

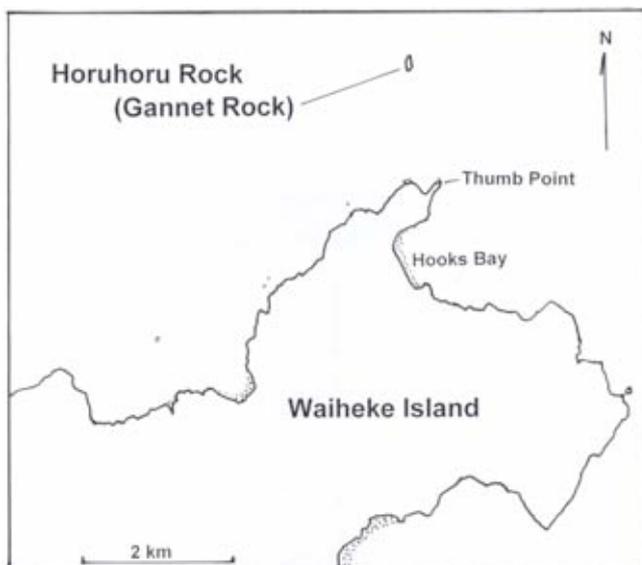
*Codium cranwelliae*  
*Codium fragile* subsp. *tomentosoides*  
*Derbesia novae-zelandiae*  
*Microdictyon mutabile* (syn. *Boodlea mutabile*)  
*Microdictyon umbilicatum*  
*Monostroma lindaueri*  
*Pedobesia clavaeformis*  
*Rhizoclonium africanum* (syn. *R. hookeri*)

*Rhizoclonium riparium*  
*Ulva intestinalis*  
*Ulva parva*  
*Ulva procera*  
*Ulva* sp. 1 (Heesch et al 2007)  
*Uronema womersleyi*  
*Wittrockiella salina*

## Vascular flora and birds of Horuhoru Rock (Gannet Rock), off northern Waiheke Island, Hauraki Gulf, Auckland

Ewen K. Cameron & Graeme A. Taylor

Horuhoru Rock (Gannet Rock) lies 1.5 km north of Thumb Point, the northeast corner of Waiheke Island in the Hauraki Gulf, Auckland: Lat. 36° 43' 28" South, Long. 175° 10' 15" East (map reference: NZMS S10 043953) (Figs. 1-3). It is a narrow, irregular, steep-sided rocky island with the long axis running N-S, 250 m long by 95 m across, covering 1.3 ha (Taylor 1989) and 22 m asl. The flattish summit ridge is cliffed right around except for the mid-western part, where a series of terraces offers easy access to the summit ridge. The island was invested by the Crown in Ngati Paoa in 1981 (Monin 1996).



**Fig. 1. Location of Horuhoru Rock (Gannet Rock), 1.5 km north of Thumb Point, the northeast corner of Waiheke Island, Hauraki Gulf, Auckland. (Drawn by Ewen Cameron)**

This article is based on a visit by Graeme Taylor and Alan Tennyson on 29 October 1988, 805-940 hrs; and Steve Benham, Ewen Cameron, Peter Hutton and Mike Wilcox on 27 September 2007, 1225-1400 hrs. Mike Wilcox separately recorded the seaweeds during this visit (Wilcox 2008). The island is a major rookery for Australasian gannets (*Morus serrator*). The 1988 survey included the upper island area occupied by the gannets; the 2007 survey was during a 3.2 m low springtide and excluded the upper nesting area.

### Introduction

Horuhoru Rock consists of folded red cherts of the Waipapa Terrane and is listed in the New Zealand Geopreservation Inventory as one of best examples of red chert in the Auckland region (Bruce Hayward pers. comm.). The rock was solid (not crumbly) and except for the steepest parts, moving around was mostly straightforward, and the rock could be circumnavigated on foot at low tide.

The main published biological work carried out on the island has been related to the nesting gannets which also includes sketches, photos and notes of the vegetation (Fleming 1947, Fleming & Wodzicki 1952, Stein 1971, Wodzicki et al. 1984). There has been a single study of the terrestrial vegetation (Gillham 1960), and a separate algal study (Dellow 1955). Based on electronic searches of the most likely New Zealand herbaria to hold relevant records, eight previous vascular plant collections from Horuhoru Rock were located in the Auckland Museum (AK) and Te Papa Museum (WELT). The Landcare Research herbarium (CHR) held at least 50 specimens collected by Mary Gillham, but none from Horuhoru Rock.

### Vegetation

#### Summit ridge vegetation

Previous images of the island compared with present day clearly illustrate the detrimental effect the expanding gannet population has had on the taupata (*Coprosma repens*) bush on the island's summit ridge. Earlier photographs and sketches that have been taken: c. 1934 photo (Fleming & Wodzicki 1952: fig. 21); 2 October 1946 sketch (Fleming 1947: fig.); mid April 1963 photo (by Mike Wilcox); and ≤1971 sketch & photo (Stein 1971: figs. 2 & 3).

The c. 1934 photo (Fig. 4) shows the taupata scrub on the summit ridge. On 2 October 1946 three areas of taupata scrub on the summit ridge separated four main groups of nesting gannets (Fleming 1947: fig.). This is further commented on and mapped in more detail by Stein (1971: fig. 2), who added that the southern stand of taupata contained many old gnarled trees up to 2 m high, that the northern taupata stand

was only shoulder high, and breast high on the northern boundary.

Based on a visit on 29 November 1957 Gillham (1960) reported the island as "...topped with *Coprosma repens* bush and belted below by *Disphyma australe* [ice-plant]. Gannets nested in both zones, and it was evident from the remains of dead trees scattered through the upper part of the colony that they had become established initially on the *Disphyma* zone and worked upwards as the trees died. The uppermost birds were very crowded, nesting close against the trees in places, and the branches of these were leafless and dead for more than 1 m from the periphery of the bushed zone. The extent of the inward migration of the gannets depended partly on the local topography and was regular, the various centers of population being separated by belts of *Coprosma*..."

In 1988 the summit vegetation consisted of several old open taupata with gannets amongst them and some dead taupata trees. In 2007 the summit ridge was totally occupied by nesting gannets and the higher plants were confined to the steep flanks of the island (Fig. 5). When viewed from the boat a few bare erect trunks to c. 1.5 m tall, and occasional logs on the ground were all that was visible of the past taupata bush of the summit ridge.

- = naturalised species

#### Ferns

*Asplenium haurakiense* – not seen 1988 & 2007. Previous collections: by W.R.B. Oliver "in scrub" (2 Jan 1916, WELT 5027 A-C); and W.R.B. Oliver (12 Jan 1929, WELT 7649).

#### Flowering plants (Dicots)

native celery (*Apium prostratum*) – not seen 1988 & 2007. Only record: an "inaccessible patch of what appeared to be" this species in Nov 1957 (Gillham 1960: p. 220). There is doubt about this record because it has never been confirmed, however, it is the right habitat for this species.

taupata (*Coprosma repens*) – locally common in 1988, and several old taupata present on summit, all open with gannets amongst them, some dead trees, others were virtually dead with scattering of leaves, on eastern slopes were dense patches of taupata. It was still locally common in 2007, being the main woody plant present, most plants prostrate on the steepest slopes, at a single locality on the eastern side it was mixed with boxthorn and both plants reached about 1.6 m tall (Fig. 6); fully flowering during the 2007 visit. Also there was a single plant amongst the ice-plant on the western side of the northern stack. A few dead

#### Flanks of the summit ridge

Most of the island's flanks in September 2007 were bare rock with gannet guano oozing down. The only woody vegetation was taupata and more locally boxthorn (*Lycium ferrossimum*), which on the mid-eastern side in a mixed patch (c.10 m across x 5 m) reached c.1.6 m tall – the island's tallest vegetation (Fig. 6). Otherwise boxthorn was scarce and taupata were mainly prostrate shrubs on the steeper faces (Fig. 7). The main vegetation was lush green mats of ice-plant on the steep faces, often associated with taupata and shore groundsel (*Senecio lautus*).

A tiny alga, *Prasiola stipitata*, formed a distinctive green turf ("paint") on the rocks, especially on the steep faces, associated with guano ooze (Fig. 8). The plants were only 1-2 mm tall and were first recorded as present on the island by Dellow (1955).

#### **Vascular flora**

Previous herbarium vascular plant collections were made on Horuhoru Rock in: 1916 (1 specimen), 1929 (1), 1947 (4), 1971 (1) and 1999 (1). Based on her visit to the island on 29 November 1957 British botanist, Mary Gillham, recorded nine species of vascular plants (Gillham 1960), but there are some inconsistencies between the text and her table II for several of the records. A total of 15 species of vascular plants are listed below, 11 were recorded during the 1988 survey and ten in 2007. Sixty-seven percent of the records are supported by herbarium voucher specimens which are cited in the relevant entry below.

standing trunks, presumed to be this species were evident where the bush was present in 1963 (Fig. 9); AK 300668. Previous records: dominant in Aug-Oct 1950 (Dellow 1955); taupata bush on top of the island, with gannets nesting along edges close to the trees, "the various centres of population [nesting gannets] being separated by belts of *Coprosma*" and the remains of scattered dead taupata trees in Nov 1957 (Gillham 1960: p. 220, but omitted from her table II); and taupata trees were clearly present on the top of the island at the southern end in mid April 1963 (Fig. 10).

ice-plant (*Disphyma australe*) – abundant in 1988. Abundant lush mats clothing the steep slopes in 2007 on both sides of the island and locally at the northern end; it covers the most area of any flowering plant on island; flowers pale yellow, white or pink; AK 300672. Previous records: frequent in Aug-Oct 1950 (Dellow 1955); "belt-forming" in Nov 1957 (Gillham 1960: p. 220).

*Einadia trigonos* – occasional to common in 1988; not seen 2007. Gillham (1960: table II) recorded *Rhagodia triandra* (= *Einadia triandra*) probably in error for *E. trigonos*.

Cook's scurvy grass (*Lepidium oleraceum*) – not seen 1988 & 2007. Only record: present in Nov 1957

(Gillham 1960: table II, but not mentioned in her text).

boxthorn (*Lycium ferrossimum*)\* – several patches, large shrubs in 1988. In 2007 a patch on eastern side, where it was mixed with taupata and up to c.1.6 m tall; also a single plant c.0.5 m tall on the western side; all plants were virtually leafless – a result of the 10-11 July 2007 storm? AK 300669. Previous record: single plant in Nov 1957 on the western side (Gillham 1960: p.220).

coastal mahoe (*Melicactus novae-zelandiae*) – occasional in 1988; single small patch on the east side of the southern point of the island in 2007. Previous record: collected by Betty Molesworth (Nov 1947, AK 23324).

dog's mercury (*Mercurialis annua*)\* – not seen 1988 & 2007. Only record: abundant in the SE corner, collected by George Wilson (Oct 1999, AK 281710).

New Zealand pellitory (*Parietaria debilis*) – common to abundant in 1988. In 2007 locally common, on the east side, especially in the soft guano piles at the foot of the steep slopes (Fig. 11). Previous records: as gannet nesting material in Oct 1946 (Fleming 1947); collected by Betty Molesworth (10 Nov 1947, AK 23326); locally abundant in Aug-Oct 1950 (Dellow 1955); and collected by Sylvia Reed (27 Sep 1971, AK 129088).

glasswort (*Sarcocornia quinqueflora*) – occasional in 1988. Occasional in 2007, both sides of the islands, lower slopes, often by high tide rock pools. Previous records: dominant in Aug-Oct 1950 (Dellow 1955); & present in Nov 1957 (Gillham 1960: table II, but not mentioned in her text).

shore groundsel (*Senecio lautus*) – common in 1988. Common in 2007, both sides of the island, usually associated with the ice-plant; many plants starting to flower. Previous records: collected by Betty Molesworth (Nov 1947, AK 35379); and present in Nov 1957 (1960: table II, but not mentioned in her text).

sow thistle (*Sonchus oleraceus*)\* – scarce to occasional in 1988. In 2007 occasional, both sides of the island, but more frequent on the eastern side. No previous records.

native sea spurrey (*Spergularia media*) – scarce in 1988. In 2007 local, east side, lower slope, flowers pink. Previous record: collected by Betty Molesworth (Nov 1947, AK 23329).

#### Flowering Plants (Monocots)

prairie grass (*Bromus willdenowii*)\* – locally common in 1988. In 2007 local, east side, most common amongst the taupata and boxthorn; AK 300671. Previous record: "considerable patches" fairly close to the gannets in Nov 1957 (Gillham 1960: p. 220, but omitted from her table II).

## **Fauna**

### Australasian gannets

Wodzicki et al. (1984) summarised the recorded gannet numbers for the island over time, stating that the rookery was established well before 1900 and that there has been a 2.65-fold increase of nesting gannets from 1928 (c.1000 pairs) to the 1980/81 season (2647 pairs). In 1988 nesting gannets were dense over all summit slopes but not onto lower steep slopes. In 2007 nesting gannets were crowding all the easy topography on the upper part of the island, also they were adding nesting material, frequently flying in with large pieces of brown algae. Stein (1971: appendix D) lists the contents of a single Horuhoru gannet nest, which totalled 542 items, 82% were algae and 11% were pieces of vascular plants – not all from the island, e.g. twigs of pohutukawa (*Metrosideros excelsa*) and a Norfolk pine (*Araucaria heterophylla*) bract.

### Other birds

In December 1946: a few starlings were believed to be nesting; and a colony of white-fronted terns on the southern ledges  $\geq 38$  nests (Cunningham 1947). In

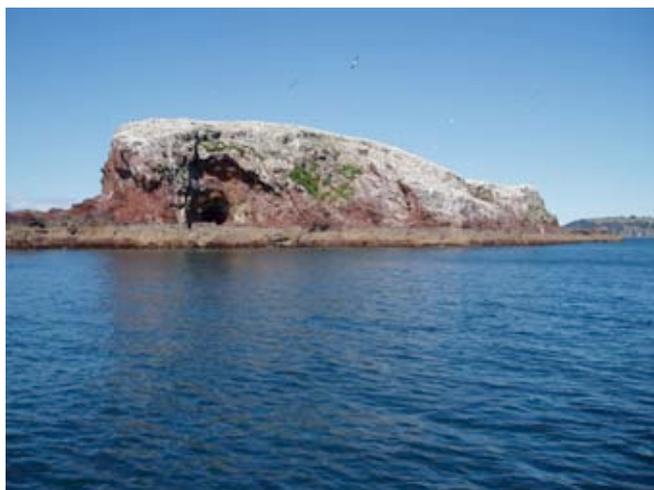
1988: 2 fluttering shearwaters in burrows on eggs; spotted shag; red-billed gull; white-fronted tern; house sparrow; and starling were recorded. In 2007: c.15 red-billed gulls on ledges at northern tip (nesting?); c.10 white-fronted terns on ledges at northern tip (nesting?); 2 spotted/pied (?) shags; 1 pair variable oystercatchers; 1 black-backed gull flying with gannets above the island; and many welcome swallows.

### Other fauna

Taylor (1989) reported the island as probably rat-free; George Wilson (pers. comm.) in October 1999 searched for rat sign on the SE corner of the island without success; in 2007 we saw no sign of rats. Stein (1971) recorded a colony of Pacific geckos (*Haplodactylus pacificus* s.lat.) under flat rocks on the west side (the Terraces); no lizards were recorded in 1988 (and they were especially searched for) or in 2007. Stein (1971) recorded many native shore earwigs (*Anisolabis littorea*); and GAT saw one in 1988. Flies (a species of small blowfly?) were abundant during the 2007 visit



**Fig. 2. Horuhoru Rock, from east side at low tide. (All photos by Ewen Cameron 27 Sep 2007 unless otherwise noted).**



**Fig. 3. Horuhoru Rock from the northwest, crowned with nesting gannets; the limited vegetation is reduced to the near vertical flanks.**



**Fig. 4. Horuhoru Rock c. 1934, from the southwest (Fleming & Wodzicki 1952: fig. 21).**



**Fig. 5. Horuhoru Rock, from east side at low tide.**

## Discussion

The island experiences a high seasonal guano coating and salt laden spray during storms. These two factors make it an extremely specialised habitat that only a few species of vascular plants can cope with. Gillham (1960) documents the species that grow around gannet and tern islands of northern New Zealand, including Horuhoru Rock, and Cameron (2006) further discusses guano islands and the relevant New Zealand literature.

Changes to the flora and vegetation appear to be directly due to the increasing number of gannets nesting on the island. Their destructiveness to the vegetation is recorded by Gillham (1960) and further illustrated here. Vegetation changes since 1916 include: taupata bush being removed from the easy upper slopes; four plant species appearing to have become locally extinct (*Asplenium haurakiense*, native celery, Cook's scurvy grass and dog's mercury); and three plant species appearing to have decreased in abundance (*Einadia trigonos*, coastal mahoe and glasswort). The apparent disappearance of two of

these species (dog's mercury, *Einadia trigonos*) between the two recent surveys (1988 & 2007) may be related to the 10-11 July 2007 storm or "weather bomb" where a wind gust of 180 km/hr was recorded on Tiritiri Matangi Island (*NZ Herald* 13 July 2007: p. A5 ). The storm loaded with saltwater would have burnt or torn off all delicate leaf tissue, which would also explain why the boxthorn was basically leafless during the September 2007 visit. It is relevant to note that on the 15 September 2007 many adult mahoe (*Melicactus ramiflorus*) on Tiritiri Matangi Island (upper Wattle Valley) were still leafless from that July 2007 storm (EKC pers. obs.).

Another terrestrial plant survey is warranted when gannets are not nest-building (as they pluck all accessible vegetation during this period), when they are not nesting (to allow easy access to the summit area, and better access to some of the steep flanks – a rope from above?), and not too soon after a severe storm (when the terrestrial vegetation would still be recovering). Of the three species of naturalised plant species present, only boxthorn warrants eradication.



**Fig. 6.** The tallest vegetation c.1.6 m tall, mixed taupata and boxthorn, mid-eastern side of Horuhoru Rock. The lack of leaves on the boxthorn is possibly due to the 10-11 July 2007 storm.



**Fig. 7.** One of the two main patches of vegetation on the west side (also visible in Fig. 3): taupata (prostrate bushes), ice-plant mats, and clumps of shore groundsel (flowering), NW side of island looking north.



**Fig. 8.** A tiny green alga, *Prasiola stipitata*, formed a distinctive green turf ("paint") on the rocks, associated with guano ooze. West side of Horuhoru Rock.



**Fig. 11.** Seedlings of the native annuals, NZ pellitory and shore groundsel, abound in the soft guano piles at the foot of the steep slopes on east side of Horuhoru Rock. A single sow thistle seedling is also present along with a leafy stem of taupata.



**Fig. 9.** Horuhoru Rock, 27 Sep 2007 from the southwest. Note the absence of taupata on the summit.



**Fig. 10.** Horuhoru Rock, mid Apr 1963, from the southwest. Note the taupata patch on the summit. Photo: Mike Wilcox.

## Acknowledgements

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## Some seaweeds of Gannet Rock (Horuhoru), Hauraki Gulf

Mike Wilcox

I spent a very rewarding two hours on Gannet Rock (Horuhoru) on 27 September 2007. It was a good low spring tide, giving a great opportunity to check out the full range of intertidal algae. The sea is clear here, and shore comparatively exposed. The rock is mostly a hard, reddish chert. A separate survey of the vascular plants was carried out during the same visit (see Cameron & Taylor 2008).

### Brown algae

The sub-littoral fringe is dominated by two large brown algae – a thick belt of *Carpophyllum maschalocarpum*, above which grows a covering of *Xiphophora chondrophylla*. *Ecklonia radiata* forms the hidden subtidal kelp forest. Other brown algae recorded were *Glossophora kunthii*, abundant in pools, and *Hormosira banksii*.

### Red algae

Red algae were prominent at all levels of the intertidal zone. *Centroceras clavulatum* occurred in several high-tidal pools, *Gelidium caulacanthum* was found in the mid-to low tidal zone, and lower down the shore was *Caulacanthus ustulatus* growing very abundantly in bushy mounds interspersed with dense beds of green mussels. *Pterocladia capillacea* was abundant in pools, sometimes with *Ceramium flaccidum*, while *Aeodes nitidissima* was sparse in a few drainage runnels from low-tidal pools. *Catenellopsis oligarthra* grew as little bubbles and *Nothogenia pulvinata* as

small cushions on open rock surfaces, while *Lophurella caespitosa*, *Rhizopogonia asperata* and *Champia laingii* were common on ledges towards the low tide mark. A band of *Pterocladia lucida* occurred below *Carpophyllum maschalocarpum*. *Antithamnion pectinatum* and *Griffithsia traversii* were commonly epiphytic on *Pterocladia lucida*, while *Abroteia suborbiculare* was found on *Carpophyllum maschalocarpum*. The most intriguing red alga seen, however, was an unidentified species belonging to the order Nemaliales. It was of a greenish colour and gooey texture, and grew in prominent patches toward low water on steep rock faces. Several other red algae were recorded by Dellow (1955) including *Phacelocarpus billardierei*, *Lomentaria umbellata* and *Lenormandia coronata*, while *Pachymenia crassa* has been more recently found in deep water at the southern tip of the island.

### Green algae

There were few green algae. Many high tide rock pools (subject to dilution by rain water) harboured dense beds of *Ulva intestinalis*. Rock surrounding the gannet nests had a green covering of the minute alga *Prasiola stipitata*. Other green algae recorded by Dellow (1955) were *Cladophora crinalis* abundantly in rock pools, *Derbesia novae-zelandiae*, *Cladophora herpestica*, *Codium convolutum* and *Bryopsis plumosa*.

## Acknowledgements

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