

Flora and vegetation of Motuketekete, and updated flora of the Moturekareka group, Hauraki Gulf

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MOTUKETEKETE

Introduction

This account is based on five individual day visits by the author to Motuketekete: 27 Jun 2014 (during a reconnoitre by the mouse eradication team); 11 Sep 2014 (during the mouse baiting), 23 Nov 2014 with the Auckland Botanical Society (ABS) (Fig. 1); 5 Jun 2015 (mouse monitoring); 7 Nov 2015 (to survey the SE coast); and is augmented by observations by ABS members, some of the mouse eradication team, and information from John Vivian, the owner of the island (Fig. 2). Mosses and seaweeds recorded during the ABS visit are discussed separately by Jessica Beever (2015) and Mike Wilcox (2015) respectively. There are geological publications and archaeological reports for the island referenced below. However, I am



Fig. 1. Bot Soc being assisted ashore by John Vivian and one of his sons. Photo: EKC, 23 Nov 2014.



Fig. 2. John Vivian, owner of Motuketekete, warmly welcoming the ABS visit to his island. Photo: Philip Moll, 23 Nov 2014.

unaware of any previous publications describing the vegetation or flora of this island or any previous herbarium collections from the island.

Motuketekete is located 2.7 km SW of Kawau Island, and separated from Moturekareka to the west by the Blanche Channel, only 360 m across at the narrowest point (Figs. 3, 4). The islands are clearly visible from parts of Mahurangi (Fig. 5). Motuketekete is c.730 m long (north-south), and a maximum of 660 m across, covering 27 ha (Taylor 1989), and reaching 54 m asl. It has been in the Vivian family since 1907 (no relation to the Vivian Bay on Kawau Island). They have a small bach on the northern of the two west bays, "Bach bay", which they occupy irregularly, mainly over the summer. There is a navigational light on the eastern Motuketekete cliff-top with a beacon marking the 150m-long reef below the light. The western and northern coast as far as the eastern reef is accessible on foot when the tide is out. Motuketekete translates to: "Food Basket Island", presumably a reflection of the rich kaimoana present around the island.

Geology

Unlike the flora and fauna, the geology has been well investigated and published (Hayward & Brook 1984, Campbell et al. 2004). "The island is greywacke with maybe some chert lenses overlain by basal Waitemata facies of the Kawau Subgroup - fossil-bearing conglomerate (including in-situ coral heads) and flaggy limestone passing up into deep-water Waitematas on the NE corner, where the best flaggy limestone occurs" (Fig. 6) (Bruce Hayward pers. comm.). For a simplified geological map of the island see Campbell et al. (2004: fig. 1c).

Brief History

Maori occupation of the island is evident by: a terraced pa on the high point of the northwestern headland, here called "Pa Hill" (Fig. 7); a small terrace immediately east of the pa; midden remains on Bach bay beach and the bay on the north side of the pa; and stone flakes (greywacke and obsidian) also in the bay on the north side of the pa (Taylor 1993, Clough et al. 1993).

As no Maori storage pits were observed and the soil is very sandy and dry, Maori agriculture was likely to be very limited (Taylor 1993). There is no natural permanent freshwater sources on the island. During heavy rain, water pools on the flat area inland from the bach (the "damp valley") and very



Fig. 3. Motuketekete and the Moturekareka group (near high tide), 2.7 km SW of Kawau Island. Image: Auckland Council GIS Viewer (adapted by Joshua Salter).

occasionally, if really heavy, flows out via a small creek by the bach (John Vivian pers. comm.). There is a beautifully constructed brick-lined well behind the bach, covered up over 18 years ago, as it would have been easy to fall into (John Vivian pers. comm.). What appears to have been a concrete holding tank for water (resembling a small tiled pool) is up the valley behind the bach (John Vivian and Jamie MacKay pers. comm.).

Frederick Whittaker and Theophilus Heale purchased Motuketekete for £59 in 1850, from Governor George Grey, along with a larger land/water claim which included Taungamaro Island (Beehive) and water up to the high-water mark around Kawau Island (<http://timespanner.blogspot.co.nz/2010/07/island-called-motuketekete.html>). The two men had been involved since 1845 with the setting up of a rival copper mining company at Kawau Island. "The original company were deeply hostile to the newcomers and refused to allow Whittaker's miners to live on Kawau, so they had to camp on Motuketekete and were ferried back and forth each day to the mines" (Maddock & Whyte 1983: p.76). Because the raw ore could self-combust it became necessary to partially smelt the ore prior to shipping. As he was barred from using the smelter on Kawau Island, Whittaker had to build his own smelter on Motuketekete around 1850 and transported the ore back to Motuketekete to smelt.

The remains of the fire boxes of the smelter furnace base (a firebrick construction 2 x 2 x 0.5 m) are still evident under the regenerating bush (Figs. 8, 9) along with slag rubble at the northern end of Bach bay. The remains of Whittaker's house (burnt down before John Vivian saw it) and a well were recorded close by (Clough et al. 1993). Just inland from the

smelter is an in-filled mineshaft related to the Whittaker period, and on the beach at the northern end is a slag dump and the remains of wooden posts indicating a jetty (Taylor 1993, pers. obs.). Another human-made structure still visible is a long drainage pipe, buried and encased in concrete, from near the bach to quite a long way out to sea, for sewage (?) from the original homestead (John Vivian pers. comm.).

Whittaker's involvement in mining on the Kawau coast ceased c. 1855 and presumably the smelting operations on Motuketekete ceased soon after, thus it was in use for about five years (Clough et al. 1993). The island changed hands several times until the Scandrett family, of Scandrett Regional Park fame, who owned Motuketekete from 1880 to 1907, sold the island to Thomas Phillip Vivian (John Vivian's grandfather) for £190.

The island had been farmed (cows and goats) and was predominantly bare at the time of the original planting of pines (*Pinus radiata*) in 1959 (cf. Figs. 3 & 4). It was originally planted in pines by John Vivian's father (John D.E. Vivian) and grandfather; these were felled and replanted in 1994 under the then new RMA legislation which prevented replanting of Pa Hill. Taylor (1993) recorded "Pines on the seaward slopes on the island are to be left and subsequent to logging the island is to be replanted in *P. radiata* and 300 pohutukawa." Most of the pohutukawa (*Metrosideros excelsa*) planting occurred on the flats from the base of Pa Hill through to the present bach. Many of these saplings died, perhaps being poisoned from the copper ore left around the smelter – this area used to turn vivid green when it rained hard (John Vivian pers. comm.). At least some of these planted pohutukawa, especially the line of them



Fig. 4. Aerial photograph taken on 13 Mar 1957 looking SSW to: Motuketekete (centre), Moturekareka group (right), Motuora (left) and Te Haupa (Saddle I.) (distant right). Note the bareness of Motuketekete compared with the Moturekareka group; pine planting occurred two years later on Motuketekete. Whites Aviation Ltd: used with permission of the Alexander Turnbull Library, WA-43318. Their permission must be obtained before any reuse of this image.

near the base of Pa Hill, are actually Kermadec pohutukawa (*Metrosideros kermadecensis*).

Vegetation Zones

The wild vegetation is mainly young, most of it probably dating back to the last pine planting in **1994**. The island doesn't appear to have been burnt in recent times, with tea tree (*Leptospermum* and *Kunzea* species) being absent apart from a single kanuka (*Kunzea robusta*) c. 7.5 m tall near the navigation light.

Pine plantation

The pine plantation covers more than half the island, excluding the steep coastal slopes, Pa Hill, the western coastal fringe (easy slopes) and a damp open hollow in the centre of the island (see Fig. 3). Near the coast there is scattered low native regeneration (<2 m tall) under the pines, and thick pine needles cover the ground (Fig. 10).

Native species present under the pines include: coastal karamu (*Coprosma macrocarpa*), karo (*Pittosporum crassifolium*), *Asplenium oblongifolium*, the grass *Microlaena stipoides*, and naturalised species of woolly nightshade and inkweed (*Phytolacca octandra*). Old pine stumps from the initial plantings are still present, partly decayed but still firm enough to commonly support leather fern (*Pyrrosia eleagnifolia*), *Asplenium haurakiense* (Fig. 11), bryophytes and occasionally *Asplenium polyodon*. In from the margins where the light levels are lower there is often little regeneration under the pines (Fig. 12).

Some old pines from the first planting still survive on the plantation margins and on Pa Hill. One of the largest trees on the island is the pine tree on the top of the slope behind the more

southern of the two western bays – it is c. 24 m tall with a basal diameter of >1 m.

Coastal slopes

On the gentler W-facing slopes pohuehue (*Muehlenbeckia complexa*) commonly dominates in large patches, usually associated with bracken (*Pteridium esculentum*), gorse (*Ulex europaeus*), bone-seed (*Chrysanthemoides monillifera*) and woolly nightshade (*Solanum mauritianum*). Bone-seed locally dominates the small headland between the two western bays along with a local patch of *Agave americana*. The exposed NW steep coastal slope of Pa Hill is dominated by a polygala (*Polygala myrtifolia*) shrubland (Fig. 13), plants 1-1.5(-2) m tall with some bone-seed, gorse and karo. The polygala continues as far as the eastern end of North Bay, and scattered along the west coast to SW Point.

Apart from the western coastline, the island's coast is steep and often rocky, supporting a predominantly native shrubland, in places with some sizeable pohutukawa, especially along the SE coast (Figs. 14, 15), and pines of various sizes, many left from the first pine planting and others more recent wildlings. The main species of these steep slopes in order of abundance: karo, coastal karamu, mapou (*Myrsine australis*), houpara (*Pseudopanax lessonii*), mahoe (*Melicytus ramiflorus*), pines, pohutukawa, *Astelia banksii* and gorse. More locally, kawakawa (*Piper excelsum*), hangehange (*Geniostoma ligustrifolium*), coastal mahoe (*Melicytus novae-zelandiae*), flax (*Phormium tenax*), *Ficinia nodosa*, rengarenga (*Arthropodium cirratum*), *Peperomia urvilleana* (Fig. 16) and smilax (*Asparagus asparagoides*) are also present. Erosion has occurred on some of the steeper slopes (Fig. 17), sometimes caused by pine trees being blown over.

Flats of Bach bay, including orchard and garden plants, leading to the damp hollow in the centre

Apart from the pines, all plantings on the island occur in the area of Bach bay (see Appendix). Many different exotic species, most likely originally planted, have since spread. They include: periwinkle (*Vinca major*) that dominates the northern flats, and mixed monocots that dominate much of the southern flats: agapanthus (*Agapanthus praecox*), *Watsonia meriana* 'Bulbilifera' and onion weed (Fig. 18), along with banana passionfruit (*Passiflora tarminiana*) (Fig. 19), tecomaria (*Tecomaria capensis*), a rambling rose (*Rosa × wichurana*) (Fig. 20), Madeira vine (*Anredera cordifolia*) (Fig. 21) and occasional tussocks of pampas grass (*Cortaderia selloana*).

Near the bach two planted Moreton Bay figs (*Ficus macrophylla*), c.25 m and 16 m tall, stand out with a 10 m-tall phoenix palm (*Phoenix canariensis*). Other suspected planted trees in this area include: a 15 m-tall puriri (*Vitex lucens*), several karaka (*Corynocarpus laevigatus*), a 9 m-tall tree privet (*Ligustrum lucidum*), an 8 m-tall coast redwood (*Sequoia sempervirens*) and 3 oak trees (*Quercus robur*). Also there are the remnants of an orchard: lemon (*Citrus limon*), edible fig (*Ficus carica*), peach (*Prunus persica*), grape (*Vitis vinifera*) and loquat (*Eriobotrya japonica*).

Further up the valley, past the orchard the damp valley supports: 3 golden weeping willows (*Salix × chrysocoma*) 8-10 m tall, tall naturalised woolly nightshade (the dominant tree here) (Fig. 22), the rambling rose, and a clump of yellow ginger (*Hedychium flavescens*). Also present are a few wetland plants: a patch of *Eleocharis acuta*, a few clumps of *Juncus sarophorus*, creeping buttercup (*Ranunculus repens*) and a patch of *Deparia petersenii*. Some garden ornamentals exist near the bach (see Appendix).

Vascular Flora

The wild and cultivated vascular plants are recorded separately in the Appendix. The wild flora numbers

174 species with 53% being native, and the cultivated flora 26 species, excluding species that have also naturalised (Table, Appendix).

Natives: three of the special Hauraki Gulf island species (see Cameron 2013) are present in small populations, i.e. coastal mahoe (Fig. 23), *Pteris comans* and tawapou (*Planchonella costata*). The kawakawa on the island matches the "Hauraki Gulf form" (Fig. 24) of Gardner (1997) which is frequent on the outer Gulf islands. Interestingly the kawakawa on the adjacent Moturekareka were both "Hauraki Gulf form" and normal mainland form.

There are three threatened species present: during the ABS trip Anthony Wright photographed what looks like a young specimen of *Picris burbridgeae* south of Pa Hill below the pines, which is ranked Nationally Endangered; *Tetragonia tetragonoides* which occurs at the back of the more southern of the western bays and is ranked as Naturally Uncommon (de Lange et al. 2013); and the Regionally threatened *Senecio quadridentatus* (two plants) which occurs just north of SW Point on exposed coastal rocks. The record of NZ chickweed (*Stellaria parviflora*) on the SE coastal cliffs is an uncommon record for the inner Hauraki Gulf.

Many species that should be present appear to be absent. Some obvious ones include: kohekohe (*Dysoxylum spectabile*), wharangi (*Melicope ternata*), ngaio (*Myoporum laetum*), manuka (*Leptospermum scoparium*), mingimingi (*Leucopogon fasciculatus*), *Coprosma rhamnoides*, *Hebe stricta*, *Carex spinirostris*, *Samolus repens*, and many fern species. These are all present on islands close by (see Appendix).

Weeds: On the flats from the bach to nearly the base of Pa Hill and up the damp valley east of the bach the vegetation is dominated by naturalised species, several mentioned above, that were most likely originally planted here and over time have spread.

Figs. 5–16: **5.** Motuketekete (left), Moturekareka (centre) and Motutara (right) clearly visible from Mullet Point looking SE, just over 4 km distant. The N tip of Motuora is just visible on the far right. Photo: EKC, 21 Jun 2015. **6.** Flaggy limestone of the NE coast with pohutukawa, karo and pines at the top. Note dead pine tree in the upper-middle. Photo: EKC, 5 Jun 2015. **7.** Pa Hill, NW point of the island, and Bach bay near high tide, looking N. Photo: EKC, 23 Nov 2014. **8.** Base of the 1850s smelter under regenerating bush in Bach bay. Photo: EKC, 5 Jun 2015. **9.** *Microsorium pustulatum* overgrowing old fire bricks of the 1850s smelter. Photo: Cheryl Taylor, 23 Nov 2014. **10.** Western margin of pine plantation with a ground cover of mainly low native shrubs. Photo: EKC, 5 Jun 2015. **11.** *Asplenium haurakiense* – a common fern of the coastal slopes and pine margins. Photo: EKC, 5 Jun 2015. **12.** In the pine plantation, away from the margins there is often no undergrowth. Photo: EKC, 27 Jun 2014. **13.** Polygala shrubland dominating the coastal slope on the NW face of Pa Hill. Photo: EKC, 27 Jun 2014. **14.** The best regenerating area of native forest, SE Motuketekete coast. Photo: EKC, 23 Nov 2014. **15.** Some good-sized pohutukawa grow along the SE coast. The steep coast here has saved it from the impact of pine harvesting in 1994. Photo: EKC, 11 Sep 2014. **16.** The native pepper (*Peperomia urvilleana*) locally common on the steep coastal slopes with rengarenga below it. Photo: looking down a steep coastal slope, SE coast, EKC, 5 Jun 2015.





Most are not present on the rest of the island. The naturalised species on the flats include five species in the iris family: stinking iris (*Iris foetidissima*) (native to Europe), and four others native to South Africa: *Chasmanthe bicolor*, montbretia (*Crocasmia × crocosmiiflora*), *Gladiolus undulatus* and *Watsonia meriana* 'Bulbilifera'.

The recommended start to a weeding strategy would be to begin controlling the environmental weed species that are spreading outside of Bach bay flats. They would include: stinking iris, banana passionfruit, smilax, bone-seed, polygala, woolly nightshade, onion weed (*Allium triquetrum*), loquat, kahili ginger, blackberry (*Rubus fruticosus*), phoenix palm, pampas grass and purple pampas grass (*C. jubata*). Also, two locally occurring species would be good to eradicate before they spread: the single patch of tradescantia (*Tradescantia fluminensis*), and the single tree privet (does it need to outcross to set seed?).

Fortunately some aggressive environmental weeds of this part of the Gulf appear to be absent, they include: climbing asparagus (*Asparagus scandens*), kikuyu grass (*Cenchrus clandestinus*), *Cotoneaster glaucophyllus*, *Dipogon lignosus*, brush wattle (*Paraserianthes lophantha*), Chinese privet (*Ligustrum sinense*), *Centranthus ruber*, and veldt grass (*Ehrharta erecta*). These are all present on islands close by (see Appendix). However, other potentially troublesome weed species are present on Kawau Island.

Bryophytes

Because of the dryness of the islands, bryophytes are limited in number and biomass. Mosses are recorded separately by Beever (2015) and five liverworts identified by John Braggins are recorded here with

their herbarium numbers: *Chiloscyphus canaliculatus* (AK 357707), and *C. semiteres* var. *semiteres* (AK 355396) both were mixed with mosses on a fallen decaying pine trunk; and *Frullania rostellata* (AK 355395) on living bark of karo with *Lejeunea ?oracola* and a *Metzgeria* sp.

Fungi

Commonly observed fungi included: wood ear (*Auricularia cornea*) abundant on many of the dead karo trees; the iconic fly agaric (*Amanita muscaria*) present throughout the pine plantation; and on dead wood the small exotic polypore, orange pore fungus (*Favolaschia calocera*).

Fauna

Mammals: guinea pigs were once feral on the island. **"The place was overrun with the guinea pigs when I visited there in the mid-1970s – there must have been hundreds" (Bruce Hayward pers. comm.). Evidently they were wiped out by the caretakers' corgi dog about 1991-1994 (Tennyson et al. 1997; John Vivian pers. comm.). King (2005) appears to have overlooked this feral Motuketekete population when she listed guinea pigs as "never established" in the wild in New Zealand.**

Mice were the only other feral mammal on the island. Auckland Council, in conjunction with eradicating mice on the adjacent Moturekareka group, also baited Motuketekete for mice in the winter of 2014 using Brodifacoum in blue Pest Off blocks (managed by Jamie MacKay), making both island groups now potentially mammalian pest-free. A check of the island with Department of Conservation and Auckland Council **rodent dogs in winter 2015 didn't detect any rodents** on either island group (Jamie MacKay pers. comm.).

Figs. 17–28: **17.** Erosion on the steep E coast, just south of the navigation light. Photo: EKC, 11 Sep 2014. **18.** Onion weed (foreground) is widespread on Motuketekete, but most common on the flats near the bach, along with bulbil watsonia (mid-left) and periwinkle (mid-right). Photo: just N of the bach, EKC, 11 Sep 2014. **19.** Fruiting plants of banana passionfruit are present on the bach flats, the headland south of the bach and by the navigation light. A few seedlings were observed in the SE native bush. Photo: EKC, 5 Jun 2015. **20.** The vigorous rambling rose (*Rosa × wichurana* 'Albéric Barbier'), from an old planting, extends c.100 m on the bach flats. Photo: just starting to flower, EKC, 11 Sep 2014. **21.** Young plants of Madeira vine carpet the ground in the central damp hollow, under a canopy of adult vines and woolly nightshade. Photo: EKC, 7 Nov 2015. **22.** Woolly nightshade canopy 5-8 m tall dominates the damp hollow in the centre of the island. Photo: EKC, 27 Jun 2014. **23.** Coastal mahoe c.3 m tall, in native bush, SE coast. Only three widely separated populations were found on Motuketekete. With the mice now thought to be eradicated, hopefully this species will increase. Photo: Philip Moll, 23 Nov 2014. **24.** The kawakawa leaves on Motuketekete are shiny and have over-lapping leaf-bases **matching the "Hauraki Gulf form" of Gardner (1997)**. Photo: EKC, 5 Jun 2015. **25.** Kahili ginger choking the best forested valley on Moturekareka. Photo: EKC, 14 Oct 2015. **26.** The old (1930s-40s) levelled Motutara quarry area (c.100 m across) is still predominantly a grassland with scattered shrubs of bone-seed, gorse and a few pines. Photo: EKC, 7 Nov 2015. **27.** Dead large karo 9 m tall, 41 cm dbh, on the upper western margin of Motuketekete – related to the drought in Feb-Mar 2013? Photo: EKC, 5 Jun 2015. **28.** Stand of dead ponga first seen Jun 2014, SE Motuketekete coastal bush – result of the Feb-Mar 2013 drought? Photo: EKC, 11 Sep 2015.

Birds: Twenty-three species of birds were passively recorded during the author's five visits: "A" for 27 Jun 2014; "B" for 11 Sep 2014; "C" for 23 Nov 2014; "D" for 5 Jun 2015; and "E" for 7 Nov 2015:

Grey-faced petrel A (c.10 burrows on Pa Hill, at least one with an adult present), C (active burrows above SW Point); blue penguin A (in a burrow), D (burrow N coast), E (burrow SE coast); pied shag B,C (several), D; little shag B,C (×1); variable oystercatcher B (1 pair), C (at least 1 pair), D; black-backed gull C; red-billed gull C; white-fronted tern C and E (flying close to island); kereru B (×2 in fig trees), C (×3 in fig trees), D (×1 in karamu by fig tree), E (×1 in woolly nightshade); Eastern rosella B-E; morepork B (SE bush), E (central damp hollow); kingfisher B-E (common); welcome swallow C,E; silvereye C,D (flock on tecomaria flowers); grey warbler A-E (common); blackbird A-E; song thrush C; fantail A-E; tui A-E (noisy and active during most visits); house sparrow B; chaffinch B-E; goldfinch B-E (common); and myna E.

Lizards: none have ever been seen on the island by the owners (pers. comm.); and none were seen by the mouse team (pers. comm.) or myself.

Invertebrates: observed a dead centipede by the bach, and garden snail shells (*Cantareus aspersus*) common and widespread.

ABS field trip participants on 23 Nov 2014

Jenny Andrew, Jessica Beever, Michelle Boulle, Ewen Cameron (leader), Lisa Clapperton, Neil Davies, Anne & Bryan Dudley, Frances Duff, Oscar Grant, Shelley Heiss-Dunlop, Charlotte Faulkner, Peter Hutton, Wendy John, Margi Keys, John Millet, Phillip Moll, Suman Pancha, Mark Paterson, Helen Preston Jones, Dhahara Ranatunga, Juliet Richmond, Joshua Salter, Bryony Smart, Vijay Soma, David Stejskal, Cheryl Taylor, Lenka Trefulkova, Val Tomlinson, Helen Turnwald, Liz Walker, Alison Wesley, Mike Wilcox, David Wilson, Anthony Wright (visiting from Christchurch), Angelina Young, Maureen Young. The island owners John and Patrice Vivian, and their sons Daniel and Isaac, were on the beach to welcome us when we arrived.

MOTUREKAREKA GROUP (Moturekareka, Motutara and Kohatutara Islands)

To compare the flora of Motuketekete with the adjacent Moturekareka group, the flora and vegetation of the later was partially updated by the author during a one day visit on the 14 Oct 2015 and a brief landing on the west end of Motutara on 7 Nov 2015. Most time was spent on Moturekareka; Motutara was mainly recorded by a circumnavigation

on foot and the quarry flat at the west end; and the brief time on Kohatutara (Rocky Islets) was spent on the lower northern sides of the two central islets of the group, and an observation of the birds from a boat at the western end. The published flora and vegetation of the Moturekareka group was based on field surveys between 1988 and 1999 (Tennyson et al. 1997, Cameron 1999, Rogan 1999). The past and present results are included in the Table and Appendix and are updated below. The recent survey adds 15 new wild records to the group, and an additional eight new records to the individual islands. Nine of these new additions are not recorded on Motuketekete. Many past records were not confirmed (see Appendix) – they may still be present because it was only a partial survey. However, the area around the past bach site (near the wreck of the *Rewa*) was more intensively surveyed and absences of previous recorded cultivated plants and weeds from this area are probably real. As on Motuketekete, many dead adult trees of karo and pines were also present on Moturekareka and Motutara. Sadly, little weed control appears to have been carried out on these Department of Conservation (DoC) islands in recent times.

Moturekareka

Wild plant additions to Moturekareka and to the Moturekareka group in 2015: *Blechnum membranaceum*, *B. molle*, *Carex spinirostris*, *Coprosma areolata*, coral tree (*Erythrina ×sykesii*), edible fig (*Ficus carica*), *Osteospermum juncundum*, blue passion flower (*Passiflora caerulea*), woolly nightshade, kikuyu grass, and *Trachycarpus fortunei*. Additions just to Moturekareka: *Cakile maritima* and *Cortaderia jubata*. Unfortunately, the ginger previously recorded as "*Hedychium* sp." proved to be kahili ginger (*H. gardnerianum*) – the species that sets seed in New Zealand – and it is now choking the best forested valley (Fig. 25) of the group. New weeds worthy of controlling include: kikuyu grass, blue passionfruit and the three adult *Trachycarpus fortunei* palms that are still present and are now starting to naturalise. All three of these species are confined to the past bach site. Otherwise all the weed issues raised by Tennyson et al. (1997) still stand. Three liverworts and a moss were collected from the main forested valley (E of past bach site) where ferns and bryophytes were frequent: *Plagiochila obscura* (AK 359509) on a fallen log and tree bases, *Chiloscyphus subporosus* var. *subporosus* (AK 359508) on a fallen pohutukawa, *Archilejeunea olivacea* (AK 359510) on a mapou trunk, and the moss *Hypnodendron arctuatum* (AK 359511) on the creek bank.

Table: Wild vascular plant totals for Motuketekete (**MK**), Moturekareka (**MR**), Motutara (**MT**), Kohatutara (**KT**), Motuora (**MO**), Te Haupa (Saddle) (**TH**), Challenger (**CH**) Islands, and their combined totals (totals from Appendix).

Plant Group	MK ¹	MR ²	MT ²	KT ²	MO ³	TH ⁴	CH ⁵	Combined
Native ferns	21	24	10	1	33	18	5	39
Native conifers	-	-	-	-	1	1	-	1
Native dicots	46	50	34	14	61	43	30	92
Native monocots	25	27	20	6	30	24	16	58
Naturalised ferns	-	-	-	-	1	-	-	1
Naturalised conifers	1	1	2	-	-	-	-	2
Naturalised dicots	50	49	38	5	108	45	13	150
Naturalised monocots	31	26	20	5	34	26	2	62
Totals (% native)	174 (53%)	177 (57%)	124 (52%)	31 (68%)	268 (47%)	157 (55%)	65 (77%)	405 (47%)
Island area (ha) from Taylor (1989)	27.0	19.0	4.5	0.9	85.5	6.0	2.9	145.5

¹ = from this article. ² = from Tennyson et al. 1997; Cameron 1999; and this article. ³ = from Heiss-Dunlop & Fillery (2006) with planted records excluded; and Cameron et al. (2011). ⁴ = from Cameron 2014. ⁵ = from Cameron et al. 2011.

Motutara

Additions to Motutara and the Moturekareka group in 2015: *montbretia*, *Osteospermum fruticosum*, and *Tetragonia tetragonoides*. Additions just to Motutara: onion weed, *Carex testacea*, *Lachnagrostis littoralis* and tawapou. The previous records of *Cakile edentula* and *Paspalum ?distichum* (Cameron 1999) are now thought more likely to be a hornless fruiting form of *C. maritima* (see Cousens & Cousens 2011) and *P. vaginatum*, which were both confirmed as present by the 2015 survey. Fruiting trees of loquat were present near the NE corner with a kereru observed visiting them. Comparing the 1970 image (Tennyson et al. 1997: fig. 7) with the current day vegetation (Fig. 26), the quarried rocky flat at the western end of the island appears little changed. A few pine trees have established but the rest of the present woody vegetation amounts to scattered shrubs of bone-seed and gorse. It is still predominantly a grassland with other herbaceous species like *Plantago lanceolata*, patches of montbretia and onion weed. Presumably as they are growing on pure rock, most larger plants except the pines die during the dry summers.

Kohatutara (Rocky Islets)

There was a single addition to the Kohatutara and the Moturekareka group in 2015: *Cotula coronopifolia*. Additions just to Kohatutara: *Astelia banksia* and *Orobanche minor*. **The island's** vegetation looked lush, well fertilised by the many seabirds present.

Birds for Moturekareka group

On Moturekareka and Motutara the following birds were seen or heard during 14 Oct 2015 and 7 Nov 2015: pied shag, black-backed gull, kereru (single bird on Motutara feeding on loquats), kingfisher, welcome swallow, silvereye, grey warbler (common and vocal), blackbird, fantail, tui, chaffinch, goldfinch and starling. On the gravel tombolo near Kohatutara Islands were little shag (×2), variable oystercatcher (1 pair), and a reef heron. On the pebble/sand bank by the mid-Kohatutara Islands a pair of Caspian terns was resting/nesting, and a New Zealand dotterel was also present – during a cursory look no nests were observed. On Kohatutara Islands: black-backed gulls (many on most of the islets), red-billed gulls (20-30) roosting and nesting on the northern outcrop of most southern islet, white-fronted terns (20-30) appeared to be nesting on the southern outcrop of the most southern islet, and starlings were also present. The NZ dotterel is additional to the birds recorded here by Tennyson et al. (1997).

Discussion

Comparing floras of adjacent islands, especially with Moturekareka, show that the Motuketekete indigenous flora is depauperate, lacking several canopy and shrub species expected for an island this size in the inner Hauraki Gulf (Table). These gaps in the native flora relate to the past island history of having a copper smelter (Figs. 8, 9), being farmed, and then cleared for pines, followed by pine logging and replanting. During February and March in 2013

there was a prolonged drought throughout the Auckland region which killed many native trees and shrubs (Wilcox 2013). This drought is probably the reason why on Motuketekete, with no free water, and shallow soils on the outer slopes, many old karo were dead-standing; the largest one seen had fallen over (Fig. 27). There were also many dead standing tree ferns (Fig. 28) with most of the mamaku (*Cyathea medullaris*) being dead, dead shrubs of what appeared to be karo on top of islet NW of Pa Hill (Fig. 29) and even some of the wild pines on the N and E cliffs were dead-standing (see upper middle of Fig. 5).

Weed issues between the local islands

The islands do not exist in isolation and exotic and indigenous seeds are dispersed between the islands, and between the islands and the mainland, by birds, wind and water. The brush cherry (*Syzygium australe*) was recorded on Kawau Island as “fully naturalised” by Alan Esler in 1977 (AK 215743). Brush cherry saplings on Motuketekete are 1.5 – 2.5 m tall, near the Moreton Bay figs and are almost certainly the result of the visiting kereru from Kawau Island. Polygala and smilax are two other species shared with Kawau Island but absent from the other nearby islands to the south (see Appendix). Polygala was collected on Kawau Island in 1903 (*F.I.B. Shakespear*, AK 128593) where it is now abundant (pers. obs.) and somehow made its way to Motuketekete, perhaps by bird, sea or the miners? Smilax was collected at Vivian Bay on Kawau Island in 2003 (*H.R. Coleman*, AK 283783) – it is dispersed by frugivorous birds. No old tawapou trees were observed on Motuketekete or on the Moturekareka group, most being seedlings. Perhaps they are coming via kereru from Challenger Island, or somewhere on Kawau Island? Phoenix palm seedlings may be coming from the single adult tree on Motuketekete which I was unable to sex. **Perhaps it's a female that occasionally gets pollinated from trees on Kawau Island, or it's a male and the seedlings have been separately brought in by kereru?** I suspect it is the former and therefore it is important that none of the juveniles on Motuketekete get to flower. The kahili ginger seedlings are presumed to come from Moturekareka (Fig. 25) via birds to Motuketekete. The woolly nightshade is suspected to have gone the other way.

This illustrates the importance of controlling weed species wherever they occur. Sadly DoC's limited budget evidently won't stretch to tackling the kahili ginger on Moturekareka (Thelma Wilson, Senior Biodiversity Ranger, Mahurangi/Warkworth Office, DoC pers. comm.) – perhaps Bot Soc could offer some volunteer labour to assist?

Regeneration rates for some plant species (native or weeds) may now increase in the apparent absence of the exotic seed-predator, mice, on Motuketekete and the Moturekareka group. Houpara appeared to increase on Te Haupa after the eradication of mice (Cameron 2014). These islands require urgent active weed management and should be monitored for changes of weed status.



Fig. 29. Limestone islet off NW point of Motuketekete with dead shrubs of karo and gorse; also related to the drought of Feb-Mar 2013? Photo: EKC, 5 Jun 2015.

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References

- Beever, J.E. 2015: Mosses of Motuketekete, Hauraki Gulf. *Auckland Botanical Society Journal* 70: 105-107.
- Cameron, E.K. 1999: Bot Soc trip to Moturekareka group, Hauraki Gulf. *Auckland Botanical Society Journal* 54: 8–12.
- Cameron, E.K. 2013: Vascular flora (and some fauna) of islands/islets of the Hauraki Gulf. *Auckland Botanical Society Journal* 68: 27–34.
- Cameron, E.K. 2014: Updated flora and vegetation of Te Haupa (Saddle) Island, Mahurangi, Hauraki Gulf. *Auckland Botanical Society Journal* 69: 127–142.
- Cameron, E.K.; Lindsay, H.; Wilcox, M.D. 2011: A Society visit to Motuora Island, Hauraki Gulf, 16 Oct 2010. *Auckland Botanical Society Journal* 66: 67–71.
- Cameron, E.K.; Taylor, G.A.; Tennyson, A.J.D.; Wilcox, M.D.; Young, M.E. 2011: Biota of Challenger and Little Markham Islands off Kawau Island, Hauraki Gulf. *Auckland Botanical Society Journal* 66: 112–121.
- Campbell, K.A.; Grant-Mackie, J.A.; Buckeridge, J.S.; Hudson, N.; Alfaro, A.C.; Hoverd, J.; Morgan, S.; Horne, N.; Banfield, A. 2004: Paleoecology of an early Miocene, rapidly submerging rocky shore, Motuketekete Island, Hauraki Gulf, New Zealand. *New Zealand Journal of Geology and Geophysics* 47: 731–748.
- Clough, R.; Sheppard, P.; Tatton, K. 1993: Motuketekete Island (Hauraki Gulf) – Archaeological Assessment on the impact of logging the island. University of Auckland, Department of Anthropology. 4p.
- Cousens, R.D.; Cousens, J.M. 2011: Invasion of the New Zealand coastline by European sea-rocket (*Cakile maritima*) and American sea-rocket (*Cakile edentula*). *Invasive Plant Science and Management* 4: 260–263.
- de Lange, P.J.; Rolfe, J.R.; Champion, P.D.; Courtney, S.P.; Heenan, P.B.; Barkla, J.W.; Cameron, E.K.; Norton, D.A.; Hitchmough, R.A. 2013: Conservation status of New Zealand vascular plants, 2012. New Zealand threat classification series 3. Department of Conservation, Wellington. 70p.
- Gardner, R.O. 1997: *Macropiper* (Piperaceae) in the south-west Pacific. *New Zealand Journal of Botany* 35: 293–307.
- Hayward, B.W.; Brook, F.J. 1984: Lithostratigraphy of the basal Waitemata Group, Kawau Subgroup (new), Auckland, New Zealand. *New Zealand Journal of Geology and Geophysics* 27: 101-123.
- Heiss-Dunlop, S; Fillery, J. 2006: Vascular flora of Moturoa Island, Hauraki Gulf. *Auckland Botanical Society Journal* 61: 113–120.
- King, C.M. (ed.) 2005: *The handbook of New Zealand mammals. 2nd edition*. Oxford University Press. 610p.
- Mabbett, H. 1977: *The rock and the sky – the story of Rodney County*. Wilson and Horton Ltd, Auckland. 490p.
- Maddock, S.; Whyte, D. 1983: *Islands of the Gulf*. Revised edition. William Collins Ltd, Auckland. 247p.
- Rogan, D. 1999: Lichens and marine algae of Moturekareka group, Hauraki Gulf. *Auckland Botanical Society Journal* 54: 12–13.
- Stanley, R.; de Lange, P.J.; Cameron, E.K. 2005: Auckland Regional Threatened & Uncommon vascular plant list. *Auckland Botanical Society Journal* 60: 152–157.
- Taylor, G.A. 1989: A register of northern offshore islands and a management strategy for island resources. Department of Conservation, Northern Region Technical Report Series no.13. 126p.
- Taylor, M. 1993: Motuketekete Island (Hauraki Gulf) – Archaeological Reconnaissance Survey. Auckland Regional Council, Cultural Heritage Inventory Project. 7pp.
- Tennyson, A.J.D.; Cameron, E.K.; Taylor, G.A. 1997: Fauna, flora and history of Moturekareka, Motutara and Kohatutara Islands, Hauraki Gulf. *Tane* 36: 27–56.
- Wilcox, M.D. 2013: Auckland's 2013 summer drought and the effects on native trees.** *Auckland Botanical Society News-sheet* July 2013: 3–4.
- Wilcox, M.D. 2015: Algae of Motuketekete, Hauraki Gulf. *Auckland Botanical Society Journal* 70: 107-108.

<http://timespanner.blogspot.co.nz/2010/07/island-called-motuketekete.html> [accessed Jul 2014].

Appendix: Annotated vascular flora for Motuketekete, including the floras of nearby islands Moturekareka group, Motuora, Te Haupa (Saddle I.), and Challenger Island. **MK** = Motuketekete; **MR** = Moturekareka; **MT** = Motutara; **KT** = Kohatutara (data for MR, MT and KT from Tennyson et al. 1997; Cameron 1999); **MO** = Motuora (Heiss-Dunlop & Fillery 2006; Cameron et al. 2011); **TH** = Te Haupa (Cameron 2014); **CH** = Challenger Island (Cameron et al. 2011). Herbarium vouchers are from Motuketekete unless followed by 'MR' which indicates a 2015 collection from the Moturekareka group.

Key: * = naturalised species; ** = exotic cultivated species; a = abundant; c = common; l = local; lc = locally common; o = occasional; s = scarce (<5 individuals seen); x = present

	MK 2014- 15	MR		MT		KT		MO	TH	CH	Notes and voucher based on Motuketekete 2014-15 observations (unless otherwise stated)
		pre- 2000	2015	pre- 2000	2015	pre- 2000	2015	2006- 10	2014	2011	
WILD PLANTS											
FERNS											
<i>Adiantum aethiopicum</i>								x			true maidenhair
<i>Adiantum cunninghamii</i>			l	o				x	o		maidenhair
<i>Adiantum diaphanum</i>								x			small maidenhair
<i>Adiantum hispidulum</i>	o	o	o	s				x	s		rosy maidenhair. Upper coastal slopes and lower pine plantation margins. AK 355799
<i>Asplenium flaccidum</i>	l	s						x	s		hanging spleenwort. Epiphytes on ponga trunks, N and E coasts
<i>Asplenium haurakiense</i>	lc	o-lc	o-lc	c	c	c	c	x	s	o	Coastal slopes and outer margins of pine plantation (Fig. 11). AK 355794
<i>Asplenium oblongifolium</i>	lc	o	o-lc	c	c			x	o-lc	lc	shining spleenwort. Coastal slopes and outer margins of pine plantation. AK355798
<i>Asplenium polyodon</i>	s	s	s	s				x	s		sickle spleenwort. Under pines on old pine stumps. AK 355779
<i>Blechnum chambersii</i>								x			lance fern
<i>Blechnum filiforme</i>			l	lc				x	l		thread fern. Moturekareka: a large population over the ground and low climbing in the upper forested valley east of the past bach site
<i>Blechnum membranaceum</i>			l								Moturekareka: small population on creek bed bank, by coral trees E of past bach site. AK 359289-MR
<i>Blechnum molle</i>			l								Moturekareka: in upper forested valley E of past bach site. AK 359286-MR
<i>Blechnum novae-zelandiae</i>			l	o				x			kiokio
<i>Blechnum parrisiae</i>	o-lc	o	o					x	la		doodia. Semi-open areas on coastal slopes and pine plantation margins. AK 357091
<i>Cheilanthes distans</i>	o-lc			s							woolly cloak fern. Open coastal slopes, W coast. AK 355783
<i>Cheilanthes sieberi</i>		(l)									cloak fern
<i>Cyathea dealbata</i>	la	c	c					x	l		ponga. Widespread in native forested coastal slopes, especially in the gullies; some dead-standing (Fig. 28)
<i>Cyathea medullaris</i>	o	o	o					x	s		mamaku. Forested coastal slopes, but not on N side; most older ones are dead-standing

<i>Cyrtomium falcatum</i> *						x			holly fern
<i>Deparia petersenii</i>	lc	la	la			x			Main colony in central damp valley, smaller colonies in saddle S of the summit. AK 355781
<i>Dicksonia squarrosa</i>	o	s	l			x			wheki. Especially in mixed tree fern stand (SSE-facing) at the NE end of the W-E valley
<i>Diplazium australe</i>		l				x			
<i>Histiopteris incisa</i>						x			water fern, mata
<i>Hymenophyllum</i> sp.						x			filmy fern
<i>Hypolepis ambigua</i>						x			
<i>Hypolepis dicksonioides</i>						x			giant hypolepis
<i>Lastreopsis glabella</i>						x			smooth shield fern
<i>Lastreopsis microsora</i>	s	l	lc			x			Forested SE cliff top. AK 359292-MR
<i>Microsorium pustulatum</i>	o	o	o	o		x	la	o	hound's tongue. Widespread: best population over old smelter base under young forest
<i>Paesia scaberula</i>	l					x			scented fern. Patch on upper margin of weedy flat, Bach bay. AK 355793
<i>Pellaea rotundifolia</i>	s					x	s		A spindly plant in shade under <i>Coprosma macrocarpa</i> canopy on Pa Hill
<i>Pneumatopteris pennigera</i>						x			gully fern
<i>Polystichum neozelandicum</i>						x	o		shield fern
<i>Polystichum wawranum</i>	o	[l]		s				o	shield fern. Coastal forested slopes, particularly on the SE coast. AK 355392
<i>Psilotum nudum</i>	s							s	A few plants in the open behind West Bay. AK 355397
<i>Pteridium esculentum</i>	o-lc	o	o	o		x	lc	l	bracken. Open, or semi-open coastal slopes, usually with pohuehue
<i>Pteris comans</i>	l	lc	l			x			coastal brake. Forested coastal slope, SE coast. AK 355391
<i>Pteris macilenta</i>						x			sweet fern
<i>Pteris tremula</i>	o	o	s	s		x	o		shaking brake. Small groups mainly by the pine/native interface
<i>Pyrrosia eleagnifolia</i>	c	c	o	o	o	x	a	o	leather fern. Throughout, coastal slopes as a low epiphyte on pohutukawa, rupestral on coastal rocks, and also terrestrial, including on old pine stumps and pine tree bases. AK 355796

CONIFERS

<i>Cupressus macrocarpa</i> *				s					macrocarpa
<i>Pinus radiata</i> *	o	a	a	lc	c				radiata pine. Plantation covers over half the island, replanted in 1994. Wildlings, many >10m tall, mainly on steep coastal slopes below the pine plantings; some were dead-standing
<i>Podocarpus totara</i>						x	lc		totara

Appendix cont.		MK	MR		MT		KT		MO	TH	CH	Notes and voucher based on Motuketekete 2014-15 observations (unless otherwise stated)
		2014-15	pre-2000	2015	pre-2000	2015	pre-2000	2015	2006-10	2014	2011	
DICOTS												
	<i>Acaena novae-zelandiae</i>	s							x			bidibid. Two patches, open area flats N of bach
	<i>Alternanthera sessilis</i> *								x			nahui
	<i>Amaranthus powellii</i> *								x			redroot
	<i>Anagallis arvensis</i> var. <i>arvensis</i> *	o	o-lc	o	o	o			x	o-lc	lc	scarlet pimpernel. Open coastal slopes; scarlet flowers
	<i>Anagallis arvensis</i> var. <i>caerulea</i> *	l			lc	lc			lc	lc		blue pimpernel. Open slope in open, W coast; flowers blue
	<i>Anredera cordifolia</i> *	la										Madeira vine. Weedy flats and damp hollow areas, present in two patches >50m long, and climbing to at least 6m. (Fig. 21). AK 357648
	<i>Anthemis cotula</i> *								x			stinking matweed
	<i>Apium prostratum</i>	l	o	l	o				x	s	x	NZ celery. Back of narrow gut, SE coast. AK 359515
	<i>Atriplex prostrata</i> *	o	o-lc	o	o	o			x	o-lc		orache. Back of W beaches
	<i>Avicennia marina</i>	s	l	s	s				x	o-lc	x	mangrove. Small plants, rocky upper intertidal, W side
	<i>Bellis perennis</i> *								x			lawn daisy
Uo	<i>Brachyglottis repanda</i>		o	l					x		lc	rangiora. Single leaf on Bach bay beach in Nov 2014; 2 leaves there on Jun 2015; origin floated in? Delete record from Te Haupa (Cameron 2014) because of similar origin.
	<i>Cakile maritima</i> *	l		o	[s]	o			x	o		sea rocket. Back of shingle beach, W coast
	<i>Callitriche muelleri</i>		l									
	<i>Callitriche stagnalis</i> *								x			starwort
	<i>Calystegia sepium</i> subsp. <i>roseata</i>	l							x			pink bindweed. Northern weedy flats of Bach bay. AK 355649
	<i>Calystegia soldanella</i> × <i>C. tuguriourum</i>	l										Weedy N flats of Bach bay
	<i>Capsella bursa-pastoris</i> *								x			shepherd's purse
	<i>Cardamine hirsuta</i> *	l							x			bitter cress. Clay bank, back of shingle beach, southern W coast bay. AK 354385
	<i>Carmichaelia australis</i>								x	o		NZ broom
	<i>Centaurium erythraea</i> *		o						x	o	o	centaury
	<i>Centella uniflora</i>								x			centella
	<i>Centranthus ruber</i> *									lc		spur valerian
	<i>Cerastium fontanum</i> *								x			mouse-ear chickweed
	<i>Cerastium glomeratum</i> *				s		o			o	x	annual mouse-eared chickweed

<i>Cestrum nocturnum</i> *								x			queen of the night
<i>Chenopodium album</i> *								x			fat-hen
<i>Chenopodium triandrum</i>		o	l							x	
<i>Chenopodium trigonon</i>	s	o				o	lc	x		lc?	Coastal rocks, S west bay. AK 355653
<i>Chrysanthemoides monilifera</i> *	o-la	c	c	c	o-lc	o		lc	s	c	bone-seed. Widespread on coastal slopes, most dominant on headland just S of bach, west coast
<i>Cirsium arvense</i> *								x			Californian thistle
<i>Cirsium vulgare</i> *	o	s	s	o	o			x	o	o	Scotch thistle. Open areas on coastal slopes
<i>Clematis paniculata</i>		o	o					x	o	lc	clematis
<i>Conium maculatum</i> *								x			hemlock
<i>Conyza sumatrensis</i> *	o	o	o	o				x	o	la	fleabane. Widespread, open sites throughout
<i>Coprosma areolata</i>			s					x		l	thin-leaved coprosma. 2m tall, near head of forested valley, E of bach site. AK 359288-MR
<i>Coprosma lucida</i>										x	shining karamu
<i>Coprosma macrocarpa</i>	a	a	a	a	a			x	a	lc	coastal karamu. One of the main wild woody species present, to 8m tall, usually growing with karo
<i>Coprosma macrocarpa</i> × <i>C. propinqua</i>								x	s		coprosma hybrid
<i>Coprosma macrocarpa</i> × <i>C. robusta</i>	o	lc	s					x		l	coprosma hybrid. By weedy flats and N cliff-tops
<i>Coprosma repens</i>	lc	o	o	a	c	a	a	x	s	lc	taupata. Lower coastal slopes, prostrate where exposed
<i>Coprosma repens</i> × <i>C. rhamnoides</i>								x			
<i>Coprosma rhamnoides</i>		o						x	o		
<i>Coprosma robusta</i>								x		l	karamu
<i>Coriaria arborea</i>								x			tutu
<i>Corynocarpus laevigatus</i>	o & P	s	l	s				x		x	karaka. Several trees by bach (planted?), seedlings present
<i>Cotoneaster francheti</i> *								x			cotoneaster
<i>Cotoneaster glaucophylla</i> *								s	s		cotoneaster
<i>Cotula australis</i>	lc					o				x	Mainly on eroding open clay coastal banks. AK 355786
<i>Cotula coronopifolia</i>							o				bachelor's button. Amongst <i>Senecio lautus</i> , taupata, allseed. AK 359294-MR
<i>Crassula multicava</i> *	l										Single sward by bach at back of beach under karo, probably originally planted, covering 6 x 5m. AK 357649
<i>Crassula sieberiana</i>	l	o				c	c			x	Exposed coastal rock, W coast
<i>Crepis capillaris</i> *	o	lc	lc	c	o			x	o	l	hawksbeard. Widespread, semi-open sites

Appendix cont.	MK	MR		MT		KT		MO	TH	CH	Notes and voucher based on Motuketekete 2014-15 observations (unless otherwise stated)
	2014-15	pre-2000	2015	pre-2000	2015	pre-2000	2015	2006-10	2014	2011	
<i>Cymbalaria muralis</i> *								l			ivy-leaved toadflax
<i>Crassula sieberiana</i>	l	o				c	c			x	Exposed coastal rock, W coast
<i>Crepis capillaris</i> *	o	lc	lc	c	o			x	o	l	hawksbeard. Widespread, semi-open sites
<i>Cymbalaria muralis</i> *								l			ivy-leaved toadflax
<i>Daucus carota</i> *								x			wild carrot
<i>Dichondra brevifolius</i>	l					[o]					On limestone islet NW off Pa Hill and also near coast of main island. AK 355788
<i>Dichondra repens</i>	o	o-lc	o-lc	lc	lc			x	s	o	Mercury Bay weed. Coastal slopes, widespread, sometimes patch-forming. AK 359293-MR
<i>Dipogon lignosus</i> *		o & P	l								mile-a-minute
<i>Disphyma australe</i>	o-lc	o	o	o-lc		a	a	x	o	lc	NZ iceplant. Particularly common by SW Point; all flowers seen were white
<i>Dodonaea viscosa</i>	o-lc	c						x	s		akeake. Back of S western bay and on ridge above SW Point; also locally on Pa Hill, most c.2(-4) m tall. AK 352671
<i>Dysoxylum spectabile</i>		lc						x	l	lc	kohekohe
<i>Entelea arborescens</i>	l	x	s					x	s		whau. Coastal forested slopes, SE coast. AK 359291-MR
<i>Epilobium ciliatum</i> *								x			tall willow-herb
92 <i>Erechtites hieraciifolia</i> *								x			American fireweed
<i>Erechtites valerianifolia</i> *								x			Brazilian fireweed
<i>Erigeron karvinskianus</i> *								x			Mexican daisy
<i>Eriobotrya japonica</i> *	o-lc & P	o & P	o	c	c				s		loquat. E of bach, seedlings under a (planted?) adult and saplings in central damp hollow; and occasional seedlings on E cliff-tops. AK 354193
<i>Erythrina × sykesii</i> *		P	l								coral tree. Moturekareka: Many trees to 15m tall, spreading vegetatively over c.50 x 40m in the bottom of the forested valley just E of the bach site; also a single tree just S of bach site.
<i>Euchiton audax</i>										lc	creeping cudweeds
<i>Euchiton sphaericus</i>								x			Japanese cudweed
<i>Euphorbia peplus</i> *	l	lc	lc	o	o			x	o-lc		milkweed. Open rocky slope, SE coast, side of a gut
<i>Ficus carica</i> *	P	l	l								edible fig. Motuketekete: small shrub, in old orchard E of bach. Moturekareka: suckering over several square metres, lower forested valley under a flame tree canopy in main valley. AK 359290-MR
<i>Ficus macrophylla</i> s.str. *	s										Two saplings and a seedling on base of a fallen pine tree; valley E of bach. x2 cultivated trees (c.25 & 16m tall) nearby, one of the largest trees on island. AK 355373
<i>Fumaria muralis</i> *									s		scrambling fumitory

<i>Galium aparine</i> *	lc	l		s	l		x	o		cleavers. In patches near bach and at back of beach of the southern West bay. AK 352676
<i>Galium divaricatum</i> *							x			slender bedstraw
<i>Gamochaeta coarctata</i> *									s	purple cudweed
<i>Geniostoma ligustrifolium</i>	o	o-lc	o-lc	s			x	o	lc	hangehange. In the better native associations on coastal slopes around the island. AK357646
<i>Geranium dissectum</i> *	o						x			Open grassy coastal sites on W coast and near navigational light on E coast. AK 355654, 355800
<i>Geranium gardneri</i> *	o	o		o	l		x	l	x?	Open coastal grassy slopes, W coast. AK 355380
<i>Geranium molle</i> *							x			dove's foot cranesbill
<i>Geranium retrorsum</i>				s						
<i>Geranium solanderi</i>							x			
<i>Gonocarpus incanus</i>		s								
<i>Haloragis erecta</i>	o	o	o	o	o		x	o	x	toatoa. Rather open coastal sites
<i>Hebe macrocarpa</i>									x	
<i>Hebe stricta</i>		o	o	s				s	x	koromiko
<i>Hedera helix</i> *							x			ivy
<i>Helminthotheca echioides</i> *	s	l					x	o		oxtongue. Base of coastal steps down from the navigation light
<i>Hoheria populnea</i>									x	lacebark
<i>Hypochaeris radicata</i> *	o	o	o	o			x	o	o	catsear. Throughout the island in +/- open coastal slopes, and margins of pine plantation. AK 355642
<i>Impatiens sodenii</i> *	l & P									Group of shrubs c.1.2m tall, in two places: by bach; and c.100m to N, by pines; larger patch 20 × 20m. Probably originally planted and now spreading. AK 352670
<i>Jacobaea vulgaris</i> *				s			l			ragwort
<i>Kunzea robusta</i>	s	l	l					s		kanuka. Single c.7.5m tall specimen below navigation light (E Point). Motuketekete: plants on the plateau dead standing. AK 355657
<i>Lagenophora pumila</i>							l			
<i>Lamium purpureum</i> *							l			red dead nettle
<i>Lantana camara</i> *							x			lantana
<i>Lapsana communis</i> *							x			nipplewort
<i>Leontodon saxatilis</i> *		o					x	c	o	hawkbit
<i>Lepidium didymum</i> *	o						x			twin cress. Coastal rocks, N and W coast
<i>Leptecophylla juniperina</i>									x	prickly mingimingi
<i>Leptospermum scoparium</i>		o					x			manuka

Appendix cont.	MK	MR		MT		KT		MO	TH	CH	Notes and voucher based on Motuketekete 2014-15 observations (unless otherwise stated)
	2014-15	pre-2000	2015	pre-2000	2015	pre-2000	2015	2006-10	2014	2011	
<i>Leucopogon fasciculatus</i>		o	o	s				x	o	s	mingimingi
<i>Ligustrum sinense</i> *									s		Chinese privet
<i>Linum bienne</i> *				lc				x	o-lc		Australian flax
<i>Linum monogynum</i>										x	rauhua
<i>Linum trigynum</i> *	l							x	lc		yellow flax. In open, by navigation light, N coast cliff-tops. AK 355801
<i>Litsea calicaris</i>									s		mangeao
<i>Lobelia anceps</i>	l	lc	o	l				x	s	x	shore lobelia. Open, but partly shaded coastal rocks, SE coast
<i>Lotus angustissimus</i> *		lc		c				x			slender birdsfoot trefoil
<i>Lotus pedunculatus</i> *	o			lc				x			birdsfoot trefoil. Weedy flats near bach (Anthony Wright, pers. comm., Nov 2014)
<i>Lotus suaveolens</i> *	o-lc	o	o?	c	o?			x	lc		hairy birdsfoot trefoil. Open coastal sites throughout
<i>Ludwigia palustris</i> *								x			water purslane
<i>Lycium ferocissimum</i> *								x			boxthorn
<i>Lythrum hyssopifolia</i> *								x			hyssop loosestrife
<i>Malva nicaeensis</i> *								l			French mallow
<i>Malva parviflora</i> *								x			small-flowered mallow
<i>Medicago arabica</i> *	l	l	lc	c				x			spotted bur medick. Open areas near bach. AK 359271-MR
<i>Medicago lupulina</i> *								x			black medick
<i>Medicago nigra</i> *	o	l	o	o	o			x	lc		bur medick. Open areas near bach and N coast
<i>Melicope ternata</i>		l	o-lc	o	o-lc					la	wharangi
<i>Melicytus novae-zelandiae</i>	s	s	s	o	o-lc			x		x	coastal mahoe. Shrubs at: Pa Hill (male); mid-W slope (2); and one 3m-tall SE coast. (Fig. 23) AK 355374
<i>Melicytus ramiflorus</i>	o	c	c	c-a	c			x	o	lc	mahoe. On the native-dominated coastal slopes; to 16m tall in the W-E valley. AK 355650
<i>Mellilotus indicus</i> *				s				x	lc		King Island mellilot
<i>Mentha pulegium</i> *								x			pennyroyal
<i>Mentha suaveolens</i> *		l									applemint
<i>Mentha spicata</i> *	s										spearmint. Patch by old smelter, on weedy flat (Mike Wilcox pers. comm., Nov 2014)
<i>Metrosideros excelsa</i>	o-lc & P	c	c	o	o	s		x	a	c	pohutukawa. Scattered along the cliffs, biggest trees on SE coast, largest with c.2.5m basal diameter (Fig. 15); some were planted on the Bach flats as part of the second pine planting- many died (see Brief History above)

<i>Modiola caroliniana</i> *								x		creeping mallow	
<i>Muehlenbeckia complexa</i>	o-la	o	o	lc	lc	o		x	lc	pohuehue. Almost pure extensive swards on some coastal slopes, e.g. S western bay	
<i>Myoporum insulare</i> *									s	Australian ngaio	
<i>Myoporum laetum</i>		o		l				x		ngaio	
<i>Myosotis arvensis</i> *								x		field forget-me-not	
<i>Myrsine australis</i>	o-lc	c	c	o	o			x	o	mapou. Coastal slopes throughout	
<i>Nasturium officinale</i> *								x		watercress	
<i>Nertera</i> sp.								x		nertera	
<i>Nestegis lanceolata</i>	s	s								white maire. Single plant under pines at the north of the island (J. MacKay pers. comm., Aug 2014)	
<i>Nicandra physalodes</i> *								x		apple of Peru	
<i>Nicotiana tabacum</i> *		s & P	s							tobacco. Single wildling, W end of past bach site on Moturekareka, Oct 2015	
<i>Olearia furfuracea</i>		o	o	s				x	s	x	akepiro
<i>Ornithopus pinnatus</i> *	l			s	lc						On open eroding clay coastal banks. AK 355787
<i>Orobanche minor</i> *	s	o	o	lc	o	o		x	lc		broomrape. Track margin below the navigation light
<i>Osteospermum fruticosum</i> *		P			s						dimorphotheca. AK 359296-MR
<i>Osteospermum juncundum</i> *		P	s								freeway daisy. AK 359275-MR
<i>Oxalis corniculata</i> *	o	?o						x		o	horned oxalis. Coastal slope S of Bach bay. AK 359653
<i>Oxalis exilis</i>	o							x			creeping oxalis. Eroding coastal slopes S of Bach bay. AK 359650
<i>Oxalis pes-caprae</i> *	l	l	lc								Burmuda buttercup. Shady weedy flat near bach
<i>Oxalis rubens</i>		l		s					l	s	shore oxalis.
<i>Paraserianthes lophantha</i> *		o-lc	o								brush wattle
<i>Parsonsia heterophylla</i>									s		NZ jasmine
<i>Passiflora caerulea</i> *			l								blue passion flower. Moturekareka: single clump, stems c.2m long, on past bach site. AK 359272-MR
<i>Passiflora tarminiana</i> *	o-lc								s?		banana passionfruit. Adults in open weedy flats N of bach; shrubby headland just S of bach; and E side by navigation light. Seedlings occasional in SE native forest. AK 352316, 354191, 355377
<i>Pelargonium inodorum</i>								x			native storksbill
<i>Peperomia urvilliana</i>	o-lc	l		lc	lc					s	Steep rocky coastal slopes from near sea level to clifftops (Fig. 16) along SE coast. AK 357647
<i>Persicaria decipiens</i>								x			swamp willow weed
<i>Physalis peruviana</i> *								x			cape gooseberry

Appendix cont.	MK	MR		MT		KT		MO	TH	CH	Notes and voucher based on Motuketekete 2014-15 observations (unless otherwise stated)
	2014-15	pre-2000	2015	pre-2000	2015	pre-2000	2015	2006-10	2014	2011	
<i>Phytolacca octandra</i> *	o	s	o	l	s			x	o		inkweed. Open coastal slopes and under pines. AK 356283
<i>Picris ?burbidgeae</i>	s										hawkweed. Single sterile plant photographed by Anthony Wright just SE of Pa Hill, below the pines, during the ABS visit
<i>Pimelea urvilleana</i>								x	o	lc	
<i>Piper excelsum</i>	o-lc	o	o	o				x		o	kawakawa. All are the "Hauraki Gulf form" of Gardner (1997) (Fig. 24). However, on Moturekareka both forms are present. AK 355643, 359274-MR
<i>Pittosporum crassifolium</i>	c-a	c	a	a	a	c	c	x	a	a	karo. Main woody species of the coastal slopes; some very large plants, many dead-standing or blown over (Fig. 27)
<i>Pittosporum tenuifolium</i>										s	kohuhu
<i>Planchonella costata</i>	lc	s			s			x		a	tawapou. Mainly present as seedlings, a few narrow trees to 6m tall, especially the SE coast forest; but also seedlings and saplings near bach - from kereru deposited seed?
<i>Plantago lanceolata</i> *	o	o-lc	o-lc	lc	lc			x	c		narrow-leaved plantain. On open coastal slopes, especially on the E clifftops
<i>Plantago major</i> *		l						x			broad-leaved plantain
<i>Polycarpon tetraphyllum</i> *	lc	c	lc	s	lc	c	c	x	o-lc	l	allseed. Open rocky areas, coastal slopes, widespread
<i>Polygala myrtifolia</i> *	o-lc										polygala. Dominating the shrubland on steep NW coastal faces of Pa Hill, plants 1-1.5(2)m tall, with boneseed, gorse and karo; also locally at back of the S western bay; and on SW Point ridge. AK 352669
96 <i>Polygonum arenastrum</i> *		l						l			small-leaved wireweed
<i>Portulaca oleracea</i> *								x			purslane
<i>Prunella vulgaris</i> *								x			selfheal
<i>Prunus persica</i> *	P	P		s							peach. Single old tree c.4m tall in old orchard E of bach, no wildlings on Motuketekete
<i>Pseudognaphalium luteoalbum</i>								x		lc	Jersey cudweed
<i>Pseudopanax arboreus</i>										s	whauwhaupaku
<i>Pseudopanax crassifolius</i>										s	lancewood, horoeka
<i>Pseudopanax crassifolius</i> × <i>P. lessonii</i>								x			pseudopanax hybrid
<i>Pseudopanax lessonii</i>	lc	o-lc	o-lc	a	c			x	lc	o	houpara. Coastal slopes with karo and coastal karamu
<i>Psoralea pinnata</i> *		s									dally pine
<i>Ranunculus parviflorus</i> *								x		x?	small-flowered buttercup
<i>Ranunculus reflexus</i>		l						x	s		hairy buttercup.
<i>Ranunculus repens</i> *	l							x			creeping buttercup. In damp weedy valley E of bach
<i>Ranunculus sardous</i> *								x			hairy buttercup.

<i>Raphanus raphanistrum</i> *									s	sea raddish	
<i>Robinia pseudoacacia</i> *								x		false acacia	
<i>Rosa</i> × <i>wichurana</i> 'Albéric Barbier' *	lc	[l]?								A vigorous Rambler for c.100m and climbing to 4m, weedy flats from base of Pa Hill to the damp hollow. On 11 Sep 2014 it was just starting to flower (yellow in bud, pure white when open), full flower in Nov; leaves shiny. (Fig. 20) AK 355376	
<i>Rubus fruticosus</i> agg. *	o							x		blackberry. Largest patch covering >20 x 8m, low-lying in bottom of E-W valley; occ. other small populations mainly on W coast	
<i>Rumex acetosella</i> *								x		sheep's sorrel	
<i>Rumex brownii</i> *								x		hooked dock	
<i>Rumex conglomeratus</i> *								x		clustered dock	
<i>Rumex crispus</i> *	o	o		s					s?	curled dock. Damp hollow E of bach and on coast of S west bay. AK 355652	
<i>Rumex obtusifolius</i> *								x		broad-leaved dock	
<i>Rumex pulcher</i> *								x		fiddle dock	
<i>Sagina apetala</i> *	o-lc								l	NW limestone islet; SE coast. AK 355789, 359649	
<i>Sagina procumbens</i> *	l							l		spreading pearlwort. On fairly bare coastal greywacke, SE coast. AK 359517	
<i>Samolus repens</i>		lc						x		shore pimpernel	
<i>Sarcocornia quinqueflora</i>	o-lc	o	o	lc	lc	c	c	x	o	glasswort. Mainly small plants on coastal rocks along W and SE coast	
<i>Scabiosa atropurpurea</i> *								x		annual scabious	
<i>Senecio bipinnatisectus</i> *				o				x	o	Australian fireweed	
<i>Senecio esleri</i> *								la		Esler's fireweed	
<i>Senecio glomeratus</i>									s	fireweed	
<i>Senecio hispidulus</i>	o	o		s	o			o	l	o	fireweed. Openings under pines and cliff faces. AK 355785
<i>Senecio lautus</i>	o-lc	lc	lc	o	o	c	a	x	o	o	shore groundsel. Coastal slopes, abundant on disturbed soil by SW Point. AK 355390
<i>Senecio quadridentatus</i>	s										cotton fireweed. Coastal rocks in open, just above the slash zone, just N of SW Point
<i>Senecio skirrhodon</i> *								x			gravel groundsel
<i>Senecio vulgaris</i> *								x			groundsel
<i>Sherardia arvensis</i> *								x			field madder
<i>Silene gallica</i> *	o			o	o	s					catchfly. On NW limestone islet and southern West bay. AK 355790
<i>Sisymbrium officinale</i> *		l						x			hedge mustard
<i>Solanum mauritianum</i> *	lc		l								woolly nightshade. Coastal slopes; major population in damp valley E of bach; 5-8m tall
<i>Solanum nodiflorum</i>	o	s		s	s	o		x	s	l	small-flowered nightshade. Widespread in gaps in coastal forest and interface between pines/natives

Appendix cont.	MK	MR		MT		KT		MO	TH	CH	Notes and voucher based on Motuketekete 2014-15 observations (unless otherwise stated)
	2014-15	pre-2000	2015	pre-2000	2015	pre-2000	2015	2006-10	2014	2011	
<i>Sonchus asper</i> *	s							x			prickly sow thistle. In the open by navigation light
<i>Sonchus oleraceus</i> *	c	o-lc	o	o	o	o		x	c	o	sow thistle. Throughout in open situations
<i>Solanum nodiflorum</i>	o	s		s	s	o		x	s	l	small-flowered nightshade. Widespread in gaps in coastal forest and interface between pines/natives
<i>Sonchus asper</i> *	s							x			prickly sow thistle. In the open by navigation light
<i>Sonchus oleraceus</i> *	c	o-lc	o	o	o	o		x	c	o	sow thistle. Throughout in open situations
<i>Sophora chathamica</i>			s					x			kowhai. Moturekareka: a single tree c.6m tall, E side of past bach site. Presumed planted
<i>Spergularia tasmanica</i>	l					o	lc				spergularia. On open coastal greywacke rock, SE coast; the black papillate seeds are wingless. AK 359518
<i>Stachys arvensis</i> *								x			staggerweed
<i>Stellaria media</i> *	l					l					chickweed. Steep coastal slope, amongst grasses, SE coast. AK359519
<i>Stellaria parviflora</i>	l							x			NZ chickweed. A few trailing plants on an eroding, steep-slope, on soil, at the head of a narrow gut, SW coast. AK 359514
<i>Symphyotrichum subulatum</i> *								x	s		sea aster
<i>Syzygium australe</i> *	l										brush cherry. Shrubs, 1.5 to 2.5m tall, E of bach - kereru deposited? AK 355393
88 <i>Taraxicum officinale</i> *								x			dandelion
<i>Tecomaria capensis</i> *	lc	l & P	lc								Cape honey suckle. Layered in patches over large area on the flat land (c.100m across) near bach and up the base of hill to pine plantation; in places to 3m tall. AK 352667
<i>Tetragonia tetragonoides</i>	s				s						NZ spinach. Back of west beach, large plant. Motutara: small patch on back of N beach. AK 355647, 359295-MR
<i>Trifolium dubium</i> *	o-lc			lc						o	suckling clover. Open coastal sites. AK 359521
<i>Trifolium repens</i> *								x			white clover
<i>Trifolium subterraneum</i> *		?s									subterranean clover
<i>Tropaeolum majus</i> *		l & P									nasturtium
<i>Ulex europaeus</i> *	lc	o	o	lc	lc			x	c		gorse. Widespread in coastal slopes, several in the open appeared to be dead
<i>Verbascum creticum</i> *								x			Cretan mullein
<i>Verbascum thapsis</i> *								x			woolly mullein
<i>Verbena litoralis</i> *								x			blue vervain
<i>Veronica arvensis</i> *								x			field speedwell
<i>Veronica persica</i> *				s				x			scrambling speedwell
<i>Veronica serpyllifolia</i> *								x			turf speedwell

<i>Vicia hirsuta</i> *							x	lc		hairy vetch
<i>Vicia sativa</i> *	l			lc?			x			vetch. Beach front of weedy flats near bach
<i>Vicia tetrasperma</i> *							x	o		four-seeded vetch
<i>Vinca major</i> *	la									Layered in dense patches over a large area on the flat land (c.100m long) near the bach, forming a "lawn" amongst other weeds. AK 352668
<i>Viola odorata</i> *		l & P	lc							English violet
<i>Vitex lucens</i>	l & P						x			puriri. Only near bach, including a mature planted tree c.13m tall
<i>Vitis vinifera</i> *	P	l								grape. Motukehekehe: single spreading plant over c. 8 x 5m, damp valley, E of bach. Moturekareka: may no longer be present
<i>Wahlenbergia violacea</i>	l								o	NZ harebell. On steep, shaded SE-facing cliff-top, flowers white; with <i>Peperomia</i> and <i>rengarenga</i>
<i>Wahlenbergia vernicosa</i>							x			NZ harebell

MONOCOTS

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<i>Acianthus sinclairii</i>				lc					s	
<i>Agapanthus praecox</i> *	lc	P	l							agapanthus. Widespread on weedy flats, around the bach and spreading up ridge to the S. AK 357644
<i>Agrostis capillaris</i> *							x			browntop
<i>Agrostis stolonifera</i> *							x			creeping bent
<i>Agave americana</i> *	l & P								s	century plant. Naturalising in shrubby-open coastal slope in a c.20 x 20m patch, S end Bach bay. Also single adult on W side of bach. AK 352674
<i>Aira caryophyllea</i> *	o-lc	o-lc		l						silvery hair grass. Rocky headlands and steep coastal slopes. AK 355784
<i>Aira praecox</i> *									l	early hair grass
<i>Allium triquetrum</i> *	lc	o-la	o-la		l		x			onion weed. Small patches in the open, scattered over much of the island; most common behind Bach bay. AK 354188
<i>Aloe arborescens</i> *							x			candelabra aloe
<i>Anthosachne kingiana</i> subsp. <i>multiflora</i>									l	blue wheatgrass
<i>Anthosachne scaber</i> *	s									Single collection by the navigation light by Vijay Soma. AK 355717
<i>Anthoxanthum odoratum</i> *	o-lc	o		lc	lc		x	o		sweet vernal. Open coastal slopes and weedy flats of Bach bay
<i>Apodasmia similis</i>		o					x			oi oi
<i>Arthropodium cirratum</i>	o-lc	c	o	c	o		x		l	rengarenga. Steep rocky coastal slopes on SW to SE coasts. AK 359516
<i>Asparagus asparagoides</i> *	o-lc									smilax. Scattered small patches on most coastal slopes; rust present on most plants in Sep and Nov. AK 355389
<i>Asparagus scandens</i> *							x		l	climbing asparagus
<i>Astelia banksii</i>	o-lc	o-c	o-lc	c-la	o-la	s	x		a	coastal astelia. Most common on steep slopes on SW and SE coast
<i>Astelia hastata</i> (<i>Collospermum hastatum</i>)	s								s	Single large clump on the ground between bach and beach

Appendix cont.	MK	MR		MT		KT		MO	TH	CH	Notes and voucher based on Motuketekete 2014-15 observations (unless otherwise stated)
	2014-15	pre-2000	2015	pre-2000	2015	pre-2000	2015	2006-10	2014	2011	
<i>Astelia solandri</i>	s										Two plants, top of steep coastal slope, SE coast
<i>Austroderia splendens</i>								x			coastal toetoe
<i>Austrostipa stipoides</i>		o-lc	o-lc	lc	lc				l		needle tussock. AK359297-MR
<i>Avena barbata</i> *		o							o		slender oat
<i>Bothriochloa macra</i> *		o-lc	lc	a							redleg grass
<i>Briza minor</i> *	l	o							lc		shivery grass. Grassy coastal slope, SE coast
<i>Bromus arenarius</i>		lc							s		early brome
<i>Bromus diandrus</i> *	o-lc	o	lc	lc	lc	o	lc	x	lc		ripgut brome. Open coastal slopes. AK 359284-KI
<i>Bromus hordeaceus</i> *	o	(o)		o	lc				c		soft brome. Open coastal sites
<i>Bromus willdenowii</i> *	o	o	o	lc		o	o	x	o		prairie grass. Open coastal site
<i>Carex breviculmis</i>	o	o							o		E coastal slopes of tall native shrubland; culms to 7cm long. AK 355778
<i>Carex dissita</i>								x			
<i>Carex divulsa</i> *	l										grey sedge. Shaded areas adjacent to bach
<i>Carex flagellifera</i>	o-lc	o-lc	o-lc	o-lc		s		x	o	x	Glen Murray tussock. Coastal slopes and pine margins, some with leaves to 2.5mm across. AK 355641
<i>Carex inversa</i>	lc										creeping lawn sedge. Bright green patches to 2 x 2m near coastal margins of pine plantations on E coast. AK 355802
<i>Carex lambertiana</i>		c	l					x			
<i>Carex lessoniana</i>								x			
<i>Carex pumila</i>								x			sand sedge
<i>Carex longebrachiata</i> *									s		Australian sedge
<i>Carex spirostris</i>			c								Moturekareka: common throughout most of the coastal forested slopes. AK 359273-MR
<i>Carex testacea</i>		l			l				l		speckled sedge
<i>Carex uncinata</i>		o		o							hook grass
<i>Carex virgata</i>	l	o						x			swamp sedge. Head of E-W valley beneath pines. AK355782
<i>Catapodium rigidum</i> *									lc		hard grass
<i>Cenchrus clandestinum</i> *			l					x			kikuyu grass. Moturekareka: through lawn at past bach site
<i>Chasmanthe bicolor</i> *	o	lc & P	o								Weedy flat at Bach bay, mixed with other iris species. AK 354189
<i>Cordyline australis</i>	s	o	o	s	s			x	o	s	cabbage tree. Single adult c.7m tall by bach; and sapling on SE slope

<i>Cordyline pumilio</i>								x			dwarf cabbage tree
<i>Cordyline rubra</i> *	l										Suckering over many square metres near bach and has been cut back in the past; to 4m tall. AK 355644
<i>Cortaderia jubata</i> *	l		s	s					lc		purple pampas grass. Motuketekete: a few plants on ridge near SW Point under pines. Moturekareka: single tussock seen (Oct 2015) on past bach site
<i>Cortaderia selloana</i> *	o	P	o	s	s			x	o	s	pampas grass. Small clumps scattered around the island with most plants (>12 large tussocks) occurring on the N-face of the Pa. AK 357645
<i>Critesion murinum</i> *								x			barley grass
<i>Crocsmia</i> × <i>crocsmiiflora</i> *	l					l					montbretia. Motuketekete: weedy flats amongst other monocots, Bach bay.
<i>Cynodon dactylon</i> *								x			Motutara: patches in old quarry. AK 355791; 359647-48-M Indian doab
<i>Cyperus eragrostis</i> *		l						x			umbrella sedge
<i>Cyperus rotundus</i> *								x			nut grass
<i>Cyperus ustulatus</i>	o			s		s	l	x	s		coastal cutty grass. Coastal slopes and pine margins
<i>Dactylis glomerata</i> *	c	o	o	o				x	c		cocksfoot. Open coastal slopes
<i>Dianella latissima</i>	o	[o]	o	[s]					o	s	tūrutu. SE coastal forest, and shrubby upper slopes. AK 359644
<i>Dianella nigra</i>								x			tūrutu
<i>Dichelachne crinita</i>	l	o		o	l				o	lc	plume grass. N coast, margin of pines and native vegetation on coastal slope. AK 355655
<i>Ehrharta erecta</i> *								l			veldt grass
<i>Eleocharis acuta</i>	l										club rush. Single patch c.4 × 4m in damp valley floor E of bach
<i>Eleusine indica</i> *								x			crowsfoot
<i>Ficinia nodosa</i>	o	o	o	lc	o	o	o	x	lc	o	knobby sedge. Widespread, open coastal slopes
<i>Gahnia lacera</i>	l	c	c					x	lc	lc	bamboo sedge. In best native bush, SE coast
<i>Gahnia setifolia</i>										x	māpere
<i>Gladiolus undulatus</i> *	o	o	o	s	o				la		wild gladiolus. Coastal slopes, southern W bay
<i>Hedychium</i> <i>gardnerianum</i> *	JM	[x]	la								kahili ginger. Motuketekete: scattered plants on E coast of Motuketekete (J MacKay pers. comm.). Moturekareka: choking the forested valley E of past bach site (Fig. 25). AK 359287-MR
<i>Holcus lanatus</i> *								x		x	Yorkshire fog
<i>Iris foetidissima</i> *	o										stinking iris. On weedy flats near bach; E cliff tops under pines; and near SW point. AK 355387, 355388
<i>Isolepis cernua</i>								x			
<i>Isolepis prolifera</i>								x			
<i>Isolepis sepalcralis</i> *								x			
<i>Juncus articulatus</i> *								x			jointed rush

Appendix cont.	MK	MR		MT		KT		MO	TH	CH	Notes and voucher based on Motuketekete 2014-15 observations (unless otherwise stated)
	2014-15	pre-2000	2015	pre-2000	2015	pre-2000	2015	2006-10	2014	2011	
<i>Juncus australis</i>	s?							x			Shaded by native vegetation on NE and SE upper coastal slopes; sterile; stems soft
<i>Juncus bufonius</i> var. <i>congestus</i> *						l		x			toad flax
<i>Juncus edgariae</i>		o?						x			leafless rush
<i>Juncus effusus</i> *								x			soft rush
<i>Juncus flavidus</i> *								x			leafless rush
<i>Juncus pallidus</i>								x			giant rush
<i>Juncus planifolius</i>								x			grass-leaved rush
<i>Juncus sarophorus</i>	s							x			leafless rush. A few clumps in opening E of bach, damp valley floor. AK 352673
<i>Lachnagrostis billardierei</i>				s					o-lc	lc	sand wind grass
<i>Lachnagrostis littoralis</i>	l	o			l	o	lc		l	lc	coastal wind grass. Open coastal rocks, SE coast.
<i>Lagurus ovatus</i> *								x	lc		hare's-tail
<i>Lepidosperma australe</i>		o									square-stemmed sedge
<i>Lolium perenne</i> *				o				x			rye grass
<i>Lolium rigidum</i> *									o		annual ryegrass
<i>Microlaena stipoides</i>	c	o-lc	o-lc	l		o		x	o	l	microlaena. Pure swards on edge of pines and scattered isolated clumps. AK 355795
<i>Microtis unifolia</i>								s			onion orchid
<i>Oplismenus hirtellus</i>	o	o	o	a				x	o	o	oplismenus. Native bush areas
<i>Parapholis incurva</i> *	o			l	l	l	l	x	l	x	sickle grass. Scattered along the N and SE coasts. AK 355453
<i>Paspalum dilatatum</i> *	o	l		lc				x	lc		paspalum. Open coastal sites
<i>Paspalum distichum</i> *								x			Mercer grass
<i>Paspalum vaginatum</i> *	o	l		[l]	l				s		saltwater paspalum. Several narrow swards, back of southern W bay; patches to 6 long x 2m. AK 355805
<i>Phoenix canariensis</i> *	l & P										phoenix palm. A single adult plant presumed planted c.10m tall near bach. Also c.12 scattered seedlings near the bach and also in the bay south of Bach bay; the largest with leaves 2m long and trunkless; all within 150m of the adult. Perhaps the adult is a female but only rarely gets pollinated? It would be unwise to let any of these seedlings mature. AK 352672, 355394
<i>Phormium tenax</i>	o	o-lc	o-lc	c	o			x	o	o	flax. Open coastal slopes
<i>Poa anceps</i>	o	c	o	o	o			x	o	l	broad-leaved poa. Open coastal slopes and pines margins. AK 355780
<i>Poa annua</i> *		s				o		x	l		annual poa

<i>Poa pusilla</i>								lc		
<i>Rhopalostylis sapida</i>	s							s		nikau. Single trunkless plant, with fronds to 1.2m long, forested SE coast
<i>Rytidosperma caespitosum</i> *								lc		danthonia
<i>Rytidosperma racemosum</i> *	o-lc	o	?o	s	l		x	c		danthonia. Exposed coastal slopes. AK 355803
<i>Rytidosperma unarede</i>		o	?o	?o				lc	o	danthonia
<i>Schedonorus arundinaceus</i> *		o	l	lc	o			lc		tall fescue
<i>Schoenus tendo</i>		o								wīwī
<i>Spinifex sericeus</i>							x			spinifex
<i>Sporobolus africanus</i> *	o			la	o		x			ratstail. Open coastal slopes
<i>Stenotaphrum secundatum</i> *	l						x	c		buffalo grass. A narrow band c.20m long on bank at back of southern West bay. AK 355804
<i>Thelymitra longiflora</i>	l	o		o	o				x?	sun orchid. On disturbed soil, base of fallen pine, SW Point
<i>Trachycarpus fortunei</i> *		P	l							Chinese windmill palm. Moturekareka: the 3 tall planted palms are still by the past bach site. However, they are now naturalising. AK 359276-MR
<i>Tradescantia fluminensis</i> *	l									tradescantia. Single sward in shade near bach c.6 × 8m. AK 355645
<i>Triglochin striata</i>				l			x			arrow-grass
<i>Trisetum arduanum</i>								l		trisetum
<i>Vulpia bromoides</i> *	lc	lc	o	l	lc		x	o	la	vulpia hair grass. Exposed coastal sites, especially cliff tops. AK 355797
<i>Watsonia meriana</i> 'Bulbilifera' *	lc									bulbil watsonia. Covering some 15 m ² with several other monocots on the weedy flats. AK 355792
<i>Zantedeschia aethiopica</i> *	lc	l					l			arum lily. Weedy flats near bach
<i>Zostera muelleri</i>								lc		eel grass
CULTIVATED PLANTS										
CONIFERS										
<i>Sequoia sempervirens</i> **	s									Coast redwood. Single tree c.8m tall, just E of bach
DICOTS										
<i>Arctotis</i> cv. *	s									African daisy. Single recent planting, ray florets orange, near SW corner of bach
<i>Bougainvillea glabra</i> **	s									Bougainvillea. Single shrub c.3m tall, just E of bach; bracts pink
<i>Camellia japonica</i> cv. **	s									camellia. Flowers pink-streaked with red, shrub 3.5m tall, just E of bach
<i>Citrus limon</i> **	s									lemon tree. Single tall tree, E of bach in old orchard
<i>Hibiscus</i> cv. **	s									Two old shrubs, E side of bach; flowers orange/red

Appendix cont.	MK	MR		MT		KT		MO	TH	CH	Notes and voucher based on Motuketekete 2014-15 observations (unless otherwise stated)
	2014-15	pre-2000	2015	pre-2000	2015	pre-2000	2015	2006-10	2014	2011	
<i>Hydrangea macrophylla</i> **	S										Two shrubs, damp valley E of bach
<i>Jasminum mesnyi</i> **	S										Single 3m shrub E side of bach; flowers yellow
<i>Lantana camara</i> var. <i>aculeata</i> **	S										lantana. Single shrub, E side of bach
<i>Ligustrum lucidum</i> **	S										tree privet. Single adult tree c.9m tall, 40m E of bach; no seedlings seen
<i>Magnolia grandiflora</i> **	S										A 2m shrub in tub by bach
<i>Melia azedarach</i> **	S										bead tree. A shrub, fruiting, near bach
<i>Metrosideros kermadecensis</i> **	I										Kermadec pohutukawa. About 6m tall, in a row by base of Pa Hill
<i>Quercus robur</i> **	S										Three small-medium trees: largest c.16 m tall, E of bach, medium on weedy flat N of bach, smallest just S of bach
<i>Salix ×chrysocoma</i> **	S										golden weeping willow. Group of three trees, 8-10m tall, in damp valley E of bach. AK 357650
MONOCOTS											
<i>Canna indica</i> **	I										Indian shot. Patch (c.8 x 4m long) with green, pointed leaves, N end weedy flat
<i>Canna ×generalis</i> cv. *	I										Small patch (c.2m long) with broad, purplish leaves, N end weedy flat
<i>Chlorophytum comosum</i> **	S		S								spider plant. Single clump near bach (N side)
<i>Chlorophytum comosum</i> 'Vittatum' *	S		S								Single clump near bach (S side), leaves pale green with a white central stripe. AK 359277-MR
<i>Freesia refracta</i> **	S										Single tall clump, E side of bach, flowers cream flushed with crimson
<i>Hedychium flavescens</i> **	S										yellow ginger. Large clump in damp valley floor E of bach, another by base of the Pa
<i>Lilium</i> sp. **	S										Small group of erect plants, E side of bach
<i>Monstera deliciosa</i> **	S										fruit salad plant. Single small plant near bach
<i>Narcissus tazetta</i> **	S										jonquil. One clump on weedy flat N of bach
<i>Ornithogalum longibracteatum</i> **	S										pregnant onion. A few under Moreton Bay fig tree near bach
<i>Phormium cookianum</i>	S										mountain flax. Single plant by bach; suspected to be planted