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FAUNA, FLORA AND HISTORY OF MOTUREKAREKA, MOTUTARA AND KOHATUTARA ISLANDS, HAURAKI GULF

Alan J.D. Tennyson[1] , Ewen K. Cameron[2] and Graeme A. Taylor[3]
[1]Museum of New Zealand, PO Box 467, Wellington, [2]Auckland Museum, Private Bag 92018, Auckland, [3] 50 Kinghorne Street, Strathmore, Wellington (current addresses)

SUMMARY

We carried out several surveys of the birds, reptiles, mammals and vascular plants on Moturekareka, Motutara and Kohatutara (northern New Zealand islands) between 1988 and 1997. These observations have been supplemented by older and contemporary observations made by several other people. We summarise the colourful history of the islands and describe two hermits that lived there, the beaching of the barque *Rewa*, quarrying operations, how the ownership of the islands eventually passed to the Crown, and when the islands were gazetted as Scenic Reserves. Although the two larger islands are highly modified we found five nationally threatened birds visit or breed there and significant numbers of nesting grey-faced petrels (*Pterodroma macroptera gouldi*) occur. We have records of 36 or 37 species of birds, 187 vascular plant taxa (including 97 native species) and two skink species from the islands. The island group has great potential for restoration if mice (the only introduced mammal) can be eradicated and weed control carried out.

Keywords: birds; grey-faced petrels; vascular plants; Hauraki Gulf islands; conservation value; history.

INTRODUCTION

Moturekareka (19ha), Motutara (4.5ha) and Kohatutara or the Rocky Islets (1.1ha) (island areas from Taylor 1989) are a group of connected islands in the inner Hauraki Gulf (36°29' S 174°47' E), located amongst a scattering of small islands in the lee of Kawau Island (Fig. 1). The three islands are Scenic Reserves managed by the Department of Conservation (DoC). Moturekareka is nearly 800m long by a maximum of 400m wide. There are two buildings, a cottage and a storage shed just above the shoreline on its northern side, and there are two existing walking tracks, which were formerly logging tracks (Anon 1996). DoC intends to remove these buildings, carry out track maintenance and install a loop track in the next ten years (Anon 1996). The coastline of

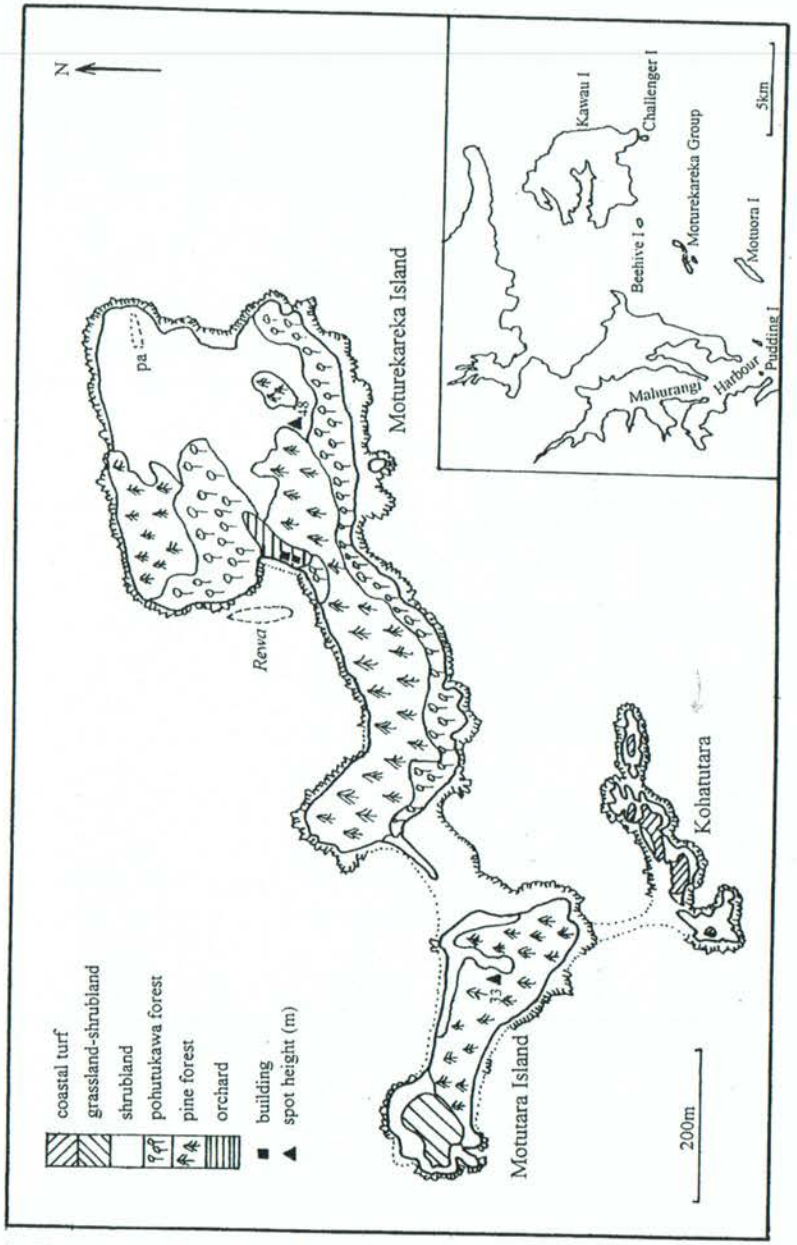

Fig. 1. Place names and location of Moturekareka, Motutara and Kohatutara Islands in the Hauraki Gulf, and vegetation zones of the three islands (modified from Anon 1996).

Moturekareka is rocky except for a short sandy beach by the buildings. The western half of Moturekareka consists of a narrow ridge with steep slopes. A plateau dominates the wider eastern half, and the highest point of the group (48m asl) is located there. A shingle tombolo connects the south-western side of Moturekareka with Motutara except for about 1.5 hours either side of high tide. Motutara has a shingle beach around much of the shoreline. There is a low saddle between two hills near either end of Motutara, and there is a collapsed trig station on the eastern hill top. A rocky shelf connects Kohatutara to Motutara at low tide. Kohatutara is composed of a cluster of two main stacks and three other vegetated rocks joined at low tide (Fig. 2). All three islands are composed of Waipapa group greywacke of probable Jurassic age (Thompson 1961). Each year about 1,000 people land on these islands and around 5,000 anchor offshore in boats (DoC 1995).

The main reason for our visits to the island group was to document the flora and fauna. AJDT & GAT were particularly interested in determining the status of rodents (see Taylor 1989) and nesting petrels on Motutara. EKC's visits were to assess the vegetation after Moturekareka's purchase by DoC in 1993, and to assist with the formation of management guidelines for the islands.

This paper deals with five surveys of the birds, reptiles, mammals and vascular plants that we made on Motutara and Kohatutara; three surveys of plants on Moturekareka; and other anecdotal observations on the flora and fauna of the islands. The following visits were made: 0910 - 1120 on 2 June 1988 (GAT, Ian McFadden); from *c.* 1200 on 30 July to *c.* 1000 on 31 July 1988 (AJDT, GAT, Sandy Taylor); from 1630 on 14 October to *c.* 0830 on 16 October 1988 (AJDT, GAT, Sandy Taylor); from *c.* 1400 on 24 February to *c.* 1300 on 25 February 1989 (AJDT, GAT, Phil Battley, Paul Scofield); from 1600 on 26 June to 1030 on 28 June 1989 (AJDT, GAT) (all times are New Zealand standard time). We camped on the low flat in the centre of Motutara. We were not on the islands continuously because we did some daytime surveys of other nearby islands. On 15 October 1988, AJDT briefly investigated the south-west end of Moturekareka, and made further observations from offshore. EKC surveyed Moturekareka on 11 November 1994 between 0930-1200; and on 12 January 1996 between 1130-1200; and Moturekareka and Motutara between 1300-1500 on 20 February 1997. Some other bird observations by Simon Chamberlain and Jeff Cook on Kohatutara and by Chris Green (17 July 1991) and Alan Esler on Moturekareka are also included. Due to the relatively short time spent on Moturekareka, the plant and bird lists are probably incomplete compared with the lists for Motutara and Kohatutara.

Bird species only seen flying offshore or washed up on beaches are not included in this article but all beached bird records were submitted to the

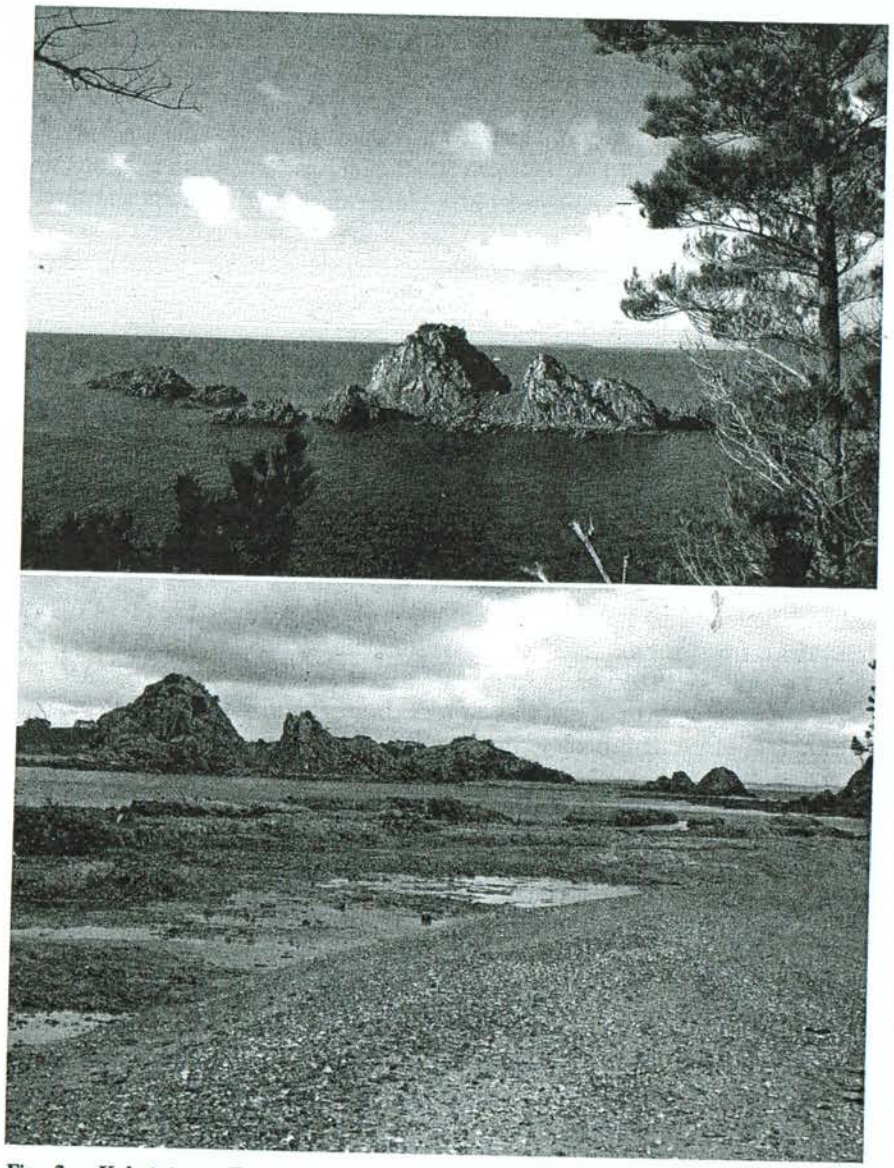

Fig. 2. Kohatutara: Top - from Motutara near high tide, July 1988; Bottom - from Moturekareka near low tide, November 1994. Photos: A.J.D. Tennyson & E.K. Cameron.

Ornithological Society's Beach Patrol Scheme. We did not survey invertebrates in general, however we did note that on Motutara introduced slugs and garden snails (*Helix aspersa*) were abundant, German wasps (*Vespula germanica*) were present, a tenebrionid (*Mimopeus elongatus*) and a carabid beetle (about 1.2cm long) were common, and one 12cm centipede (*Cormocephalus rubriceps*) was found in February 1989. Garden snails were also present on Moturekareka. A few invertebrate specimens were collected and are held in the Museum of New Zealand.

HUMAN HISTORY

The following fragmentary account of the islands' histories are based on references given in the text and the Department of Lands & Survey files: 8/5/296 and NP30, now held in the DoC Auckland Conservancy office.

Residents/Ownership of the islands - Archaeological surveys of Moturekareka and Motutara were carried out by DoC in 1994 (DoC 1995). The flat land adjacent to the *Rewa* hulk was found to be the main area of both Maori and European settlement. Midden deposits and evidence of stoneworking is evident along this foreshore. Midden material is also present at the west end of Moturekareka. At the north-east end of Moturekareka is a defended pa site. Brassey (1994) recorded a large midden containing shell, fish bone and ovenstone material at the north-east tip of Motutara. Archaeological evidence suggests that these islands were not permanently inhabited prior to European settlement (DoC 1995).

"Three islands, Moturekareka, Motuora and Motuketekete (presumably Kohatutara was also included) were purchased by John Long Haydon on 18 March 1845 from Ngati Paoa chiefs, Te Ruinga and others, and on 23 March 1845, from Te Hemara Tauhia and others of Ngati Rongo (Kawerau hapu of Mahurangi) for a total of 18 pounds Sterling and twelve blankets. In 1848 the old Land Commission ruled that these islands were part of the 'Mahurangi and Omaha Purchase' and paid compensation of 90 pounds 15 shillings to Haydon. The Crown later sold Moturekareka to one Theophilus Heale, who was involved in working the copper deposits on Kawau Island" (DoC 1995).

Perhaps the most documented of owners/residents on Moturekareka are two eccentric hermits, Charlie P. Hansen, a fine-looking, big, jovial Scotsman (Wilson 1980), and Snow Harris (Fig. 3). In the early 1920s Hansen, a retired sheep farmer, purchased Moturekareka, Motutara, Kohatutara and Motuketekete (Clarkson 1991: 35). He lived on Motuketekete until the late 1920s when he moved into a new house he had built on Moturekareka (Clarkson 1991). Part of

Motutara was taken by the Crown in 1929 for a quarry. Hansen's home was on Moturekareka in the northern bay where the *Rewa* rests (*The Auckland Weekly News*, 2 July 1930: 23). According to Maddock & Whyte (1966: 92) "not ... many people landed ... when he was alive, except the scow with his grog and his supplies of food, since he was more inclined to welcome uninvited guests with a shot gun than ask them in to tea". Although Clarkson (1991) records him of a generous, hospitable nature with lots of visitors, he also records Hansen stalking and firing his shot gun into the rear of a person poaching his turkeys at night.

In 1941 Hansen wrote to the Crown asking if it would like to purchase the remainder of Motutara and the whole of Moturekareka. A note scribbled on the side of the letter by a staff member for the Commissioner of Crown Lands noted "... the island [Moturekareka] was mostly in scrub with possibly a little grass and some scrubby bush in the gullies. Hansen has a shack on it and *Rewa* is beached as a breakwater". The then Commissioner of Crown Lands showed little vision and advised "... good idea for the Crown to obtain these small islands ... but little can be done with them ... unless ... suitable for a quarry or ... substantial shingle deposits ... hardly ... any use for defence purpose ... also five mortgages ... [so] hardly likely ... [to] acquire these islands cheaply ...". Consequently the Crown did not buy the islands and Hansen sold them in

Fig. 3. The second Moturekareka hermit, Snow Harris, lived on the island 1962-1978. *NZ Herald*, 26 June 1978 held by the Auckland Museum library.

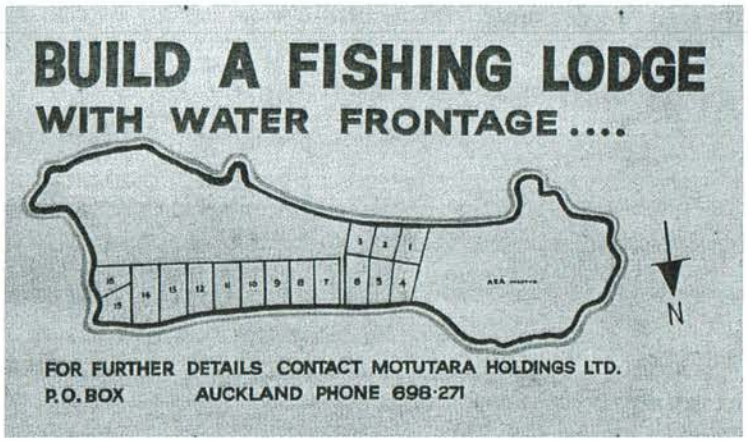

Fig. 4. Illegal subdivision proposal for the freehold part of Motutara in 1970. The western part of the island is wrongly labelled Auckland Regional Authority (ARA) reserve. From Lands & Survey File NP 30, held by DoC, Auckland.

the 1940s privately. Due to ill health Hansen left the island and died in Auckland in the early forties (Clarkson 1991).

In 1967 J.D. O' Brien as Commissioner of Crown Lands (an unsung hero of securing northern offshore islands into public ownership) wrote to the Commissioner of Works and asked if he was willing to have the Motutara quarry reserve vested in the Hauraki Gulf Maritime Park (HGMP). Mr O' Brien also wrote to each of the now three joint owners (Mr Harding, Hayman and Johansen) of the other two-thirds of Motutara (and Moturekareka) asking if they would sell the Motutara portion to the Crown for the soon to be created HGMP. In 1968 the quarry reserve was transferred to the new HGMP for recreation purposes.

In 1970 the three joint owners of the larger portion of Motutara formed the Motutara Holdings Company. They tried to sell shares in the company for the right to build on one of the 16 waterfront sections (Fig. 4). Mr O' Brien pointed out to the owners that the subdivision was illegal and asked the Marine Department to intervene. After more than 20 letters from Mr O' Brien to the three owners, the balance of Motutara was finally added to the HGMP in 1975, increasing the size of the existing Recreation Reserve. In 1977, after a title search, Kohatutara was also added to the HGMP as a Recreation Reserve. In 1980 both Kohatutara and Motutara were reclassified as Scenic Reserves.

The second hermit, Snow Harris (Fig. 3), lived on Moturekareka in Hansen's hide-out from 1962-1978 (DoC 1995). Harris talked to the occasional yachtie, rowed monthly to Kawau Island for his supplies, and died on the island on 25

June 1978, aged 73 (*NZ Herald*, 26 June 1978). More recently the caretaker of Moturekareka owned two large dogs which discouraged visitors and presumably preyed on any seabirds nesting on the island (e.g. on 15 April 1993, a dog accompanying visitors to Ihumoana Island, Auckland west coast, killed an adult grey-faced petrel within the first ten minutes of reaching the island, GAT & AJDT pers. obs.).

DoC purchased Moturekareka as a Recreation Reserve in October 1993 after a lease arrangement with an American, Richard Taubman, did not eventuate. On 21 May 1996, it was gazetted as a Scenic Reserve. Currently there is a voluntary resident caretaker on Moturekareka and the Ministry of Fisheries occasionally rents the cottage as a base for research work nearby (Anon 1996). In 1996 DoC released "Guidelines for Management" for all three islands of the group after receiving public submissions on the draft document in 1995 (Anon 1996).

Hulks - Hansen purchased the steel four-masted barque *Rewa*, formerly the *Alice A. Leigh*, primarily as a breakwater to protect his home bay. For a photograph of it under sail see Wilson (1980: 71). The rusting hulk had been moored at the Chelsea sugar works for years, and it was towed to the island by the Auckland Harbour Board tug *Te Awhina* (Clarkson 1991). *The Auckland Weekly News* (2 July 1930: 23) records that the *Rewa*, the largest British-owned sailing ship afloat ..." was run gently ashore (on 28 June 1930) ... serving the unromantic use of a harbour breakwater." On 3 July "... the bowline parted ... and the barque heeled over to port ... with a list at an angle of about 45 degrees" (*The Auckland Weekly News*, 16 July 1930: 23) (Fig. 5). Hansen possibly intended to equip the ship with accommodation facilities for friends and perhaps paying guests but this was not possible when it tipped over (Clarkson 1991). Others say that he had plans to use it for a floating cabaret (Wilson 1980). Hansen was generous in gifting pieces of the ship to visiting boat owners and he used the ship's superstructure (radio shack) to build a hide-out on top of the hill due south of the *Rewa* (Wilson 1980, Clarkson 1991). All that remains today of the hide-out is scattered building materials and some refuse (DoC 1995). Wray (1939) describes his conversations with Hansen and exchanging food for rigging off the *Rewa* to equip his yacht. The *Rewa* never moved again, and today only the rusting hull remains (Fig. 6).

Hansen also had beached the much smaller iron-hulled schooner, *Otimai*, on the starboard side of the *Rewa* (DoC 1995: 6 & map 3), presumably shortly after the *Rewa* stranding because it is not visible in Fig. 5 (bottom).

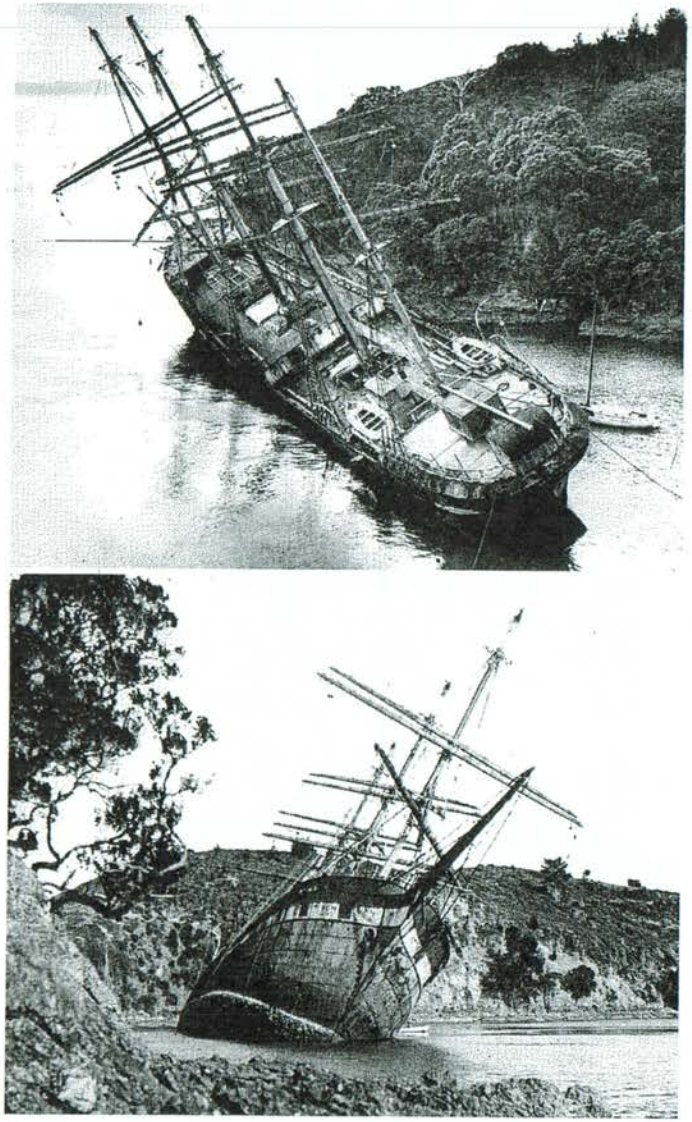

Fig. 5. Top - view of Moturekareka looking NNE with the stranded *Rewa* in the small northern bay. Note the pohutukawa trees in the background and the young pine trees on the skyline. Bottom - looking SSW at the *Rewa*. Note the very short scrub in the background with the occasional small pine tree. *NZ Herald*, July 1930, held by the Auckland Museum library.

Fig. 6. Remains of the *Rewa* near high tide, November 1994, cf. Fig. 5 (Top) for changes in vegetation over 64 years. Photo: E.K. Cameron.

Quarrying - The western third of Motutara was taken from Hansen for quarry purposes in 1929 under the Public Works Act to supply road metal for the main highway upgrade between Auckland and Whangarei (Fig. 7). The quarry operation, primarily in the 1930s and 1940s, removed a lot of rock from the western end of the island where the remains of an old wharf, rock walls and building sites are still present. Old tracks, tunnels (which were probably explosive stores, R. Brassey pers. comm.), timber and concrete are scattered over the rest of the island. Presumably these structures were associated with the quarrying operation. A letter to the Commissioner of Crown Lands in 1960 stated that "... the quarry has been virtually worked out and we understand that this has been the position for some years".

Extensive shingle dredging around the coast of these islands was carried out to the extent that it prompted Maddock & Whyte (1966: 92) to comment that Moturekareka was "worn almost in two by the shingle dredges". Before 1941, it appears that Hansen was selling shingle from these islands (according to a note from the Commissioner of Crown Lands' office, 30 April 1941).

Fig. 7. The levelled Motutara quarry area (about 100m across), building and western high point, from west looking ESE, November 1970. The building has now collapsed and the grassy flat is now dominated by shrubs of bone-seed. From Lands & Survey File NP 30, held by DoC, Auckland.

NATURAL HISTORY

(For brevity in this section, MR = Moturekareka, MT = Motutara and K = Kohatutara.)

Birds

Grey-faced petrel/oi (*Pterodroma macroptera gouldi*) - MT: there was a nesting colony on the slope at the south-eastern end, extending up to, but not onto, the top of the eastern hill. Just over 100 burrows were counted in June 1988. Another 10+ burrows were found on a knoll at the western end of MT. Birds were present in many burrows on 2 June 1988. On 30 July 1988 we banded two birds incubating in burrows. At night, they were common in flight and several were brought down by "war-whooping" (see Tennyson & Taylor 1990); 18 were banded on this occasion. In October 1988, no petrels were heard and none responded to "war-whoops" but one adult was caught in a burrow with

a medium-sized, all downy chick which regurgitated squid when handled; both were banded. No petrels were observed on our February 1989 visit. In June 1989 the colonies were very active with much ground and aerial calling at night and good responses to "war-whoops". We banded 25 adults, including three females which had just laid. MR: although no systematic survey was carried out, several burrows were found at the western end in 1988, and one half grown chick was seen there. Chris Green (in 1991) and EKC (in 1994) also noted a few burrows at the western end of the island but not elsewhere. K: we did not record any petrels on these islets. The soil is a maximum of only about 5cm deep in small patches, and is too shallow for petrel burrows.

Blue penguin/korora (*Eudyptula minor*) - MT: small numbers breeding, with one found in a burrow on a freshly laid egg at the south-eastern end of the island and two other birds heard in burrows at the western end of island in October 1988. A couple of old moulting sites were found in February 1989, and a pair was found in a burrow at the eastern end of the island in June 1989. At night up to five penguins were seen or heard on the surface on each visit. A total of 11 dead birds was found on beaches during the October 1988 and February 1989 visits, but these most probably originated from other colonies given the small numbers nesting here. MR: one was found in a burrow, and about 20 were offshore before dusk in 1988; in 1994 one nest was found under a building, and others were nesting on the south side of island.

Pied shag/karuhiruhi (*Phalacrocorax varius*) - MT: noted on coast on all surveys except June 1989, a maximum of four roosting on rocks on 2 June 1988. MR: one recorded on rocks in 1988. K: one on rocks on 2 June 1988, up to about five in July 1988.

Little shag/kawaupaka (*Phalacrocorax melanoleucos*) - MT: one or two seen along the coast during each survey, except none in February 1989. K: singles noted on 2 June 1988 and 30 July 1988, four birds and four empty nests, probably of this species, in a pohutukawa (*Metrosideros excelsa*) on 15 October 1988. Jeff Cook noted 15 nests containing 26 nearly-fledged chicks and 15 adults in a grove of pohutukawa on the north-western side on 2 December 1994.

Reef heron/matuku-moana (*Egretta sacra*) - MR: one flying past heading towards nearby Motuketekete in 1988. K: singles in June 1988 and February 1989.

Grey duck/parera (*Anas superciliosa*) and mallard (*A. platyrhynchos*) - Two grey/mallard ducks were seen flying past MT on 31 July 1988, and a wary pair of grey ducks was disturbed from a nest containing nine eggs in a thicket of taupata (*Coprosma repens*) and *Isolepis nodosa* on the top of one of the K stacks on 15 October 1988. MR: one mallard was seen in the bay by the *Rewa* on 22 February 1997.

Domestic fowl (*Gallus gallus*) - MR: Alan Esler saw free-roaming chickens from offshore in the 1970s.

Turkey (*Meleagris gallopavo*) - MR: Clarkson (1991) mentions that turkeys running free over the island were quite a feature during Hansen's time.

Pukeko (*Porphyrio porphyrio*) - MT: one on 16 October 1988.

Variable oystercatcher/torea (*Haematopus unicolor*) - K: Simon Chamberlain recorded one pair with a clutch of two on 31 November 1984. On 15 October 1988 a pair with a clutch of three chased off two other birds, and two of this group visited MT. Two were also noted in July 1988 and June 1989.

Pied stilt/poaka (*Himantopus himantopus*) - MT: At least two heard flying over at about 2400hrs on 26 June 1989.

Shore plover/tuturuatu (*Thinornis novaeseelandiae*) - occasional visitors to K since they were first transferred to neighbouring Motuora Island in 1994 (J. Cook pers. comm., 1997).

Southern black-backed gull/karoro (*Larus dominicanus*) - MT: present on each survey with a maximum of four in July 1988. MR: present in 1988 and 1994. K: Simon Chamberlain noted seven and at least one nest on 31 November 1984, six pairs on 25 November 1987 and some birds present on 22 October 1988. We noted this species on all surveys except June 1988 with a maximum of 20, and three bulky but empty nests (probably of this species) on the top of the highest stack on 15 October 1988. Jeff Cook recorded six nests containing a total of 12 eggs and one chick on 2 December 1994.

Red-billed gull/tarapunga (*Larus novaehollandiae*) - Simon Chamberlain noted nesting birds on K (uncounted) on 2 December 1959, 12 December 1986 and 6 November 1987. He counted 160+ pairs nesting on K on 31 November 1984 and 82 nesting on 25 November 1987. Although *c.* 200 birds and 2-3

empty nest scrapes probably of this species were present on the northern K stack on 15 October 1988, the only other records we have are one heard on MT on 14 October 1988, and three long-dead single birds found on the MT coast in February and June 1989, and on K on 27 June 1989.

Caspian tern/taranui (*Sterna caspia*) - Simon Chamberlain noted one pair with two running chicks on K on 31 November 1984. We saw three adults including a pair with a clutch of two on K on 15 October 1988. The only other occasion when we saw this species was July 1988, when two were seen resting on K, and one was noted in flight from MT. Jeff Cook noted one nearly-fledged chick on K on 2 December 1994.

White-fronted tern/tara (*Sterna striata*) - MT: the only records are six flying over in February 1989 and one humerus found on 26 June 1989. K: Simon Chamberlain noted nesting on 2 December 1959, 12 December 1986, 16 January 1987 and 6 November 1987 but did not make counts. On 31 November 1984, Simon Chamberlain counted 300+ pairs, most had one egg clutches; on 25 November 1987 he noted 79 birds nesting. On 30 July 1988 we found about five old nests including one containing egg shell fragments and another containing a deserted egg (50.4 x 35.1mm) but no birds were present. About 40 birds were present mainly around the northern islet on 15 October 1988, but none was seen on any other of our surveys. Simon Chamberlain saw none on 22 October 1988, no sign of breeding on 9 January 1990, about 20 starting to nest (at least one egg) on 2 October 1990, but no colony on 14 December 1995. Jeff Cook noted two nests with adults sitting on single eggs on 2 December 1994.

Kereru/New Zealand pigeon (*Hemiphaga novaeseelandiae*) - MR: reported to Chris Green by the resident caretaker in July 1991.

Rock pigeon (*Columba livia*) - K: A large bulky empty stick nest under a karo (*Pittosporum crassifolium*) was found on 15 October 1988. A nervous-looking pigeon was flying around MT and resting on K at the time and was presumed to be associated with the nest. No sign of the species was seen on other visits.

Kaka (*Nestor meridionalis*) - MR: reported to Chris Green by the resident caretaker in July 1991 that the species is an occasional visitor.

Eastern rosella (*Platycercus eximius*) - MR: noted by Chris Green in July 1991.

Morepork/ruru (*Ninox novaeseelandiae*) - MT: one or two heard at night on each visit, and one seen in July 1988. MR: one seen roosting in 1994.

Kingfisher/kotare (*Halcyon sancta*) - MT: recorded on each survey with a maximum of about five seen in July 1988. In February 1989, a nest was found in a hole in a bank with the remains of at least three eggs outside and two naked chicks calling inside. MR: present in 1988, July 1991 and 1994. K: noted each survey except February 1989, with a maximum of two birds on 15 October 1988.

Welcome swallow (*Hirundo tahitica*) - MT: singles on 31 July 1988 and 15 October 1988, two on 16 October 1988. K: two on 15 October 1988. MR: three in 1988, many on 20 February 1997 around the internal framing of the *Rewa* where they appeared to be nesting.

Dunnock (*Prunella modularis*) - MT: one or two heard on 31 July 1988 and 15-16 October 1988.

Blackbird (*Turdus merula*) - MT: fairly common, being noted on each survey. In June 1989 two females were eating houpara (*Pseudopanax lessonii*) fruit in trees and one male was eating the fruit on the ground. MR: present in 1988, July 1991 and 1994.

Song thrush (*Turdus philomelos*) - MT: one in February 1989.

Grey warbler/rironiro (*Gerygone igata*) - MT: common on all surveys, however, very quiet on 2 June 1988. MR: present in 1988 and 1994. K: one on 15 October 1988.

Fantail/piwakawaka (*Rhipidura fuliginosa*) - MT: several recorded on every survey. MR: noted in 1988 and July 1991.

Silvereye/tauhou (*Zosterops lateralis*) - MT: common on each survey, except not noted in February 1989. Noted eating houpara fruit in June 1989. MR: noted by Chris Green in July 1991.

Tui (*Prosthemadera novaeseelandiae*) - MT: June 1988, none; 4-5 individuals, including at least two feeding from karo flowers in July 1988; 3-4 in October 1988; February 1989, none. Most prominent in June 1989 - a minimum of six on 28 June, calling, chasing and displaying, and many eating ripe houpara fruit. MR: present in 1988 and 1994.

Yellowhammer (*Emberiza citrinella*) - unsourced record for the island group in DoC (1995).

Chaffinch (*Fringilla coelebs*) - MT: several in July and October 1988. MR: seen in 1988. K: one on 15 October 1988.

Goldfinch (*Carduelis carduelis*) - MT: June 1988, none; most common in February 1989 when several, including juveniles were noted; two in July and October 1988; June 1989, none.

Redpoll (*Carduelis flammea*) - K: two possibles on 15 October 1988.

Starling (*Sturnus vulgaris*) - MT: a maximum of seven in July 1988, also noted in October 1988 and February 1989 with a probable nest in bank in October 1988. MR: seen in 1988. K: only recorded in October 1988 when four noted, including one flying about a crevice on the highest stack - possibly nesting.

Australian magpie (*Gymnorhina tibicen*) - MR: reported by resident caretaker to Chris Green in July 1991.

Lizards

Two moko skinks (*Oligosoma moco*) were caught and two other skinks probably of this species were seen on MT in February 1989. There is an unsourced report of copper skink (presumably *Cyclodina aenea*) from the island group in DoC (1995). No lizards were noted on K or MR by us, although little searching was carried out.

Mammals

Wilson (1990: 78) recorded that Hansen sometimes arranged shooting parties for the guests of Mansion House, Kawau Island, to help him rid MR of goats (*Capra hircus*). We are unaware of any recent record of goats on the Moturekareka Group.

We set 15 rat and 15 mouse snap traps on MT on 30 July 1988, and overnight caught seven house mice (*Mus musculus*) in mouse traps and two mice in rat traps. The peanut butter bait was eaten by snails and slugs which probably sprung several traps. Mice were not observed in June or October 1988, but a few were seen at night in February and June 1989. The resident caretaker

reported to Chris Green in July 1991 that mice were present on MR. Although we did not sample for rodents on K, as the islands are connected, presumably their rodent status is the same. No other mammals were noted.

Vegetation communities (see Fig.1)

The vegetation of MR and MT is highly modified. In 1930 the vegetation of the western end of MR was low scrub with the occasional pine (*Pinus radiata*) (Fig. 5, bottom) and MR east of the *Rewa* had pines on the higher land with large pohutukawa on the coastal slope (Fig. 5, top). The 1970 view of MT from the west (Fig. 7) indicates the state of the vegetation (heavily modified but no pines visible) after the quarry was closed.

There are six broad vegetation classes:

Pine forest - Pines are the tallest vegetation on MR and MT. They are up to 20m tall and form an almost continuous cover, mainly on the higher areas, especially on MR. The understory of the pines varies from almost bare ground covered with pine needles (NW point of MR, SE point of MT), to pine litter with ferns and *Astelia banksii* locally common, to native shrubland where the vegetation is less exposed. The main understory shrubs are coastal karamu (*Coprosma macrocarpa*), karo, houpara and mapou (*Myrsine australis*). The pines probably originated from a planting on MR; they were logged there in about 1964 and never replanted (J. Cook pers. comm., 1994). The mixed spacings, growing sites and size ranges of the present pines supports that they originated from wildings.

Pohutukawa forest - The best developed native forest is next to and in the small valley east of the *Rewa*. Large pohutukawa are present with good sized mahoe (*Melicytus ramiflorus*), mamaku (*Cyathea medullaris*) and ponga (*Cyathea dealbata*). Karaka (*Corynocarpus laevigatus*), wharangi (*Melicope ternata*) and kawakawa (*Macropiper excelsum*) are locally present. The 1930 photograph (Fig. 5, top) indicates that this vegetation has been undisturbed for some time. Pohutukawa forest also dominates the south-facing cliffs of MR, below the pines. Occasional pines are also present amongst the pohutukawa. Karo is the most abundant shrub; coastal karamu, mahoe, houpara, *Astelia banksii* and rengarenga (*Arthropodium cirratum*) are locally common. Occasional on these southern cliffs are shrubs of kawakawa, akepiro (*Olearia furfuracea*), mapou (near the top) and taupata.

Shrubland - Quite a dense shrubland is present on the high eastern end of MR with occasional emergent pines. The main species are coastal karamu, mapou, karo, hangehange (*Geniostoma rupestre*) and akeake (*Dodonaea viscosa*); mahoe, manuka (*Leptospermum scoparium*) and brush wattle (*Paraserianthes lophantha*)

are locally common; other species include mingimingi (*Leucopogon fasciculatus*), akepiro, koromiko (*Hebe stricta*), rangiora (*Brachyglottis repanda*), kanuka (*Kunzea ericoides*), bracken (*Pteridium esculentum*) and gorse (*Ulex europaeus*).

On the eastern end of MT a strip of native shrubland of karo forms the coastal fringe in front of scattered pohutukawa and emergent pines behind.

Grass - shrubland - In 1988 an exotic grassland covered the old quarry site, some 100m across, at the western end of MT (Fig. 7). The dominant species were red-leg grass (*Bothriochloa macra*), ratstail (*Sporobolus africanus*), sweet vernal (*Anthoxanthum odoratum*), paspalum (*Paspalum dilatatum*), tall fescue (*Festuca arundinacea*) and brome species (*Bromus* spp.). Although this area has little soil, shrubs of bone-seed (*Chrysanthemoides monilifera*) [*c.* 1m tall in 1997] dominate this site with a few pine trees (up to *c.* 6m tall), a patch of gorse and grassy strips between the shrubs.

Coastal turf - Although small patches of coastal turf vegetation are locally common around the shoreline and on rocky headlands on all three islands, it is the main vegetation type only on K. The main turf forming species are the salt tolerant NZ ice plant (*Disphyma australe*), glasswort (*Sarcocornia quinqueflora*) and shore groundsel (*Senecio lautus*). Others include *Dichondra repens*, *Einadia trigonos*, sea spurrey (*Spergularia media*) and *Lachnagrostis littoralis*. Scattered, wind-shorn woody plants, mainly taupata, karo and bone-seed occur on the higher slopes or in more sheltered sites.

Orchard/garden plants - Behind the two buildings on MR (see Fig. 1) in a small valley is the remnants of a small orchard where loquat (*Eriobotrya japonica*), peach (*Prunus persica*), grapefruit (*Citrus paradisi*), edible fig (*Ficus carica*) and a grape vine (*Vitis vinifera*) survive. Garden ornamentals are also present: coral tree (*Erythrina* x *sykesii*), Chinese windmill palm (*Trachycarpus fortunei*), apple mint (*Mentha suaveolens*), a spreading rose (*Rosa* sp.), tecoma (*Tecomaria capensis*), tabacco (*Nicotiana tobacum*), mile-a-minute (*Dipogon lignosus*), *Chasmanthe bicolor*, agapanthus (*Agapanthus ?praecox*), garden nasturtium (*Tropaeolum majus*), two species of *Osteospermum*, pampas grass (*Cortaderia selloana*), and violet (*Viola odorata* - which is also at the west end of MR where it was possibly planted as well). Most likely arum lily (*Zantedeschia aethiopica*), ginger (*Hedychium* sp.), onion weed (*Allium triquetrum*), and dally pine (*Psoralea pinnata*) were also originally planted on the island. Several of the above species have naturalised and some others have spread vegetatively.

Environmental weeds

The worst weeds or potentially invasive species present are:

Pines - widespread and common.

Bone-seed - widespread in open sites.

Mile-a-minute - on MR by the buildings and occasional elsewhere as small vines. White-flowered form.

Purple pampas grass (*Cortaderia jubata*) - only on MT where it was scarce in 1988-89 and 1997.

Pampas grass - cultivated in front of the buildings on MR and single wild clump on south coast of MT in 1997.

Ginger - single clump found on MR in 1994 (C.R. Veitch pers. comm.).

Brush wattle - scattered on MR, mostly young plants in bush on the eastern and central parts of the island.

Loquat - two mature planted trees in the former orchard on MR, also occasional seedlings in the bush. On MT seedlings were occasional in 1988 but frequent in 1994 (C.R. Veitch pers. comm.). R. Brassey (pers. comm.) noted mature trees at north-east end of MT in 1994 which appeared to be associated with the quarry house sites. These trees were also noted by EKC in 1997.

Gorse - although this species generally assists forest regeneration there are many cliffs and bush margins where it is locally common and could continue to persist. It has been on MT for some time as a note accompanying a photograph of the quarry area in 1970 (Fig. 7) says that gorse is starting to take over and recommends spraying.

Agapanthus - although only recorded by the buildings on MR, it is very drought tolerant and has the potential if left to dominate many open sites on these islands.

Onion weed - locally abundant by the buildings and former orchard on MR where it grows with rank grasses and apple mint. Onion weed could spread and dominate much of the ground cover if left uncontrolled.

Chasmanthe bicolor - spreading from behind one of the buildings on MR.

Dally pine - occasional in the bush only at the eastern end of MR.

Other originally cultivated species spreading locally behind the buildings on MR are: apple mint, tobacco, rose (a single plant), tecoma, garden nasturtium, and arum lily.

Vascular flora

The vascular flora of the three islands totals 187 taxa: 154 on Moturekareka, 114 on Motutara and 30 on Kohatutara (see Table 1). Many of the 34 plant taxa found on Motutara and Kohatutara but not recorded on Moturekareka probably also occur on the large island. More searching is needed. However, grassland habitat is not well represented on Moturekareka, and this may account for some of the plant omissions.

Table 1. Vascular flora totals of Moturekareka (MR), Motutara (MT), Kohatutara (K) Islands and their combined flora.

	MR	MT	K	Totals
Native ferns	20	9	1	21
Native dicotyledons	42	31	13	47
Native monocotyledons	25	18	5	29
Adventive gymnosperms	1	2	-	2
Adventive dicotyledons	45	37	6	60
Adventive monocotyledons	21	17	5	28
TOTALS	154	114	30	187
% native	57	51	63	52

The species list which follows (Table 2) includes all vascular plant taxa seen during our visits. Abundance for each taxon is noted using a five-tiered scale. Where a voucher exists to support the record, the herbarium sheet is listed. A search of the AKILLES databases of AK (Auckland Museum) and AKU (Auckland University) herbaria revealed only one previous collection from the group: *Asplenium haurakiense*, collected by A.E. Wright in 1974 on Motutara.

Table 2. Vascular plant list for Moturekareka (MR), Motutara (MT) and Kohatutara (K) Islands

Key

* = adventive species
N = recorded (pers. comm.) but not seen by us
a = abundant
c = common
o = occasional
l = local
s = scarce (< 5 plants seen)
P = planted
K & MT records are for 1988-89 unless otherwise stated

	MR	MT	K	Voucher specimens
Ferns (21 + 0) (native + adventive planted totals)				
Adiantum cunninghamii	l			
A. hispidulum	o	s		
Asplenium ? flaccidum	s			
A. haurakiense	o-lc	c	c	AK 134543 (MT)
A. oblongifolium	o	c		
A. polyodon	s	s		
Blechnum filiforme	l			
B. sp."1"	l			
Cheilanthes distans		s		
Cyathea dealbata	c			
C. medullaris	o			
Deparia petersenii	la			
Diplazium australe	l			
Doodia media	o			
Lastreopsis microsora	l			
Phymatosorus pustulatus	o	o		
Polystichum richardii	l			
Pteridium esculentum	o	o		
Pteris comans	lc			
P. tremula	o	s		
Pyrrosia eleagnifolia	c	o		
Conifers (0 + 2)				
*Cupressus macrocarpa**		s		
*Pinus radiata**	a	lc		
Dicotyledons (47 + 60)				
Anagallis arvensis var. *arvensis**	o-lc	o		
A. arvensis var. *coerula**		lc		
Apium prostratum s.str.	o	o		
*Atriplex prostrata**	o-lc	o		
Avicennia marina	l	s (1997)		
Brachyglottis repanda	o			
Callitriche muelleri	l			AK 229627
Calystegia soldanella	lc	o		
*Centaurium erythraea**	o			
*Cerastium glomeratum**		s	o	
*Chrysanthemoides monilifera**	c	c	o	

*Cirsium vulgare**	s	o		
*Citrus paradisi**	P			
Clematis paniculata	o			
*Conyza albida**	o	o		
Coprosma macrocarpa	a	a		
C. macrocarpa x *C. robusta*	lc			
C. repens	o	a	a	
C. rhamnoides	o			
Corynocarpus laevigatus	s	s		
Cotula australis			o	
Crassula sieberiana	o		c	
*Crepis capillaris**	lc	c		
Dichondra repens	o-lc	lc	o	
*Dipogon lignosus**	o & P			AK 229611
Disphyma australe	o	o-lc	a	
Dodonaea viscosa	c			AK 229617
Einadia trigonos	o		o	
Entelea arborescens	N			
*Eriobotrya japonica**	o & P	o (c in 1994)		AK 229616 (MR)
Erythrina x *sykesii**	P			
*Euphorbia peplus**	lc	o		
*Ficus carica**	P			
*Galium aparine**	l	s		
Geniostoma rupestre	o-lc	s		
Geranium retrorsum		s		AK 229600
G. solanderi "coarse hairs"*	o	o		AK 229613 (MR)
Haloragis erecta	o	o		
Hebe stricta agg.	o	s		AK 231285 (MR)
*Hypochoeris radicata**	o	o		
Kunzea ericoides	l			
*Leontodon taraxacoides**	o			
Leptospermum scoparium	o			
Leucopogon fasciculatus	o	s		
*Linum bienne**		lc		
Lobelia anceps	lc	l (1997)		
*Lotus angustissimus**	lc	c		
*L. pedunculatus**		lc		
*L. suaveolens**	o	c		
Macropiper excelsum	o	o		
*Medicago arabica**	l	c		
*M. nigra**	l			
*M. polymorpha**		o		
Melicope ternata	l	o		
Melicytus novae-zelandiae	s	o		AK 229624 (MR)
M. ramiflorus	c	c-a		
*Melilotus indicus**		s		
*Mentha suaveolens**	l			AK 229618
Metrosideros excelsa	c	o	s	
Muehlenbeckia complexa	o	lc	o	

Myoporum laetum	o	l		
Myrsine australis	c	o		
*Nicotiana tabacum**	s & P			AK 229612
Olearia furfuracea	o	s (1997)		
*Ornithopus pinnatus**		s		AK 229601
*Orobanche minor**	o	s		
*Osteospermum fruticosum**	P			
*O. juncundum**	P			
*Oxalis ? corniculata**	o			
*O. pes-caprae**	l			
O. rubens		s		
*Paraserianthes lophantha**	o-lc			AK 221626
Peperomia urvilleana	l	lc		
*Phytolacca octandra**	s	l		
Pittosporum crassifolium	c	a	c	
*Plantago lanceolata**	o-lc	lc		
*Polycarpon tetraphyllum**	c	s	c	
Pouteria costata	s			
*Prunus persica**	P	s		
Pseudopanax lessonii	o-lc	a		
*Psoralea pinnata**	s			
Ranunculus reflexus	l			
*Raphanus raphanistrum**	s			
Rosa sp.*	l			AK 229614
*Rumex crispus**	? o	s		
Samolus repens	lc			
Sarcocornia quinqueflora	o	lc	c	
*Senecio bipinnatisectus**		o		
S. hispidulus	o	s		
*S. jacobaea**		s		
S. lautus	lc	o	c	
*Silene gallica**		o	s	
Solanum americanum		s	o	
*S. nigrum**	o	o		
*Sonchus oleraceus**	o-lc	o	o	
*Sisymbrium officinale**	l			
Spergularia media			o	
*Stellaria media**			l	
*Tecomaria capensis**	l & P			
*Trifolium dubium**		lc		
*T. ? subterraneum**		s		
*Tropaeolum majus**	l & P			
*Ulex europaeus**	o	lc		
*Veronica persica**		s		
Vicia sp.*		lc		
*Viola odorata**	l & P			AK 229632
*Vitis vinifera**	l			

Monocotyledons (29 + 28)

Acianthus sinclairii		lc		
*Aira caryophyllea**	o-lc	l		
*Agapanthus ? praecox**	P			
*Allium triquetrum**	o-la			
*Anthoxanthum odoratum**	o	lc		
Arthropodium cirratum	c	c		
Astelia banksii	o-c	c-la		
*Avena barbarata**	o			
*Bothriochloa macra**	o-lc	a		AKU 22499 & 22503 (MT)
*Briza minor**	o			
*Bromus arenarius**	lc			AK 229629
*B. diandrus**	o	lc	o	
*B. hordeaceus**		o (1997)		
*B. willdenowii**	o	lc	o	
Carex breviculmis	o			
C. flagellifera	o-lc	o-lc	s	
C. lambertiana	c			AK 229615
C. testacea	l			
C. virgata	o			
*Chasmanthe bicolor**	lc & P			AK 221625
Cordyline australis	o	s		
*Cortaderia jubata**		s		
*C. selloana**	P	s (1997)		
Cyperus ustulatus		s	s	
*Dactylis glomerata**	o	o		
Dianella nigra	o	s		
Dichelachne crinita	o	o		
*Festuca arundinacea**	o	lc		
Gahnia lacera	c			
*Gladiolus undulatus**	o	s		
Hedychium sp.*	N			
Isolepis nodosa	o	lc	o	
Juncus bufonius s.str.*			l	AK 229603
J. ? gregiflorus	o			
Lachnagrostis billardierei		s		
L. littoralis s.str.	o		o	
Lepidosperma australe	o			
Leptocarpus similis	o			
*Lolium perenne**		o		
Microlaena stipoides	o-lc	l	o	
Oplismenus imbecillis	o	a		
*Parapholis incurva**		l	l	
*Paspalum dilatatum**	l	lc		
Phormium tenax	o-lc	c		
Poa anceps	c	o		
*P. annua**			o	
*Rytidosperma racemosum**	o	s		

R. unarede	o	
Schoenus tendo	o	
*Sporobolus africanus**		la
Stipa stipoides	o-lc	lc
Thelymitra longifolia	o	o
*Trachycarpus fortunei**	P	
Triglochin striata		l
Uncinia uncinata	o	o
*Vulpia bromoides**	lc	l
*Zantedeschia aethiopica**	l	

DISCUSSION

Conservation opportunities

Despite Moturekareka and Motutara being severely modified by people, the whole Moturekareka Group is of considerable importance for conservation. Their most significant conservation feature is the lack of introduced mammalian pests other than mice. Although Anon (1996) states that it is possible that rats are present, we consider this unlikely given our observations. Given recent developments in rodent eradication techniques (e.g. McFadden & Greene 1994, Towns *et al.* 1994), it should be a relatively simple operation to eradicate mice from the group. DoC intends to remove the mice within the next ten years but is concerned that garden snails may increase markedly as a result of such an operation (Anon 1996). However as these snails are already abundant on Motutara it seems mice are having little impact on their current population density.

Once eradication of mice is achieved, the islands offer good potential for restoration (e.g. introduction of rare invertebrates, reptiles and birds) as they are well offshore and predatory mammals should not reach them in the future unless they escape from boats. The island group is 2.9km from the mainland and 3.9km from Kawau Island. This separation puts the islands well outside the known swimming range of mustelids and rats. Nearby Beehive Island (2.8km to the north) and Motuora Island (2.2km to the south-east) are both free of introduced mammalian predators (Taylor 1989). Only Motuketekete Island (350m to the east) lies within the swimming range of introduced mammals. The status of introduced mammals on Motuketekete is unknown (Taylor 1989). However, a letter from the owners to the former New Zealand Wildlife Service (file report, Auckland DoC office) stated that feral guinea pigs (*Cavia porcellus*) were present on the island. Past caretakers of that island, Heather and Dennis Lilly, told Jeff Cook that their corgi dog caught and ate the last guinea pigs. Phil Thomson (pers. comm., 1997) found no guinea pigs on a short visit to

Motuketekete in 1982. The presence of guinea pigs suggests that Norway rats (*Rattus norvegicus*) and feral cats (*Felis catus*) were probably absent at the time as feral guinea pigs would be unlikely to survive with these predators present. Any future management of the Moturekareka Group for species conservation initiatives will need to involve the owners of Motuketekete to ensure that there is no chance that introduced mammals will swim between these islands in the future.

Impacts of mice

How and when mice first established on the Moturekareka Group is unknown but there have been plenty of opportunities. The most likely is amongst stores or equipment sent to people living on the islands or used in the construction of their dwellings. Mice may have arrived during the regular shipments to and from the quarry site. There is also a possibility that mice were aboard the *Rewa* or the *Otimai* at the time of their beaching. In recent decades, the island group has become popular with recreational boaties who anchor offshore. Sometimes boats are parked on the beach and mice may have escaped from these craft. It is fortunate that rats failed to colonise the islands given all the opportunities they have had.

Mice appear to have less impact on the vegetation of offshore islands than has been observed with the more arboreal ship rats (*Rattus rattus*) and Pacific rats (*Rattus exulans*) (Atkinson 1986, GAT pers. obs.). Ship and Pacific rats take fruit or other food from all over trees including the high outer branches (pers. obs.). Ship rats also chew the bark on trees to obtain sap (e.g. on 14 April 1990 GAT and AJDT observed 'barking' by ship rats on taupata and karo on Saddle Island, off Port Fitzroy, Great Barrier Island) but we have not seen any evidence that mice 'bark' trees. Taupata is abundant on Motutara, but is often rare or absent on small northern islands where rats are present and water is lacking (Cameron & Taylor 1991). 'Barking' will kill trees and shrubs and have a greater and more immediate effect on vegetation regeneration than situations where the majority of fruit produced each season is eaten by rodents. We have seen mice eat karo fruit that had fallen on the ground under trees (GAT pers. obs.), but we have no evidence that they eat fruit in the canopy of tall trees. Mice appear to spend more time on the ground feeding amongst leaf litter.

Wildlife values

The island group has a significant grey-faced petrel population for the inner Hauraki Gulf. While the timing of the species ashore fits generally with the

seasonal timetable of the New Zealand race elsewhere (see Imber 1976), it is notable that we found no birds ashore on 25 February 1989, because according to standard works (e.g. Oliver 1955, Imber 1976, Marchant & Higgins 1990) birds are supposed to be ashore then. These authorities follow Falla (1934) who stated that a few birds are ashore in February. In fact we know of no records of grey-faced petrels at breeding colonies in New Zealand in February. Our earliest record of a bird ashore is at the beginning of the season on 16 March 1996 at Kauwahaia Island, Auckland west coast (GAT pers. obs.). J.A. Bartle (pers. comm., 1996) did not record the species ashore on a visit to the Poor Knights Islands from 19 February to 9 March 1980.

Excluding shore plover, the other birds present are typical birds of the inner Hauraki Gulf. However, along with shore plover, reef heron, Caspian tern, variable oystercatcher, kereru and kaka are listed by DoC as nationally threatened species (Molloy & Davis 1994). Given the brief length of our visits to Moturekareka, more detailed surveys of grey-faced petrels, blue penguins and coastal-nesting shore birds and waders there would be particularly valuable. A thorough survey of lizards and invertebrates on the whole island group is still required.

Native plants

The percentage of native flora (52%) on these islands (Table 1) is quite low compared with other northern offshore islands. This is not surprising however, as the two larger islands have had a long history of disturbance (pines, quarrying, habitation and possibly fire). The highest percentage of native flora is found on Kohatutara, which supports our observations that it is the least modified of the three islands.

Challenger Island (2.85 ha) on the southern side of Kawau Island is probably the nearest island to the Moturekareka Group with a relatively intact, although not pristine, forest vegetation (see Esler 1971). Of the species listed by Esler (1971), 13 have not been recorded on the Moturekareka Group. The most interesting omissions include kohekohe (*Dysoxylum spectabile*), *Pimelea* cf. *urvilleana*, *Linum monogynum* and *Einadia triandra*. These species may eventually colonise the Moturekareka Group as the islands' vegetation continues to recover from the effects of past disturbance. For example tawapou (*Pouteria costata*) occurs on Moturekareka only as a few saplings (up to 3m tall) and appears to be a relatively recent introduction probably transported to Moturekareka by kereru.

Unusual plant records

There are no nationally Threatened or Local plant species present (see Cameron *et al.* 1995). However some species are worth commenting on:

Geranium retrorsum - only found locally on Motutara. It is uncommon in the North Island (Gardner 1984: 130). De Lange & McFadden (1995) discuss its current distribution and threats to it in the Auckland and Hauraki Gulf area.

Thelymitra longifolia - occasional on the two largest islands. In November 1994 on Moturekareka the white flowers were wide open, apparently matching the insect-pollinated form of *T. longifolia* recorded by McCrae (1990) for Northland, though the flowers were not as large as the North Cape specimens (EKC pers. obs., 1995).

Toad rush (*Juncus bufonius*) - only found on Kohatutara. Judging by published species lists and herbarium records (AK & AKU) this small naturalised rush is an unusual record for a small islet in the Hauraki Gulf. Its presence may be related to a pair of nesting grey ducks recorded on Kohatutara in October 1988. It is likely that these ducks would graze in wet areas on the adjacent mainland and/or on larger islands - sites where toad rush is more likely to grow. We suspect toad rush was transported to the island by the ducks ingesting the seed.

Macrocarpa (*Cupressus macrocarpa*) - the record for Motutara is based on a single tree lying at the back of the southern beach in 1988. It was either washed up alive or was dislodged from the steep slope above. In 1997 it was still alive with side branches up to *c.* 8m tall.

A more detailed survey of higher plants on Moturekareka would be valuable, and a survey of lower plants on the whole island group is still required.

Weed management

Most invasive weeds on these islands apparently originated from plantings made on Moturekareka (pines, mile-a-minute, *Cortaderia selloana*, ginger, loquat, agapanthus, onion weed, *Chasmanthe bicolor*, dally pine). Gorse and brush wattle may have been planted or floated (seeds?) from adjacent islands or mainland. We suspect purple pampas grass is a fairly recent wind-blown arrival

years it is remarkable that it has not spread further. Bone-seed has fleshy that presumably were ingested and dispersed to these islands by frugi birds. It has probably been there a long time as it is well-established on a islands. Bone-seed could have come from many local sources as it is wid on the inner Hauraki Gulf islands (pers. obs.). The distribution of seedlings away from the old orchard area and probable plantings on M supports the report that kereru visit the islands and disperse seed as fev birds can swallow the large fruits. Alternatively, the fruit may have been by people visiting the islands.

As the native vegetation recovers, many of the introduced plant species die out or become much less common, but weed control (and eradication possible) of the invasive species noted above should be undertaken. particularly important to tackle some species before they become widespread and consequently much more difficult to manage, such as minute, pampas grasses, ginger, loquat, agapanthus, dally pine and *Chasm* DoC intends to remove the pine trees and control/eradicate selected weed next ten years (Anon 1996). Ongoing monitoring of the vegetation for the of new weed species is also important, as the islands lack many of Aucl most aggressive bush weeds, and most of these are well established on Kawau Island.

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