

Flora and fauna of Kahakaha/Frenchmans Cap, inner Hauraki Gulf, Auckland

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Introduction

Kahakaha/Frenchmans Cap, at 36° 48' 13" S, 175° 11' 6" E, is a small, steep island in the Inner Hauraki Gulf, situated east of Waiheke Island, towards Rotoroa Island and closest (850 m) to Pakatoa Island (Fig. 1). At high tide it roughly measures 37 m east-west by 23 m north-south, c.0.08 ha, 16 m asl (from Geomaps), surrounded by an intertidal storm platform 25-50 m wide (Fig. 2). Although steep, the island can be traversed fairly easily up to the summit from all but the east side (Fig. 3). See Lee (1999) for possible meanings of its Māori name, a brief summary of its European ownership and then becoming Crown Land.

The island is composed of Waipapa Terrane greywacke and also red chert; the reef shows that a considerable amount of the island is red chert and argillite – the difference is how much silica is in the rock (Bruce Hayward pers. comm., based on our photographs). There is a shallow cave in the northeast corner (Fig. 4). with interbedding red layers of ordinary cherts (due to high contents of iron oxides), alternating with black manganese-rich layers.

As on Pakihi Island (Cameron 2009), c.11 km to the south, the slow rate of the weathering chert (the siliceous rocks make them more resistant to erosion) results in a thinner soil layer than the thicker decomposing layer of rock that occurs over greywacke. The resulting thin soils make it difficult for many plants to grow or survive droughts. The sandy / pebble / shell beach on the western side makes the island easy to land on. However, the authors saw no evidence of frequent human visitors.



Fig. 1. Location of Kahakaha (Frenchmans Cap), Inner Hauraki Gulf. Topomap modified by Joshua Salter. Scale = grid of 1 km squares.

Summary of historical and recent biological surveys

Four previous recording events are presented chronologically along with our combined recent observations (see Appendix):

25 Jan 1947 – H. Ross McKenzie collected white-fronted tern eggs, vouchered in the Auckland Museum, Land vertebrates (LB 1325-26)

29 Oct 1988 – Graeme A. Taylor and Alan J.D. Tennyson visited the island for 30 minutes and

recorded vascular plants (GAT) and fauna (GAT and AJDT): 45 species of vascular plants, and nine bird species (Taylor 1988, Tennyson 1988, partly published by Lee 1999).

1996 and 1997 – three terrestrial biological surveys were made by Michael Lee on 21, 28 March and 1 June 1996 towards his MSc degree (Lee 1996) and a later follow-up visit on 27 November 1997. These surveys were later published by Lee (1999), including additional species from Taylor (1988). Note – mile-a-minute (*Dipogon lignosus*) recorded by Lee (1999: Appendix 5) as a “GAT” for Kahakaha was a mistake.

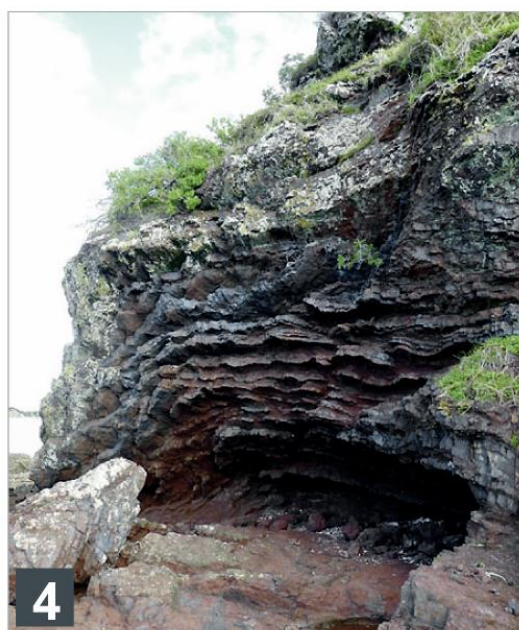
6 Jan 2010 – Ewen K. Cameron (EKC), as part of a wider group, carried out a vascular plant and bird survey on 6 January 2010 when the island was very dry, recording 39 vascular plant and three bird species during a brief visit.

Jan 2022–Feb 2023 – the current authors visited Kahakaha seven times during this period: 9 Jan

2022, bird observations from boat (SHD); 14 Aug 2022, brief landing (SHD); 2 Sep 2022, 3 hours (joint visit); 09 Sept 2022, brief landing (SHD); 26 Oct 2022, 3 hours (joint visit); 26 Nov 2022, landed for nearly 1 hour (SHD); and 18 Feb 2023, 3 hours (SHD).



Fig. 2. Aerial image of Kahakaha, showing the extensive intertidal reef encircling the island. Auckland Council GeoMap (aerial base map) flown 15 Dec 2020, modified by Joshua Salter. Scale bar = 20 m.



Figs. 3 & 4: **3.** Kahakaha from the east, the steepest side; karo are the main tall shrubs; tussocks of *Astelia banksia* and rengarenga are common; and the annual grasses have dried off. Waiheke I. in background. Photo: SHD, 18 Feb 2023. **4.** Shallow cave on NNE coast, with interbedded bands of red and black chert/rock. SHD, 14 Aug 2022.

Table 1. Numbers of vascular plants of Kahakaha/Frenchmans Cap recorded at four different periods over the last 35 years. For the data source see Appendix and "Summary of historical and recent biological surveys" (Introduction, above).

	1988	1996-97	2010	2022-23	TOTALS	Unconfirmed by 2022-23 surveys	Additions by 2022-23 surveys
Native ferns	3	4	5	5	5	-	-
Native dicots	13	8	9	17	18	2	3
Native monocots	3	2	5	5	7	3	2
Naturalised dicots	18	5	12	25	29	3	9
Naturalised monocots	8	2	8	10	12	2	2
TOTALS	45	21	39	62	71	10	16
% native species of totals in bold	42%	67%	49%	44%	42%	50%	31%

Results

Vegetation and vascular flora

The thin soil of this steep rocky island limits the size the plants can attain, especially for woody species. An exotic grassland sward between rocky outcrops dominates most of the lower parts of the island and most of the main west-east ridge (Fig. 5; see also cover illustration). Scattered shrubs are present on the upper part of the island, and only on the south side down to the shore margin, but not forming a continuous cover. The best woody cover is a group of loosely associated shrubs on the southern face (Fig. 6). The tallest plants are houpara (*Pseudopanax lessonii*) (to 5 m), karo (*Pittosporum crassifolium*) (to 4 m) and pōhutukawa (*Metrosideros excelsa*) just west of the summit (3.5 m tall) (Fig. 7), taupata (*Coprosma repens*) (to 2.5 m, most are much less, and wider than tall) and boxthorn (*Lycium ferrocissimum*) (to 1 m). However, an uprooted larger plant skeleton was present on the grassy west-east ridge, just below the tallest pōhutukawa – we suspect this is the large taupata tree mentioned by both Taylor (1988) and Lee (1999: 121); it would have been >3 m tall, with a lower trunk diameter of

20 cm (Feb 2023) (Fig. 8). The grass sward is dominated by kikuyu (*Cenchrus clandestinus*) (Fig. 9), with scattered taller annual grasses emergent though it in spring and summer (Fig. 10), particularly slender oat (*Avena barbata*) to 1.4 m tall, prairie grass (*Bromus catharticus*), and ripgut brome (*Bromus diandrus*) (Fig. 11). Commonly through the sward were *Geranium purpureum*, *Stellaria media*, *Vicia sativa*, catchfly and locally pōhuehue (*Muehlenbeckia complexa*) and pūhā (*Sonchus oleraceus*). Yellow patches of Bermuda buttercup (*Oxalis pes-caprae*) flowers stood out in Aug-Oct 2022 as two main patches (c.5 m x 6 m each) by the lower western edge (Figs. 12, 13), and scattered small clumps over quite a wide area, the highest being at c.8 m asl (see Fig. 8) on the main grassy west-east ridge. By 26 November the Bermuda buttercup had died right down and virtually disappeared out of sight. The grassland sward was lush in the spring and looked quite different when brown and dried off in the summer (Fig. 10). The exposed rocky outcrops provide an open habitat for many of the smaller herbaceous species.

Figs. 5–14: **5.** Kahakaha from the west, showing the grassland sward up the main west-east ridge. Photo: SHD, 14 Aug 2022. See also cover illustration. **6.** SSE side, supporting the woodiest vegetation on the island; at low tide. Photo: SHD, 26 Nov 2022. **7.** Tallest pōhutukawa just west of the summit, 3.5 m tall; appears to be a single multi-trunked tree (fallen and regrown?). Photo: EKC, 2 Sep 2022. **8.** The uprooted dead tree is thought to be a taupata, lower trunk diameter of 20 cm; pōhutukawa (above), houpara (behind), karo (right), and the highest Bermuda buttercup clump up the island, among the kikuyu grass; main ridge on west side. Photo: SHD, 9 Sep 2022. **9.** A sward of kikuyu dominates much of the warmer, northern slope, with rocky outcrops above. The main shrubs are boxthorn near summit, and on the right, pōhutukawa (upper) and karo (lower). Photo: SHD, 9 Sep 2022. **10.** Kahakaha from the west in the summer with annual grasses dried up – compare with Fig. 5, a winter photo from a similar angle. Photo: EKC, 6 Jan 2010. **11.** Ripgut brome briefly dominating the kikuyu grass sward (where it is thin) in the spring; NW slope. Photo: SHD, 26 Oct 2023. **12.** The two largest patches of Bermuda buttercup near sea level, their winter/early spring flowers locally dominate the pasture; looking east. Photo: SHD, 9 Sep 2022. **13.** Flowers of Bermuda buttercup with petals arranged spirally in bud, and the sepals, red-purple tipped (= mid-styled form) – the commonest wild form in New Zealand. Photo: SHD, 14 Aug 2022.





Figs. 14–19: **14.** Clumps of *Astelia banksii* along the SE clifftops, with *Asplenium haurakiense* by their bases and a single rengarenga. Photo: EKC, 26 Oct 2022. **15.** Rengarenga in full flower on the S-facing cliffs, with smaller plants of *Senecio lautus*. Photo: EKC, 26 Oct 2022. **16.** The small annual *Crassula sieberiana* – common on these mossy, S-facing rocky ledges. Small herbs like this rely on open rocky habitats. Photo: EKC, 2 Sep 2022. **17.** A mossy sward of *Triquetrella papillata*, dry on the left, wet on the right; upper south side. Photo: SHD, 14 Aug 2022. **18.** Onion orchids near the top of the steep western face in hummocks of moss (*Hypnum cupressiforme*). Photo: SHD, 26 Nov 2022. **19.** A typical hairy seedling of the coastal harebell (*Wahlenbergia vernicosa*). Locally common on the steep, rocky south face; all plants had pale-blue flowers. Photo: SHD, 2 Sep 2022.

The lower open rocky fringe of the island, which the spring tides would reach, allows a habitat for a few annuals that can withstand some exposure to saltwater. For example, the exotic orache (*Atriplex prostrata*), *Cakile maritima*, *Melilotus indicus* and

Sagina apetala. Previous records of sickle grass (*Parapholis incurva*) and the native perennial *Calystegia soldanella* should grow well here, but they appear to have died out.

The 2022-23 botanical surveys of the island bring the total recorded flora for the island to 71 vascular species (42% indigenous) see Table 1 and Appendix. Sixty-two vascular plant species were actually recorded during our 2022-23 survey, of which 16 were new records for the island (31% indigenous), but ten previous records were not confirmed (50% indigenous), see Table 1. The seven woody shrubs/trees recorded, are present in low numbers, apart from karo which was locally common. The two woody species that have died out include boneseed (*Chrysanthemoides monilifera*) – a probable target of eradication, and a single shrub of coastal karamū (*Coprosma macrocarpa*) recorded in the 1990s.

The grass component of this vascular flora is quite large at 20%, but only 3/15 were native species. The rocky outcrops provided habitat for small herbaceous native species that would otherwise get smothered by the larger exotic grasses, e.g., *Crassula sieberiana*, *Cotula australis*, *Senecio lautus*, harebell (*Wahlenbergia vernicosa*), sun orchid (*Thelymitra longifolia*), onion orchid (*Microtis unifolia*), *Rytidosperma unarede*, woolly cloak fern (*Cheilanthes distans*) and rock fern (*C. seiberi*), mosses and lichens; and exotic vascular species, allseed (*Polycarpon tetraphyllum*), catchfly (*Silene gallica*), *Medicago nigra*, *Trifolium dubium*, *Festuca bromoides*, twin cress (*Lepidium didymum*), *Cerastium glomeratum* and small grass species.

The steep, south-facing rocky slopes towards the eastern end contained the best herbaceous indigenous vegetation and flora, with little kikuyu grass present (Fig. 6). The three main herbaceous species were clumps of *Astelia banksii* (Fig. 14), rengarenga (*Arthropodium cirratum*) (Fig. 15) and *Asplenium haurakiense*, mixed with smaller species of *Senecio lautus*, *Crassula sieberiana* (Fig. 16), harebell, *Chenopodium trigonon* and *Peperomia*

urvilleana. Occasional shrubs of karo, houpara and taupata were also present. Exotic herbaceous species included *Medicago nigra*, catsear (*Hypochaeris radicata*), fleabane (*Erigeron sumatrensis*) and *Festuca bromoides*. High up in a mossy sward of *Triquetrella papillata* (Fig. 17), sun and onion orchids (Fig. 18) were locally common in the open, but not many sun orchids flowered.

The only Threatened or At-Risk species present is the Regionally At-Risk/Declining coastal harebell (*Wahlenbergia vernicosa*) (Fig. 19) (Simpkins et al. 2022) which is common on the south-facing steep rocky slope, from the summit down to near the shoreline, but having to compete with annual exotic species, such as: *Festuca bromoides*, scarlet pimpernel (*Lysimachia arvensis*), *Cerastium glomeratum* and *Trifolium subterraneum*.

A piece of flotsam – a hard woody shell (Fig. 20, AK 386208) unfamiliar to us, was spotted in the beach drift in October 2022. After some assistance it was resolved as black walnut (*Juglans nigra*), presumably washed down from a tree planted somewhere in the Hauraki Gulf catchment. The kernel did not survive the immersion in seawater.

Fauna

Rodents

Based on a trap line set for 21 trap-nights in 1996 that failed to detect rodents, and the presence of crickets, shore earwigs and darkling beetles, it appeared that rodents were absent (Lee 1999: 122). Rat bait stations have been maintained on Kahakaha by Rotoroa Island staff since 1993 (Lee 1999). Glen Lucas (pers. comm. to EKC Apr 2023), of Rotoroa Island, has maintained a DOC-200 rat trap and a tracking tunnel on Kahakaha for the last 3 years, and in that time has only caught

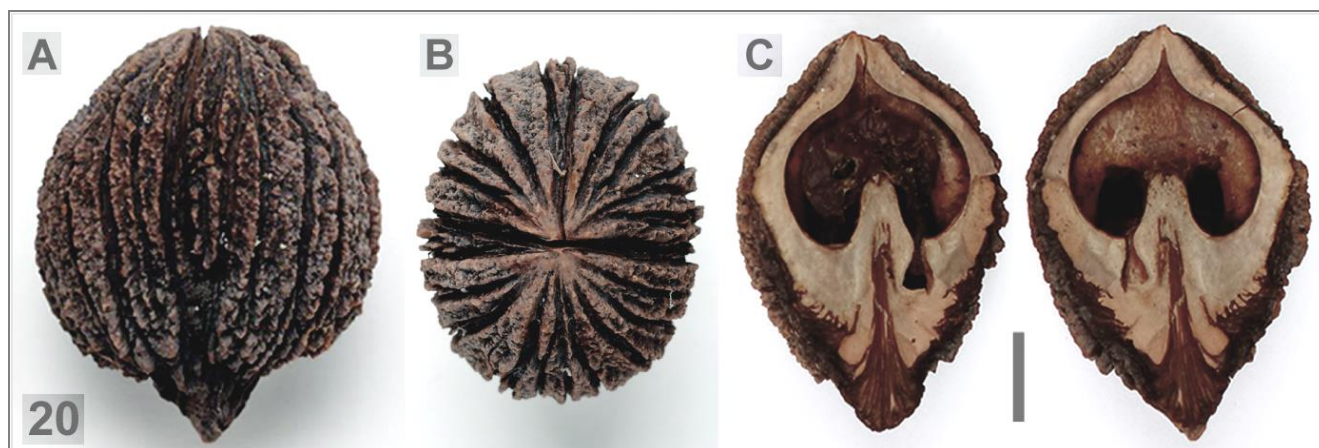


Fig. 20. The woody shell (endocarp) of a black walnut (*Juglans nigra*), 51 mm long, found washed up in the drift on 26 Oct 2022. **A.** View of widest side (apex at top, remains of peduncle at bottom) showing dehiscence line through middle. **B.** View of apex (dehiscence line horizontal through middle). **C.** Two halves split open, showing rotten kernel inside LH half, no kernel in RH half. Scale bar = 1 cm. Photos: Jessie Maucor and Darryl Jeffries, Auckland Museum.

one rat – a Norway rat in Mar/Apr 2022. This bait station is maintained as part of their outer perimeter protection of the mammalian-pest-free Rotoroa Island.

Birds

Generally, the island is unsuitable for petrels and penguins because the soils are too shallow for them to burrow in. However, because it is mammalian-pest-free it is an ideal nesting place for other shore and seabirds, such as NZ dotterel (Fig. 21), variable oystercatcher, black-backed gull, red-billed gull, Caspian tern and white-fronted terns, erratically, in large numbers (Fig. 22), which have all nested here. The extensive intertidal reef is good feeding habitat for many of the species – it includes large oyster beds which the oystercatchers feed on. Pied and little shags also frequent the reef area, and kingfisher and spur-winged plover were also recorded. The present surveys added two new bird records for birds actually on the island (Canada goose and house sparrow) leaving two earlier records unconfirmed by the current surveys (goldfinch and yellowhammer). For a full list of the bird species recorded for Kahakaha and notes see the Appendix.

Nationally threatened or At-Risk species (following Robertson et al. 2021) which nest on the island, in order of their threat status include:

Caspian tern – Nationally Vulnerable
northern NZ dotterel – Nationally Increasing (Fig. 21)
white-fronted tern – At-Risk/Declining (Fig. 22)
red-billed gull – At-Risk/Declining
variable oystercatcher – At-Risk/Recovering

Most of these species were known to have nested on the island 35 years ago, or earlier in the white-fronted tern case (see Appendix). The importance of the Hauraki Gulf for seabirds is documented by Gaskin and Rayner (2017), and Rayner (2021).

Lizards

Although briefly searched for, no lizards were seen by Taylor (1988) or Tennyson (1988), they were

not mentioned by Lee (1999), and none were seen by the visiting group in January 2010 (EKC pers. comm.), or during the present 2022-23 surveys.

Invertebrates

Shore earwigs were recorded by Tennyson (1988), Lee (1999) and the present survey (on 18 Feb 2023). Black field crickets and darkling beetles were recorded by Lee (1999) and the present survey (18 Feb 2023) also recorded the crickets and darkling beetles (*Mimopeus elongatus*, vouchered Auckland Museum). Cicadas were abundant and loud, a number of black cockroaches and a lichen bag moth (*Cebysa leucotelus*) were seen during the present survey (18 Feb 2023). A large spider web photographed (26 Oct 2022) was probably the common garden orb web spider (*Socca pustulosa*) (John Early pers. comm., from image). The easiest place to observe many of the invertebrates was under a black plastic sheet near the single rat trap at the base of the western side of the island. No garden snails (*Cantareus aspersus*), or their discarded shells, were observed in 2022-23.

Discussion

Vegetation and flora

On 2 September 2022 we saw many plants wilting on the rocky northern slopes of the island after two fine spring days during an otherwise damp spring – a reflection of the shallow soils and the tough conditions for plants to grow here. From Johnson's 1840 sketch of 'Singular Rock' [Kahakaha] (Fig. 23) it can be seen that the island's woody vegetation 183 years ago was restricted to the summit area (probably pōhutukawa, but not the same one as is currently near the summit – the woody base appeared too young), but otherwise the island's shape is unchanged: dipping bedding is visible on the north side; and the wide intertidal storm platform is present. Today, there is increased woody vegetation on the island, especially on the southern slopes (Fig. 6). We suspect that the island was probably burnt before 1840, because even though the soils are shallow,

Figs. 21–25: **21.** A safe place for the threatened NZ dotterel to nest; a nest of 3 camouflaged eggs amongst the beach drift; SW side of island. Photo: SHD, 26 Oct 2022. **22.** Some 540 white-fronted terns, most nesting, with some red-billed gulls on Kahakaha, looking ENE. The terns failed to nest there the following summer. Photo: SHD, 9 Jan 2022. **23.** Sketch by John Johnson, 28 Dec 1840, looking ENE. "Singular Rock [Kahakaha I.] off Waiheke S.side [Waiheke, E. side]". Auckland Museum, Pictorial, PD-1963-8-21. Note – Pakatoa I. on left, Tarahiki immediate left (in reality Tarahiki is just hidden from view by Pakatoa at this angle), Rotoroa I. on right, and Coromandel Ranges behind. Compare the 1840 woody vegetation with present day (e.g., Fig. 5 from a similar angle). In 1840, the lack of trees on the sides and the tuft of trees on the summit probably contributed to the name, Frenchmans Cap, because such conical hats typically had a floppy folded top. **24.** A large Canada goose nest with four eggs, amongst the best native vegetation on the island; c.8 m asl, on a narrow ledge on the steep south side. What seeds might they disperse to this island? Photo: SHD, 26 Oct 2022. **25.** The presence of many invertebrates usually indicates a rat-free island, e.g., darkling beetles under a plastic sheet near the rat trap. However, the many dead beetle bodies present here also indicates that a rat has recently been present, gathering up the beetles to eat at their favoured husking station. Photo: SHD, 18 Feb 2023.



21



22



23



24



25

they should still be able to support at least a low woody canopy over much of the island. In 1840 the composition of the total vegetation would have been predominantly indigenous, unlike the current flora which is composed of 58% exotic species. Note – two-thirds of the recent additions were naturalised species (Table 1).

Because the 2022–23 surveys were far more intensive and during different seasons than any of the previous ones, some of these “new” records may have just been overlooked in the past. In contrast, at least some of the unconfirmed records are most likely to have died out. But it is hard to see how three very successful Hauraki Gulf weeds would have died out: boneseed, *Plantago lanceolata* and sickle grass. It is likely that the several boneseed shrubs present in 2010 were purposely weeded out; much of the sickle grass habitat is still available (low exposed rocks in the splash zone), and habitat for *Plantago lanceolata* is still present, but both their habitats would have been reduced by the expansion of kikuyu grass.

It is surprising that *Ficinia nodosa* has never been recorded on the island, as it is often on other small islands in the Hauraki Gulf (pers. obs.), and harakeke (*Phormium tenax*) is occasionally also found on islands this size in the Gulf.

Possible modes of arrival for some of the apparent recent plant records

Apple of Sodom (*Solanum linnaeanum*) – possibly arrived by sea (floating fruit?), because it is growing near the foreshore on the northern side of the island (also observed near sea level on Tiritiri Matangi, pers. obs). Another possibility is in the gut of a frugivorous bird.

Bermuda buttercup (*Oxalis pres-caprae*) – which isn’t known to set seed in New Zealand, may have reached the island by its floating bulbs. It is now locally common on several Hauraki Gulf islands and frequently grows near sea level (pers. obs.).

Moth plant (*Araujia sericifera*) – presumably reached the island by wind-blown seed.

Phoenix palm (*Phoenix canariensis*) – the seed of the two seedlings on the island probably travelled in a bird’s gut (most likely a NZ pigeon/kereru?) – has the potential to locally dominate the vegetation. Cultivated and naturalising phoenix palms are common on two adjacent islands, Pakatoa and Rotoroa (see Cameron 2007, 2010).

Sun (*Thelymitra longifolia*) and onion orchids (*Microtis unifolia*) – both have fine dust-like seeds that can disperse long distances by the wind.

Grasses (14 spp.) – although not recent additions (apart from two spp.), many of the grasses may have reached the island by gulls carrying nesting material, containing grass heads, to the island. Gilham (1960: 212) made the comment that terns have a less deleterious effect on the indigenous flora of a breeding area than gulls because little or no nest material is used, and terns feed at sea, and are therefore unlikely to introduce any alien weeds.

The presence of the expanding mat of kikuyu grass is the biggest challenge to the returning of the vegetation to a predominantly native state. However, it does die out when shaded. The other main weed to eradicate is boxthorn. Management is desirable to control these environmental weeds. Monitoring is also desirable to be able to react quickly if new environmental weeds establish, e.g., such as rhamnus (*Rhamnus alaternus*), veldt grass (*Ehrharta erecta*), or pampas grasses (*Cortaderia jubata* and *C. selloana*), and to prevent boneseed from re-establishing. The authors intend to return to the island to complete the killing of the apple of Sodom (*Solanum linnaeanum*), one of the phoenix palms and moth plant. Just as the rat trap is maintained to stop mammalian pests ‘island-hopping’, there should be similar defences (i.e., weed monitoring and eradication) to prevent environmental weeds from doing the same.

Fauna

Being mammalian-pest-free, and apparently not frequently visited by humans, Kahakaha is an important island for several nesting native bird species, including the five Threatened/At-Risk species listed above (under Results/Fauna). The extensive intertidal reef is ideal for feeding shorebirds, such as variable oystercatchers and NZ dotterel (Fig. 21). It is surprising that reef herons were never observed feeding in the intertidal reef area.

The most surprising bird we found nesting there was a Canada goose, which appears to be one of the first nesting records for this species in the Hauraki Gulf on such a small island (Heiss-Dunlop & Cameron in prep.). The first sign that they were visiting the island was on 14 August 2022 when the lower pasture grasses (W side) were locally grazed, along with pūhā – as if a rabbit had been grazing there. Then on 9 September droppings of a goose were seen on coastal rocks, and finally on 26 October a nest with four eggs high up on a ledge on the south side (Fig. 24) and an upset noisy parent that we disturbed. The nest was deserted on 26 November 2002, and presumably the resulting chicks successfully fledged. It is concerning that Canada geese are frequenting and beginning to nest in the Hauraki Gulf. There needs to be an urgent

well-coordinated campaign to prevent Canada geese fully establishing north of the Waikato.

A recent incursion of a single rat occurred on Rotoroa Island on 05 April 2023; it is thought to have arrived from a boat anchored in Home Bay (Radio NZ, 7 April 2023). Since rats were eradicated from Rotoroa Island in 2011 there have been several incursions of Norway rats, one in 2015 and two in 2017 (Hauraki Gulf Forum, May 2018). From DNA testing it appears that these previous rats most likely arrived from Ponui Island or Waiheke Island, over 1 km away. If rats did establish on the island, they would be a threat to the nesting birds, the invertebrate fauna (Fig. 25) and to some of the plant species by eating seed, seedlings and bark. With the extensive intertidal area there is plenty of food available to them, the two limiting factors being fresh water (especially during a drought) and the desire to reproduce (if a single individual) (Graeme Taylor, pers. comm.). It is therefore important that the rat trap/bait station is maintained on the island. The apparent absence of lizards on Kahakaha is probably due to rats previously establishing on the island for extended times.

Other biological threats

Lee (1999: 128) reported two planter bags with cannabis (*Cannabis sativa*) being present on

Kahakaha. This type of behaviour, that involves bringing soil to the island, could potentially introduced new weed species and/or invertebrate pests such as slugs or snails. Note – the long-term health of the rengarenga possibly relies on the absence of garden snails.

Acknowledgements

EKC thanks: Graeme Taylor and Alan Tennyson for their Kahakaha data recorded on 25 Oct 1988; Mark Bellingham, Michael Lee, John McCallum (skipper) for organising and inviting EKC to visit Kahakaha on 6 Jan 2010; Graeme Taylor for general comments, particularly on the invertebrate images; Glen Lucas of Rotoroa Island for comments on maintaining the current rat trap and tracking tunnel station on Kahakaha; Jessica Beever for moss identifications; Dan Blanchon for assistance with lichen identifications; Rhys Gardner for assisting with the *Juglans* seed identification; John Early for some invertebrate identifications; Susan Tolich, Auckland Museum library, for providing the 1840 Johnson sketch (Fig. 23); and Jessie Maucor and Darryl Jeffries for the walnut shell images (Fig. 20). SHD thanks: Karen Creagh for assistance during the 18 Feb 2023 visit. We both thank: Wolfgang Heiss-Dunlop, our patient boat skipper, excellent fisherman and useful counter of terns from photographs; and Joshua Salter for useful comments on an earlier draft of this article and for producing Figures 1 & 2.

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APPENDIX. Vascular plant and bird observations on Kahakaha/Frenchmans Cap.

Made during four separate time periods, by four different recorders – Graham A. Taylor (GAT), Michael Lee (ML), Ewen K. Cameron (EKC), Shelley Heiss-Dunlop (SHD). Some recent moss and lichen records are also included. For the data sources see “Summary of historical and recent biological surveys” (Introduction, above).

Key

a = abundant
c = common
o = occasional
l = local
lc = locally common

s = scarce (<5 plants seen)
+ = present
++ = signs observed of fauna breeding on the island
×1 = only 1 plant seen (×2 = 2 plants present), etc.
* = wild exotic species

Taxon	25 Oct 1988 (GAT)	1996-97 (ML)	6 Jan 2010 (EKC)	Aug 22-Jan 2023 (EKC & SHD)	NOTES –remarks relate to the 2022-23 visits, unless stated otherwise
FERNS (5 + 0) (= native + naturalised)					
<i>Asplenium haurakiense</i>	c	+	+	lc	Mainly S-facing slope (incl. Lee's (1996-7) unlikely record of <i>A. flaccidum</i> for such a small island)
<i>Cheilanthes distans</i>			lc	lc	Growing with <i>C. seiberi</i> , mainly northern slopes
<i>Cheilanthes seiberi</i>		+	lc	o	Growing with <i>C. distans</i>
<i>Lecanopteris pustulata</i>	lc	+	+	o	Hounds tongue. Terrestrial, S-facing slope, ledges and grassland, under shrubs
<i>Pyrrosia elaeagnifolia</i>	o	+	l	o	Leather fern. On rock and epiphytic on lower trunk of summit pohutukawa
DICOTS (18 + 29)					
<i>Araujia sericifera</i> *				×1	Moth plant. c.3m long. N side c.5m asl. Partly uprooted
<i>Atriplex prostrata</i> *	o	+	+	lc	Orache. W-foreshore
<i>Cakile maritima</i> *	+ [#]			l	W- foreshore ([#] as <i>Cakile</i> sp.)
<i>Calystegia soldanella</i>	lc				Widespread (1988). Outcompeted by kikuyu grass, now extinct?
<i>Cardamine hirsuta</i> *				l	In mossy patches, lower S-facing slope, short-lived. AK 385080
<i>Cerastium glomeratum</i> *	s			lc	In grassland sward and rocky ledges on south side
<i>Chenopodium trigonon</i>	o			l	Small patches, lower steep S-slopes
<i>Chrysanthemoides monilifera</i> *			o		Boneseed. Several in 2010. Weeded out by someone?
<i>Cirsium vulgare</i> *			s	×1	Scotch thistle. Seedling on ledge on north side, uprooted
<i>Coprosma macrocarpa</i>		+			Coastal karamū. A single plant recorded in 1996-97 that died out?
<i>Coprosma repens</i>	o	+	+	o	Taupata. Scattered, but most low-lying and nearly prostrate, tallest 2.5m; one shrub was monoecious (AK 385119); the large one mentioned by Taylor (1988) and Lee (1999) is probably the uprooted dead tree at top of main grassy ridge (Fig. 8)
<i>Cotula australis</i>				lc	On rocky ledges E and S-facing; this small annual is more likely to have been previously missed, rather than new to the island
<i>Crassula sieberiana</i>	o			lc	On rocky outcrops throughout (Fig. 16)
<i>Dichondra repens</i> agg.	+		s	l	S-slope, under karo, edge of grass sward. AK 278585
<i>Disphyma australe</i>	o	+	+	o	Only small clumps, on steep E and S rocky slopes
<i>Erigeron sumatrensis</i> *	c	+	+	o	Fleabane. In grassland
<i>Gamochaeta ?coarctata</i> *	+				Outcompeted, population invaded by kikuyu?
<i>Geranium purpureum</i> *				c	Mainly in grass sward, especially on north side. AK 385337
<i>Hypochaeris radicata</i> *	s		l	o	Catsear. S-facing steep face and by summit
<i>Lepidium didymum</i> *	+			l	Twin cress. On rock by summit and on S face
<i>Lycium ferocissimum</i> *	lc	+	lc	o	Boxthorn. To 1.5m tall (1988); scattered throughout, most <1m tall
<i>Lysimachia arvensis</i> s.s. *	o		l	o	Scarlet pimpernel. Scarlet flowers. South face

<i>Medicago nigra</i> *	+			lc	Margin of grassland on rocky outcrops, in grassland and beach margin
<i>Melilotus indica</i> *	o		+	lc	Erect plants, mainly around the shoreline
<i>Metrosideros excelsa</i>	l	+	×2	×2	Pōhutukawa. Up to 5 (1988). 2-3 in total (2 joined?) both 3.5m tall, W side summit, and 1 top on N slope c.2 m tall
<i>Muehlenbeckia complexa</i>	o	+	o	o	Pōhuehue. Mainly small plants on rocky outcrops throughout, and on north side in grassland
<i>Oxalis pes-caprae</i> *				lc	Bermuda buttercup. Two main patches each c.5 x 6m edge of beach NW and SW-facing (Figs. 12, 13); also scattered clumps on N side to NE corner, single small clump on main ridge c.8m asl; all sepals red-tipped. Dies down in summer. AK 385018
<i>Peperomia urvilleana</i>				l	A few small clumps, steep S-facing slope
<i>Phytolacca octandra</i> *	s	+		s	Inkweed. Single patch (1988). Seedling and fruiting adult lower main W-E ridge
<i>Pittosporum crassifolium</i>	l	+	+	lc	Karo. About 5 shrubs (1988). Most abundant woody plant, most plants youthful, to 4m tall
<i>Plantago lanceolata</i> *			lc		Population smothered by the kikuyu?
<i>Polycarpon tetraphyllum</i> *	lc		+	o	Allseed. On rock outcrops
<i>Pseudognaphalium luteoalbum</i>	+			×1	A minute plant was removed from open E-facing cliffs when c.15 mm tall, grown on to flowering at 25 mm tall. AK 385411
<i>Pseudopanax lessonii</i>	o	+	lc	o	Houpara. 1 large tree, several small ones (1988). Mainly young plants on S-slopes, to 5m tall
<i>Sagina apetala</i> *				l	Foreshore on rock in open, S side
<i>Salicornia quinqueflora</i>	o	+	o	o	Glasswort. Lower rocky cliffs, S & E coast
<i>Senecio lautus</i>	+		+	lc	Rocky outcrops throughout from near shoreline to summit
<i>Silene gallica</i> *	c	+	c	lc	Catchfly. Mainly on rocky outcrops throughout. AK 308744
<i>Solanum linnaeanum</i> *				l	Apple of Sodom. Single small fruiting plant (c.40cm) and a few adjacent seedlings, near the coast on N side; fruit removed (c.7)
<i>Solanum nigrum</i> *				l	Black nightshade. South side of main grassy ridge, partial shade
<i>Sonchus oleraceus</i> *	c		+	o	Pūhā. Scattered plants throughout
<i>Stellaria media</i> *				lc	On edge and through grassland throughout
<i>Tetragonia ?trigyna</i>				l	Seedlings only, on unstable slope, S side, c.12m asl
<i>Trifolium dubium</i> *	+			l	Rocky summit area
<i>Trifolium subterraneum</i> *				l	A few plants on steep S-facing slope. AK 385338
<i>Vicia sativa</i> *	o			c	Through grassland throughout
<i>Wahlenbergia vernicosa</i>	s [#]			lc	Coastal harebell. Widespread on S-facing rocky slopes, from summit to shore; also, upper N slopes; flowers pale blue. ([#] as <i>W. gracilis</i>) (Fig.19)

MONOCOTS (7 + 12)

<i>Arthropodium cirratum</i>	lc	+	lc	lc	Rengarenga. Steep S-facing and E-facing slopes, several patches, flowering 26 Oct 22 (Fig. 15)
<i>Astelia banksii</i>	l	+	+	lc	1 large patch (1988). Most plants, on S-facing and E-facing cliffs
<i>Avena barbata</i> *	+		+	lc	Slender oat. Widespread, especially on the sunny rocky ledges. AK 385340
<i>Briza minima</i> *				l	By summit area (where the gulls nest)
<i>Bromus catharticus</i> *	c	+	+	o	prairie grass. Open areas and scattered through kikuyu
<i>Bromus diandrus</i> *	a		+	lc	Ripgut brome. When flowering in Oct 2022 dominated the main kikuyu grassy ridge (Fig. 11)
<i>Cenchrus clandestinus</i> *	o	+	la	a	Kikuyu grass. Occasional patch (Taylor 1988). Dominating the sward on the main E-W ridge and flanks; lush growth in Sep 2022 (Fig. 9)
<i>Festuca bromoides</i> (<i>Vulpia bromoides</i>) *			lc	la	Small annual grass on ledges and rocky outcrops in the open
<i>Microtis unifolia</i>				lc	Onion orchid. Open mossy slope, damp steep upper S-slope, many in full flower, 27 Nov 2022. AK 385346. (Fig. 18)
<i>Parapholis incurva</i> *	s				Sickle grass. Surprisingly died out, because plenty of habitat still present

<i>Paspalum dilatatum</i> *			o	o	Mainly on margin of rocky outcrops and kikuyu sward on N slopes
<i>Pentapogon crinitus</i>			o		Near summit (2010) – outcompeted by exotic grasses?
<i>Phoenix canariensis</i> *				×2	Seedlings, leaves to 40cm long, S side, 3.5m apart. c.2m and 4m asl. Very long tap root; one uprooted. AK 385331
<i>Poa anceps</i>	l		lc		1 large patch (1988). Locally extinct – outcompeted by exotic grasses?
<i>Poa annua</i> *	+				Smothered by kikuyu?
<i>Rytidosperma pilosum</i> *	s		+	l	Danthonia. On ledges and margins of rocky outcrops in the open
<i>Rytidosperma unarede</i>			+		Danthonia. Outcompeted?
<i>Sporobolus africanus</i> *	o		l	lc	Ratstail. N-facing slope
<i>Thelymitra longifolia</i>				lc	Sun orchid. Open mossy area, damp steep upper S-slope; few just finished flowering 26 Nov 2022
MOSSES (4 + 0) under-recorded					
<i>Bryum dichotomum</i>				+	Tight clumps on rock, upper splash zone (N side, 2 m asl). AK 385115
<i>Hypnum cupressiforme</i>				lc	Mat-forming, upper S-facing slope (Fig. 18)
<i>Tortella flavovirens</i>				+	Tight clumps on rock, upper splash zone (N side, 2 m asl). AK 385116
<i>Triquetrella papillata</i>				lc	Mat-forming on steep damp S -facing slope, covering several m ² . AK 385117 (Fig. 17)
LICHENS (4 + 0) under-recorded					
<i>Cladonia</i> sp.				l	Patch in open on thin soil, just S of summit
<i>Heterodermia arbuscula</i>				lc	On coastal rocks
<i>Parmotrema reticulatum</i>				c	Over rocks near coast
<i>Ramalina celastri</i>				lc	Attached to bare rock near coast
FAUNA, Birds (14 + 5)					
fluttering shearwater				>20	Flying past, 9 Sep 2022
gannet				×1	Just offshore, 2 Sep 2022
pieb shag		+		×3	Outer reef 14 Aug 2022 ×1, 26 Oct 2022 × 3
little shag				×1	Outer reef, 2 Sep 2022 ×1 and 26 Nov 2022 ×1
spotted shag	+				Offshore (1988) – decreasing in the Gulf (Rayner 2021)
variable oystercatcher	++	+	×4	++	Nest 3 eggs + 1 other pair (1988); 2 pair on beach (6 Jan 2010); nest 1 egg, S-face ledge (26 Nov 2022); 2 pairs, 2 Sep 2022 and 18 Feb 2023
Canada goose *				++	Grazed grass (14 Aug 2022); goose droppings (9 Sep 2022); single nest with 4 eggs, ledge on S side (26 Oct 2022) (Fig. 24); deserted nest 26 Nov 2022 (thought to have fledged successfully)
spur-winged plover		+		×3	A pair 2 Sep 2022; 3 adults 18 Feb 2023
northern NZ dotterel	++	++		++	Nest with 3 eggs (Oct 1988 and Oct 2022) (Fig. 21)
black-backed gull	++			++	Nest, 1 egg + 2 empty nests (1988); a pair with chick on summit (9 Jan 22); 1 flying overhead (Aug 22), outer reef 26 Nov 2022 ×1
red-billed gull	+	+		++	Offshore (1988); several nesting next to white-fronted terns (9 Jan 22); two 2 Sep 2022; ×10 on beach (26 Oct 22)
Caspian tern	++		×2	×2	Nest, 2 chicks (1988); pair on beach (6 Jan 10 and 2 Sep 22)
white-fronted tern	+	++?		++	Eggs vouchered (25 Jan 1947); several offshore (1988); visits of Lee (1999) outside breeding time; none nesting (6 Jan 10); >300 nesting back of beach and steep grassland (9 Jan 22) (Fig. 22); some still present 26 Feb 2022, none nesting (Nov 22-Jan 23)
kingfisher		+		×1	14 Aug 2022
welcome swallow	+		+	++	Old nest in rocky shallow cave, NE corner (2 Sep 22); new nest, same place (26 Oct 22), many flying around
house sparrow *				×6	Six, 14 Aug 2022; and three 2 Sep 2022
goldfinch *	+				Irregular visitor?
yellowhammer *		+			Irregular visitor?
Indian myna *		+		×2	14 Aug 2022