

6. Pouto Peninsula

6.1 Grevilles Lagoon, the lake north of Kapoai (Pouto), NRC Lake No. 295; surveyed in 2005.



Plate: Grevilles Lagoon, set in a pastoral catchment, with margins retired.

Summary

Overall ranking

Moderate: Fully fenced with native submerged vegetation, but emergent zone impacted by the weed *Alternanthera philoxeroides*.

Threats

Difficulty of access makes likelihood of pest plant introduction low, but a major impact could result should introduction occur. Catchment impacts are unlikely to change in the immediate future.

Management recommendations

No monitoring is recommended.

Description

This sand dune lake (1674139E; 6011706N) is approximately 2 ha in area and over 4 m in depth, with a steep-sided catchment comprised of rough pasture heavily impacted by the terrestrial weed african feather grass (*Pennisetum macrourum*), or planted dune to the north-west (see plate) with wide retired margins. Access to the lake is across 3 km of steep private farmland and access to the lake perimeter by vehicle not possible.

Wetland vegetation

Typha orientalis dominated emergent vegetation, 5 – 10 m wide, growing to 0.5 m deep, rings the lake. Scattered plants of *Schoenoplectus tabernaemontani* were also present. The pest plant alligator weed (*Alternanthera philoxeroides*) was abundant at the sample point, at the western end of the lake, forming floating mats amongst *T. orientalis*.

Submerged vegetation

No turf plants were found – suitable sites were absent. Tall-growing native species were *Potamogeton ochreatus* and *P. cheesemanii*, with charophyte meadows of *Nitella* aff. *cristata* and some *Chara australis* present. The maximum depth of the vegetation was 4 m (*N. aff. cristata*).

LakeSPI

Reconnaissance only – no LakeSPI score generated.

Water birds

This isolated and inaccessible lake would provide good habitat for water birds. None were recorded during the field visit. DoC SSBI reports the nationally endangered bittern (*Botaurus poiciloptilus*) and the regionally threatened dabchick (*Poliiocephalus rufopectus*).

Fish

No fish were seen during the dive.

Aquatic invertebrates

No invertebrates were seen during the dive.

Changes in indicators

No previous surveys.

Threats

Exotic species would grow well in this lake, but access is difficult.

Management recommendations

The margins have recently been retired from grazing and planting has been undertaken. Alligator weed is well established at this site. No monitoring is recommended.

6.2 Lake Humuhumu, Pouto, NRC Lake No. 350; surveyed in 2005 and 2007.



Plate: Lake Humuhumu showing pastoral catchment in foreground, pine forest in background and the large island (centre right) which divides the lake.

Summary

Overall ranking

Outstanding: A large, relatively deep, clear lake with diverse biota including nationally rare plants, fish and birds, with no major pest species.

Threats

High risk of introduction and establishment of invasive pests. High risk of nutrient enrichment from pine plantation activities (fertilisers) and nutrient run-off from farmland.

Management recommendations

Annual invasive weed surveillance at access point. Condition monitoring every 3-5yrs.

Description

A large (139.4 ha) dune lake (1700789E, 5979177N) with a maximum depth of 16 m. The lake has a predominantly pastoral catchment with scattered pockets of manuka and kanuka scrub, except for the western shore, which was comprised of sand dunes with pine forest. A large island with indigenous vegetation divides the lake into two basins. There are no inlet or outlet streams. Easy access from roadway across firm grassed ground. Small boats can be launched with 4-WD.

Wetland vegetation

About 70% of the shoreline had a narrow (< 5 m) band of emergent species extending into about 1 m depth of water. *Schoenoplectus tabernaemontani* and *Eleocharis acuta* were the most common species with *Apodasmia similis*, *Baumea articulata*, *B. arthropphylla*, *Bolboschoenus fluviatilis*, *Cyperus ustulatus*, *E. sphacelata*, *Juncus pallidus* and *Typha orientalis* also present. The invasive exotic weed alligator weed (*Alternanthera philoxeroides*) was present in the marginal vegetation on the north-east shore.

Submerged vegetation

Turf was common with *Lilaeopsis novae-zelandiae* and *Glossostigma elatinoides* the dominant turf species. One plant of the nationally rare *Trithuria inconspicua* was found in 2005 but the species was not recorded in 2007. A single plant of this species was found during 2009 surveillance. The regionally uncommon *Myriophyllum votschii* was also recorded. Overall the submerged vegetation was dominated by *Chara globularis* and *Chara australis* at high covers and on two profiles to depths approaching 10 m. There were some scattered low-density growths of tall-growing natives commonly *Myriophyllum triphyllum* but also *Potamogeton cheesemanii* and *P. ochreatus* (5.7 m deep). The native *Ruppia polycarpa* was recorded at one transect near the access point. The nationally threatened *Lepilaena bilocularis* was reported in 2001, but the specimen held at the Auckland Herbarium (AK) was subsequently determined (by PDC) to be *Ruppia polycarpa*.

The lake had all native vegetation except *Otellia ovalifolia* and *Potamogeton crispus* (found outside profiles), which are of little consequence to native biodiversity.

LakeSPI

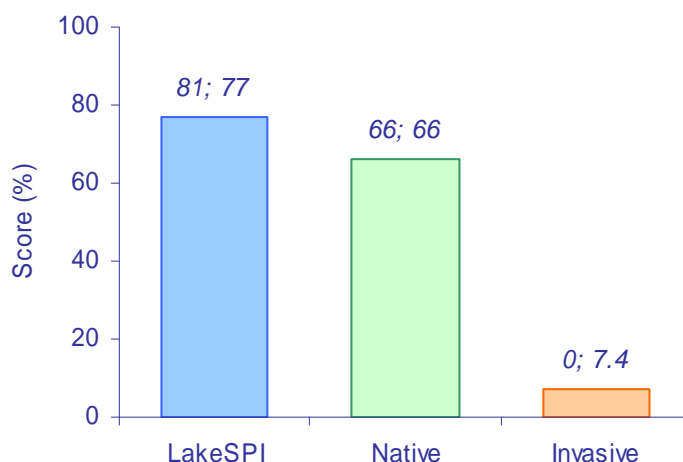


Figure: 2007 LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right) with 2005; 2007 values shown respectively.

A relatively high LakeSPI score of 77% was calculated, as there was little invasive impact at the sites sampled and the vegetation was diverse and growing to 10 m.

Water birds

The lake provides significant bird habitat with abundant waterfowl noted on the lake including the regionally significant dabchick (*Poliiocephalus rufopectus*) and scaup (*Aythya novaezeelandiae*). The nationally endangered bittern (*Botaurus poiciloptilus*) was also seen at this lake. OSNZ also recorded the nationally endangered Caspian tern (*Sterna caspia*), regionally significant fernbird (*Bowdleria punctata vealeae*) and spotless crane (*Porzana tabuensis plumbea*).

Fish

The common bully (*Gobiomorphus cotidianus*) was most commonly seen. The rare dwarf inanga (*Galaxias gracilis*) was present on most profiles in the shallows. There were no introduced fish species recorded.

Aquatic invertebrates

Nine invertebrates have been recorded including koura (*Paranephrops planifrons*) and freshwater mussels (*Hyridella menziesii*) and the snail (*Glyptophysa variabilis*).

Changes in indicators

Previous surveys 1984, 1985, 1988, 2001 and 2005, have shown little change in comparison with the latest 2007 survey. At times the depth limits of the vegetation have been up to 1 m shallower than present, possibly reflecting inter-annual variations with water clarity. The increase in Invasive Impact came about with *Potamogeton cirspus* being recorded on one profile at 3 m depth only.

Threats

This lake has no pest fish; Lake Rototuna with *Gambusia affinis* is the closest threat. No invasive submerged plants of any consequence are present but invasive species would do well in this lake. Nearby Lake Swan would present the most immediate threat with regard to a source of invasive weeds.

Alternanthera philoxeroides was recorded at the access point, and could be a threat to sheltered margins.

Management recommendations

Annual pest plant surveillance at access point.

Lake condition monitoring every 3-5 yrs.

Surveillance of margins for alligator weed and control for removal if deemed achievable.

6.3 Lake Kahuparere (Pouto), NRC Lake No. 384; surveyed in 2005 and 2007.



Plate: Lake Kahuparere showing pasture foreground, and pine forest on sand dunes to the rear.

Summary

Overall ranking

High: Medium sized lake with native vegetation, but nutrient enriched with livestock access to margins.

Threats

Access restricted, but tall-growing native vegetation would be easily invaded by tall-growing exotic species. Already nutrient enriched and low water clarity. Susceptible to further enrichment and possible plant collapse.

Management recommendations

Lake condition monitoring every 5 years. Livestock have been excluded from the eastern lake margin.

Description

A small (9.4 ha) dune lake (1703965E, 5974380N) with a maximum depth of 7.5 m. The lake is situated on sand dunes in a mostly pastoral catchment, with pine forest fringed by kanuka scrub on the steep western dune face. Access across 2 km of private farmland, 4-WD access only and no trailer boat access.

Wetland vegetation

The lake was ringed with emergent vegetation 10 to 15 m wide and dominated by *Schoenoplectus tabernaemontani* (growing to 0.7 m deep) and *Typha orientalis* (growing to 1 m deep) with lesser amounts of *Eleocharis sphacelata*, *Baumea articulata* and *Bolboschoenus fluviatilis*. Other marginal species recorded in 2007 were *Carex secta*, *Cyperus ustulatus*, *Eleocharis acuta*, *Juncus pallidus*, *Myriophyllum propinquum*, *Persicaria decipiens* and the introduced *Ludwigia palustris*. Where cattle could access the lake edge, the landward edge of the emergent vegetation was patchy and reduced in height.

Submerged vegetation

No turf species, dense *Potamogeton ochreatus* beds to 5.6 m deep with a mix of charophyte species at some locations in shallow water (to 2 m) only. *Utricularia gibba* formed mats in the SE end of lake to 0.6 m water depth.

LakeSPI

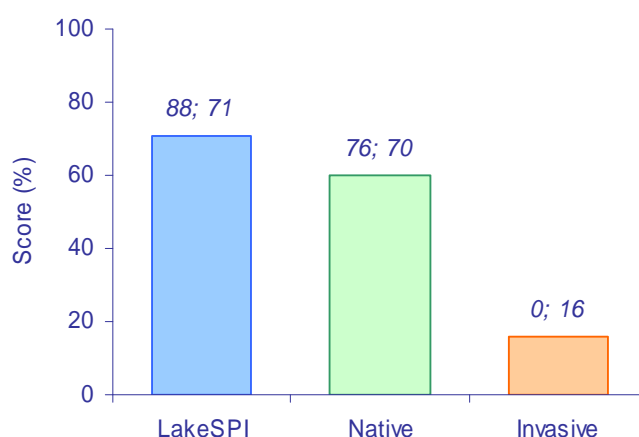


Figure: 2007 LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right) with 2005; 2007 values shown respectively.

High LakeSPI score of 71% driven by high cover native vegetation to 5.6 m but decreased from 2005 assessment due to *U. gibba* invasive impact.

Water birds

The dense emergent beds on the western side of the lake along with marginal scrub provide good habitat for waterbirds. Pukeko (*Porphyrio melanotus*) and the regionally threatened dabchick (*Poliocephalus rufopectus*) were seen during sampling. DoC SSBI reports these species and also nationally endangered bittern (*Botaurus poiciloptilus*) and Caspian tern (*Sterna caspia*) and the regionally threatened scaup (*Aythya novaeseelandiae*) and spotless crake (*Porzana tabuensis plumbea*). The migrant Eastern little tern (*Sterna albifrons sinensis*) was noted in 2007.

Fish

The extensive emergent beds and tall submerged vegetation provide suitable habitat for various fish and NIWA FBIS records include the nationally endangered dwarf inanga (*Galaxias gracilis*), whilst common bully (*Gobiomorphus cotidianus*) were noted during the vegetation sampling.

Aquatic invertebrates

Koura (*Paranephrops planifrons*) were recorded in 2007 and freshwater mussels (*Hyridella menziesi*) were noted in the 2001 survey. The native snail *Glyptophysa variabilis* was seen.

Changes in indicators

Previous surveys, 1985, 1988, 2001, and 2005 show no change in species, with the bottom depth limit for *P. ochreatus* changing from 4.5, 5.5, 5.9 to 5.6 respectively. 5.6 m was also the bottom limit measured in 2007. *Utricularia gibba* was found for the first time in 2007 and increased the Invasive LakeSPI index.

Threats

Currently no pest species are present apart from *Utricularia gibba*. Access is through 2 km of private farmland so the risk of introduction is low for the oxygen weeds but the lake would be very susceptible to invasion if introduced.

The relatively poor visibility and presence of filamentous algae covering the submerged vegetation indicated nutrient enrichment. Cattle access to the east shoreline not only has damaged the marginal vegetation through grazing and trampling, but can also lead to direct addition of nutrients to the lake by defecation and urine. Fencing of

the margin was noted in 2009, with a corresponding decline in the abundance of filamentous algae.

Management recommendations

Maintain the awareness of the threats posed by introduced weeds and their mode of introduction on contaminated fishing nets to the owner. Fencing of the lake margin has occurred.

Lake condition monitoring every 5 years.

6.4 Lake Kanono (Pouto), NRC Lake No. 377; surveyed in 2005 and 2007.



Plate: Lake Kanono showing the fenced margin and an access point in the foreground.

Summary

Overall ranking

Outstanding: This large lake has diverse submerged and emergent vegetation with no significant weed species and provides habitat for large numbers of water birds including several endangered species.

Threats

Access restricted, but if invasive species are introduced, they are likely to dominate the lake vegetation as tall growing native species do well. There are indications of nutrient enrichment and a decline in water quality although the lake is currently mesotrophic and much of the pasture margin is fenced.

Management recommendations

Pest plant surveillance every 3-5 yrs. 3 -5 lake condition monitoring.

Description

This lake (1702592E, 5975202N) is large (74.4 ha) and 15.5 m deep. The lake is situated on sand dunes with a pastoral catchment to the east and forestry to the west. Access is across 3 km of private farmland and the lake margin is fenced. Access to shore was through a locked gate and it was possible to launch tailored boats off a firm sloping beach using 4-WD.

Wetland vegetation

Much of the normally emergent vegetation was exposed or only extended into shallow water (< 0.5 m). It was sparse on the east side, usually less than 1 m wide, but had a broad 5 to 10 m zone present on the western lake edge. *Schoenoplectus tabernaemontani* was most common with some *Typha orientalis*, *Bolboschoenus fluviatilis*, *Cyperus ustulatus* and *Eleocharis acuta*. Exposed turf areas contained several amphibious species including *Glossostigma elatinoides* and *Limosella lineata*.

Submerged vegetation

Turf species were not common but were present on the exposed sandy locations with *Lilaeopsis novae-zelandiae* and *G. elatinoides* dominant. Charophytes dominated the vegetation with *Chara australis*, *C. globularis*, and *Nitella* aff. *cristata* all abundant. Maximum charophyte depth was 7.6 m, and very similar to 2005. Tall-growing natives were present with *Potamogeton ochreatus* abundant (median covers of 26-50%). The nationally 'At-risk' pondweed *Stuckenia pectinata* was recorded in shallow water in 3 of the 5 profiles. The exotic pondweed *Potamogeton crispus* was found at one site in 2005 and 2007 but was not displacing native vegetation.

LakeSPI

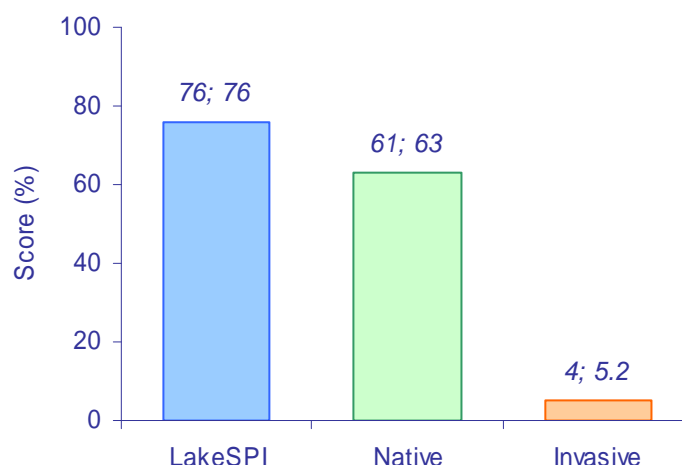


Figure: 2007 LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right) with 2005; 2007 values shown respectively.

A high LakeSPI score of 76% was driven by high cover native vegetation to 7.7 m and a lack of invasive species, apart from a few plants of *P. crispus* at one profile.

Water birds

A large isolated lake with retired margins and extensive areas of emergent vegetation makes it a good habitat for water birds. Large numbers (over 100 and approximately 40 respectively) of black swan (*Cygnus atratus*) and the regionally significant scaup (*Aythya novaeseelandiae*) seen on the field visit illustrated this. Two pairs of the regionally rare dabchick (*Poliocephalus rufopectus*) were also noted. The migrant Eastern little tern (*Sterna albifrons sinensis*) was noted in 2007. DoC SSBI reports these species and also nationally endangered bittern (*Botaurus poiciloptilus*) and Caspian tern (*Sterna caspia*) and the regionally threatened spotless crake (*Porzana tabuensis plumbea*).

Fish

The extensive aquatic vegetation provides good habitat for fish, with schools of the nationally endangered dwarf inanga (*Galaxias gracilis*) and also common bullies (*Gobiomorphus cotidianus*) were observed during the survey.

Aquatic invertebrates

The indigenous koura (*Paranephrops planifrons*), large freshwater mussels (*Hyridella menziesi*) and *Glyptophysa variabilis* snails were all abundant.

Changes in indicators

Previously surveyed in 1985, 1988, 2001 and 2005. Bottom limits for vegetation were in the 9 – 10 m range in earlier surveys, but were close to 7.6 m in the 2005 and 2007 surveys.

Vegetation composition has remained similar throughout.

Threats

Currently the submerged vegetation is comprised of native submerged plants except for *P. crispus*, which is having no impact on native species. The isolated nature of the lake and lack of easy access reduce the threat of introduction, but if introduced, pest species are likely to grow well and threaten indigenous biota.

The lake may be undergoing nutrient enrichment that could contribute to a future decline in water clarity.

Nutrients from the catchment and those generated from lake stratification could be impacting on the lake with poorer water clarity and lower depth limits for the vegetation. The water level was down 0.5 m (owners pers. comm.).

Management recommendations

Pest plant surveillance every 3-5 years.

Lake condition monitoring recommended every 5 years.

A sustained drop in water level of the magnitude observed is likely to deleteriously impact lake condition.

6.5 Lake Kapoai (Pouto), NRC Lake No. 296; surveyed in 2005, visited in 2007.



Plate: Lake Kapoai set in a pastoral catchment.

Summary

Overall ranking

Low-moderate: No submerged vegetation and marginal vegetation sparse. Fencing of lake margin almost complete, water quality may improve over time.

Threats

Access difficult and likelihood of submerged pest plant establishment is currently low.

Management recommendations

Lake condition monitoring every 5 years.

Description

A dune lake (1674985E, 6010755N) 1.6 ha, depth not determined. The lake is set within a pastoral catchment but has been fenced around much of the perimeter. There is an inlet at the northern end of the lake, draining approximately 2 km of pasture to the north-east. Access to the lake is across 2 km of private farmland with access through a locked gate.

Wetland vegetation

The emergent sedges *Schoenoplectus tabernaemontani* and *Eleocharis sphacelata* were re-establishing on the lake margins. Short turf communities were common at the lake edge with the regionally significant *Fimbristylis velata*, *Centipeda aotearana* and *Alternanthera* aff. *sessilis* present with the amphibious *Limosella lineata*, *Myriophyllum propinquum* and *Callitriche petriei*.

Submerged vegetation

The lake had a heavy algal bloom and no submerged native species seen in 2007 although some detached leaves of *Potamogeton ochreatus* were noted on the shoreline in 2005.

LakeSPI

No LakeSPI score generated as no plant cover present for this method.

Water birds

The lack of emergent vegetation and the modified catchment would provide limited habitat for water birds. However 20 mallard (*Anas platyrhynchos*), a pair of black swans (*Cygnus atratus*) and 6 black shags (*Phalacrocorax carbo*) were observed on the lake during the field visit in 2005. Black swan, mallard and grey duck (*Anas superciliosa*) were noted in 2007. DoC SSBI reports the regionally threatened scaup (*Aythya novaezeelandiae*) and dabchick (*Poliocephalus rufopectus*) from this lake.

Fish

NIWA FBIS records from this lake include common bully (*Gobiomorphus cotidianus*), shortfin eel (*Anguilla australis*) and the pest fish rudd (*Scardinius erythrophthalmus*). There are reports of tench (*Tinca tinca*) introduced to this lake. A dead goldfish (*Carassius auratus*) was noted on the field visit.

Aquatic invertebrates

No invertebrates recorded.

Changes in indicators

No previous surveys.

Threats

Access difficult and likelihood of submerged pest plant establishment is currently low.
A small part of the lake is still open to cattle grazing.

Management recommendations

Much of the lake margin has recently been retired from grazing. Fencing the remainder of the lake margin is advocated.

6.6 Lake Karaka (Pouto), NRC Lake No. 347; surveyed in 2005 and 2007.



Plate: Lake Karaka viewed from the access point showing pasture to the lake edge. The remainder of the lake margin is wetland.

Summary

Overall ranking

High: A lake with an indigenous vegetation and fauna, much of the margin surrounded by wetland with nationally endangered plants, fish and birds present.

Threats

Isolation and difficulty of access make likelihood of pest introduction very low, but a major impact could result should introduction occur. Possibly water quality impacted by cattle access.

Management recommendations

Infrequent pest plant surveillance and lake condition monitoring (5 to 10 years). Recommend fencing of the eastern margin to exclude cattle.

Description

This dune lake (1693415E, 5980559N) is 11.1 ha in size and about 6 m deep with an undulating bottom. It is one of the lakes situated on the south-western Pouto Peninsula between consolidated dunes to the east and mobile dunes to the west. The catchment is pastoral (25%), and flax/sedge/raupo wetlands (75%) extending to the north and south of the lake, linking it with other waterbodies and mobile sand dunes at the western end. There are no inflow or outflow streams. Difficult access through 10 km of forestry roads and 2 km across rough pasture/scrub, through two padlocked gates across Maori land. 4-WD access only, not suitable for tailored boat.

Wetland vegetation

Emergent species encircle most of the lake, except the margin bordered by pasture and open to cattle grazing. *Typha orientalis* and *Baumea articulata* dominated. These extended over a 20 m wide band in most areas growing to depths of up to 2 m. Common amongst the emergent vegetation were plants of the nationally threatened fern *Thelypteris confluens*. Other emergent species seen in 2007 included *Apodasmia similis*, *Baumea arthrophylla*, *Baumea juncea*, *Carex maorica*, *Carex secta*, *Cyperus ustulatus*, *Eleocharis acuta*, *Isachne globosa*, *Isolepis prolifer*, *Juncus pallidus*, *Schoenoplectus tabernaemontani*, flax and cabbage trees.

Submerged vegetation

All native vegetation. No turf species. Charophyte dominated, with *Chara australis* exceptionally abundant and very tall (to 1.8 m!) and to 4.8 m deep. Tall-growing native species were also present at low average covers with *Potamogeton cheesemanii* dominant and growing to 4.1 m deep.

LakeSPI

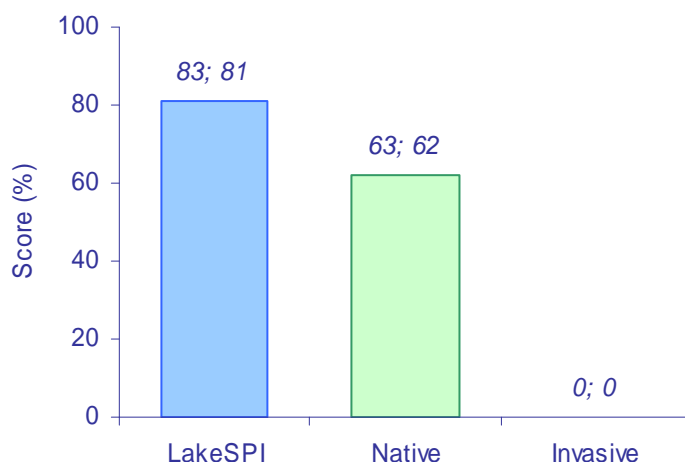


Figure: 2007 LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right) with 2005; 2007 values shown respectively.

A high LakeSPI score of 81% reflects extensive charophyte meadows and a lack of invasive species.

Water birds

The extensive wetland areas provide outstanding habitat for water birds. Threatened species reported include the nationally rare bittern (*Botaurus poiciloptilus*) and regionally significant banded rail (*Rallus philippensis assimilis*), spotless crake (*Porzana tabuensis plumbea*), dabchick (*Poliocephalus rufopectus*), fernbird (*Bowdleria punctata vealeae*) and scaup (*Aythya novaezeelandiae*). Formerly the critically endangered brown teal (*Anas aucklandica chlorotis*) were also recorded in this area. Dabchick and black-backed gulls (*Larus dominicanus*) were seen during the field visit.

Fish

Moderate water quality and diverse macrophyte habitat. The common bully (*Gobiomorphus cotidianus*) was very common, with most specimens having swollen abdomens indicative of an infestation of endoparasitic cestode or trematode species. Both longfin and shortfin eels (*Anguilla dieffenbachii* and *A. australis*) are reported from this lake and several eels were seen during the survey. The endangered giant kokopu (*Galaxias argenteus*) was recently collected from Lake Karaka (T. Birch, DoC pers. comm.)

Aquatic invertebrates

The native snail *Potamopyrgus antipodarum* was recorded from one profile.

Changes in indicators

Surveyed for vegetation in 2000 and 2005 with similar species composition and depth limits. Water clarity at the time of survey in 2007 was <1 m and dark beyond 3.5 m. The presence of giant kokopu increase the value of this lake. Water clarity can fluctuate markedly with algal blooms.

Threats

Relative isolation and difficulty of access makes risk of introduction of pest species low. However, should these be introduced they would displace or significantly impact indigenous biota.

Management recommendations

Lake condition monitoring and pest plant surveillance every 5 to 10 years.

Advocate fencing off the eastern shoreline to prevent cattle access to the lake.

6.7 Lake Mokeno (Pouto), NRC Lake No. 356; surveyed in 2005, and 2007.



Plate: Lake Mokeno surrounded by wetland and indigenous scrub vegetation.

Summary

Overall ranking

Outstanding: A large lake with all native vegetation, functioning as an integral part of a wetland/scrub/dune complex covering the south-western Pouto Peninsula. Contains nationally significant populations of endangered biota.

Threats

Exotic plant invasion, though risk low due to isolation. Possibly impacted by forestry fertiliser inputs.

Management recommendations

Yearly surveillance for pest plants and lake condition monitoring.

Description

Lake Mokeno (1695174E, 5977171N) is a dune lake 148.3 ha in area with a 6.1 m maximum recorded lake depth. The catchment is mostly kanuka scrub adjacent to pine plantation forestry, with large areas of wetland and some unconsolidated dunes on the western margin. There are no inflow or outflow streams but it appears that water flows south from the lake towards Lake Whakaneke eventually discharging to the entrance to Kaipara Harbour via an extensive wetland. Access to the northern end of the lake is through forestry and Māori land (7 km of well formed tracks) requiring access through a locked gate. Small boats can be launched with difficulty using a 4-WD.

Wetland vegetation

The entire lake was surrounded by extensive beds (up to 20 m across and extending from the lake edge to 2 m deep) of emergent species including *Typha orientalis*, *Baumea articulata*, *B. arthropphylla*, *B. rubiginosa*, *B. juncea*, *Eleocharis sphacelata*, *E. acuta*, *Schoenoplectus tabernaemontani*, *Carex secta* and *Phormium tenax*. This vegetation merged into a manuka (*Leptospermum scoparium*)/flax (*P. tenax*) wetland zone around much of the lake. At the south east end of the lake a distinctive *C. secta*-*B. arthropphylla* /*Thelypteris confluens* wetland was noted. The nationally threatened fern *Thelypteris confluens* (classified as 'Gradual Decline') was also found on the lakeward edges of flax and *C. secta* tussocks, is a nationally endangered species with Pouto being the national stronghold of this species. The invasive royal fern (*Osmunda regalis*) is presently being managed at the northern end of Lake Mokeno by DOC. This species poses a severe threat to the wetlands surrounding this lake and elsewhere in the region.

Submerged vegetation

Entirely native vegetation with the whole main lake bottom vegetated to 5.3 m. Turf species including *Lilaeopsis novae-zelandiae* (growing to 0.4 m tall) and *Glossostigma elatinoides* were seen in shallow margins growing amongst emergent vegetation. *Chara australis* filled the lake with a maximum height of 1.8 m (very tall for this species). *C. australis* grew to 5.3 m deep with only a small area of the lake deeper than this (6.0 m max. depth, found in the south end). Dead mussels at this depth indicated oxygen depletion at times. Tall-growing native species, *Potamogeton cheesemanii* and *P. ochreatus* were the only other submerged species found in the main body of the lake, however *Chara globularis* and *Myriophyllum triphyllum* were also found in the narrow channelized northern part of the lake.

LakeSPI

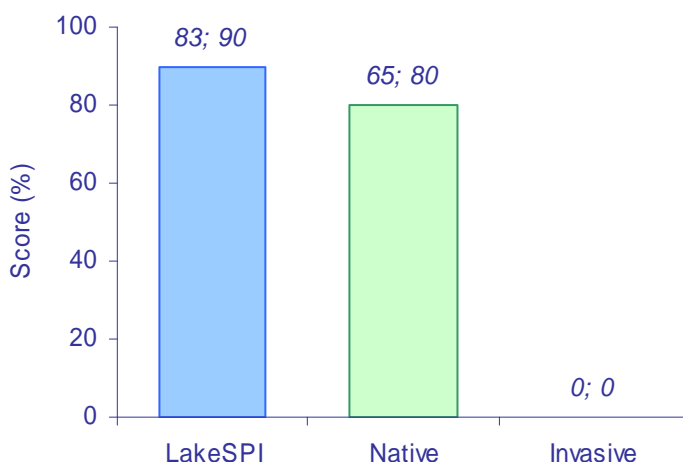


Figure: 2007 LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right) with 2005; 2007 values shown respectively.

The high LakeSPI condition of 90 % reflects high cover charophyte meadows and absence of introduced submerged invasive weeds. The increase in value since 2005 is because the deep portion of the lake was found and charophyte meadows grew to beyond 5 m deep.

Water birds

The indigenous scrub, wetland and emergent margins provide excellent water bird habitat reflected in the large number of species reported from this lake and seen during the field visit. Threatened species reported include the nationally rare bittern (*Botaurus poiciloptilus*) and Caspian tern (*Sterna caspia*) and regionally significant banded rail (*Rallus philippensis assimilis*), spotless crane (*Porzana tabuensis plumbea*), dabchick (*Poliiocephalus rufopectus*), fernbird (*Bowdleria punctata vealeae*) and scaup (*Aythya novaezeelandiae*). Formerly the critically endangered brown teal (*Anas aucklandica chlorotis*) were also recorded in this area. The indigenous species dabchick, scaup, grey teal (*Anas gracilis*), grey duck (*Anas superciliosa*), shoveler (*Anas rhynchotis*) and two species of shag (*Phalacrocorax* spp.) were seen during the field visit.

Fish

Good habitat, with fish access to the sea. Species recorded were common bully (*Gobiomorphus cotidianus*), inanga (*Galaxias maculatus*), smelt (*Retropinna retropinna*) and shortfin eel (*Anguilla australis*).

Aquatic invertebrates

Freshwater mussels (*Hyridella menziesii*) were common, introduced freshwater jellyfish (*Craspedacusta sowerbyi*) were also noted.

Changes in indicators

Previous vegetation surveys in 2000, 2001 and 2005 were similar to the latest survey. There was a dense algal bloom which reduced underwater visibility to 0.1 m in May 2001, but the water was very clear (~4m) in the 2007 m survey.

Threats

No pest plant or fish impacts evident and the likelihood of introduction of freshwater pests are low. Exotic species would establish in this lake if introduced. Royal fern could invade large areas of the wetland fringe.

The catchment is well buffered by an extensive wetland, but water quality and observations of past algal blooms indicate nutrient enrichment, possibly from fertilisation of pine forests. This would be a worthwhile area for further study.

Management recommendations

5 year monitoring of lake condition and pest plant surveillance recommended.

6.8 Lake Parawanui (Pouto), NRC Lake No. 297; surveyed in 2005.



Plate: Southern end of Lake Parawanui showing the pasture catchment and grazed margin with an exposed turf community.

Summary of last survey 2001

Overall ranking

Low: A degraded lake, with poor water quality, grazed lake margins, sparse submerged vegetation and pest fish present.

Threats

Pest fish and *Potamogeton crispus* already established. Nutrient enrichment and cattle access to margin.

Management recommendations

No monitoring recommended.

Description

Lake Parawanui (1676581E, 6008811N) is a dune lake 5.8 ha in area with a 20 m maximum recorded depth. The catchment is pasture. There is one inflow entering the eastern bay at the southern end of the lake draining from approximately 1 km to the east. There is no outlet. Access is through 1 km of private farmland, mostly on well-formed tracks. Small boats can be launched from much of the shore with a 4-WD.

Wetland vegetation

Emergent vegetation was sparse (5%) with *Schoenoplectus tabernaemontani* the dominant species in this lake. The turf community lining the southern margin of the lake contained the regionally threatened *Fimbristylis velata*.

Submerged vegetation

The only vegetation present in 2001 was the exotic weed *Potamogeton crispus*, present at low covers from 0.2 to 2.4 m depth.

LakeSPI

LakeSPI score is not generated from previous survey data.

Water birds

The pasture catchment and poor emergent cover provide poor waterbird habitat. There are previous reports of large numbers of waterfowl including the regionally rare dabchick (*Poliocephalus rufopectus*), however this was prior to the collapse of submerged vegetation.

Fish

The pest fish rudd (*Scardinius erythrophthalmus*), koi carp (*Cyprinus carpio*) and orfe (*Leuciscus idus*) were reported as liberated into Lake Parawanui. NIWA FBIS records include shortfin eel (*Anguilla australis*), common bully (*Gobiomorphus cotidianus*) and rudd caught in this lake.

Aquatic invertebrates

Abundant freshwater mussels (*Hyridella menzesii*) were noted.

Changes in indicators

Seven submerged species were present in 1988, with beds of *Potamogeton ochreatus* and *Nitella hookeri* extending to 5.5 and 8 m water depth respectively, while *P. crispus* was not reported.

Threats

It appears that coarse or pest fish have been deliberately stocked in this lake. Possibly a combination of this, cattle access and nutrient run-off from the steep pasture catchment has resulted in nutrient enrichment and a loss of submerged vegetation. Further pest plant or fish introductions are unlikely to further impact on the lake.

Management recommendations

No monitoring recommended.

6.9 Phoebe's Lake (Pouto), NRC No. 346; surveyed in 2001, re-visited in 2008



Plate: Phoebe's Lake with a dense margin of *Eleocharis sphacelata*.

Summary

Overall ranking

Low: A small lake, heavily impacted by the exotic submerged weed *Lagarosiphon major*.

Threats

Highly impacted by aquatic weeds.

Management recommendations

Consider management of *L. major*. No monitoring recommended.

Description

A small (0.9 ha) dune lake (1696778E, 5981948N), 4 m deep. The catchment is primarily pasture. There are no inflows or outflows. Access is through less than 1 km of well-formed track, but with no easy access into the lake.

Wetland vegetation

Emergent vegetation was dense and surrounded the lake; with Manchurian wild rice (*Zizania latifolia*) occupied 50% of the margin in 2001. Manchurian wild rice has been targeted for eradication and in 2008 only small patches of young re-growth were found. *Typha orientalis*, *Eleocharis sphacelata*, and *Baumea articulata* were abundant.

Submerged vegetation

Lagarosiphon major was the dominant species in shallow water forming dense surface-reaching beds extending to 2.6 m water depth. Below this, 1.5 m tall beds of *Potamogeton ochreatus* with occasional plants of *Nitella* aff. *cristata* were found to a maximum depth of 3.6 m. *Utricularia gibba* was common in shallow areas, sprawling over *L. minor*.

LakeSPI

LakeSPI score was not generated.

Water birds

The dense emergent cover may provide good habitat for crakes and other secretive water birds. One pair of the regionally rare dabchick (*Poliocephalus rufopectus*) was reported as resident on the lake and paradise ducks (*Tadorna variegata*) were present at the time of the 2008 visit.

Fish

NIWA FBIS records shortfin eel (*Anguilla australis*) caught in this lake. Golden bell frogs (*Litoria aurea*) were common.

Aquatic invertebrates

None reported. No mussels or koura were found.

Changes in indicators

Submerged vegetation was similar to that described in 2001, with the presence of *Utricularia gibba* a new record.

Threats

Control of Manchurian wild rice has reduced the risk of its spread. Follow-up control is required. Other submerged species e.g., *Ceratophyllum demersum* could possibly displace native species growing in areas deeper than *L. major*. Lake Swan is the nearest source of *C. demersum* and spread via eel nets is currently a minor possibility. Fencing of the lake and a dense margin of kikuyu and emergent vegetation is likely to intercept any nutrient run-off from surrounding pasture.

Management recommendations

Consider management of *L. major*. Currentl no monitoring recommended.

6.10 Lake Rotokawau (Pouto), NRC Lake No. 364; surveyed in 1985, 1988, 2001, 2005 and 2007.



Plate: Lake Rotokawau showing the exposed north east shoreline with few emergent species.

Summary

Overall ranking

High: The submerged vegetation was invaded by *Egeria densa*, however it had good water quality and extensive turf communities dominated by the nationally endangered *Trithuria inconspicua*, charophyte meadows with tall-growing native species, and a good population of nationally rare dwarf inanga.

Threats

E. densa (introduced in early 1990's) dominated many submerged profiles. and *Utricularia gibba* was present but prolific only in the sheltered lagoon. *Ceratophyllum demersum* could have a much greater impact if introduced, with nearby Lake Swan the most likely source. Presumably eel fishing nets were the mode of introduction and pose a threat for future introductions. Water quality is still good but prone to nutrient enrichment if pastoral practices intensified.

Management recommendations

Annual pest plant surveillance at access points. Lake condition monitoring every 5 years.

Description

This dune lake (1702929E 5976997N) is 26.4 ha in size and 12 m deep. The catchment is pastoral, with plantation pine and shrubland. Access is across private farmland, requiring 4-WD but it is possible to launch a boat.

Wetland vegetation

Pockets of emergent species on occasional soft shores occupied 15% of the lake margin. Dominant species included *Schoenoplectus tabernaemontani*, *Baumea articulate*, *Baumea juncea*, *Eleocharis acuta*, *Isolepis prolifer*, *Typha orientalis* and *Eleocharis sphacelata*. The sheltered lagoon had a dense fringe of emergents. Exposed turf communities were common just above the water line and included regionally significant *Myriophyllum votschii*.

Submerged vegetation

Turf communities were well developed with *Lilaeopsis novae-zelandiae* and the nationally threatened *Trithuria inconspicua* co-dominants. There was a very significant *T. inconspicua* habitat within this lake, apparently the largest population of this species in Northland. Tall-growing native species, *Potamogeton cheesemanii* and *P. ochreatus* were common. The exotic species *Egeria densa*, with lesser amounts of *Elodea canadensis*, were widespread but were not having a major impact on native vegetation at three of the five profiles. *Utricularia gibba* was present but prolific only in the sheltered lagoon where it covered dense charophyte beds. Charophytes were the dominant vegetation in much of the lake with *Chara fibrosa* the most abundant species.

LakeSPI

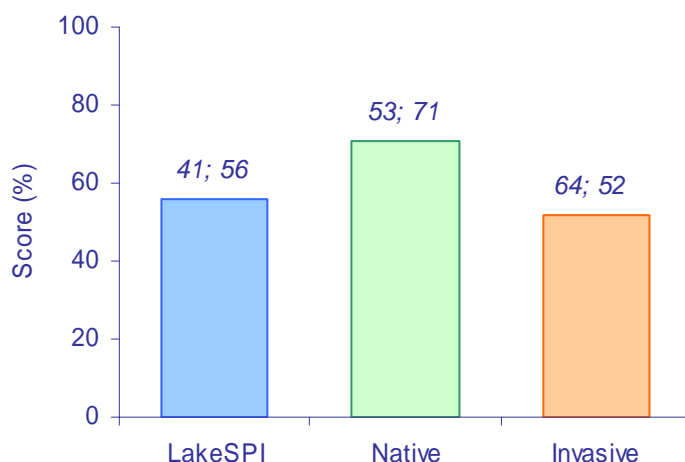


Figure: 2007 LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right) with 2005; 2007 values shown respectively, values shown indicating a marked improvement in the lake.

The LakeSPI Index has improved markedly. A closer look at the difference since 2005 found that charophyte meadows were limited to around 6 m deep in 2005 but in 2007 extended to around 10 m. Such a large increase in native cover also reduced the Invasive Index as it occupied a smaller % of the total vegetation. Water clarity in the lake is likely to have improved or perhaps the lake has not stratified in 2007 but was in 2005.

Water birds

Limited marginal vegetation provides limited cover for resident water birds although good water clarity and submerged vegetation would attract feeding birds. No birds were seen during the field visit but Logan Forrest recorded a total of 19 aquatic birds from Lake Rotokawau including the nationally endangered bittern (*Botaurus poiciloptilus*) and regionally significant dabchick (*Poliocephalus rufopectus*) and scaup (*Aythya novaezeelandiae*).

Fish

Good habitat for fish. Common bully (*Gobiomorphus cotidianus*) and the rare dwarf inanga (*Galaxias gracilis*) were observed in this lake, with NIWA FBIS records of these species and also shortfin eel (*Anguilla australis*).

Aquatic invertebrates

Abundant freshwater mussels (*Hyridella menziesii*), leeches (*Richardsonianus mauianus*), and *Potamopyrgus antipodarum* snails.

Changes in indicators

Other surveys were carried out in 1985, 1988, 2001, and 2005. Depth limits of the vegetation have varied between 8.5 and 6.0 m and are currently at 10.5 m. Charophytes grew to a maximum depth of 7.6 m in 2001, now 10.5 m. The exotic weeds *E. densa* were first reported in 1993 and *E. canadensis* in 2001 and both were common throughout the lake with *E. densa* probably having reached its maximum impact in the 2007 survey. *Utricularia gibba* was reported for the first time in 2007.

Threats

Ceratophyllum demersum introduction would be the greatest threat to the high ecological values. *C. demersum* is invasive in clear water low-nutrient lakes (e.g., Taupo, Tarawera) and would pose a much greater threat to this lake than *E. densa*.

Management recommendations

Annual pest plant surveillance at access points.

Lake condition monitoring every 5 years.

6.11 Lake Roto-otuaauru / Swan, (Pouto), NRC Lake No. 355; surveyed in 2005 and 2009



Plate: Lake Roto-otuaauru (Swan) showing access (centre foreground) and the lake catchment.

Summary

Overall ranking

Moderate: Highly degraded by presence of invasive plant pests. It has the rare fish *Galaxias gracilis*, and several threatened birds utilise the lake margins.

Threats

Already has the worst invasive weeds. Lake could ‘flip’ into an algal dominated lake.

Management recommendations

Invasive species *Egeria densa* and *Ceratophyllum demersum* need containment urgently and if possible, eradication. Options for eradication have been considered and grass carp were introduced in May 2009. Ongoing monitoring is recommended.

Description

The lake (1702249E, 5978792N) is 17.4 ha and is 5.5 m deep. The catchment was mostly pasture, with 30% pine plantation and some areas of scrub. The lake perimeter was fenced. Access is by 4-WD across private land and small boat launching is possible.

Wetland vegetation

Emergent species surrounded about 75% of the lake forming a dense fringe about 5 to 10 m wide of *Eleocharis sphacelata* (to 2 m tall) with a mix of *Eleocharis acuta*, *Schoenoplectus tabernaemontani*, *Baumea articulata* and *Typha orientalis* also present.

Exposed turf areas contained large mats of the 'Regionally Rare' *Gratiola sexdentata*, and also *Triglochin striata* and *Myriophyllum votschii*. The invasive alligator weed (*Alternanthera philoxeroides*) was present at low cover in this area.

Submerged vegetation

At a few locations a wide range of turf species were present with *Glossostigma elatinoides* the dominant species. The rare plant *Hydatella inconspicua* has not been reported since 1988. In 2009 charophytes persisted in shallow water on the northern shore of the main body of the lake but have been displaced from deeper depths by invasives and no charophyte meadows existed below 1.8 m deep. The submerged vegetation was dominated by tall-growing invasive species *Egeria densa* and *Ceratophyllum demersum*. *E. densa* was first reported in the lake in 1992, *C. demersum* was first recorded in the 2005 survey.

Utricularia gibba heavily covered much of the egeria in 2009.

LakeSPI

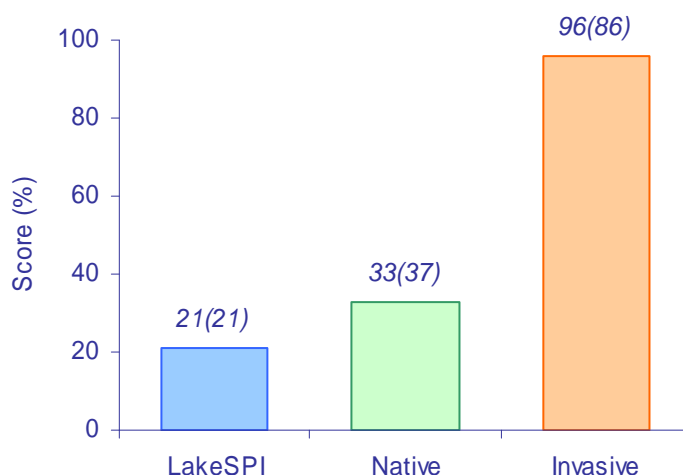


Figure: LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right) with 2005 scores in brackets.

A very low LakeSPI score of 21% as *E. densa* and *C. demersum* have greatly reduced native values in the lake.

Water birds

Fencing of the lake to exclude cattle and the large emergent beds surrounding much of this lake have created a desirable habitat for many water birds. Large numbers of black swan (*Cygnus atratus*) and mallard (*Anas platyrhynchos*) were recorded. Threatened species recorded from the lake include the nationally endangered bittern (*Botaurus poiciloptilus*) and regionally significant dabchick (*Poliocephalus rufpectus*) and fernbird (*Bowdleria punctata vealeae*).

Fish

The presence of dense weed beds may cause dissolved oxygen depletion and reduce available habitat for fish species. In shallower water, the large emergent beds provide good habitat for some species. Dwarf inanga (*Galaxias gracilis*), bully (*Gobiomorphus cotidianus*) and shortfin eels (*Anguilla australis*) were recorded on the field visit.

Following this visit grass carp were introduced (May 2009).

Aquatic invertebrates

Large numbers of invertebrates including freshwater mussels (*Hyridella menziesi*) were recorded.

Changes in indicators

Previously this was a native lake of high value, with charophyte meadows and the tall-growing species *Potamogeton ochreatus* dominant. Now native species are nearly all displaced by the pest plants *E. densa* and *C. demersum*.

Threats

E. densa and *C. demersum* cover most of the lake and are at or near the surface. These species pose a significant risk to other lakes in the region, particularly nearby 'outstanding' Lakes Humuhumu and Kanono. Boat access to Lake Swan with a 4-WD is easy across private land.

Alligator weed is apparently only present at the access point and threatens the marginal vegetation of this lake.

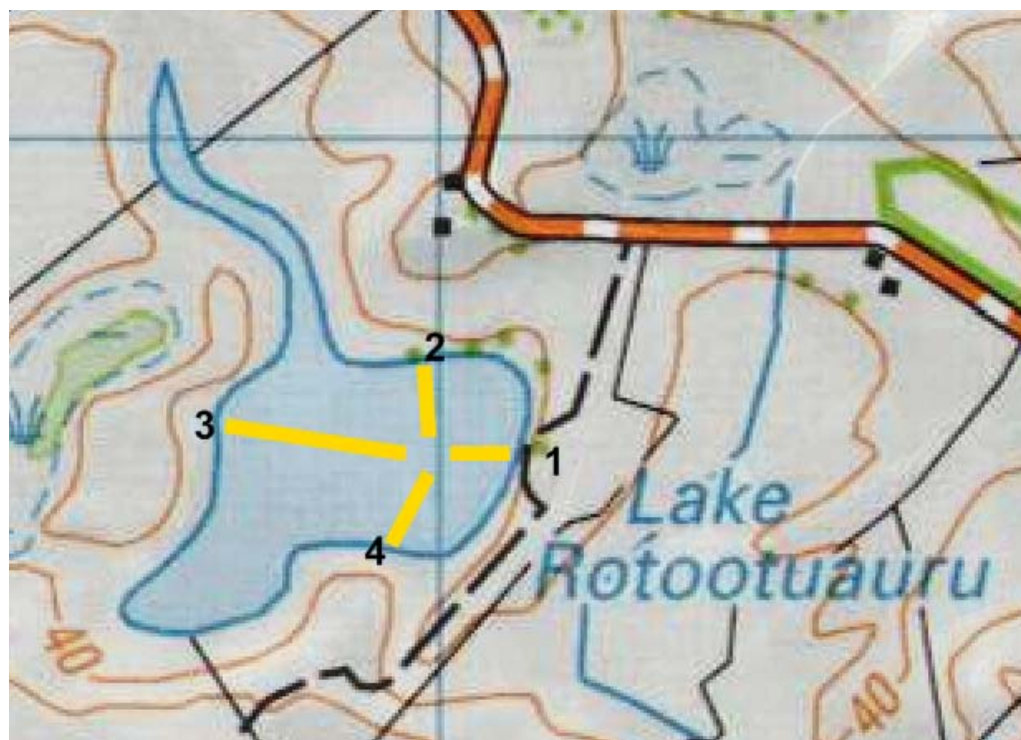
Management recommendations

Recommendations to isolate the lake to contain the submerged invasive weeds have been followed to protect the nearby pristine lakes. Eradication of submerged weeds by introduction of grass carp has been implemented and this eradication strategy will be monitored.

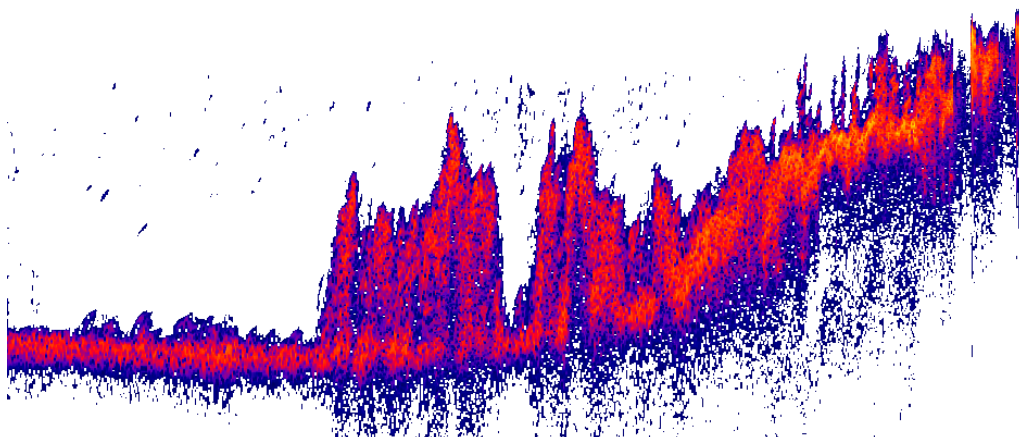
A survey of alligator weed abundance and management (if appropriate) is recommended.

Baseline vegetation pre-grass carp survey April 2009

A sonar survey of the lake was conducted along the four SCUBA profiles as shown on the map. In addition observations were made of the vegetation in the north arm.

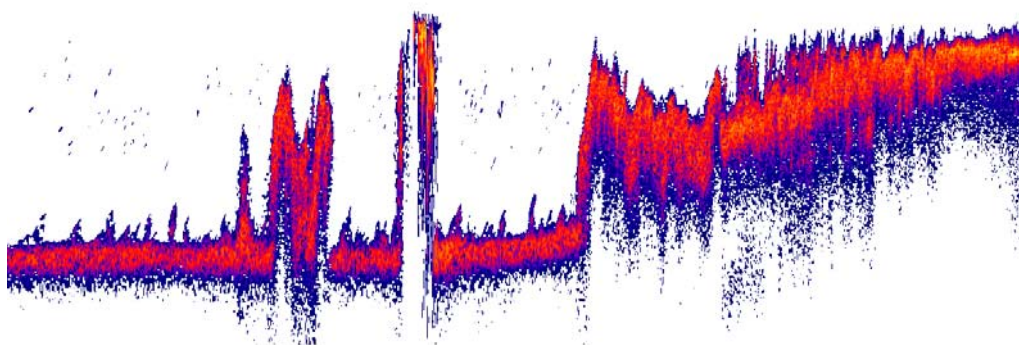


Map: Lake Roto-otuaauru showing the location of the four profile sites.



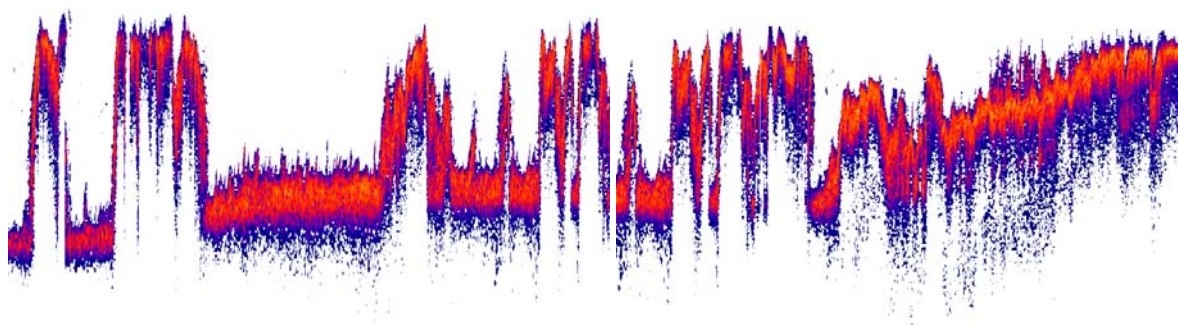
Sonar image Profile 1:

The sonar image shows an outline of the weed beds in April 2009. This transect is about 120 m long and the maximum depth is 5 m to the top of the red band (soft sediment) at left of image. See the map of Lake Roto-otua for profile location.

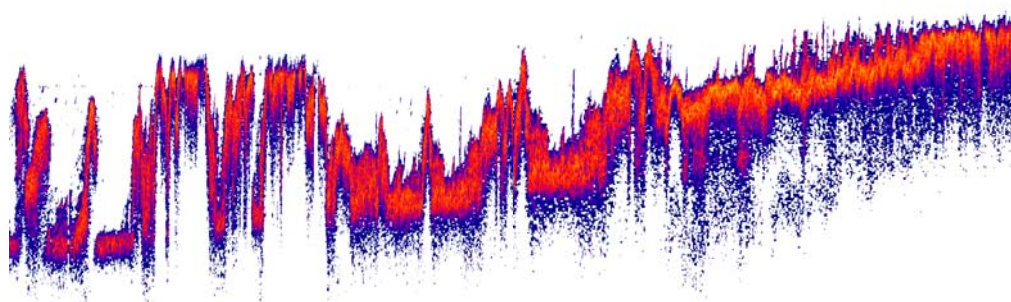


Sonar image Profile 2:

The sonar image shows an outline of the weed beds in April 2009. This transect is about 150 m long and the maximum depth is 5 m to the top of the red band (soft sediment) at left of image. See the map of Lake Roto-otua for profile location.



Sonar image Profile 3: The sonar image shows an outline of the weed beds in April 2009. This transect is about 350 m long and the maximum depth and height of weed bed is 5 m to the top of the red band (soft sediment) at left of image. See the map of Lake Roto-otua for profile location.



Sonar image Profile 4: The sonar image shows an outline of the weed beds in April 2009. This transect is about 160 m long and the maximum depth and height of weed bed is 5 m to the top of the red band (soft sediment) at left of image. See the map of Lake Roto-otua for profile location.

In ground truthing these profiles it was noted that kuta beds (*Eleocharis spachelata*) dominated the emergent vegetation on the margins of the lake. Egeria dominated the vegetation on profiles from about 2 m water depth (near the outer margin of the kuta beds) to 2.8 m and hornwort dominated from 2.8 m to 5 m, the maximum depth the submerged vegetation grew to. Egeria mostly grew to about 1 m of the surface (swan browsed) whereas hornwort was often surface-reaching even from 5 m water depth. Profile 2 had the only significant native submerged vegetation which were made up mainly of charophytes and restricted to less than 1.8 m water depth. Hornwort was the dominant plant in the northern arm with a large area of egeria at the entrance.

6.12 Lake Rotopouua (Pouto), NRC Lake No. 348; first surveyed in 2008.



Plate: Lake Rotopouua.

Summary

Overall ranking

Outstanding: Good intact native emergent margin and submerged vegetation with some endangered biota. *Utricularia gibba* present.

Threats

Introduction of invasive species. Nutrient enrichment.

Management recommendations

Lake condition monitoring every 5 years.

Description

Lake Rotopouua (1699531E, 590047N) is a small (<5ha) lake with a maximum depth c. 9 m. The lake is ponded between dunes to the west and weathered hill country, with heavy clay soils, to the east. The catchment is primarily plantation pine forestry manuka/kanuka scrub and fenced pasture. Access is across farm land from the Pouto

Road and the lake has limited boat access (carry across a fence) and is fenced off from stock.

Wetland vegetation

The lake is completely fringed with emergent species. The dominant emergent species are *Eleocharis sphacelata*, *Typha orientalis*, *Baumea juncea*, *B. articulata*, *Schoenoplectus tabernaemontani* and *Carex secta* growing from the lake margin to ~1.0 m or less. The nationally threatened fern *Thelypteris confluentis* was common growing amongst emergent sedges.

Submerged vegetation

Turf communities were not recorded due to extensive and dense emergent beds. Some *Utricularia gibba* was found in shallow water amongst emergent sedges. Tall-growing *Potamogeton ochreatus* was common with charophyte meadows dominated by *Nitella* aff. *cristata* and *Chara australis* to about 6 m.

LakeSPI

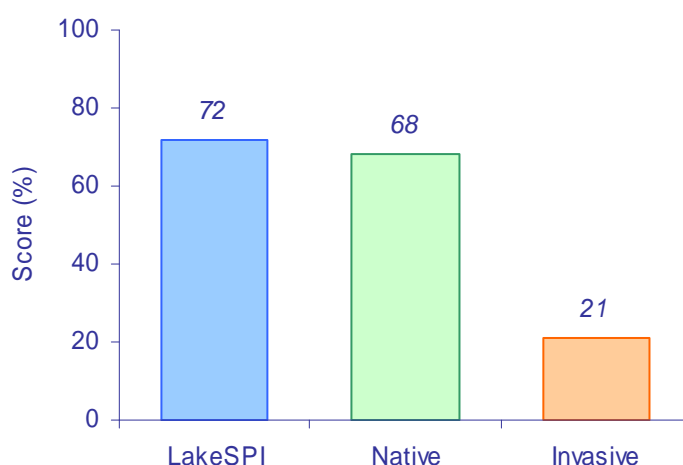


Figure: LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right).

The invasive impact is from *Utricularia gibba*; otherwise the lake has a high LakeSPI.

Water birds

Extensive emergent vegetation and a relatively isolated lake provide good habitat for water birds. The nationally endangered bittern (*Botaurus poiciloptilus*) and regionally threatened dabchick (*Poliocephalus rufopectus*) were seen.

Fish

Abundant common bullies (*Gobiomorphus cotidianus*), were observed during vegetation surveys. The endangered dwarf inanga (*Galaxias gracilis*) were reported as common in this lake (Rowe and Chisnall 1997), but a thorough search by DoC Northland Conservancy staff could not relocate this species.

Aquatic invertebrates

Many dead shells of the freshwater mussels (*Hyridella menziesi*) were common throughout the lake but no live ones were found. It is likely the lake has had a recent anoxic event. Snails, *Potamopyrgus antipodarum*, as well as freshwater sponges and hydra were common.

Changes in indicators

This was the first time this lake has been surveyed.

Threats

The restricted access to this lake reduces the threat of introduction of pest plants. Should invasive species be introduced to the lake it is likely that they would displace much of the current native vegetation. The lake appears to have deteriorated recently with a mass extinction of mussels and apparently dwarf inanga, probably caused by the lake going anoxic for a period. This indicates increased nutrient input (from farming or forestry?) and resulting algal loads in the lake in recent times.

Management recommendations

An assessment of lake condition at 5 yearly intervals is recommended.

Annual monitoring of water quality should be undertaken to determine the extent of nutrient enrichment.

6.13 Lake Rototuna (Pouto), NRC Lake No. 328; surveyed in 1988, 2001, 2005 and 2007.



Plate: Lake Rototuna in a pastoral catchment with some pines on the western margin.

Summary

Overall ranking

High: A lake with retired margins, mostly vegetated with endangered biota, and pest fish established.

Threats

Invasive submerged weeds would displace the existing vegetation, though access is now more difficult. Possibly issues with road run-off entering lake via a culvert with turbidity/nutrient issues. The invasive reed sweet grass (*Glyceria maxima*) threatens the lake margins.

Management recommendations

Lake condition monitoring every 2 to 3 years. Eradicate *Glyceria maxima*.

Description

A dune lake 6 ha in area and 5.1 m deep. The catchment is pasture with some pine trees, and the margin fenced since 1999 with a thick mat of kikuyu surrounding the lake. No inflow or outflow streams. Adjacent to main Pouto Road, but fenced off with padlocked gate.

Wetland vegetation

About 50% of the shoreline had emergent species, with *Typha orientalis*, *Eleocharis sphacelata* and *E. acuta*, and *Schoenoplectus tabernaemontani* forming a narrow band 5 - 10 m wide. *E. sphacelata* beds extended to 1.8 m deep, the other species < 0.5 m. The invasive reed sweet grass (*Glyceria maxima*) was found for the first time in 2007. It was located amongst raupo on the south-eastern shore of the lake.

Submerged vegetation

Turf species were present around about half of the lake, with *Glossostigma elatinoides* and *Lilaeopsis novae-zelandiae* most common but always at low covers (<26%). Tall-growing native species were present on all profiles with *Potamogeton ochreatus* the most abundant (26-95% median cover) and *Myriophyllum triphyllum* widespread and occasionally abundant. No tall-growing exotic species were present except *Potamogeton crispus*, found in 2005 but not seen in 2007. Charophytes were the dominant vegetation in the lake, with *Nitella* aff. *cristata* at high (>75%) average cover at all profiles and composing the deepest growing vegetation to 5.0 m. *Chara australis*, *Nitella pseudoflabellata* and *N. hyalina* were also recorded. The nationally 'At-risk' *Stuckenia pectinata* was recorded in 2005 but not found in 2007.

LakeSPI

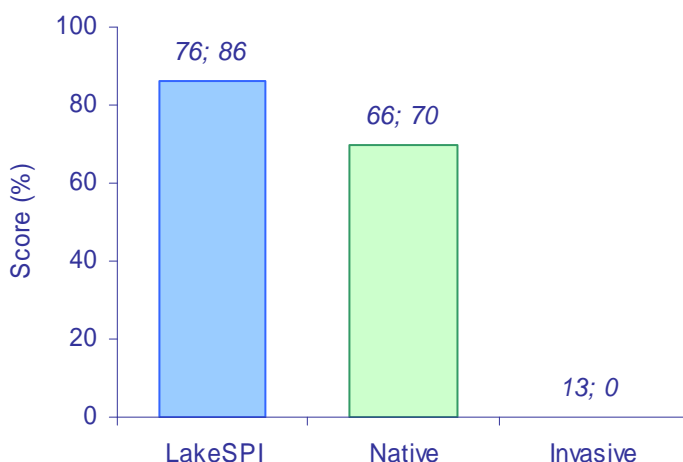


Figure: 2007 LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right) with 2005; 2007 values shown respectively.

The improvement in lake condition was due to *P. crispus* presence in 2005, but not recorded in 2007. The lake had a high LakeSPI Index of 86% with no invasive macrophyte impact.

Water birds

Dabchick (*Poliiocephalus rufopectus*), regionally significant, and scaup (*Aythya novaezeelandiae*) were noted with 18 other common birds, mostly black swans (*Cygnus atratus*) and paradise shelduck (*Tardorna variegata*).

Fish

Nationally threatened dwarf inanga (*Galaxias gracilis*) were recorded by the NIWA FBIS database although none were seen during the survey. Common bully (*Gobiomorphus cotidianus*) and exotic *Gambusia affinis* were observed. Rudd (*Scardinius erythrophthalmus*) were also reported.

Aquatic invertebrates

The introduced snail *Physella acuta* was recorded during the vegetation survey.

Changes in indicators

Previous surveys were conducted in 1988, 2001 and 2005 survey. The 1988 survey had much reduced bottom limits with the maximum depth of vegetation only as 2.5 m, but subsequent surveys have shown the lake to be mostly vegetated with only a small area deeper than 5 m beyond the bottom limit of the vegetation.

Threats

The vegetation is native dominated and introduction of other weed species is now less likely due to fencing of access points and the diligence of landowners. The sprawling emergent weed reed, sweet grass, threatens much of the marginal vegetation.

Pest fish (gambusia and rudd) are of concern. The possible loss of dwarf inanga from Lake Kai-iwi, may have resulted from gambusia impacts, and the recent introduction of these pest fish may have similar impacts in Lake Rototuna. Rudd are herbivorous in large part and have been implicated in loss of vegetation in nutrient stressed lakes such as this one, however they have been present in the lake for around a decade with little apparent impact.

Management recommendations

Lake condition monitoring every 2-3 years.

Eradicate reed sweet grass from the lake margin using a grass-specific herbicide.
Investigate dwarf inanga recovery.

6.14 Lake Waingata (Pouto), NRC Lake No. 371; surveyed in 2005.



Plate: Lake Waingata surrounded by pasture with emergent vegetation completely lacking.

Summary from 2001 (lake not dived 2005)

Overall ranking

Low: Mostly de-vegetated (both submerged and emergent) by grass carp, but the endangered dwarf inanga are probably still abundant.

Threats

Low risk of introduction and establishment of invasive weeds. Water quality poor.

Management recommendations

No lake condition monitoring until grass carp removed. Advocate removal of grass carp.

Description

A small (9 ha) dune lake (1703256E, 5976471N) of 9.5 m depth, set in a pastoral catchment. Access through 2 km private farmland, mostly on a well-formed track and requiring 4-WD if wet. Small boats can be launched with 4-WD from northern lake edge.

Wetland vegetation

No emergent vegetation. The pest plant *Alternanthera philoxeroides* was recorded in several areas around the lake in 2001.

Submerged vegetation

Casual observations made in 2005 showed turf community was common, with *Lilaeopsis novae-zelandiae*, *Elatine gratioloides* and *Glossostigma elatinoides* the dominant turf species. These species and 6 others were found in 2001, with the turf extending between the lake margin and 1 m deep with scattered plants of *Chara australis* extending to 1.9 m.

LakeSPI

LakeSPI score is not generated from previous survey data.

Water birds

The lake provides minimal bird habitat. Twenty scaup (*Aythya novaezeelandiae*) were seen on the lake in 2005. Early (pre-1995) records from this lake included the regionally significant dabchick (*Poliocephalus rufopectus*).

Fish

The lake was stocked with rainbow trout (*Oncorhynchus mykiss*) in the 1950's until 1980, but have since died out. The nationally endangered dwarf inanga (*Galaxias gracilis*) is present in the lake, and was recorded as abundant in 1997. Common bully (*Gobiomorphus cotidianus*) were the only other fish present in Lake Waingata until 67 grass carp (*Ctenopharyngodon idella*) were introduced in 1995 to eradicate the elodea.

Aquatic invertebrates

No invertebrates were recorded in 2001.

Changes in indicators

Prior to grass carp introduction there was a marginal emergent cover of 77% of the shoreline dominated by *E. sphacelata*, but also including *Baumea articulata*, *B. arthropphylla*, *E. acuta*, *Schoenoplectus tabernaemontani* and *Typha orientalis*. Thirteen submerged species were reported including the nationally endangered *Trithuria inconspicua* and *Nitella* aff. *cristata* which grew to a maximum depth of 6 m along with *C. australis*. The exotic weed *Elodea canadensis* was present in Lake Waingata until 1996, after which it was eliminated by grass carp browsing. Grass carp have subsequently eliminated all emergent vegetation and restricted submerged vegetation to shallow turfs.

Threats

The isolation of the lake and absence of eels provide a low risk of introduction and establishment of invasive weeds is most unlikely due to grass carp browsing pressure. Water quality is currently poor.

Management recommendations

No lake condition monitoring until grass carp removed.

Advocate removal of grass carp.

6.15 Lake Wainui (Pouto), NRC Lake No. 305; surveyed in 2001, 2005 and 2007.



Plate: Lake Wainui viewed from the south boat access point. Note the steep sided pasture catchment.

Summary

Overall ranking

Moderate to High: A small lake with native submerged vegetation, prone to nutrient enrichment.

Threats

Risk of pest introduction is low, but should these be introduced there would be major impacts on the lake. Nutrient enrichment and nutrient release from anoxic bottom sediments from stratification turnover.

Management recommendations

Lake condition monitoring every 5 years. Advocate fencing and re-vegetation of steep sloping margins.

Description

A small (4.8 ha) dune lake (1679414E, 6004475N) with a maximum depth of 11.8 m and situated in a pastoral catchment with cattle grazing to the lake edge. No inflow or outflow streams. Access across 1 km private farmland by 4-WD, difficult with a boat.

Wetland vegetation

Narrow (2 to 5 m) marginal fringe on ~75% of shoreline dominated by *Schoenoplectus tabernaemontani* with some areas of *Typha orientalis*, *Baumea articulata*, *Eleocharis acuta* and *E. sphacelata* growing to a maximum depth of 1.5 m. Apart from the western shore where emergent vegetation grew to the lake edge, emergents in Lake Wainui were disturbed by cattle access on the shoreline, with a zone of bare pugged soil surrounding the lake (Plate). Mostly annual weeds dominated this zone although one plant of the regionally significant native sedge *Fimbristylis velata*, a new record, found for the first time.

A new record the pest plant primrose willow, (*Ludwigia peploides*) formed floating mats at the south end of the lake. A non-weedy exotic, swamp lily (*Ottelia ovalifolia*), was also present with both submerged and floating leaved forms.

Submerged vegetation

No turf species were noted and charophyte meadows composed mostly of *Nitella* aff. *cristata* and *Chara australis* grew to 5.9 m deep with tall-growing native species mostly *Potamogeton ochreatus* (to 3.5 m deep), and some *P. cheesemanii* and *Myriophyllum triphyllum* dominated the submerged vegetation. No exotic submerged species were recorded.

LakeSPI

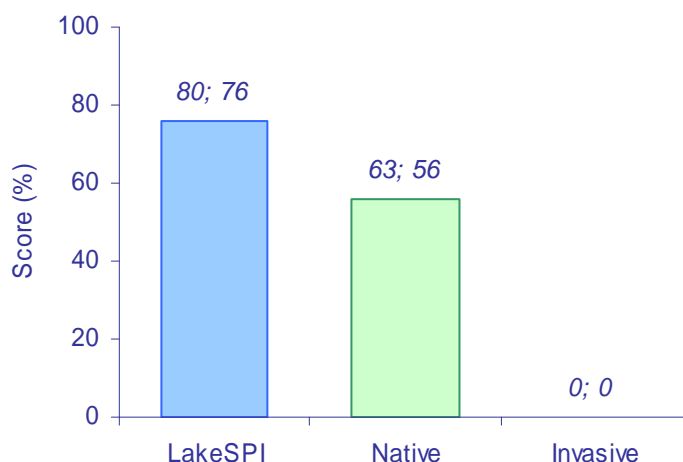


Figure: 2007 LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right) with 2005; 2007 values shown respectively.

A high LakeSPI score of 76% is driven by a totally native vegetation, but moderated by poor water clarity and shallow depth limits.

Water birds

Limited marginal habitat, due to grazing. Four regionally rare dabchick (*Poliocephalus rufpectus*) and black swan (*Cygnus atrata*) and paradise shelduck (*Tadorna variegata*) were seen during the 2007 field visit. Earlier reports include the nationally endangered bittern (*Botaurus poiciloptilus*) and regionally significant scaup (*Aythya novaezeelandiae*).

Fish

No species recorded.

Aquatic invertebrates

Leeches (*Richardsonianus mauianus*), backswimmers (*Sigara arguta*) and *Physella acuta* snails were common.

Changes in indicators

In 2001 submerged vegetation reached a depth of only 2.6 m whilst bottom limits of up to 5.6 m were recorded in 2005 and 5.1 in 2007. Similar species composition was recorded on all surveys.

Threats

An indigenous submerged vegetation with tall-growing natives, is very susceptible to invasion by tall-growing exotic species. Risk of introduction is low. The catchment is grazed pasture with little buffer to run-off entering the lake.

Management recommendations

Lake condition monitoring every 5 years.

Recommend fencing lake and enhance/stabilise the steep catchment with marginal plantings.

6.16 Lake Wairere (Pouto), NRC Lake No. 339; surveyed in 2005



Plate: Lake Wairere surrounded by rough pasture and scrub to the west (left) and steep scrub covered cliffs to the east. Note the raupo (*Typha orientalis*) dominated emergent vegetation.

Summary

Overall ranking

Moderate-High: Isolated and set within mostly indigenous vegetation, with native aquatic vegetation, but algal bloom, endangered bird spp. present.

Threats

Low risk of introduction of invasive weeds. Water quality poor.

Management recommendations

Lake condition monitoring every 5 years.

Description

This narrow (~2 km long, <100 m wide) dune lake (1691256E, 5985189N) is 16.5 ha in size and at least 2 m deep. It has a margin of steep scrub covered cliff to the east and rough pasture, wetland and mobile sand dunes to the west. Access is through 3 km

of pine forestry roads and rough pasture, mostly on a well-formed track requiring 4-WD. No boat access.

Wetland vegetation

Extensive wetlands to the west of lake with *Typha orientalis*, *Schoenoplectus tabernaemontani*, *Baumea articulata*, *B. arthropphylla*, *Eleocharis acuta*, *E. sphacelata* and *Carex secta* common. The lake was fringed with a dense 5-10 m bed of *T. orientalis*.

Submerged vegetation

Vegetation comprised a dense 0.4 m tall meadow of *Chara australis* extending to over 2 m deep with a few shoots of *Potamogeton cheesemanii* present.

LakeSPI

Reconnaissance only – no LakeSPI score generated.

Water birds

The lake and surrounding wetlands provide excellent bird habitat. DoC SSBI records (1977) of the nationally threatened bittern (*Botaurus poiciloptilus*) and regionally threatened dabchick (*Poliocephalus rufopectus*) and scaup (*Aythya novaezeelandiae*). A spotless crane (*Porzana tabuensis plumbea*) was seen in the wetland during the field visit.

Fish

Poor underwater visibility, no fish seen.

Aquatic invertebrates

Poor underwater visibility, no invertebrates seen.

Changes in indicators

First surveyed in 2005.

Threats

The isolation of the lake provides a low risk of introduction of invasive weeds but establishment is likely should this occur. Water clarity is currently poor due to a dense planktonic algal bloom, probably due to nutrient addition from the forestry area to the east.

Management recommendations

Lake condition monitoring every 5 years.

6.17 Lake Whakaneke (Pouto), NRC Lake No. 390; surveyed in 2005 and 2007



Plate: Lake Whakaneke surrounded by manuka scrub with dense emergent vegetation dominated by *Typha orientalis* and *Schoenoplectus tabernaemontani*.

Summary

Overall ranking

High: Isolated and set within indigenous vegetation and dense emergent margins, with excellent water bird habitat and good populations of several endangered birds, but with no submerged vegetation and poor water clarity.

Threats

Low risk of introduction of invasive weeds.

Management recommendations

Lake condition monitoring every 5 years.

Description

A dune lake (1696559E, 5973120N) of 20.5 ha size, about 2.5 m deep, set within a manuka scrub covered area. There were no inflow streams but it appears that water flows south from Lake Mokeno via areas of wetland, with an outflow at the entry point on the western shore, discharging to the entrance to Kaipara Harbour via an extensive wetland. A dune face is situated to the east and rough pasture, wetland and mobile sand dunes to the west. Access is by 4-WD through forestry and Māori land (15 km of tracks, some very boggy) requiring passage through a locked gate. No boat access.

Wetland vegetation

The lake was fringed by dense 10-20 m wide beds of *Typha orientalis* and *Schoenoplectus tabernaemontani* extending from the shore to 0.5 m deep. *Eleocharis sphacelata*, *E. acuta* and *Baumea articulata* were present in the emergent zone, with the indigenous *Persicaria decipiens* and *Isachne globularis* commonly sprawling amongst these emergent beds.

Submerged vegetation

No submerged vegetation was found in 2007 and only occasional stalks of *Myriophyllum triphyllum* and *Chara australis* fragments were found in 2005.

LakeSPI

No LakeSPI score generated as vegetation not present.

Water birds

The lake and surrounding wetlands provide excellent bird habitat. The nationally rare bittern (*Botaurus poiciloptilus*) and 20 of the regionally threatened dabchick (*Poliocephalus rufopectus*), 10 scaup (*Aythya novaezeelandiae*) and a spotless crake (*Porzana tabuensis plumbea*) were observed from the lake margin. Other threatened species reported include the regionally significant banded rail (*Rallus philippensis assimilis*) and fernbird (*Bowdleria punctata vealeae*). Brown teal (*Anas aucklandica chlorotis*) ‘critically endangered’, were recorded in this area.

Fish

Common bullies (*Gobiomorphus cotidianus*) were seen.

Aquatic invertebrates

Backswimmers (*Sigara arguta*), snails *Potamopyrgus antipodarum* and *Physella acuta* (exotic species) were present with a large number of chironomids.

Changes in indicators

No submerged plant indicators to monitor. The lake continues to support good populations of a number of endangered birds.

Threats

Isolation provides a lower risk of introduction of invasive weeds and establishment is unlikely should this occur as water clarity is currently very low.

Management recommendations

Lake condition monitoring every 5 years.