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 (*Poliocephalus 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. arthrophylla, 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 and 2010 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

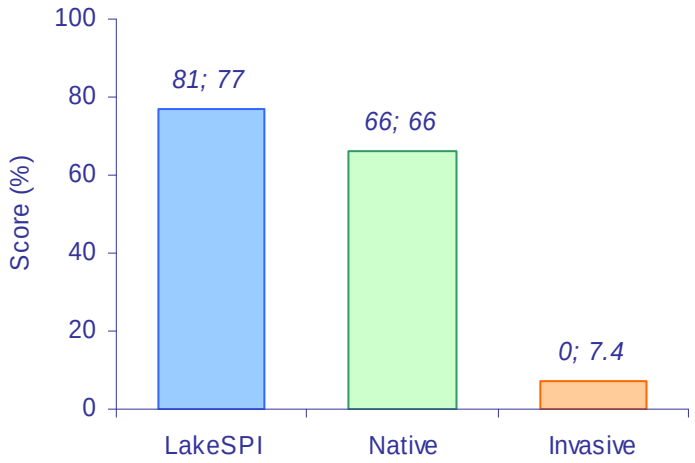

Figure: 2007 LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right) with 2005; 2007 values shown respectively.

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 (*Poliocephalus 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 crake (*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 native biodiversity value 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 native biodiversity value 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

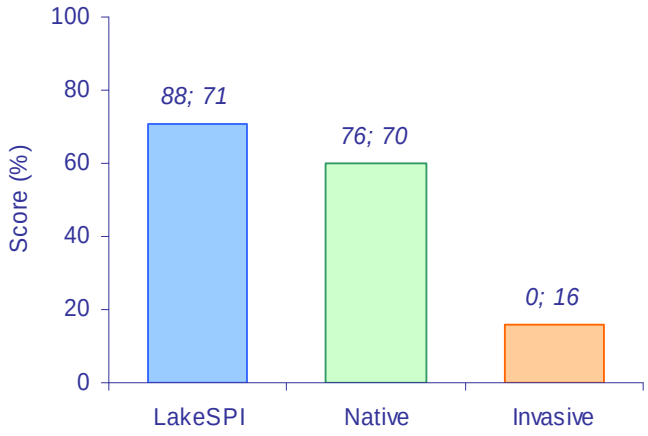

Figure: 2007 LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right) with 2005; 2007 values shown respectively.

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 novaezeelandiae*) 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 native biodiversity value 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 native biodiversity value 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

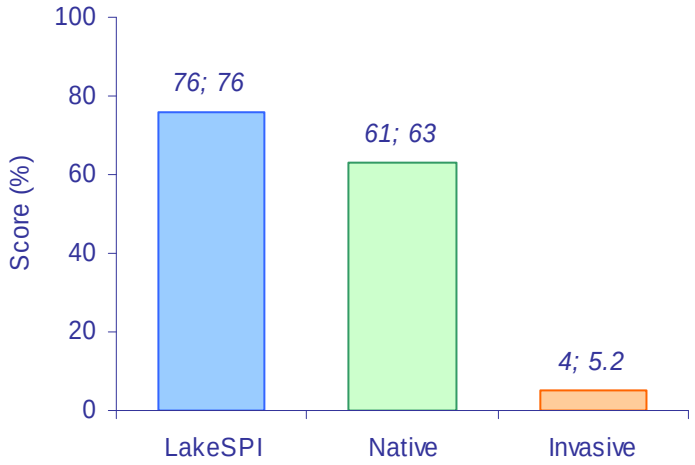

Figure: 2007 LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right) with 2005; 2007 values shown respectively.

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 novaezeelandiae*) 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 native biodiversity value 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 native biodiversity value 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 platyrhynchus*), 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 native biodiversity value 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

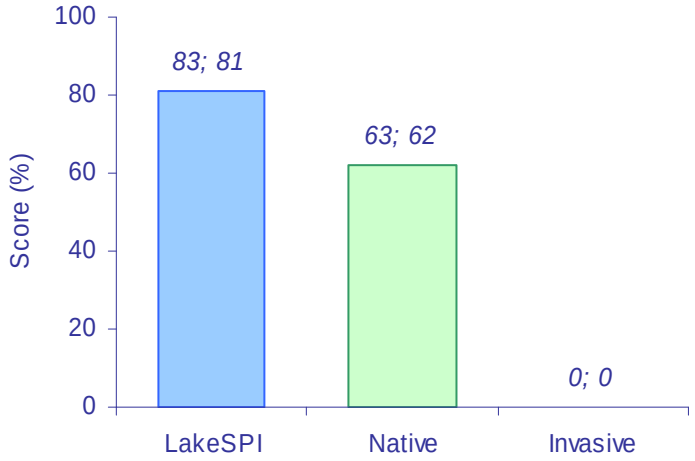

Figure: 2007 LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right) with 2005; 2007 values shown respectively.

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 native biodiversity value 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 native biodiversity value 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. arthrophylla, B. rubiginosa, B. juncea, Eleocharis sphacelata, E. acuta, Schoenoplectus tabernaemontani, Carex secta* and *Phormiun 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. arthrophylla* /*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

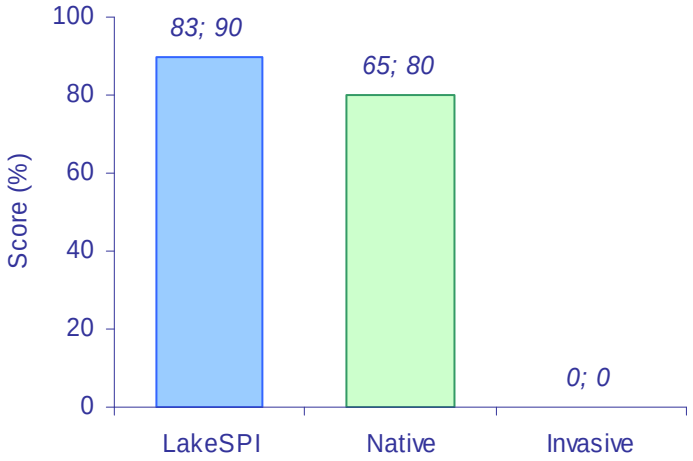

Figure: 2007 LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right) with 2005; 2007 values shown respectively.

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 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. 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 native biodiversity value 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*. Currently no monitoring recommended.