The Flora of Gannet Island (Karewa), Tasman Sea, Western North Island

P.J. de Lange[1]

SUMMARY

Gannet Island is an eroded basaltic tuff remnant situated within the Tasman Sea, 19 km west of Kawhia Harbour. The physical environment of the island is harsh. Nevertheless a limited terrestrial flora of four cryptogamic plants occurs there. A brief account of this flora follows. The absence of any vascular plants and the restricted cryptogamic flora is attributed to the extreme isolation and exposure of the island within the Tasman Sea and the limited range of habitats available for terrestrial plant colonisation.

INTRODUCTION

Gannet Island (Fig. 1) is an extremely isolated rocky islet (300 m long, 200 m wide), situated 19 km west of Kawhia Harbour (NZMS 260 Q15 478578), on the west coast of the North Island. The island is administered as a Wildlife Management Reserve by the Department of Conservation, with permit-only access (Wassilieff and Timmins 1984).

The physiography of the island is simple, comprising a single low-lying rock, rising gently from the south to a maximum elevation of 14 m a.s.l.[2], where the northern margin is abruptly terminated by a precipitous cliff (Fig. 2). Geologically the island is an eroded remnant tuff ring, of late Pleistocene age, consisting of well indurated, palagonitic tuff and lapilli tuff, with occasional scoriaceous basaltic bombs and blocks (Briggs *et al*. 1992).

The physical environment of the island is harsh. There is no permanent freshwater and the island has such low relief that even in a moderate swell it is often entirely washed over. Despite this, Gannet Island is a significant breeding ground for gannet (*Morus serrator*) (Fleming and Wodzicki 1952, Wodzicki *et. al*. 1984), and is also used as a haul out site by the New Zealand fur seal (*Arctocephalus forsteri*) (Crawley and Wilson 1976).

An interesting historical account of visits to the island is given by Fleming and Wodzicki (1952). They also discuss the island's significance to the tangata whenua, note a short-lived attempt at guano mining toward the end of the 1800s,

[1] Science and Research Regional Station, Department of Conservation, Private Bag 68908, Newton, Auckland.

[2] The altitude given for Gannet Island by NZMS 269 Q15 is 13 m.a.s.l. As part of the geological survey carried out on this visit stratigraphic logs were prepared which fix the island's height at 14 m a.s.l.

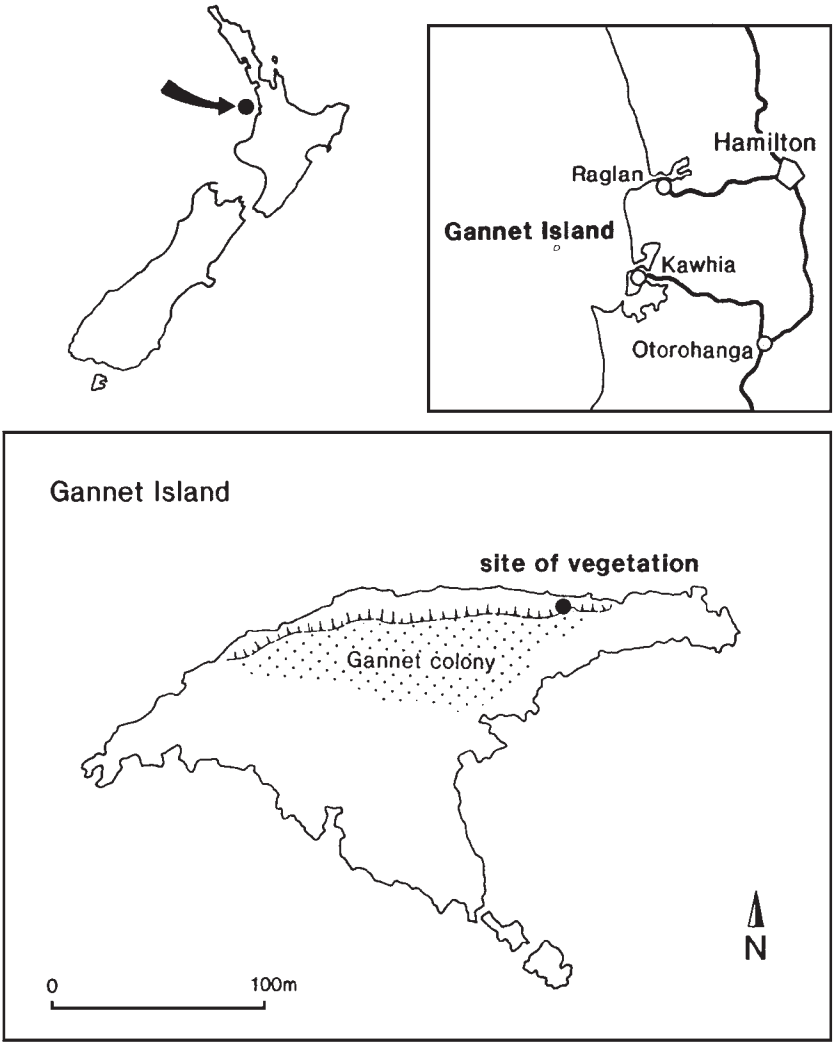

Fig. 1. Location of Gannet (Karewa) Island off the west coast of the North Island. Top: Location and Bottom: Detail of Island.

and provide a brief summary of scientific expeditions to the island. These have been remarkably few and were invariably carried out by ornithologists.

On 28 March 1992 I visited the island with four other people to conduct a botanical and geological survey. A total of five hours was spent ashore, during which time the geology of the island was described (see Briggs *et al*. 1992) and a thorough search was made for vascular and cryptogamic plants. Prior to our visit we were unaware of any published accounts of the island's geology or

Fig. 2. Profile of Gannet (Karewa) Island looking west. In this photograph the guano deposits of the Gannet Colony can be seen along the northern margin of the island.

flora. This paper describes the flora of Gannet Island and discusses it in relation to other isolated islands off northern New Zealand. A more thorough account of the island's geology than that provisionally given by Briggs *et al*. 1992 will be published elsewhere.

FLORA

No vascular plant species were found on Gannet Island. The terrestrial flora comprises two lichens, a moss, and a semi-marine green alga (Table 1), all confined to a small area ($3m^2$) on the summit cliffs at 13.5 m a.s.l (Fig. 3). The substrate colonised by these species is a coarse, heavily weathered tuff richly manured with guano derived from adjacent gannet nests.

Of the four taxa recorded the most common, the green alga *Prasiola stipitata*, is the only one which requires periodic inundation by saltwater or spray (W.A. Nelson *pers. comm.*). There are four species of *Prasiola* recorded from New Zealand, of which *P. stipitata* is the most widespread (Womersley 1984). *Prasiola* species have a preference for nitrogen-rich substrates such as guano (Womersley 1984) and frequently form a conspicuous "green band" beneath bird nests.

The next most abundant species was the lichen *Xanthoria ligulata*. This coastal species often forms a conspicuous yellow band well above the algal and marine lichen zone but still within the spray zone of most northern rocky shores of New Zealand (Hayward and Hayward 1974, Galloway 1985, Wardle 1991). This zonation pattern was hardly developed on Gannet Island, with the majority

Fig. 3. The extent of the flora discussed in the text.

of *Xanthoria* specimens occurring intermixed with *Prasiola*. This occurrence, along with the smaller than usual greenish mottled thalli and a general absence of apothecia in Gannet Island specimens of *X. ligulata*, suggests the habitat available for the lichen is far from optimal.

The remaining two species, the moss *Tortula princeps* and the lichen *Xanthoparmelia scabrosa*, are common pioneer species of open sites (Alison and Child 1971, Galloway 1980). On Gannet Island both taxa have a precarious existence, sparingly colonising the margins of thick guano deposits within the cracks of the summit cliff face supporting the previously mentioned taxa. Of the two, *Xanthoparmelia* was the more common and, in contrast to the island's only other terrestrial lichen *Xanthoria ligulata*, was often fertile. *Xanthoparmelia scabrosa* has a preference for rocks and is widespread throughout New Zealand where it is often found in coastal situations (Galloway 1980, 1985) so its presence on Gannet island is not wholly unexpected. Nevertheless the harshness of the island environment was reflected by the smaller overall thalli size and the absence of any rosettes, which is the usual morphology adopted by this species on rock substrates (Galloway 1980). The most restricted species of the Gannet Island flora was the moss *Tortula princeps*. This species was considered by Allison and Child (1971) as one of the few mosses commonly encountered on coastal rocks throughout New Zealand. On the Island *T. princeps* was confined to several tufts within a small (20 × 30 mm) crevice.

DISCUSSION

The absence of a vascular flora and the small size and restricted distribution of the cryptogamic flora on Gannet Island is hardly surprising. Taylor (1991) noted that of those islands under 10 ha in size, Gannet Island is the most isolated in northern New Zealand. Isolation alone, however, is not the only factor preventing successful plant colonisation as evidenced by the more extensive floras of similar small islets off the eastern North Island (Cameron and Wright 1990; Taylor *et al*. 1990, Taylor 1991).

As Gannet Island is located within the Tasman Sea, well beyond the sheltering land mass of New Zealand, it is fully exposed to the prevailing winds and sea swells. More importantly, the southern shoreline rises gently to the summit cliffs (Fig. 2). Therefore, even moderately sized southerly swells frequently wash over the island and it may be fully submerged for brief periods during severe storms (T. Stephens *pers. comm*. 1992). These conditions not only act against the successful establishment of a vascular flora but also make it a precarious nesting ground for gannets. Indeed, a 1930 newspaper account cited by Fleming and Wodzicki (1952) records the effects of a storm which sent waves rolling across the island drowning thousands of gannet fledglings in the process. Such storms occur sufficently often to permit the establishment of the barnacles *Chamaesipho brunnea* and *Elminius plicatus* – species typical of exposed shores washed by surf (Heath and Dell 1975) – within the main gannet nesting area.

Aside from the extreme exposure of the island, there is the obvious lack of suitable terrestrial habitats for plants to colonise. As previously noted the low relief of the island means few sites are sheltered from the sea and, of those that are, only the dry summit cliffs provide conditions suitable for plant colonisation.

Table 1. Terrestrial flora of Gannet Island (herbarium abbreviations follow Holmgren et al. 1990).

Species	Voucher
Lichens	
PARMELIACEAE	
Xanthoria ligulata	AK 199508
Xanthoparmelia scabrosa	AK 210992
Alga	
PRASIOLACEAE	
Prasiola stipitata	WELT A20052
Mosses	
POTTIACEAE	
Tortula princeps	WELT M28986

Despite this the cliffs are by no means an hospitable environment, being fully exposed to the sun and salt spray, lacking any permanent source of fresh water, and because of their tuff substrate, unstable and prone to collapse. Added to this is the steady trickle of guano which, while a rich source of mineral salts and other nutrients, is so fertile as to burn all but the most salt-tolerant of halophytes (see Gillham 1961, Meurk and Fogo 1988). Indeed there is also the possibility that the nesting behaviour of the gannets may have reduced the island flora to its present restricted state. Gannets have been observed to denude their nesting areas of vegetation (Stein 1971) and are in part cited as the cause for the decline in the vascular flora on Oaia Island (off Muriwai Beach, west Auckland) by Cameron and Taylor (1989). Possibly then, gannets may have contributed to the present lack of any vascular plants on Gannet Island.

The final possible explanation for the island's near barren state concerns the short-lived guano mining venture discussed by Fleming and Wodzicki (1952). Although little is known of this enterprise, beyond that it was of short duration and failed, it is possible that the mining could have removed any vegetation were it present.

I have no evidence that Gannet Island was ever more vegetated than at present, however, with even the earliest written account of the island, given by Joseph Banks and Captain James Cook in 1770, noting it as bare (Beaglehole 1962, 1968). The expansion of the gannet colony (see Wodzicki *et al*. 1984) and the more recent attempt at guano mining seem the least likely of all the factors contributing to the island's current absence of a vascular flora.

In conclusion, I consider that Gannet Island is unlikely to have had a more extensive flora than the present one for at least the last 220 years and probably for most of its geological history. The extreme exposure, isolation from mainland seed sources, and otherwise harsh physical environment are seen as the major constraints on any further development of the island flora.

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