Austrostipa stipoides				*Juncus effusus* *			
Axonopus fissifolius *				*Juncus maritimus*	S		
Bulbophyllum pygmaeum				*Juncus pallidus*	S		
Carex lambertiana				*Machaerina tenax*			+●
Carex lessoniana				*Machaerina teretifolia*			
Carex litorosa	● H			*Microlaena stipoides*			
Carex solandri			+●	*Oplismenus hirtellus*			+
Carex testacea				*Phormium* ? *cookianum*			
Carex virgata				*Phormium tenax*			
Cenchrus clandestinus *				*Poa anceps*			
Collospermum hastatum			+	*Pterostylis alobula*			
Cordyline australis			+	*Pterostylis banksii*			
Cortaderia selloana	A			*Pterostylis graminea*			
Cortaderia banksii			+	*Pterostylis trullifolia*			
Cortaderia pumilio			+	*Rhopalostylis sapida*			+
Corunastylis pumila				*Ripogonum scandens*			+
Corybas cheesemanii				*Rytidosperma biannulare*			
Corybas oblongus				*Rytidosperma gracile*			+●
Corybas trilobus				*Rytidosperma racemosum**			
Cyperus ustulatus	S			*Schedonorus arundinaceus* *			
Dactylis glomerata *				*Schoenus apogon*			
Dianella nigra			+	*Schoenus maschalinus* +			+
Earina mucronata			+●	*Schoenus tendo* +			+
Eragrostis brownie *				*Simpliglottis cornuta*			
Freycinetia banksii			+	*Sporobolus africanus**			
Gahnia lacera			+	?*Tetraria capillaris*			
Gahnia pauciflora			+	*Thelymitra longifolia*			
Gahnia setifolia			+	*Uncinia banksii* +			+
Gahnia xanthocarpa			+	*Uncinia uncinata* +			+
Holcus lanatus *				*Uncinia zotovii*			
Isolepis reticularis	A						

Field trip to Rototoa Scenic Reserve (Lake Ototoa), south Kaipara Peninsula, 17 May 2014

David Wilson

Participants: *John Ayres, Bruce Calvert, Lisa Clapperton, Geoff Davidson, Ed Donald, Natalie Donald, Nicola Donald, Helen Frampton, Harley Gray, Margaret Gray, Anne Griffiths, Bill Griffiths, Leslie Haines, Barbara Harvey, David Harvey, Wendy John, Juliet Richmond, Vijay Soma, Adrienne Stanton, David Wilson* (leader)*, Alison Wesley, Angelina Young, Maureen Young*.

Rototoa Lake lies near the northern end of the South Kaipara Peninsula. It is the largest and deepest of a row of lakes on the Peninsula, behind and roughly parallel with Muriwai Beach. The lakes have filled depressions between sand dunes that formed during the last two million years, as eroded sand (some originating from the North Island's volcanic eruptions) was transported north along the coast by a combination of wind, ocean currents and the rise in sea level following the last ice age. The dunes are now stabilised by vegetation, principally pine (*Pinus radiata*) plantation, kanuka (*Kunzea* sp.) forest and pasture. The lakes, while still valuable habitat for a range of aquatic species, are subject to ecological impacts from human-induced algal

blooms, weed invasion and the introduction of pest fish. Their water levels are at times unstable, due to the effects of weather and the water uptake by trees in the nearby pine plantation.

Rototoa differs from most of the other lakes in several respects. It is not only the largest, but also the deepest, with a maximum depth of around 29 m. The lake bed has a rocky, rather than a sandy base, making it less permeable and perhaps contributing to its more stable water level compared with some of the other lakes. The water itself has low levels of suspended sediment and algal blooms, and the quality of the water is among the highest of any lake in the Auckland region. The impact of invasive species has been felt less here than in other South Kaipara lakes, but is increasing, through the introduction in recent years of fish such as redfin perch (*Percia fluviatilis*) and weeds such as the aquatic hornwort (*Ceratophyllum demersum*).

Fig. 1. *Machaerina arthrophylla*, showing top of a culm with inflorescence branches, and culms and foliage in the background, Rototoa Lake. All photos by David Wilson, 17 May 2014.

Fig. 2. *Myriophyllum propinquum*. Leaves on this specimen appear to be of an intermediate form between the finely filiform submerged leaves, and the linear shape typical of emergent stems.

Two reserves administered by the Department of Conservation give legal protection to the lake shore, the adjacent native forest and, unusually for such reserves, the lake water itself. Regular visitors to the lake may have noticed the recent change in spelling of the lake's name on reserve signage; the return of the letter 'R' to the beginning of the name 'Ototoa' has restored the full Maori prefix *Roto*, which denotes 'lake' in this and many other Maori place names.

The lake and its environs benefit from the work of the South Kaipara Landcare group, which includes weed control, fencing to exclude feral deer, and recent enhancement of the informative signage and parking area at the reserve entrance on Donohue Road. It was at this entrance, near the south eastern corner of the lake, where we assembled for our trip. From there we walked along the southern shoreline of the lake, to the embayment at the south west corner known locally as Honeymoon Bay.

A conspicuous feature of the shallows along many parts of the lake edge are stands of tall, emergent sedges. *Machaerina articulata* was the predominant species visible along the route we walked. In places, the deeper water immediately in front of these stands had another band of emergent, made up of the shorter, brighter green culms of *Eleocharis sphacelata*. Less commonly, the more slender, and from a distance less conspicuous, *Schoenoplectus tabernaemontani* was also present. All three species have the internal air spaces characteristic of many semi-aquatic species, and which presumably allow for ease of air movement in partly submerged stems and leaves. In the case of *M. articulata* and *E. sphacelata*, the culms are divided by transverse septa into a series of hollow compartments. The culms of *Schoenoplectus tabernaemontani* are more pithy, with both horizontal and vertical divisions. A fourth species, which we found in two places along the shore, was an addition to our species list (see Appendix). This was *Machaerina arthrophylla* (Fig. 1), recognisable by its dark culms with slender, drooping inflorescence branchlets, the lowermost of which is often widely separated from those above it.

On the shoreward side of these tall emergents was often a dense sward of wiry, bluish-green *Machaerina juncea*. Sometimes it was accompanied by the restiad *Apodasmia similis*, showing its ability to grow in freshwater as well as estuarine habitats.

Fig. 3. Field trip participants explore an arm of the southern end of Rototoa Lake. Emergent sedges are a feature of the lake shore.

Smaller native plants in and around these areas included *Myriophyllum propinquum* (Fig. 2), *Lobelia anceps*, *Ficinia nodosa*, *Lepidosperma australe* and species of *Isolepis*. Adventive species included *Ludwigia palustris*, which is normally associated with wetland habitat and was common here, as well as several other species of more general habitat preference. Species of *Juncus*, both native and exotic, were present also.

In a few places we found the small, creeping native herb, *Glossostigma elatinoides*, with a few flowers for us to prod and see the resulting movement of the irritable stigma. Unvegetated areas of bare mud showed that the water level in the lake was relatively low at the time of our visit, no doubt due to the very low rainfall over the Auckland region during the preceding summer.

The backdrop to the lakeside vegetation along the southern shoreline is a band of kanuka forest, with an understorey of common shrubs such as *Geniostoma ligustrifolium*, *Myrsine australis*, *Coprosma robusta* and *C. rhamnoides*. In places, the lakeshore topography and density of sedges required us to depart from the water's edge and follow a trail through this forest. We noted that sword sedge *Lepidosperma laterale* was common, as it is under kanuka canopy in other parts of the South Kaipara Peninsula. We also saw the sedge referred to by the tag name *Carex* "raotest".

Brush wattle (*Paraserianthes lophantha*) was present in places, and pampas grass (*Cortaderia selloana*) was a conspicuous lakeside weed. We found an individual of Mickey Mouse plant (*Ochna serrulata*) in the lakeside forest (and another on the roadside near the reserve). We passed through a particularly weedy gully with arum lilies

Fig. 4. A section of lake shore, perhaps temporarily exposed by low lake level. A sparse covering of *Eleocharis acuta* is visible in the foreground.

Fig. 5. *Myriophyllum votschii*, showing a creeping growth form across the sandy substrate on an exposed section of lake bed.

(*Zantedeschia aethiopica*), ginger (*Hedychium* sp.) and nasturtium (*Tropaeolum majus*) being prominent, along with the native umbrella sedge *Cyperus ustulatus*.

An elevated section of the path afforded a good view towards the north-west arm of the lake. It was in that arm where in 2007 the invasive submerged

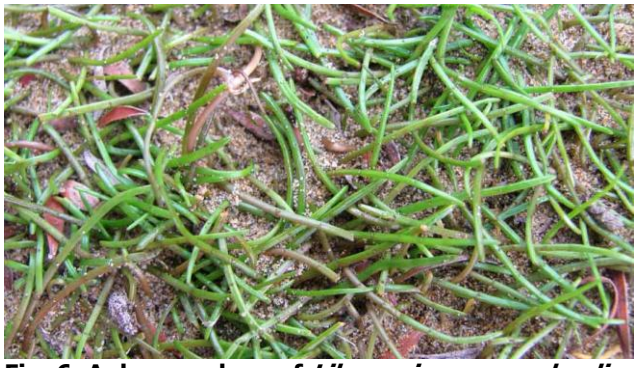

Fig. 6. A dense colony of *Lilaeopsis novae-zelandiae* on the lakeshore.

Fig. 7. The exotic fern *Azolla pinnata*, which often floats on the surface of standing water, but is shown here resting on lakeshore mud.

Fig. 8. Part of a culm of the native sedge *Carex maorica*, showing elongated, sessile spikelets.

Fig. 9. Juvenile mangeao (*Litsea callicaris*), beside the shore of Rototoa Lake.

aquatic hornwort was first found in the lake. Two booms were placed across the arm as part of an unsuccessful attempt at containing and eradicating the weed. Unfortunately, it has since spread to other parts of the lake. We had little difficulty in finding some, with its distinctive whorls of toothed leaves. Another exotic species we found in some quantity, mostly submerged in shallow water, was the bladderwort (*Utricularia gibba*). We only found one specimen of swamp lily (*Ottelia ovalifolia*), a species which is kept at low abundance in the lake by the South Kaipara Landcare group.

An area of dense, planted manuka (*Leptospermum scoparium*) had reasonable groundcover of the maidenhair fern *Adiantum aethiopicum*, clearly showing drought stress but likely to recover over winter. We concluded that some good-sized *Corokia cotoneaster* had originally been planted, although this species does form part of the understorey in the forest around Waionui Inlet, a short distance to the north of Rototoa.

After lunch we explored a narrow, sheltered arm of the lake (Fig. 3). The promontory at the entrance to this arm had a shore of exposed, sandy substrate (Fig. 4), sparsely vegetated with *Eleocharis acuta* and *Myriophyllum votschii* (Fig. 5). Both species could be expected to tolerate fluctuating water levels and periods of inundation in a site such as this. The more enclosed shoreline of the lake arm itself had the familiar fringe of *Machaerina articulata* with a bed of *Eleocharis sphacelata* out in front of it. This was one of the locations where we also found *Machaerina arthrophylla*. Smaller plants on the muddy ground on the shoreward side included *Isolepis inundata*, *Juncus planifolius*, *Centella unifolia* and *Triglochin striata*. Amongst the *Triglochin* we also found *Lilaeopsis novae-zelandiae* (Fig. 6). A few individuals of the floating fern *Azolla pinnata* were resting on the mud (Fig. 7).

At the head of this arm, *Eleocharis sphacelata* was at the lake edge, but was now separated from the *Machaerina articulata*, which was some distance back from open water. Between the two species was saturated ground with a dense mat of *Isolepis prolifer*, *Eleocharis acuta*, *Cyperus* sp. (probably *congestus*) and *Paspallum distichum*. We also found some Brazilian fireweed (*Erichtites valerianifolia*) here.

Continuing around this arm, we found a small stand of raupo (*Typha orientalis*). *Calystegia tuguriorum* was suddenly common, climbing up lakeside trees and even scrambling over open ground. We added another sedge, *Carex maorica* (Fig. 8), to the list of species seen during the day, and paused to admire a juvenile mangeao (*Litsea calicaris*, Fig. 9), just before arriving at Honeymoon

Bay, the south western corner of the lake. From there, with the kind permission of the landowner, we took a shortcut over farmland and back to Donohue Road and our vehicles.

We had covered just over a tenth of the lake's 9.5 km of shoreline, and seen a good range of species, despite these being a relatively small proportion of those on the list (see Appendix). The forested slopes on the western and northern side of the lake were beyond the scope of our trip, but would seem to hold a good proportion of the species to be found in the vicinity of the lake.

Acknowledgements
Local resident and South Kaipara Landcare member John Ayres accompanied us and provided assistance during the day, and Judy Bendall granted permission to cross her land. Maureen Young updated many of the plant names on the original species list.

References

Mackinder, J (editor) 1984: Some botanical notes on Lake Ototoa, South Head, Kaipara. *Auckland Botanical Society Newsletter* 39: 25-29.

Appendix: Vascular plants of Lake Rototoa, South Kaipara Head

Checklist of vascular indigenous and naturalised plants, based on Mackinder (1984) with additions by ABS on 17 May 2014.

* = exotic
\+ = recorded again May 2014
\# = additions May 2014

	observed May 2014
Ferns & Lycophytes	
Adiantum aethiopicum	+
Adiantum cunninghamii	
Adiantum fulvum	
Adiantum hispidulum	+
Adiantum viridescens	
Arthropteris tenella	
Asplenium bulbiferum	
Asplenium flaccidum	+
Asplenium hookerianum	
Asplenium oblongifolium	+
Asplenium polyodon	
Azolla pinnata *	+
Blechnum chambersii	
Blechnum filiforme	
Blechnum fraseri	
Blechnum membranaceum	
Blechnum novae-zelandiae	+
Cyathea dealbata	+
Cyathea cunninghamii	
Cyathea medullaris	+
Dicksonia squarrosa	+
Doodia australis	+
Gleichenia dicarpa	+
Gleichenia microphylla	
Histiopteris incisa	
Hymenophyllum demissum	
Hymenophyllum flexuosum	
Hymenophyllum sanguinolentum	
Hypolepis (probably *ambigua*)	
Lastreopsis glabella	
Lastreopsis hispida	
Lastreopsis microsora	
Lastreopsis velutina	
Lindsaea trichomanoides	
Loxogramme dictyopteris	
Lycopodium deuterodensum	
Lycopodium volubile	
Lygodium articulatum	
Microsorum pustulatum	+
Notogrammitis ?	
Paesia scaberula	+
Phlegmariurus varius	
Pneumatopteris pennigera	
Polystichum neozelandicum	+
Pteridium esculentum	+
Pteris macilenta	
Pteris tremula	+
Ptisina salicina	
Pyrrosia eleagnifolia	+
Rumohra adiantiformis	
Tmesipteris lanceolata	
Tmesipteris tannensis	
Trichomanes endlicherianum	
Gymnosperms	
Agathis australis	
Dacrydium cupressinum	+
Dacrycarpus dacrydioides	
Phyllocladus trichomanoides	
Pinus radiata *	+
Podocarpus totara	
Prumnopitys ferruginea	+
Prumnopitys taxifolia	

Dicotyledons	
Acaena anserinifolia	
Acaena novae-zelandiae	+
Ageratina adenophora *	
Alectryon excelsus	
Alseuosmia macrophylla	
Alternanthera denticulata	
Anagallis arvensis *	+
Beilschmiedia tarairi	
Beilschmiedia tawa	
Brachyglottis repanda	
Buddleja davidii *	+
Callitriche muelleri	
Calystegia sepium	
Calystegia tuguriorum	+
Carmichaelia australis	
Cardamine debilis	
Carpodetus serratus	
Centella uniflora	+
Centipeda ?minima	
Cerastium fontanum	+#
Ceratophyllum demersum *	+#
Cirsium vulgare *	
Clematis cunninghamii	
Clematis forsteri	
Clematis paniculata	
Conyza sumatrensis *	+
Coprosma arborea	
Coprosma areolata	
Coprosma lucida	
Coprosma macrocarpa	
Coprosma propinqua × *C. robusta*	
Coprosma rhamnoides	+
Coprosma robusta	+
Coprosma spathulata	
Corokia buddleoides	
Corynocarpus laevigatus	+
Cotoneaster glaucophyllus *	+#
Cotula coronopifolia	
Crepis capillaris *	
Dichondra repens	
Dodonaea viscosa (probably naturalised)	+#
Dracophyllum latifolium	
Drosera auriculata	
Dysoxylum spectabile	
Elaeocarpus dentatus	
Elatostema rugosum	
Entelea arborescens	
Epilobium ciliatum *	+#
Epilobium pallidiflorum	
Erechtites valerianifolia *	+#
Euchiton involucratus	
Euchiton japonicus	
Fuchsia excorticata	
Galium aparine *	+
Galium propinquum	
Gamochaeta coarctata *	
Gamochaeta simplicicaulis *	+#
Gaultheria antipoda	
Geniostoma ligustrifolium	+
Glossostigma elatinoides	+
Gonocarpus incanus	
Gomphocarpus fruticosus *	+#
Griselinia lucida	
Haloragis erecta	+
Hebe stricta	+
Hedycarya arborea	
Helminthotheca echioides *	+#
Hoheria populnea	+
Hydrocotyle elongata	
Hydrocotyle novae-zeelandiae	
Hypericum pusillum	
Hypochaeris radicata *	+#
Jacobaea vulgaris *	+
Knightia excelsa	
Kunzea sp.	+
Lagenophora pumila	
Lagenophora stipitata	
Laurelia novae-zelandiae	
Leionema nudum	
Leontodon saxatilis *	
Leptecophylla juniperina	
Leptospermum scoparium	+
Leucopogon fasciculatus	+
Lilaeopsis novae-zelandiae	+#
Limosella lineata	
Linum bienne *	+
Litsea calicaris	+
Lobelia anceps	+
Lophomyrtus obcordata	
Lotus pedunculatus *	
Ludwigia palustris *	+
Lupinus arboreus *	
Lythrum hyssopifolia *	+#
Melicope ternata	
Melicytus macrophyllus	
Melicytus ramiflorus	+
Metrosideros excesla	+#
Metrosideros diffusa	
Metrosideros fulgens	
Metrosideros perforata	
Mida salicifolia	

Muehlenbeckia complexa	+
Myriophyllum propinquum	+
Myriophyllum triphyllum	
Myriophyllum votschii	+
Myrsine australis	+
Nasturtium officinale *	
Nertera dichondrifolia	
Nestegis lanceolata	
Nestegis montana	
Ochna serrulata *	+#
Olearia furfuracea	+
Olearia rani	
Oxalis exilis	
Oxalis rubens	
Paraserianthes lophantha *	+#
Parsonsia capsularis	
Parsonsia heterophylla	
Passiflora tetrandra	
Pastinaca sativa *	
Pelargonium inodorum	
Peperomia urvilleana	
Persicaria decipiens	+
Persicaria hydropiper *	+
Physalis peruviana *	
Phytolacca octandra *	
Piper excelsum	+
Pittosporum cornifolium	
Pittosporum crassifolium (naturalised)	+#
Pittosporum eugenioides	
Pittosporum tenuifolium	
Plagianthus divaricatus	
Plantago lanceolata *	+#
Pomaderris amoena	+
Pomaderris kumeraho	
Prunella vulgaris *	+
Pseudognaphalium luteoalbum	+
Pseudopanax arboreus	
Pseudopanax crassifolius	+
Pseudopanax lessonii	
Ranunculus macropus	+#
Ranunculus reflexus	
Ranunculus sardous *	
Rhabdothamnus solandri	
Rubus australis	
Rubus cissoides	
Sagina procumbens *	
Schefflera digitata	
Senecio bipinnatisectus *	+
Senecio esleri *	+#
Senecio glomeratus	
Senecio hispidulus	
Senecio minimus	+
Sigesbeckia orientalis *	
Solanum aviculare	
Solanum mauritianum *	+
Solanum nigrum *	+#
Solanum nodiflorum	+
Sonchus oleraceus *	+
Sophora chathamica	
Streblus heterophyllus	
Stellaria media *	
Symphyotrichum subulatum *	
Syzygium maire	
Tetragonia implexicoma	+#
Toronia toru	
Tropaeolum majus *	+#
Ulex europaeus *	+#
Utricularia gibba *	+#
Vellereophyton dealbatum *	
Vinca major *	+#
Vitex lucens	
Wahlenbergia violacea ?	
Weinmannia silvicola	
Monocotyledons	
Acianthus sinclairii	
Aira caryophyllea *	
Anthoxanthum odoratum *	+
Apodasmia similis	+
Aristea ecklonii *	+
Astelia solandri	
Astelia trinervia	
Austroderia fulvida	
Austroderia splendens	
Bromus diandrus *	
Bromus wildenowii *	
Carex breviculmis	
Carex dissita	
Carex flagellifera	
Carex lambertiana	
Carex maorica	+
Carex "raotest"	+#
Carex secta	
Carex solandri	+#
Carex spinirostris	
Carex testacea	
Carex virgata	+
Cenchrus clandestinus *	+
Collospermum hastatum	
Cordyline australis	+
Cordyline banksii	
Cordyline pumilio	

Cortaderia jubata *		*Machaerina articulata*	+
Cortaderia selloana *	+	*Machaerina juncea*	+
Cyperus brevifolius *	+#	*Machaerina sinclairii*	
Cyperus congestus *	+#	*Microlaena avenacea*	
Cyperus eragrostis *	+#	*Microlaena polynoda*	
Cyperus ustulatus	+	*Microlaena stipoides*	+
Dactylis glomerata *	+#	*Morelotia affinis*	+
Dianella nigra/latissima ?	+#	*Nematoceras orbiculatum*	
Dichelachne crinita		*Nematoceras trilobum*	
Earina mucronata		*Oplismenus hirtellus*	+
Eleocharis acuta	+	*Ottelia ovalifolia* *	+
Eleocharis sphacelata	+	*Paspalum dilatatum* *	+
Ficinia nodosa	+	*Paspalum distichum* *	+#
Freycinetia banksii		*Paspalum urvillei* *	+#
Gahnia lacera	+	*Phormium tenax*	+
Hedychium gardnerianum *	+#	*Poa anceps*	
Holcus lanatus *	+#	*Poa pusilla*	+
Iris foetidissima *	+#	*Polypogon monspeliensis* *	
Isachne globosa	+	*Potamogeton cheesemanii*	+#
Isolepis cernua		*Pterostylis banksii*	
Isolepis inundata	+	*Rhopalostylis sapida*	
Isolepis prolifera	+	*Ripogonum scandens*	
Isolepis sepulcralis *	+	*Rytidosperma gracile*	
Juncus articulatus *		*Rytidosperma racemosum* *	
Juncus bufonius *		*Rytidosperma unarede*	
Juncus edgariae		*Schedonorus arundinaceus* *	
Juncus effusus *		*Schoenoplectus tabernaemontani*	+
Juncus microcephalus *	+#	*Schoenus maschalinus*	+
Juncus pallidus	+	*Schoenus nitens*	
Juncus planifolius	+	*Schoenus tendo*	
Juncus sonderianus *	+#	*Sporobolus africanus* *	+
Juncus tenuis *	+	*Stenotaphrum secundatum* *	
Juncus usitatus		*Thelymitra longifolia*	
Kyllinga brevifolia *	+#	*Triglochin striata*	+
Lepidosperma australe	+	*Typha orientalis*	+
Lepidosperma laterale	+	*Uncinia banksii*	
Libertia grandiflora		*Uncinia uncinata*	+
Libertia ixiodes		*Winika cunninghamii*	
Lolium perenne *		*Zantedeschia aethiopica* *	+
Machaerina arthrophylla	+#		