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PRELIMINARY REPORT OF THE FLORA AND FAUNA OF FANAL ISLAND, MOKOHINAU ISLANDS NATURE RESERVE

by

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PRELIMINARY REPORT OF THE FLORA AND FAUNA OF FANAL ISLAND, MOKOHINAU ISLANDS NATURE RESERVE

by

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ABSTRACT

Fanal Island (Motukino), the largest of the islands within the Mokohinau Islands Nature Reserve, was visited for 9 days in September 1994. During the visit the flora, vegetation and fauna of the island was investigated. A total of 94 non-vascular (lichens and bryophytes) and 80 vascular plants (ferns and angiosperms) were collected from Fanal, while the status of problem weed species noted by previous workers was also investigated. The conservation status of 9 nationally threatened vascular plants, size of resident grey faced petrel (*Pterodroma macroptera gouldi*) populations, and continued persistence of the 1985 saddleback (*Philesturnus carunculatus rufusater*) liberations is documented. A thorough search for the critically endangered fern *Asplenium pauperequitum* was unsuccessful. In addition notes on the cryptogamic flora, vegetation structure, reptile fauna, presence of pupuharakeke (*Placostylus hongii*) and effects of kiore (*Rattus exulans*) are also detailed. It is concluded that Fanal Island is a significant fauna and flora habitat within the Mokohinau Islands Nature Reserve, and that these values will continue to deteriorate if kiore are not eradicated from the island.

1. INTRODUCTION

Fanal (Motukino) Island (Fig. 1) at 73 ha, is the largest and most southerly of the c. 33 islands, islets and rock stacks which make up the Mokohinau Island Nature Reserve (Auckland CMS 1995). The vegetation of the island is markedly different from the rest of the Mokohinau Group because it is larger, without recent modification, and possesses large areas of forest. Maori occupation was limited, with the island primarily used for mutton birding (Spring-Rice 1980, W McGregor, Ngati Wai Trust Board, pers. comm. 1994). Hence, aside from occasional firing of the island's vegetation, Fanal has not been subject to the farming, and other land use activities associated with the lighthouse settlement on nearby Burgess (Pokohinu) Island, the next largest in the Mokohinau Group (Cameron 1990). Kiore (*Rattus exulans*) are still present on Fanal Island, which is now the last island of the Mokohinau Group to retain this species.

We visited Fanal to reassess the flora, prepare conservation status reports for the threatened species reported from there in the past, investigate the status of problem weeds identified by Wright (1980b) and Cameron and Wright (1990), as well as investigate the effect kiore were having on the islands biota. The Auckland CMS lists Fanal as top priority for the removal of kiore, and so with this in mind, we set up three vegetation plots to obtain data to assist with quantifying any effects kiore were having prior to their eradication.

Fanal was last examined scientifically in May 1979 by the Auckland University Field Club (Wright 1980a). The seven-member party examined the flora, avifauna, geology, geomorphology, and archaeology of the island, providing the first comprehensive account of the islands biological and physical features. Since then botanical exploration has been limited to a day trip by Cameron and Wright (1990) 10 years prior to our visit.

As part of an on going programme of survey within the Mokohinau Islands Nature Reserve the authors visited Fanal for nine days, during September 1994. For most of our stay we camped within Central Valley (for this and other geographic locations refer to Fig. 1), which provided the only reliable water source on the island for that time of year. For the last night of our visit we camped above the Western landing.

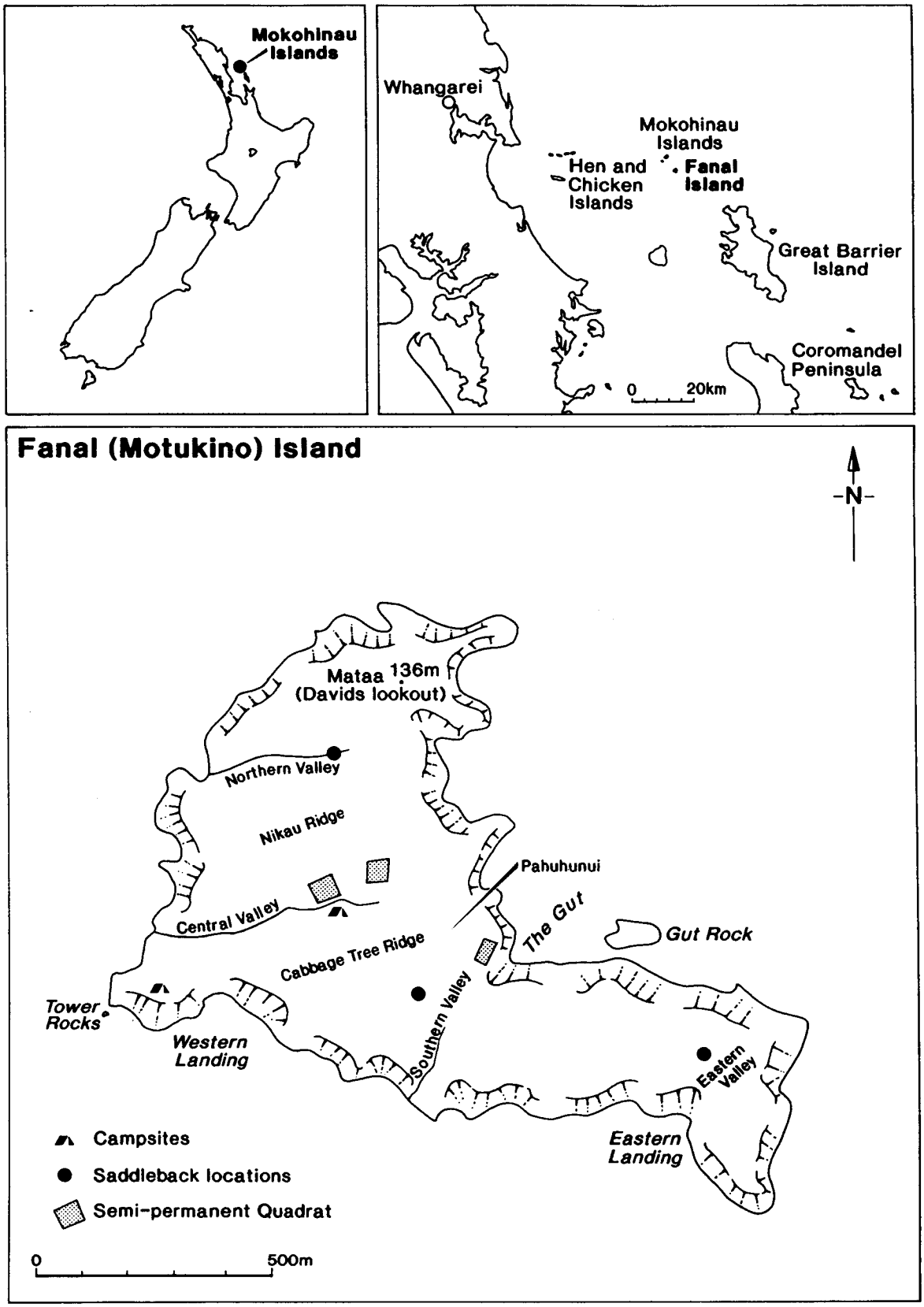

Figure 1 Location of Fanal Island (Mokohinau Islands Nature Reserve) and all geographic localities discussed. The approximate positions of the campsites and quadrats as well as saddleback distribution is also given.

2. RESULTS

2.1 Plant collections and additions to the island flora

A total of 94 non-vascular (lichens and bryophytes) and 80 vascular plants (ferns and angiosperms) were collected from Fanal Island (174 total). All collections have been lodged in the Auckland Institute and Museum Herbarium (AK). Also duplicates of some specimens will be lodged in CHR and PDD (acronyms follow Holmgren *et al.* 1990).

Approximately 21 additions were made to the published flora of Fanal Island (see Wright 1980b, Cameron and Wright 1990). Details of these additions and a reassessment of the island's flora and vegetation will be the subject of a later publication.

2.2 Problem weeds

Three weeds posing a threat to Fanal have been identified from previous reports: Mexican devil (*Ageratina adenophora*), pampas grass (*Cortaderia selloana*) and purple pampas grass (*Cortaderia jubata*) (see Wright 1980b, Cameron and Wright 1990).

Of the three, only one species, pampas grass (*C. selloana*) was located during our visit. This solitary plant was situated on the northern side of Central Valley, near the apex of Nikau Ridge. The plant was subsequently destroyed. It would appear that the other species have since become extinct, possibly as a result of natural regeneration and expansion of the indigenous forest and shrubland communities.

Above Eastern Valley the site of a small marijuana (*Cannabis sativa*) plot was discovered. The plot, probably emplaced in the previous year was no longer active, however several seedlings of marijuana were discovered and these were destroyed. The presence of a marijuana plot on Fanal is concerning. Marijuana plantations have been identified as the point of introduction for brown scale (*Saissetia coffeae*) on Aorangi Island, in the Poor Knights Group (de Lange 1994). Marijuana plantations have also been discovered on Hokoromea Island within the northern Mokohinau Group. As the risk of disease and weed transfer via plant introductions is a serious threat to the flora and fauna of offshore islands (Hutching 1995), we would suggest that Fanal should be visited at least every two-three years as recommended by Taylor (1989) for high quality northern offshore islands.

2.3 Cryptogamic flora

Although our collections of cryptogamic plants still require further study, the mosses have been identified by J.E. Beever (Landcare Research Ltd) and these are listed in Appendix 1. One of these *Fissidens hyophilus*, is an uncommon species which has a New Zealand distribution primarily centred on the more remote offshore islands of the Hauraki Gulf (J.E. Beever, Research Associate, Landcare Research, pers. comm. 1995). A smaller collection of liverworts is currently being examined by J.E. Braggins (University of Auckland). Along with bryophytes we collected a large number of lichens which, together with those gathered from the Northern Mokohinau Group by one of us (P dL.) in 1993, once identified, will be described separately.

2.4 Vegetation quadrats

Three semi-permanent quadrats were established on Fanal, their position being marked with a single 80 cm long marker pegs (end painted white) placed in one corner. Two of these were established within Central Valley as 50 m^2 quadrats, while the third, a 60 x 20 m plot was established on the ridge below Pahuhunui (Fig. 1). The Central Valley quadrats were sampled semi-randomly using five 10 m^2 stratified plots; data obtained included dbh, species composition, seedling number and frequency of species, and associated groundcover. This data is being analysed and will be incorporated into a future publication on the flora and vegetation of Fanal. The third quadrat was primarily established to record the occupancy of the burrows by petrel's, however it was also sampled in the manner described above to obtain information on forest composition.

2.5 Threatened species - Flora

2.5.1 Poor Knights spleenwort (*Asplenium paupere quitum*) Although this critically endangered fern (Cameron *et al.* 1995) was first described from the Poor Knights Islands, it has never been considered truly endemic there (Brownsey and Jackson 1984). This view was confirmed recently when a previously unrecognised collection of this distinctive fern was discovered in the Pteridophyte collection at AK[1] (Cameron 1993). Although precise location details are lacking from the specimen, it is clear that this fem was collected from a location somewhere within the Mokohinau Islands (Cameron 1993). In November 1993 specific searches for this fern were made within the northern Mokohinau Island group by one of us (P.dL.) without success. We surveyed areas of suitable habitat on Fanal Island, which retains much larger areas of indigenous vegetation in a considerably less modified state, and therefore had the best potential to harbour a population of this fern. In line with the recommendations of the Auckland CMS (1995) we surveyed areas of suitable habitat on Fanal Island. Unfortunately our survey was unsuccessful, although we were unable to survey all of the island. The possibility that the fern may still occur there, or elsewhere in the Mokohinau Islands Nature Reserve cannot, therefore, be discounted. Accordingly, we recommend that future visits to Fanal continue to search for this elusive fern, surveying in particular, the densely vegetated cliff faces along the northeastern margin of the island - an area which we were unable to explore in sufficient detail during our stay.

2.5.2 *Hebe* "Mokohinau" In contrast to the scarcity of this unnamed taxon within the northern Mokohinau Group (Cameron 1990), Fanal is clearly its stronghold. The *Hebe* dominates the woody component of most non-forest vegetation, and often extends into forested areas, where it is common on slips or around tree falls. Morphologically plants are quite variable, ranging from sprawling decumbent plants to large shrubs 1.5-2 m tall. Foliage varied from specimens with broadly elliptical leaves to those with either oblanceolate-lanceolate ones. Flower colour varied from pale white, lilac through

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[1] AK 13500 Mokohinau, *P(?F). S. Sandager* ! Although no collection date was given, Cameron (1993) suggests the specimen was gathered sometime between 1883 and 1888, the period in which the most probable collector F.S. Sandager was resident on Burgess Island, and known to be sending specimens to the Auckland Institute and Museum curator Thomas Cheeseman.

to dark blue. Traditionally the Mokohinau *Hebe* has either been placed within a broad concept of *H. bollonsii* (Moore 1961), or treated as a distinct taxon allied to *H. pubescens* (Eagle 1982- as *Hebe* sp. "v"). Therefore on our visit we collected cutting material to assist with a national revision of Northern *Hebe* being carried out by Landcare Research staff. In addition to the specimens sent to this CRI, some material was also lodged within the *Hebe* collection of the Manurewa Botanic Gardens.

The conservation status of this taxon is currently Local (Cameron *et al.* 1995). Although widespread on Fanal, the *Hebe* is scarce on the northern Mokohinau Islands, and as the taxon appears endemic to the island group, this ranking should be maintained.

2.5.3 Cook's scurvy grass (*Lepidium oleraceum*) Initially reported by Wright (1980b) from the cliffs below the summit of Mataa (David Lookout), and last seen there by one of us (E.K.C.) in 1984, Cook's scurvy grass no longer occurs at that site. A new population was discovered on the cliffs on the northern side of The Gut. This population of c. 70-100 plants occurs within dense petrel scrub associated with petrel burrows. Although a sizeable population, all plants examined were infected with white rust (*Albugo candida*), some seriously so. This fungal disease can severely damage scurvy grass, and in some situations cause the death of the plant (Baker 1956, de Lange 1986). The fungus infects all stages of the plant's life cycle, and over time populations of scurvy grass may be eliminated (Norton *et al* in press). Despite the severity of white rust infections on many *Lepidium* populations, it is unknown whether this fungus is indigenous or introduced to New Zealand (E.H.R. McKenzie, Landcare Research, pers. comm. 1995). Further research into the distribution of this fungus, its hosts and ecology is needed before any management decisions could be anticipated.

Despite favourable habitat elsewhere on Fanal Island, no further populations of Cook's scurvy grass were discovered. The national status of this species has recently changed from Vulnerable to Endangered (Cameron *et al.* 1995), reflecting the considerable improvements in our knowledge of this species' population ecology and distribution. The Mokohinau Islands is probably this species stronghold for northern New Zealand. In view of this it is important that regular visits (i.e., every 2-3 years) are made to assess the status of all Mokohinau Cook's scurvy grass populations, and that precautions are taken to prevent the accidental spread of white rust between the islands until further research into the threat posed by this disease has been completed.

2.5.4 *Picris burbidgei* Recently segregated from the northern hemisphere *P. hieracioides* (Holzapfel and Lack 1993), *P. burbidgei* is an Australasian species of oxtongue indigenous to New Zealand (Holzapfel 1994). On the New Zealand mainland it has declined markedly over the last 100 years to the extent that it is now only occasionally collected from the more remote parts of the north-eastern North Island (P J. de Lange unpubl. data). In fact the majority of recent (i.e., last 20 years) records come from the outer Hauraki Gulf Islands, Hen (Taranga), Fanal, and the associated smaller islands, islets and rock stacks which surround Great Barrier Island. On Fanal, this weedy native is widespread in a variety of habitats including shrub and flaxland, slips and tree falls within forest, and occasional bare soil around petrel colonies.

In view of the mainland and near-shore island decline of *P. burbidgei,* this species has been listed as Local by the New Zealand Threatened Plants Committee (Cameron *et al.* 1995). This means that those populations within the conservancy should be regularly inspected to ensure that they remain stable. Reasons for the decline of this species remain uncertain although research by one of us (P. dL.) suggests that competition by the introduced oxtongue (*Helminotheca echioides*) could be partly responsible for the loss of *Picris* from many mainland and near-shore island locations. Competition from this species has also been suggested as one of major causes of the decline and local extinction of many Australian *Picris* (Holzapfel 1994).

2.5.5 ***Rorippa divaricata*** This weedy relative of water cress is widespread on Fanal Island. Plants are most common within the forested margins of petrel scrub in, and around, the burrows of grey-faced petrels. Outside these areas occasional plants were noted within the forest, where they were often associated with slips, rocky ground and tree falls.

While Fanal Island supports a large population of this species (estimated at 300-500 plants), we were dismayed to discover many plants infected with white rust. This fungus has not previously been recorded from wild plants of *R. divaricata* (E.H.R. McKenzie, Landcare Research, pers. comm. 1994), although it is known to infect cultivated specimens (PJ. de Lange unpubl. data). While the fungus can kill Cook's scurvy grass, the impact it has on *Rorippa* is unknown.

Formerly ranked as a Vulnerable species *Rorippa divaricata* is now considered Endangered (Cameron *et al.* 1995). This change in status reflects increasing herbarium and field evidence for a continuing range contraction of this species. Our assessment of recent (i.e., < 20 years old) herbarium collections suggest that the major stronghold for this species is now the outer islands of the Hauraki Gulf. While the populations on Fanal Island are not the largest known from the Gulf they are probably some of the most secure. Therefore we advocate that their condition is regularly assessed along with Cook's scurvy grass.

2.5.6 ***Senecio marotiri*** Described by Webb (1988) from plants gathered from Coppermine Island in the Chickens Group, islets within the Bay of Islands, and along the eastern side of Coromandel, *S. marotiri* has since been collected from a number of sites spanning the Hauraki Gulf. Within the Mokohinau Island Group, *S. marotiri* was first recorded from Stack "D" and Burgess (Pokohinu) Island in 1993 (PJ. de Lange unpubl. data). In neither of these localities was it common. On Fanal we discovered two populations of this species; one on Cabbage Tree Ridge under kanuka (*Kunzea ericoides*) forest, and the other within petrel scrub north of The Gut. At the first site plants were locally distributed through a forest clearing, while at the second site *S. marotiri* was abundant.

Senecio marotiri is presently ranked as a Rare species (Cameron *et al.* 1995), which is probably still valid, since none of known populations are spatially that extensive, and few contain more than 5-10 plants. The two populations on Fanal are quite large and

collectively may contain between 150-200 plants. Fanal, therefore, constitutes a major stronghold for this species.

2.5.7 ***Senecio*** **"Pokohinu"** This undescribed *Senecio* is allied to a similar taxon known from Cuvier and Great Barrier Islands (*S.* "Cuvier" of Webb 1988). It is abundant on the Mokohinau Island Group, where it is apparently endemic (P J. de Lange unpubl. data). On Fanal it is widespread in most vegetation types, reaching its greatest numbers within petrel scrub. Although threats are not obvious it is currently listed as Local (Cameron *et al.* 1995).

2.5.8 ***Senecio scaberulus*** A single seedling of this Vulnerable (Cameron *et al.* 1993) species was located within kanuka forest on Cabbage Tree Ridge. *Senecio scaberulus* is often confused with *S. hispidulus*, which is widespread on Fanal, however the plant has a distinctive silvery-grey appearance when fresh, and unlike the harsh sandpaper texture of *S. hispidulus* the leaves of *S. scaberulus* have a soft velvety feel. No further plants were seen despite diligent searching.

This pattern of distribution is not unusual for *S. scaberulus*, which is now a rather uncommon plant of northern New Zealand. Similar isolated occurrences have been noted from other Hauraki Gulf islands such as Motuhoropapa Island in the Noises Group (de Lange unpubl. data) and Motuihe Island (de Lange and Crowcroft 1994).

2.5.9 **Mawhai (*Sicyos australis*)** Wright (1980b) indicates this species was reasonably widespread on Fanal during his visit there in 1979. During our stay only six vines of mawhai were discovered despite the abundance of apparently suitable habitat. Possibly this scarcity is an artifact of the timing of our visit (early spring) because although very little is known about the phenology of *Sicyos* it is thought that this species exhibits seasonal growth. Nevertheless we noted caches of gnawed mawhai seed at one mawhai population below Mataa, and it seems possible that kiore may be exerting some influence on the overall abundance of this vine on Fanal. Within the other islands of the Mokohinau Group *Sicyos* is uncommon with only a small scattering of plants known from Burgess (Pokohinu), Atihau (Cameron 1990) and more recently Hokoromea (de Lange unpubl. notes) Islands.

Elsewhere within New Zealand mawhai appears to be undergoing a dramatic decline (Cameron 1992). This decline initially prompted its inclusion within the New Zealand Threatened and Local Plant Lists as Rare (Cameron *et al.* 1993) but more recently this status has changed to Vulnerable (Cameron *et al.* 1995). The most recent change in conservation status relates to the discovery that further near shore island populations have declined since Cameron (1992) first documented the plight of the species. Presently the exact cause of this decline is uncertain, however it appears that cucumber mosaic virus, common in cultivated cucurbits, could be partly responsible (A.L. Thomson, Consultant, Christchurch, pers. comm. 1994). If this is the case, it is important that parties visiting "*Sicyos* islands" refrain from taking such vegetables on to these islands.

2.5.10 Coastal milk tree (*Streblus banksii*) Nine adult trees of coastal milk tree were located (4 female, 3 male, 2 unknown). Although reported as regenerating by Wright (1980b) no seedlings or saplings were located during our visit. Furthermore, as the species is dioecious, the current distribution of both sexes is not likely to result in a significant seed set. Coastal milk tree is now scarce on the mainland of New Zealand, and viable populations only occur on islands free of introduced mammals. Outside these areas the species is threatened by possum (*Trichosurus vulpecula*) browse, while ship rats (*Rattus rattus*) and kiore eat the fruit and seedlings, as well as damaging the bark of adult trees (Atkinson 1972).

Within the Hauraki Gulf, coastal milk tree often survives as isolated trees or moribund stands on rodent infested islands. Fanal is no exception. It is clear from our visit that many of the milk trees are in ill thrift. Unless kiore are removed from Fanal extinction of this species from the Mokohinau Group is inevitable.

Recently coastal milk tree has been listed as a Local species (Cameron *et al.* 1995) reflecting increasing concern over the loss of this species from the mainland and rodent-infested islands.

2.6 Threatened species - Fauna

2.6.1 Saddleback (*Philesturnus carunculatus rufusater*) Twenty-five North Island saddleback (*Philestrunus carunculatus rufusater*) from Hen Island were liberated on Fanal in February 1968 (Adams 1968). Subsequent visits failed to find many birds surviving and by November 1973 only three male birds could be found (Veitch 1973). A second liberation, this time of 29 Cuvier Island birds was made in March 1985. Unfortunately by November 1986 only 5 birds were confirmed from the island (Lovegrove 1990). During our visit a thorough search of Fanal was made and only three birds were located (see Fig. 1). A single bird occupied the north side of Central Valley and the Northern Valley (see Fig. 1). This bird was coloured banded Right Leg, Yellow/White and Left Leg Metal. A second bird occupied the Southern Valley over into the south side of Central Valley, and was banded Right Leg Metal and Left Leg Yellow/White. A third saddleback was heard on several occasions but not seen in Eastern Valley. We consider it most unlikely that further saddleback exist on Fanal. It is possible that those birds seen were males while any attached females were sitting on nests. However early September is too soon for normal breeding so that scenario remains unlikely. In the most recent assessment of the world's threatened birds, saddleback are treated at specific level only and are classified as "Conservation Dependant" (Collar *et al.* 1994). However, within New Zealand the North Island subspecies of saddleback is classified as a "Rare" species (Bell 1986).

2.6.2 Grey-faced petrel (*Pterodroma macroptera gouldi*) Although not a nationally threatened species, we include information of the Fanal Island populations of the northern muttonbird, of or grey-faced petrel (*Pterodroma macroptera gouldi*) because of concerns expressed by Ngati Rehua over their apparent decline within the Mokohinau Group (W. McGregor, Ngati Wai Trust Board, pers. comm. 1994). On Fanal, adult birds of this species were frequently encountered, while numerous burrows attributed to this species were noted along the cliff tops and down the steeper seaward faces. Great

Barrier Island Maori have traditional harvesting rights and have regularly visited Fanal in the past to harvest of chicks. Declining numbers of these birds has resulted in a rahui on harvesting which has been in place over the last ten years. However Aotea Ngati Wai believe that poaching of Fanal Island birds has occurred within the last 1-2 years (W. McGregor, pers. comm. 1994).

As our visit coincided with the time of year when grey faced petrel chicks are normally resident in burrows (Imber 1985) we decided to obtain some idea of of occupancy. We set up a plot on one of the traditional muttonbird harvesting sites, Pahuhunui (Fig. 1, see also Spring-Rice 1980). The plot runs from just below the summit of Pahuhunui along the cliff edge eastwards (above The Gut) and just inside the margin of the coastal forest. The outside edge is marked by three pegs set 30 m apart. A 30 m tape was run out for 10 m inland to mark off an area of 60 x 10 m (600 m^2). This area contained 45 large open burrows of a size consistent with that used by oi. Each burrow was examined by hand. Occupancy was determined by chick vocalisation or the presence of down. Only 6 burrows contained oi chicks, the remainder were empty.

2.6.3 Tuatara (*Sphenodon punctatus punctatus*) There are historical records of what is assumed to be the northern subspecies of tuatara (*Sphenodon punctatus punctatus*) from the Mokohinau Islands (Sandager 1889, McCallum 1980). Tuatara were not considered a nationally threatened species by Bell (1986) who treated the species as monotypic. Recently the taxonomy of tuatara has been reviewed and one species (*S. guntherii*) and two subspecies (*S. punctatus punctatus* and *S. punctatus reischekii*) previously recognised have been reinstated and another new subspecies (*S. punctatus* "Cook Strait") proposed (Daugherty *et al.* 1990). As a result of these systematic changes, the most recent revision of the Department of Conservation Species Priority Ranking System, has classified the northern subspecies of tuatara as a Category B taxon (Molloy and Davis 1994). Tuatara were last reported from Fanal Island in 1922 (McCallum 1980), nevertheless it is possible that they still persist there, and so some time was spent searching in suitable habitat at night. Day time surveys identified Pahuhunui as the most likely site for a residual population of tuatara. This area was characterised by bare forest floor, under a dense canopy of pohutukawa (*Metrosideros excelsa*), and sheltered by a coastal margin of petrel scrub. The ground was extensively burrowed. A total of 15 people-hours of searching failed to locate any tuatara. Whilst the area searched was only a small part of Fanal it was similar to that in which the main concentration of tuatara were found on the Red Mercury Island (I. McFadden, pers. obs.).

2.7 General observations

2.7.1 Vegetation Fanal Island contains the most extensive tracts of forest within the Mokohinau Islands Nature Reserve. It is also the stronghold for a number of nationally threatened species, as well as several which are otherwise absent from the rest of the Mokohinau Island Group.

The vegetation of Fanal is undergoing regeneration, with several of the vegetation types recorded by Wright (1980b) now absent or reduced in extent. Several vegetation types are rather unusual, the most interesting of which is houpara (*Pseudopanax lessonii*)

forest. Houpara usually forms a small tree rarely exceeding 8 m in height. At the head of the Central and Southern valleys dense houpara forest is present, where houpara trees are often 10-15 m tall, forming a dense continuous canopy rarely broken by other species. Such forest often has a poorly developed understorey.

The forest of the upper exposed Northern and Eastern valleys has developed a peculiar morphology, with many of the mature trees assuming grotesque twisted forms. The most marked of these was a purid (*Vitex lucens*) which attained a mere 3 m in height but trailed for 16 m rooting wherever the trunk touched the ground. Such specimens were by no means uncommon, and arose, we suspect, through past fires exposing these trees to the elements, whence they were toppled over. Being a resilient species, many continued to grow in their fallen positions, remaining low due to wind shear, thereby producing a distinctive forest type dubbed here "Fanal Island Serpent Forest".

The impact of kiore on the flora of Fanal is readily apparent. While many species are regenerating several prominent tree species either are not, or are being severely restricted in their ability to do so. Fanal contains numerous large parapara (*Pisonia brunoniana*) and karo (*Pittosporum crassifolium*), beneath which caches of gnawed seeds were conspicuous. Despite extensive searching only one seedling of parapara was found- and that at a cotyledon stage only, while seedling karo were absent. The situation for coastal milk tree has already been noted, however we also noted few purid, tawapou (*Pouteria costata*), taraire (*Beilschmedia tarairi*) and tawa (*Beilschmedia tawa s.l.* including *B. tawaroa*) seedlings. This is despite the fact that purid and tawapou in particular, are very common adult trees of the mature coastal forest.

2.7.2 Indigenous fauna As with its vegetation, Fanal Island has a fauna assemblage typical of those northern offshore islands with a history of anthropogenic modification by clearance and fire, and through the presence of kiore. Whilst those species able to coexist with kiore are relatively common, there is a large range of fauna either absent or so scarce as to be conspicuous by their rarity.

Birdlife in general was typical of that seen in northern offshore islands, and a checklist of those species observed or heard is appended (Appendix 2). Of particular interest was the abundance of kereru (*Hemiphaga novaeseelandiae novaeseelandiae*) presumably due to the large variety of food species, e.g., karaka (*Corynocarpus laevigatus*), coastal maire (*Nestegis apetala*), kohekohe (*Dysoxylum spectabile*), purid, nikau (*Rhopalostylis sapida*) and houpara (*Pseudopanax lessonii*). We also suspect the island's isolation has secured this population from the effects of poaching. We were also pleased to observe kaka (*Nestor meriodionalis septentrionalis*) which appeared to have taken up residence in the dense coastal forest of Central Valley. Past accounts of the island's birdlife have reported only solitary birds. In addition to these species we noted an abundance of bellbirds (*Anthorcis melanura melanura*), tui (*Prosthemadera novaeseelandiae novaeseelandiae*) and red-crowned parakeet or kakariki (*Cyanoramphus novaezelandiae novaezelandiae*).

Reference to the failure of saddleback liberations on Fanal has already been made. Saddleback are hole-nesting birds, and they are quite capable of coexisting with kiore

provided they are able to nest in sites out of the reach of these rodents. We suspect that the failure of these birds to establish on Fanal is the result of the low stature of Fanal Island forest, which means that any nesting holes would be located close to the ground, where they can be easily reached by kiore. Therefore we expect that any future liberations of saddlebacks on Fanal will fail, until such time as the kiore are removed, or the forest has attained a greater canopy height.

Aside from our searches for tuatara, time was spent examining suitable habitat for lizards. The only skinks observed were the moko skink (*Leiolopisma moco*) which was occasionally observed within the short scrub and grasses along the cliff edges. The only gecko seen, was a single adult female *Hopalodactylus duvaucelii*, which was discovered amongst the damp foliage on the trunk of a large tawa tree. The scarcity of lizards has already been commented on by Witch (1973) and we attribute this to predation from kiore.

Casual searches were also made for invertebrates to obtain some idea of their relative abundance. From these searches we can only conclude that Fanal is an entomological desert. Large flightless beetles and common soil dwelling organisms were absent. Whilst searching for lizards many boulders on the forest floor were overturned, and logs of various sizes examined. Even these relatively safe refugia for large invertebrates were devoid of such taxa.

As previously noted by Browne (1980) weathered shells of pupuharakeke (*Placostylus hongii*) were noted in several sites on Fanal. As these finds tended to coincide with sites of former Maori occupation, Browne (1980) interpreted these occurrences as evidence that pupuharakeke had been introduced to Fanal as a food source by the Maori (see also Hayward and Brook 1981). In fact we found Placostylus shells were also located in sites well away from the more obvious signs of human habitation. We suggest that the occurrence of Placostylus within or adjacent to archaeological sites is probably more accidental than deliberate, as empty Placostylus shells are readily transported by water (PJ. de Lange pers. obs.), it is possible that they may have been washed down from the plateau of the island into the valleys and along the cliff faces, following forest clearance. In this way they have occasionally become incorporated into midden deposits. Browne (1980) also favoured a recent and anthropogenically engineered release of Placostylus because she found no significant morphometric differences between Fanal Island shells and those of mainland *P. hongii.* Recently one of us (I. McF.) discovered a thriving colony of *Placostylus* on "Gut Rock", a near inaccessible rock stack located within the Gut, adjacent Fanal Island. This location is virtually impossible to reach from the sea and access was only made possible by helicopter. The presence of *Placostylus* on this rock stack, therefore, tends to argue against these snails being released on Fanal as food by the Maori. Furthermore, in contrast to Browne's analyses of Fanal material, the shells of these specimens differ from *P. hongii s.s* through their consistently smaller size, and lack of the prominent mouth thickening so characteristic of "typical" populations of *P. hongii.* (G. Sherley, DoC, pers. comm. 1995). Further study is needed to ascertain their taxonomic status.

2.7.3 Kiore (*Rattus exulans*) Fresh sign of kiore was not abundant. However, within three nights of our arrival, kiore were observed digging up cooking scraps from our rubbish pit, and on the sixth evening kiore fouled many of our cooking utensils.

The general scarcity of kiore during our visit was anticipated, as this species is usually in quite low numbers during September, as a consequence of the annual winter die off prior to the summer breeding season. Nevertheless, the deleterious effect kiore have on fauna and flora is now well documented (Campbell 1978; Towns 1991, 1994), and we believe, well demonstrated on Fanal. In particular we note that the numbers of smaller petrel and of are much lower than would otherwise be expected for an island the size of Fanal.

In recent years research within the Mercury Islands by Graeme Taylor (DoC, pers. comm. 1994) has suggested that kiore may play a more significant role in predating of than had previously been believed. Similarly many of the smaller burrowing petrels, e.g., diving petrel (*Pelecanoides urinatrix*), white-faced storm petrel (*Pelagodroma marina maoriana*) and allied shearwater (*Puffinus assimilis*) were scarce on Fanal, while adjacent naturally rodent-free islets of the northern Mokohinau (e.g., Groper (Tatapihi), Lizard and Stack "H") Group retain significant populations of these birds (T. Green, Consultant, Auckland, pers. comm. 1994). Furthermore following the removal of kiore from the main islands of the Northern Mokohinau Group populations of all these petrels have expanded their range within the permanent quadrats established on Burgess and Hokoromea Islands (McFadden and Green unpubl. data).

While kiore remain on Fanal Island further contraction of these smaller petrels and possibly oi can be expected.

3. CONCLUSIONS

Fanal Island is clearly a significant fauna and flora habitat within the Mokohinau Islands Nature Reserve. It is particularly notable because the vegetation of the island is the least modified of the four major islands within the group. Our survey recorded nine species of threatened plant, of which Fanal forms the Mokohinau stronghold for five taxa (*Hebe* "Mokohinau", *Picris burbidgei, Rorippa divaricata, Senecio marotiri* and coastal milk tree). One of these taxa, *Hebe* "Mokohinau" is presently considered endemic to the Mokohinau Islands.

Besides threatened plants, the vegetation of Fanal contains a number of coastal tree species whose New Zealand distribution is now largely centred on offshore islands of the Hauraki Gulf, e.g., coastal maire, parapara. Both species are absent from the Northern Mokohinau Group (Cameron 1990).

Our preliminary investigation of the forest structure of Fanal suggests that further research within this area may be warranted. In particular, our field work indicates that the forested areas of Fanal may represent a complex mosaic of regeneration events following periods of anthropogenic disturbance, especially fires. We also noted that many trees originated from epicormic growths off apparently burned stumps, while charred *in-situ* logs and stumps were not uncommon throughout the island. Obtaining ages on the various forested areas through judicious use of an incremental tree borer and possible radiocarbon dating of *in-situ* burned stumps, may help determine the nature, age, and extent of past forest clearance patterns by Maori. This in turn would help develop a better understanding of offshore island forest dynamics and responses to human intervention which could assist in future island restoration projects and management.

The most obvious result of our visit, however, was confirmation that kiore remain a significant threat to the biota of Fanal. This is disturbing as the island clearly contains the best areas of mature vegetation within the Mokohinau Island Nature Reserve. Furthermore several important populations of threatened plants and prominent canopy trees are suffering from the affects of kiore predation. We also suspect that the petrels of Fanal are declining.

To help provide much needed baseline data on the impact of kiore on Fanal Island three semi-permanent quadrats within the forested areas of Central and Southern valleys were emplaced to provide data on forest composition and health. Hopefully further visits to the island will be able to establish further plots within the Northern, Eastern and main part of Southern Valley to provide a more representative sample of the main vegetation types of the island.

Information obtained from these plots we hope will then be used in the future to back up our recommendation that kiore be eradicated from Fanal Island as soon as possible. This recommendation is in line with that suggested by the Auckland CMS (1995), and has the support of the Aotea Ngati Wai (W. McGregor, Ngati Wai Trust Board, pers. comm. 1994).

Finally, our visit to Fanal completes a two year investigation into the flora and fauna of the Mokohinau Islands Nature Reserve. As our level of information on these islands is now significantly improved on earlier accounts we recommend that a Mokohinau (Pokohinu) Island Nature Reserve Ecological Action Plan should be prepared. We see this plan as forming a basis from which the Auckland Conservancy can co-ordinate and prioritise future visits to the Mokohinau Islands Nature Reserve, research and monitoring activities, weed control, historic and archaeological site management and projected island restoration activities.

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APPENDIX 1

List of bryophytes collected and identified from Fanal Island

Voucher specimens of these taxa have been lodged in AK.

Bryum billardierei
B. campylothecium
Camptochaete pulvinata
Campylopus introflexus
C. sp.
Echinodium umbrosum
Eurhynchium muriculatum
Fissidens hyophilus
F. leptocladus
F. pungens
Hypnum cupressiforme var. *cupressiforme*
Ischyrodon lepturus
Leptostomum macrocarpum
Macromitrium gracile
M. sp.
Pendulothecium punctatum
Ptychomitrium australe
Pottiaceae
Racopilum convolutaceum
Rhychnostegium tenuifolium
Sematophyllum amoenum
S. homomallum
Thuidium furfurosum
T. sparsum
Weissia controversa

APPENDIX 2

Avifauna recorded during a nine-day visit to Fanal Island, Mokohinau Islands Nature Reserve

	Species
[δ]Little blue penguin	*Eudyptula minor iredalei*
Grey-faced petrel	*Pterodroma macroptera gouldi*
[δ]Fluttering shearwater	*Puffinus gavia*
[δ]Allied shearwater	*Puffinus assimilis*
[δ]Diving petrel	*Pelecanoides urinatrix*
Australian gannet	*Morus serrator*
Pied shag	*Phalacrocorax varius varius*
Australasian harrier	*Circus approximans gouldi*
Southern black-backed gull	*Larus dominicanus*
Red-billed gull	*Larus novaehollandiae scopulinus*
Kereru	*Hemiphaga novaeseelandiae novaeseelandiae*
North Island kaka	*Nestor meridonalis septentrionalis*
Red-crowned parakeet	*Cyanoramphus novaezelandiae novaezelandiae*
Morepork	*Ninox novaeseelandiae novaeseelandiae*
Welcome swallow	*Hirundo tahitica neoxena*
North Island fantail	*Rhipidura fuliginosa placabilis*
Blackbird	*Turdus merula merula*
Bellbird	*Anthornis melanura melanura*
Tui	*Prosthemadera novaeseelandiae novaeseelandiae*
[δ]North Island saddleback	*Philesturnus carunculatus rufusater*
Starling	*Sturnus vulgaris vulgaris*
Indian myna	*Acridotheres tristis*

[δ] denotes an addition to those species listed by Bellingham 1980.