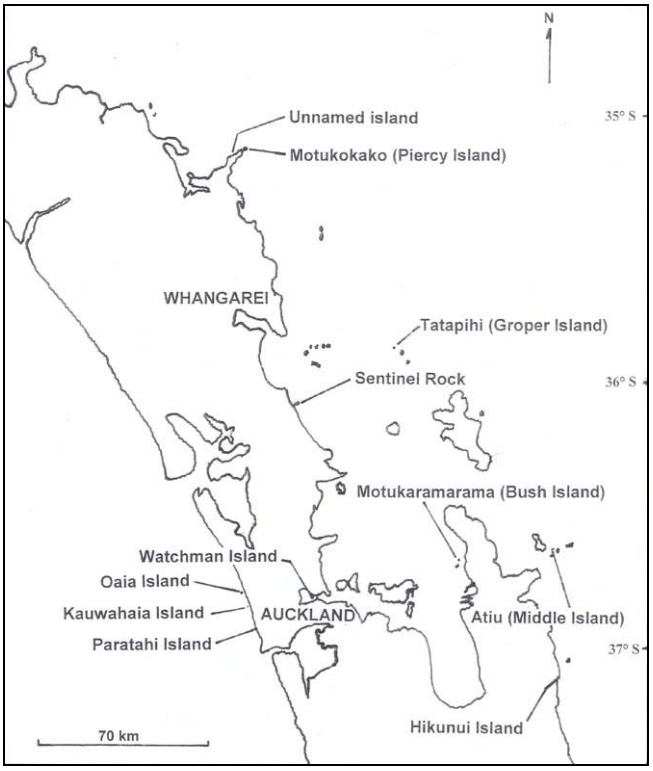

Fig. 1. Location of 11 of the 12 small northern New Zealand islands (note Hinemoa Rock of the Three Kings Islands is not included).

Small islands are very numerous in northern New Zealand. For the Hauraki Gulf, Lee (1999) based on Taylor (1989: appendix 1), showed that there were 351 islands ≥0.1ha, and 67% of these were 0.1–1.0ha in size (islands <0.1ha were omitted because they are unlikely to support vascular plants). The island examples discussed below range from 0.1–13.1ha, with most ≤3.0ha. Many small islands are not formally owned and exist in legal limbo as "uninvestigated" (Lee 1999).

Ideal prerequisites for islet study: surfing background; being seasick-free; enjoy boating, kayaking and swimming; a head for heights; have good field companions; enjoy all aspects of natural history; and a sense of adventure.

Good signs

When first landing on an island encouraging fauna signs include copious invertebrates indicating the island is rat-free, e.g. darkling beetles (c.150 spp. in New Zealand) or large native shore earwigs (*Anisolabis littorea*) under pieces of wood, etc. Good reptile numbers also indicate a lack of rats. Large numbers of nesting sea birds like white-fronted terns, red-billed gulls or burrowing species (petrels, shearwaters) – all indicate a lack of mammalian predators (e.g. rats, stoats, possums, cats).

The presence of the more special northern "island" plant species. Many of these species would have once been common on the mainland coast but have now been mainly reduced to island "refugia" because of various mainland pressures, e.g. from direct grazing, seed destruction, lack of nutrients, pest pathogens, competition with weeds, etc. These species would include: coastal mahoe (*Melicytus novae-zelandiae*), Cook's scurvy grass (*Lepidium oleraceum*), milk-tree (*Streblus banksii*), mawhai (*Sicyos australis*), and parapara (*Pisonia brunoniana*).

Bad signs

Husking stations of chewed fruit, e.g. karo (*Pittosporum crassifolium*) capsules indicates rats are present. Mammalian faecal pellets indicate the presence of certain mammals, e.g. rats, possums, etc. Presence of aggressive weed species, e.g. mile-a-minute (*Dipogon lignosus*), smilax (*Asparagus asparagoides*), kikuyu grass (*Pennisetum clandestinum*), pampas grass (*Cortaderia selloana*), boxthorn (*Lycium ferocissimum*) and bone-seed (*Chrysanthemoides monilifera*) can be very detrimental to the native vegetation.

Rodents are major predators of birds (Atkinson 1973, Dingwall et al. 1978, Imber 1984, Moors 1985, Booth 1995, 1996, Lovegrove 1996, Pierce 1998), lizards (Whitaker 1973, 1978) and are detrimental to certain plant species (Atkinson 1972, 1986, Campbell 1978, 2002, Campbell et al. 1984, Allen et al. 1994, Campbell & Atkinson 1999, 2002) in New Zealand.

Unnamed island, near Cape Brett, Bay of Islands (Fig. 2)

2.1ha; 45m asl; 72* spp. (<93% native); 0.01km; ship rat, possum; Cameron 1980

(This summary = island area; height; total vascular spp. (% native); proximity to larger land mass; exotic mammals present; references) (= adventive species under recorded for this island)*

On 23 June 1980 I surveyed my first small island, unnamed, when returning because of rough weather from a failed attempt to land on the nearby Motukokako (Piercy Island) at Cape Brett. The adjacent mainland at that time had feral goats and the islet stood out with its intact understorey and ground cover. Several special "island" plants were present: coastal mahoe, tawapou (*Pouteria costata*) and coastal maire (*Nestegis apetala*). There were no goats present, but, faecal pellets indicated the presence of possums and probably ship rats. No environmental weeds were recorded.

Motukokako (Piercy Island), off Cape Brett, Bay of Islands (Fig. 3)

6.9ha; 152m asl; 101 spp. (82% native); 0.8km; none; Cameron & Taylor 1991a

Seven years later, in 1987, during a successful visit to this steep island with Graeme Taylor we were surprised to find 1.3ha of forest on the upper NE-

slope dominated by tawapou. Other "island" plants noted included: milk-tree, parapara, coastal mahoe, tawaroa (*Beilschmiedia tawaroa*), koru (*Colensoa physaloides*), *Rorippa divaricata*, *Wahlenbergia littoricola* and the bright orange epiphytic lichen *Teloschistes flavicans*. The fauna included: two petrel species, including a colony of black-winged petrel – which appeared to be new colonists; red-crowned parakeet; two lizard species; and a medium-sized land snail (*Rhytida dunniae*). The titoki was intermediate in leaflet size and leaflet number between the Three Kings endemic taxon (*Alectryon grandis*) and the mainland species (*A. excelsus*), which later led to a closer look at these taxa and to rank the differences at subspecies level (de Lange et al. 1999). No environmental weeds were recorded. Additions to our 1991 list are *Macropiper excelsum* (omitted by mistake) and *Carmichaelia williamsii* seen by Atkinson (Heenan & de Lange 1999), here at its northern geographical limit.

Watchman Island, Waitemata Harbour, Auckland (Fig. 4)
0.1ha; 6m asl; 27 spp. (30% native); 0.6km; ?rats; Cameron 1988, pers. ob. 2006
Because of my young family in 1987 I looked close to home for some of my botanising, much as Peter de Lange is currently doing (e.g. de Lange et al. 2005). With a Sunday afternoon leave-pass I dusted off my old surfboard and paddled out to the Watchman Island by the Auckland harbour bridge. This highly modified, flat-topped island supported a mainly exotic herbaceous sward, but also include the regionally threatened native geranium, *Geranium retrorsum* (see Stanley et al. 2005, Sperber 2006). This population appears to be the best remaining in the region. Garden snails were present. This island shows that even highly modified inshore islands can support threatened plants – perhaps because of the lack of rabbits that are partial to this thick-rooted species (Peter de Lange pers. comm.), and/or less competition from weeds, especially kikuyu grass which was absent.

A revisit on 26 September 2006 for a photo shoot (see Sperber 2006), at least six plants of the geranium were present, and two were flowering (Fig. 5). The island looked much like it was 19 years before and the only additions were: a single plant of *Oxalis* ? *rubens*, a pair of oystercatchers (no nest) and two old gull nests – most likely of black-backed gull.

Hinemoa Rock, Three Kings Islands (Fig. 6)
5.0ha; 80m asl; 22 spp. (91% native); 1.0km; none; Cameron & Wright pers. ob.
The shrub *Elingamita johnsonii* was first discovered in January 1950 on West Island in the Three Kings Islands by Magnus Johnson and was described as endemic to that island by Geoff Baylis the following year. It was named after its discoverer and the steamer *Elingamite* which in thick fog struck West Island in 1902 killing 45 people. In November 1983 after an unplanned two-night sojourn on West Island, Anthony Wright and I were put ashore by zodiac on the adjacent Hinemoa Rock for a quick botanical survey. After traversing a gannet colony with only minor pecks, we jointly spotted the red fruit of *E. johnsonii* on the karaka (*Corynocarpus laevigatus*)-like trees below on SW side of the island – extending its known distribution to two islands (Godley 1993). In 1996 Peter de Lange found an *E. johnsonii* sapling on the islet between Hinemoa Rock and West Island. Only two exotic plants were seen on Hinemoa Rock (*Poa annua*, *Solanum nigrum*); and "island" species included *Parietaria debilis,* taupata (*Coprosma repens*), *Einadia trigonos,* NZ ice-plant (*Disphyma australe*) and a few plants of Cook's scurvy grass.

On the adjacent West Island (16.3ha) in November 1983 more than 15 plants of Cook's scurvy grass were present among a red-billed gull colony (see photo in Wilson and Given 1989: p.83). Oddly, because there was still plenty of guano (see Discussion, point 6), 20 years later at the same time of year I could only locate one small Cook's scurvy grass plant at this site.

Hikunui Island, Opoutere, SE Coromandel Peninsula (Fig. 7)
0.2ha; 12m asl; 17 spp. (65% native); 0.1km; none; Cameron 2005, pers. ob. 2006
At the mouth of the Wharekawa Harbour is a rocky islet, Hikunui Island, <100m offshore that I boogie boarded out to in 1997, 1998 and 2006. Red-billed gulls, white-fronted terns and a pair of reef herons nest on the islet. The two main plant species were taupata and NZ ice-plant; *Einadia trigonos, Spergularia media*, coastal mahoe and *Lachnagrostis littoralis* were also present, the latter four species were unrecorded on the adjacent mainland.

On 29 July 2006, I revisited this island at low tide and walked right around and over most of it. New additions: *Crassula sieberiana, Poa annua* and *Stellaria media* – all quite local. Other 2006 observations: no pohutukawa seen; coastal mahoe had spread (or a separate plant?) c.4m to the west, prostrate amongst rough rock and intermixed with taupata; the single karo was still present c.1.6m tall, and 5 new seedlings were present 20-40cm tall; 2 old shag nests present in large taupata towards south end of the island (not the more northern taupata bush they were previously nesting in), 3 old pale blue shag eggs on the ground c.52mm long which shows that the nesting shags are little shags; 1 pair of variable oystercatchers, 1 kingfisher, 1 pied shag and 1 little shag were all roosting near water level. The vegetation looked bright green and lush compared with my past summer-autumn visits, making the point that it's important to visit these islands several times to record all their biota, especially at different times of the year (the annuals are more obvious in the winter).

Sentinel Rock, Mangawhai Heads (Fig. 8)
0.2ha; 21m asl; 50 spp. (64% native); 0.3km; Norway rat; Cameron & Taylor 1997
The islet can be reached at low tide with dry feet, and is commonly visited, but few people venture up the steep sides to the flat summit. It was rather surprising that in the low summit vegetation of flax (*Phormium tenax*), *Ficinia nodosa* and exotic grasses there was a breeding colony of grey-faced petrels represented by >50 burrows. The islet used to be crowned with pohutukawa (*Metrosideros excelsa*) until a fire in 1954. The modified flora contained no special "island" plants, but the presence of the single bone-seed in 1992 (uprooted) probably marked the beginning of that species trying to establish from the mainland.

Atiu (Middle Island), Mercury Islands (Fig. 9)
13.1ha; 80m asl; 96 spp. (75% native); 1.7km; none; Atkinson 1964, Cameron 1990
In terms of flora and fauna conservation this is one of New Zealand's most outstanding small islands with minimal human disturbance. It has never had rats. Although nearly 4 times larger it compares well with Sail Rock in the outer Hauraki Gulf which Atkinson (1972) reported as the least modified of the small islands so far described from the Hauraki Gulf (Sail Rock: *3.4ha; 139m asl; 45 spp. (87% native); 3.2km; none; Atkinson 1972*). I was fortunate to have two weeklong trips camping on Atiu in January and December 1983 assisting Ian Southey who was studying the lizards. Main points:

An abundance of "island" species: milk-tree – a major forest component and only known nationally as such on 3 small islands and is best developed on Atiu (Atkinson 1986); tawapou – local; karo – common; taupata – abundant; NZ ice-plant – abundant; coastal mahoe – common; mawhai – common; *Einadia trigonos* – abundant; *Parietaria debilis* - locally common; poroporo (*Solanum aviculare*) – abundant; Cook's scurvy grass – six populations; and *Asplenium haurakiense* – abundant.

The apparent absence of manuka (*Leptospermum scoparium*)**,** tauhinu (*Ozothamnus leptophyllus*), bracken (*Pteridium esculentum*); the low frequency of pohutukawa and flax; and the apparent localised charcoal deposits were interpreted by Atkinson (1962, 1964, 1972) as evidence of little disturbance by fire for some considerable time on Atiu. More recent findings of charcoal and bracken on the island suggest it has been burnt at least once (Cameron 1990).
Environmental weeds: barberry (*Berberis glaucocarpa*) – 2 seedlings (uprooted); boxthorn – 3 small populations; inkweed – locally abundant (likes high nutrients); Japanese wax-tree (*Rhus succedanea*) – 2 seedlings (1 dug up and grown on, AK 272946) the first wild record for New Zealand; and woolly nightshade (*Solanum mauritianum*) 1 sapling (uprooted). Frugivorous birds probably introduced all these species, the most likely vector was starlings which in 1983 roosted in the forest every evening in their thousands.

It has the largest number of reptile species known for such a small area in New Zealand: tuatara, 7 species of skinks (mainly nocturnal species), and 3 species of geckos – several are threatened species**.**

Tens of thousands of nesting seabirds: diving petrels, flesh-footed and little shearwaters were common; grey-faced petrel, fluttering shearwater and little blue penguins were present in smaller numbers. The little shearwaters were interesting to see run up the trees to get airborne, unlike most other shearwaters and petrels which launch from bush margins, cliff tops, etc. The smooth milk-tree trunks bore the scratch marks from their toes.

An endemic tusked weta (*Motuweta isolata*) was discovered by Tony Whitaker in 1970 and described 27 years later (Johns 1997). We were fortunate to see both male and female wetas which appeared in the forest one summer evening after rain (Fig. 10), evidently they remain underground only to emerge to feed on the darkest nights, when its calm, warm and damp (McIntyre 2001).

Tatapihi (Groper Island), Mokohinau Islands (Fig. 11)
3.0ha; 39m asl; 20 spp. (100% native); 3.8km; none; de Lange et al. 1995
Tatapihi is Auckland region's most remote island and the regions largest lacking introduced plant species. Peter de Lange and I visited the island by helicopter for 2 hours in September 1994. The tallest vegetation of this rocky island was a crowning taupata shrubland with coastal mahoe to 1.5m tall. The island was in pristine condition with no exotic plants and no exotic mammals. The main points:

The "island" plants: taupata – abundant; NZ ice-plant – abundant; coastal mahoe – locally common; *Einadia trigonos* – frequent; *Parietaria debilis* – locally common; *Asplenium haurakiense* – scarce.
Large population of diving petrels: 2000 breeding pairs which burrow under NZ ice-plant and taupata.
Seven lizard taxa (2 geckos, 5 skinks).

Kauwahaia, Te Henga, west Auckland (Fig. 12)
0.7ha; 20m asl; 89 spp. (60% native); 0.05km; ship rat eradicated Dec 1989; Taylor & Cameron 1990, G.A. Taylor pers. comm..
This privately owned island lies on the north side of Erangi Point and is about the size of a large two-storied house. Apart from the cliffs it can be accessed at low tide (ladder required). The woody vegetation is dominated by karo, houpara (*Pseudopanax lessonii*) and kawakawa (*Macropiper excelsum*). Remarkably the island supports some 300 pairs of winter-nesting grey-faced petrels and a small breeding population of diving petrels, sooty shearwaters and flesh-footed

shearwaters. Graeme Taylor has been studying the seabirds on this island for the last 17 years and I have occasionally assisted him. In December 1989 Taylor poisoned the ship rats and has maintained bait stations on the island since that time. Including the adjacent Ihumoana Island on the south side of Erangi Point with 100 pairs of grey-faced petrels, Taylor has banded 4,000 petrels and shearwaters on the two islands over 17 years. Main points:

The "island" plants: taupata – occasional; NZ ice-plant – abundant (increased since rat eradication).

The first Waitakere locality for *Senecio rufiglandulosus* and it is at its northern geographical limit (Cameron 2005b).

The glaucous native grass grows on the cliffs: *Elymus multiflorus.*

A remarkable seabird population, with four breeding species – this is the only island connected to the New Zealand mainland with more than two breeding species of petrel (G.A. Taylor pers. comm.).

Taylor (pers. comm.) believes Kauwahaia, Ihumoana and Erangi Point should be the centre of a 'mainland island' management project to protect and expand the best inshore petrel/shearwater colony in New Zealand.

Oaia (Fig. 13) & Paratahi (Fig. 14) Islands, west Auckland

Oaia: 0.14ha; 25m asl; 4 spp. (100% native); 1.4km; none; Cameron & Taylor 1989, de Lange 1997

Paratahi: 0.3ha; 12m asl; 4 spp. (100% native); 0.25km; none; Cameron 1991

These two very exposed west coast islets are more rock than vegetation, each support only four species of vascular plants. Both support large seabird populations and both are now pull-out areas for New Zealand fur seals. I swam out to Paratahi in 1991, and Graeme Taylor and I were taken out to Oaia by the Muriwai surf club on 6 March 1988 at the onset of Cyclone Bola. Main points:

NZ ice-plant, taupata are present on both islets.

Spinach (*Tetragonia implexicoma*) and shore groundsel (*Senecio lautus*) are present on Paratahi, and "island" plants *Einadia trigonos* and Cook's scurvy grass were present on Oaia. The Cook's scurvy grass is interesting because it is the only west Auckland record of this species; it was first collected on Oaia in 1953 and again accidentally in 1996 by Peter de Lange (de Lange 1997).

Large gannet colony on Oaia.

Red-billed gulls and white-fronted terns nest on Paratahi.

Why is taupata so common on Paratahi, yet so uncommon along the adjacent coast? The high amount of bird nutrients would certainly boost it on the island, perhaps coupled with the absence of rats that may eat its seed and bark?

Motukaramarama (Bush Island), west Coromandel (Fig. 15)

10.9ha; 71m asl; 118 spp. (74% native); 0.5km; Norway rat; Newhook et al. 1971, Esler 1978, pers. ob. 2005-06

I visited this forested island as a day trip in February 2005 and February 2006; previous workers had recorded the flora and vegetation in the 1970s. There are three gannet colonies present. Below the gannet colonies the guano supports lush mats of NZ ice-plant, bushes of taupata (Fig. 16) and Cook's scurvy grass. There are some fine straight-trunked milk-trees in the forest, but not many. A couple of small shrubs of the special "island" plant, *Carmichaelia williamsii*, were present – this species has very low recruitment on islands where kiore are present (Heenan & de Lange 1999).

Discussion: Why are these "island" plants restricted mainly to the islands?

1. Intact habitat

Small islands usually escape land clearances, wetland draining, pastoral farming, plantation forestry, fires, pollution, etc.

2. Absence/fewer of exotic mammals

The exotic plant browsers and grazers such as goat, deer, possum, pig, rabbit and wallabies are usually absent from small islands. However, there was evidence of possums on the unnamed island by Cape Brett (see above). Rats (kiore, ship rat or Norway rat) however, are often present on small islands close to a larger landmass and apart from their animal diet they also eat seed and vegetable matter. Kiore are known to eat flower buds, flowers, leaf laminae, petioles, rhizomes, bark, shoot apices, fleshy fruit, seeds, seed capsules and seedlings (Campbell & Atkinson 1999). The seed predation on islands by kiore of certain plant species can be so severe that recruitment is considerably reduced (Atkinson 1972, 1986, Campbell & Atkinson 1999, 2002, Campbell 2002,), e.g. coastal mahoe, coastal maire, karo, milk-tree, parapara, tawapou and taupata. However, tawapou on Red Mercury were abundant in all size classes when kiore were present (G.A. Taylor pers. comm.). Ship and Norway rats also eat seed, however, Norway rats appear to have less of an impact (Cameron & Taylor 1991b). On small islands lacking water it is suspected that rats also eat succulent plants like NZ ice-plant and glasswort (*Sarcocornia quinqueflora*) (Cameron & Taylor 1991b).

Tony Whitaker showed the importance of small rat-free islands for lizards by observing that many threatened lizard species survived on remarkably small islands in northern New Zealand. He was the first to recognise the problem of rodent predation on lizards by discovering that rat-free islands had a greater species-richness and greater densities of lizards, and that some of these lizard species only survived on islands free of introduced mammals (Whitaker 1973, 1978, Whitaker pers. comm.). Note – lizards may aid plant pollination and seed dispersal (Whitaker 1987).

3. Absence/fewer exotic invertebrates

Exotic garden snails, slugs can virtually defoliate some plant species, e.g. rengarenga lily (*Arthropodium cirratum*). And what do the exotic ants eat?

The illegal planting of marijuana (*Cannabis sativa*) on islands is a threat to island biota because of what might be accidentally transported with the plants, e.g. exotic invertebrates, exotic pathogens and weed species.

4. Absence/fewer exotic diseases

Exotic pathogens (fungi, viruses, bacteria) on native plants may be difficult to detect and are probably more prevalent than realised. The following example is one of the few that has been studied. Thomson & Ebdon (1999) pointed out that mawhai (*Sicyos australis*) was experimentally susceptible to Cucumber mosaic virus (CMV) after Cameron (1992) documented the puzzling decrease of mawhai's natural range over the last 50 years. Since then Delmiglio & Pearson (2006) have shown that CMV can severely affect the growth of mawhai and how CMV may make it more susceptible to other environmental stresses leading to the decline and death of the population. Therefore the cultivation of any cucurbits (as most are susceptible to CMV) near mawhai puts it at risk from CMV and the Department of Conservation (DoC) now bans cucurbits being grown on DoC-staffed islands and is developing strict rules about cucurbits being taken to DoC-managed islands where mawhai is present (Rolien Elliot, DoC, pers. comm.).

5. Absence/fewer weeds

Sullivan et al. (2005) found the proximity and size of human settlement were the dominant factors controlling the number of exotic plant species in adjacent coastal forests. We are just seeing the start of many of these weeds moving out of urban areas and starting to island hop. Weeds with fleshy fruit are usually dispersed by frugivorous birds, e.g. bone-seed, Japanese wax-tree. Many weeds with dry seeds are dispersed by the wind, e.g. by 1993 Mexican devil (*Ageratina adenophora*), mistflower (*A. riparia*), moth plant (*Araujia sericifera*) and pampas grass have all reached the uninhabited Poor Knights Islands which lie 20km off the northeast coast of Northland (de Lange & Cameron 1999). In 2002 on a remote cliff top on eastern Great Island of the Three Kings Islands, a single flowering pampas plant was discovered, presumably from mainland windblown seed some 60km away (*L.J. Forester,* AK 258172) – or did a seed adhere to a bird or human?

The presence of the high-climbing vine, mile-a-minute, on two uninhabited islands, Maria Island of The Noises (Cameron 1998) and Moturemu in the Kaipara Harbour (Cameron & Beard 1990), may be due to the petrels which nest there. Tennyson (1995) suggested that brush wattle (*Paraserianthes lophantha*) possibly got onto Karewa Island in the Bay of Plenty by petrels swallowing the seed because such birds swallow floating objects at sea and that he had observed kowhai (*Sophora* sp.) seeds in the guts of white-faced storm petrels on the Chatham Islands. Storm petrels nest on Maria Island, and grey-faced petrels nest on Moturemu Island. The only problem with this hypothesis was that when I tried to float mile-a-minute seed in seawater it sank. Further experimental work is required with a larger sample, with seeds from different plants, and seed of different ages. An alternative possibility is that humans accidentally took mile-a-minute to both islands, especially because both show human disturbance in the form of a few planted exotic pines and eucalypt species on Moturemu, and Maria has a navigation light at its summit.

Aggressive mat-forming grasses, such as kikuyu and buffalo (*Stenotaphrum secundatum*) grasses prohibit most regeneration of native plants. For example cushions of *Scleranthus biflorus* used to grow on the Auckland volcanic cones (*T. Kirk* collected it on Mt Eden [1863-74], AK 11296), but now in the Auckland region *S. biflorus* is restricted to remote rocky island coasts, and the rocky volcanic cone outcrops are now clothed with swards of kikuyu grass. Exotic grasses may reach islands by different methods, e.g. gulls using seeding grass material for nesting material on inshore islands or hairy grass seeds accidentally adhering among bird feathers. Weedy grass species are quite common around gull colonies (pers. ob.). Colin Ogle (pers. comm.) commented that veldt grass (*Ehrharta erecta*) is beginning to dominate open spaces on islands such as Kapiti, Mana, and some of the Taranaki Sugar Loaf islands (which is supported by specimens in AK herbarium). However, I haven't recorded this aggressive grass yet on any of the smaller northern islands. Kikuyu grass appeared on Kauwahaia Island when someone tried to cultivate marijuana on the island (G.A. Taylor pers. comm.).

6. Nutrients still present

Many of the special "island" plants are restricted, most abundant, or most luxuriant on islands with high amounts of nutrients. Such islands have large numbers of nesting seabirds, such as white-fronted terns, red-billed gulls, gannets, shags, petrels or shearwaters.

Fig. 2. Unnamed island west side, near Cape Brett, Bay of Islands. Jun 1980.

Fig.3. Motukokako (Piercy Island) (south side), off Cape Brett, Bay of Islands. Nov 1983.

Fig. 4. Watchman Island south side at high tide, Waitemata Harbour, Auckland. Sep 2006.

Fig. 5. *Geranium retrorsum* flowering on Watchman Island, Waitemata Harbour. 26 Sep 2006 (AK 297537).

Fig. 6. Hinemoa Rock north side, Three Kings Islands. Nov 1983.

Fig. 7. Hikunui Island northwest side, Opoutere, southeast Coromandel Peninsula. Jul 2006.

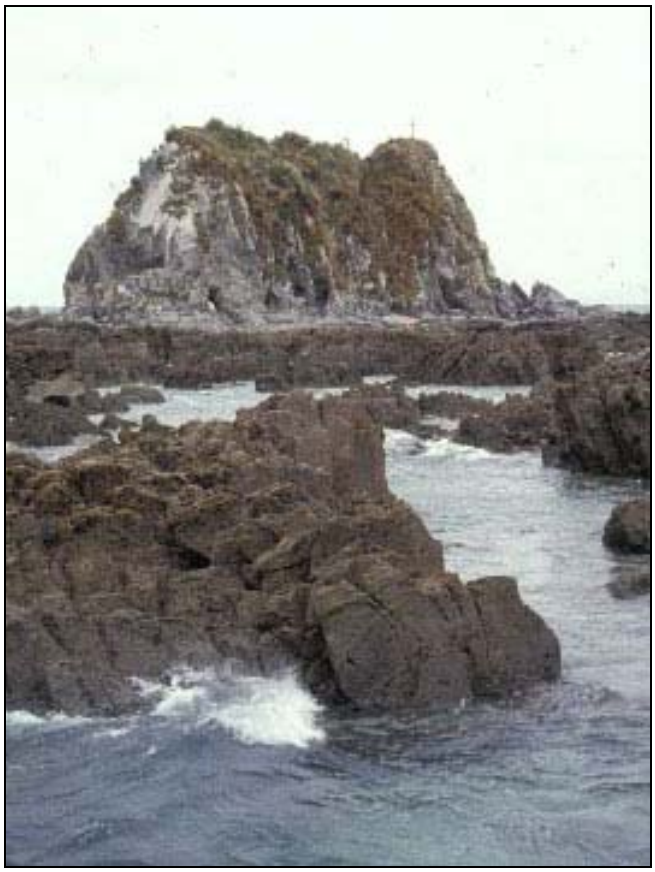

Fig. 8. Sentinel Rock west side, Mangawhai Heads. Mar 1991.

Fig. 9. Atiu (Middle Island) east side, Mercury Islands. Jan 1983.

Fig. 10. Tusked weta (*Motuweta isolata*) on Atiu, Mercury Islands. Dec 1983.

Fig. 11. Tatapihi (Groper Island) northwest side, Mokohinau Islands. Sept 1994.

Fig. 12. Kauwahaia south side, Te Henga, west Auckland, from near the base of Erangi Point. 1 May 2005.

Fig. 13. Oaia Island, Muriwai, west Auckland, from above Maori Bay. Feb 2006.

Fig. 14. Paratahi Island north side, from Comans Track, Karekare, west Auckland. May 2006.

Fig. 15. Motukaramarama (Bush Island) south side, west Coromandel. Feb 2006.

Fig. 16. At its best! Guano-fed lush hanging mats of NZ ice-plant, and prostrate luxuriant bushes of taupata on cliffs below a gannet colony, Motukaramarama (Bush Island) northeast side, west Coromandel. Feb 2006.

Fur seals are making a comeback to northern New Zealand and now pull out on many northern rocky islands; it may not be long before they are again breeding in northern waters and their nutrients terrestrial ecosystems. Sea lions are now known to have breed at the northern tip of the North Island in pre-European times (Gill 1999), but their rookeries were more likely to have been on sandy beaches and associated dunes rather than rocky islands.

British botanist, Mary Gillham (1960 a,b,c), recorded the flora of seabird colonies throughout New Zealand, and noted that many species thrived on these guano-rich islands, e.g. NZ ice-plant, taupata, shore groundsel, Cook's scurvy grass, *Einadia allanii* (most likely *E. trigonos*), glasswort and sea celery (*Apium prostratum*). Gillham (1960c) used Robert Ornduff's term 'ornithocoprophilous' for these guano-associated plants. Colin Ogle (1987) was the first to make the link of the decline of some these plant species being related to the decline of seabird colonies. He related this to human disturbance and predations on the mainland which resulted in seabirds being now restricted to islands for nesting and roosting. Norton et al. (1997) expanded on this and suggested that the major cause of the decline of the coastal New Zealand *Lepidium* species was the decline in seabirds through predation and seals through past culling - they saw the role of seabirds and seals as crucial for keeping sites open by disturbance, dispersing seed, and providing nutrient. In a list of plants that frequent seabird colonies, Norton et al. (1997, table 4) mark species that they think benefit from nutrient enrichment, 10 of these are northern New Zealand species.

Conclusions

Small islands:

- are special habitats
- ignored by most people
- some contain intact seabird populations
- fur seals returning to the north – firstly to the rocky islands
- home to many threatened biota
- percent of native species indicates the health/naturalness of the island
- weeds slowly establishing (islands may act as 'stepping stones') – action required!
- most pests can easily be removed – action required!
- indicate the status of native species and the spread of pest species
- ideal study sites to compare the effect of rats on native biota
- source for future translocations to restored habitats
- their biological importance is out of proportion to their small size.

NOTE ADDED IN PROOF

I recently discovered veldt grass on Motutara (Henry Island), outer Whangaruru Bay in eastern Northland (260-Q05 354451); in a black-backed gull nesting area – 570m from the mainland.

Acknowledgements

Family, friends & colleagues for congenial field assistance, especially Graeme Taylor; Colin Ogle and Graeme Taylor for comments on a draft of this article; boat skippers and helicopter pilots for safe transport; land owners & managers (where known) for permitting access; and Frances Duff & Mei Nee Lee for helping to scan the slides for the talk.

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Some Norfolk Island plant records

Rhys Gardner

These notes come from my third visit to Norfolk Island, in July '06. To the degree that this truely subtropical realm (lat. 29 deg. S) ever has a winter, that month was a cold and rainy one. But it satisfied the locals (and the flora), the previous several years having been excessively dry.

As in 1989 and '91, resident naturalists Owen and Beryl Evans helped me in all regards. I mention below a number of their observations, made in more than five decades of working to preserve Norfolk's natural bounty.