3.17 Lake Pretty (Aupouri), NRC Lake No. 24; surveyed in 2005

Plate: Lake Pretty from the access point (north-eastern end of lake) showing sparse emergent vegetation.

Summary

Overall ranking

Moderate: Small shallow lake with no invasive biota, low vegetation covers, poor habitat for fauna.

Threats

Low risk of introduction of invasive pests. Moderate-low risk of nutrient enrichment from pine plantation activities (logging, fertilisers). Continued decline in water level may further deteriorate lake habitat.

Management recommendations

No monitoring or active management.

Description

The lake (1584443E 6173185N) is approximately 5.7 ha in area with a maximum recorded depth of 4.4 m. Catchment of plantation pine forestry on Holocene sand dune field. No inflows or outflows. Accessed through well-formed private forestry roads, no boat access.

Wetland vegetation

Mostly steep sided, with margin predominantly of kanuka scrub with rushland at access point. Emergent vegetation was sparse (30% of lake shore), forming a narrow (~1 m wide) intermittent fringe. Dominant species were *Eleocharis sphacelata, E. acuta, Baumea articulata* and *Juncus pallidus*.

Submerged vegetation

Open turf was dominated by *Myriophyllum propinquum* from lake margin to 1.2 m deep. Below this a charophyte meadow dominated by *Nitella pseudoflabellata* in a mosaic with *Potamogeton ochreatus* extended to 3m, with scattered plants of these spp. deeper than this (to maximum depth of 4.4 m). It is the only Northland lake surveyed with *N. pseudoflabellata* dominated vegetation. No endangered or invasive plant species were found.

LakeSPI

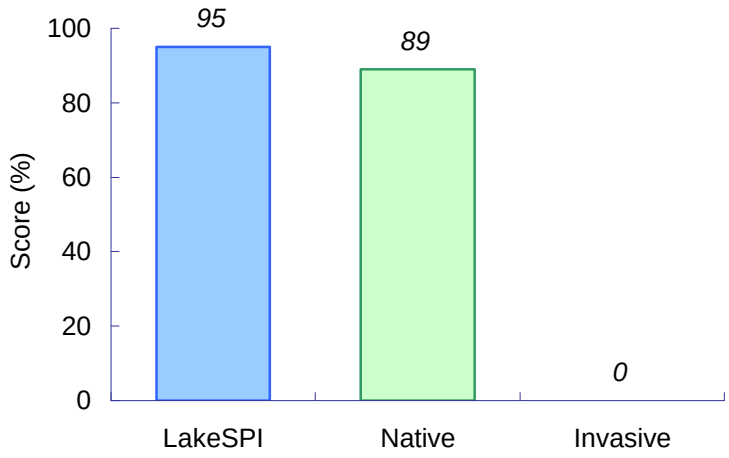


Figure: LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right).

A high LakeSPI index of 95% reflects the totally native submerged vegetation present over most of this shallow lake.

Water birds

Poor water bird habitat provided by the sparse wetland vegetation. No birds seen on field inspection, with common waterbirds reported in earlier surveys.

Fish

Common bullies (*Gobiomorphus cotidianus*) frequently observed on field inspection.

Aquatic invertebrates

No aquatic invertebrates recorded on field inspection.

Changes in indicators

This lake was sampled for the first time in November 2004.

Threats

There are currently no pest plants or fish reported from this lake. The access through private forestry roads (6 km off access road) and poor boat access mean the likelihood of introduction of alien species is low, but if introduced, these could have major deleterious impacts on the lake.

There is apparently some livestock access (cattle, horses?) based on pugged lake margins and absence of emergent vegetation in shallow water areas (see plate).

The water level had dropped by approximately 3 m since pines were planted in the catchment and future decreases could occur.

Management recommendations

No monitoring is recommended.

3.18 Lake Rotokawau (Aupouri), NRC Lake No. 116; surveyed in 2005 and 2009

Plate: Lake Rotokawau from access point.

Summary

Overall ranking

High: Impacted by *Utricularia gibba*. The 'Nationally Endangered' *U. australis* was re-discovered in 2009 raising the ranking from Moderate-High to High.

Threats

Biosecurity, possible introduction of *Ceratophyllum demersum* or *Egeria densa.*

Management recommendations

Lake native biodiversity value monitoring required at 5 year intervals. Survey lake for land-locked inanga.

Description

A dune lake (1618821E, 6124849N) accessed through private land via 2-wheel drive under fair weather conditions, and accessible for small boats. A small (14.2 ha), shallow (3.1 m) water body within a catchment of fenced pasture (70%), scrub (30%) and planted forest, with no major inflows or outflow. Access is through private land managed by owners who are aware of lake threats.

Wetland vegetation

The lake was encircled by a reed bed of *Eleocharis sphacelata* extending out 10-30 m to a maximum depth of 2 m (90% cover). *Baumea arthrophylla*, *B. articulata*, *B. juncea*, *Apodasmia similis* and *Eleocharis acuta* were also present.

Submerged vegetation

Turf plants were occasional at the inshore edge of the reed bed, and included the regionally rare *Gratiola sexdentata* and *Triglochin striata*. The submerged vegetation was dominated by the charophyte *Chara fibrosa* to the maximum lake depth (3.1 m), but with the exotic invasive species *Utricularia gibba* covering much of the lake vegetation (cover >50%) between 0.5 and 2.8 m. The only other exotic plant, *Juncus bulbosus,* was limited to shallow water at one site only. The 'Nationally Endangered' *Utricularia australis* was present low to medium covers at ~2 m depth (amongst *U. gibba*) throughout the lake in 2009, after not being recorded in 2004.

LakeSPI

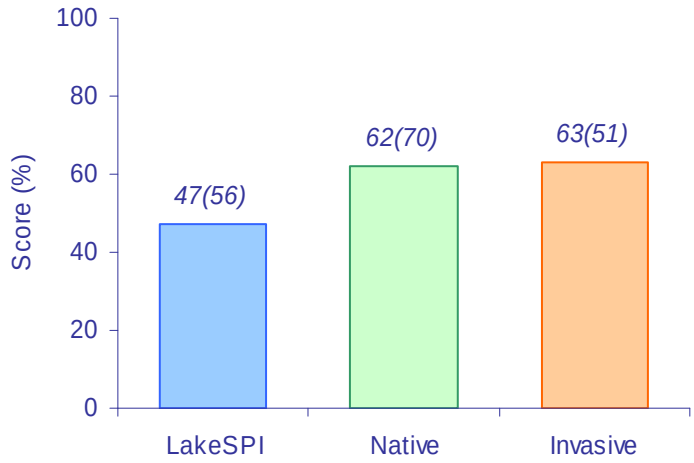


Figure: LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right) with 2004 results in brackets.

The LakeSPI score of 47% is moderate, reflecting the presence of several key native plant communities, but impacted by the extent of the invasive exotic, *U. gibba*. Relative to 2004 there was a slight decrease in maximum depth of native species and an increase in the depth of *U. gibba* lowering the LakeSPI score.

Water birds

The extensive emergent beds and adjacent scrub areas provide good habitat for water birds. The nationally threatened bittern (*Botaurus poiciloptilus*) and regionally significant dabchick (*Poliocephalus rufopectus*), Australasian little grebe (*Tachybabptus novaeholandiae*) and fernbird (*Bowdleria punctata vealeae*) were all previously recorded from this lake.

Fish

Common bullies (*Gobiomorphus cotidianus*) and the exotic pest gambusia (*Gambusia affinis*) were observed. There are also reports of a landlocked population of inanga (*Galaxias maculatus*), which may be of special status (cf. recent evaluation of Lake Ngatu population of inanga (B. David pers. comm).

Aquatic invertebrates

The introduced snail *Physella acuta* was noted.

Changes in indicators

Both the exotic species *U. gibba* and *J. bulbosus* were new records for this lake in 2004. *U. gibba* is now one of the dominant plants within the lake. The charophyte meadows have survived despite the extensive covering by *U. gibba,* and at the time of the 2009 survey were of lower cover than recorded in 2004. Previous observations recorded the 'Nationally Vulnerable' *Trithuria inconspicua* (1988, 1991). The 'Nationally Endangered' *U. australis* was prominent in 2009 raising the lake ranking from Moderate-High to High.

Threats

U. gibba a recent invader in 2004 appeared to have displaced the native *U. australi*s, but in 2009 *U. australi*s was recorded on all profiles growing amongst the *U. gibba*. Access through private land minimises the risk of further exotic plant introductions. The exotic pest fish gambusia will have impacts on other fish.

Management recommendations

Lake native biodiversity value monitoring every 5 yrs.

Sample for land-locked inanga to determine their status and compare with Lake Ngatu fish.

3.19 Lake Rotoroa (Aupouri), NRC Lake No. 126; surveyed in 2005 and visited in 2010

Plate: Lake Rotoroa, approaching from the north-east and showing the predominantly pastoral catchment and much of the lake edge fenced with riparian plantings.

Summary

Overall ranking

High: Submerged vegetation dominated by invasive *Egeria densa*, but large population of the endangered *Trithuria inconspicua*, moderate water quality and good water bird habitat.

Threats

Current high level of impacts from *E. densa*. *C. demersum* is present in adjacent Lake Heather and poses a risk to this lake. Alligator weed (*Alternanthera philoxeroides*) could displace other emergent species. Margins fenced, re-vegetation of riparian zone undertaken, but cattle access to the lake is still evident.

Management recommendations

Lake native biodiversity value monitoring every 5 years.

Description

Part of the Sweetwater group of lakes (1617883E, 6120400N). The lake is fairly large (26.5 ha) and relatively deep (8 m). This lake is accessed across 2 km of private pastoral land that comprises most of the catchment; boat access is difficult. The lake has no defined inflows or outflows.

Wetland vegetation

The south-western half of the lake is encircled by dense beds of emergent species extending over 20 m wide, dominated by *Eleocharis sphacelata* to 1.8 m deep, with lesser amounts of *Schoenoplectus tabernaemontani*. The northern part of the lake has much sparser emergent vegetation, with extensive turf communities in shallow waters.

The invasive pest plant alligator weed (*Alternanthera philoxeroides*) was noted in small patches adjacent to mai-mais on the south-western part of the lake.

Submerged vegetation

Species-rich turf vegetation occurred at shallow (<2 m) shoreline areas, except where dense emergents occurred. Turfs were dominated by *Lilaeopsis novae-zelandiae* and in some areas the nationally rare *Trithuria inconspicua*. *Utricularia gibba* was present at low covers in association with stands of emergents, extending to 2.5 m deep on one profile. The exotic *Egeria densa* dominated from depths of 2 m to c. 5 m depth, forming dense beds up to 3.5 m tall. Isolated clumps and shoots of *E. densa* were present to the maximum surveyed depth of the lake at 7 m. *Potamogeton ochreatus* and *Chara australis* co-existed with low covers of *E. densa*.

LakeSPI

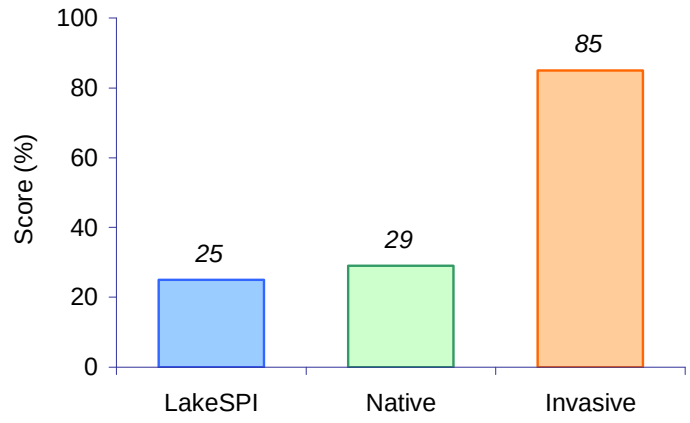


Figure: LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right).

The low LakeSPI score of 25% reflects the pervasive nature of invasion by *E. densa* and reduced extent of native plant communities.

Water birds

The extensive emergent vegetation provided good water bird habitat. Black swans (*Cygnus atratus*) and paradise shelduck (*Tadorna variegata*) were noted during the field visit. Recent OSNZ records include the nationally threatened bittern (*Botaurus poiciloptilus*) and regionally significant scaup (*Aythya novaezeelandiae*), dabchick (*Poliocephalus rufopectus*) and Australasian little grebe (*Tachybaptus novaehollandiae*).

Fish

Common bullies (*Gobiomorphus cotidianus*), smelt (*Retropinna retropinna*) and inanga (*Galaxias maculatus*) were seen on the vegetation survey. Both smelt and inanga are lake-bound populations. NIWA FBIS database also reports shortfin eels (*Anguilla australis*) from this lake. Mosquito fish (*Gambusia affinis*) were recorded for the first time in 2010.

Aquatic invertebrates

Freshwater mussels (*Hyridella menziesi*) and pea mussels (*Sphaerium novaezelandiae*) were abundant in the north eastern end of the lake.

Changes in indicators

The maximum recorded depth for submerged plants has varied somewhat over four vegetation surveys, from 4.5 m in 1985, greater than 5.5 m in 1988, 5.3 m in 2001 and at least 7 m in the current survey. The vegetation composition remains similar, with the exception of the introduction of the exotic *Utricularia gibba* since 2001, and absence of the regionally significant *Triglochin striata*. Alligator weed was recorded for the first time in 2004.

Threats

The pest plant *E. densa* has been well established since 1985 and has had a substantial impact on the native vegetation. *C. demersum* is present in adjacent Lake Heather and would pose a risk to this lake. *U. gibba* is a new pest record, however it is not expected to have a large impact in this large, and relatively wave exposed lake. The exotic plants *Otellia ovalifolia* and *Potamogeton crispus* have been recorded at times, probably when introduced as seed by water fowl, but have minimal impact. Access to the lake is difficult and the likelihood of future pest plant or fish introductions is low. Floating mats of *Alternanthera philoxeroides* could threaten shallow sheltered areas by smothering other vegetation.

The lake is now completely fenced and development of riparian and emergent vegetation in formerly grazed lake margins is likely to reduce nutrient inputs from the catchment. However, cattle access to the lake margin is still evident.

Management recommendations

Lake native biodiversity value monitoring every 5 years.

The status of inanga and relation to Lake Ngatu fish needs further investigation.

3.20 Salt Lake (Aupouri), NRC Lake No. 48; surveyed in 2005

Plate: Salt Lake showing the large beds of emergent raupo (*Typha orientalis*) surrounding open water.

Summary

Overall ranking

Low: Poor submerged vegetation, recent vegetation clearance.

Threats

Already appears to be nutrient enriched. No pest species but low value habitat.

Management recommendations

No monitoring recommended.

Description

Salt Lake (1602314E, 6159583N) is 2.2 ha in area with a maximum recorded depth of 1.5 m. It is situated in a pasture catchment, with a surrounding fringe of wetland, much of which was recently drained. There are no inflow streams but the lake discharges into the Tauwhia Stream via a wetland at the southern end of the lake. This stream flows to the East Coast. Access is off the Onepu Block Road through approximately 500 m of private farmland. Boat access is difficult.

Wetland vegetation

Tall (2.5 m) *Typha orientalis* dominated the emergent vegetation and occupied 50% of the lake area to a depth of 0.5 m, although rhizome mats had rafted over water 1 m deep in some areas. At one site *Baumea articulata* and *Eleocharis sphacelata* were also present. The wetland on the northern lake boundary was of similar composition to the emergent vegetation with additional cabbage trees (*Cordyline australis*), and mat-forming *Persicaria decipiens, Ranunculus amphitrichus* and the exotic *Ludwigia palustris.*

Submerged vegetation

A sparse submerged vegetation was present at one of the three profiles with low covers of *Potamogeton ochreatus* (0.5 to 1 m deep) and *Nitella* sp. aff. *cristata* (0.5 m deep).

LakeSPI

No LakeSPI score generates as vegetation cover <10%.

Water birds

The dense raupo vegetation provides good shelter for water birds. Paradise shelduck (*Tadorna variegata*) were the only species seen during the field visit. No rare species were reported in previous surveys.

Fish

No fish were observed.

Aquatic invertebrates

Backswimmers (*Sigara arguta*) were common.

Changes in indicators

Not previously surveyed. It appears that much of the wetland and scrub vegetation described in the 1991 DoC SSBI report has been cleared, some relatively recently.

Threats

No pest species present, but low habitat value. Drainage and clearance of surrounding native vegetation, especially wetland, further reduces value.

Management recommendations

No monitoring.

3.21 Lake Taeore (Aupouri), NRC Lake No. 38 reconnaissance in 2010

Plate: Lake Taeore with no water in April 2010.

Summary

Overall ranking

Moderate-low: Ephemeral lake.

Threats

Further decline in water table would reduce the habitat value.

Management recommendations

No monitoring.

Description

Lake Taeore (2512332E, 6725132N) is a wetland of 14.7 ha area. The catchment is in farmland with a wetland margin. There are no inlets or outlets. Access is through private farmland by permission only.

Wetland vegetation

The lake basin was surrounded by *Typha orientalis* and *Schoenoplectus tabernaemontani*.

Submerged vegetation

No water present. The dry lake bed was mainly covered in *Ludwigia palustris* and seedling *Typha orientalis*. The rare annual species *Fimbristylis velata* (northern most record in NZ) *Alternanthera nahui* and *Centipeda aoteorana* were present on the drying mud along with a range of weed species.

LakeSPI

No LakeSPI score could be generated.

Water birds

Fish

Desiccated eels.

Aquatic invertebrates

Desiccated mussels.

Changes in indicators

First visited in 2010. The 2010 drought is likely to be the first time this lake has dried up as recently mussels were present.

Threats

A lowering water table is the main threat to this lake and many other Northland lakes and wetlands.

Management recommendations

No monitoring.

3.22 Te Arai Ephemeral Wetland and Pond (Aupouri), NRC Lake No. 46; surveyed in 2005

Plate: Te Arai Pond with grazed margins and sparse emergent vegetation, note the exotic floating fern (red) *Azolla pinnata*.

Summary

Overall ranking

Moderate: Small areas of water, with decreasing water level, grazing damage by horses.

Threats

Further decline in water table would reduce the habitat value.

Management recommendations

No monitoring.

Description

This dune wetland area (1598022E 6159812N) supports a small pond ~ 0.2 ha in area with a maximum depth of ~ 1 m and an adjacent shallow ephemeral turf area (total area 2.3 ha). The catchment is pine plantation forestry with a fringe of grass and scrub around the wetland margin. There are no inlets or outlets. Access is through 2 km of forestry roads past Bulrush Lake.

Wetland vegetation

Much of the area accessible to grazing had scattered clumps of *Typha orientalis* (pond) and *Eleocharis sphacelata* with widespread turf communities in the ephemeral wetland. Dominant species here were the native *Centella uniflora, Myriophyllum propinquum, Centipeda*

aotearana and the introduced *Ludwigia palustris, Callitriche stagnalis* and *Paspalum distichum*.

Submerged vegetation

The pond was dominated by *Chara australis* forming a 0.8 m tall turf across the bottom (1 m) with surface-reaching *Potamogeton cheesemanii* occasionally present.

LakeSPI

Reconnaissance only – no LakeSPI score generated.

Water birds

Approximately 20 mallard (*Anas platyrhynchus*) and pairs of Canada goose (*Branta canadensis*) and paradise shelduck (*Tardorna variegata*) were seen.

Fish

No fish were seen.

Aquatic invertebrates

Backswimmers (*Sigara arguta*) were noted.

Changes in indicators

First visited in November 2004.

Threats

Decreasing water table and horse grazing appear to be the main Threats to this area.

Management recommendations

No monitoring.

3.23 Te Arai Lake (Aupouri), NRC Lake No. 47; surveyed in 2006

Plate A: Te Arai Lake with scrub and forestry margins and mobile sand dunes to the north-west.

Summary

Overall ranking

Low: remote dune lake, little invasive species impact, low macrophyte abundance, high wildfowl values.

Threats

Further decline in water table would reduce the habitat value.

Management recommendations

No lake native biodiversity value monitoring.

Description

This dune lake (1597154E 6159761N) is recorded as a 12.9 ha area in the NRC database, but the lake occupies ~ 6 ha, with an ephemeral wetland to the west of the lake formerly contiguous with this. The lake had a maximum depth of 1.9 m. The catchment is mostly scrub, with pine forest to the south and mobile dunes to the north-west. There are no inlets or outlets. Access is through 3 km of forestry roads past Bulrush Lake and ~ 100 m of steep sided scrub margin.

Wetland vegetation

The eastern half of the lake was predominately vegetated with emergent *Typha orientalis* and *Baumea arthrophylla* (0 to 0.5 m deep) with *Eleocharis sphacelata* growing in deeper water (to 1 m) on about 25% of the lake margin. Other parts of the lake were fringed with a narrow (<5 m) emergent margin of the same species but with significant sections without emergent vegetation. Here turfs were dominated by *Elatine gratioloides* and *Glossostigma diandrum.*

Submerged vegetation

When visited in 2005 only the east end of the lake was accessed and shallow areas of the lake (up to 0.5 m), amongst emergent vegetation was dominated by a dense bed of *Chara australis* and small amounts of the exotic *Utricularia gibba,* with *Potamogeton cheesemanii* dominated the vegetation from 0.5 m to a maximum of 1.5 m deep. In 2006 only the west end of the lake was accessed. The same species were recorded but cover was very sparse with just the odd plant present due to heavily stained water. Lisa Forester (pers. comm.) recalled this was the situation in 2005, so it does not represent a change in Lake Condition.

Plate B: Lake Te Arai west end 2006, showing highly stained water not suitable for submerged vegetation.

LakeSPI

Reconnaissance only – no LakeSPI score generated as the submerged vegetation was too sparse.

Water birds

The regionally threatened dabchick (*Poliocephalus rufopectus*) and mallard (*Anas platyrhynchus*) were seen. DoC SSBI records from 1991 report regionally rare fernbird (*Bowdleria punctata vealeae*) and nationally threatened bittern (*Botaurus poiciloptilus*).

Fish

No fish were seen.

Aquatic invertebrates

Backswimmers (*Sigara arguta*) and the introduced snail *Physella acuta* were noted.

Changes in indicators

First visited in November 2004, no change in indicators.

Threats

Few invasive Threats noted as access to lake difficult, but water levels are receding.

Management recommendations

No monitoring recommended.

3.23.1 Lake Te Kahika (Aupouri), NRC Lake No. 29.

Plate: Lake Te Kahika set in a mature plantation pine catchment, (top 2009); now de-forested and a section of shore line wetland vegetation affected by fire, 2013 (bottom).

Summary

Survey dates **1991, 1996, 2005, 2006, 2009 and 2013.**

Overall ranking

Moderate-High with water heavily coloured with red / brown staining, now with only 2 - 3 m visibility (with a minimum recorded transparency of 0.3 m in May 2012) and invasive *Utricularia gibba* present to 3 m water depth. Threatened species are still present, with two nationally threatened species discovered.

In 2009 rated **High** as a unique clear-water acidic lake with sparse submerged vegetation limited to some *Sphagnum* and high covers of *Utricularia australis* in the south western inflow.

Threats

Pine harvesting impacting water quality and nutrient status. Fire risk to marginal species.

Low risk of introduction and establishment of invasive pests. Low to moderate risk of nutrient enrichment from pine plantation fertilisation with urea.

Management recommendations

Undertake a full investigation of the impact of logging on Lakes Te Kahika, Te Kahika South, Morehurehu and Morehurehu South 1 and 2 (also Parengarenga Harbour). Review recent changes in the catchment and document impacts in all receiving waters. Lake monitoring annually to evaluate rate of recovery. Provide advice to forestry companies or other land-use in these poorly buffered water bodies to modify activities that caused such extensive environmental damage.

Description

The lake (1600007E 6168587N) is approximately 18 ha in area with a maximum recorded depth of 10.8 m. It is situated on Lower Quaternary sand dunes, formed by a stream system impounded by dunes. The catchment is vegetated by pine plantation forestry with a narrow intermediate zone of scrub (manuka and hakea). The mature pines have been harvested recently and re-planted. The lake is comprised of two arms each fed by an inflow, with the outflow (Kahika Stream) at the western edge of the lake discharging into Great Exhibition Bay (East Coast). Access is through private forestry roads, not currently gated. There are no formed tracks leading to the lake edge and no formed boat access.

Wetland vegetation

There was a complete fringe of emergent vegetation, although the southern area has recently been burnt destroyed marginal manuka and emergent vegetation. *Eleocharis sphacelata* dominated a zone 5 to 20 m across which grew to depths of 1.5 m, with swamp millet (*Isachne globosa*) and *Gleichenia dicarpa* also common. Several species typical of bog vegetation (including *Machaerina teretifolia* and the regionally significant *Empodisma robustum* bounded much of the lake in shallow water (to 0.2 m deep). In 2009 the 'Nationally Endangered' *Todea barbara* was recorded in tall manuka. Additional species seen in 2013

included the ‘Nationally Endangered’ *Centipeda minima* growing in the burnt area adjacent to the south western inlet.

Submerged vegetation

The invasive *Utricularia gibba* has extensively colonised the lake margins to a maximum depth of 4 m. It was one of the few Northland lakes without *U. gibba* in 2009. The ‘Nationally Critical’ *Utricularia australis* was found in one location amongst U. gibba on the submerged roots of marginal vegetation. The ‘Nationally Vulnerable’ *Isolepis fluitans* (previously only recorded from Lake Wahakari) was located at one transect site (D) at 2 m depth.

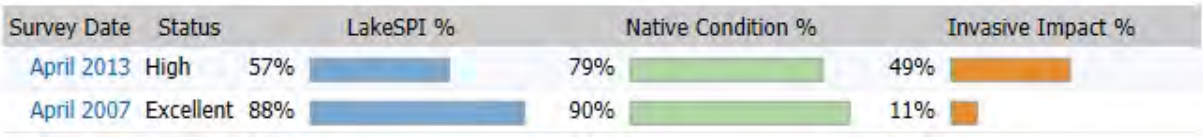
In 2009 there was no submerged vegetation reported in this lake despite good water clarity apart from high covers of the moss *Sphagnum* sp. amongst *E. sphacelata* at two sites and of significance the ‘Nationally Critical’ *Utricularia australis* formed 100% covers in the inlet stream (Figure 3-3).

Now lower water clarity prevents plant growth on the stream bed and the sides of the stream are covered in *U. gibba* rather than *Sphagnum* sp (Figure 3-3).

Figure 3-3: Lake Te Kahika 2009 showing clear water with Sphagnum (top left) at 1.0 m deep water in marginal emergent vegetation; a rare sight, Utricularia australis (top right) abundant on the bottom of an inflowing stream >3 m deep; (bottom) 2013 the same location but showing poor water clarity, Utricularia australis absent on the bottom and Sphagnum replaced by U. gibba on the sides.

LakeSPI

Figure: LakeSPI for Lake Te Kahika



Survey Date	Status	LakeSPI %	Native Condition %	Invasive Impact %
April 2013	High	57%	79%	49%
April 2007	Excellent	88%	90%	11%

In previous surveys the LakeSPI score generated was zero as vegetation cover <5%. The 2013 score was driven entirely by the presence of *U.gibba* an invasive species and the Native Condition remains at 0%.

Water birds

The isolated nature of the lake and large areas of emergent and wetland vegetation provide good habitat for many wetland birds, although lack of submerged vegetation and fish would limit the habitat for some species. Few birds were noted during the field visit. Threatened species include fernbird (*Bowdleria punctata vealeae*) noted at the southern end of the lake, dabchick (*Poliocephalus rufopectus*) and little black shag (*Phalacrocorax silcirostis*) recorded in 2009. The endangered spotless crake (*Porzana tabuensis plumbea*), and Caspian tern (*Sterna caspia*) were previously recorded.

Fish

No fish were seen in the lake in 2013, however previously a shortfin eel (*Anguilla australis*) was noted in one inlet stream, and eel holes were common in places.

Aquatic invertebrates

Few aquatic invertebrates were noted, with *Sigara arguta* the most prevalent, with caddisfly (Trichoptera) and dragonfly larvae (Odonata).

In 2009, the rarely seen whirligig beetle *Gyrinus convexiusculus* was noted at the access point. It is a self-introduced Australian species which lives in ponds and lakes in Waikato and Northland.

Lake Ecological Value

Based on the 2009 survey a Lake Ecological Value rating of 11 (High) was calculated. A deterioration in the rating of the following parameters: water quality (water transparency and total nitrogen values from 2010 to 2013 indicate Eutrophic condition whereas chlorophyll a and total phosphorus indicate Oligotrophic condition) and aquatic vegetation diversity has resulted in a revised score of 9 (Moderate to High).

The lake has changed from being exceptionally clear (>6 m visibility) when last visited to having a dark brown / red stain with about 2 m in-water visibility, with a minimum recorded transparency of 0.3 m in May 2012.

As for nearby Lake Morehurehu, the recent pine plantation harvest may have caused the change in water quality which was widely noted in other lakes and also Parengarenga Harbour in this area.

Plants have started growing in the lake albeit the invasive *U. gibba*. The lake has been sampled on three previous occasions, in summer 1991, 1996 and 2005, when the water was very clear. As this lake previously lacked extensive submerged vegetation, LakeSPI could not be used as an indicator in the lake. Water quality records provide the best indicator to this change.

Threats

The marked change in water clarity and total nitrogen concentration is significant and needs further attention to find the cause and prevent it from re-occurring in future.

The main risks for invasive species come from use of diggers in associated streams, or pine plantation harvesting gear that may be contaminated with invasive weeds such as alligator weed, (*Alternanthera philoxeroides*), or eel fishers using nets contaminated with submerged weeds. Due to the acid nature of the lake, the likelihood of establishment is low.

Fertilisation of pine forests and run-off as a result of harvesting could result in nutrient enrichment. As the lake is possibly N limited, urea fertiliser application could deleteriously affect clarity and increase planktonic algal abundance.

Management recommendations

The lake has been recently impacted by a marked change in water clarity, most like from resin acids resulting from pine harvesting. Comments and recommendations on possible impacts of pine harvesting made for Lake Morehurehu apply here also.

Biosecurity threats are low. The chemistry of the lake is very unusual and warrants further study to explain the source of acidity (with a minimum pH of 3.3) and elevated sulphate concentrations. It is recommended that the lake be monitored every year to follow its recovery or further deterioration.

3.24 Te Kahika Sth (Aupouri), NRC Lake No. (30); reconnaissance 2010

Plate: Te Kahika South, a coastal dune lake surrounded by a narrow wetland \ scrub margin within pine plantation forestry.

Summary

Overall ranking

High: A small remote lake, with the endangered *Todea barbara* and *Utricularia australis.*

Threats

Low risk of introduction and establishment of invasive pests. Low to moderate risk of nutrient enrichment from pine plantation forestry fertilisation with urea. Pine harvesting could impact water quality and nutrient status.

Management recommendations

Lake native biodiversity value monitoring every 5 years.

Description

The lake (2511204E, 6730451N) is small (1.43ha), shallow 3 m+ deep. Peat-stained acidic water (pH 4.7). The catchment is plantation forestry, lake and wetland. Access is through forest track and walking. No boat access.

Wetland vegetation

Emergent species encircled the lake and were *Baumea arthrophylla*, *B. rubiginosa*, *B. juncea*, *Empodisma minus*, *Eleocharis sphacelata* and *Phormium tenax* growing to a depth of 1.8 m. Several plants of the endangered *Todea barbara* were seen.

Submerged vegetation

The nationally endangered *Utricularia australis* was locally common amongst marginal emergents.

LakeSPI

None generated.

Water birds

No birds seen.

Fish

No fish seen.

Aquatic invertebrates

Dragonfly nymphs and adults and *Sigara arguta* were noted. No mussels or koura seen.

Changes in indicators

Not previously surveyed.

Threats

Access for vectors of pest species is difficult, and low water clarity and acid pH would make this threat unlikely. Forestry fertilising would have impacts on lake nutrients pH and clarity, although wetland and scrub vegetation is likely to buffer much of this impact.

Management recommendations

Monitoring recommended every 5 years.

3.24.1 Te Paki Dune Lake (Aupouri), NRC Lake No. 15.

Plate: Te Paki Dune Lake showing the manuka and sand dune catchment.

Summary

Survey dates 2005, 2007 and 2013.

Overall ranking

High: This isolated shallow lake, within native scrub and dunes, has an outstanding indigenous vegetation including an endangered species but with some impact by the invasive *Utricularia gibba,* which is now widespread in Northland. This lake supported the highest known covers of the 'Nationally Critical' *U. australis* in Northland.

Threats

Low risk of introduction of invasive pests. There are few threats of nutrient enrichment if the catchment is not developed.

Management recommendations

Lake native biodiversity value monitoring every 5 years.

Description

The lake (1580999E, 6178871N) is 2.2 ha, about 2.2 m deep and situated between mobile dunes and areas vegetated by manuka and hakea. The lake has no inflows or outflows.

Access is through private land and a narrow sandy overgrown track (4-WD). There are no formed tracks for lake entry and no ready boat access.

Wetland vegetation

Approximately 60% of the lake was covered with emergent vegetation, dominated by *Machaerina articulata* and *Eleocharis sphacelata* growing to depths of 1.0 and 2.2 m respectively. There was no emergent vegetation in the vicinity of the dune face. Other emergents reported from water less than 0.2 m depth were *Machaerina juncea, Eleocharis acuta* and the regionally uncommon *Sparganium subglobosum*. New records for 2013 included *Typha orientalis, Isolepis prolifera* and *Persicaria decipiens*.

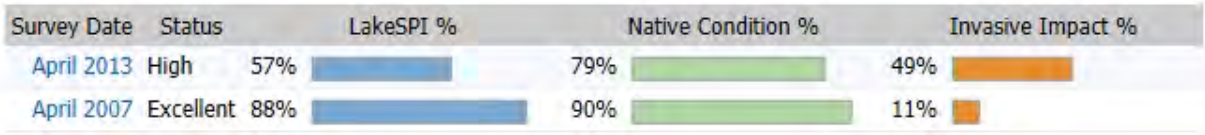
Submerged vegetation

Charophyte meadows of *Chara fibrosa* (Figure 3-4), *C. australis* (~ 0.5 m tall) and *Nitella* sp. aff. *cristata* were present in open areas of water and amongst emergents with some areas of tall *Potamogeton cheesemanii* (2.0 m tall) and *Myriophyllum propinquum* (1 m tall). The nationally endangered *Utricularia australis* was abundant (about 50% cover) throughout the lake (Plate 2). The invasive exotic *Utricularia gibba* was the only invasive present but had native charophytes growing beneath it (Figure 3-4). *Ottelia ovalifolia* was also found for the first time in 2007 but not since. The dune face had some turf species in 2007 including *Callitriche petriei, Myriophyllum votschii, Limosella lineata* and *Lilaeopsis novae-zelandiae* but sprawling marginal species have now displaced these.

LakeSPI

A drop in LakeSPI score to 57% reflected the increased extent of the invasive *U. gibba*.

Figure: 2007 LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right). 2007 and 2013 values shown.



Water birds

The isolated nature of the lake and large areas of emergent and wetland vegetation provide good habitat for many aquatic birds. Few birds were seen during the field visit, but it is likely that several endangered species utilise this area. Fernbird (*Bowdleria punctata vealeae*) were reported on the DOC SSBI from 1991.

Fish

Several large shortfin eels (*Anguilla australis*) were noted in the lake in 2007.

Aquatic invertebrates

The native leech *Richardsonianus mauianus* was present.

Lake Ecological Value

Based on the 2007 survey a Lake Ecological Value rating of 10 (High) was calculated. An improvement in the rating of aquatic vegetation diversity has resulted in a revised score of 11 (still rated as High). The invasive impact index has increased with *Utricularia gibba* found in the lake but it was not displacing native species to any great extent and had little impact on vegetation growing in water greater than 1 m deep. This lake supported the highest known covers of the 'Nationally Critical' *U. australis* in Northland.

Figure 3-4: Te Paki Dune Lake flora. with the critically endangered *Utricularia australis* on a native charophyte meadow of *Nitella* sp. aff. *cristata* (top left); tall-growing *Potamogeton cheesemanii* reaching the surface (top right); and the emergent rush *Eleocharis sphacelata* in a meadow of *Chara fibrosa* covered with the invasive *Utricularia gibba* (bottom).

Threats

Due to the poor access and isolated nature, the likelihood of additional invasive introductions is very low.

Threats of modification of the scrub/mobile dune catchment are not foreseeable. Dune encroachment could fill in the lake.

Management recommendations

Lake native biodiversity value monitoring every 5 years.

3.25 Te Paki dune lake south (Aupouri), NRC Lake No. 16.

Plate: A dune lake just south of Te Paki Dune Lake

This lake is 0.53 ha in area and is located on Department of Conservation land. It was viewed from the dunes to the west of the lake. The lake colour was highly discoloured brown/red and so was assumed to have no submerged vegetation. We did not investigate further.

3.26 Te Werahi Lagoon (Aupouri), NRC Lake No. 6.

Plate: Te Werahi Lagoon showing the pasture, protective fencing, mobile sand dune catchment and extensive beds of raupo (*Typha orientalis*).

Summary

Survey dates 2004 and 2013.

Overall ranking

Moderate heavily impacted by invasive submerged species including hornwort and egeria. The first record of the invasive marginal species gypsywort (*Lycopus europaeus*) in Northland was discovered at this water body. Good in-water visibility of around 4 m.

In 2004 rated **High** as a large wetland/open water complex with some indigenous submerged vegetation.

Threats

Already impacted by problem submerged weeds *Ceratophyllum demersum*, *Egeria densa* and *Potamogeton crispus*.

Management recommendations

It is suitable habitat for wildfowl particularly black swan. No further monitoring. Assess the potential for gypsywort eradication to protect other Northland water body margins.

Description

This lagoon (1573420E, 6184962N) is an 11 ha water body with a maximum recorded depth of 4 m. It is situated on sand dunes, formed by a stream system impounded by dunes. The catchment is pasture (cattle grazed) apart from mobile dunes to the west and a few wetlands associated with inflow streams. The lagoon is the largest impounded water body on the Te Werahi Stream which flows from the south, draining land from Scott's Point and discharging to the north in Te Werahi Bay (West Coast). Access was through private farmland (4-WD) with no formed tracks leading to the lagoon edge and no boat access other than over a fence.

Wetland vegetation

A lot of the lake was fringed with pasture, however sections of wetland vegetation dominated by *Typha orientalis* with *Machaerina articulata, Eleocharis sphacelata, Carex maorica* and *Phormium tenax* were noted. The nationally threatened herb *Mazus novae-zeelandiae* ssp. *impolitus* was collected from this area in 1966 but has not been recorded since.

The first record of the invasive marginal species gypsywort (*Lycopus europaeus*) in Northland was discovered at this water body (Figure 3-5).

Figure 3-5: Gypsywort (*Lycopus europaeus*). The first record of this invasive marginal species in Northland was discovered at Te Werahi Lagoon in 2013.

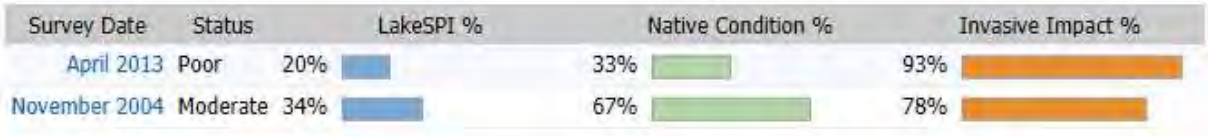
This species is widespread and has a major impact on many lowland wetlands in Waikato and is spreading in Bay of Plenty and Auckland. It is of limited distribution at the Te Werahi site and efforts should be made to eradicate it.

Submerged vegetation

There were high covers of the tall exotic weeds *Ceratophyllum demersum* and *Egeria densa* and also the native pondweed *Potamogeton ochreatus*. Lower covers of the exotic *Potamogeton crispus* and the native charophytes *Chara australis, Nitella* sp. aff. *cristata,* and *N. leonhardii* were noted.

LakeSPI

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



The low LakeSPI score of 20% reflects the impact of invasion by *C. demersum* and *E. densa*.

Water birds

The large areas of wetland may provide good habitat for many aquatic birds, although grazing access may disturb some species. Hundreds of black swans (*Cygnus atratus*) and a flock of Canada geese (*Branta canadensis*) were noted in 2004. No endangered birds were recorded.

Fish

Grey mullet (*Mugil cephalus*) were observed in 2004. Bullies were present in 2013.

Aquatic invertebrates

No aquatic invertebrates were noted.

Lake Ecological Value

Based on the 2004 survey a Lake Ecological Value rating of 11 (High) was calculated based on the lagoon being a large wetland/open water complex with some indigenous submerged vegetation. A deterioration in the rating of the following parameters: aquatic vegetation integrity (a reduction in cover of native submerged vegetation from 67% to 33%) and endangered species (with no rare species found) has resulted in a revised score of 7 (Moderate).

Threats

Although situated in farmland, the lagoon is easily observed from State Highway 1 and access is relatively easy.

The highest ranked submerged weed species *C. demersum* is already present in the lagoon. This lagoon may provide the local source of this species and also *E. densa*, both are also located in the lakes near Te Paki (Ngakeketa and Ngakeketa North respectively).

Transfer could be from fishing nets, so local fishers should be informed of the risks.

Gypsywort (*Lycopus europaeus*) is apparently restricted to this site in Northland. It is likely to have been introduced on the waders of duck shooters or fishermen from the Waikato and poses a major threat to similar wetland margins throughout Northland.

The lake could be in danger of becoming a flipping lake. It is common for shallow lakes with dense weed beds to change rapidly losing plants and shifting to a dirty water algal dominated state.

Management recommendations

No monitoring is recommended.

A more comprehensive survey of the wetlands surrounding the Te Werahi Stream is recommended to delimit the gypsywort incursion. Management for eradication of gypsywort is advocated if deemed feasible following the wetland survey.

Control of submerged weeds is not recommended, as only short-term reduction in abundance would be achieved at this site.

3.26.1 Lake Wahakari (Aupouri), NRC Lake No. 35.

Plate: Lake Wahakari.

Summary

Survey dates 1985, 1988, 2001, 2004, 2008 and 2013.

Overall ranking

Outstanding: Good emergent and submerged vegetation with numerous endangered biota. The pest species *Utricularia gibba* and mosquitofish were present.

Threats

Introduction of invasive species.

Harvesting pine trees in the catchment could be threatening water quality and vegetation abundance and extent.

Management recommendations

Possible water quality decline requires investigation.

Lake native biodiversity value monitoring every 5 years.

Description

Lake Wahakari (1592960E, 6165597N) is a large (84.4 ha) lake with a maximum depth c. 12 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 recently harvested plantation pine forestry (50%) manuka / kanuka scrub (40%) and fenced pasture (10%). There is an inflow at the north-western end of the lake, apparently surrounded for much of its 3 km length by bog vegetation. The outlet at the south-eastern end passes through a raupo/flax swamp and discharges into Parengarenga Harbour via the Te Kao Stream. Access is a rough gravel track via a locked gate from Te Ahu Road. The lake serves as a water supply to the district and boat access is difficult even for 4-WD launching. However, it appears that the road access to the southern end of the lake is now possible, with several boats and waka ama at this site.

Wetland vegetation

Most of the lake margins have beds of emergent species of up to 10 m wide. The dominant emergent species were *Eleocharis sphacelata, Apodasmia similis, Machaerina juncea, M. arthrophylla, M. articulata* and *Typha orientalis* growing from the lake margin to 2.6 m depth. *Machaerina rubiginosa* was noted as emergent in the south eastern bay during the 2008 survey. Additional emergent species recorded in 2013 were *Schoenoplectus tabernaemontani* and *Eleocharis acuta*. The regionally uncommon *Sparganium subglobosum* and *Juncus holoschoenus* were found in grazed wetland adjacent to emergent beds. This is the first record of this species from the Northland lakes survey.

Submerged vegetation

Turf communities were sparse due to extensive and dense emergent beds. The 'Nationally Vulnerable' species *Isolepis fluitans* (Plate below) was found in three locations. This included two profiles, amongst *E. sphacelata* beds and also amongst *Apodasmia similis* at the south eastern bay. *Utricularia australis* was relocated at one site in 2008 but not seen in 2013. Charophytes (mostly *Nitella* sp. aff. *cristata*, *Chara fibrosa,* and *C. australis*) were found from the edge of emergent communities to a maximum depth of ~3 m in 3 profiles. Below this, the pondweed, *Potamogeton ochreatus* formed scattered low density growths (~ 0.5 m tall) to 3.9 m. *Utricularia gibba* spread to this lake after 2004 but has not become a dominant feature, probably because this lake is relatively exposed. It was mostly restricted to the emergent vegetation zone but sometimes to a depth of 3.3 m, and occasionally with high covers.

The maximum depth of the vegetation has declined since 2004 when *Potamogeton ochreatus* was abundant and tall (2.5 m) growing to 7.3 m deep. In 2013, the maximum depth of vegetation was only 4.1 m.

Plate: *Isolepis fluitans*.

LakeSPI

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

Survey Date	Status	LakeSPI %	Native Condition %	Invasive Impact %
April 2013	High	59%	53%	28%
April 2008	High	65%	54%	19%
November 2004	Excellent	80%	63%	0%

A high LakeSPI score of 80% in 2004 reflected a high and diverse cover of indigenous plants extending to over 7 m deep. Since then, declining LakeSPI scores reflect the impact *U. gibba* is now having on the lake with additional reduction in native submerged plant covers and their depth limits.

Water birds

Extensive emergent vegetation and a relatively isolated lake provides good habitat for water birds. The 'Nationally Vulnerable' dabchick (*Poliocephalus rufopectus*) and fernbird (*Bowdleria punctata vealeae*) were reported in DOC SSBI records. Canada geese (*Branta canadensis)* were noted during the 2008 survey.

Fish

Common bullies (*Gobiomorphus cotidianus*), eels (*Anguilla* spp.) and the exotic pest gambusia (*Gambusia affinis*) were observed during vegetation surveys. NIWA FBIS also records smelt (*Retropinna retropinna*) caught in this lake.

The Golden Bell frog (*Litoria aurea*) is also common in the margins.

Aquatic invertebrates

Freshwater mussels (*Echyridella menziesi*) were common throughout the lake including below the vegetated zone. The snail *Potamopyrgus antipodarum* and freshwater sponges were also seen.

Lake Ecological Value

Based on the 2008 survey a Lake Ecological Value rating of 12 (Outstanding) was calculated. A slight improvement in the rating of aquatic vegetation diversity has resulted in a revised score of 13 (still Outstanding).

The vegetation in Lake Wahakari has been sampled since 1985. Between 1988 and 2001 the dominant submerged vegetation switched from charophytes to *Potamogeton ochreatus* although bottom limit was similar. In 2004 the vegetation retained tall growths of *Potamogeton ochreatus* to 2.5 m tall growing at high covers to depths of 7.3 m but in 2008 the *P. ochreatus* was much less abundant and much of the deeper depth range had little vegetation present. In 2013 the vegetation has retracted much further. The maximum depth of vegetation was 4.1 m and *Potamogeton ochreatus* less abundant.

Threats

Reducing submerged native plant cover and a substantial reduction in bottom limits signal concerns for this lake. The indicators of lake condition are showing a decline. The drivers of vegetation decline in this lake need further consideration. Drivers likely include decline in water quality with increased TN, TP and chlorophyll a. Impacts from forestry harvesting could be the cause.

The apparently improved access to this lake drastically increases 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 vegetation.

The pest fish *Gambusia affinis* may have a deleterious impact on other fish such as smelt.

Management recommendations

The decline in vegetation bottom limit is significant and the possible cause of bottom limit decline needs investigation.

Monitoring of water quality should be undertaken to determine if there are any indications of what might be driving the changes.

The status of access to the southern end of the lake should be discussed with the local community. Should the lake be more readily accessible then annual surveillance for pest plants should be undertaken.

3.26.2 Lake Waihopo (Aupouri), NRC Lake No. 78.

Plate: Lake Waihopo from the north side, note the extensive emergent vegetation.

Summary

Survey dates 1985, 2001, 2004, 2006, 2009 and 2013.

Overall ranking

High: Well developed submerged vegetation, with dense emergent beds supporting numerous endangered biota.

Threats

Risk of invasive species introductions.

Nutrient enrichment from farming in the catchment.

Management recommendations

Lake native biodiversity value monitoring every 5 years.

Description

Lake Waihopo (1603898E, 6154039N) is a small (3.3 ha) dune lake with a maximum depth of ~3 m. The catchment is primarily pasture (80%) with areas of grazed manuka/kanuka scrub. However, the lake is completely fenced to exclude livestock, but cattle have been observed accessing the margins of the lake in 2009 and 2013. There are no inlet streams, but the outlet, Waihopo Stream, flows through a wetland area at the eastern end of this lake discharging into Houhora Harbour (East Coast). Access is through private farmland off Kimberley Road. Power boat access is difficult due to emergent vegetation, shallow water and a deep peaty-muddy lake bottom, though access is relatively easy for light boats.

Wetland vegetation

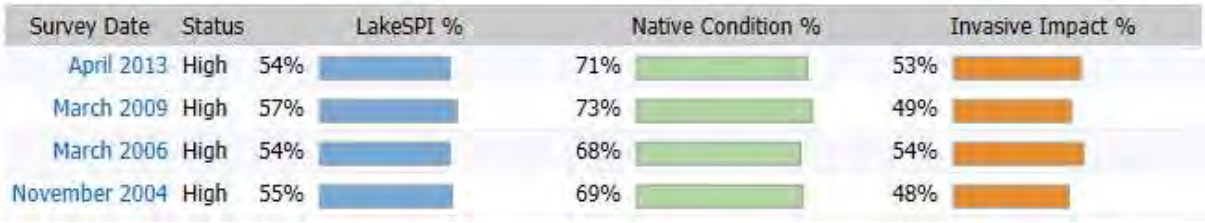
Much of the lake (70%) is occupied by large beds of emergent species, up to 50 m wide. The dominant emergent is *Eleocharis sphacelata* growing from the lake margin to 1.8 m, with other species including *E. acuta*, *Machaerina articulata, M. juncea, M. rubiginosa, Isolepis prolifera* and *Typha orientalis* all common. The regionally significant *Sparganium subglobosum* was noted in the peaty marginal vegetation. The 'At Risk-Nationally Uncommon' *Thelypteris confluens* is present at this lake. A large population of the 'At Risk-Declining' fern *Cyclosorus interruptus* was found in 2006.

Submerged vegetation

In 1985 the lake vegetation was dominated by unusually tall *Chara australis* (to 1.5 m) and extended to 2.8 m deep with the Nationally Critical *Utricularia australis* common and widespread. In 2001 the lake had changed markedly. *Chara australis* was nearly gone, no species exceeded 5% in cover and *Utricularia australis* was not found. In 2004, a recovery was noted and the dominant submerged vegetation was a meadow of charophytes dominated by *Nitella* sp. aff. *cristata* extending from the edge of emergent vegetation to a maximum depth of 2.4 m. The exotic *Utricularia gibba* was recorded sprawling over this meadow, with a median cover of 26-50%. *Utricularia australis* was found in pools amongst the emergent vegetation. In 2006, the maximum depth of vegetation had increased to 2.7 m and further increased to 3.3 m in the 2009 survey. Essentially the entire bottom of this shallow lake was then vegetated. In 2013 it had retracted to 3 m. The dominant species remains *Nitella* sp. aff. *cristata* with some *Chara australis* and lesser amount of *Potamogeton cheesemanii*. *U. gibba* extends over the charophyte dominated vegetation to depths of ~ 2 m with high covers in shallow water. *Utricularia australis* has not been found since 2004.

LakeSPI

Figure: LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right) for 2009.



Survey Date	Status	LakeSPI %	Native Condition %	Invasive Impact %
April 2013	High	54%	71%	53%
March 2009	High	57%	73%	49%
March 2006	High	54%	68%	54%
November 2004	High	55%	69%	48%

Lake Waihopo retains a "High" LakeSPI rank and stable condition despite being impacted by the invasive *U. gibba* which has sprawled over much of the submerged vegetation.

Water birds

Extensive emergent vegetation and surrounding scrub areas provide excellent habitat for water birds. The 'Nationally Endangered' bittern (*Botaurus poiciloptilus*) and the 'Nationally Vulnerable' fernbird (*Bowdleria punctata vealeae*) and 'At Risk – Relictural' spotless crake (*Porzana tabuensis plumbea*) were seen on the field trip. Dabchick (*Poliocephalus rufopectus*) and the Australian vagrant chestnut-breasted shelduck (*Tardorna tardornoides*) were reported in OSNZ records from 2000.

Fish

No fish were seen during the survey. The ‘At Risk – Relictural’ black mudfish (*Neochanna diversus*) was reported from this lake.

Aquatic invertebrates

Freshwater sponges, hydra and backswimmers (*Sigara arguta*) were recorded in the lake.

Lake Ecological Value

Based on the 2009 survey a Lake Ecological Value rating of 11 (High) was calculated. This varies from the assessment in Champion & de Winton (2012) where aquatic vegetation integrity was scored a 3 rather than 2 in error. The latest assessments of endangered biota has led to a reduced endangered biota score, as black mudfish and *Thelypteris confluens* are no longer regarded as ‘At Risk-Declining’ species and this has resulted in a revised score of 10 (still High).

The vegetation in Lake Waihopo has been sampled on 5 previous occasions. The 1985 survey reported charophyte beds dominated by tall *Chara australis* with *U. australis* common throughout the vegetation profile to about 2 m deep. In 2001 the lake was essentially de-vegetated, with *N*. sp. aff. *cristata* the dominant species. In the 2005, 2006, 2009 surveys submerged vegetation had re-established with *N*. sp. aff. *cristata* the dominant species extending to 2.7 m in 2006, but the alien *U. gibba* was covering much of this meadow. The 2009 showed further increase in bottom limit of the vegetation to 3.4 m, with *C. australis* also a common component of this vegetation. In 2013 the vegetation depth limit has retracted to 3.0 m but the species composition is unchanged.

Threats

Submerged weed species are unlikely to be introduced in Lake Waihopo, but could badly impact the lake if this occurs.

Lake water quality is currently eutrophic; the recent fencing could result in an improvement in lake condition, but cattle were present inside the fenced zone during the 2009 visit and were noted wading into the lake, with evidence of this still occurring in 2013. Vegetation history has shown the lake is vulnerable to change and vegetation collapse.

Management recommendations

Carry out lake native biodiversity value monitoring every 5 years.

Small changes improvements in the submerged plant integrity and effective buffering would re-establish the rating of Outstanding for this lake. The lake is vulnerable to nutrient enrichment and we recommend engagement with local landowners to ensure general improvements in the condition of the lake over the past decade continue.

3.27 Lake Waimimiha North (Aupouri), NRC Lake No. 136; surveyed in 2005

Plate: Lake Waimimiha North showing surface-reaching beds of *Ceratophyllum demersum* (bottom left) on the margin of emergent vegetation.

Summary

Overall ranking

Low: The pest plant *Ceratophyllum demersum* has displaced all other submerged species, but emergent vegetation provides valuable habitat for endangered waterbirds.

Threats

Highly impacted by pest plants and nutrient enrichment.

Management recommendations

No monitoring recommended.

Description

This lake (1615456E 6111245N) is 2.2 ha in area, with a maximum recorded depth of ~ 2 m. It is situated on sand dunes. The catchment is predominantly pasture with some market gardening. The Wairoa Stream (running parallel to the coastline for 5 km north of this lake) discharges into this lake via a wetland on the eastern side and the lake is linked to Waimimiha South from the south. The outflow stream passes through a further lake before flowing into Ahipara Bay (West Coast). Access is via 2 km of rough track on private property. No boat access.

Wetland vegetation

There is a dense fringe of emergent vegetation up to 10 m across comprised predominantly of *Typha orientalis*, with a deep water outer edge of *Eleocharis sphacelata* to depths of 1 m.

Submerged vegetation

The submerged vegetation was dominated by surface-reaching (~ 2 m tall) beds of *Ceratophyllum demersum* covering the entire lake outside of the emergent beds.

LakeSPI

Reconnaissance only – no LakeSPI score generated.

Water birds

The large areas of dense tall emergent vegetation provide good habitat for many aquatic birds, although no endangered species were observed during the field visit. The regionally significant spotless crake (*Porzana tabuensis plumbea*) and fernbird (*Bowdleria punctata vealeae*) are reported from this lake complex.

Fish

No fish were seen in the lake.

Aquatic invertebrates

No aquatic invertebrates were noted.

Changes in indicators

This lake was surveyed for the first time in November 2004.

The limited available data suggest there has been little change in lake water quality between 1991 and 2003.

Threats

The worst invasive submerged weed *C. demersum* completely dominated the lake. Alligator weed (*Alternanthera philoxeroides*) was found further downstream and possibly could occupy the open lakeward edges of *T. orientalis* dominated emergent vegetation in the future.

Water quality is already poor (hypereutrophic status).

Management recommendations

No monitoring is recommended.