

- Jones, D.L.; Clements, M.A.; Sharma, I.K.; Mackenzie, A.M. 2001: A new classification of *Caladenia* R.Br. (Orchidaceae). *Orchadian* 13: 389–419.
- Keith, D. 2004: *Ocean Shores to Desert Dunes. The Native Vegetation of New South Wales and the ACT*. CSIRO.
- Pellow, B.J.; Henwood, M.J.; Carolin, R.C. 2009: *Flora of the Sydney region: a complete revision*. Sydney University Press.
- Robinson, L. 2003: *Field guide to the native plants of Sydney*. 3rd edit. Kangaroo Press, Sydney.
- Williams, J.B.; Harden, G.J.; McDonald, W.J.F. 1984: *Trees & shrubs in rainforests of New South Wales & southern Queensland*. Botany Department, University of New England, Armidale, NSW.
- Williams, J.B.; Harden, G.J. 2000: *Rainforest climbing plants. A field guide to the rainforest climbing plants of New South Wales using vegetative characters*. Botany Department, University of New England, Armidale, NSW.

Vascular Flora of Pakatoa Island – the missing link, inner Hauraki Gulf

Ewen K. Cameron

Introduction

In a continuation of the Auckland Botanical Society (ABS) visiting and recording the vegetation and floras of Hauraki Gulf Islands, on 17 Oct 2009 we visited the privately owned Pakatoa Island which was one of the largest Hauraki Gulf islands with little botany recorded. It was also the missing link in the seven-island chain, east and south east of Waiheke Island published by Cameron et al. (2007).

We departed from the Maraetai wharf at 9.15 am with 41 people on the Department of Conservation (DoC) boat *Hauturu*. Ten minutes after leaving the wharf a fur seal was observed rolling around in the water (flippers in the air). Rotoroa Island, which was the destination of ABS's 2006 island trip (see Cameron 2007), looked quite different with its screen of planted exotic trees (mainly pines) around most of the island's perimeter having very recently been cut down and mulched *in situ*. We arrived at the Pakatoa wharf about 10 am where we were welcomed by the island caretaker Tony Russell. After a brief introduction from Tony we drifted into small informal groups and attempted to cover most of the island – the 1.15 pm low tide assisted coastal access. The wild vascular plants were the focus of most people's interest; however, Mike Wilcox concentrated on the marine algae.

The forecast for the day was for thunderstorms and possible hail, however, the worst that we received was a light short-lived shower, and until later in the afternoon the winds remained light. At the end of the day we all met up at 4 pm and departed Pakatoa 15 minutes later.

Participants of the field trip (41): Chris Ashton, Ezra Barwell, Steve Benham, Duncan Benzie, Linda Bethell, Robert Brassey, Jan Butcher, Ewen Cameron (leader), Paul Cashmore, Xin Cheng, Jess Clark, Bev & Geoff Davidson, Claire de Luen, Frances Duff, Christine Fildes, Alan Foubister, Michelle Findlay, Richard Gallen, Simon Grant, Leslie Haines, John Hobbs, Marcel Horvath, Richard Hursthouse, Peter Hutton, Mei Nee Lee, Helen Lyons, Elaine Marshall, Carol & Garry McSweeney, Suman Pancha, Helen Preston Jones, Juliet Richmond, Emily Roper, Bec Stanley

(booking officer), Claire Stevens, Valerie Tomlinson, Liesbeth Van Kerckhoven, Mike Wilcox, and Philip & William Wrigley.

Brief history of Pakatoa Island (from: *NZ Herald*, 15 & 24 Dec 1992; Paul Monin *in*: Craig & Lee 1993; Lee 1996; and Cameron 2007)

1845 – Pakatoa (and Rotoroa Id) purchased from its Maori owners (Ngati Paoa) by Charles H. McIntosh for £20, 10 blankets and 23 lbs of tobacco (all pre-1900 information from Monin *in*: Craig & Lee 1993).

1848 – Pakatoa purchased by I.A. Smith for £34 and sold onto Edward Fisher.

1861 – purchased by Donald McLean for £100.

1865 – leased to a fisherman (probably Alfred Sanford – founder of the Sanford fishing empire).

1870 – Alfred Sanford shifted his family to Pakatoa and set up a fish curing factory which was unsuccessful.

1871 – purchased by Thomas Fitzgerald for £150 who sold it in 1897; it then passed through several hands.

1901 – purchased by Mary Bell, wife of Frank Bell of Waiheke. During this period it became more than just a base for fishing: a long bungalow was built to accommodate c.50 people, presumably to serve as a tourist boarding house, with a boiler house, a smoke house, even a tennis court, and was known during this period as "Bell's Island".

1907 – Salvation Army leased Pakatoa to provide a safe place for recovering male alcoholics.

1909 – the 50 men were transferred to Rotoroa Id, and replaced with 50 women alcoholics on Pakatoa.

1932 – Salvation Army purchased Pakatoa Island.

1942-43 – to accommodate some of the Porirua psychiatric patients displaced by an earthquake, the women on Pakatoa were discharged or transferred and the men on Rotoroa Id were transferred to Pakatoa for 12 months.

1943-49 – after 12 months the men were moved back to Rotoroa Id, and Pakatoa was used as an Aged Man's retreat.

1949 – Salvation Army sold Pakatoa Id.

1951 – most of the island was grazed pasture (see Fig. 1).



Fig. 1. Pakatoa Island in 1951 looking ENE, with Tarahiki behind. Note – apart from the steepest slopes, the two main gullies and the occasional tree, the island is in pasture. Whites Aviation, Auckland Museum DU436.1189 P152.



Fig. 2. View from Stony Batter (Waiheke Id, foreground), looking SSE showing the NE cliffs of Pakatoa Id in native shrubland, and pines on the closest point; with Rotoroa Id behind. Photo: Cheryl Taylor, 19 Jan 2010.



Fig. 3. View from above Cowes Bay (Waiheke Id, foreground), looking NE showing Pakatoa Id on the left, Rotoroa Id on right, Tarahiki between them in the distance, and the tiny Frenchman's Cap (0.4 ha) in front of Pakatoa Id. Photo: Cheryl Taylor, 19 Jan 2010.

1964 – Sir Robert Kerridge purchased Pakatoa Id and developed it as a holiday resort with 62 self-contained chalets, a hotel with all amenities, heated swimming pool, restaurant, squash court, boats for hire, a 9-hole golf course, a new jetty, electricity via a submarine cable from Waiheke, and a hydrofoil boat service from downtown Auckland. By 1965 it was running as a nationally important resort: "Jewell of Auckland's Heavenly Hauraki Gulf" claimed the advertisements.

1991 – after Kerridge's death the company became Pacer Kerridge and went into receivership in the late 1980s, the island was sold in 1991 for \$8.5 million to a group of German investors (Gecco Venture Trust Ltd) led by Ralf Simon which was disallowed by the Government (*NZ Herald*, 15 Dec 1992: p.1, sect. 3), and then the resort lay abandoned for 18 months (Lee 1996).

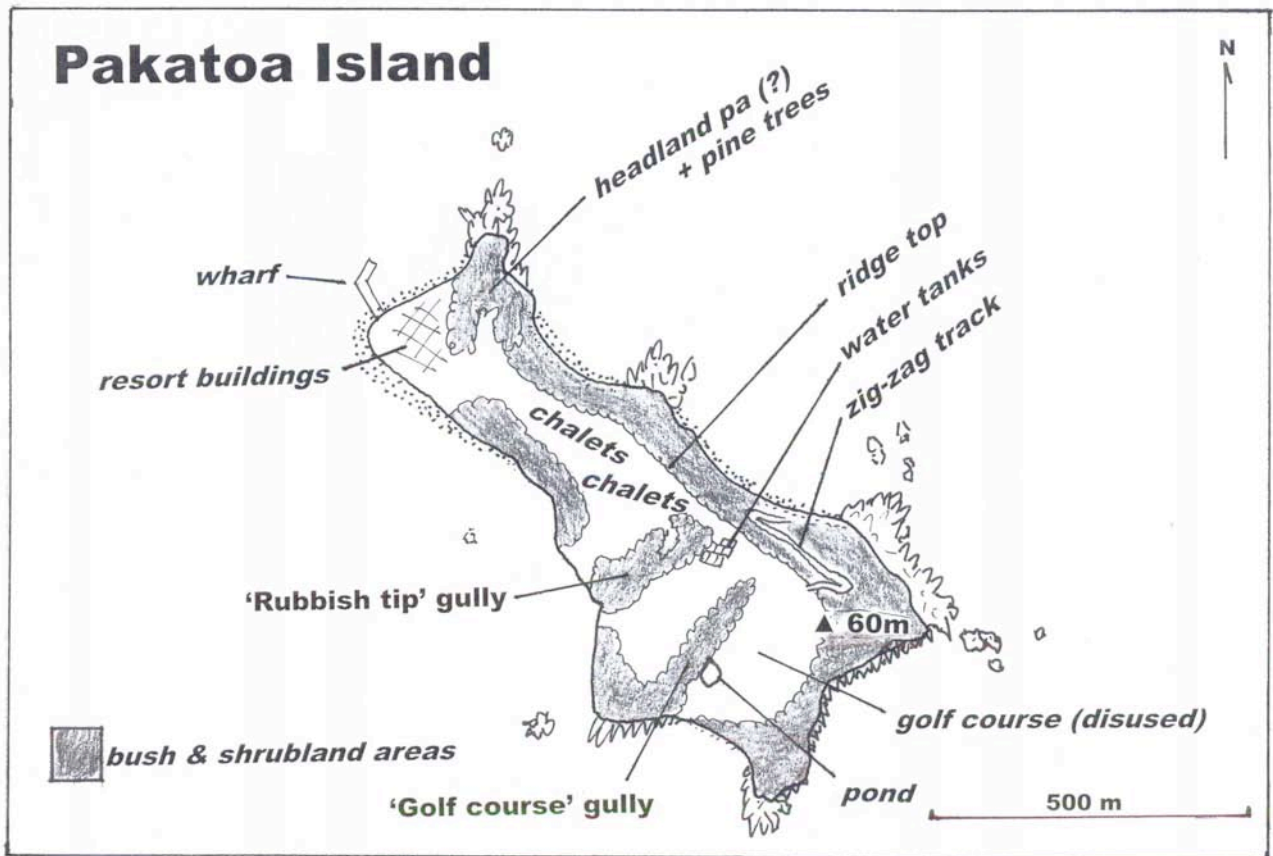


Fig. 4. Place names and outline of the privately owned Pakatoa Island (29 ha), Hauraki Gulf (drawn by EKC).

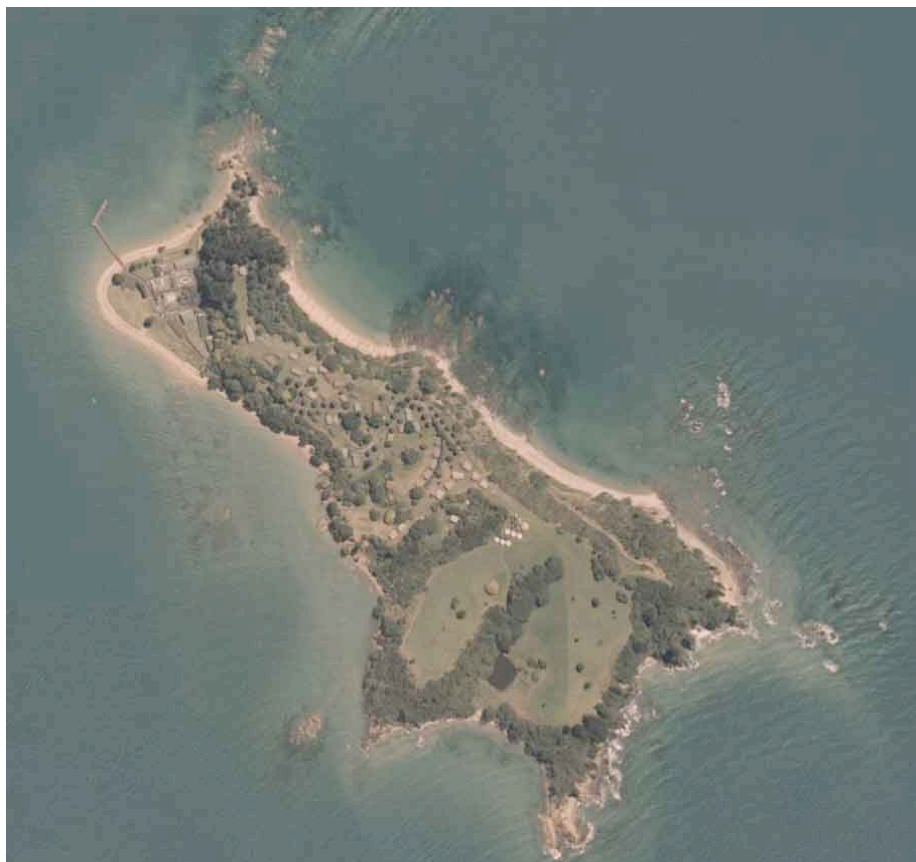


Fig. 5. Aerial view of Pakatoa Island showing mown pasture, bush areas and buildings. Ignore island outline in white. Image from: Auckland Local Government Geospatial Information group (accessed May 2010).

1992-93 – in late 1992 the island was leased by John Gray, who with family support, built up the abandoned resort once again into a going concern (Lee 1996); during this time an informal group tried to give the island an ecological focus, beginning with the eradication of Norway rats (*Rattus norvegicus*) in Dec 1992: "Goodbye rats, hello bird sanctuary" was the Pakatoa article heading in: *NZ Herald* (24 Dec 1992: p.3 sect. 1) and a Heritage Park plan for the island was produced the following year (Craig & Lee 1993).

1994-present – businessman John Ramsey, the present owner, purchased Pakatoa in early 1994 and kept the resort going; in 1995 created a pond below the 9-hole golf links; in 1996 weka were released on the island; and in 2001 the resort was closed. It has been advertised for sale now for several years at \$30-40 million.



Fig. 6. An artificial pond created in 1995 at the bottom of golf course gully to irrigate the golf course – margin planted with natives on 3 sides and natural bush on the other. If not otherwise stated all photos by EKC, 17 Oct 2009.

General characteristics of Pakatoa Island

For the location of Pakatoa Island with respect to adjacent islands and the mainland see Figs. (2 & 3) and for a map Cameron et al. (2007: fig. 1). Pakatoa is highly modified – the long axis (NW-SE) is 880 m long by 130-400 m across; covers 29.3 ha (Taylor 1989), and the high point is 60 m asl at the SE end (Figs. 4 & 5). The island is prone to summer droughts, especially during the El Niño conditions (Beauchamp et al. 2009). It is entirely composed of Mesozoic Waipapa Terrane greywacke rocks (Schofield 1979). At the very northern tip of the island Ian Lawlor recognised a probable Headland Pa which is currently covered in tall pine trees (*Pinus radiata*) (Lawlor in: Craig & Lee 1993). He also recognised four other archaeological sites: comprising midden (shell) and/or Findspots (brick and stone flakes), and also ash at one of the Findspots.

Apart from steep coastal slopes much of the island is easy contours (see Fig. 1) with two main gullies ('Rubbish tip' and 'Golf course') draining via

ephemeral streams to the SW and SSW. Lovely sandy beaches are present on the NW end, and two on the east coast. A relatively recent tractor track has been made down to the southern NE coast beach from the high southern end – "zig-zag track" (visible in Fig. 2). No permanent water exists except for a pond (c.35 m across) (Fig. 6) created in 1995 at the bottom of golf



Fig. 7. A low manuka gumland-scrub-type association along the upper NE coastal slope (right foreground), adjacent to the top of the golf course; water tanks are centre midfield. Looking NW (Man o' War Bay on Waiheke Id in background).



Fig. 8. Upper 'Rubbish tip' gully viewed from NW side. Note – the mainly kanuka canopy (not planted) behind the building, and wildling phoenix palms in front.

course gully to irrigate the golf course. However, it hasn't been used for irrigation since the resort was closed in 2001 (Beauchamp et al. 2009). Three rows of water tanks (Fig. 7) are positioned in the upper northern corner of the golf course. The moth-balled resort complex occupies the NW end of the island and the 62 vacant chalets spread from the resort up the easy slope to the N edge of the 'Rubbish tip' gully (Fig. 8) – combined they occupy more than half of the island. The disused 9-hole golf course (fairways still mown, greens not maintained) occupies about a quarter of the island. There is a single tar-sealed road from the wharf to the top of the golf course – in part



Fig. 9. Single road from the wharf to the top of the disused golf course lined with c. 40 phoenix palms – a weed time bomb. Note – the wilding Moreton Bay fig sapling popping out of the leafy palm head on the left (above the road).



Fig. 10. View of Pakatoa Island looking east from the sea. Note – the feature of pine trees on the northern end.

lined with phoenix palms (*Phoenix canariensis*) (Fig. 9).

Vegetation

The tall pine trees on the high ridge at the northern end, along with several scattered Norfolk pines (*Araucaria heterophylla*) to the south of them, are a major landscape feature when viewing the island from the sea (Fig. 10). Most of the island is highly modified – the resort and chalet area with mown lawns, planted shrubs and trees, raised garden beds (Figs. 11 & 12), and the 9-hole golf course of mown kikuyu grass (*Pennisetum clandestinum*) (Fig. 13) occupy most of the island.

The best area of native forest is the forested tongue dividing the golf course ('Golf course' gully). Here there is a grove of karaka (*Corynocarpus laevigatus*) under taller pohutukawa (*Metrosideros excelsa*) and puriri (*Vitex lucens*). Also present is a few kohekohe



Fig. 11. Lower chalets by the resort, exotic succulents in the foreground of *Aloe attenuata* and *Agave americana* 'Marginata'.



Fig. 12. Deserted chalets going up the hill towards 'Rubbish tip' gully and planted shrubs and trees.



Fig. 13. View across the top of the disused golf course, looking SSW from near the water tanks on Pakatoa, mown kikuyu pasture and golf course gully forest in foreground (plus some planted NZ ngaio); Rotorua Id visible in centre above the trees (rather bare NW point – west side of Cable Bay).

(*Dysoxylum spectabile*), mahoe (*Melicytus ramiflorus*), a single large taraire (*Beilschmiedia tarairi*) with saplings and seedlings nearby, and abundant young

nikau palms without trunks (grazed out by stock in the past?). Near the lower end is a splendid 30 m-tall, multi-trunked tawapou (*Planchonella costata*) with a few saplings nearby. The shrub layer was mainly *Coprosma macrocarpa*, *Cyathea medullaris*, young nikau and *Gahnia lacera*. A small patch of healthy *Pteris comans* (Fig. 14) was also present in the gully bottom. The other gully ('Rubbish tip' gully) on the northern side of the golf course used to have the Resort's organic waste tip and recycling centre (Beauchamp et al. 2009) and today is mainly regenerating kanuka (*Kunzea ericoides*), and exotic shrubs and trees along the upper edges – I didn't personally explore inside the bush area of this gully.



Fig. 14. A fine clump of *Pteris comans* being admired by Geoff Davidson in the forested lower golf course gully. Photo: Bev Davidson, 17 Oct 2009.

The steep coastal slopes on the southern part of the island and eastern side in places contained some good native vegetation often dominated by karo and pohutukawa (Fig. 15); in places *Astelia banksii* tussocks were particularly common. Other native shrubs locally present included: manuka (*Leptospermum scoparium*), *Leucopogon fasciculatus*, *Leptecophylla juniperina*, karamu (*Coprosma robusta*), *Hebe* aff. *macrocarpa*, houpara (*Pseudopanax lessonii*), low mats of *Pimelea urvilleana*, and two shrubs of NZ broom (*Carmichaelia australis*). Weedy exotics on the steep coastal slopes included: phoenix palms, macrocarpa (*Cupressus macrocarpa*), pines, *Banksia integrifolia*, boxthorn (*Lycium ferrocissimum*), *Cotoneaster glaucophyllus*, *Rosa rubiginosa*, kikuyu grass, and pampas grass (*Cortaderia selloana*) (Fig.

16). The steeper eroding greywacke faces were often only supported a low shrubland or were devoid of vegetation altogether.



Fig. 15. Steep coastal slopes at the SE end of the island contain some of the best remaining native forest, such as the karo-pohutukawa dominated slopes here – looking NE at low tide.



Fig. 16. A large patch of weedy pampas grass (*Cortaderia selloana*) where the relatively recent zig-zag track comes down to the NE coast; mainly shrubby native species above the pampas.

A type of low vegetation partly mowed, like a gumland-scrub association, locally existed along the upper NE coastal slope for c. 20 m, adjacent to the top of the golf course where we saw: *Thelymitra longifolia* commonly in full flower (Fig. 17), *Microtis unifolia*, *Wahlenbergia littoricola*, *Microlaena stipoides*, *Drosera auriculata*, low manuka (<1 m tall) (Fig. 7), *Pomaderris amoena*; and exotics of *Dichelachne rara*, *Juncus bufonius* var. *congestus*, *Aphanes inexpectata* and *Centaureum erythraea*.

No areas of saltmarsh vegetation were observed and even on the coastal rocks *Samolus repens* appeared to be absent. However, two other usual constituents of saltmarsh vegetation were present: glasswort (*Sarcocornia quinqueflora*) locally present on coastal rocks, and *Selleria radicans* was spotted at a single locality by a seep on the NE coast.



Fig. 17. *Thelymita longifolia* locally common, all flowers white and with many open at once (insect-pollinated form) in a low manuka area above NE coast by the golf course (see Fig. 7 for edge of habitat). This plant is dark-stemmed, others had green stems. Photo: Bev Davidson, 17 Oct 2009.

Flora

Vascular plants

Previous plant collections from Pakatoa Island held in the Auckland Museum herbarium (AK) only totalled: two vascular plants (*Medicago nigra*, *Muehlenbeckia complexa*) collected by JM Gurr in April 1973; nine native fern species by Anthony Wright in May 1973; and a tawapou (*Planchonella costata*) from a large tree by DJR Elton in July 2000. A list of 35 native and six exotic vascular species was included in a chapter titled 'Botanical Inventory and Restoration Plan' by Neil Mitchell and Mairie Fromont *in*: Craig & Lee (1993) and a similar list with seven native and 11 exotic additions was appended to a chapter on Pakatoa by Lee (1996). Otherwise the island's flora appeared to be unknown. Landcare Research (CHR), Te Papa (WELT) and National Forestry (NZFRI) herbaria held no databased specimens from Pakatoa

Table 1. Wild vascular plant flora of Pakatoa Island*.

Plant Group	Native	Naturalised	Totals (% native)
Ferns	17	1	18 (94)
Conifers	-	3	3 (0)
Dicots	57	88	145 (39)
Monocots	22	25	47 (47)
Totals	96	117	213 (45)

- * = two native hybrids excluded from the totals (*Coprosma* & *Pseudopanax*)

Island (pers. comm., May 2010). Twenty-seven vascular plant herbarium vouchers were collected during the ABS trip, 26 accessioned into AK and a grass into NZFRI.

This survey records 213 wild vascular plants (45% native) see Table 1, and for an annotated list see Appendix 1. The ratio of native to naturalised species is similar to the adjacent, much larger Rotoroa Island which has a wild flora of 398 species (Cameron 2010: table 1). The vegetation and human history of both these islands is similar: Maori occupation (at least seasonally); nearly totally cleared for pasture in European times; and the best surviving native vegetation generally restricted to the steep eroding coastal slopes (except for the forest tongue in Pakatoa's golf course valley). There were no Nationally threatened species recorded for Pakatoa (cf. de Lange et al. 2009), however, there were four Regionally threatened species present: *Einadia triandra*, *Geranium retrorsum*, *Pteris comans* and *Wahlenbergia littorcola* (cf. Stanley et al. 2005) – all four species were represented by small populations (cf. Appendix 1).

Vascular weed species

Naturalised species total 55% of the total wild flora, and some of the more aggressive ones (environmental weeds) should be controlled. Fortunately many of them appeared to be present in quite small populations. Species recommended for control/eradication include: *Nephrolepis cordifolia*, *Cupressus macrocarpa*, *Acanthus mollis*, *Anredera cordifolia*, *Banksia integrifolia*, *Chrysanthemoides monolifera*, *Cotoneaster glaucophyllus*, *Erica lusitanica*, *Euonymus japonicus* (single planted specimen), *Ficus* spp. (seedlings need controlling), *Hedera helix*, *Homalanthus populifolius*, *Ligustrum lucidum*, *Lycium ferrocissimum*, *Olea europaea* subsp. *cuspidata*, *Paraserianthes lophantha*, *Passiflora* spp., *Ricinus communis*, *Rosa rubiginosa*, *Salix cinerea*, *Senecio mikanioides*, *Solanum mauritianum*, *Ulex europaeus*, *Verbascum creticum*, *Agapanthus praecox*, *Asparagus asparagoides*, *Carex divulsa*, *Cortaderia selloana*, *Crocsmia ×crocsmiiflora*, *Ehrharta erecta*, *Pennisetum clandestinum* (in association with a revegetation planting?), *Phoenix canariensis*, *Setaria palmifolia*, and *Stenotaphrum secundatum*.



Fig. 18. Wild spiny phoenix palms at the back of the more northern of the NE sandy bays. These wild palms are common throughout the island.

By far the largest and most obvious weed problem is the naturalising spiny phoenix palms (Fig. 18). The seed source is the large number of planted ones, including an avenue of them (Fig. 9). The size of these palms indicates that they would have been planted when the resort was being set up in the 1960s – presumably to give a tropical atmosphere similar to coconut palms (*Cocos nucifera*). The wildlings (virtually all are trunkless) are throughout the island, including the steep coastal slopes, back of beaches, around the accommodation, and in the bush areas.

Seaweeds

Two significant seaweeds were collected during the ABS visit by Mike Wilcox: the Japanese *Undaria pinnatifida* locally common on the south-eastern side, in the mid-low intertidal zone; and *Sporochnus stylosus* (2 drift samples, from two different spots).

Cultivated plants

During 1993-99 several conservation-type plantings have occurred on Pakatoa, including seed collected from the large pohutukawa at the top of the Golf Course gully, germinated, raised by Project Crimson, and c.100 of this progeny were planted mainly around the upper coastal slopes of Pakatoa – most of these plants have survived (Mike Lee, pers. comm.). In 1995 kanuka, karamu, taupata (*Coprosma repens*), wharangi (*Melicope ternata*), mahoe and flax (*Phormium tenax*) were also planted out by Forest & Bird volunteers and the island's owner, including the most recent bare area around the newly created pond – the plants were sourced from the Waiheke Native Plant Nursery and the Whakanewha Park Nursery on Waiheke Island (Lee 1996, and Lee pers. comm., May 2010).

No systematic survey of the cultivated plants was attempted. However, the following were recorded:

during our visit; ones marked "(ML)" were recorded by Mike Lee (1996) without specifying whether wild or planted – the ones listed below are assumed to be planted because they are commonly cultivated species; and two previous native species by Mitchell & Fromont "(MF)" in: Craig & Lee (1993) are assumed to be planted because both are commonly planted species and both are unlikely to be natural on this small island:

Ferns: *Nephrolepis cordifolia*.

Conifers: *Araucaria heterophylla* (& also ML), × *Cupressocyparis leylandii* (ML), *Cupressus macrocarpa* (& also ML), *C. macrocarpa* 'Aurea Saligna', and *Pinus radiata* (& also ML).

Dicots: *Arbutus unedo*, *Banksia ?ericifolia*, *B. integrifolia* (& also ML), *Callistemon citrinus* (ML), *Casuarina* sp. (ML), *Coprosma repens* (& also ML), *Coprosma robusta* (ML), *Escallonia bifida*, *Eucalyptus* spp. (ML), *Euonymus japonicus* (1 plant below chalets), *Ficus carica*, *F. macrocarpa* (2 trees), *F. rubiginosa* (2 trees), *Hebe pubescens* ? × *H. stricta* (a planting by golf course dam; no leaf bud sinus), *Hedera canariensis*, *H. helix*, *Hoheria populnea* (MF), *Kunzea ericoides* (ML), *Leptospermum scoparium* (appeared to be planted by the pond), *Lunaria annua*, *Melicope ternata* (ML), *Melicytus ramiflorus* (ML), *Metrosideros excelsa* (see below), *Myoporum insulare*, *M. laetum*, *Nerium oleander* (& also ML), *Olea europaea* subsp. *cuspidata*, *Olearia ?albida*, *O. solandri* (single specimen on SW cliffs, appeared to be wild, but most unlikely habitat), *Pittosporum eugenioides* (ML), *Pittosporum tenuifolium* (MF), *Schefflera actinophylla*, *Tamarix* sp., and *Westringia fruticosa*.

Monocots: *Agapanthus praecox*, *Agave americana* 'Marginata', *Aloe attenuata*, *Cordyline australis*, *Howea forsteriana* (1), *Kniphofia uvaria*, *Phoenix canariensis*, and *Phormium tenax* (& also ML).

Fauna

Birds

John Craig in: Craig & Lee (1993) recorded 14 native and six naturalised bird species for Pakatoa Island (ABS = also seen during ABS trip): little blue penguin (ABS – a dead one on a beach), gannet (ABS – flying close by), oystercatcher (ABS – 4 variables oystercatchers together), black-backed gull (ABS), red-billed gull, kereru (ABS – 2 birds in a Moreton Bay tree, later observed doing stall flights; have nested on the island in the 1990s (Lee 1996)), red-crowned parakeet (aviary), ruru (morepork), kingfisher (ABS), welcome swallow (ABS), silvereye, grey warbler (ABS), blackbird (ABS), fantail (ABS), tui (ABS), goldfinch (ABS), greenfinch (ABS), starling, Indian myna (ABS), and magpie (ABS). During the ABS visit we also observed an additional eight species: pied shag, little shag, Paradise shelduck (with a duckling

on dam pond), North Island weka (many), pukeko, shining cuckoo, house sparrow (also recorded by Lee 1996), and chaffinch. Also song thrush was recorded by Lee (1996) and Australasian harriers were seen during 10/11 visits between Aug 1996 and Apr 2002 by Beauchamp et al. (2009).

Less than ten red-fronted parakeets (kakariki) were held in an aviary on the island in the spring of 1993 and when they started fighting they were released, but did not last long on the island (Lee 1996, and Lee pers. comm.). Thirty-one North Island weka originally from Kawau Island were released on Pakatoa in Aug 1996 (Beauchamp et al. 2009) and successfully established. However, the high resulting numbers of weka were seen as something of a nuisance while the resort was operational, e.g. jumping in the swimming pool, entering the houses and fouling public areas. It is suspected that the small number of weka on the adjacent Rotoroa Island (Cameron et al. 2007) and at Kawakawa Bay originated from Pakatoa Island. A study of weka on Pakatoa between Aug 1996 and Apr 2002 by Beauchamp et al. (2009) found that the population fluctuated between c.19 and 182 individuals and the dry summers in El Niño times appeared to be the major limiting factor.

Other fauna

Cattle and sheep were removed from Pakatoa Island c.1980 (Lee 1996) and have never been re-established. We observed: garden snails (*Cantareus aspersus*). The island was believed to be mammalian pest-free at the time of our visit.

Paul Monin *in*: Craig & Lee (1993) records the deliberate release of rabbits on Pakatoa for sport shooting by Navy Officers in c.1840s while their boats were being loaded ('wood & water') in the adjacent Man o' War Bay on Waiheke Island, and as a result Pakatoa was known as 'Rabbit Island' until the 1860s. It is unclear if the rabbits were all shot or died out naturally, however, they have not been seen on the island in living memory (Lee 1996).

Norway rats were eradicated from Pakatoa in Dec 1992 by Forest & Bird volunteers from Waiheke and Rotoroa Islands (Lee *in*: Craig & Lee 1993) and the island was believed to be rat-free until they re-appeared in Nov 1997 and Talon® bait was laid to poison them from late Dec 1997 to Jun 1999 (Clout & Russell 2006, Beauchamp et al. 2009). Rats were again observed in May 2009 by the resort area – bait was immediately laid out and no further rats had been seen up until our visit (Tony Russell pers. comm.).

Acknowledgements

John Ramsey, the current owner of Pakatoa Island, for allowing the trip to take place and the collection of herbarium specimens; Tony Russell the island caretaker (for 4 months) for a friendly reception; all ABS field trip participants for their additions to the plant and bird lists; Mike Lee and Rhys Gardner for comments on a draft of this article; Rhys and Peter de Lange for discussions over some of the plant identifications; Mike Lee for general island information of the 1990s; Gordon Maitland of Pictorial Department of Auckland Museum for Figure

Discussion

A reasonable number of further additions to the Pakatoa Island flora would be found with more field surveys because not all areas were covered by us. The 24 Pakatoa additions (23 dicots, 1 monocot) to the seven island chain (marked "+" in Appendix 1) are all exotic species derived from human activities, e.g. 58% intentional introductions (garden ornamentals and planted trees), and 42% accidental (soil contaminants or accidental hitchhikers), that have all naturalised to some degree. It's important that these species are controlled because most of them could potentially become far more common on Pakatoa and then island hop along the island chain.

Apart from the smaller quarried Karamuramu Island, Pakatoa and Rotoroa Islands are the most modified islands in the chain E and SE of Waiheke Island with only 44–45% of their floras being of native species (cf. Cameron et al. 2007, Cameron 2009a, 2010). In terms of natural values Pakatoa is severely degraded, which isn't surprising when looking at its European history. However, there are still important areas of predominately native vegetation, e.g., golf course gully, steep coastal slopes and the summit area (SE high point). This combined with its possible mammalian-pest free status and its current lack of farm stock gives it a high potential to be an important conservation island in the future as long as the weeds are managed. Especially because its closet neighbour (Rotoroa) is now being managed more for its ecological importance, Tarahiki to the east is one of the least disturbed islands in the chain, and Waiheke Island to the west still has important native forest areas along its adjacent coast (pers. ob.). Pakatoa is the fourth largest island in the seven island-chain east of Waiheke island, and also contains the fourth largest flora (Cameron 2010: table 1). Because of the islands close proximity to each other, in terms of pest management (flora and fauna); the seven-island chain would be better considered as a single unit.

The much larger and more biologically diverse Waiheke Island (9333 ha) to the west of this island chain, is in places only 1.3 km distant. Many of its biota will continue to disperse onto the adjacent islands. The size of Waiheke Island's plant diversity is partially indicated by two reasonably-sized areas with their vascular floras recorded: the closer one to the seven island-chain is Te Matuku Bay catchment with a flora of 368 species (68% native) (Cameron 2009b) with additions by Wilcox & Jane (2009), and the smaller Whakanewha Regional Park (274 ha) with 432 species (58% native) (Wilcox et al. 2002).

1; Heather Stone of Auckland City Libraries for helping locate newspaper references; Jane Cruickshank, Pat Brownsey and Chris Ecroyd respectively for checking the databases at CHR, WELT and NZFRI herbaria for Pakatoa holdings; and the Department of Conservation for the boat transport (*Hauturu*), especially the skipper James Emslie.

References

- Beauchamp, A.J.; Hanbury, J.; Hanbury, R. 2009: Changes in the population size of North Island weka (*Gallirallus australis greyi*) during establishment on Pakatoa Island, Hauraki Gulf, New Zealand. *Notornis* 56: 124–133.
- Cameron, E.K. (ed.) 2007: Rotoroa Island, inner Hauraki Gulf, trip report. *Auckland Botanical Society Journal* 62: 124–135.
- Cameron, E.K. 2009a: Updated Vascular Flora of Pakihi Island, with notes on fauna, geology and some history, Hauraki Gulf, Auckland. *Auckland Botanical Society Journal* 64: 154–169.
- Cameron, E.K. 2009b: Te Matuku Bay catchment, Waiheke Island (ABS camp, January 1994). *Auckland Botanical Society Journal* 64: 54–69.
- Cameron, E.K. 2010: Updated vascular flora for the seven-island chain east and southeast of Waiheke Island. *Auckland Botanical Society Journal* 65: 37–38.
- Cameron, E.K.; de Lange, P.J.; McCallum, J.; Taylor, G.A.; Bellingham, P.J. 2007: Vascular flora and some flora for a chain of six Hauraki Gulf islands east and southeast of Waiheke Island. *Auckland Botanical Society Journal* 62: 124–156.
- Clout, M.N.; Russell, J.C. 2006: The eradication of mammals from New Zealand islands. Pages 127–141. *In*: Koike, F., Clout, M.N.; Kawamichi, M.; De Poorter, M.; Iwatsuki, K. (eds), *Assessment and Control of Biological Invasions Risks*. Shoukadoh Book Sellers, Kyoto, Japan and IUCN, Gland, Switzerland.
- Craig J.; Lee, M. 1993: Pakatoa Island – Auckland’s Heritage Park, a conservation enterprise. Unpublished report. 24p.
- de Lange, P.J.; Norton, D.A.; Courtney, S.P.; Heenen, P.B.; Barkla, J.W.; Cameron, E.K.; Hitchmough, R.; Townsend, A.J. 2009: Threatened and uncommon plants of New Zealand (2008 revision). *New Zealand Journal of Botany* 47: 61–96.
- Lee, M. 1996: New Zealand the 10,000 island archipelago. Unpublished MSc Thesis, University of Auckland.
- Schofield, J. C. 1979: Geological map of New Zealand, 1:63 360. Part sheets N38, N39, N42 and N43. Waiheke. Wellington, NZ Geological Survey.
- 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 Auckland. Northern Regional Technical Report Series 13.
- Wilcox, M.D.; Spence, A.; White, P. 2002: Botanical features of Whakanewha Regional Park, Waiheke Island. *Auckland Botanical Society Journal* 57: 34–46.
- Wilcox, M.D.; Jane G. 2009: Waiheke Island: Labour weekend, October 2008. *Auckland Botanical Society Journal* 64: 1–9.

Appendix 1. Pakatoa Island annotated wild vascular flora list.

* = naturalised

† = addition to the island chain E & SE of Waiheke Id (cf. Cameron et al. 2007, Cameron 2009a)

a = abundant

c = common

l = local

o = occasional

s = scarce (<5 individuals observed)

AW = collected by Anthony Wright on 12 May 1973 (not seen 2009)

MF = mentioned by Neil Mitchell & Mairie Fromont *in*: Craig & Lee (1993)

ML = additions by Mike Lee (1996) to those recorded by Mitchell & Fromont (see above)

	Abundance	Comments & voucher herbarium number
Ferns (18 + 1) (= native + naturalised)		
<i>Adiantum cunninghamii</i>	l	Mid-west coast by a seep. AK 132067, 214799
<i>Asplenium flaccidum</i>	l	In bush, and on palm trunks. AK 132069
<i>Asplenium haurakiense</i>	o	Steep coastal slopes
<i>Asplenium oblongifolium</i>	s	Epiphyte on phoenix trunk by resort complex. AK 132068
<i>Asplenium polyodon</i>	l	Epiphytes on phoenix palm trunk by resort complex
<i>Blechnum filiforme</i>	s	By seep, W coast. AK 132066
<i>Blechnum novae-zelandiae</i>	ML, l	Damp shaded areas. Recorded as ' <i>Blechnum</i> sp.' by Lee (1996)
<i>Cyathea dealbata</i>	MF, o	Regenerating bush. AK 132072
<i>Cyathea medullaris</i>	MF, o	Mainly golf coarse gully. AK 132071
<i>Dicksonia squarrosa</i>	s	Bush by chalets near the resort
<i>Doodia australis</i>	ML, l	Golf course gully. AK 132070, 223029
<i>Microsorium pustulatum</i>	l	On coastal rocky slopes; and on palm trunks
<i>Nephrolepis cordifolia</i> *	l	Epiphyte on palms by resort; also planted nearby

<i>Polystichum neozelandicum</i>	AW	AK 132073, 223126
<i>Pteridium esculentum</i>	MF, lc	Widespread, bush margins
<i>Pteris comans</i>	l	Single patch of large plants, lower golf course gully (Fig. 14). AK 311815
<i>Pteris macilentata</i>	s	Dry site under trees by chalets near resort
<i>Pteris tremula</i>	o	Lower golf course gully, & epiphyte on phoenix palms by resort
<i>Pyrrosia eleagnifolia</i>	l	On coastal rocky slopes. AK 132074

Conifers (0 + 3)

<i>Araucaria heterophylla</i> *	lc	>27 seedlings to 40 cm tall, W side of chalets, on slopes in medium shade; adult trees widely planted, with most above resort (visible in Figs. 9 & 10)
<i>Cupressus macrocarpa</i> *	MF, c	Young plants, coastal slopes; widely planted adults present
<i>Pinus radiata</i> *	MF, lc	Mainly young plants close to adults, and locally wild adults on cliffs. Main planted adults at N end of island (see Fig. 10)

Dicots (57 + 97)

<i>Acaena novae-zelandiae</i>	l	Grassy area by dam pond, lower golf course gully
<i>Acanthus mollis</i> *†	lc	By accommodation
<i>Anagallis arvensis</i> var. <i>arvensis</i> *	lc	Gravel road margin & coastal slopes
<i>Anagallis arvensis</i> var. <i>caerulea</i> *	l	Track margin near island summit
<i>Anredera cordifolia</i> *†	MF, lc	By accommodation
<i>Aphanes inexpectata</i> *	l	Bare clay areas on track. AK 311817
<i>Apium prostratum</i>	l	Coastal slopes, especially just north of most E point
<i>Araujia hortorum</i> *	s	Single plant with old seed pods, E cliff top
<i>Aster subulatus</i> *	o	Uphill from dam edge, golf course gully
<i>Atriplex prostrata</i> *	s	Back of sandy beach, NE coast
<i>Avicinnia marina</i>	s	Single 40 cm plant in crack in rock, NE coast
<i>Banksia integrifolia</i> *†	o-lc	Saplings mainly on open NE coast. A few planted adults near resort. AK 306380
<i>Beilschmiedia tarairi</i>	MF, l	Single large tree, saplings & seedlings, golf course gully
<i>Bellis perennis</i> *	lc	Lawn/pasture areas by accommodation
<i>Brassica rapa</i> subsp. <i>rapa</i> *	l	Back of sandy beach, NE coast; petals 11-12mm long. AK 312609
<i>Cakile maritima</i> *	lc	Back of beaches, NE coast. Plants with and without horns on fruit. AK 306377
<i>Calystegia sepium</i> ssp. <i>roseata</i> × <i>C. silvatica</i> ssp. <i>disjuncta</i> *†	l	By accommodation; flowers pale pink
<i>Calystegia soldanella</i>	MF, lc	Back of sandy beaches, NE coast
<i>Capsella bursa-pastoris</i> *	s	Pasture
<i>Carmichaelia australis</i>	MF, s	2 plants on NE coastal slope
<i>Centaurium erythraea</i> *	o	Widespread, open sites
<i>Cerastium glomeratum</i> *	o	Lawn/pasture areas by accommodation
<i>Chrysanthemoides monolifera</i> *	l	A few fruiting plants above watertanks; and one on NE coast
<i>Cichorium intybus</i> *	lc	NE coastal slope (cliff top to sea level). AK 306399
<i>Cirsium vulgare</i> *	o	Open sites throughout
<i>Clematis paniculata</i>	s	Single flowering plant, W side of lower golf course gully
<i>Conyza sumatrensis</i> *	o	By accommodation & coastal slopes
<i>Coprosma macrocarpa</i>	[MF], l	Coastal slopes & golf course gullies. The <i>Cop. lucida</i> record of MF is assumed to be this sp.
<i>Coprosma macrocarpa</i> × <i>C. robusta</i>	s	Coastal slopes
<i>Coprosma repens</i>	MF, s	Coastal slopes; also planted by accommodation and elsewhere?

<i>Coprosma rhamnoides</i>	MF, o	Bush areas - surprisingly uncommon
<i>Coprosma robusta</i>	MF, o	Shrubby areas; also planted on the island
<i>Corynocarpus laevigatus</i>	MF, lc	Adults and saplings in golf course gully
<i>Cotoneaster glaucophyllus*</i>	MF, o-lc	By accommodation & coastal slopes
<i>Crassula sieberiana</i>	o	Rocky coastal slopes
<i>Crepis capillaris*</i>	l	Upper E coastal slope
<i>Dichondra repens</i>	l	NE rocky coast
<i>Disphyma australe</i>	l	Coastal rocks, especially by S point
<i>Dodonaea viscosa</i>	MF, s	Single plant (cv. 'Purpurea') on SW cliffs appeared to be wild
<i>Drosera auriculata</i>	l	Open clay area, NE cliff top. AK 312390
<i>Dysoxylum spectabile</i>	MF, l	Forest gully in golf course
<i>Einadia triandra</i>	s	NE coast, small clump.
<i>Erica lusitanica*</i>	s	Single plant on SW cliffs
<i>Euchiton collinus</i>	lc	Open E cliff top
<i>Euchiton sphaericus</i>	l	Margin of grassy track down NE coastal slope
<i>Euphorbia peplus*</i>	o	Open areas throughout
<i>Fatsia japonica*</i>	s	Two plants epiphytic on phoenix trunk by lower accommodation; AK 306378
<i>Ficus macrophylla*†</i>	l	Epiphytes on palm trunks, near 2 planted adults & <i>F. rubiginosa</i> adults - centre of chalets
<i>Ficus rubiginosa*†</i>	s	Single epiphyte sapling on palm trunk, near 2 planted adults - centre of chalets
<i>Fumaria capreolata*†</i>	s	By resort complex near wharf. AK 312392
<i>Fumaria muralis*</i>	l	Lawn/pasture areas by accommodation
<i>Galium aparine*</i>	o	Mainly by accommodation
<i>Geniostoma ligustrifolium</i>	MF, l	NE coastal slopes
<i>Geranium dissectum*</i>	o-lc	Lawn/pasture areas
<i>Geranium molle*</i>	lc	Lawn/pasture areas by resort & chalets
<i>Geranium retrorsum</i>	l	Open E cliff top. AK 306890
<i>Haloragis erecta</i>	o	Scattered throughout
<i>Hebe aff. macrocarpa</i>	l	Low plants (too low for this species?), NE coastal slopes. AK 312393
<i>Hedera helix*†</i>	l	By accommodation; also planted in this area
<i>Helminthotheca echioides*</i>	o	Especially by accommodation
<i>Homalanthus populifolius*</i>	s	By accommodation
<i>Hypochaeris radicata*</i>	o	Open areas throughout
<i>Impatiens walleriana*†</i>	s	A few plants epiphytic on phoenix trunk by the resort. AK 306379
<i>Kunzea ericoides</i>	MF, l	Mainly by 'Golf course' & 'Rubbish tip' gullies; also some planted on the island
<i>Lactuca sativa*†</i>	l	In lawn by the resort complex
<i>Lavatera cretica*†</i>	lc	Rough areas by the chalets. AK 306373
<i>Leptecophylla juniperina</i>	MF, o	E coastal slopes
<i>Leptospermum scoparium</i>	MF, lc	Especially coastal slopes & golf course margin; planted by the pond?
<i>Leucopogon fasciculatus</i>	MF, o	Mainly coastal slopes
<i>Ligustrum lucidum*</i>	l	By accommodation
<i>Linaria purpurea*†</i>	l	By accommodation
<i>Linum trigynum*</i>	lc	Especially open coastal slopes
<i>Lobelia anceps</i>	l	Coastal seeps
<i>Lotus pedunculatus/suaveolens*</i>	l	Young plants, coastal slopes

<i>Lunaria annua</i> *†	I	By lower accommodation
<i>Lycium ferrocissimum</i> *	ML, o	Scattered plants around coast
<i>Macropiper excelsum</i>	ML, o	Uncommon shrub
<i>Medicago arabica</i> *	I	Gravel road by upper chalets
<i>Medicago nigra</i> *	o-lc	By accommodation and open coastal slopes. AK 131987
<i>Medicago sativa</i> *†	I	Open grassy area, NE coast. AK 311811
<i>Melicope ternata</i>	MF, I	Lower forested golf course gully; also planted on the island
<i>Melicytus ramiflorus</i>	MF, I	A few trees & saplings golf course gully; also planted on the island
<i>Melilotus indicus</i> *	I	Mainly at back of beaches
<i>Metrosideros excelsa</i>	MF, o-lc	Largest trees in golf course gully; also planted on the island
<i>Modiola caroliniana</i> *	o	lawn/pasture areas by accommodation
<i>Muehlenbeckia complexa</i>	MF, o	By accommodation & coastal slopes. AK 131980
<i>Myoporum laetum</i>	MF, o	Coastal slopes; also planted trees by accommodation & golf course
<i>Myrsine australis</i>	MF, o	Localised occurrences
<i>Olea europaea</i> subsp. <i>cuspidata</i> *†	s	Wild sapling, E cliff top; and 1 cultivated adult. AK 306375-76
<i>Olearia furfuracea</i>	MF, o	Coastal slopes
<i>Orobanche minor</i> *	s	Upper NE cliffs
<i>Oxalis corniculata</i> *	s	Track margin between lower and upper accommodation
<i>Oxalis exilis</i>	I	In lawn
<i>Oxalis incarnata</i> *	I	By accommodation
<i>Oxalis pes-caprae</i> *	s	By tennis court
<i>Oxalis rubens</i>	I	Coastal slope, NE coast. AK 312484
<i>Parentucellia viscosa</i> *†	s	Open clay area, E cliff top
<i>Paraserianthes lophantha</i> *	I	By accommodation
<i>Passiflora caerulea</i> *†	s	Climbing into trees near main path by the workshop
<i>Passiflora ?tarminiana</i> *†	s	Juveniles only by accommodation
<i>Peperomia urvilleana</i>	I	Steep shaded slope on NE coast
<i>Pescicaria decipiens</i>	I	Dam edge, golf course gully
<i>Physalis peruviana</i> *	s	Pasture margin
<i>Phytolacca octandra</i> *	ML, o	Mainly by accommodation
<i>Pimelea urvilleana</i>	o	Small patches on lower coastal slopes
<i>Pittosporum crassifolium</i>	MF, a	Commonest woody plant on island - seedlings to adults, mainly on cliffs
<i>Planchonella costata</i>	MF, I	Single multi-trunked tree c.30m tall & saplings nearby - lower golf course gully. AK 283336
<i>Plantago lanceolata</i> *	lc	Lawn/pasture & coastal slopes
<i>Polycarpon tetraphyllum</i> *	o	Widespread, open sites
<i>Pomaderris amoena</i>	I	A few adult plants covered in flowers, E coastal slopes
<i>Prunella vulgaris</i> *	s	On road near water tanks
<i>Prunus persica</i> *	s	Bush margin, 'Rubbish tip' gully
<i>Pseudopanax arboreus</i>	s	Golf course gully
<i>Pseudopanax crassifolium</i>	s	Young plant in golf course gully
<i>Pseudopanax crassifolius</i> × <i>P. lessonii</i>	s	Single seedling, NE coast
<i>Pseudopanax lessonii</i>	ML, o	Coastal slopes
<i>Ranunculus bulbosus</i> *†	s	Damp lawn margin with long grass. AK 306401
<i>Ranunculus parviflorus</i> *	I	Lawn margin with bush. AK 306469

<i>Ricinus communis</i> *†	l	By accommodation
<i>Rosa rubiginosa</i> *	o	Throughout open areas. AK 306470
<i>Rumex acetosella</i> *	l	Open clay area, E cliff top
<i>Rumex conglomeratus/obtusifolius</i> *	l	Young plants, margin golf course dam
<i>Rumex crispus</i> *	l	Many plants, margin of golf course dam
<i>Rumex pulcher</i> *	l	Wet lawn by accommodation
<i>Sagina apetala</i> *	o	Open areas throughout
<i>Salix cinerea</i> *	ML, l	A few c.15-20 year-old trees, pond margin (by old stream bed) below golf course; unlikely to have been planted
<i>Sarcocornia quinqueflora</i>	l	Coastal rocks, especially by S point
<i>Selleria radicans</i>	s	Single clump by seep NE coast
<i>Senecio esleri</i> *	s	By accommodation
<i>Senecio hispidulus</i>	o	Open coastal slopes
<i>Senecio lautus</i>	la	Coastal slopes throughout
<i>Senecio mikanioides</i> *†	l	By lower accommodation
<i>Sherardia arvensis</i> *	l	Gravel road, near upper chalets
<i>Silene gallica</i> *	o	Upper NE cliffs
<i>Solanum mauritianum</i> *	ML, s	By accommodation
<i>Solanum nigrum</i> *	s	By accommodation
<i>Solanum nodiflorum</i>	s	Under trees between lower and upper accommodation
<i>Soliva sessilis</i> *	lc	Gravel road
<i>Sonchus asper</i> *	s	N end, near pa site
<i>Sonchus oleraceus</i> *	o	Open areas throughout
<i>Sophora chathamica</i>	MF, l	Mainly small trees on E coastal slopes
<i>Stellaria media</i> *	l	NE coast
<i>Taraxacum officinale</i> *	o	Lawn/pasture areas by accommodation
<i>Tetragonia implexicoma</i>	o	Patches mainly on coastal slopes - widespread
<i>Trifolium dubium</i> *	lc	Especially coastal slopes
<i>Trifolium pratense</i> *	l	Grassy area, back of beach, NE coast
<i>Trifolium repens</i> *	lc	Lawn/pasture areas by accommodation
<i>Trifolium resupinatum</i> *†	o	Lawn above beach, S of wharf
<i>Trifolium subterraneum</i> *	lc	Lawn/pasture areas
<i>Tropaeolum majus</i> *	l	By accommodation
<i>Ulex europaeus</i> *	s	A few plants on steep coastal slopes
<i>Verbascum creticum</i> *	l	E coastal slope (top to bottom). AK 306473
<i>Veronica arvensis</i> *	o	lawn/pasture areas by accommodation
<i>Veronica persica</i> *	o	Lower accommodation area
<i>Vicia sativa</i> *†	l	Near pa site & accommodation (N end of island)
<i>Vitex lucens</i>	ML, l	Mature trees in golf course gully
<i>Wahlenbergia littorcola</i>	l	Open clay area, upper NE coastal cliffs. AK 306374

Monocots (21 + 27)

<i>Acianthus sinclairii</i>	l	Forest near high point
<i>Agapanthus praecox</i> *	ML, lc	By accommodation
<i>Anthoxanthum odoratum</i> *	lc	Margin pasture & bush
<i>Arthropodium cirratum</i>	MF, lc	Steep coastal slopes
<i>Arum italicum</i> *	l	By accommodation

<i>Asparagus asparagoides</i> *	s	Single plant (uprooted) pa site
<i>Astelia banksii</i>	[MF], o-lc	Mainly NE coastal slopes. The <i>Ast. solandri</i> record of MF is assumed to be this species
<i>Austrostipa stipoides</i>	l	On coastal rocks just E of wharf
<i>Avena barbata</i> *	l	NE coast
<i>Bolboschoenus</i> sp.	s	By seep, near mouth of 'Rubbish tip' gully
<i>Briza minor</i> *	o	Coastal slopes, especially near S point
<i>Bromus diandrus</i> *	o-lc	Coastal slopes & by accommodation
<i>Bromus willdenowii</i> *	o	Coastal slopes & by accommodation
<i>Carex divulsa</i> *	lc	Bush/pasture margins
<i>Carex flagellifera</i>	o	Coastal slopes and golf course gully
<i>Carex virgata</i>	s	By seep, near mouth of 'Rubbish tip' gully
<i>Catapodium rigidum</i> *	lc	Gravel road by accommodation. NZFRI 27731
<i>Collospermum hastatum</i>	s	Terrestrial, in bush near high point
<i>Cordyline australis</i>	MF, s	Seedlings epiphytic on palm trunks; adult plants all appeared to be planted
<i>Cortaderia selloana</i> *	MF, o-lc	Widespread, but mostly northern NE coast
<i>Critesion murinum</i> *	l	Lawn/pasture areas by accommodation
<i>Crocoshia ×crocoshiiiflora</i> *	MF, lc	By accommodation. AK 306397. The presence of green capsules on 1 plant in Oct 2009 suggests that a spring flowering iris might also be present, e.g. <i>Chasmanthe bicolor</i> ?
<i>Cynodon dactylon</i> *	l	Lawn/pasture margins
<i>Cyperus ustulatus</i>	l	A few clumps along SW coast
<i>Dactylis glomerata</i> *	o	Lawn/pasture margins
<i>Dianella nigra</i>	s	E coastal slopes
<i>Dichelachne rara</i> *	lc	E coastal slopes. AK 306865
<i>Ehrharta erecta</i> *	l	Weed in garden by accommodation
<i>Ficinia nodosa</i>	o	Coastal margins
<i>Gahnia lacera</i>	MF, c	Throughout
<i>Juncus bufonius</i> var. <i>congestus</i> *	l	Bare open clay area, track above NE cliffs; plants to 15mm tall. AK 312350
<i>Juncus sarophorus</i>	s	A few clumps margin lawn by accommodation
<i>Lagurus ovatus</i> *	l	Slopes, NE coast
<i>Microlaena stipoides</i>	o	By accommodation and a cliff top manuka shrubland
<i>Microtis unifolia</i>	s	Open area upper NE cliffs, with sun orchids
<i>Oplismenus hirtellus</i>	s	Golf course gully
<i>Pennisetum clandestinum</i> *	ML, la	Dominates pasture areas
<i>Phoenix canariensis</i> *	MF, a	Wildlings throughout, most young & lacking trunks; long avenue of planted adults. AK 311808
<i>Phormium tenax</i>	MF, l	Mainly young plants on NE coastal slopes; all adults appeared to have been planted
<i>Poa anceps</i>	l	NE coast
<i>Poa annua</i> *	lc	Especially by accommodation
<i>Rhopalostylis sapida</i>	ML, lc	Mainly young trunkless plants in forest golf course gully
<i>Rytidosperma racemosum</i> *	o	Coastal slopes - may also be other species present but most plants sterile
<i>Setaria palmifolia</i> *†	lc	Margin pasture & bush
<i>Sporobolus africana</i> *	lc	Especially open coastal slopes
<i>Stenotaphrum secundatum</i> *	lc	Especially lawn by wharf
<i>Thelymitra longifolia</i>	lc	Open coastal slopes, many with numerous open flowers (insect-pollinated form)(Fig. 17)

Updated vascular flora for the seven-island chain east and southeast of Waiheke Island

Ewen K. Cameron

This update to the published island chain vascular flora of the islands east and southeast of Waiheke Island of Cameron et al. (2007) is based on: a short visit to Tarahiki Island and part of Ponui Island (Scully Reef) (see below); the 2009 survey of Pakatoa Island (Cameron 2010); the additional two surveys of Pakihi Island (Cameron 2009); and some extra information regarding Rotoroa and Karamuramu Islands (see this article). For the location of these islands see Cameron et al. (2007: fig. 1). Updated flora totals are given in Table 1 – Rotoroa Island and “Ruthe Islet” flora totals are unchanged from Cameron et al. (2007).

Table 1. Wild vascular plant totals in different groups, area, maximum height and proximity to a larger island for the seven islands E and SE of Waiheke Island.

Plant Group	Ta*	Paka	Rot	Rut	Pon	Paki	Kar	Totals
Native ferns & fern allies	14	17	26	8	75	28	3	81
Native conifers	-	-	1	-	8	-	-	8
Native dicots	51	57	99	49	112	77	18	147
Native monocots	27	22	48	16	85	50	7	104
<i>Native sub total</i>	<i>92</i>	<i>96</i>	<i>174</i>	<i>73</i>	<i>280</i>	<i>155</i>	<i>28</i>	<i>340</i>
Naturalised fern & fern allies	-	1	2	-	-	-	-	2
Naturalised conifers	-	3	4	1	3	3	1	5
Naturalised dicots	30	88	153	23	96	102	47	221
Naturalised monocots	20	25	65	14	45	44	22	84
<i>Naturalised sub total</i>	<i>49</i>	<i>117</i>	<i>224</i>	<i>38</i>	<i>144</i>	<i>149</i>	<i>70</i>	<i>312</i>
Overall totals	142	213	398	111	424	304	98	652
% native	65	45	44	66	66	51	29	52
Area, height, & distance to a larger island								
Area (ha) (from Taylor 1989)	5.9	29.3	90.0	0.6	1795	114	7.3	[2042]
ASL (m)	68	60	76	20	173	125	20	
Prox. to a larger island (km)	2.5	0.7	0.9	0.2	1.3	1.3	0.4	

*Ta = Tarahiki, Paka = Pakatoa, Rot = Rotoroa, Rut = “Ruthe Islet”, Pon = Ponui, Paki = Pakihi, Kar = Karamarama Islands

Tarahiki (Shag Island) - vascular plant additions

On 6 Jan 2010 with a three others I circumnavigated Tarahiki by boat and went ashore for c.1 hour, landing by the main beach on the west side, climbing up to and around the summit area and descended to the SW coast. Six to seven new vascular plant records were added to the island’s flora of Cameron et al. (2007), two earlier records were confirmed and three appeared to require their abundance status changed (see below). None of the additions were additional to the island chain flora of Cameron et al. (2007).

Symbols

a = abundant, c = common, o = occasional, l = local, lc = locally common, s = scarce, * = naturalised species, AK = herbarium voucher number

New records for Tarahiki

*Anthoxanthum odoratum** lc, on dry E-facing ridge. AK 308748

*Atriplex prostrata** l, back of main beach on W side

*Cortaderia selloana** l, on huge bare slip on W side (slip present in Sep 2007, pers. ob.)

Dianella latissima lc, just W of summit. AK 308738. Unsure if this is new or simply replaces the previous *D. nigra* record

*Leontodon taraxacoides** s, back of main beach on W side

Rytidosperma unarede lc, open sites

*Vulpia bromoides** lc, open sites

Confirmation of two 1988 records and abundance rankings added

*Cirsium vulgare** s, lower bush margin, W side of island

*Polycarpon tetraphyllum** lc, open sites

Suggested changes to previous abundance rankings

Collospermum hastatum lc (was previously a)

Hebe stricta o (lc)

Pyrrhosia eleagnifolia lc (a)

Rotoroa Island – additional comments

Early herbarium specimens – there are at least five early collections from “Ruth’s Island” (= Rotoroa