5. Kai-Iwi and north Dargaville lakes

5.1 Freidrich's Lake (north Dargaville), NRC Lake No. 282; surveyed in 2005

Plate: Freidrich's Lake showing the artificially maintained area of open water evidenced by the straight line of emergent kuta (*Eleocharis sphacelata*).

Summary

Overall ranking

Low: A shallow, modified lake in a pasture catchment.

Threats

The only lake surveyed south of Kaitaia with the invasive weed *Utricularia gibba*. This site is thus a possible threat to other waterbodies in the vicinity. *Alternanthera philoxeroides* may spread further and have a major impact in the future. Further pest incursions are unlikely.

Management recommendations

No lake native biodiversity value monitoring recommended.

Description

A small (3.5 ha) dune lake (1668632E, 6022433N)only 2-3 m deep. Pasture catchment grazed by cattle to lake edge in some areas, fenced elsewhere. No inflows or outflows. Access is across private farmland, and can be reached by 2WD in dry weather.

Wetland vegetation

Eleocharis sphacelata was the dominant emergent vegetation and would fill the lake if the owner had not sprayed it. The straight edge to the E. sphacelata beds was taken as evidence of spraying, presumably for duck hunting purposes. Biodiversity has been enhanced by this action as it creates habitat for submerged species. The invasive weed A*lternanthera philoxeroides* was well established amongst marginal kikuyu (*Pennisetum clandestinum*).

Submerged vegetation

No turf species, the submerged vegetation was dominated by *Chara australis* and there were two native tall-growing species, *Potamogeton cheesemanii* and *P. ochreatus*. Plants grew across the deepest parts of the lake to less than 3 m deep. The exotic bladderwort *Utricularia gibba* was common in areas to 1 m deep where it sprawled over other vegetation. One shoot of the nationally endangered *Utricularia australis* was found.

LakeSPI

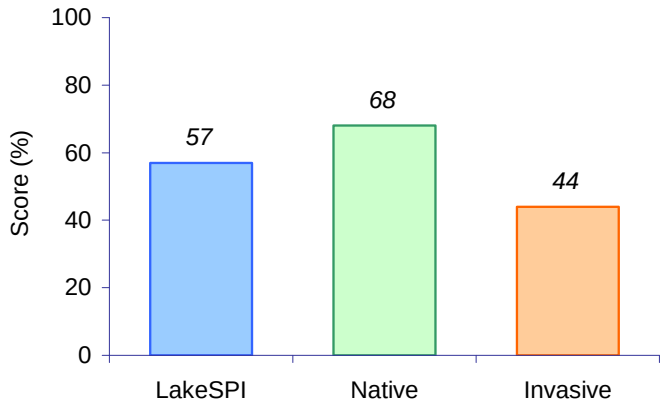

Figure: LakeSPI condition as % of potential score, native index, and invasive index from left to right.

The moderate LakeSPI score of 57% reflects the presence of the invasive *U. gibba* and its impact on native submerged vegetation. Profiles were limited so this LakeSPI assessment should be considered provisional.

Water birds

The areas of emergent vegetation provides moderate waterfowl habitat, with black swans (*Cygnus atratus*) and mallard (*Anas platyrhynchus*) the only species seen. There are 1980's records of the nationally threatened bittern (*Botaurus poiciloptilus*) and regionally important dabchick (*Poliocephalus rufopectus*).

Fish

Several shortfin eels (*Anguilla australis*) were seen.

Aquatic invertebrates

Freshwater sponges were noted on submerged vegetation.

Changes in indicators

This lake has no previous survey information.

Threats

A. philoxeroides and *U. gibba* were present, and both can be very invasive. Their impact on this lake was minimal at the time of survey but could increase in the future.

Tall-growing exotic pest weeds have potential to invade this lake if introduced, but risk of introduction is minimal.

The lake is unsuitable for boating, but eel fishing and shooting activities are likely.

Management recommendations

No monitoring for lake native biodiversity value required.

5.2 Lake Kai-iwi (Kai-iwi Lakes) NRC Lake No. 236; surveyed in 2005 and 2007

Plate: Lake Kai-iwi from the access point showing an extensive margin of emergent vegetation and the only sandy margin on the lake.

Summary

Overall ranking

Outstanding: A native plant dominated lake, no pest plants species present and presence of nationally rare plants.

Threats

Low risk of pest plant introduction but subsequent impact is likely. High impact from *Gambusia affinis* has contributed to the possible extirpation of the nationally threatened dwarf inanga. Moderate catchment risk is associated with pine plantation management.

Management recommendations

Lake native biodiversity value monitoring every 5 years, pest plant surveillance annually. Prevent uncontrolled access for boats.

Description

This dune lake (1659066E, 6036450N) is 22.6 ha in area, with a 16 m maximum depth. The lake margin is predominantly vegetated by scrub (70%) and (recently felled) pine plantation (30%), with pasture in the larger catchment. Minor drainage inflows from Lake Taharoa and at the south of the lake, but no outlet. There is poor roading access to this lake in the final approach and no formed boat ramp. Motorised boats are not permitted, though no obvious signage indicates this.

Wetland vegetation

Most of the lake had a wide (3-10 m) band of emergent vegetation, with *Apodasmia similis, Baumea arthrophylla* (especially on the exposed eastern shore), *B. articulata* and *B. juncea* were common in shallow water up to 0.7 m deep and an outer zone of *Eleocharis sphacelata* extended to 2.8 m deep in one transect. The invasive *Utricularia gibba* was noted amongst emergent vegetation in 2008 and 2009 surveillance surveys, but not in 2010.

Submerged vegetation

Turf plants occurred to 2 m depth in several locations with the nationally rare *Trithuria inconspicua* and two other species. Charophyte meadows extended from < 2 m to 13.7 m and were dominated by *Chara australis* (deeper extent), and by *C. fibrosa* to c. 9 m depth. *Potamogeton cheesemanii*, a native tall-vascular plant, frequently occurred at low covers to about 4 m water depth.

LakeSPI

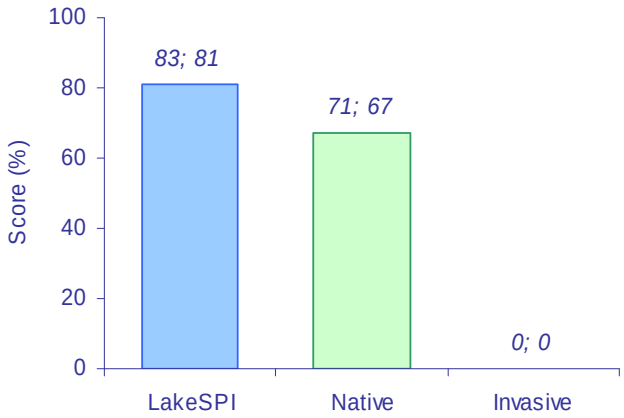

Figure: 2007 LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right) with 2005; 2007 values shown respectively.

The high LakeSPI score of 81% reflects the extent of vegetation development, the presence of several key native plant communities and absence of invasive exotic species.

Water birds

The isolated nature of much of this lake and extensive emergent and scrub vegetation provide good habitat for water birds, probably acting as a refuge from the human-mediated disturbance in the two adjacent lakes. Pied shags (*Phalacrocorax varius*) were noted during the field visit and there are earlier reports of large numbers of waterfowl utilizing this lake, including the nationally threatened bittern (*Botaurus poiciloptilus*) and regionally rare dabchick (*Poliocephalus rufopectus*).

Fish

Native fish records included common bullies (*Gobiomorphus cotidianus*) and dwarf inanga (*Galaxias gracilis*), although this nationally endangered species may be extinct in this lake. Exotic fish present were *Gambusia affinis*, rudd (*Scardinius erythrophthalmus*), and a stocked population of rainbow trout (*Oncorhynchus mykiss*).

Aquatic invertebrates

Invertebrates were abundant in the lake. The empty shells of freshwater mussels (*Hyridella menziesi*) were seen.

Changes in indicators

Fluctuations in the maximum depth of vegetation from 11.5 to 15 m depth are known from previous surveys. It is likely related to periods of anoxia in bottom waters, when conditions favour the establishment of a thermocline.

Threats

The lack of motorised boat traffic to this lake reduces the risk of pest plant introduction. However conditions are suitable for the establishment and growth of large vascular plants (e.g., presence of *P. cheesemanii*) and if pest plants were introduced they would be expected to establish and impact on lake values to some a significant extent. Impact of *U. gibba* needs monitoring, but is expected to be restricted to sheltered shallow-water sites amongst emergent reeds.

Rudd have been present in the lake since c. 1991, with little apparent impact on plants, however these herbivorous fish have been implicated in loss of vegetation elsewhere, so remain a threat.

Pine plantation management in the catchment, harvesting practice and fertilizer usage, remains a threat to water quality and lake values. The recent harvest of pines has not impacted bottom vegetation limits which were 1 m deeper in 2007 than in 2005.

Management recommendations

Invasive pest plants probably pose a greater threat to this lake than the adjacent lakes and an annual surveillance of access points for pest plant incursion is advocated.

5.3 McEvoy's Lake (north Dargaville) NRC Lake No. 277; surveyed in 2005

Plate: McEvoy's Lake showing the pasture catchment and impacts of cattle access.

Summary

Overall ranking

Low: No submerged vegetation, cattle access has displaced emergent vegetation to deep water, *Gambusia affinis* present.

Threats

Few threats due to already degraded habitat.

Management recommendations

No management recommendations apart from cattle exclusion.

Description

A small (1 ha), probably shallow (depth not ascertained) dune lake (1666781E 6023612N) situated in a pasture catchment. There is an inflow at the south-eastern end of the lake linking with a smaller waterbody further up-stream. The outlet on the western side flows to the west coast approximately 2 km north of the lake. Access is

through private land on a well-formed track, but boat access would be difficult due to pugged, muddy margins.

Wetland vegetation

The dominant emergent species was *Eleocharis sphacelata* which formed a 3 to 5 m wide zone, excluded from the lake edge by cattle grazing/trampling. A zone of exposed turf plants was occasionally seen including *Myriophyllum propinquum* and *Potamogeton cheesemanii*.

Submerged vegetation

No submerged vegetation was observed.

LakeSPI

Reconnaissance only – no LakeSPI score generated.

Water birds

Poor aquatic habitat with disturbed grazed lake margin, poor emergent vegetation and no submerged vegetation. No birds were seen.

Fish

Poor aquatic habitat, *Gambusia affinis* common around the margins.

Aquatic invertebrates

No invertebrates were sampled.

Changes in indicators

This is the first time the lake has been surveyed.

Threats

Access is through private land, and the current lake condition is not conducive for submerged plant growth, therefore risk of introduction and establishment is low. The pest fish *G. affinis* is established in the lake. The lake is severely degraded, with turbid water.

Management recommendations

No monitoring recommended.

5.4 Midgley's Lake (north Dargaville), NRC Lake No. 257; surveyed in 2005

Plate: Midgeley's Lake showing the pasture and plantation pine catchment and extensive emergent vegetation**.**

Summary

Overall ranking

Moderate-high: Small lake with contiguous native submerged vegetation including a large population of the endangered *Utricularia australis*.

Threats

Isolated lake with access through private land would make introduction of pest species unlikely, but impact would be high. A steep catchment, the inflow stream enters the lake through a dense wetland providing nutrient stripping function.

Management recommendations

Lake native biodiversity value monitoring every 5 to 10 years.

Description

A small (2 ha), shallow (3 m) dune lake (1664168E 6028159N) situated in a pasture catchment with a small woodlot of pines on the northern side. There is an inflow at the eastern end of the lake entering through a dense wetland area. The outlet on the

western side flows to the Moremonui Gulley on the west coast approximately 2.5 km south-west of the lake. Access is through private land across pasture, and boat access would be difficult due to the steep lake margins.

Wetland vegetation

The dominant emergent species were *Eleocharis sphacelata* and *Typha orientalis* that formed extensive beds over 30% of the lake wide zone. *E. sphacelata* grew to a maximum depth of 2 m. A zone of exposed turf plants was seen bordering the lake including the native *Myriophyllum propinquum* and *Glossostigma elatinoides* and the exotic *Ludwigia palustris* and *Juncus bulbosus*. The invasive weed *Alternanthera philoxeroides* (alligator weed) is present on the property (landowner pers. comm.) so its spread to the lake cannot be discounted.

Submerged vegetation

At the profile site, turf species extended to 0.5 m including dense areas of *J. bulbosus.* The dominant submerged vegetation was an extensive bed of *Chara australis* extending from 0.6 to 3 m, with patches of the taller (approximately 1 m tall) *Potamogeton ochreatus*. The nationally endangered *Utricularia australis* was common in shallow water in the vicinity of the inlet, with scattered plants elsewhere in the lake. It was flowering at this site, the only occasion where flowers of this species were seen in this survey.

LakeSPI

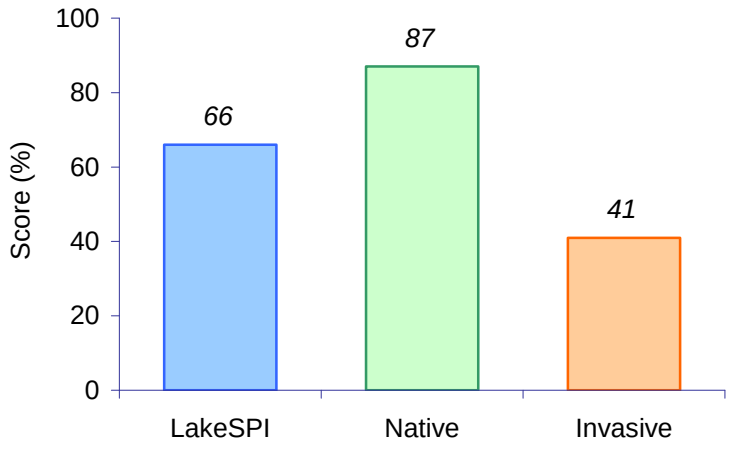

Figure: LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right).

A moderate LakeSPI score of 66% reflects high native vegetation values, including extensive charophyte meadows but impacted by dense stands of the invasive exotic *J.*

bulbosus to depths of 1 m. Profiles were limited so this LakeSPI assessment should be considered provisional.

Water birds

Good aquatic habitat provided by the emergent vegetation, but situated within a modified catchment where disturbance of birds may occur. Areas of dense emergent plants provide ideal habitat for crakes and rails. Common water birds were noted with 12 mallard (*Anas platyrhynchus*) and 3 black swan (*Cygnus atratus*) seen. One bittern (*Botaurus poiciloptilus*) (nationally threatened) was observed in the eastern area. OSNZ recorded regionally important dabchick (*Poliocephalus rufopectus*) in 1991.

Fish

No fish were observed in the lake.

Aquatic invertebrates

The introduced *Physella acuta* snail was common amongst submerged vegetation.

Changes in indicators

This is the first time the lake has been surveyed.

Threats

Access through private land, therefore risk of introduction is low but should pest species be introduced, their impact is likely to be great. Alligator weed impacts would be great within the shallow emergent vegetation dominated areas. The lake is moderately enriched, and some nutrient stripping role is performed by wetland/emergent vegetation. Water quality measurements indicate N sensitivity so application of fertiliser to pasture in the immediate catchment could lead to increased algal blooms/decrease in water clarity. Access to the lake by livestock is also a threat to water quality and marginal emergent vegetation.

Management recommendations

Lake native biodiversity value monitoring every 5 to 10 years.

Pest species are only likely to be introduced through deliberate introduction or contaminated nets from eel fishing. Prohibiting access to the lake is recommended.

Recommend fencing lake perimeter.

Evaluate the threat posed by alligator weed.

5.5 Shag Lake (Kai-Iwi), NRC Lake No. 221; surveyed in 2005 and 2010

Plate: Shag Lake showing grazing to the lakeshore.

Summary

Overall ranking

Moderate: A nutrient rich lake with no significant invasive aquatic plants and submerged vegetation to 6.9 m; cattle access has displaced emergent vegetation to deep water, bullies, eels and *Gambusia affinis* present.

Threats

Susceptible to submerged vegetation loss.

Management recommendations

Retire the margins and encourage emergent species. Look at ways to reduce nutrient inputs. This lake has much potential.

Description

A 15 ha dune lake (1654908E 6039010N) with a maximum depth of 12 m, situated in a pasture catchment. There was a small inflow at the south-eastern end of the lake but no outlet. Access is through private land via paddocks, boat access requires a 4-WD.

Wetland vegetation

The dominant emergent species occupying <20% of the shoreline was *Eleocharis sphacelata*, which formed a 3 to 15 m wide zone, extending to depths of 2 m but excluded from the lake edge (depths less than 1 m) by cattle grazing/trampling.

Submerged vegetation

The turf species *Lilaeopsis novae-zelandiae* and *Glossostigma submersum* were present in less than 1.3 m depth. *Chara australis*, *Potamogeton cheesemanii* and *P. ochreatus* were the most common species with maximum depth of vegetation extended to 6.9 m with average overall covers of about 50%.

In 2005 the submerged vegetation was much less with all profiles having median average covers of ≤5% and a bottom limit of plant colonisation of only 4.5 m.

LakeSPI

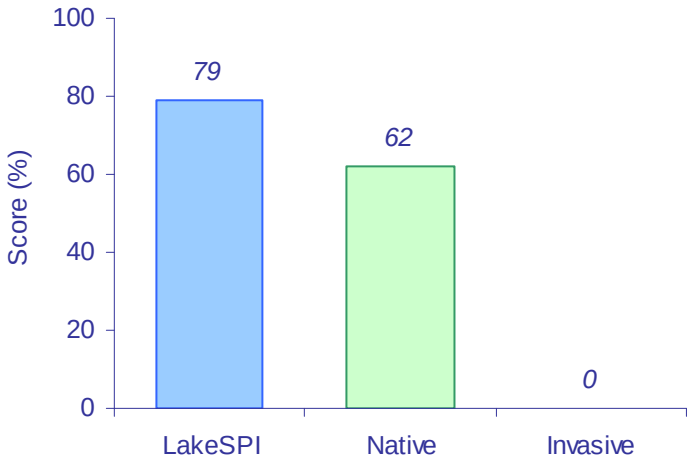

Figure: 2010 LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index.

A high LakeSPI score of 79% reflects the predominance of the native macrophytes community with no invasive impact. LakeSPI score was zero, the default score as there was insufficient submerged vegetation (<10% on a majority of profiles). This indicates the fragile balance that this lake is in.

Water birds

Poor aquatic habitat with mostly disturbed, grazed lake margins, limited emergent vegetation. Black swans (*Cygnus atrata*) were seen in 2001. The nationally threatened bittern (*Botaurus poiciloptilus*) and regionally important dabchick (*Poliocephalus rufopectus*) and Australasian little grebe (*Tachybaptus novaehollandiae*) were recorded in the late 1970's-1991. The lake was then regarded as an important refuge for birds disturbed from the Kai-iwi lakes when used for water skiing. It appears that the habitat provided by this lake was severely degraded in the 1990's but has recovered somewhat since the 2004 survey.

Fish

Bullies (*Gobiomorphus cotidianus*) observed in 2001 and also in 2010 along with large numbers of eels holes and the odd eel. NIWA FBIS reports both longfin and shortfin eels (*Anguilla dieffenbachii* and *A. australis*), bullies and the exotic *Gambusia affinis*, as present in Shag Lake.

Aquatic invertebrates

Pea mussels (*Sphaerium novaezelandiae*) and backswimmers (*Sigara arguta*) were recorded in 2001 and 2010.

Changes in indicators

The number of submerged species noted in 1984/85 and 1988 was 9 and 10 respectively, compared with 6 in 2001. In addition to the lower number of species seen in 2001, the plant cover and maximum depth colonised had reduced markedly over that time (from >95% to < 10% and 6.5 to 4.5 m). The 2010 survey results are encouraging with vegetated depth limits restored and a marked increase in submerged vegetation cover to around 50%.

Threats

The current lake condition is marginal for good submerged plant growth. The lake is prone to nutrient enrichment and could also be threatened by liberation of pest fish and plants. The pest fish *G. affinis* is established in the lake. Access is through private land so recreational boating is not a strong pressure on this lake; introductions would be more like to come from eel fishers with contaminated nets or duck shooters thinking pest plants would enhance the habitat.

Management recommendations

This lake would be suitable for enhancement, by retiring and planting the margins and considering ways to reduce pastoral enrichment of water.

5.6 Lake Taharoa (Kai-iwi) NRC Lake No. 229; surveyed in 2005 and 2007

Plate: Lake Taharoa from access road, note the exposed beach and paucity of emergent vegetation.

Summary

Overall ranking

Outstanding: Probably the best example of a clear-water lake, with the deepest recorded submerged vegetation in the North Island

Threats

Invasive species: high risk of pest plant introduction, but impact likely to be low.

Catchment: moderate, associated with pine plantation management.

Management recommendations

Surveillance for pest plant introductions at access points annually, and lake native biodiversity value monitoring at 5 year intervals.

Description

This dune lake (1658567E, 6037260N) is the second largest (197 ha) and deepest lake (37 m) in Northland. It is a situated in a catchment of shrub land, pastoral land and planted forest. The immediate surrounds include a domain with two camping grounds and the lake is popular for boating swimming and water skiing. There are two minor inflows at the south-west end of the lake, with no outflow. Access is via public roads with several boat launch areas.

Wetland vegetation

Much of shore was wave exposed, with hard iron pan or sand, and unsuitable for emergent vegetation development. Low covers (25%) of oioi (*Apodasmia similis*) and *Schoenus brevifolius* were present in places, and seedlings of *Eleocharis sphacelata* were also observed at one site. A survey of marginal zones of Lake Taharoa in 2007 recorded the following additional emergent, or potentially emergent species: *Baumea arthrophylla, Baumea articulata, Baumea juncea, Eleocharis acuta, Eleocharis sphacelata, Ficinia nodosa, Isachne globosa, Isolepis prolifer, Juncus pallidus* and *Typha orientalis.* The nationally 'at-risk' *Centrolepis strigosa* was found in the marginal turf of this vegetation in 2009 and 2010. This is the first known collection from the Kai-Iwi Lakes since the 1980's.

Submerged vegetation

Sparse turf plants grew on the shallow (0-1 m) sandy substrates of the wave-cut shelves and included nationally rare *Trithuria inconspicua* and regionally significant *Triglochin striata.* The exotic rush, *Juncus bulbosus*, was also recorded in these areas and small amounts of *Utricularia gibba*, but it was limited to isolated plants. Steep slopes immediately beyond these shelves were largely devoid of plants from 1 to 4 m. Charophyte meadows, dominated by *Chara fibrosa*, extended from < 4 m to between 22 and 24 m depth.

LakeSPI

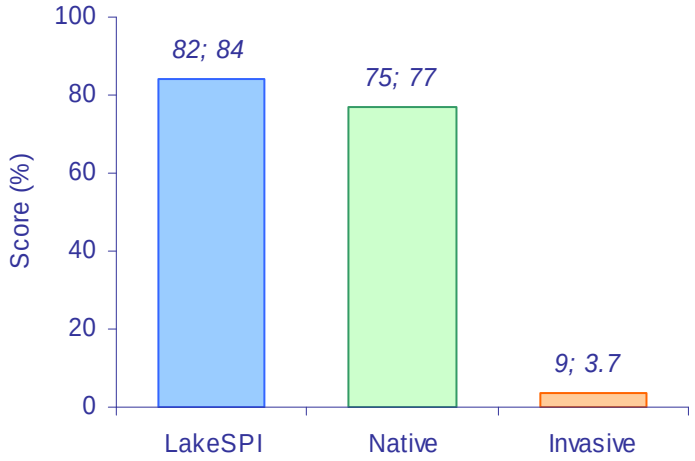

Figure: 2007 LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right) with 2005; 2007 values shown respectively.

A high LakeSPI score of 84% reflects the depth of vegetation extent, the predominance of the native charophyte community and the limited impact by invasive exotic plants.

Water birds

The poor development of marginal and emergent vegetation and popular use of this lake by the public reduce the suitability to water birds. Despite this, large numbers of waterfowl are reported to utilise the Kai-iwi lakes although the numbers are noted to be declining. The regionally rare dabchick (*Poliocephalus rufopectus*) was reported. Few birds were noted during the current survey.

Fish

Native fish sighted during surveys included common bullies (*Gobiomorphus cotidianus*) and koaro (*Galaxias brevipinnis*), while the exotic pest gambusia (*Gambusia affinis*) were also observed. Previous surveys have recorded shortfin eels (*Anguilla australis*), and rainbow trout (*Oncorhynchus mykiss*) have been stocked to the lake. The nationally threatened dwarf inanga (*Galaxias gracilis*) has been recorded from Lake Taharoa as recently as 1999.

Aquatic invertebrates

Koura (*Paranephrops planifrons*) were observed during the current survey, as were the freshwater crabs (*Halicarcinus lacustris*).

Changes in indicators

The depth extent of the high cover *C. fibrosa* meadows has varied between 18 and 25 m between vegetation surveys and is currently close to 24 m. This measure will be a sensitive baseline for future assessments of long-term water clarity and probably reflects whether the lake has been recently stratified. The nationally significant species, *H. inconspicua*, was recorded on two previous surveys as well as presently, while regionally significant *Myriophyllum votschii* (last recorded in 1987) was rediscovered. The exotic rush, *J. bulbosus*, was recorded at similar abundance to previous surveys.

Threats

The only plant present is *J. bulbosus*, which has an insignificant impact on the lake's ecology despite having been present for at least 18 years. While good boat access to the lake results in a high risk for introduction of pest plants, the potential for impacts is very low. Firstly, the exposed wave cut platforms around the lake reduce the likelihood of establishment. Secondly, unusual water chemistry limits the development of large vascular plants, likely due to dissolved carbon limitation, although changes in water chemistry could make the lake more vulnerable to pest plant invasion. Such a change would be initially indicated by development of tall-growing native vascular plants such as *Myriophyllum* spp., and *Potamogeton* spp.

The pest fish gambusia is known to harass some native fish and could threaten the endangered dwarf inanga.

Nutrient loading from the catchment is of greatest threat, with potential sources from pine plantation management. Such changes in water chemistry could facilitate pest plant establishment.

Management recommendations

Pest plant surveillance at access points annually.

Lake native biodiversity value monitoring every 5 years.

Seasonal sampling targeting the summer stratification / autumnal mixing period is recommended to gauge the duration, extent and impact of bottom water anoxia, associated sediment nutrient releases and stimulation of algal growth.

5.7 Te Riu (Waipuoa), NRC Lake No. 409; surveyed in 2006

Plate A: Te Riu Lagoon, showing the west half of the lagoon left and eastern on the right.

Summary

Overall ranking

High: A native plant lake with no pest plants and the nationally endangered *Utricularia australis*.

Threats

Biosecurity, low risk of pest plant introduction but subsequent impact likely to be high. Catchment: sand dune forestry likely the cause of lower water levels.

Management recommendations

Lake native biodiversity value monitoring every 5 years.

Description

The lagoon (2555191E, 6613202N) is accessible by 4 WD only via forestry roads. It is long and narrow and open water is not continuous between the eastern and western ends. The catchment is pine plantation with some scrub.

Wetland vegetation

The lagoon is fringed with wetland plants, predominantly *Eleocharis sphacelata, Baumea articulate, B. arthrophylla* and some *Typha orientalis,* and *Schoenoplectus tabernaemontani*.

Submerged vegetation

In the western end charophytes grow down to 3.0 m water depth the depth of the lagoon. In the eastern end the lagoon is deeper (3.5 m and) and the vegetation stops at 3 m. *Chara australis* was the only charophyte present and formed continuous meadows with some tall growing *Potamogeton cheesemanii* and the nationally endangered *Utricularia australis* (cover photo).

LakeSPI

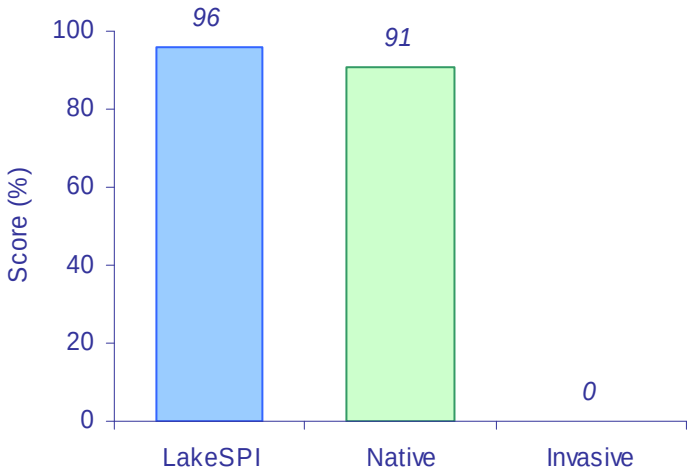

Figure: LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right).

A high LakeSPI Index was driven by high native cover over most of the lake and no invasive species.

Water birds

None noted.

Fish

The shortfin eel (*Anguilla australis*) was seen (cover photo). Bullies were abundant.

Aquatic invertebrates

None noted.

Changes in indicators

No previous records.

Threats

Low water levels threaten the survival of this lagoon, which was much larger in the past. Access is difficult and so introductions are unlikely but would displace the native vegetation if it occurred. *Utricularla gibba* may be transferred by birds.

Management recommendations

Lake native biodiversity value should be monitoring every 5 years.

5.8 Waikere (Kai-iwi Lakes) NRC Lake No. 227; surveyed in 2005 and 2007

Plate: Lake Waikere, view from the boat ramp at the west end of the lake.

Summary

Overall ranking

Outstanding: A native plant dominated lake, negligible impact by pest plants and the presence of nationally rare plants and fish.

Threats

Biosecurity: high risk of pest plant introduction but subsequent impact likely to be low. Catchment: moderate risk of increased nutrient loading with impact on current values and increased biosecurity risk.

Management recommendations

Pest plant surveillance at access points annually. Lake native biodiversity value monitoring every 5 years.

Description

The lake (1656902E, 6038255N) is accessible for trailer boat traffic via a sealed road and concrete boat ramp. The catchment is manuka scrub (50%), pine plantation (45%),

and a campground. This moderately large (26.5 ha) and deep (30 m) dune lake is an important venue for water skiing. There is no outlet and only minor drains enter the lake.

Wetland vegetation

Emergent vegetation was sparse, only occurring around 15% of the lake shore, with *Eleocharis sphacelata*, *Baumea arthrophylla*, *B. articulata*, *B. juncea*, *Apodasmia similis* and *Schoenus brevifolius* present in some areas. Emergents were usually in narrow bands < 2 m across extending to water depths between 0.5 m and 2 m.

Submerged vegetation

Turf plants were restricted due to the predominance of iron pan reefs around the lake, but included the nationally rare *Trithuria inconspicua*. Isolated plants of the exotic rush, *Juncus bulbosus* were also recorded in shallow areas. Charophytes comprised the remainder of the vegetation. Dense charophyte meadows were present from < 2.5 m to 16.5 m depth, with *Chara fibrosa* dominant in the upper region and *C. australis* solely from 13 m to a maximum recorded depth of 19 m.

LakeSPI

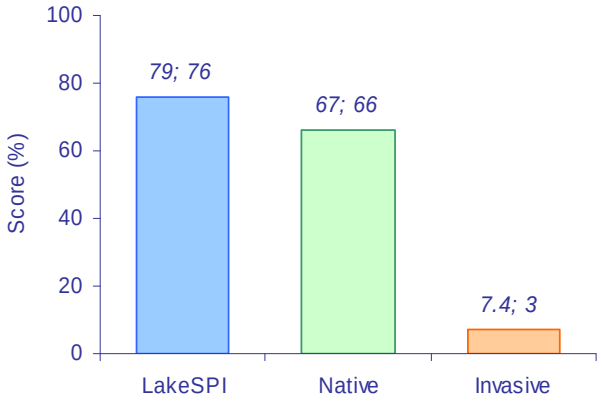

Figure: 2007 LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right) with 2005; 2007 values shown respectively.

A relatively high LakeSPI score of 76% driven by the large extent of vegetation development, presence of charophyte meadows with little impact from invasive exotic plants.

Water birds

The limited emergent vegetation and use of the lake for water skiing would limit the attractiveness of the lake to water birds. A grey heron (*Ardea novaehollandiae*) and 5 little shags (*Phalacrocorax melanoleucos*) were noted during the survey.

Fish

Native fish records included common bullies (*Gobiomorphus cotidianus*) and dwarf inanga (*Galaxias gracilis*), shortfin eel (*Anguilla australis*) and longfin eel (*Anguilla dieffenbachii*). Large pelagic schools of juvenile bullies were noted at several sites. Exotic fish present were gambusia (*Gambusia affinis*), common in shallow areas, and a stocked population of rainbow trout (*Oncorhynchus mykiss*).

Aquatic invertebrates

Koura (*Paranephrops planifrons*) and pea mussels (*Sphaerium novaezelandiae*) were recorded from Lake Waikere though were not abundant.

Changes in indicators

The vegetation remains similar to previous surveys, including the abundance of the nationally rare *T. inconspicua*. The exotic *J. bulbosus* has been present since at least 1985 and does not impact on the ecology of the lake. The depth for charophyte meadows (currently up to 16.5 m) is a sensitive indicator for water quality change and is very similar to 2005 data. Point sources of nutrients have in the past been associated with local development by large vascular plants that are otherwise absent from this lake.

Threats

The ease of access and high boat traffic to this lake results in a very high risk of pest plant introduction, however the subsequent impacts would be low. Water chemistry currently limits the development of large vascular plants, and pest plants are unlikely to establish, but changes in water quality parameters could increase the likelihood of pest plant establishment. *C. demersum* however may be able to thrive in this lake.

The biggest threat is in nutrient loading from the catchment, which will not only impact upon current values but also create an increased threat of pest plant establishment. The most immediate concern is associated with pine plantation management in the catchment, or possibly farming activities within the catchment. Given the value and moderate water quality of this lake, the possibility of water quality deterioration requires further consideration.

Management recommendations

Pest plant surveillance should be carried out at access points annually.

Lake native biodiversity value should be monitoring every 5 years.

5.9 Lake Waingata (Waipoua) NRC Lake No. 200; surveyed in 2006

Plate: Lake Waingaata.

Summary

Overall ranking

High: An all native plant lake, but with low covers due to steep bathymetry.

Threats

Biosecurity, low risk of pest plant introduction because it is remote and access difficult Catchment: moderate risk of increased nutrient loading with forestry nutrient additions.

Management recommendations

Lake native biodiversity value monitoring every 5 years.

Description

The lake (2555791E, 66137496N) is accessible via forestry roads, then by walking down a steep bank through pine plantation. No outflows are apparent.

Wetland vegetation

The lake had a fringe of emergent vegetation dominated by *Eleocharis sphacelata* in a band 2- 5m wide. At one end there was a 5 metre wide bed of *Baumea articulata* and at the other a 10 metre wide bed of *B. arthrophylla*. *B. juncea* and *Isachne globosa* were also present.

Submerged vegetation

The *Eleocharis sphacelata* extended with a high cover into about 2.5 m of water. Submerged vegetation was all native but generally sparse throughout the lake down to 5-6 m deep, with most in the north end where the slope was much less. *Chara australis* was the dominant charophyte but *Chara fibrosa* and was also present with some *Potamogeon ochreatus*.

LakeSPI

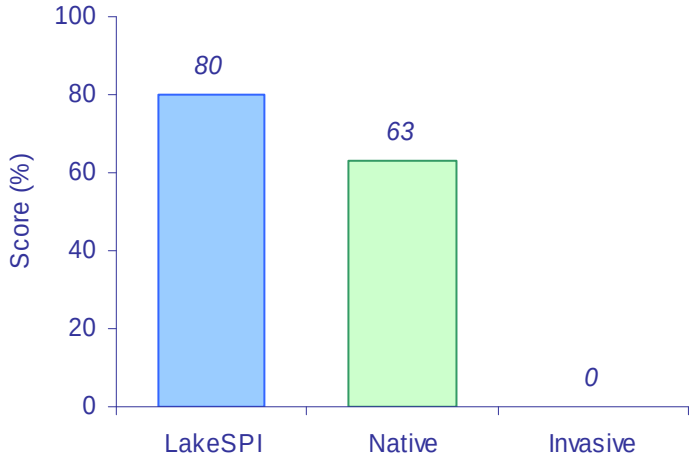

Figure: LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right).

No invasive species present but also a low cover of native species accounted for the LakeSPI Index of 80.

Water birds

None recorded.

Fish

Eels are probably present as holes were frequent in the bottom sediment.

Aquatic invertebrates

None noted.

Changes in indicators

No previous records.

Threats

There is a low risk of pest plant introduction because it is remote and access difficult. However, *Utricularia gibba* is a possibility if brought in by birds. The catchment has a moderate risk of increased nutrient loading from forestry nutrient additions.

Management recommendations

Lake native biodiversity value should be monitoring every 5 years.