3. Inventory of Lakes in Northland

Aupouri Lakes

3.1 Lake Austria (Aupouri), NRC Lake No. 22; surveyed in 2005.

Plate: Lake Austria margin showing exposed turf communities and *Apodasmia similis* tussocks. Note humic stained water and floating mats of *Utricularia gibba* (centre right).

Summary

Overall ranking

Moderate: This humic-stained lake was severely impacted by the pest plant *Utricularia gibba* and water level is decreasing, but it provides valuable habitat for endangered water birds.

Threats

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

Management recommendations

No monitoring or active management.

Description

This dune lake (1584726.7E, 6174708.5N) is 18 ha in area, with a maximum recorded depth of 3 m. It is situated on a ponded area between Holocene and Pleistocene sand dunes. The catchment is vegetated by pine plantation forestry (50% of margin) and kanuka scrub (50%). The lake has no inflows or outflows. Access is through well-formed private forestry roads but boat access would require a 4-WD.

Wetland vegetation

There is a sparse fringe of emergent vegetation in the vicinity of the access point, but extensive beds (30% lake area) dominated by *Eleocharis sphacelata* with lesser amounts of *Baumea articulata* grew at the western end of the lake to depths of 2 m. Exposed turfs with a mosaic of amphibious and annual herbs was common at the access point and bordering pine forestry, interspersed with tussocks of oioi (*Apodasmia similis*).

Submerged vegetation

Turf communities were also prevalent to a depth of 1 m, occurring where dense beds of emergent sedges were absent. Dominant species included *Glossostigma elatinoides* and *Lilaeopsis novae-zelandiae*. A range of charophytes were also present in this shallow water zone, with *Chara australis* locally abundant and the milfoil *Myriophyllum propinquum* growing to the maximum vegetation depth recorded in the lake (2.5 m). The nationally endangered *Utricularia australis* was found at low covers throughout the submerged vegetation. The exotic *U. gibba* formed dense surface-reaching mats and extended over much of the submerged vegetation with average covers exceeding 50%.

LakeSPI

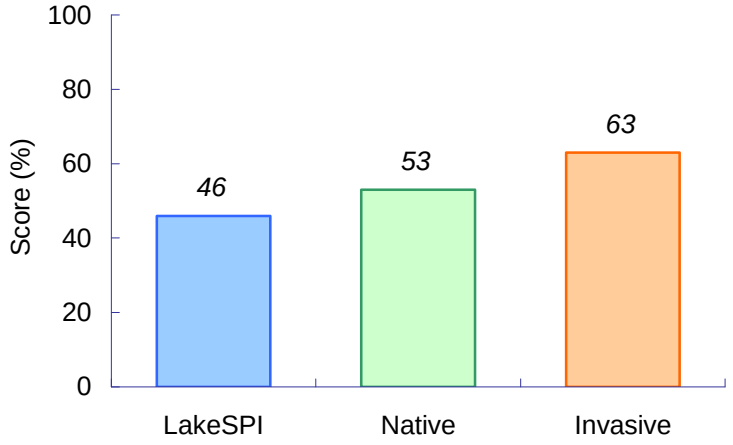

Figure: LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right).

The low LakeSPI score of 46% reflects the smothering impact of the invasive *U. gibba* on the submerged vegetation. Profiles were limited so this LakeSPI assessment should be considered provisional.

Water birds

The isolated nature of the lake and large areas of emergent and wetland vegetation provide good habitat for many aquatic birds, although no endangered species were observed during the field visit. The following rare species are reported: fernbird (*Bowdleria punctata vealeae*), spotless crake (*Porzana tabuensis plumbea*), dabchick (*Poliocephalus rufopectus*), Australasian little grebe (*Tachybaptus novaehollandiae*) and scaup (*Aythya novaezeelandiae*).

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.

Threats

The alien bladderwort (*U. gibba*) is having a major impact, forming a sprawling mat that extends over other submerged vegetation. The access through private forestry roads (3 km off access road) mean the likelihood of introduction of other alien species is low, but if introduced, these would have major deleterious impacts on the lake values.

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 appeared to have had dropped about 1 m since pines were planted in the catchment, and future decreases could occur.

Management recommendations

The lake is highly impacted by *U. gibba*, but the likelihood of introduction of other alien species is low. No monitoring is recommended.

3.2 Lake Bulrush (Aupouri), NRC Lake No. 49; surveyed in 2005.

Plate: Lake Bulrush showing the lack of emergent vegetation and unfenced shoreline.

Summary

Overall ranking

Low: Minimum submerged, emergent and riparian vegetation. Nutrient enriched with cattle access.

Threats

Risk of introduction is moderate and some species could establish, but with little impact on ecological values.

Management recommendations

None recommended.

Description

Located at 1599677.7E, 6159353.9N, this lake is 4.9 ha in size and at least 2 m deep. The catchment is pine plantation and scrub to the west and pasture surrounding the remainder. Inflow to north end of lake drains 2 km of pine, native forest and pasture. No outflow stream. Access is via a well-formed track across 2 km of private land, with relatively easy boat access from the shoreline.

Wetland vegetation

Marginal vegetation sparse. Fenced area on eastern side vegetated with *Juncus pallidus* and turf communities dominated by the exotic *Ludwigia palustris* and *Myriophyllum propinquum*. No emergent vegetation.

Submerged vegetation

Sparse covers of *Glossostigma elatinoides, Potamogeton ochreatus, P. cheesemanii* and *Chara australis* to 0.7 m.

LakeSPI

Reconnaissance only – no LakeSPI score generated.

Water birds

Common water birds present, historical records of dabchick (*Poliocephalus rufopectus*).

Fish

No fish seen.

Aquatic invertebrates

The snails *Potamopyrgus antipodarum* (indigenous) and *Physella acuta* (exotic) were common.

Changes in indicators

A large wetland adjacent to the south western end of the lake reported in 1991 appears to have been drained. Two formerly separate lakes have coalesced into one.

Threats

Risk of introduction is moderate, with a well-formed track through private land affording relatively easy access and some invasive species could establish. However current indigenous values are minimal. Prolonged cattle access to this lake has removed emergent vegetation and the lake appears to be highly nutrient enriched.

Management recommendations

No monitoring recommended.

3.3 Lake Carrot or Ngakapua West (Aupouri), NRC Lake No. 118; surveyed in 2005.

Plate: Carrot Lake showing areas of unfenced pastoral catchment and cattle access to the waters edge around the eastern margin of the lake.

Summary

Overall ranking:

High: Predominantly native vegetation over much of the lake bottom.

Threats

Restricted access means the risk of pest plant introduction is low, but impact would be high. Nutrient run-off from pastoral practices and forestry management threaten water quality.

Management recommendations

Completion of the lake edge retirement is recommended. Lake condition monitoring should be undertaken at 5 yearly intervals.

Description

This dune lake is part of the Sweetwater group of lakes (1617118.4E, 6124466N). The catchment also includes forestry land (c. 25%) which appeared to have been harvested relatively recently. The lake is small (1.7 ha), but relatively deep (8.2 m) and has no defined inflows or outflows. Access is through plantation forestry and private pastoral land; boat access is very difficult.

Wetland vegetation

Extensive emergent vegetation is present on the north-western side of the lake with beds up to 12 m across. Elsewhere the emergent zone is sparse with evidence of extensive clearance of emergent vegetation from the south-western end of the lake (submerged bases covered the lake bottom. The dominant species were *Eleocharis sphacelata* and *Typha orientalis* growing to 2.3 and 1.2 m respectively. The regionally rare maru (*Sparganium subglobosum*) was present in the emergent vegetation.

Submerged vegetation

The turf species *Myriophyllum pedunculatum* was restricted to the few shallow (≤0.5 m) areas where emergent stands were not present. The exotic *Utricularia gibba* was commonly found at low covers within the shallow zone in <2.5 m depth. Tall (up to 1.5 m), dense (>75% cover) beds of *Nitella* aff. *cristata* comprised the majority of the submerged vegetation to a maximum depth of 5.7 m. Occasional plants of *Chara australis* and *Potamogeton cheesemanii* were present to <2 m depth. One plant of the nationally threatened *Utricularia australis* was found in this lake.

LakeSPI

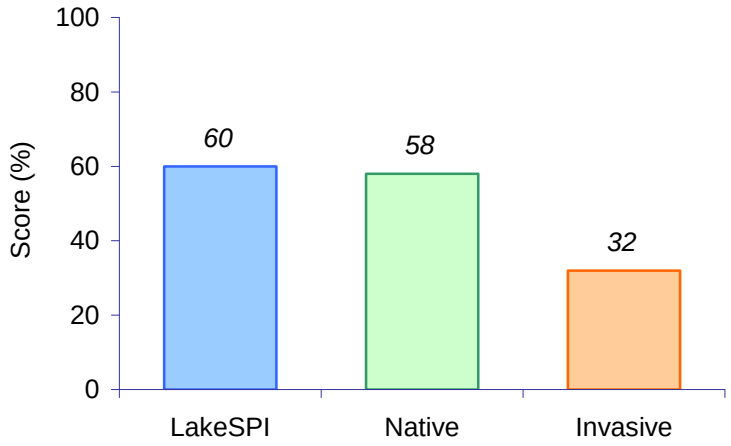

Figure: LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right).

The moderately high LakeSPI score of 60% reflects the extent of development of the charophyte meadows and relatively small impact by the exotic species *Utricularia gibba*.

Water Birds

The emergent vegetation and scrub on the northwestern margin provide good water bird habitat. No birds were reported during the field visit but historical records report

the nationally threatened bittern (*Botaurus poiciloptilus*) and regionally significant dabchick (*Poliocephalus rufopectus*) and Australasian little grebe (*Tachybaptus novaehollandiae*) (all in 1988) with a 1978 record of the critically endangered brown teal (*Anas aucklandica chlorotis*) nesting on this lake. No water birds were recorded in the OSNZ survey in 1996.

Fish

Common bullies (*Gobiomorphus cotidianus*) were recorded during the vegetation survey.

Aquatic invertebrates

The alien snail *Planorbarius corneus* and freshwater sponges were recorded.

Changes in indicators

A large increase in vegetation depth occurred between earlier surveys, from 2.5 m in 1985, to 5.5 m in 2001. This extension in depth extent was accompanied by the development of *N.* aff. *cristata* beds that replaced the previous shallow beds of *C. australis*. The current depth extent (5.7 m) and vegetation composition are similar to the 2001 survey, with the exception of a recent invasion by the exotic bladderwort, *U. gibba*, and the apparent decline of the nationally threatened native *U. australis.* The latter has declined from average covers of over 25% in the 3 profiles sampled to only one plant found in the current survey.

Threats

Although widespread, the low cover of the pest plant *U. gibba* suggested a minimal impact in this water body, however the loss of the native *U. australis* may be due to replacement by this more competitive species. The difficult access and absence of eels would make the likelihood of further introduction of pest species low. Impacts are likely should pest plants be introduced.

The predominantly pastoral catchment is a likely source of nutrients, with areas of the lake remaining unfenced and the infringing emergent plants susceptible to cattle grazing and trampling.

Management recommendations

Forestry management practices associated with the latest rotation need to minimise potential nutrient loadings to the lake.

Retirement of the lake edges around the eastern sector of the lake will encourage vegetation development and the interception of diffuse nutrient-runoff.

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

3.4 Forest Lake or Deans Swamp (Aupouri), NRC Lake No. 114; surveyed in 2005.

Summary (based on 2001 survey)

Overall ranking

Low: Very poor water quality and limited submerged vegetation.

Threats

Additional pest impacts unlikely. Few additional threats to an already nutrient enriched lake.

Management recommendations

No monitoring recommended.

Description

This dune lake (1617411.9E, 6125152.1N) is 1 ha in area with a maximum depth of 4.5 m. The catchment is pasture with pine plantation forestry present further back from the lake edge. There are no inflows or outflows. Access is through well-formed forestry roads, 1 km from the main road, no boat access.

Wetland vegetation

Forest Lake was completely encircled by a dense *Eleocharis sphacelata* reed bed extending out to a maximum water depth of 3 m with a maximum height of 3.5 m tall, with lesser amounts of *Baumea articulata* in shallow areas.

Submerged vegetation

Utricularia australis was the commonest species with average covers of ≤5%, it extended from 0.5 to 3 m depth. Other species present were *Potamogeton cheesemanii* in the shallows (≤0.5 m depth) and at the outside edge of the reed beds (2.5 to 3 m depth) and *Nitella leonhardii* growing beneath the reed bed. Both had covers ≤5%. Submerged vegetation did not extend far from the *E. sphacelata* bed. A thick mat of blue-green algae was noted growing on the sediment to at least 3.5 m depth.

LakeSPI

No LakeSPI score generates as vegetation cover <10%.

Water birds

The dense emergent vegetation would provide good habitat. The most recent OSNZ survey (1996) reported a pair of the regionally significant Australasian little grebe (*Tachybaptus novaehollandiae*) at this lake.

Fish

Common bully (*Gobiomorphus cotidianus*) was the only species recorded in the NIWA FBIS records.

Aquatic invertebrates

None recorded.

Changes in indicators

Chara australis and *C. fibrosa* were present in 1984/85 but not in 2001. The total submerged vegetation cover has reduced from >75% to <26%. Now absent, the alien free-floating species *Salvinia molesta* was present in 1984/85 but has been eradicated since.

Threats

Difficult access and lack of eel records would reduce the likelihood of pest introduction. Poor water quality would reduce the risk of establishment of submerged pest species.

Management recommendations

No monitoring.

3.5 Half Mile Lagoon (Aupouri), NRC Lake No. 62; surveyed in 2005.

Plate: Remnant pools in pasture occupying the area previously containing Half Mile Lagoon.

Summary

Overall ranking

Low: Almost completely dry.

Threats

Further decrease in water level.

Management recommendations

No monitoring.

Description

Half Mile Lagoon is situated 1599378E, 6157875N, and once covered an area 3.6 ha. The plate shows the largest of the remaining pools (approximately 100 m^2).

Wetland vegetation

Myriophyllum propinquum was present in marginal vegetation.

Submerged vegetation

None.

Threats

This area is an extreme example of decreasing water levels that have impacted on many of the smaller Aupouri dune lakes.

Management recommendations

No monitoring.

3.6 Lake Heather (Aupouri), NRC Lake No. 125; surveyed in 2005 and 2008; rapid assessment in 2009.

Plate: Lake Heather set in a pasture catchment fenced off with a wetland margin.

Summary

Overall ranking

High: Although highly impacted by exotic submerged weeds, the lake has excellent water bird habitat and endangered plants present.

Threats

Alligator weed (*Alternanthera philoxeroides*) poses a threat to emergent vegetation. Hornwort and egeria are well established as surface-reaching beds throughout much of the lake. Crack willow (*Salix fragilis*) locally established adjacent to a maimai.

Management recommendations

Lake condition monitoring is recommended at an interval of 5 years. Eradicate the crack willow cutting planted by a maimai. Eradicate hornwort and egeria from the lake using grass carp. Assess feasibility of alligator weed control/eradication.

Description

This dune lake (1617665E, 6121295N NZTM) is 8 ha in area with a maximum depth of 5.6 m (4.7 in April, 2008). The catchment is mostly pasture, with scrub along the eastern edge. There are no inflow or outflow streams. Access is through 3 km of private land with a locked access gate.

Wetland vegetation

The entire lake is surrounded with emergent vegetation 5 to 20 m wide, extending from the shoreline to a maximum of 2.3 m depth. The margins have been fenced. The dominant species was kuta (*Eleocharis sphacelata*), with *Baumea articulata, E. acuta,* raupo (*Typha orientalis*) and *Schoenoplectus tabernaemontani* locally important. On the western edge, a low sudd dominated by *Ludwigia palustris, Isolepis prolifer* and mats of the exotic weed *Utricularia gibba* was present between tall emergent vegetation and pasture and on submerged vegetation. The nationally threatened *Myriophyllum robustum* was present amongst tall emergent vegetation at one profile in 2005. DoC SSBI records the presence of another rare species, swamp fern (*Thelypteris confluens*) presumably in the wetland at the north-eastern end of the lake. The alien pest plant alligator weed (*Alternanthera philoxeroides*) was present over an area of 80 m^2 amongst kuta and raupo in the vicinity of a mai-mai, and there was a crack willow cutting (April 2009).

Submerged vegetation

No turfs were present because of the dense encircling reed beds. *Myriophyllum propinquum*, the regionally significant *Utricularia australis* were uncommon and restricted to within the reed beds to <2 m depth in 2005. The exotic *U. gibba* was common. *Chara australis* and *Potamogeton cheesemanii* were also found in this shallow zone, but occasionally grew deeper. The vegetation from 2 m depth was dominated by combinations of three species: *Potamogeton ochreatus* (common in the northern basin only) and the exotic species, *Ceratophyllum demersum* and *Egeria densa*. *E. densa* (to 3.5 m tall) was common from the *Eleocharis sphacelata* margins on the steep sides of the lake with *C. demersum* (up to 4.3 m tall and often surface reaching) further out in the lake. *C. demersum* abundance had increased markedly since 2005. *Potamogeton ochreatus* grew up to 2 m tall in the northern basin and extended right across the lake beyond the egeria.

LakeSPI

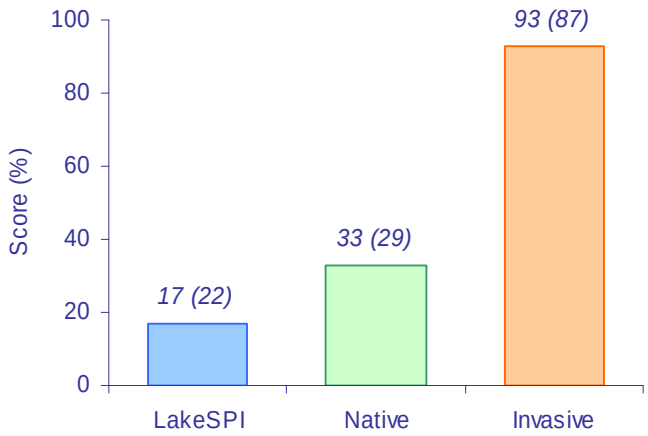

Figure: LakeSPI Index 2008 as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right); 2004 figures in brackets.

The low LakeSPI score of 17% reflects the high extent that native vegetation has been impacted by invasive exotic species. Little change was evident in 2009.

Water birds

Over 50 paradise shelducks (*Tardorna variegata*) and 3 Canada geese (*Branta canadensis*) were seen during the field visit in 2005. Records from the 1990's include the nationally threatened bittern (*Botaurus poiciloptilus*) and the regionally significant dabchick (*Poliocephalus rufopectus*) and Australasian little grebe (*Tachybaptus novaehollandiae*). This lake is an important moulting site for paradise shelduck.

Fish

Common bullies (*Gobiomorphus cotidianus*) were abundant in this lake; the NIWA FBIS database also recorded shortfin eels (*Anguilla australis*). NRC water quality sampling team reported a large fish leaping from the lake.

Aquatic invertebrates

Sigara arguta was commonly observed in the lake.

Changes in indicators

An increase in the maximum depth of submerged vegetation took place between 1985 (3 m depth limit) and 2001 (to the maximum lake depth of ~5 m). Invasion by *C. demersum* and *E. densa* took place between 1988 and 2001, and *E. densa* has shown an increase in abundance since 2001. *U. gibba* was a new record in 2001. Nationally significant species *U. australis* and *M. robustum* were present (hard to find) at similar levels in 2005 to that recorded previously, but were not found in searches associated with submerged vegetation assessments in 2008 or 2009.

Threats

The pest plants *C. demersum* and *E. densa* have had an extensive impact on the native vegetation, with only *P. ochreatus* co-exists in any great abundance, though this is now mostly restricted to the deepest parts of the northern basin. If these species are present long term in the lake whey will change the lake sediments in time making them highly organic, flocculent and unsuitable for future submerged vegetation The pest plant *U. gibba* is a recent introduction and was abundant in shallow water on the egeria. The presence of alligator weed adjacent to a maimai (also the case in Lake Rotoroa and some Karikari lakes) and discussion of its distribution with several locals suggests that it was deliberately introduced. By another maimai there was a crack willow cutting (April 2009). Crack willow is highly invasive and threatens the wetland margin's native character and habitat values for other biota.

Management recommendations

Remove all crack willow planted by the maimai and discourage use of willow planting around maimais by duck hunters.

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

Recommend surveying lake margin for alligator weed and control if feasible.

Control / eradication egeria and hornwort using grass carp.

3.7 Katavich Lake - west of Lake Waiparera (Aupouri), NRC Lake No. 103; surveyed in 2005.

Plate: Katavich Lake showing margin of lake impacted by cattle access.

Summary

Overall ranking

Low: impacted by cattle grazing, no submerged and limited emergent vegetation.

Threats

Appears to be highly nutrient enriched.

Management recommendations

No monitoring recommended.

Description

This lake (1614995E, 6133225N) is 6.3 ha in area. The catchment is predominantly (90%) pasture with unimpeded cattle access to the lake, with some scrub and pine plantation to the west. A drain enters the western end of this lake, but there is no outlet. Access is 500 m along a private, well-formed track off Katavich Road, with relatively easy boat access.

Wetland vegetation

There is a sparse fringe comprised predominantly of *Typha orientalis, Eleocharis sphacelata, Schoenoplectus tabernaemontani and Baumea articulata*.

Submerged vegetation

No LakeSPI score generates as vegetation cover <10%.

LakeSPI

No LakeSPI index generated.

Water birds

Previously there were large areas of dense, tall emergent vegetation providing good habitat for many aquatic birds, with DoC SSBI survey in 1991 recording several regionally significant spotless crake (*Porzana tabuensis plumbea*). Mallard ducks (*Anas platyrhynchus*) and paradise shelduck (*Tardorna variegata*) were seen on this survey.

Fish

The pest fish *Gambusia affinis* were seen in the lake. NIWA FBIS records common bullies (*Gobiomorphus cotidianus*) and shortfin eels (*Anguilla australis*).

Aquatic invertebrates

No aquatic invertebrates were noted.

Changes in indicators

Lake flora and fauna were assessed for the first time in November 2004.

Threats

Access is easy, but introduced pest plants would not threaten any significant habitat.

Water quality appears to be already very poor.

Management recommendations

No monitoring is recommended.

3.8 Lake Kihona (Aupouri), NRC Lake No. 31; surveyed in 2005.

Plate: Lake Kihona set in a forestry catchment, note the recent harvesting and limited development of emergent vegetation.

Summary

Overall ranking

Low: Submerged vegetation dominated by *Ceratophyllum demersum*, poor water quality and emergent vegetation.

Threats

Invasives already present.

Management recommendations

Evaluate options for control of alligator weed (*Alternanthera philoxeroides*). No monitoring.

Description

A dune lake (1591072E, 6168119N) formed from a gully system dammed by sand dunes to the west and is 7.8 ha and 8.3 m deep. The catchment is pine plantation forest (half recently logged) with a manuka scrub buffer between the lake and pines on the northern side. The inflow stream enters the north-eastern end of the lake, with the outlet (Pukekura Stream) discharging to the west coast 5 km to the south-west. Access is through approximately 10 km of well-formed forestry roads to the outlet. Small boat access can be made at this point.

Wetland vegetation

A low density margin of emergents up to 2 m across was present with *Eleocharis sphacelata* the dominant species, present around most of the lake with an average cover of about 10%, growing to a maximum depth of 2.5 m. *Typha orientalis*, *Baumea articulata*, *Cyperus ustulatus*, *Carex secta*, *Carex virgata*, *Carex maorica* and *Eleocharis acuta* were also present.

Alligator weed (*Alternanthera philoxeroides*) was present at the access point.

Submerged vegetation

The lake was steep sided and no significant turf communities were present. The vegetation was dominated by the invasive weed *Ceratophyllum demersum*, present throughout the lake with an average cover 26-50% and extending to 3.8 m deep. *Chara australis* was present at low (≤5%) average cover. The endangered *Utricularia australis* was recorded on one of the 3 profiles.

LakeSPI

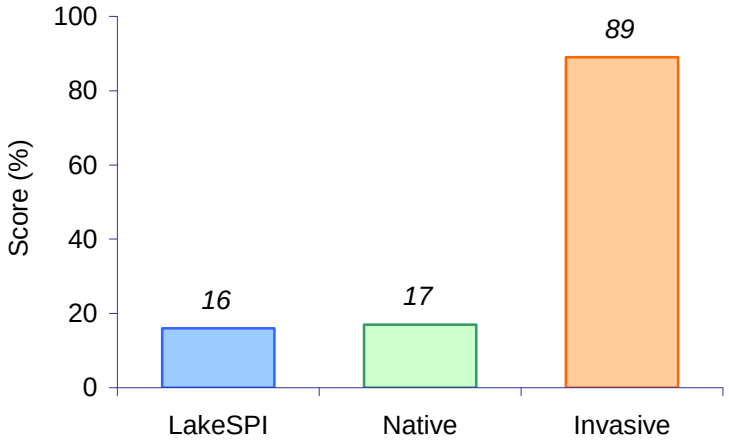

Figure: LakeSPI Index as % of potential score, Native Condition Index, and Invasive Impact Index (from left to right).

The LakeSPI score of 16% is low as the lake is dominated by the invasive weed hornwort (*Ceratophyllum demersum*), with little native vegetation present.

Water birds

A poor water bird habitat. Black swan (*Cygnus atratus*), pukeko (*Porphyrio melanotus*), pied shag (*Phalacrocorax varius*) and shoveler (*Anas rhynchotis*) were seen. Fernbird (*Bowdleria punctata vealeae*) were previously recorded in 1991 (DoC SSBI) but were not noted by this survey or the 1996 OSNZ survey. Recent logging would have caused major disruption of the lake and its surrounding vegetation.

Fish

Shortfin eel (*Anguilla australis*) and common bully (*Gobiomorphus cotidianus*) were seen during the vegetation survey. DoC SSBI also reports grey mullet (*Mugil cephalus*) in this lake.

Aquatic invertebrates

No koura or mussels were found.

Changes in indicators

No previous vegetation surveys.

Threats

The lake is isolated with difficult access, however both *C. demersum* and alligator weed have been introduced; the former probably with eel nets, the latter via a digger used to deepen the outlet as an emergency water supply for forest fire management. Alligator weed poses a threat to emergent vegetation and is absent from the main body of the lake.

Forestry activities e.g., fertiliser application and logging within the catchment could impact the nutrient status of the lake although it is already nutrient enriched.

Management recommendations

Recommend surveying lake margin for alligator weed and control if feasible.

No monitoring required.