observation in mind, and partly because having data from such a large sample might allow an inference about a fundamental aspect of the species's biology, its natural sex-ratio.

The trees fell predominantly into the text-book classes: male, and bisexual. But there were five "odd men out": like Duguid's tree, their flowers were mostly male, but there were also a few developing fruit on some inflorescences, or else there was some matured fruit in their crowns. There were a dozen trees whose gender I could not determine. Some of these seemed to be "resting", that is, as far as I could tell they lacked new inflorescences and old fruit. Among this type were some relatively young and healthy trees as well as a few shaded or decrepit ones.

Neglecting the five oddities and the twelve resting trees, the ratio of "abundantly fruiting" to "not-fruiting" (i.e., male) trees was 51:43. At first sight then, some reasonable degree of support is given to the hypothesis of equal abundance of the two principal genders. If the fruit-bearing trees are also acting as males to some degree the situation would described as being one of androdioecy, with some amount (the five oddities) of male "leakiness".

How well might this sample represent the species in the wild? I think one has to be cautious here. Even if these trees had been raised from seed and not from cuttings there would still be the possibility that they originated from just one or a few bisexual individuals, selected perhaps by the nurseryperson from one season's exceptional abundance of fruit. So their genotypes might be a restricted sample -- in the worst case, only those from the self-pollination of one bisexual tree in one year.

Studying the sexual biology of trees in the wild is strenuous and time-consuming (John Braggins, pers. comm.) so one naturally seeks relief in historical aspects of the subject. The name *Alectryon* (our species was the first-described in the genus) means "rooster" in Greek, and while many have supposed this would refer to the crimson aril of the seed Eric Godley (1997) has pointed out that a much more likely origin is to be found in the appearance of the unopened fruit-capsule (Fig. 1).

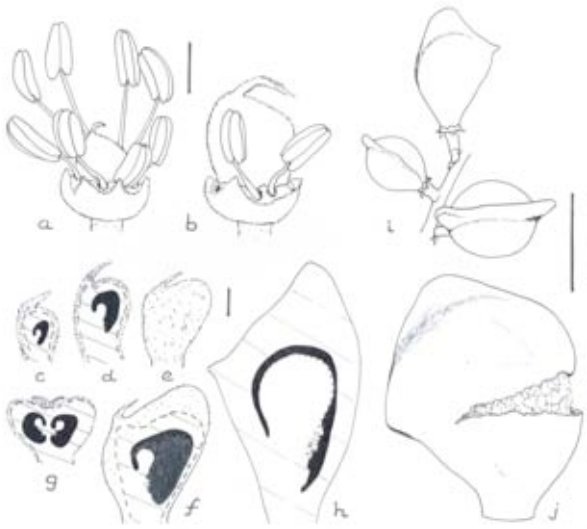

Fig. 1. Titoki observed flowers and fruit. a: Male flower; b Female flower, only two of the eight stamens shown; c-f Ovaries enlarging, the ovule located towards the base of the ventral (left-hand) side of the chamber, its basal aril present but small; g 2-chambered ovary; h: part-matured fruit, the seed-coat (hatched) beginning to harden, starting from above the contorted aril; i part of unripe infructescence ; j ripe fruit, dehiscing. Scale bars : a, b 1 mm; c-h 1 mm; i-j 1 cm

The beak of the rooster is the remnant of the style, and the rooster's crest is made by the single carpel's dorsal edge, which enlarges after fertilization (Fig. 1c-f) to form a conspicuous latero-apical wing. (Very occasionally in the trees studied I saw flowers with 2-locular ovaries (Fig. 1g)). Presumably it is the stress created by this asymmetric growth that eventually leads to the capsule tearing open in its characteristic "irregularly equatorial" way (Fig. 1 h-j).

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Orona Island, eastern Manukau Harbour, Auckland

Ewen K. Cameron

Orona Island (island name from Anon. 2006) (Figs. 1-3) lies some 300 m off the shoreline of the new Karaka Harbourside Estate subdivision, and 170 m off the eastern margin of farmed Pararekau Island in the Pahurehure Inlet, eastern Manukau Harbour, Auckland (Fig. 4). The island lies within the Manukau Ecological District and is clearly visible from the southern motorway (you've all seen it!) just north of the Papakura interchange (Beach Road). It is oddly absent from most maps – *Google Maps* was used to calculate its size, position and distances from adjacent land. I visited the island briefly on 22 Sep 2007 (for 30 minutes) and again on 16 Dec 2007 (60 minutes) – both times during a low tide.

The long axis of the elliptic-shaped island runs NW-SE and is 55 m long by 30 m across (c.0.15 ha), 6 m asl (map reference: NZMS 260 806584). The pale-coloured eroding cliffs standout on the southern and eastern sides (Figs. 1-2), and are composed of rapidly

eroding, soft Pliocene sand unconformably overlain by Pleistocene mud (Berry 1986, Bruce Hayward pers. comm.). Midden shells (mainly cockles) were commonly eroding out of the cliff-top soil layer. There is a narrow high tidal platform surrounding the island, which is widest at the south end on the west side (c.10 m wide), and the north end on the NE side (c.5 m), but elsewhere is mainly <1 m wide (see Fig. 2).

The island is surrounded by tidal mudflats and there is a shallow channel between the island and Pararekau Island to the west. The main Pahurehure Inlet channel lies 65 m to the north of the island. I reached the island by walking over the mudflats from the Karaka Harbourside Estate subdivision and fortunately the mud was just below boot-height. Pacific oyster beds were locally common, mud snails (titiko) were abundant, and snapping shrimps were constantly evident from their snapping. The island showed few signs of recent human visits, except for an occasional piece of rubbish, a suspected planted conifer, an informal track along the summit ridge and a small grassy cliff-top clearing at the SE end (c.4 x 3 m) – an old cannabis (*Cannabis sativa*) cultivation site or a clearing by adventurous children?

Vegetation

It is a dry island, and the only lush looking vegetation was the saltmarsh, especially the bright green *Selliera radicans* mats. Three vegetation zones were recognized: saltmarsh, open shrubby slopes, and the flat-topped summit ridge. The vegetation is all youthful and perhaps it is recovering from being burnt less than 30 years ago.

Saltmarsh: a narrow band of saltmarsh is present around most of the island (Fig. 5). It was dominated by *Samolus repens, Selliera radicans*, Buck's horn plantain (*Plantago coronopus*), glasswort (*Sarcocornia quinqueflora*) and patches of *Parapholis strigosa*. *Apium* "white denticles" was present on the NE side, and gladiolus (*Gladiolus undulatus*) was present locally at the upper saltmarsh edge on the west side. On the edge of the saltmarsh swards were sizeable plants of needle tussock (*Austrostipa stipoides*), occasional clumps of sea rush (*Juncus kraussii*) and locally oioi (*Apodasmia similis*) on the SW side.

Open shrubby slopes: the vertical slopes were bare; however, there were steep slopes with a scattered shrubby canopy 1-4 m tall of mapou (*Myrsine australis*), tree privet (*Ligustrum lucidum*), brush wattle (*Paraserianthes lophantha*), gorse (*Ulex europaeus*) complete with gorse spider mite (*Tetranychus lintearius*), boneseed (*Chrysanthemoides monilifera*) and bracken (*Pteridium esculentum*). Chinese privet (*Ligustrum sinense*) is present as an understorey shrub, and there are scattered ground cover species of *Poa anceps*, haloragis (*Haloragis erecta*) and dichondra (*Dichondra repens*).

Flat-topped summit ridge: this level area was c.25 m long x 8 m across, and was dominated by mapou c.4 m tall with dense stems around 2-3 cm diameter, with scattered tree privet 4-5 m tall with thicker stems. There was a good leaf litter and virtually no ground cover plants. Remains of a few dead trunks on the ground appeared to be brush wattle. The margin of this ridge along the cliff-tops in December was lined with the native plume grass (*Dichelachne crinita*) in full flower – the commonest grass on the island. Clumps of the glaucous native grass *Elymus multiflorus* were locally present amongst the plume grass on the SW cliff-tops.

Fig. 4. Location of Orona Island, Pahurehure Inlet, eastern Manukau Harbour, Auckland (Drawn by Ewen Cameron).

Vascular Flora

Fifty living vascular plant species (46% native), and a single dead exotic conifer, coast redwood (*Sequoia sempervirens*) were recorded (see Appendix 1). A single regionally threatened native species, *Elymus multiflorus* was observed, which is ranked as 'Gradual Decline' by Stanley et al. (2005).

Many aggressive environmental weed species were present, e.g. tree privet, Chinese privet, bone-seed, brush wattle, gorse, Japanese honeysuckle (*Lonicera japonica*), pampas grass (*Cortaderia selloana*), smilax (*Asparagus asparagoides*) and buffalo grass (*Stenotaphrum secundatum*). Most of these weed species have fleshy fruit (e.g. tree privet, Chinese privet, bone-seed, Japanese honeysuckle and smilax) and were probably transported to the island by frugivorous birds, most likely by blackbirds or starlings. Brush wattle and gorse seeds, and gladiolus cormils probably floated there. Pampas grass has wind-blown seeds. How buffalo grass, which doesn't set seed in New Zealand (Edgar & Connor 2000), reached the island is a mystery – perhaps living material was carried there as nesting material by black-backed gulls

Fig. 1. Orona Island, from southeast. Note – the Pacific oyster beds in foreground. (Ewen Cameron, 16 Dec 2007).

Fig. 2. Orona Island, from east side. Note – the high tide platform. (Ewen Cameron, 22 Sept 2007).

Fig. 3. North end of Orona Island, from west side. Note – needle tussocks on the narrow high tide platform. (Ewen Cameron, 16 Dec 2007).

Fig. 5. A band of saltmarsh, east side of the island looking south. (Ewen Cameron, 22 Sept 2007).

Fig. 6. Probable Norway rat burrows – numerous along the cliff-tops, southeast tip of island. (Ewen Cameron, 16 Dec 2007).

Fig. 7. Probable Norway rat burrows – numerous along the cliff-tops, mid-eastern side of island. (Ewen Cameron, 16 Dec 2007).

which may have nested there in the past when it was more isolated (pre the Karaka Estate).

Other plants
Because of the dryness of the island there were few bryophytes present – one of the few terrestrial clumps that I saw was on the SW side was the moss *Weissia* sp. (AK 301363) with the leafy liverwort *Archilejeunea olivacea* (AK 301364) mixed with it. Lichens were common on the exposed twiggy mapou branches, but not identified or collected. On the SW side just above the high tide line along the muddy edge of the island in September was a bright green band of green algae, *Ulva compressa* (AK 300645) and another species, probably *Rhizoclonium riparium* (AK 300644). By December these were largerly dried up.

Birds
Birds seen during the two visits on the island were: a duck (mallard/grey?) Sep 2007 which flew out from the grassy ledge on the NW end (nesting?); grey warblers which were vocal on the island (during both visits); a song thrush was heard; and a starling seen. Birds seen on the adjacent tidal mudflats during the Dec 2007 visit comprised: a group of 11 mallard ducks; some kingfishers feeding and calling; white-faced herons (up to 5 together); a pair of spur-winged plover; a group of at least 20 little-black shags resting on the bank of the main inlet channel; some pied stilts; some bar-tailed godwits; a black-backed gull; a harrier; many small waders too far away to identify; and 5 pukeko present on the shoreline by the Karaka Harbourside Estate.

Burrows?
At the top of the cliffs on both sides of the island were numerous burrows, c.10cm diameter – obvious when viewed from the shore (Figs. 6-7). Initially I thought they might be kingfisher burrows, except there were no birds coming or going, no chicks chirping, and no droppings outside the burrows. However, some droppings that I collected from the island's saltmarsh were identified on size as most likely to be Norway rat (Graeme Taylor pers. comm.). Based on the photos of the burrows Graeme Taylor (pers. comm.) felt because of their abundance that they were most likely to be Norway rats – possibly exposed by the eroding cliffs, and situated on the outer edge like this would decrease their vulnerability to any visiting stoats. The island itself may not support many rats but the tidal mudflats would – it might be where they hole up during the day and come out at night to feed. Also the burrows might be quite stable and could be the result of several decades of digging.

I later showed the photos to James Russell who agreed that they were probably Norway rat burrows, though he'd never seen such expansive tunnel networks by Norway rats. He also suggested considering rabbits and old tree roots e.g. pohutukawa which had eroded. However, they are too small for rabbit burrows (size not given to Russell), and I'd expect tree roots to be far more variable in size. Therefore I conclude they are most likely Norway rat tunnels.

Adjacent Karaka Harbourside Estate coastline
The mangroves along this coastline had all been cut off leaving just the pneumatophores and cut stems (up to 9 cm diameter). The cliffs (c.6 m tall) of soft sediments were eroding and in many places looked like recent fill as part of the subdivision. Apart from a row of pine tree stumps the only surviving woody plant was a 7 m-tall mapou with a trunk c.35 cm diameter. Large saltmarsh patches of *Isolepis cernua* with *Cotula coronopifolia,* saltwater paspalum (*Paspalum vaginatum*) and *Lobelia anceps* were locally present along the base of the cliffs – these four species were unrecorded for the island. Scattered clumps of sea rush, glasswort, *Selliera radicans*, *Samolus repens*, *Atriplex prostrata*, were also locally present, along with *Cyperus ustulatus* behind. Weeds such as bone-seed, pampas grass, gorse and *Senecio esleri* were present, amongst recently planted natives, especially ngaio (*Myoporum laetum*), cabbage trees (*Cordyline australis*), houpara (*Pseudopanax lessonii*) and native cultivars including hebes, phormiums and pittosporums along the open cliffs. Closer to the road in from the cliffs were two planted kowhai (*Sophora microphylla*) and planted pohutukawa (*Metrosideros excelsa*) lined the road for over 1.5 km. The main surviving native woody species in the local area, mapou, sadly wasn't utilized in the plantings.

Discussion
The dryness of the island limits what can grow there. The probable reason for the saltmarsh species growing along the foot of the new Estate cliffs, but absent in the saltmarshes of the nearby Orona Island (e.g. *Isolepis cernua*, *Cotula coronopifolia,* saltwater paspalum and *Lobelia anceps*), is probably that there is freshwater seepage from the Estate land and that the island is too dry for them. Pure mapou being the island's dominant crowning vegetation was surprising, especially for such a small island. A more likely seral cover would have been manuka (*Leptospermum scoparium*) or kanuka (*Kunzea ericoides*) – both of which were absent. However, Esler (2004: p.26) points out that mapou may play this role in Auckland in the absence of manuka and kanuka, and that it is tolerant of dry soil, salt spray and that it root suckers – all these attributes would assist it growing on this island. Plants of the stature on the island would be quite young, possibly only 10-12 years old (John Ogden pers. comm.). They probably emerged through a bracken-gorse cover, which most likely established after a fire.

The annual exotic estuarine grass, *Parapholis strigosa* is local in the Auckland region, but present in all three

of Auckland's harbours and, based on specimens in three herbaria (AK, CHR, WELT), it was apparently first collected in the Manukau Harbour in 1978 (Kiwi Drive, Mangere, *A.E. Esler & M.L. Scott*, 5 Jan 1978, CHR 321639). The characters that distinguish it from its cousin, sickle grass (*Parapholis incurva*) are listed in Table 1. *Parapholis strigosa* is a diffuse grass that can easily be over-looked and the flowering spikes can be difficult to distinguish from the similar looking leafy shoots.

Table 1. Distinguishing differences of the two exotic annual *Parapholis* grasses*.

	Parapholis incurva	*Parapholis strigosa*
Colour	often reddish	always green
Culms & spikes	curved & rigid	straight
Height (cm)	<20	20-40
Anthers (mm)	<1	2-3
Habitat (coastal)	hard & soft shores	usually soft shores

* based on field observations, specimens in AK herbarium, Hubbard (1984) and Edgar & Connor (2000)

In July 2007 during a cursory look Andrea Julian (pers. comm.) discovered 80-100 *Korthalsella salicornioides* plants parasitising six manuka shrubs on the adjacent private island in Bottle Top Bay by the causeway to the Pararekau Island (see Fig. 4). This location is c.1 km SW of Orona Island and it appears to be the first record of *K. salicornioides* for the Manukau Ecological District (cf. Cameron 2001). In the absence of manuka and kanuka it is unlikely that *K. salicornioides* is present on the island, although it has occasionally been found parasitising mapou (Peter de Lange pers. comm.). An attempted search quickly revealed how difficult it would be to spot growing on mapou. A search of the wider general area for *K. salicornioides* would be good to ascertain the local abundance of this nationally threatened species ranked as 'Sparse' (de Lange at al. 2004).

When the Karaka Harbourside Estate subdivision is completed, human visitation to the island will probably increase, although it has no great draw card except perhaps for adventurous children (and some adults!).

Acknowledgements

Andrea Julian for her nearby *Korthalsella* observation which gave me the impetus to finally visit Orona Island; Graeme Taylor for comments on the rat droppings; Graeme Taylor and James Russell for comments on the burrows (from photos); Bruce Hayward for geological comment; Jessica Beever and John Braggins for bryophyte identifications; Mike Wilcox for comment on the algae; John Ogden for possible age of the mapou; Peter de Lange for the mistletoe comment; and Pat Brownsey (WELT) and Jane Cruickshank (CHR) checking for *Parapholis strigosa* herbarium specimens.

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Appendix 1. Orona Island vascular plant flora.

* = naturalised species
** = presumed to be planted
a = abundant
c = common
o = occasional
l = local
s = scarce (<5 plants seen)
AK = herbarium voucher numbers are cited where they support the record

Ferns (1 native + 0 exotic)	
Pteridium esculentum	o, steep shrubland throughout

Conifers (0 + 1)	
*Sequoia sempervirens***	s, single erect dead tree, 1.66m tall, middle of summit ridge, shaded out by the mapou; AK 301386

Dicots (10 + 20)	
Anagallis arvensis s.str.*	o, few small plants, back of saltmarsh NE side, & open SW slope
Apium "white denticles"	l, saltmarsh, NE side; AK 300643, 301379
*Atriplex prostrata**	s, saltmarsh, NE side
Avicennia marina	o, small unbranched plants only, adjacent mudflats
*Centaurium erythraea**	o, shrubby steep slope W side, & NW tip; AK 301389
*Centaurium ?tenuiflorum**	s, shrubby steep slope W side; flower buds present, no open flowers; AK 301388
*Chrysanthemoides monilifera**	lc, steep shrubby slopes & lower shrubland fringe
*Cirsium vulgare**	s, margin of shrubland & saltmarsh, NE side
*Conyza sumatrensis**	s, margin of shrubland & saltmarsh, NE side
Coprosma robusta	o, shrubland slopes
Dicrondra repens	o, ground cover under shrubland
*Euphorbia peplus**	o, cliff-top & steep slope SE end
*Galium aparine**	l, cliff-top SE end
*Geranium molle**	s, margin of shrubland & saltmarsh, NE side
Haloragis erecta	l, shrubby steep slope W side
Hebe stricta	s, shrub on steep open slope E side
*Ligustrum lucidum**	c, shrubland throughout, 3-5m tall; AK 301383
*Ligustrum sinense**	o, as understorey shrubs, <1m tall
*Lonicera japonica**	l, cliff-top SE end
Myrsine australis	a, dominant woody plant, 3-4m tall
*Paraserianthes lophantha**	o, steep shrubby slopes & lower shrubland fringe
*Phytolacca octandra**	o, lower shrubland fringe
*Plantago coronopus**	lc, saltmarsh throughout
*Plantago lanceolata**	lc, lower shrubby slope, NE side
Samolus repens	la, saltmarsh & upper tide line
Sarcocornia quinqueflora	lc, saltmarsh
Selliera radicans	lc, saltmarsh
*Solanum nigrum**	l, margin of shrubland & saltmarsh, NE side
*Sonchus oleraceus**	o, coastal margins
*Ulex europaeus**	lc, shrubby steep slopes throughout

Monocots (12 + 7)	
Apodasmia similis	l, saltmarsh W side
*Asparagus asparagoides**	s, lower shrubby slope, NE side
Austrostipa stipoides	lc, upper tidal fringe throughout; AK 301373
Baumea juncea	lc, lower slopes, NW end
Carex brevifolius	s, semi-open clay slope, NW tip
*Cortaderia selloana**	s, single large clump by NE side; smaller one on SW slope
*Dactylis glomerata**	o, open areas, NE side
Dichelachne crinita	c, upper cliff-tops throughout; AK 301385
Elymus multiflorus	l, scattered clumps, cliff-tops; SW side; AK 301384
Ficinia nodosa	s, cliff-top, NW tip
*Gladiolus undulatus**	l, west side, behind saltmarsh & NW tip
Juncus kraussii	o, saltmarsh margins
Microlaena stipoides	lc, cliff-top, SE end
*Parapholis stricta**	lc, scattered patches in saltmarsh; AK 300642, 301108, 301370
Phormium tenax	s, single large clump on NW tip
Poa anceps	lc, shrubby steep slope, W side; AK 301387
*Rytidosperma pennicillatum**	l, open shrubby slope NE side
Rytidosperma unarede	o, lower shrubby slope, NE side; AK 301381
*Stenotaphrum secundatum**	l, narrow patch by NW tip