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FLORA AND FAUNA OF SENTINEL ROCK, MANGAWHAI HEADS, NORTHERN NEW ZEALAND

E.K. Cameron¹ and G.A. Taylor²

¹Auckland Museum, Private Bag 92018, Auckland, ²50 Kinghorne Street, Strathmore, Wellington

SUMMARY

The vegetation of Sentinel Rock is recovering from a fire in 1954. A vascular flora of 50 species (64% native) is recorded. The conservation values of the islet are discussed and management recommendations are presented. A significant feature of the islet is an isolated population of grey-faced petrels (*Pterodroma macroptera*). Norway rats (*Rattus norvegicus*) are present.

Keywords: tidal islet; vascular flora; grey-faced petrels; Norway rats; conservation; management recommendations.

INTRODUCTION

Mangawhai Heads is a popular swimming and surfing beach c. 80km north of Auckland. The Heads is also a popular holiday and retirement village and it is one of the favoured launching sites for fishing and diving trips to the Hen and Chickens Islands which lie only 15.5km offshore (Owen 1984: 145).

Sentinel Rock (36°05'S, 174°36'E; map reference 260 R08 550675) lies 350m off Mangawhai Heads in the Hauraki Gulf (Fig. 1). The islet is Maori Customary Land and has an area of only 0.2ha (Taylor 1989). Sentinel Rock is some 40m long (NNW-SSE) by 25m across and a summit ridge runs the length of the island. There is a small navigation light on the highest point at the southern end, 21m asl. The middle of the ridge dips down to a narrow saddle which is being eroded underneath on the east side where a small cave exists. A narrow tidal cave runs underneath the north-west corner (not right through yet) and vertical cracking is common throughout the islet. There is a small shell beach in the south-west corner. A rocky intertidal platform exists around the islet c. 30m wide and this reef extends for c. 80m towards the mainland and is cut across by a small channel. Near the south-eastern side of this channel a rock outcrop, "The Knob", protrudes from the reef for c. 10m asl.

The islet, reef and The Knob, and the adjacent mainland is composed of pale Pukekaroro Dacites, volcanic rocks aged about 19 million years old (B.W. Hayward pers. comm., 1992).

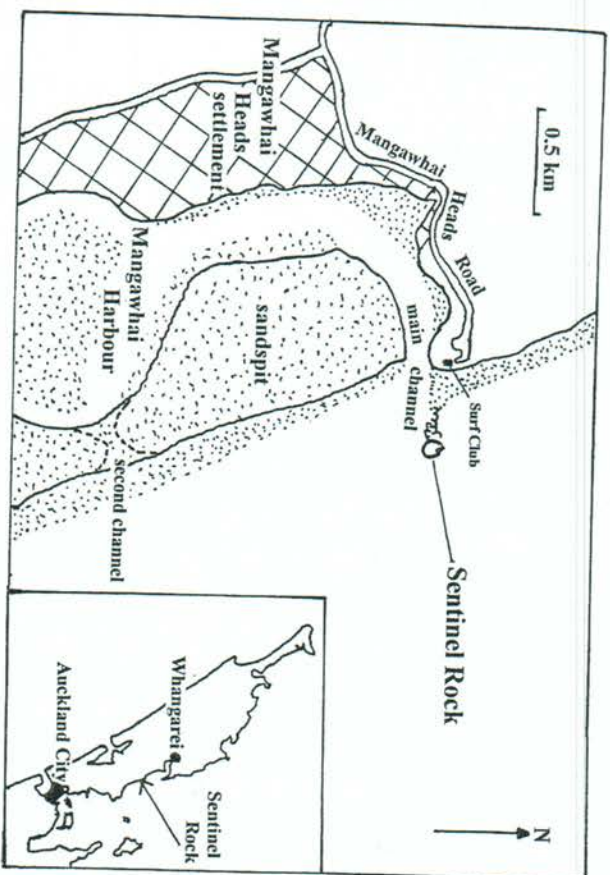


Fig. 1. Place names and location of Sentinel Rock, northern New Zealand.

Sentinel Rock is accessible on foot only around low tide, and in the early 1990s sand buildup allowed access for 1.5 hours either side of low water. These sand deposits are influenced by the adjacent Mangawhai Harbour (Fig. 1). In the 1860's, using Government money to assist unemployment, a groyne of dacite boulders was built (Fig. 2) to connect the islet reef to the mainland (Mabbett 1977). It was hoped that this breakwater (c. 150m long x 8m wide x 2m tall) would concentrate the flow of the outgoing tide to the channel on the south side of Sentinel Rock. The breakwater was never finished to the appropriate height and "... the sea resumed its old course on either side of Big (Sentinel) Rock..." (op. cit.). Today it does flow to the south side of Sentinel Rock.

This article is based on four short visits to the islet on 1 April 1988 (GAT, day time), 5 March 1991 (EKC, day time), 8 July 1992 (EKC, day time) and 19 July 1992 (EKC & GAT, 1645-1840 hrs), comments from G.R. Parrish who visited the islet for 30 minutes on 3 September 1993 (Parrish 1993) and again on 17 December 1996, and comments from D.B. Rogan who visited the islet on 9 November 1996. There appears to be no previous published account about the islet's biota.

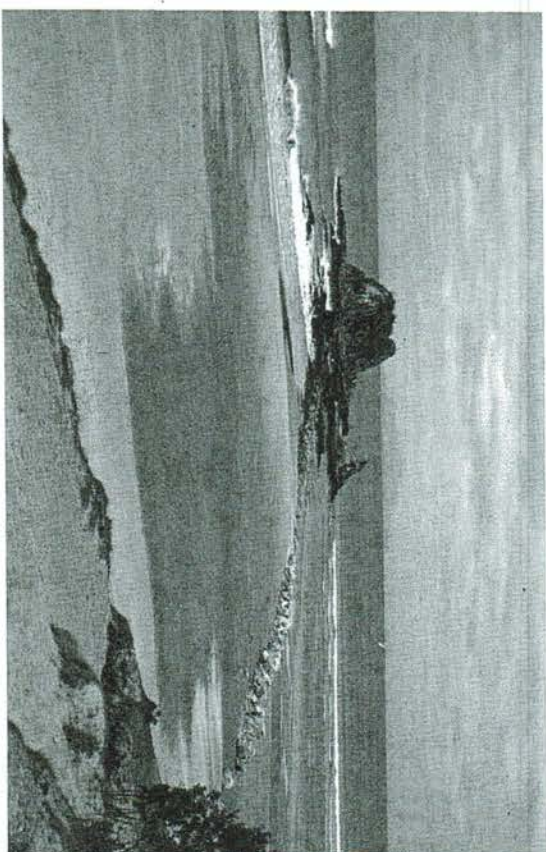


Fig. 2. Sentinel Rock at low tide with adjacent reef and "The Knob" outcrop, and breakwater built in the 1860's. March 1991.

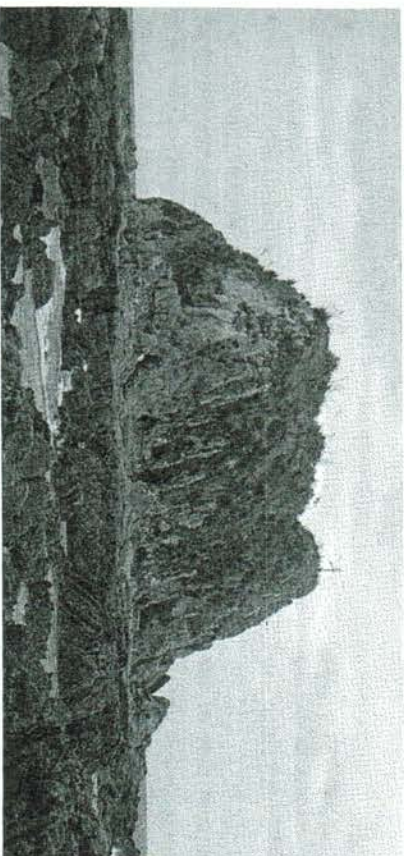


Fig. 3. Sentinel Rock at low tide from western side. Note - eroding north-west cliffs and numerous small caves at base of islet. Main vegetation is needle tussock and New Zealand flax.

VEGETATION

Sentinel Rock is an exposed inshore stack with low vegetation and bare rock on some of the steep sides (Fig. 3).

East side of the islet - the main vegetation is on this side of the summit ridge, apart from the central eroding area which is bare. The dominant species are flax (*Phormium tenax*), coastal toetoe (*Cortaderia splendens*), knobby sedge (*Isotria medeoloides*), pohuehue (*Muehlenbeckia complexa*), with scattered exotic grass species and giant umbrella sedge (*Cyperus usitatus*). Needle tussock (*Stipa stipoides*) is very common on the most exposed faces and also scattered along the lower margin of the main vegetation. The slope below this zone is mainly bare except for patches of New Zealand ice plant (*Disphyma australe*) and glasswort (*Sarcocornia quinqueflora*).

West side - much of it is nearly vertical and is steeper than the east face except near the top (Fig. 3). Needle tussock is abundant all over this face; clumps of flax are present on the higher slopes; NZ ice plant and glasswort are common on the steep faces and *Samolus repens* occurs by the shoreline.

South side - is narrower than the east or west sides and is cliffed with 30% bare rock supporting abundant crustose lichens and tufts of the foliose lichen *Ramalina celastri*. Needle tussock is the most abundant higher plant; NZ ice plant, glasswort and *Asplenium haurakiense* are common.

North side - is similar to the south side except there is more bare rock and the north-western corner is actively eroding (see Fig. 2).

Summit ridge - is 1.5-6m wide by c. 35m long and is cliffed all around except for the north and south portions of the east face (the only climbable parts). The southern part of the summit ridge has exposed rocks with low vegetation of knobby sedge, pohuehue and adventive grasses. The northern part of the ridge has a dense cover of flax, knobby sedge, pohuehue and exotic grasses. *Ascladia banksii* and *mingimingi* (*Leucopogon fasciculatus*) are local. The *mingimingi* forms a windswept "hedge" a metre high by 8m long by up to 3m wide. Petrel burrows are common here and *Etinidia trigonos*, chickweed (*Stellaria media*) and a patch of onion weed (*Allium triquetrum*) grow by the rather bare burrow entrances. Pohutukawa (*Metrosideros excelsa*) was represented by one living seedling and pieces of roots and stems (up to 10cm diameter) lying on the ground

sua) 3m tall pohutukawa stems were present on the upper mid-western steep face.

The Knob - this narrow exposed outcrop near the channel supports only mats of NZ ice plant and a few shore groundsel (*Senecio lanius*) plants.

FLORA

The vascular flora of Sentinel Rock numbers 50 species, of which 32 (64%) are native (see below). In addition four moss species were collected, crustose lichens were common on the bare rock but were not collected, and one foliose lichen (*Ramalina*) was gathered.

The annotated species list which follows includes all vascular plants seen and a few of the more obvious mosses. Where a voucher specimen exists to support the record the herbarium sheet is listed.

Key

- a = abundant
- c = common
- o = occasional
- l = local
- E = eradicated
- AK = Auckland Museum herbarium
- voucher number
- * = adventive species

s = scarce (< 5 individuals seen) † = recorded by D.B. Rogan 9 November 1996, not seen previously

(x1) = single individual seen

Ferns (2 + 0) (native + adventive totals)
Asplenium haurakiense c - on upper west- and east-facing cliffs, AK 206878, 207272

Pyrrhosia elegnifolia s - single small clump, top of south cliffs

Dicotyledons (20 + 9)
Anagallis arvensis s.str. * o

Centaurium erythraea * c - AK 229838
Chrysanthemoides monilifera * (x1) E - single plant 27cm tall, upper east side, AK 208628

Cirsium vulgare * s

Conyza albida * o
Coprosma macrocarpa† (x1) - single seedling c. 1m tall, northern ridge top

C. repens o

<i>Dichondra repens</i>	0
<i>Disphyma australe</i>	c - low down on cliffs and on The Knob
<i>Einadia trigonos</i>	0
<i>Gnaphalium aundax</i>	o - cliff ledges
<i>Leucopogon fasciculatus</i>	s - summit, north end c. 1m tall, wider than tall, interlacing and windswept
<i>Labellia anceps</i>	0
<i>Metrosideros excelsa</i>	(x1) - seedling (20cm tall) in rock crevice on south side; otherwise dead trunks and roots
<i>Muehlenbeckia complexa</i>	o - mainly along summit ridge
<i>Ornithopus pinnatus</i> * [†]	lc - mainly along summit ridge, AK 229839
<i>Oxalis rubens</i>	0
<i>Pittosporum crassifolium</i> [†]	(x1) - single seedling c. 30cm tall through <i>Muehlenbeckia</i> , northern ridgetop
<i>Pseudognaphalium luteoalbum</i> agg.	lc
<i>Sagina procumbens</i> *	0
<i>Samolus repens</i>	lc - lower cliffs, particularly west side
<i>Sarcocornia quinqueflora</i>	lc - on cliffs, particularly west side
<i>Senecio laetus</i>	o - and on The Knob
<i>Solanum americanum</i>	0
<i>Sonchus oleraceus</i> *	0
<i>Spergularia media</i>	Parrish (1993)
<i>Stellaria media</i> *	lc - summit by burrows
<i>Wahlenbergia "vernicaosa"</i>	o - pale blue flowers (see Petterson 1993), AK 229840
Monocotyledons (10 + 9)	
<i>Aira caryophylla</i> s.str. *	0
<i>Allium triquetrum</i> *	1 - summit by burrows, 2m x 1m patch
<i>Astelia banksii</i>	1
<i>Briza minor</i> *	0
<i>Bromus willdenowii</i> *	0
<i>Cortaderia splendens</i> s.lat.	o - scattered through main upper vegetation
<i>Cyperus usitatus</i>	o - scattered through main vegetation
<i>Dactylis glomerata</i> *	0
<i>Holcus lanatus</i> *	0
<i>Isolepis nodosa</i>	c - scattered through main upper vegetation
<i>Lachnarrhiza hilliardieri</i>	0

<i>Lagurus ovatus</i> *	c
<i>Paspalum dilatatum</i> *	0
<i>Phormium tenax</i>	o - scattered through main upper vegeta
<i>Rytidosperma unarede</i>	0
<i>Sporobolus africanus</i> *	lc
<i>Stipa stipoides</i>	a - on steep exposed sites from cliff down to the storm platform on the v side (Fig. 3)
<i>Zoysia pauciflora</i>	1 - single small mat by navigation ligh
Mosses (4 + 0) (under recorded)	
<i>Bryum hillardieri</i>	AK 207301, 208867
<i>Ceratodon purpureus</i>	AK 207300
<i>Thuidium furfursum</i>	AK 207301
Indet. (Brachytheciaceae)	AK 207302

FAUNA

Birds

House sparrows (*Passer domesticus*) (many), red-billed gulls (*La scopulinus*), black-backed gulls (*Larus dominicanus*), pied shags (*Phalacrocorax varius*), little shags (*P. melanoleucos*) and starlings (*Sturnus vulgaris*) were noted using the island. The Knob is a perching site for shags, white-fronted terns (*Sterna striata*) and gulls. On 5 March 1991 many large overc burrows were noted on the northern summit of the island. On 19 July 1992 m than 50 burrows in good deep soil were located and most were occupied breeding grey-faced petrels (*Pterodroma macroptera*). Ten petrels were band On 3 September 1993, G.R. Parrish (1993) recorded breeding red-billed gulls the islet and breeding white-fronted terns on The Knob. On 9 November 19 D.B. Rogan (pers. comm.) recorded white-fronted terns resting on the islet, r billed gulls nesting (three nests) near summit ridge at north end, and a bro starting egg by the entrance of a petrel burrow. On 17 December 1996 G Parrish (pers. comm.) recorded four pairs of red-billed gulls with chicks hatching; house sparrows, starlings and welcome swallow (*Hirundo tahitica*) breeding on the islet.

Rats

Although rats were not seen on the island, a few old rat droppings were for in July 1992. On 9 November 1996 D.B. Rogan collected further rat droppi

Norway rat (*Rattus norvegicus*) pellet size using the formula in King (1990).

DISCUSSION

Native flora and vegetation

Sentinel Rock was crowned with pohutukawa until 1954 when the island was burnt (B.A. Foster pers. comm., 1991). This explains the current presence of pohutukawa wood on the islet.

De Lange *et al.* (1995) compared the vascular floras of 15 relatively undisturbed, exposed northern New Zealand islets. From their table coastal mahoe (*Melicope novae-zelandiae*) is the most likely plant to occur on Sentinel Rock which is absent. It occurred on 12 of their 15 islets. Sentinel Rock is probably too close to the mainland to have ever had coastal mahoe which is more an offshore island species. The closest known site is Sail Rock, 12 km away where it is abundant (Atkinson 1972). *Poa anceps* was also expected as it occurred on 10-12 of the 15 islets (de Lange *et al.* 1995). The absence of *Poa anceps* could be related to habitat destruction as it usually grows in rather sheltered sites which are virtually absent now on Sentinel Rock.

Only occasional shrubs of taipata (*Coprosma repens*) were present on the island and these were rather sparsely foliated. Taipata was scarce on the adjacent headland. There is circumstantial evidence that rats browse taipata (Cameron & Taylor 1991, Cameron 1991) as it is frequently more common on rat-free islets/islands than adjacent coasts. The similar low density of taipata on both Sentinel Rock and the adjacent mainland may be because rats inhabit both areas. The absence of karo (*Pitiosporum crassifolium*) on the island in 1991-92 may also be due to rats.

Naturalised flora

Although 17 naturalised species of vascular plants are present, only two species pose any threat to the island's vegetation:

The woody South African shrub bone-seed (*Chrysanthemoides monilifera*) has the potential to completely dominate the island's vegetation. Fortunately only one young plant was found which was uprooted. Bone-seed is a remarkable daisy in that it has drupes instead of dry seeds which can be dispersed to the islet by birds ingesting the fleshy fruit. Bone-seed would have to be eliminated from the adjacent mainland where it is common, otherwise it will re-establish on the islet. This species is actively increasing its range in northern New Zealand and it is already having a major impact on the cliffs of many islands of the inner Hauraki Gulf (pers. obs.).

or accidental seed dispersal by humans. It is also present on Watchman Islet in the Waitemata Harbour (Cameron 1988), three islets in the Bay of Islands; Flat Island off Mahinepua Peninsula (G.R. Parrish pers. comm., 1996). If it not removed, the patch of onion weed on the top of Sentinel Rock will continue to spread where there is sufficient soil.

Fauna

Finding grey-faced petrels on such a tiny islet connected to the mainland; yet isolated from other colonies was quite unexpected and a significant discovery. Very few grey-faced petrel colonies now persist on inshore islands and mainland due to predation and human disturbance. The nearest known grey-faced petrel colony to Sentinel Rock is Sail Rock, 12 km away; a skull was recorded there in 1971 and the species was previously reported on the island P. Stein (Atkinson 1972: 556). The nearest inshore colonies are on Goat Island 27 km to the south (EKC pers. obs., 1996), and Mautiaha Island of the Bre Islands, 27.5 km to the north (G.R. Parrish pers. comm., 1996). Because burrows on Sentinel Rock were overgrown in March 1991 there doesn't appear to be any summer nesting petrels using the islet.

Lizards were not specifically searched for and none were observed. Evidence of possums (*Trichosurus vulpecula*) was seen.

Conservation values and management recommendations

The adjacent mainland coast is a popular area especially in the summer. Because access is limited by the tide few people visit the islet except fishermen and curious day-trippers. Most of these people stay on the shore platform. Fortunately access to the top of the islet is rather steep and this restricts people visiting the upper, sensitive, burrowed area. The artificial groyne has aided access of pests to the islet.

In 1978 a storm cut a new channel in the barrier sand spit of Mangaw Harbour (see Fig. 1), resulting in a dual inlet system (Flood *et al.* 1995). Cyclone Bola in 1988 increased the break in the spit causing both harbour openings to be shallow. The northern opening became so silted that its residents on 11 February 1991 defied officialdom and organised machinery to reopen the northern opening and unsuccessfully attempted to close part of the southern entrance. Although they were temporarily successful using a suction barge keeping the northern entrance open for boating, easterly storms reclosed the entrance. On 29-30 June 1996 a 1.5 km x 100 m sand wall was completed with legal approval finally closing the "rogue" southern entrance to Mangawhai Harbour (NZ Herald 1 July 1996: 20). The reopening of

This causes the harbour channel to be close to the artificial groyne removing the buildup of sand and resulting in the islet being more difficult of access for people and introduced mammals. The deep channel may better protect fairy terns (*Sterna nereis*), NZ dotterels (*Charadrius obscurus*), variable oystercatchers (*Haematopus unicolor*), Caspian terns (*Sterna caspia*), white-fronted terns, banded dotterel (*Charadrius bicinctus*), red-billed gulls and black-backed gulls which nest on the sand spit on the south side of the harbour entrance (G.R. Parrish pers. comm., 1996). This sand spit is part of the 245ha Mangawhai Wildlife Refuge, rated as outstanding wildlife habitat (Department of Conservation 1995: 120) and is also utilised by godwit (*Limosa lapponica*), knot (*Calidris caninus*), turnstone (*Arenaria interpres*) and South Island pied oystercatchers (*Haematopus ostralegus*).

Continuing survival of the grey-faced petrels on Sentinel Rock is probably only possible due to the absence of large predators. Species such as cats (*Felis catus*) and mustelids (*Mustela* spp.) would be unable to stay there long as the islet is too small to sustain them.

Sentinel Rock is the only inshore islet on this coastline between Whangarei Harbour and Goat Island. Although very small and highly modified the islet has biological significance, in particular due to the small colony of grey-faced petrels. No threatened plant species are present but the vegetation is slowly recovering naturally, shown by the recent establishment of pohutukawa, karo and coastal karamu (*Coprosma macrocarpa*). Pohutukawa is common on the adjacent headland and it should further establish on Sentinel Rock. On such an exposed islet growth rates will be slow but the islet will naturally recover with little management required.

Norway rats probably impact on the breeding success of the seabirds (Imber 1978) and will be detrimental to both the fauna and flora of the islet and should be eradicated. Because rats would likely recolonise the islet after eradication, seasonal poisoning would be the most effective control. Baits should be laid in June and August to protect the petrels. Further surveys are warranted to confirm the lizard status for the islet. Rat eradication, onion weed removal and general weed monitoring is the only flora management that is currently required. Because it is only an island at mid to high water adjacent mainland weed removal and predator control would greatly increase the possibility of Sentinel Rock retaining its conservation values in the longer term. It would be an ideal local community project, with some professional advice.

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