North of Dargaville

Lake Waikare (Kai-Iwi Lakes), NRC Lake No. 227

Lake Waikare showing the bare iron pan substrate typical of the lake margins (2023, Inigo Zabarte-Maeztu).

Summary	Lake Waikare
Surveyed:	1985, 1987, 2001, 2005, 2007, 2011, 2014, 2018 and 2023.
Overall ranking:	**Outstanding**: A native plant dominated lake with the presence of nationally rare plants and fish. Negligible impact by pest plants.
Threats:	High risk of pest plant introduction but subsequent impact likely to be low due to very low nutrient status and steep bathymetry. Moderate risk of increased nutrient loading from the catchment with impact on current values and consequent increased biosecurity risk.
Management recommendations:	Pest plant surveillance should be carried out at access points annually. Lake native biodiversity value monitoring is recommended every 5 years. Monitoring of the critically threatened *Trithuria inconspicua* populations is required.

Description

The lake (1656902E, 6038255N) is accessible for trailer boat traffic via a sealed road and concrete boat ramp. Permission to use a powered boat is required from the Taharoa Domain

Board. The catchment is predominantly kānuka scrub (50%), recently harvested pine plantation (45%), and a campground. This moderately large (26.5 ha) and deep (30 m) dune lake was an important venue for water skiing, but in 2016, the Kai Iwi Lakes (Taharoa Domain) Reserve Management Plan banned power boats from the lake. There is no outlet and only minor drains enter the lake.

Wetland vegetation

Emergent vegetation was sparse on all survey occasions, only occurring around 15% of the lake shore, with *Eleocharis sphacelata, Machaerina arthrophylla, M. articulata, M. juncea, Apodasmia similis* and *Schoenus brevifolius* present in some areas. Emergent plants were usually in narrow bands <2 m wide extending to water depths between 0.5 m and 2.5 m. Much of the shoreline has a hard ferrocrete substrate that is unsuitable for development of emergent vegetation.

Submerged vegetation

Turf plants remained sparse in 2023 due to the prevalent ferrocrete reefs around the lake but turfs were locally common and associated with emergent vegetation. Species included *Trithuria inconspicua, Lilaeopsis novae-zelandiae* and *Myriophyllum votschii*. Isolated plants of the exotic rush*, Juncus bulbosus* were also recorded in shallow areas. The turf species *Triglochin striata* and *Glossostigma elatinoides* were recorded for the first time in 2023.

In 2023, the submerged vegetation was dominated by charophytes forming meadows (with a median cover class of 96 to 100 % cover over the five transects), up to 1 m tall and extending to 22 m. The dominant deep water species was *Chara australis*, occasionally found in shallow water but commonest from 10 m to the maximum vegetation depth. *Nitella leonhardii* was also recorded in deep vegetation (>15 m).

Lake Waikere showing a charophyte meadow at 10.5m (2023, Svenja David).

Chara fibrosa was dominant in shallower water from 1.5 m to 12 m. *Nitella pseudoflabellata* was locally abundant from 1 m to 8.4 m on the profile nearest the boat ramp and *N. hyalina* was

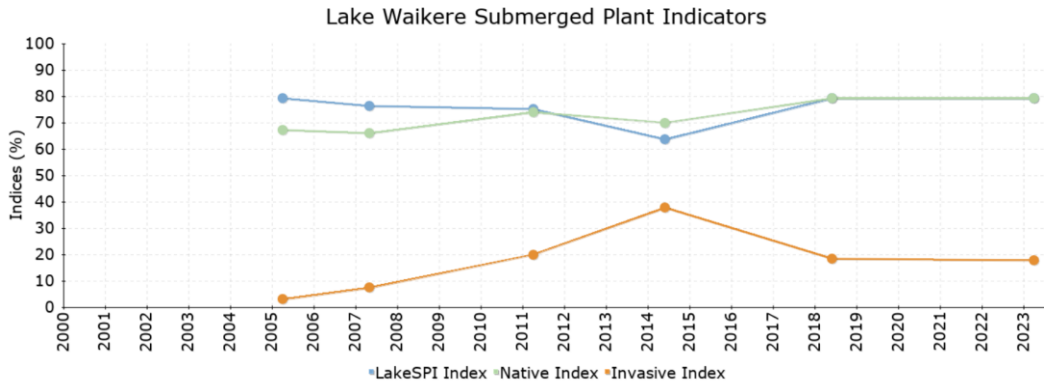
found at covers ≤5% in water 1 to 2.5 m at one profile. *Potamogeton cheesemanii* was found at two profiles to a maximum depth of 3.5 m with covers of 5%. The invasive *Utricularia gibba* both found in low covers (<10%) in the shallows (≤2 m) at three transects.

A similar vegetation was described in 2018, although a maximum depth of 22.6 m was recorded on that occasion.

Before 2005, *Chara fibrosa* dominated the charophytes to the bottom limit, which was 19 m in 2001. *Utricularia gibba* was recorded from between 11 and 16 m in 2014, the deepest record yet for this invasive species, where it formed high covers on charophyte meadows. It was not found at these depths or covers in the two subsequent assessments.

One small patch of the native *Potamogeton ochreatus* was noted near the boat ramp in 2012 and the introduced *P. crispus* was recorded in the same location in 2017 as part of a dune galaxias survey (Alisha Frost, NorthTec pers. comm.). This may indicate increased nutrients in that area. The plant was removed, and neither species were seen in the 2018 or 2023 surveys.

LakeSPI



Survey Date	Status	LakeSPI %	Native Condition %	Invasive Impact %
March 2023	Excellent	79.2%	79.3%	17.8%
May 2018	Excellent	79.2%	79.3%	18.5%
May 2014	High	63.6%	70.0%	37.8%
March 2011	Excellent	75.2%	74.0%	20.0%
April 2007	Excellent	76.4%	66.0%	7.4%
March 2005	Excellent	79.2%	67.3%	3.0%

LakeSPI Index for Lake Waikare as % of potential score since 2005. Native Condition Index, and Invasive Impact Index are also shown.

The LakeSPI Index of Lake Waikare has remained in Excellent status, with only the 2014 LakeSPI assessment falling below this level. Invasive Impact Index peaked in 2014 with a High LakeSPI Index, but has since had a low impact on submerged vegetation. The LakeSPI indices have generally remained stable over the 18 year monitoring period.

Water birds

The depauperate emergent vegetation limits the habitat available in this lake to water birds. Banning power boats may lead to reduced disturbance of water birds on this lake.

Fish

Native fish records include common bullies (*Gobiomorphus cotidianus*) and dune lakes galaxias, shortfin eel (*Anguilla australis*) and longfin eel (*Anguilla dieffenbachii*). Large pelagic schools of juvenile bullies were noted at several sites. Exotic fish present were gambusia (*Gambusia affinis*), common in shallow areas. Previously, a stocked population of rainbow trout (*Oncorhynchus mykiss*) was recorded as present in Lake Kai-Iwi. Trout are no longer stocked in the Kai-Iwi lakes.

Department of Conservation (DOC) conducted a fish survey during 2014 using a combination of Gee minnow (4) and fyke nets (2). They recorded a total of 96 gambusia, 589 common bullies, 20 dune lakes galaxias, 8 longfin and 2 shortfin eels (all large ≥540 mm long).

Aquatic invertebrates

Kēwai (*Paranephrops planifrons*) and pea mussels (*Sphaerium novaezelandiae*) have been recorded from Lake Waikare, although they are not abundant. The DOC fish survey in 2014 recorded 3 dragonfly nymphs and one kēwai. No kēwai were recorded in 2023.

Endangered species

The Nationally Endangered spring annual *Centrolepis strigosa* was abundant in marginal vegetation in 2014 and the remnants of last winter/spring plants were seen in 2023. The Nationally Critical *Trithuria inconspicua* was locally abundant in this lake with large patches adjacent to the concrete boat ramp on the western shore and the eastern side of the southernmost bay.

The At Risk Naturally Uncommon dune lake galaxias (restricted to the Kai iwi lakes) appears to be abundant in Lake Waikare with large schools of this fish commonly seen during dive surveys and also sampled during the 2014 DOC fish survey. A few At-Risk Declining longfin eel were also sampled by DOC.

Lake Ecological Value

In 2023, Lake Waikare was assessed with an Outstanding Lake Ecological Value score of 15, equal to the score generated in 2018. It is currently the best example of a clear-water Northland lake due to the deterioration of the other two Kai Iwi lakes noted in 2023. Submerged vegetation is dominated by dense charophyte meadows with *Chara australis* extending to a maximum depth of 22 m, with three other charophyte species recorded in these meadows. The lake does stratify over summer and should low dissolved oxygen levels develop in the hypolimnion this could threaten its status in the future.

Threats

The ease of access and boat traffic to this lake previously resulted in a very high risk of pest plant introduction, however the ban on power boats has undoubtedly reduced the risk substantially.

Water chemistry currently limits the development of large vascular plants and further pest plants are unlikely to establish. However, changes in water quality parameters could increase the likelihood of pest plant establishment. Nevertheless, hornwort (*Ceratophyllum demersum*) may be able to establish in this lake under current nutrient levels. *Potamogeton ochreatus* and *P. crispus* noted near the boat ramp may indicate localised nutrient enrichment in that area.

The biggest threat to Lake Waikare would be increased nutrient loading from the catchment,

which would not only impact upon water clarity and current ecological values but also create an increased likelihood of pest plant establishment. Given the excellent water quality of this lake and Outstanding ecological value rating, the possibility of water quality deterioration requires further consideration.

Management recommendations

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

Lake native biodiversity value should be monitoring every five years.

Lake water quality and catchment nutrient sources need to be closely monitored and managed.