3.28 Lake Waimimiha South (Aupouri), NRC Lake No. 137; surveyed in 2005

Plate: Lake Waimimiha South showing margin of emergent vegetation. Note the green tinge to the water indicating an algal bloom.

Summary

Overall ranking

Low: No submerged species were seen, but emergent vegetation provides valuable habitat for endangered water birds.

Threats

Highly impacted by pest plants and nutrient enrichment.

Management recommendations

No monitoring recommended.

Description

This lake (1615561E, 6110795N) is 9.2 ha in area. It is situated on sand dunes. The catchment is predominantly pasture with some market gardening. There is a small stream entering the southern end of this lake and an outlet to the north linking to Lake Waimimiha North. Access is via 12 km of rough track on private property. Difficult boat access.

Wetland vegetation

There is a dense fringe of emergent vegetation up to 10 m across comprised predominantly of *Typha orientalis*, with occasional clumps of *Eleocharis sphacelata* in deeper water. No investigation of depth of vegetation was attempted due to possibly toxic algal blooms. The problem weed *Glyceria maxima* was collected from this lake in 1988, but not seen on the reconnaissance visit.

Submerged vegetation

No investigation of submerged vegetation was attempted due to possibly toxic algal blooms, however development of plants with such restricted clarity is unlikely.

LakeSPI

Reconnaissance only – no LakeSPI score generated.

Water birds

The large areas of dense tall emergent vegetation provide good habitat for many aquatic birds, with one nationally endangered bittern (*Botaurus poiciloptilus*) observed during the field visit. Conning and Holland (2003) report the regionally significant spotless crake (*Porzana tabuensis plumbea*) from this lakes complex, while OSNZ survey in 2000 recorded fernbird (*Bowdleria punctata vealeae*).

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

Poor water clarity would restrict the development of submerged vegetation. 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.

3.29 Lake Waipara / Dead Lake (Aupouri), NRC Lake No. 25; surveyed in 2005

Plate: Lake Waipara showing the margin of scrub vegetation with pine forestry behind this. Note the narrow emergent zone.

Summary

Overall ranking

High: Indigenous lake with indigenous scrub margin, reduced submerged vegetation due to humic staining, endangered birds present.

Threats

Low; isolated lake, possible threat from diggers, buffered from groundwater nutrient additions.

Management recommendations

Lake native biodiversity value monitoring every 5 years.

Description

Lake Waipara (1586647E, 6172834N) is 1.3 ha in area and > 5 m deep. Ringed by a narrow margin of manuka scrubland, a forest road and then plantation pine forestry. No inflow or outflow streams. Access is through 7 km of forestry roads with trailer access possible at one point (bulldozed track to lake margin).

Wetland vegetation

The lake was ringed by a narrow (2 to 5 m wide) emergent band of *Baumea articulata* (edge to 0.5 m deep) and *Eleocharis sphacelata* (0.5 to 2 m deep).

Submerged vegetation

Submerged vegetation was native but depauperate due to low light penetration. *Chara australis* the most common charophyte extending from the edge of emergent vegetation to a maximum depth of 2.8 m. *Potamogeton cheesemanii* was the only tall-growing species.

LakeSPI

Reconnaissance only – no LakeSPI score generated.

Water birds

The isolated nature of this lake with a scrub margin, but relatively poorly developed emergent vegetation provides a moderate habitat for water birds. The nationally threatened bittern (*Botaurus poiciloptilus*) and regionally significant fernbird (*Bowdleria punctata vealeae*) were both recorded at this lake during the vegetation survey.

Fish

No fish were recorded.

Aquatic invertebrates

Pea mussels (*Sphaerium novaezelandiae*) and freshwater sponges were observed during the vegetation survey.

Changes in indicators

No previous surveys.

Threats

Risk of introduction is low, unless drainage machinery accesses the lake. Pest impacts would be minimal due to low light penetration. Good buffer to nutrient addition via ground water/run-off.

Management recommendations

Lake native biodiversity value monitoring every 5 years.

3.30 Lake Waiparera (Aupouri), NRC Lake No. 102; surveyed in 2005 and 2010

Plate: Lake Waiparera.

Summary

Overall ranking

Moderate-high: Submerged native vegetation to 3 – 4 m deep with invasive species (weeds and fish) present, but good water bird habitat and threatened plants and fish present.

Threats

An easily accessed lake with *C. demersum* introduction a threat. The lake is nutrient enriched and submerged vegetation is threatened by further enrichment.

Management recommendations

Lake native biodiversity value monitoring every 5 years.

Description

The lake (1616526E, 6133135N) is the largest of the Aupouri lakes (103 ha) but relatively shallow (6 m). This catchment is approximately 70% pasture (mostly fenced) with the remainder in native scrub or wetland. The lake has several inflows, mostly drains on the south western side, but also a drain on the north-western and north eastern shores. There are no obvious outflows. Access for vehicles and boats is easy with a driveway off SH 1.

Wetland vegetation

Emergent vegetation nearly encircled the lake extending over 10 m wide in many places. Vegetation was dominated by monocultures of: *Typha orientalis, Apodasmia similis, Baumea articulata, B. arthrophylla* and *Eleocharis sphacelata* to 0.2 m deep. Water levels were low at the time of survey, perhaps by 05 - 1.0 m.

The alien invasive alligator weed (*Alternanthera philoxeroides*) formed floating mats on the south western shore and appeared to be well established around the southern part of this lake. One 2 m tall royal fern (*Osmunda regalis*) was located at the north western end of the lake amongst manuka, the first record of this species north of Kaipara District. This species is a major wetland weed. Several plants of the endangered fern *Cyclosaurus interuptus* were found amongst emergent vegetation.

Submerged vegetation

The lake is shallow and gently slopes, so the area vegetated is large with all profiles over 100 m long and some ~200m long. Low cover turf vegetation occurred at shallow (<1 m) shoreline areas, except where dense emergents occurred. Turfs were dominated by *Lilaeopsis novae-zelandiae* with several charophytes including *C. globularis, Nitella hyalina* predominantly restricted to this vegetation. The exotic *Utricularia gibba* was present at low covers in 2005 but not recorded in 2010. The exotic oxygen weeds *Egeria densa* and *Lagarosiphon major* formed low average covers (<26%) from 1 m to 3 m deep. The native *Potamogeton ochreatus* had a similar depth range but much higher average covers (79 – 95%). *Nitella* sp. aff. *cristata* also formed dens covers 51 - 75% as did *Chara australis*, though the latter was mostly found >2 m deep. The native vegetation cover and depth range was greater than in 2005.

LakeSPI

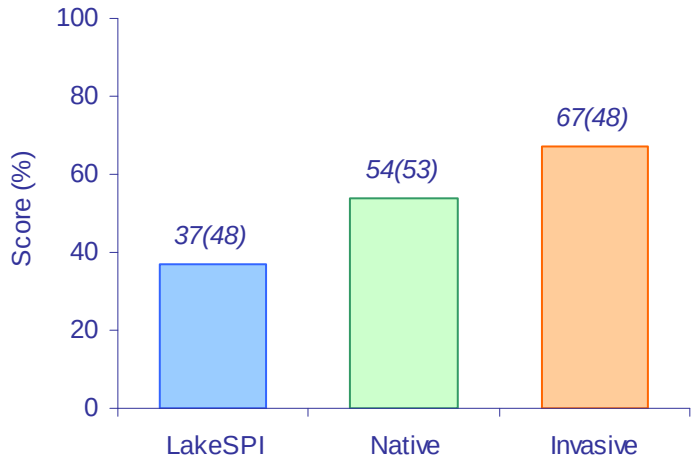

Figure: 2010 LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right). 2005 score in brackets.

The low LakeSPI score of 37% reflects the increased impact (deeper growing) of the invasive alien species *E. densa* and *L. major* in 2010 compared to 2005.

Water birds

The extensive emergent vegetation and fenced areas provided good water bird habitat. Several of the regionally significant scaup (*Aythya novaezeelandiae*) were present on the lake at the time of survey with other common species such as black swans (*Cygnus atratus*) and paradise shelduck (*Tadorna variegata*). DoC SSBI records include the nationally threatened bittern (*Botaurus poiciloptilus*).

Fish

NIWA FBIS database reports common bullies (*Gobiomorphus cotidianus*), lake-bound inanga (*Galaxias maculatus*), long and shortfin eels (*Anguilla dieffenbachii* and *A. australis*) and the pest fish *Gambusia affinis* from this lake. DoC sampling on the 2005 field trip sampled many goldfish (*Carassius auratus*), but no rudd (*Scardinius erythrophthalmus*) were caught, despite being seen in 2001.

Aquatic invertebrates

Freshwater sponges and the native snail *Potamopyrgus antipodarum* were commonly observed in the lake.

Changes in indicators

The submerged vegetation declined between the 1980's and 2001 with reduced cover (~ 90% to <5%) and bottom limit (4 to 2.5 m). The 2005 survey reported a denser vegetation ~50% with a slightly deeper bottom limits (2.8 m). This 2010 survey again had covers comparable to the 1980's with average vegetation covers around 90% and bottom limits may have been as deep if the water level had not been so low at the time of survey (2010 was a drought year). The pest plants *E. densa* and *L. major* were first recorded in Lake Waiparera in 1990 and 1975 respectively, but *A. philoxeroides* and *U. gibba* were reported for the first time in 2005. The nationally endangered turf species *Trithuria inconspicua*, was last recorded here in 1993.

Threats

The lake is already impacted by introduced species with further impacts likely if *C. demersum* was introduced. Access to the lake is easy and has resulted in several pest plant incursions in the last 40 years. Neither of the current submerged oxygen weed species form dense tall beds in this lake. *U. gibba* and alligator weed are also predicted to have limited impact. *U. gibba* was present in 2005 but not found in 2010. Pest fish may impact on the vegetation and other fish within the lake.

Royal fern (*Osmunda regalis*) was located at the north western end of the lake amongst manuka, the first record of this species north of Kaipara District. Department of Conservation is managing this species (G. Williams pers. comm.).

The lake is now fenced and development of riparian and emergent vegetation in formerly grazed lake margins is likely to reduce nutrient inputs, however drains entering provide point sources of nutrients draining from pastoral land.

Management recommendations

The lake may provide a source of pest plants and fish to other water bodies. Signage and possible weed control in the vicinity of the boat ramps are suggested.

Lake native biodiversity value monitoring every 5 years.

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

3.31 Waitahora Lagoon (Aupouri) NRC Lake No. 4; surveyed in 2007 and 2009

Plate 1: LEFT 2007 showing the east end of Waitahora Lagoon, showing a saline influenced wetland dominated by the green oioi (*Apodasmia similis*) and brown sea rush (*Juncus kraussii* var. *australiensis*). RIGHT 2009 showing a closer of the same area but with the oioi impacted by saltwater intrusion.

Summary

Overall ranking

Outstanding: Pristine wetland complex with both saline and freshwater components, numerous endangered biota, and an indigenous catchment. No pest species were recorded.

Threats

Low risk of introduction of invasive pests. The isolated nature of this lagoon and the surrounding indigenous vegetation indicates there is little immediate invasive threat to this site. Saline intrusions due to cyclical changes at the outlet could impact freshwater components.

Management recommendations

Ecological condition monitoring every 5 years.

Description

Waitahora Lagoon (NZMG 2493880E, 6749715N) is a large (20.7 ha) coastal lagoon surrounded by indigenous vegetation. It was linked to the sea at the western end and most of the lagoon was saline. The catchment was primarily scrub although a large wetland was present around the Waitahora Stream and other unnamed streams, at the east end of the lagoon. This section of the lagoon and links with smaller freshwater lakes (see next section). The lagoon is accessed from the Cape Reinga Walkway some 6 km west of the Kapowairua Camp Ground. It can be accessed through a locked gate under DoC control and a 4 WD track.

Wetland vegetation

The west half of Waitahora Lagoon lacked significant wetland margins being situated between scrub on the southern side and dunes to the north. Dune vegetation included the nationally rare grass *Austrofestuca littoralis*. The east half of the lagoon was surrounded by an extensive wetland dominated by oioi (*Apodasmia similis*) and sea rush (*Juncus kraussii* var. *australiensis*). Marginal areas contained *Baumea juncea, Cyperus ustulatus* and the nationally endangered *Hibiscus diversifolius*. In 2009, salt water intrusion into the lagoon had killed shoots of oioi, and *Baumea juncea,* but seedlings of *Lilaeopsis novaezelandiae*, *Mimulus repens* and *Selliera radicans* were noted. Amongst the tall emergent vegetation and along the channels of the upper lagoon were typical salt marsh species such as *Selliera radicans* and *Samolus repens* and large areas of the nationally 'At-risk' *Mimulus repens*. It is a rare plant in Northland with only two other sites known and the Waitahora Lagoon site comprises the largest and least vulnerable population for the species.

Submerged vegetation

Most of the lagoon was saline with no submerged vegetation. However, some sparse vegetation (5-25% cover) was noted in 2007 in the upper channels (as shown in Plate 1). Species present included *Ruppia polycarpa, Triglochin striata, Mimulus repens* and a charophyte in the genus *Lamprothamnium*. All these species are typical from brackish areas, although the first of these plants is also relatively common in freshwater lakes. Prior to the 2007 survey one species of *Lamprothamnium* (*L. macropogon*) was recorded from the southern North Island, the South Island and Chatham (Rekohu) Island, with the northernmost record from the Whakaki Lagoon near Wairoa (Hawkes Bay). The Waitahora Lagoon plant appears to be a different species (M. de Winton pers. comm.) and has been planted to grow on to enable its identification. In 2009 the *Lamprothamnium* site had recently been affected by a saline intrusion and no submerged plants were found and surrounding rushes / sedges were brown. A channel closer to the freshwater wetland supported *Utricularia australis* growing over dead rushes / sedges.

LakeSPI

LakeSPI score not generated for this lagoon.

Water birds

Extensive emergent vegetation and relatively undisturbed nature of this lake provides a good habitat for water birds. The regionally significant fernbird (*Bowdleria punctata vealeae*) was heard in the wetland areas at the east end of Waitahora Lagoon. OSNZ records from this locality include the nationally endangered brown teal (*Anas chlorotis*) and one of the few Northland records of marsh crake (*Porzana pusilla*).

Fish

About a 40 strong school of grey mullet (*Mugil cephalus*) up to 30 cm long was observed in the clear waters of the lagoon in 2007. There are no NIWA FBIS records of fish from this location.

Aquatic invertebrates

No invertebrates were noted.

Changes in indicators

Too shallow for LakeSPI.

Threats

The isolated nature of this lagoon (with locked gate) and the surrounding indigenous vegetation indicates little immediate threat to this site. Periods of saline inflow when the western end of the sand bar is open (as was the case in 2009) along with periods where the lagoon is dominated by freshwater results in a highly dynamic habitat.

Management recommendations

Carry out 5 - year ecological condition monitoring.

A fish survey is advocated to determine the fauna of the saline and freshwater parts of the Waitahora wetland complex.

3.32 Waitahora Lakes (Aupouri) NRC Lake No. 3; surveyed in 2007 and 2009

Plate 2: Freshwater lake, east of Waitahora Lagoon dominated by Eleocharis sphacelata.

Summary

Overall ranking

Outstanding: Pristine wetland complex with both saline and freshwater components with numerous endangered biota and an indigenous catchment. No pest species recorded.

Threats

Low risk of introduction of invasive pests. The isolated nature of these lakes and the surrounding indigenous vegetation indicates little immediate threat to this site. Wetland is dependent on water banking up behind the dune complex.

Management recommendations

Ecological condition monitoring every 5 years.

Description

There were several small freshwater bodies to the east of Waitahora Lagoon (NZMG 2494230E, 6749760N), the largest being 2.3 ha in area, although most of this was covered by tall emergent vegetation. The catchment was primarily manuka scrub with a large wetland around the Waitahora Stream, other unnamed streams, and surrounding the freshwater

lakes. Water was tea-stained indicating high humic content (Plate 3). The lakes are accessed from the Cape Reinga Walkway some 5.5 km west of the Kapowairua Camp Ground.

Wetland vegetation

The water bodies were predominantly filled with the emergent sedges *Eleocharis sphacelata* (Plate 2) and *Baumea articulata* growing to depths of 1 m. The nationally endangered *Hibiscus diversifolius* (classified as 'National Vulnerable') was common in the marginal vegetation of these lakes.

Submerged vegetation

In 2007, open areas of water had some *Chara australis* and *C. fibrosa*, with pondweeds (*P. cheesemanii* and *P. ochreatus*), the milfoil *Myriophyllum propinquum* and the introduced swamp lily (*Ottelia ovalifolia*). The nationally endangered *Utricularia australis* was commonly found (Plate 3). The introduced water purslane (*Ludwigia palustris*) was found at the margin of the lake.

In 2009 in the same area was covered in *Azolla pinnata* covered open water amongst the *Baumea articulatata* and *Eleocharis sphacelata* with submersed *Myriophyllum propinquum* and sprawling *Percicaria decipiens*.

LakeSPI

No LakeSPI score was generated for this lagoon.

Water birds

Extensive emergent vegetation and relatively undisturbed nature of this lake provides a good habitat for water birds. The nationally threatened bittern (*Botaurus poiciloptilus*) was seen and the regionally significant fernbird (*Bowdleria punctata vealeae*) was heard.

Fish

No fish were seen and there are no NIWA FBIS records of fish sampled from this location.

Aquatic invertebrates

No invertebrates were noted.

Changes in indicators

First sampled in 2007.

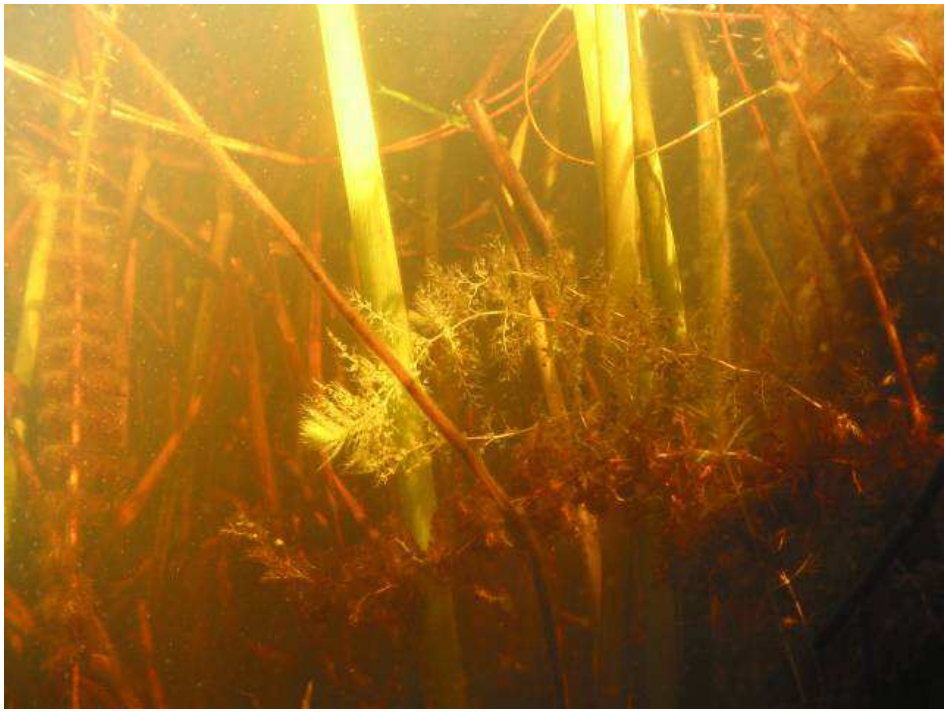

Plate 3: Freshwater lake east of Waitahora Lagoon with the endangered bladderwort (*Utricularia australis* – centre) and the milfoil *Myriophyllum propinquum* (left and right) in open water amongst the culms of *Eleocharis sphacelata* (centre background).

Threats

The isolated nature of this lagoon and the surrounding indigenous vegetation indicates little immediate threat to this site. The introduced swamp lily and water purslane are common species in Northland and pose little threat to the ecology of this otherwise pristine system.

Management recommendations

Ten year ecological condition monitoring.

A fish survey is advocated to determine the fauna of the saline and freshwater parts of the Waitahora wetland complex.

3.33 West Coast Road (Aupouri), NRC Lake No. 121; surveyed in 2005, visited in 2007 and 2010

Plate: West Coast Road Lake showing emergent dominated water body with the endangered *Myriophyllum robustum* (bottom right) 2005. However (without disturbance spraying) emergents have taken over the whole lake and there is no open water and no *M. robustum* was seen in 2010.

Summary

Overall ranking

Low: Outstanding water bird habitat, but endangered plants now displaced by the dense *Eleocharis sphacelata*, and invasive *Utricularia gibba* present.

Threats

U. gibba may be out-competing some endangered species, but dense reedbeds of *E. sphacelata* are likely to have a greater impact on the endangered *Myriophyllum robustum.*

Management recommendations

Control the *E. s*phacelata to maintain some open water. Lake native biodiversity value monitoring every 5 years.

Description

This dune lake (1616741E 6123403N) is 1.6 ha in area with a maximum depth of ~ 1.5 m. The catchment is pine plantation forestry (50%), wattle scrub (20%), pasture and roadside grassland (30%). There are no inlets or outlets. Access is directly off the West Coast Road, but boating is not an option in this lake. The emergent cover in 2010 had increased leaving no open water habitat.

Wetland vegetation

Approximately 90% of the lake was covered with dense emergent vegetation dominated by *Eleocharis sphacelata* with local patches of the taller *Baumea articulata*. In the early 1990's *Salvinnia molesta* covered the water surface. An aerial spray programme to eradicate the *S. molesta* also reduced the cover of *E. spacelata* providing areas of open water. In 2005 the nationally endangered *Myriophyllum robustum,* a sprawling emergent species, was restricted to areas of open water amongst the taller sedges (see plate). However when visited in 2007 these plants could not be found and sedges occupied its former habitat. In 2010 the whole lake had been colonised by *E. sphacelata*.

Submerged vegetation

In 2005 vegetation in the roadside pools were dominated by dense mats of the exotic *Utricularia gibba*, in full flower, with *M. robustum, M. propinquum, Isolepis prolifera* and *Persicaria decipiens* emergent through the mat. In 2010 however, the open water was gone with *E. sphacelata* now growing densely at that location. At the eastern end of the lake the landowners had cleared the emergent vegetation with an area of open water resulting. Submerged vegetation was sparse in this area.

LakeSPI

Reconnaissance only – no LakeSPI score generated.

Water birds

The dense tall emergent vegetation provided excellent habitat for many aquatic birds, including the nationally threatened bittern (*Botaurus poiciloptilus*) and regionally significant dabchick (*Poliocephalus rufopectus*) and spotless crake (*Porzana tabuensis plumbea*).

Fish

The pest fish *Gambusia affinis* were abundant in the lake, the only species seen and recorded in the NIWA FBIS database.

Aquatic invertebrates

No aquatic invertebrates were noted.

Changes in indicators

The invasion of *U. gibba* into this sheltered shallow water body may have displaced a range of submerged species previously recorded (1984 to 2001) including the charophytes *Nitella* sp. aff. *cristata* and *N. leonhardii* and the nationally threatened *U. australis*. Emergent vegetation appears to have encroached on previously open water areas also out-competing *M. robustum*.

Threats

The free-floating pest plant *Salvinia molesta* previously dominated the vegetation of this lake but was eradicated in the mid-1990's. Control measures (aerial application of herbicide) opened up the wetland vegetation and provided habitat for other species. Invasive submerged species are unlikely to impact this water body.

Management recommendations

Lake native biodiversity value monitoring every 5 years.

Control some areas of *E. sphacelata* with glyphosate to provide open water habitat for growth of the endangered *M. robustum*.

3.34 Lake Yelavich (Aupouri), NRC Lake No. 105; surveyed in 2008 and 2010

Plate: Lake Yelavich, a dune lake within plantation pine forestry.

Summary

Overall ranking

High: A shallow lake with a large population of the endangered *Myriophyllum robustum*, a large entire marginal fringe of emergent species, and a *Chara australis* dominated submerged vegetation to 2.5 m but with high covers of *Utricularia gibba*.

Threats

Low: Isolated with access through private forestry, but it is visited by duck shooters.

Management recommendations

Monitoring for nutrient status and 5 yearly condition monitoring.

Description

Lake Yelavich (1614575E, 6132392N) is about 3 ha in area. The lake was tannin stained, but not turbid with visibility of around 2.5 m. The lake lies in a scrub and pine plantation catchment. Access was through Juken Nissho Ltd forestry roads.

Wetland vegetation

The lake was encircled with emergent vegetation 10 – 20 m wide dominated by *Eleocharis sphacelata* extending to 2 m depth.

Submerged vegetation

There was submerged vegetation (mainly *Chara australis* with some *Potamogeton cheesemanii* and *Nitella* sp. aff. *cristata*) beyond the emergent vegetation. *Utricularia gibba* was thick to 2 m deep with covers exceeding 95% on all profiles. The nationally threatened *Myriophyllum robustum* was widespread at low covers from 1.4 to 1.7 m deep amongst less dense fringes of *E. sphacelata*.

LakeSPI

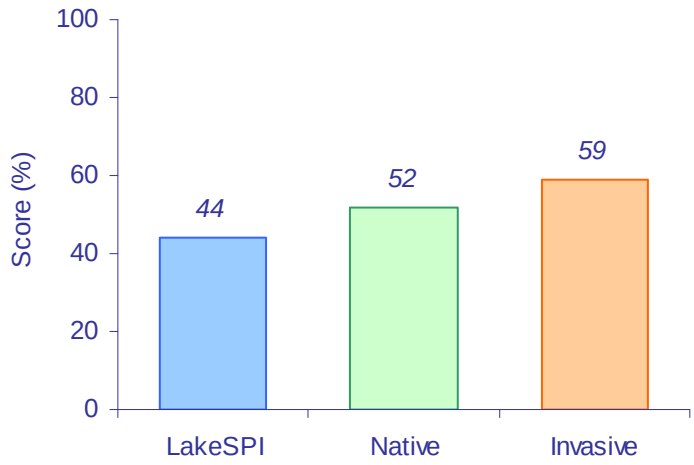

Figure: LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right).

The LakeSPI Index was low (44%), as this measure focuses on submerged plants which were limited with limited (shallow) development of native submerged vegetation and impacted by the invasive species *Utricularia gibba*.

Water birds

The lake has good habitat for birds (large expanses of tall emergent vegetation) although none were recorded during the visit.

Fish

Bullies were seen on this visit with visibility about 2.5 m in 2010.

Aquatic invertebrates

None seen.

Changes in indicators

Overall submerged vegetation has increased in abundance since 2008, but so has the *Utricularia gibba.*

Threats

Pines were recently harvested but no effects (e.g., high suspended sediments) were recorded. The isolated nature of the lake and large surrounding wetland indicate that there are few Threats of nutrient enrichment or invasive species. Duck shooting was evident from empty cartridges around the margins; hopefully pest plants such as alligator weed, willow and oxygen weeds are not introduced misguidedly to ‘enhance’ the habitat for wildfowl.

Management recommendations

This is a good example of a shallow tannin-stained lake, with intact fringe of emergents and no livestock access. An assessment of lake native biodiversity value at 5 yearly intervals is recommended.

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

4 Karikari Peninsula, central and east

4.1 Horahora Dune lake (central and east Northland), NRC Lake No. 199A; visited in 2008

Plate: Horahora Dune Lake, Ngunguru.

Summary

Overall ranking

Low: Isolated, with some endangered birds. Water body very shallow, dominated by the introduced swamp lily.

Threats

High risk of drying completely.

Management recommendations

No further monitoring.

Description

Horahora Dune lake (1736048E, 6051806N) was almost dry when visited, with two shallow (0.5 m deep) ponds <1ha in area. The lake is situated on the northern side of the Horahora River mouth accessed through private Maori land. The catchment was rough pasture and scrub, with a 3 ha wetland fringe around some of the lake.

Wetland vegetation

Some areas of *Eleocharis sphacelata* were present within the lake. This and other species including *Eleocharis acuta*, *Baumea articulata*, *Cyperus ustulatus*, *Persicaria* spp. and *Alternanthera sessilis* were present in the wetland.

Submerged vegetation

The lake was dominated by the introduced swamp lily (*Ottelia ovalifolia*), with *Myriophyllum propinquum*, *Potamogeton cheesemanii* and *Ludwigia palustris* in the shallows.

Water birds

The wetland provided good bird habitat. The endangered fernbird (*Bowdleria punctata vealeae*) and bittern (*Botaurus poiciloptilus*) were seen as well as the more common mallard (*Anas platyrhynchos*), coot (*Fulica atra*) and paradise duck (*Tadornia variegata*).

Fish

Shortfin eels (*Anguilla australis*) were present.

Aquatic invertebrates

Sigara arguta were common.

Changes in indicators

This was the first time this lake has been surveyed.

Threats

The water level in the lake is now very low, apparently reducing over the past 30 years (pers. comm. owner). Further falls in water level will completely drain the waterbody.

Management recommendations

No further monitoring.

4.2 Jack's lake (Central Northland), NRC Lake No. 180; surveyed in 2005

Plate: Access point showing forest remnant at the northern end of Jack's Lake.

Summary

Overall ranking

Low: This artificially dammed lake has little current ecological value.

Threats

The location on private land reduces the threat of further pest introduction, however the presence of *Egeria densa* in neighbouring Lake Owhareiti represents the most immediate weed risk.

Management recommendations

No monitoring.

Description

This dammed lake (1684321E, 6083377N), adjacent to Lake Owhareiti, was created ~ 20 years ago. It is accessed via well-formed tracks across private pastoral land and ~ 20% of the catchment is in indigenous forest. The lake is 16.6 ha in size, 6.5 m depth and while the lake level is currently maintained by a dammed outlet, it has been known to have dried out in the past (landowner pers. comm.). There is one inlet drain to the south of the lake, with no outlet. Boat access is difficult.

Wetland vegetation

The only tall emergent species recorded at the lake was *Eleocharis sphacelata* restricted to around 25% of the lakeshore, with grazing on much of the margin except for forest areas. The regionally uncommon *Gratiola sexdentata* was found in marginal turf areas. The pest plant *Glyceria maxima* was seen adjacent to the forest remnant.

Submerged vegetation

The turf plant *Glossostigma elatinoides* was common, together with low covers of *Myriophyllum propinquum*, *M. triphyllum* and *Nitella pseudoflabellata* that were also restricted to the shallow margin in depths <1 m. Beyond 1 m depth the vegetation was equally dominated by *Potamogeton ochreatus* and the exotic *P. crispus* to a maximum depth of 2.9 m. *Chara australis* and *Potamogeton cheesemanii* were occasionally encountered to 2.5 m.

LakeSPI

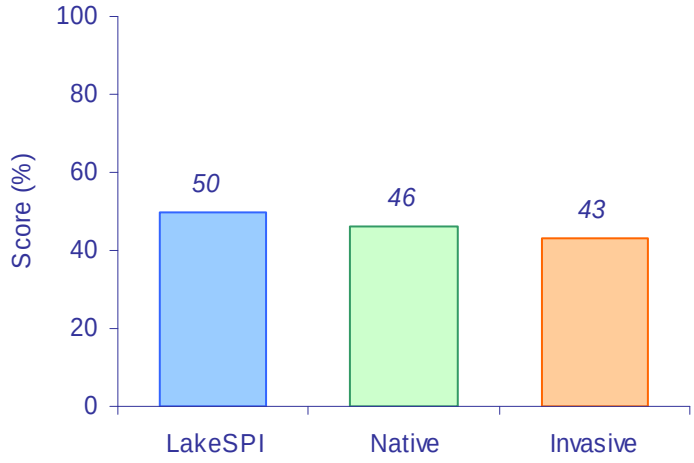

Figure: LakeSPI condition as % of potential score, native index, and invasive index (from left to right).

The moderately low LakeSPI score of 50% reflects a restricted development by native vegetation and the presence of *P. crispus*.

Water birds

The restricted emergent vegetation would provide limited water bird habitat, but the lake is fairly isolated. Black shag (*Phalacrocorax carbo*), black swan (*Cygnus atratus*) and mallard (*Anas platyrhynchus*) were noted during the visit. DoC SSBI reports regionally threatened dabchick (*Poliocephalus rufopectus*) and scaup (*Aythya novaezeelandiae*) in 1991, with only common species recorded by the more recent OSNZ survey.

Fish

Common bullies (*Gobiomorphus cotidianus*) were seen with many dead fish noted.

Aquatic invertebrates

The indigenous snails *Austropeplea tomentosa, Potamopyrgus antipodarum*, pea mussel (*Sphaerium novaezelandiae*) and backswimmers (*Sigara arguta*) were recorded.

Changes in indicators

Since 2001 there has been a large change in the composition and abundance of submerged vegetation. Previously, dense beds of *C. australis* extended to 3.4 m, however charophyte beds were not present in the current survey. The exotic *P. crispus* has increased in frequency since 2001.

Threats

The pest plant *P. crispus* was noted as present in 2001, but currently appears to have become more frequent, now being the co-dominant submerged species. The presence of *Egeria densa* in neighbouring Lake Owhareiti is the most immediate additional pest plant risk to this waterbody, although access to the lake is limited.

This dammed lake may be susceptible to water level reductions, as has occurred in the past, but currently the water level is rising and of concern to the landowners.

Management recommendations

No monitoring.

4.3 Lake Kaiwai (Central Northland), NRC Lake No 193.

Plate: Lake Kaiwai.

Summary

Survey date: 2012.

Overall ranking

High; although submerged vegetation is sparse, the wide emergent vegetation zone grading into indigenous forest on surrounding western hills and the presence of rare plants and animals make this a regionally important lake.

Threats

Few, the landowners are keen to maintain the lake in its current condition and were informed of potential threats from pest plant and fish introductions.

Management recommendations

Lake ecological assessment every 5 years. Livestock should be excluded from the wetland margin.

Description

A small (7.5 ha) peat lake (2595306E, 6641419N) with a maximum depth of 8.0 m. The lake is a naturally dammed stream with two arms situated in plantation forest, regenerating native bush and farmland. The outlet, the Terewatoa Stream flows into the Orauta Stream, discharging into the southern part of the Bay of Islands. Access is across private farm land, with no trailer boat access, and no powered craft permitted by the owners.

Wetland vegetation

The lake was ringed with emergent vegetation up to 30 m wide and *Typha orientalis* (growing to 1 m deep) with lesser amounts of *Eleocharis sphacelata, Machaerina articulata, M. arthrophylla* and *M. teretifolia* with the native swamp millet (*Isachne globosa*). *E. sphacelata* extended to 2.5 m water depth. *Potamogeton cheesemanii* and *Myriophyllum robustum* were present amongst the marginal species and *Utricularia gibba* formed mats to 0.5 m depth throughout the wetland margins. Closer to the shore, the vegetation also contained mats of *Sphagnum cristatum* with emergent flax (*Phormium tenax*), *Gleichenia dicarpa, Juncus bulbosus, J. fockei* and *J. prismatocarpus* with the regionally rare maru (*Sparganium subglobosum*). Much of the lake margin was forested with manuka fringe vegetation and further from the lake, diverse podocarp dominated vegetation on the western side and plantation pine forest on the eastern side.

Submerged vegetation

Dark stained water significantly reduced light penetration effectively removing visibility beyond 2.5 m. Profiles from the deep emergent fringe descended steeply to 6 m before levelling off. No submerged vegetation was found although some floating fragments of *Potamogeton ochreatus* were noted.

LakeSPI

This lake generates a default LakeSPI Index of 0% (Non-vegetated) on account of submerged plants being recorded at <10% cover.

Water birds

The lake provides significant bird habitat with waterfowl noted in the margins including the regionally significant fernbird (*Bowdleria punctata vealeae*), with the nationally endangered bittern (*Botaurus poiciloptilus*) reported (Paki Thompson, landowner, pers. comm.).

Fish

Williams et al. (2011) recorded longfin and shortfin eels and common bullies in the lake and the Terewatoa Stream.

Aquatic invertebrates

None recorded.

Changes in indicators

Not surveyed before.

Threats

Few, the isolated nature of the lake and access through private land should reduce the risk of pest transfer. Land owners do not permit the use of motorised boats (Paki Thompson pers. comm.) and the risk posed by contaminated eel fishing nets was discussed during the 2012 field visit.

Management recommendations

Conduct a survey of the fish fauna. Local landowners were keen to exclude cattle from the wetland margins and financial assistance available to fence off the wetland was discussed by NRC staff with the owner.

4.4 Roadside pond, Matai (Karikari), no NRC Lake No.; surveyed in 2005

Plate: Roadside pond at Matai, note the sprawling *Isolepis prolifera* margin (light green), contiguous mat floating mats of *Utricularia gibba* around the pond (pale brown) and floating leaves of swamp lily (*Ottelia ovalifolia*).

Summary

Overall ranking

Low: This artificially dammed pond has little current ecological value.

Threats

Utricularia gibba is abundant, the only known site on the Karikari Peninsula.

Management recommendations

No monitoring.

4.5 Lake Manuwai (Central Northland), NRC Lake No. 146

Summary from 2001 survey.

Summary

Overall ranking

Low: This artificially dammed reservoir has limited ecological value.

Threats

Probably low impact of invasive species due to steep topography.

Management recommendations

No monitoring.

Description

This reservoir (1678437E 6107774N) is formed from a dam on the Waipapa River. The lake is 133 ha in size and over 10 m deep. Surrounding catchment is mostly pasture and forest. The reservoir is open to the public where boat access is easy with a concrete ramp provided.

Wetland vegetation

Emergent vegetation is sparse due to the steep topography and exposed nature of the lake. *Eleocharis sphacelata* and *Typha orientalis* were present growing to 1.8 and 1.4 m respectively.

Submerged vegetation

A turf community was also present in the shallows (to 1.5 m deep) consisting of *Glossostigma submersum, Myriophyllum propinquum* and the regionally significant *Gratiola sexdentata*. Below this vegetation consisted of a charophyte meadow (predominantly *Nitella* aff. *cristata*) extending from 1 to 4 m deep with scattered plants to 6.1 m. *Potamogeton ochreatus* emerged from this vegetation (up to 1.5 m tall) at low density.

LakeSPI

LakeSPI score is not generated from previous survey data.

Water birds

The restricted emergent vegetation would provide limited water bird habitat, but the lake is fairly isolated. Only common species were recorded by the recent OSNZ survey.

Fish

Gambusia affinis were seen.

Aquatic invertebrates

Dragonfly (*Odonata*) larvae were recorded.

Changes in indicators

Water quality of this lake has been sampled twice a year since 1991. Previous Secchi data (1.0-2.2 m) suggest low water clarity. There is no evidence of a change in water quality. Current nutrient and chl a levels are within the range previously recorded (TN <50-800 mg N m^{-3}, TP <4-574 mg P m^{-3}, chl a <3-<10 mg m^{-3}).

Threats

Egeria densa was sampled in neighbouring streams and dams but should this or other weeds establish the probable impact would be low due to steep topography.

Management recommendations

No monitoring.

4.6 Lake Omapere, (Central Northland) - NRC Lake No. 173

Plate: Lake Omapere in a predominantly pastoral catchment.

Summary based on previous surveys

Survey dates

2005, 2012.

Overall ranking

High: This lake is currently de-vegetated with high nutrients an issue, but extensive margins support three critically endangered species.

Threats

Low threat of weed invasion due to grass carp and currently degraded state, with hypereutrophic nutrient status.

Management recommendations

Consider lake restoration initiatives such as attempting to restore the critically endangered *Isoëtes kirkii* var. *flabellata* to its last known locality, monitoring of other critically endangered species and potential establishment of native submerged vegetation.

Description

Lake Omapere (1671879E 6088198N) is the largest lake in Northland being 1,197 ha in area but is only 2.6 m deep (as low as 1.5 m during summer). It was formed by a volcanic flow damming the outlet, with evidence of the lake becoming a forested wetland, then re-flooded following a fire around 1300 (Newnham et al. 2004; Williams et al. 2009). The surrounding catchment is mostly pasture. There are a few inflow streams, mostly in the southern part of the lake, with the outflow, the Utukura River flowing from the south-western margin of Lake Omapere to the Hokianga Harbour. Access is through private property, boats can be launched with a 4-WD.

Wetland vegetation

The western shore of Lake Omapere supported emergent vegetation consisting of dense bands (>75% cover) of *Machaerina articulata*, *Schoenoplectus tabernaemontani* and *Typha orientalis* to a water depth of 1.2 to 1.3 m. The remainder of the shoreline was pasture with the rush *Juncus edgariae* common near the water's edge and a range of turf species such as *Lilaeopsis novae-zelandiae, Myriophyllum propinquum, Gratiola sexdentata, Glossostigma elatinoides* and *G. cleistanthum* in the wettest areas. Two nationally critically threatened plants (de Lange et al. 2009) were discovered during the 2012 field trip. These were the annual composite *Centipeda minima* subsp. *minima* and the fern *Ophioglossum petiolatum*. These discoveries significantly increase the ecological value of this lake. Alligator weed (*Alternanthera philoxeroides*) was well established and formed large floating mats on the eastern shoreline of the lake.

Submerged vegetation

The submerged vegetation of Lake Omapere collapsed in 2001 and the lake has remained in a de-vegetated state dominated by cyanobacterial blooms since that time. On 16th April 2012, a profile from the south side of the lake to the north side, about 3.3 km long from NZMG 2582533E, 6648324N to 2583273E, 6651676N was spot dived. Very small amounts of *Glossostigma cleistanthum* were found at 0.4 m deep at the south end and one tiny plant *Chara australis* at 1.4 m deep was found. High covers of *G. cleistanthum* and *G. elatinoides* were found amongst basalt boulders during a snorkel search around the eastern shore in 2012.

LakeSPI

This lake generates a default LakeSPI Index of 0% (Non-vegetated) on account of submerged plants being recorded at <10% cover. This status is the result of management stocking of grass carp (see below).

Water birds

The restricted emergent vegetation would provide limited water bird habitat, but the lake is fairly isolated. Only common species were recorded by the recent OSNZ survey. Previous surveys reported the presence of the nationally rare bittern (*Botaurus poiciloptilus*) and regionally significant fernbird (*Bowdleria punctata vealeae*) from this lake.

Black swan (*Cygnus atratus*) numbers fluctuate with submerged plant biomass. Prior to the collapse of weed beds in 1985 an estimated 8000 swans utilised Lake Omapere. This

dropped to 1000 the following year, which increased to 3000 in 1995 and 9000 in 2002. This number has again dropped since the second weed collapse, with annual counts varying between 50 and 400 over the last decade (Northland Fish and Game unpublished data).

Fish

Eels (*Anguilla dieffenbachii* and *A. australis*), common bully (*Gobiomorphus cotidianus*), smelt (*Retropinna retropinna*), goldfish (*Carassius auratus*) and brown bullhead catfish (*Amieurus nebulosus*) have been caught from Lake Omapere. Two carp species introduced for algal and weed control; silver carp (*Hypophthalmichthys molitrix*) and grass carp (*Ctenopharyngodon idella*) are both present in the lake. *Gambusia affinis* have been recorded from this lake. Large populations of nationally significant Northland mudfish (*Neochanna helios*) has been recorded from the wetland margins of Lake Omapere (Barrier 2003).

Aquatic invertebrates

Freshwater mussels, known locally as torewai (*Echyridella menziesi*), koura (*Paranephrops planifrons*), *Potamopyrgus antipodarum*, *Austropeplea tomentosa*, *Hygraula nitens*, dragonfly (Odonata) larvae, planarians, freshwater sponges, bryozoans and chironomids have been recorded. Torewai underwent a major decline during 2001/02 (Champion 2002) and were rare within the lake in 2005. In 2012 torewai had recovered and were abundant right across the lake confirming the lake is not currently experiencing anoxic (minimal oxygen) episodes.

Changes in indicators

The genetically distinct *Isoetes kirkii* var. *flabellata* was last collected from this lake in 1998 and may be extinct apart from cultivated plants held by NIWA.

Utricularia gibba was noted in the eastern basin of the lake during 2000, but has not been seen since.

The exotic invasive *Egeria densa* completely covered the lake during 1984. However, these surface-reaching stands of *E. densa* collapsed in 1985 and the lake became dominated by algal blooms and remained de-vegetated until 1994. From that time *E. densa* re-established weed beds in the lake until 2000 when it again reached maximum biomass, with surface-reaching weed beds covering the lake. From 2001 onwards these beds collapsed and the lake suffered toxic algal blooms again. To prevent this cycle continuing, grass carp (a weed-eating fish) were released to the lake to prevent re-establishment of the *E. densa*.

Threats

The lake is hyper-eutrophic (very high nutrient levels). While catchment loadings are high due to farming, nutrients arising from lake sediments during anoxic (low oxygen) episodes have had a much greater influence on the nutrient budget of Lake Omapere and elevates nutrients in the lake in the order of 380% greater than catchment inputs (Verburg et al. 2012). Currently the water quality of this lake is improving without excessive weed growth causing anoxia and with suspended sediments flushing from the lake during turbid water events.

Egeria densa could re-establish (without grass carp) and the cycle of vegetation collapse and nutrient release from sediments would continue if unmanaged.

Management recommendations

Discussions with Te Roopu Taiao o Utakura and DOC held at the lake during our trip highlighted a number of lake restoration initiatives already underway, such as fencing and planting of indigenous vegetation around lake margins. It is timely to discuss in-lake restoration initiatives such as attempting to restore the critically endangered *Isoetes* (*Isoëtes kirkii* var. *flabellata*) to its last known locality and potential to establish native submerged vegetation. Discovery of populations of two nationally critical plants require further monitoring and conservation effort.

Egeria densa could re-establish and the cycle of excessive weed beds, anoxia, nutrient release, vegetation collapse and toxic algal blooms is likely to continue if unmanaged. The introduction of grass carp has prevented this in the medium term, but efforts to ensure the lake catchment is free of this weed and that new introductions do not occur, need attention.

4.7 Lake Owhareiti (Central Northland), NRC Lake No. 177; surveyed in 2006

Plate: Lake Owhareiti margin showing pasture margins and emergent beds of *Eleocharis sphacelata*.

Summary based on 2006 survey

Overall ranking

Low: This large lake was severely impacted by the pest plant *Egeria densa* and water quality is poor, but provides valuable habitat for endangered water birds.

Threats

Highly impacted by pest plants and nutrient enrichment.

Management recommendations

No monitoring.

Description

This lake (1685502E 6083555N) is 95.9 ha in area, with a maximum depth of 16 m. It was formed by a volcanic flow damming the outlet. Surrounding catchment is mostly pasture. The lake has one inflow (to the south east) but no outflows. Access is through well-formed private roads and with gate access to adjacent farmland. Boat access requires a 4-WD.

Wetland vegetation

There was a fringe of emergent vegetation around much of the lake, 5-10 m across to 2.5 m deep. It was dominated by *Eleocharis sphacelata* with lesser amounts of *Baumea articulata.* There is cattle access to much of the lake.

Submerged vegetation

The submerged vegetation was dominated by tall beds of the exotic *Egeria densa* growing from the emergent vegetation zone to 4 m, with scattered plants to 5 m deep.

LakeSPI

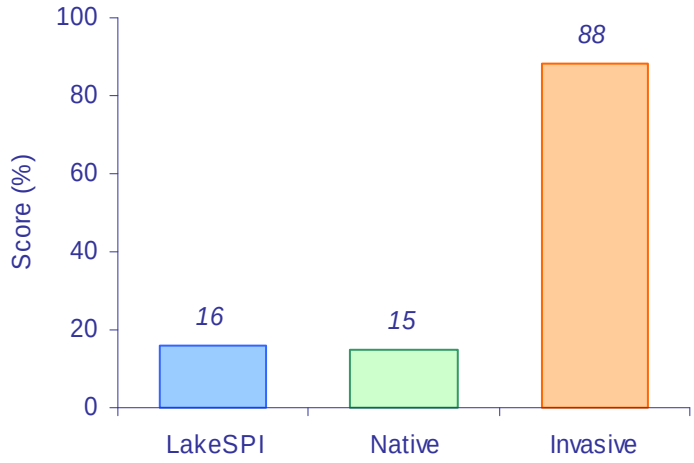

Figure: LakeSPI condition as % of potential score, native index, and invasive index (from left to right).

The low LakeSPI Index (16% of potential) was driven by the very high Invasive Impact Index (88%) with *E. densa* dominating the vegetation and displacing native values.

Water birds

The large areas of emergent and wetland vegetation provide good habitat for many aquatic birds. A recent OSNZ survey reported over 1000 birds seen including the following regionally rare species: fernbird (*Bowdleria punctata vealeae*), dabchick (*Poliocephalus rufopectus*), Australasian little grebe (*Tachybaptus novaehollandiae*) and scaup (*Aythya novaezeelandiae*), with 6 nationally endangered bittern (*Botaurus poiciloptilus*) seen in 1990.

Fish

Common bullies (*Gobiomorphus cotidianus*) were seen in the lake.

Aquatic invertebrates

Few aquatic invertebrates were noted.

Changes in indicators

This aquatic vegetation of this lake was very similar to 1984/85 surveys.

Threats

Egeria densa had a major impact on other submerged vegetation, displacing other species from much of the depth range, but hornwort could displace the egeria and lead to vegetation decline.

There was livestock access to the lake, contributing to the poor water quality measured.

Management recommendations

No monitoring is recommended.

4.8 Lake Ora (Whangarei / Kamo), NRC Lake No. 205; surveyed in 2006

Plate: A lake with few submerged and emergent plants.

Summary

Overall ranking

Low: Very low water clarity prevents submerged vegetation establishing and there was little marginal vegetation.

Threats

Management recommendations

No monitoring. Consider marginal planting and lake restoration.

Description

This lake (2626940E 6619823.8N) is a small 2.19 ha lake in a volcanic crater. Surrounding catchment is pasture. Access is by road to within 50 m then across pasture. Boat access requires a 4-WD.

Wetland vegetation

There were a few patches of *Eleocharis sphacelata.*

Submerged vegetation

There was no submerged vegetation, just the odd amphibious *Myriophyllum propinquum* and *Potamogeton cheesemanii*. The lake was not dived as the water clarity was less than 0.1 m due to a heavy algal bloom.

LakeSPI

Not applicable.

Water birds

Not recorded.

Fish

No records.

Aquatic invertebrates

No records.

Changes in indicators

Not known.

4.9 Lake Rotokawau East (Karikari), NRC Lake No. 96; surveyed in 2005

Plate: Margin of Lake Rotokawau East showing floating mats of the pest plant alligator weed (*Alternanthera philoxeroides*) with clumps of wire rush (*Empodisma minus*) (left), pampas (*Cortederia selloana*) (mid-right) and flax (*Phormium tenax*) (right) in the marginal vegetation behind this. Note the humic-stained water.

Summary

Overall ranking

Moderate: This large shallow lake was severely impacted by the pest plant *Alternanthera philoxeroides* and water quality is poor, but provides valuable habitat for endangered water birds and fish. The adjacent wetland may contain endangered plants.

Threats

Highly impacted by pest plants and nutrient enrichment.

Management recommendations

No monitoring.

Description

This lake (1629202E 6141108N) is shallow (< 1m) with a hard iron pan base overlaid by sand. It is the smaller of the two lakes near Rangiputa, being 21.3 ha in area. The surrounding catchment is kanuka/manuka scrub, with a large wetland to the north (not investigated). The lake has no inflows or outflows. Access is through a well-formed track off Puheke Road. Too shallow for boat access.

Wetland vegetation

There was a narrow fringe of emergent vegetation around much of the lake, mostly < 5 m across. Large floating rafts of the exotic alligator weed (*Alternanthera philoxeroides*) were noted around the access point. These were interspersed with clumps of *Eleocharis acuta, Baumea juncea, Schoenoplectus tabernaemontani, Typha orientalis, E. sphacelata* and *Phormium tenax.* Immediately adjacent to this was bog/heath vegetation dominated by the regionally significant *Empodisma minus, Gleichenia dicarpa, Schoenus brevifolius* and the scrub weeds, gorse and pampas. The endangered ferns and fern ally, *Todea barbara, Cyclosorus interuptus* and *Lycopodiella serpentina* were reported from this marginal area.

Submerged vegetation

Submerged vegetation was lacking apart from small patches of *Glossostigma elatinoides* growing on sheltered parts of iron pan in water 1 cm deep. A combination of hard bottom, humic-staining and exposed shallow water would preclude vegetation development.

LakeSPI

Reconnaissance only – no LakeSPI score generated.

Water birds

The large areas of wetland adjacent to the lake provides good habitat for many aquatic birds. Black swans (*Cygnus atratus*) were seen on the field visit, with previous records of the nationally threatened Caspian tern (*Sterna caspia*) and bittern (*Botaurus poiciloptilus*) and regionally threatened marsh crake (*Porzana pusilla*), spotless crake (*Porzana tabuensis plumbea*), fernbird (*Bowdleria punctata vealeae*), Australasian little grebe (*Tachybaptus novaehollandiae*) and scaup (*Aythya novaezeelandiae*).

Fish

Common bullies (*Gobiomorphus cotidianus*), inanga (*Galaxias maculatus*), shortfin eels (*Anguilla australis*) and the pest fish *Gambusia affinis* were recorded on the NIWA FBIS database for this lake. DoC SSBI reported the nationally threatened black mudfish (*Neochanna diversus*) from this lake in 1993.

Aquatic invertebrates

No aquatic invertebrates were noted but DoC SSBI reported the freshwater shrimp *Paratya curvirostris*.

Changes in indicators

No previous survey.

Threats

Conditions would not favour the establishment of other pest plants. Alligator weed is well established and beyond control.

The lake is highly nutrient enriched.

Management recommendations

No monitoring is recommended.

4.10 Lake Rotokawau West (Karikari), NRC Lake No. 95; surveyed in 2005

Plate: Lake Rotokawau West from the north-east. Note the beach ridge with scrub vegetation (right) and wetland area separating the two Rotokawau lakes.

Summary

Overall ranking

Moderate: The margins of this large lake were severely impacted by the pest plant *Alternanthera philoxeroides* and water quality is poor, but provides valuable habitat for endangered water birds and fish. The adjacent wetland may contain endangered plants.

Threats

Highly impacted by pest plants and nutrient enrichment.

Management recommendations

No monitoring.

Description

This lake (1628266E 6141280N) is 12 m deep with a hard iron pan base overlaid by sand. It is the larger of the two lakes near Rangiputa being 63.3 ha in area. The surrounding catchment is kanuka/manuka scrub and pasture, with pohutukawa forest on the beach ridge to the north of the lake. The lake has no inflows or outflows. Access is through a 1 km track off Puheke Road, then bush crash through forest to the lake edge. There may be easier access at the western end. No boat access at eastern end.

Wetland vegetation

There was a narrow fringe of emergent vegetation around much of the lake, mostly < 5 m across. Large floating rafts of the exotic alligator weed (*Alternanthera philoxeroides*) were noted. These were interspersed with clumps of *Eleocharis sphacelata, Baumea juncea, B. arthrophylla* and *Phormium tenax.* *Sphagnum* sp. formed a wetland area on the landward side of the emergent zone.

Submerged vegetation

Submerged vegetation was lacking. A combination of hard bottom, algal bloom and exposed lake would preclude vegetation development.

LakeSPI

Reconnaissance only – no LakeSPI score generated.

Water birds

The large areas of wetland adjacent to the lake provides good habitat for many aquatic birds. No birds were seen on the field visit, with previous records of the nationally threatened Caspian tern (*Sterna caspia*) and bittern (*Botaurus poiciloptilus*) and regionally threatened marsh crake (*Porzana pusilla*), spotless crake (*Porzana tabuensis plumbea*), fernbird (*Bowdleria punctata vealeae*), Australasian little grebe (*Tachybaptus novaehollandiae*) and scaup (*Aythya novaezeelandiae*).

Fish

Common bullies (*Gobiomorphus cotidianus*), inanga (*Galaxias maculatus*), shortfin eels (*Anguilla australis*) and the pest fish *Gambusia affinis* were recorded on the NIWA FBIS database for this lake. DoC SSBI reported the nationally threatened black mudfish (*Neochanna diversus*) from this lake in 1993.

Aquatic invertebrates

No aquatic invertebrates were noted but DoC SSBI reported the freshwater shrimp *Paratya curvirostris*.

Threats

Conditions would not favour the establishment of other pest plants. Alligator weed is well established and beyond control.

The lake is highly nutrient enriched.

Management recommendations

No monitoring is recommended.

4.11 Lake Rotopokaka or Coca Cola (Karikari), NRC Lake No. 104; surveyed in 2005

Plate: Lake Rotopokaka. Note: *Typha orientalis* dominated emergent vegetation with manuka scrub in the background.

Summary

Overall ranking

Moderate: Water quality is poor, but lake provides valuable habitat for endangered water birds and fish. The adjacent wetland may contain endangered plants.

Threats

Highly impacted by nutrient enrichment.

Management recommendations

No monitoring.

Description

This lake (1634813E 6132432N) is 11 ha in area, c. 3.5 m depth. The surrounding catchment is manuka scrub, with pohutukawa, cabbage tree and flax along the eastern margin. The lake has no inflows or outflows. Access is off Ramp Road, with well-formed tracks to the western and northern shore. Boat access difficult.

Wetland vegetation

There were large areas of emergent vegetation around much of the lake, mostly up to 20 m across. Dominant species were *Typha orientalis*, *Eleocharis sphacelata, Baumea juncea, Schoenoplectus tabernaemontani, Apodasmia similis* and *Phormium tenax.*

LakeSPI

Reconnaissance only – no LakeSPI score generated.

Submerged vegetation

Submerged vegetation was lacking, apart from low covers of *Glossostigma elatinoides, Myriophyllum propinquum* and *Potamogeton cheesemanii* in areas shallower than 0.5 m. There was a dense algal bloom when this lake was visited.

Water birds

The large areas of wetland adjacent to the lake provides good habitat for many aquatic birds. No birds were seen on the field visit, with previous records of the nationally threatened bittern (*Botaurus poiciloptilus*) and regionally threatened spotless crake (*Porzana tabuensis plumbea*) and fernbird (*Bowdleria punctata vealeae*).

Fish

Common bullies (*Gobiomorphus cotidianus*), inanga (*Galaxias maculatus*), longfin eels (*Anguilla dieffenbachii*) and the nationally threatened black mudfish (*Neochanna diversus*) were recorded from this lake in 1993 (DoC SSBI).

Aquatic invertebrates

No aquatic invertebrates were noted.

Changes in indicators

No previous flora and fauna surveys.

Threats

No pest species evident, but possible risk of transfer if the area is fished for eels. Water appeared to be nutrient enriched.

Management recommendations

No monitoring is recommended.

4.12 Lake Sands Lake at Mangawhai, (central and east Northland), NRC Lake No. 309A; first surveyed in 2008

Plate: Lake Sands is a dune lake now within an area for which residential development is planned.

Summary

Overall ranking:

Moderate: A small lake with mostly native aquatic species.

Threats

Water quality could change markedly with residential development if used for residential storm water. Invasive species could be introduced by future residents.

Management recommendations

If the natural character of the lake is to be retained, careful consideration needs to be given to maintaining water quality and native biota.

Description

This dune lake (1742260E, 6004678N NZTM) is about 1 ha in area with a maximum depth of 1.6 m (in April 2008 during low water levels). The catchment was mostly pasture, but with plans for residential development. There are no inflow or outflow streams or boat launching points.

Wetland vegetation

The lake is surrounded by emergent vegetation mostly 10 m wide, extending from the shoreline to a maximum of 1.4 m depth. The dominant species were *Eleocharis sphacelata* and *Baumea articulata*.

Submerged vegetation

The whole lake was vegetated. No turfs were present because of the dense encircling reed beds. *Chara fibrosa* was the dominant submerged plant with surface-reaching *Potamogeton cheesemanii* common. The invasive *Utricularia gibba* was common sprawling through emergent and over submerged species throughout the lake.

Water birds

Fernbirds (*Bowdleria punctata vealeae*) were heard and mallard ducks (*Anas platyrhynchos*) were seen.

Fish

Not recorded.

Aquatic invertebrates

Sigara arguta and a diving beetle were common in the lake.

Changes in indicators

This was the first time this lake has been surveyed.

Plate: 1995/96 aerial photograph showing the position of the Sands Lake, Mangawhai.

Threats

There is some debate about the natural status of this lake. A 1995/96 aerial photograph (Map Toaster 2008) shows no open water and the area surrounded by a pine plantation. Since the removal of pines it may have become wetter and possibly earth works could have deepened parts of the area. There are few dune water bodies of this type between Whangarei and the Auckland Region border so it does have some significance. Residential development has the potential to threaten the current status of Sands Lake.

Management recommendations

It is currently a shallow coastal dune waterbody with strong native floristic elements offering good bird habitat. If these values are to be retained or enhanced consideration needs to be given to catchment development activities.

4.13 Smith's Dam Hikurangi (central and east Northland) NRC Lake No. 199B; visited in 2008

Plate: Smiths Dam, Hikurangi.

Summary

Overall ranking

Low: No submerged vegetation, poor water clarity.

Threats

Low risk of introduction.

Management recommendations

No further monitoring.

Description

Smith's Dam, Hikurangi (1709540E, 6066276N) was a turbid waterbody managed as an irrigation dam. Catchment was mostly pasture with some scrub/forest. Access was by private road.

Wetland vegetation

No wetland vegetation.

Submerged vegetation

Very poor water clarity prevented visual assessment, and insufficient light would prevent plant growth if sustained for several months. No submerged plants were found by dragging the bottom with a grapnel.

Water birds

None seen.

Fish

None seen.

Aquatic invertebrates

None seen.

Changes in indicators

This was the first time this lake has been surveyed.

Threats

The dam was of very low ecological value and is unlikely to deteriorate further.

Management recommendations

No further monitoring.

4.14 Stanners Road Dam, Kerikeri (central and east Northland) NRC Lake No. 148A; visited in 2008

Plate: Stanners Road Dam.

Summary

Overall ranking

Low: Irrigation dam with reasonable water clarity, highly impacted by *Egeria densa*.

Threats

Egeria possibly introduced by eel fisherman or flooding. Potential for other weeds to be introduced.

Management recommendations

No monitoring recommended.

Description

Stanners Road Dam, Kerikeri (1683149E, 6107066N) is a dammed irrigation lake (16 ha) on the Kapiro Stream. The catchment is mostly pasture and arable land. Access is through private property with several properties adjacent to the dam.

Wetland vegetation

Eleocharis sphacelata was common, but much of the lake lacked emergent vegetation.

Submerged vegetation

Egeria densa about 2 m tall growing to 3.5 m water depth formed nuisance beds. *Utricularia gibba* was common to 2 m deep and charophyte meadows of *Nitella* sp. aff. *cristata* extended to 3 m.

Water birds

None seen.

Fish

Gambusia were abundant and locals had seen an eel fisherman operating on the lake.

Aquatic invertebrates

None seen.

Changes in indicators

This was the first time this lake has been surveyed.

Threats

Further invasions such as hornwort could have a greater impact than egeria. The land owners were keen to manage egeria, with the aquatic herbicide diquat.

Management recommendations

No monitoring recommended.

4.15 Tapui Rd Quarry Lake (central and east Northland) NRC Lake No. 199C; visited in 2008

Plate: The Taupiri Rd quarry lake with minimal marginal vegetation and no inflow or outflow.

Summary

Overall ranking

Low: Poor submerged vegetation, habitat unsuitable.

Threats

Low risk of introduction.

Management recommendations

No further monitoring.

Description

Tapui Rd Quarry Lake (1709510E, 6072069N) was a flooded road metal quarry. It was therefore very steep sided. Access was via private land.

Wetland vegetation

None, the margin was steep sided with terrestrial weeds such as pampas (*Cortaderia selloana*) present.

Submerged vegetation

The lake had mostly steep rock walls with little silt. Low covers of *Nitella pseudoflabellata*, *Nitella sp. aff. cristata* and *Potamogeton ochreatus* were sporadically present to a maximum depth of 2 m.

Water birds

No birds were present at the time.

Fish

Gambusia affinis was present.

Aquatic invertebrates

None seen.

Changes in indicators

This was the first time this lake has been surveyed.

Threats

The quarry lake was of limited ecological value and is unlikely to deteriorate further.

Management recommendations

No further monitoring.

4.16 Lake Tauanui Lake No. 198; surveyed in 2011

Plate: Lake Tauanui a volcanic lake with steep boulder strewn margins.

Summary

Overall ranking

High: There was a native vegetation cover to 4 m water depth and no exotic species present.

Threats

An isolated lake with low potential for inadvertent pest fish and plant introductions. Water quality is impacted by farming and a nutrient rich volcanic catchment.

Management recommendations

Lake native biodiversity value monitoring every 5 years.

Description

This lake (1677769E 6071132N) is 6.2 ha in area and about 9 m deep. The surrounding catchment is in pasture and grazed native forest. Access is off Mangakahia Road and via 2 km of farm tracks.

Wetland vegetation

There was little emergent or other wetland vegetation present, apart from isolated patches of kuta (*Eleocharis sphacelata*) and *Baumea articulata* on the shore of the north eastern island.

Submerged vegetation

The whole lake was vegetated to 4 m. There was a diverse native community with charophyte meadows dominated by *Chara fibrosa* and *Nitella* sp. aff. *cristata*. *Potamogeton*

ochreatus was the tall growing native plant present and *Glossostigma elatinoides* was the dominant turf plant, with lesser amounts of *Elatine gratioloides*, a plant rarely encountered in Northland lakes.

LakeSPI

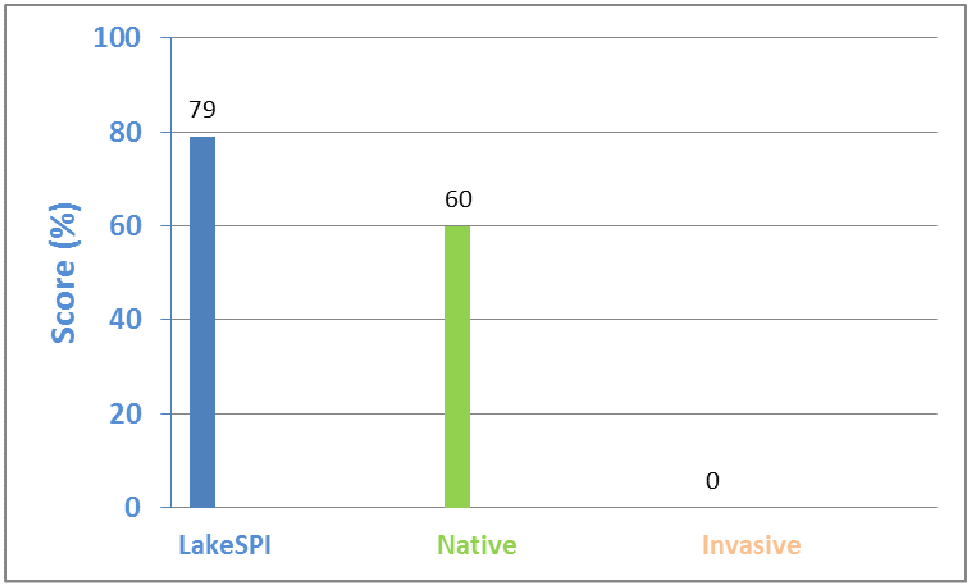

Figure: LakeSPI Index for Lake Tauanui as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right).

The LakeSPI score was excellent at 95% reflecting an indigenous submerged flora with high covers and diversity. No weed species were present.

Water birds

Black swan, paradise ducks, mallard, pied shag, kingfisher, spur winged plover, observed.

Fish

No information. A survey by Mike McGlynn setting 27 traps at 4 locations, 26-27 September 2011 caught nothing. No fish have been observed.

Aquatic invertebrates

No mussels or koura seen, *Physa* abundant.

Changes in indicators

No previous survey.

Threats

Water quality is eutrophic and could be threatened by stratification and anoxic bottom waters releasing nutrients from bottom sediments. If exotic weeds were introduced they would have a high impact as conditions would favour extensive growths.

Management recommendations

Lake native biodiversity value monitoring every 5 years.

Survey lake for fish.