

Acknowledgment

I thank Ewen Cameron for useful comments on the draft of this note and for identifying the *Entada* seed.

Reference

Mason, R. 1961: Dispersal of tropical seeds by ocean currents. *Nature* 191: 408-409.

Waipareira Bay, Upper Waitemata Harbour

Marjorie Cutting and Ewen Cameron

Waipareira Bay (grid reference: R11 570866) is on the western side of the Upper Waitemata Harbour, just north of the Te Atatu North Peninsula, Auckland. Westpark Marina encloses the bay to the north. We visited the area on the request of Waitakere City Council staff on the 18 May 1994, to assess the botanical values of an inlet on the southern edge of the bay. (Scientific names for all plant species seen are listed in the appendix.)

This particular area has suffered considerable environmental damage as a result of a bund failure which occurred during the construction of the Westpark Marina in the early 1980s. Approximately 8000 cubic metres of silt flowed into the bay, followed by a period of leachate exposure from rotting vegetation under the construction area. Spoil from the marina construction was also dumped into the bay. Prior to these incidents the inlet supported a mangrove shrubland with small areas of saline marsh and coastal shrubland around the coastal margin. Photos (held by ARC Environment) taken around this time indicate that the coastal cliffs had already been substantially modified, and were primarily covered with gorse, although they probably supported young kanuka and manuka as well.

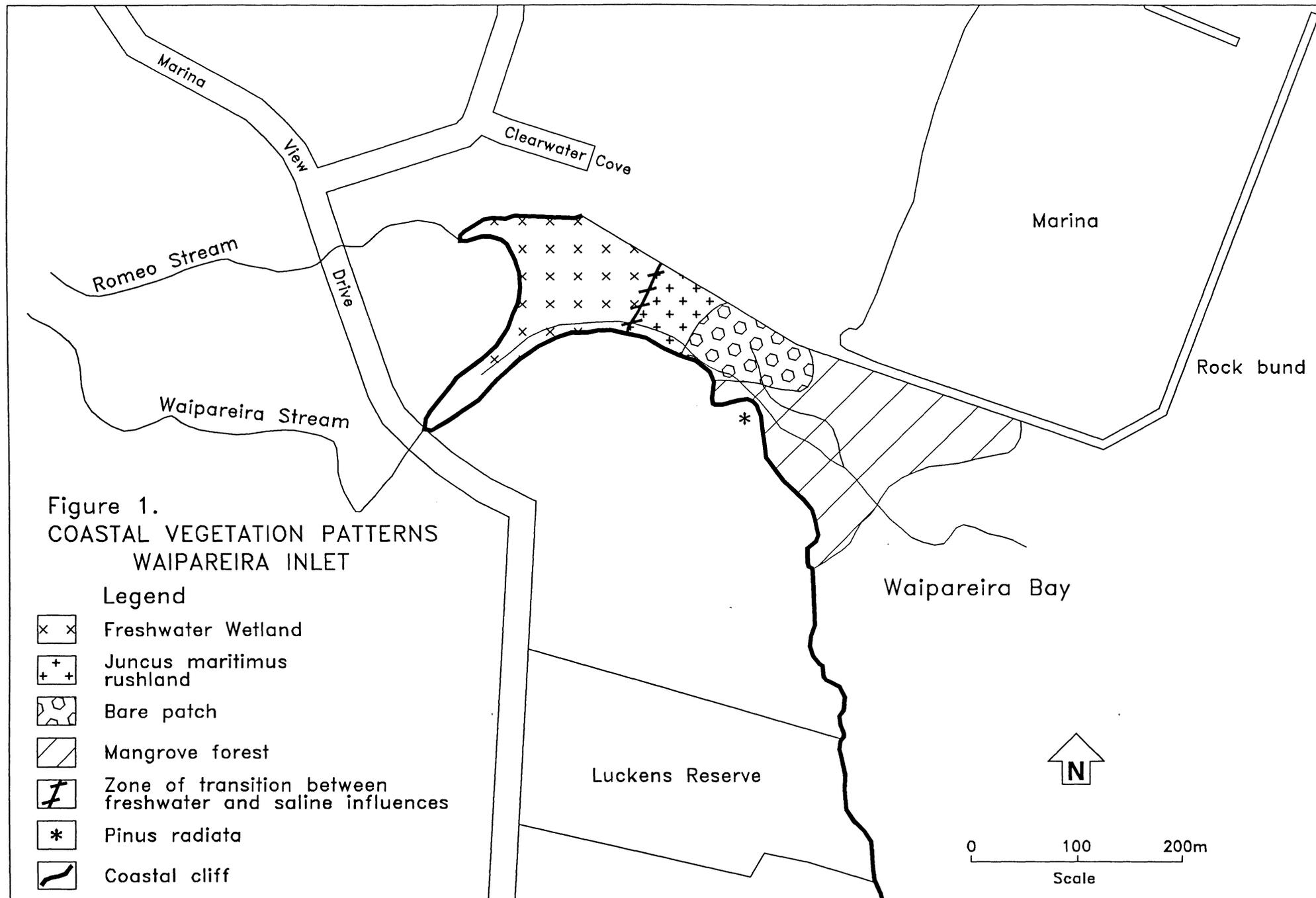
Nearly ten years later the inlet has become a freshwater wetland as a result of the sediment deposition described above, and probably also from the subsequent urbanisation of the catchment. This wetland is now one of few freshwater wetlands found in the Waitakere City's part of Tamaki Ecological District (K. Denyer pers. comm., 1994). Mangrove shrubland and sea rush marsh have re-established on the new seaward edge of the inlet. Some of the original salt marsh has remained intact on the margins of the inlet. During the last few years the coastal cliff vegetation has grown in height, and gained a higher species diversity.

For the purpose of this description we have broadly divided the inlet into four areas. These are:- the coastal cliff line; freshwater wetland; saline wetland; and the rock bund of the marina (see Figure 1). The entire area has a vascular plant species diversity of 91 of which 45 species are adventive (lower plants were not recorded). The area is about 5 hectares in size.

Coastal cliff vegetation

The more exposed coastal cliff line as it runs from the point of the bay (marked by a *Pinus radiata* tree) along to Luckens Reserve is composed of Waitemata Sandstone with small 'sandy' areas along the coastal margin. Along the coastal cliffs a remnant gumland vegetation association occurs represented by kumerahou (as small trees and seedlings), *Lepidosperma laterale*, manuka and gorse. A few taupata seedlings were also found. While gorse is still predominant, native species are regenerating throughout.

The coastal cliff vegetation extends into the bay itself. In a small indentation in the cliffs the species diversity increases with mapou, gorse, mamaku, *Coprosma robusta*, kumerahou, hangehange, manuka, woolly nightshade apparent in the canopy. We also found a small area of Japanese honeysuckle. At this point also on the coastal margin several bushes of shore ribbonwood occurred behind bands of saline rushes, sedges and grasses. This tall shrubland on the coastal cliff extends



almost to Marina View Drive as it runs along the Waipareira Stream. Pampas grasses line the banks of the Waipareira Stream as far as Marina View Drive.

Further along the coastal cliffs (on the western edge of the bay) we found Chinese privet, with larger kanuka trees and mapou. The cliffs around Romeo Stream also contain a larger number of introduced species, again particularly abundant was Chinese privet. Ponga, wheki, *Carex virgata*, *Pneumatopteris pennigera* were also recorded. As the cliff drops to the Westpark marina area, a number of wattles, a towai tree, gorse, Chinese privet, *Fatsia japonica*, and coprosma were present. Along the reclaimed area next to the marina, alder and eucalypts have been planted. Again pampas grass occurs here along the coastal margin.

The presence of towai at this point of the harbour is of interest. Esler (1991) records towai as fairly local for urban Auckland. For the Waitakere Ranges, Mead (1972) records the only known trees (at Waiatarua) as probably adventive. Towai is occasional to locally common south of Waipareira Bay around Massey (e.g. Moire and Lowtherhurst Parks) and south-west at Swanson Scenic Reserve (J. Komsars pers. comm.), to the north it occurs at Paremoremo, to the east it is present in most bush remnants in the Birkenhead-Northcote area, and on the northern Manukau Harbour it is known at Blockhouse Bay. It is common north of the Auckland Region, locally common on several islands in the Hauraki Gulf and occasional in the Hunua Ranges (Barton 1972). Areas in Massey and around Birkenhead-Northcote are its urban Auckland stronghold.

Freshwater wetland

The freshwater wetland in the bay is the largest vegetation type found in this area. At the time we were there the water level was approximately 30 cm on average throughout, although deeper in channels. There were several ponds of open water present in the wetland, with one just above the saline-freshwater interface, and one closer to the western coastal cliff and Waipareira Stream channel. Within the wetland area are a few "islands of higher ground" marked by pampas grass. Occasional flax clumps mark the edge of the Waipareira Stream channel as it flows into the wetland. There was also a stump of an old cabbage tree in the wetland but no living specimens were found.

The freshwater wetland is predominantly composed of swards of *Isolepis prolifera* and Mercer grass (*Paspalum distichum*) with scattered *Aster subulata* and *Rumex conglomeratus*. *Senecio esleri* is also scattered throughout the area. The mats of Mercer grass tend to be single species in nature, in contrast accompanying the *Isolepis* in the areas of standing water are *Apium nodiflorum* and *Ludwegia palustris*. Associated species include *Eleocharis acuta*, *Juncus acuminatus*, the smaller *Juncus articulatus* and *Juncus effusus*. Away from the salt-freshwater interface, towards Romeo Stream there are noticeably more exotic species, including *Ranunculus repens*, Kikuyu grass, brown top, with arum lilies on higher ground. A small area of raupo occurs close to the cliff as it runs back into the Romeo stream-plain. *Juncus articulatus* is present amongst the raupo. Around Romeo stream the ground was firm and less wet underfoot. In this area impatiens, nasturtium, arum lilies, *Ranunculus repens* and wild radish were present. It is fortunate that no willows (*Salix* spp.) have established in the area.

Saline Vegetation

There are a number of different types of saline vegetation of interest. These include the mangrove shrubland on the coastal margin, small areas of salt marsh adjoining areas of coastal shrubland on the southern portion of the bay, small areas of salt herbs, and the larger sea rush marsh which runs for 30 or more metres behind an area of bare mudflat, to then merge with the freshwater wetland on the landward side.

Mangrove shrubland

A relatively extensive area of mangroves has re-established itself on the coastal side of the bay since the bund failure. The mangrove forest extends out towards the seaward end of the rock bund and runs inland to a point approximately 20 m west of the pine tree. The mangroves also extend along the coastline towards Lucken Point. Around the edge of the mangroves are salt marsh species. The mangroves are at their maximum height of about 1.5 m next to the rock bund and around the channel

edges. They were fairly dense close to the bund, and scattered in their distribution in the middle of the mangrove area. They appeared youthful and growing strongly. Adjoining the mangroves closer the landward side are areas of salt herbs containing *Triglochin striata*, shore primrose, bachelor's button, *Apium* "white denticles", and glasswort. Occuring locally behind these herb areas are mats of two exotic grasses, saltwater paspalum and Indian doab.

Salt marsh areas

The sea rush (*Juncus maritimus*) is the most predominant coastal rush in the area and forms the largest area of salt marsh. On the high tide reaches, particularly on the southern side of the bay, are smaller areas (about 2 m x 5 m long) of salt marsh and coastal shrubland composed of *Baumea juncea*, sea rush, *Plagianthus maritimus*, and oioi. The sequence of species as they occur from the lower shore to the landward margin begins with oioi, then sea rush, and ends with *Baumea juncea*. Three or four large shore ribbonwood *Plagianthus maritimus* shrubs are also present. In the cliff indentation is an area of the tall sedge, *Bulboschoenus ? medianus* covering an area about 6 m x 20 m long. On the outer extremity of the *Bulboschoenus* area a number of mangrove seedlings are present.

In between the mangroves and the freshwater wetland to the west is a large predominantly bare patch of mudflat with scattered mangroves and sea rush and cut stumps of mangroves (presumably cut after the bund failed). Behind this is a large area of sea rush indicating the high tide reach. Once past this point a merging between fresh and saline influences occurs which is reflected in the species composition by a mixture of *Isolepis prolifera* and sea rush.

Rock Bund

Although mainly bare rock a number of species have established on the rock bund of the marina. These species included *Atriplex prostrata*, *Suaeda novae-zelandiae*, *Microlaena stipoides*, glasswort, and even some mangrove seedlings which had germinated in the interstices of the rocks. Eight species were recorded on the rock bund.

Wildlife

We watched a number of bird species using the inlet area. Along the intertidal flats South Island pied oystercatchers, pied stilts, ducks, and white faced herons were seen feeding. Fantails and kingfisher were using the mangroves and coastal cliffs. In the freshwater wetland areas, especially in the areas of open water and by the stream, were a number of pukeko and ducks. Welcome swallows were seen flying around and under the stormwater outlet, where they possibly nest.

Discussion

Although most of the vegetation has been devastated there is enough remaining to indicate what it may have been like in the past and enough to propagate from to begin a restoration project. Waitakere City Council has proposed to restore this part of the Waipareira Inlet as part of the remedial works considered desirable as mitigation measures to repair the environmental damage inflicted in this coastal area. City Council staff are proposing to remove the rubbish which has been dumped in the area which includes car bodies, oil drums, and plastic waste. Weed removal, particularly the Chinese privet, is also proposed for 1995 followed by the replanting of suitable native species along the coastal margins of the bay.

Acknowledgments

Thanks to Michelle Tyrrell of Waitakere City Council who requested and accompanied us on this visit and for her comments on the text. Also to Karen Denyer for her original comments on towai and freshwater wetlands in Tamaki and to Janis Komsars for his towai locality record.

References

- Barton, I.L. 1972: On the vegetation of the Hunua Ranges, Auckland. *NZ Journal of Botany* 10: 8-26.
- Esler, A.E. 1991: Changes in the native plant cover of Urban Auckland, New Zealand. *NZ Journal of Botany* 29:177-196.
- Mead, A.D. 1972: *Native flora of the Waitakere Range, Auckland*. Auckland Botanical Society. 24pp.

Appendix: Vascular Flora of Waipareira Bay, Upper Waitemata Harbour

Ferns (5)

<i>Cyathea dealbata</i>	ponga	c, CL
<i>C. medullaris</i>	mamaku	o, CL
<i>Dicksonia squarrosa</i>	wheki	r, CL
<i>Pneumatopteris pennigera</i>	paakau	r, CL
<i>Pteridium esculentum</i>	bracken	la, CL

Gymnosperms (1)

<i>Pinus radiata</i> *	Monterey pine	r, CL
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Dicotyledons (47)

<i>Acacia decurrens</i> *	green wattle	r, CL
<i>A. mearnsii</i> *	black wattle	r, CL
<i>Albizia lophantha</i> *	brush wattle	l, CL
<i>Apium nodiflorum</i> *		a, FR
<i>A. "white denticles"</i>		o, SA
<i>Aster subulata</i> *	sea aster	o, SA
<i>Atriplex prostrata</i> *	orache	c, RO; o, SA
<i>Avicennia marina</i>	mangrove	a, SA
<i>Conyza albida</i> *	fleabane	o, FR
<i>Coprosma repens</i>	taupata	r, CL
<i>C. robusta</i>	karamu	c, CL
<i>Coronopus didymus</i> *	twin cress	o, RO
<i>Cotula coronopifolia</i>	Bachelor's button	o, RO & SA & FR
<i>Cyathodes juniperina</i>	mingimingi	r, CL
<i>Fatsia japonica</i> *	fatsia	r, CL
<i>Geniostoma rupestre</i>	hangehange	c, CL
<i>Haloragis erecta</i>	shrubby haloragis	o, CL
<i>Impatiens walleriana</i> *	impatiens	r, FR, AK 219697
<i>Kunzea ericoides</i>	kanuka	l, CL
<i>Leptospermum scoparium</i>	manuka	a, CL
<i>Ligustrum sinense</i> *	Chinese privet	lc, CL
<i>Lonicera japonica</i> *	Japanese honeysuckle	l, CL
<i>Lotus pedunculata</i> *	lotus	o, FR
<i>Ludwegia palustris</i> *	water purslane	c, FR
<i>Melicytus ramiflorus</i>	mahoe	o, CL
<i>Mentha pulegium</i> *	pennyroyal	r, FR
<i>Myrsine australis</i>	mapou	o, CL
<i>Picris echinoides</i> *	oxtongue	l, FR
<i>Plagianthus maritimus</i>	shore ribbonwood	l, SA
<i>Plantago coronopus</i> *	buck's-horn plantain	lc, SA
<i>P. lanceolata</i> *	narrow-leaved plantain	o, FR
<i>Polygonum punctatum</i> *	American willow weed	o, FR
<i>P. salicifolium</i>		c, FR

<i>Pomaderris kumerahou</i>	kumerahou	o-lc, CL
<i>Ranunculus repens</i> *	creeping buttercup	lc, FR
<i>Raphanus raphanistrum</i> *	wild radish	l, CL
<i>Rumex conglomeratus</i> *	clustered dock	o, FR
<i>Samolus repens</i>	shore primrose	c, SA
<i>Sarcocornia quinqueflora</i>	glasswort	o, RO & SA
<i>Selliera radicans</i>	remuremu	lc, SA
<i>Senecio esleri</i> *		o, FR
<i>Solanum mauritianum</i> *	woolly nightshade	o-lc, CL
<i>Sonchus oleraceus</i> *	sow thistle	o, RO & FR
<i>Suaeda novae-zelandiae</i>		r, RO, AK 219694
<i>Tropaeolum majus</i> *	garden nasturtium	r, FR
<i>Ulex europaeus</i> *	gorse	a, CL
<i>Weinmannia sylvicola</i>	towai	r, CL, AK 219699

Monocotyledons (39)

<i>Agrostis capillaris</i> *	brown top	o, FR
<i>Baumea juncea</i>		lc, SA
<i>Bolboschoenus ? medianus</i>		la, SA
<i>Carex virgata</i>		o, FR
<i>Cordylina australis</i>	cabbage tree	r, FR (dead stump)
<i>Cortaderia jubata</i> *	purple pampas grass	r, RO; la, CL
<i>Cynodon dactylon</i> *	Indian doab	lc, SA
<i>Cyperus eragrostis</i> *	umbrella sedge	o, FR
<i>Dactylis glomerata</i> *	cocksfoot	o, FR
<i>Deyeuxia billardierei</i>	sand wind grass	r, SA
<i>Eleocharis acuta</i>	spike-rush	l, FR
<i>Festuca arundinacea</i> *	tall fescue	c, SA; o, FR
<i>Gahnia lacera</i>	cutty grass	o, CL
<i>Gladiolus undulatus</i> *	wild gladiolus	lc, SA
<i>Holcus lanatus</i> *	Yorkshire fog	o, FR
<i>Isolepis cernua</i>		o, SA
<i>I. prolifera</i>		a, FR
<i>Juncus acuminatus</i> *	sharp-fruited rush	o, FR
<i>J. articulatus</i> *	jointed rush	lc, FR
<i>J. effusus</i> *	leafless rush	la, FR
<i>J. maritimus</i>	sea rush	la, SA
<i>Lepidosperma laterale</i>		l, CL
<i>Leptocarpus similis</i>	oioi	l, SA
<i>Lolium multiflorum</i> *	Italian ryegrass	o, FR, AK 219696
<i>Microlaena stipoides</i>		o, RO
<i>Morelotia affinis</i>		o, CL
<i>Paraphololis incurva</i> *	sickle grass	o, RO
<i>Paspalum distichum</i> *	Mercer grass	a, FR, AK 219695
<i>P. urvillei</i> *	Vasey grass	o, FR
<i>P. vaginatum</i> *	saltwater paspalum	lc, SA
<i>Pennisetum clandestinum</i> *	Kikuyu grass	l, FR
<i>Phleum pratense</i> *	timothy	r, FR, AK 219698
<i>Phormium tenax</i>	flax	o, FR
<i>Rytidosperma biannulare</i>	danthonia	l, CL
<i>Schoenoplectus validus</i>		l, FR
<i>Stipa stipoides</i>	needle tussock	o, SA
<i>Triglochin striata</i>		lc, SA
<i>Typha orientalis</i>	raupo	lc, FR
<i>Zantedeschia aethiopica</i> *	arum lily	l, FR

Legend

Habitats

CL	=	cliff/bank
FR	=	freshwater
RO	=	rock (breakwater)
SA	=	salt (marine)
*	=	adventive species

Abundance

a	=	abundance
c	=	common
o	=	occasional
l	=	local
r	=	rare (< 5 plants seen)

AK = herbarium voucher specimen in the Auckland Museum

Some seeds in *Melicytus* (Violaceae)

R.O. Gardner

The Seed Atlas for our native flora currently being compiled by Landcare NZ botanists will no doubt help solve various outstanding taxonomic problems. In some groups though, an unsuspected amount of variability may well be revealed, and comparative work using extra-New Zealand species (e.g., Webb & Simpson, 1991), painstaking studies of development, and investigation of the seed with respect to its dispersers and predators, will all be required for a proper understanding of evolutionary relationships. *Melicytus* would seem to present such a complex case, and all I want to do here is to note a number of features of its seeds that have mostly been overlooked.

At pollination, *Melicytus* ovules are orientated with their micropyle upwards. The ovary stalk, or funicle, comes from an ascending vascular strand in the middle tissue of the ovary wall. It enters the ovule just below the micropyle and passes down to the ovule's lower end (chalaza), where it may break into a number of smaller strands that reascend for some way. The line of the vascular strand between its entry and the chalaza is known as the raphe. The ovule has two coats (integuments), and the various cell layers of these differentiate characteristically as the seed matures. In the seed, the outer integument (testa) is mostly fleshy but its innermost layer or layers also contain deeply coloured cells; the inner integument (tegmen) is largely composed of spiralling thick-walled fibres (cf. the account of other genera of Violaceae in Corner, 1976).

Figure 1.

A. *M. ramiflorus*. Fresh seeds lying at various angles, purplish in colour except around micropyle and raphe, where the testa is swollen to form respectively a collar and a ridge. The enlargement of the micropylar region shows the dark base of the broken-off funicle; in this species, a ripe fruit always yields its seed cleanly.

B. *M. macrophyllus*. The seed lacks testal colour-cells and is less swollen at the micropyle and raphe. Vascular strands ascending from the chalaza are often conspicuous. As shown, the funicle is (sometimes) relatively strongly attached to the seed, so when a ripe fruit is squeezed or bitten the seeds often emerge all attached to the inner pellicular layer of the fruit wall and with fleshy mesophyll adhering to this. Perhaps this is relevant to some feature of bird-feeding. The flesh of the fruit is sweet-scented, like the drying leaves of this plant.

C. *M. lanceolatus*. Seed (fresh) is dark purple, almost entirely so except for the paler and only slightly swollen raphe, which runs down the edge of the curved dorsal face. There is only a minute collar around the micropyle, and the seed usually detaches cleanly from its funicle. A fruit has up to 11 seeds (cf. us. 5-7 for *M. ramiflorus* and 2-4 for *M. macrophyllus*), so it is understandable that its close-packed seeds should be faceted ventrally. But most notable are the numerous tubercles; these are very evident in dried seeds, and are formed by aggregations of lignified cells in the inner part of the testa (or outer tegmen?).