

Te Hiku

Ngatu, (Sweetwater) NRC Lake No. 120.



Ngatu, from the northern access point (2020, Tracey Burton).

Summary	Ngatu
Surveyed:	1984, 2001, 2004, 2006, 2010, 2014, 2016 and 2020.
Overall ranking:	Outstanding: Good emergent and submerged vegetation with some endangered biota, but indications of significant vegetation decline. Pest plants and fish present. Water quality varies considerably but is recently improving.
Threats:	Threats of eutrophication from residential development, farming intensification and possibly kauri log recovery from wetlands. The invasive submerged weed lagarosiphon was controlled in 2020 using endothall, but there is a high risk of further species introductions.
Management recommendations:	Lake native biodiversity value monitoring every 5 years. FIF programme to eradicate lagarosiphon. Post-monitoring of submerged vegetation is a requirement for the Environmental Protection Authority permission. Eradicate water lily, yellow flag iris, alligator weed, mile-a-minute and Christmas berry from Ngatu.

Description

Ngatu (2528991E, 6685555 N) is a large (50.3 ha) dune lake with a maximum depth of 6.5 m. The catchment is primarily manuka / kanuka scrub and fenced pasture. There are houses overlooking the lake on the north-western fringe. It is a popular recreational lake with easy access from West Coast Road to the north and from Sweetwater Road along the eastern shore. Boats are launched from firm sand at the northern and southern end and a large number of waka ama are stored on the south western edge of the lake.

Wetland vegetation

Most of the lake margins have large beds of emergent species, with up to 100 m wide beds on the eastern margin associated with islands in this area. The dominant emergent is kuta (*Eleocharis sphacelata*) growing from the lake margin to 2.6 m depth, with other species including *Apodasmia similis*, *Machaerina articulata*, *M. arthrophylla*, *M. juncea* and *Schoenoplectus tabernaemontani* all common. *Eleocharis sphacelata* appears to be declining in parts of the lake.

One small clump of the invasive alien yellow flag iris (*Iris pseudacorus*) was removed in 2007. The invasive alligator weed (*Alternanthera philoxeroides*) was noted for the first time in 2012 and has been repeatedly treated with the herbicide metsulfuron-methyl (Kevin Matthews, pers. comm.), but plants still remain. The invasive climber mile-a-minute (*Dipogon lignosus*) was found near an inlet drain at the northern end of the lake. This was removed by hand weeding and picloram gel was applied to remaining stems. The problem woody wetland weed Christmas berry (*Schinus terebinthifolia*) was found amongst manuka on the eastern edge of the lake and has been removed. It has yet to invade wetland margins in New Zealand as it does in warm temperate Australia and Florida.

Submerged vegetation

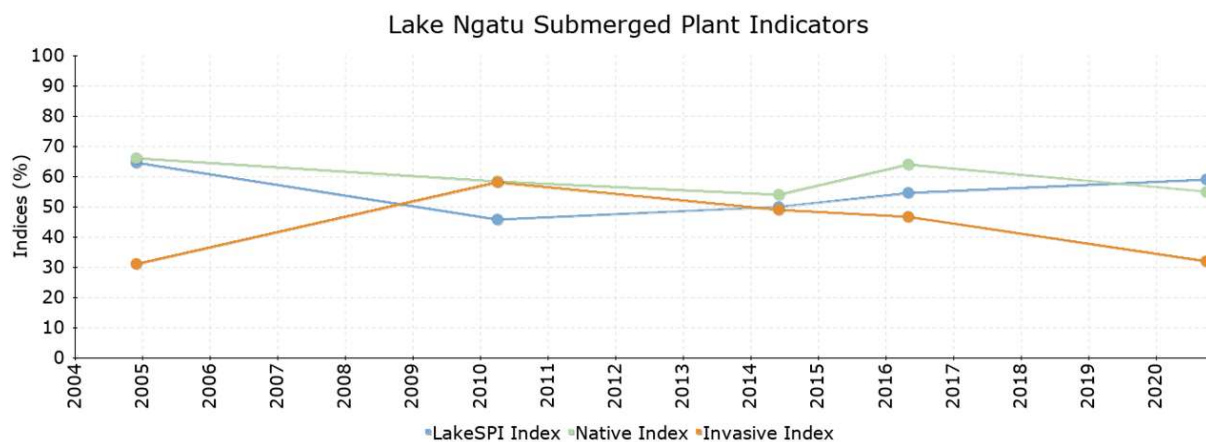
Turf communities were common in areas to ~ 1 m deep where *E. sphacelata* did not form dense emergent beds. Common species were *Lilaeopsis novae-zelandiae*, *Myriophyllum votchii*, *Trithuria inconspicua*, *Triglochin striata*, *Utricularia gibba* and the exotic *Juncus bulbosus*. In 2020, *Limosella lineata* was recorded for the first time since 1984 (Tanner et al. 1986). It was growing in recently flooded areas amongst submerged terrestrial grasses and Asteraceae species near the northern access.

In 2020, charophytes dominated the vegetation from the edge of emergent or turf communities to a maximum depth of 4.6 m. The dominant species were *Chara fibrosa* with *Chara australis* and *Nitella leonhardii*. *Nitella pseudoflabellata* was common in shallow water (<2 m) at one site. Prior to 2010, *Chara fibrosa* and *Nitella leonhardii* were the dominant charophytes with only low covers of other species present (although Cunningham (1953) indicated some areas of the lake were dominated by *C. australis*). Prior to 2020, the average cover of charophytes has also been declining over the years from nearly 100% cover up to 2006, reducing to average covers of 51 -75 % in 2010 and 2014, but in 2016 is less than 5% with occasional patches only across the main body of the lake. This had apparently improved in 2020, where charophyte meadows were present at four sites, with the deepest extent to 4.1 m deep (>10% cover).

The alien invasive lagarosiphon (*Lagarosiphon major*) was present at the main launching site at depths between 0.5 and 3.0 m with an average cover less than 25%, also present at <5% at another monitoring site. The abundance of lagarosiphon has declined since 2010 possibly due lower water clarity. Large mats of *Utricularia gibba* associated with periphyton were reported in autumn surveys

but this species only occurred at two sites at low cover in 2020. *Utricularia australis* was once common within this lake but has not been seen here since 2007.

LakeSPI



Survey Date	Status	LakeSPI %	Native Condition %	Invasive Impact %
September 2020	High	59.0%	55.0%	31.9%
April 2016	High	54.5%	64.0%	46.7%
May 2014	Moderate	50.0%	54.0%	48.9%
March 2010	Moderate	45.8%	58.3%	58.0%
November 2004	High	64.5%	66.0%	31.1%

LakeSPI for Ngatu. Four LakeSPI surveys are recorded between 2004 and 2016.

Ngatu is categorised as being in high ecological condition with a LakeSPI Index of 59%.

A decrease in LakeSPI score from 65% in 2004 to 46% in 2010 was a result of increasing invasive impact from *U. gibba*, and a decrease in native condition. A minor improvement driven by reduced invasive impact is indicated since 2010, but the Native Condition Index has declined slightly. Charophyte meadows have apparently re-established and impacts of *U. gibba* declined since 2016.

Water birds

Extensive emergent vegetation provides a good habitat for water birds, however human disturbance reduces the desirability for more secretive species. The 2016 survey recorded ten waterfowl species including, scaup (*Aythya novaeseelandiae*) dabchick (*Poliiocephalus rufopectus*) and Caspian tern (*Hydroprogne caspia*). Bittern (*Botaurus poiciloptilus*) were seen on previous lake surveys.

Fish

Common bullies (*Gobiomorphus cotidianus*), inanga (*Galaxias maculatus*) and the exotic pest gamba (*Gambusia affinis*) were observed. The landlocked population of inanga are of special status, possibly a new species with a larger number of gill rakers than migratory (diadromous) inanga (B. David, D. Rowe pers. comm.). The introduced rainbow trout (*Oncorhynchus mykiss*), rudd (*Scardinius erythrophthalmus*) and goldfish (*Carassius auratus*) were also reported in the NIWA FBIS database. A rudd was noted amongst emergent vegetation at the southern end of the lake. The pest fish perch (*Perca fluviatilis*) was reported by a diver in 2009, but presence was not been confirmed. A combination of Gee minnow traps, seine and gill nets were deployed in 2010 but only inanga, bullies, gamba and a goldfish were caught. An attempt was made to confirm perch presence in April 2010

by overnight gill netting but only goldfish were caught. Perch could have a major impact on other fish species. Holes in vegetation and sediment surface, indicative of bottom feeding pest fish were noted in 2010.

DOC conducted a fish survey during 2014 using a combination of Gee minnow (10) and fyke nets (9). They recorded a total of >13,000 gambusia, 369 common bullies, 1,249 īnanga, 5 longfin and 1 shortfin eels (all large ≥680 mm long) with 56 diving beetles (*Onychohydrus hookeri*) also caught.

Aquatic invertebrates

The introduced ramshorn snail (*Planorbarius corneus*) was common in the lake. The introduced snail *Planorbella scalaris* was reported from Lake Ngatu and identified by Brian Smith (NIWA, Hamilton) in March 2007. It is endemic to the central and southern part of the Florida peninsula where it is found in marshes and lakes. This was the first record of this species in New Zealand. However, it was not found during the later surveys. Large numbers of New Zealand's largest dytiscid beetle *Onychohydrus hookeri*, were caught in the Gee minnow traps deployed in 2010. They are carnivorous and were observed feeding on gambusia in the nearby Little Gem Lake.

Endangered species

The Nationally Endangered *Trithuria inconspicua* had apparently disappeared from amongst open emergent beds of *M. arthrophylla* adjacent to the northern boat ramp, but were relocated in September 2020 (L. Forester, NRC, pers. comm.). This species appears to be increasing in abundance in shallow water at the south eastern edge of the lake and maintains a good population in the south western shallows between the waka ama area and the grassed southern end of the lake. This species is now restricted to Ngatu, Rotoroa and Rotokawau in the Te Hiku lakes, having been lost from two other lakes in the region. The Nationally Critical *Utricularia australis* was a common component of the submerged vegetation up to 2004 but was last seen in this lake in 2007. The At-Risk Declining fern *Cyclosorus interruptus* was reported from the marginal vegetation for the first time in 2007 and appears to persist in the same area.

The At-Risk Declining īnanga were sampled by DOC in 2014. These fish are land-locked and differ from migratory (diadromous) īnanga by having a larger number of gill rakers. The lake population of this fish appears to be secure, despite huge numbers of gambusia.

Lake Ecological Value

Ngatu charophyte species composition has changed over the monitoring programme and since 2010, charophyte abundance has markedly diminished lake wide, indicating that nutrient enrichment stress is likely. However, charophyte abundance had increased in 2020 compared with 2014 and 2016. Similar declines in kuta have also been recorded. No trends in degrading water quality using TLI have been detected, with 2018 and 2019 data showing an improving trend. The lake is classified as mesotrophic and trend analysis showed water quality declined over the 5 years prior to 2011 with water clarity decreasing at a rate of 0.31 m per year and TLI degrading 1.64% per year. The ecological value rating of Ngatu has increased to 14 "Outstanding", with improved aquatic species richness.

Threats

Lagarosiphon has been present in the lake since 1988, has spread little and is restricted to a few locations. Other weed species, such as hornwort (*Ceratophyllum demersum*), could displace all other submerged vegetation. As access to Ngatu is easy, the risk of spread from other areas by boat traffic is high.

Five marginal weeds have been detected at an early stage of invasion at Ngatu. Of these, yellow flag iris and Christmas berry have been eradicated, while mile-a-minute and alligator weed eradication programmes near completion. Two patches of water lily (*Nymphaea* sp. – possibly *N. mexicana*) have been discovered in October 2016 at the northern end of the lake (A. Macdonald pers. comm.). Both sites were around 10m² in knee deep water.



***Nymphaea* hybrid waterlily from Ngatu (Lisa Forester, 25 September 2020).**

This species was previously thought to have been eradicated in the 1990's where it was found at the southern end of the lake.

The pest fish *Gambusia affinis* may have a deleterious impact on other fish like the nationally significant īnanga. Rudd do not appear to be impacting submerged vegetation under current conditions. Perch (reported in 2009) were not captured in the 2010 fish survey. Perch could have a major impact on other fish species as they are piscivorous.

Concerns have been raised about nutrient and other water quality impacts related to land use change, septic tanks and kauri log removal from the catchment. No clear trends are evident in the TLI or LakeSPI condition indicators. But there has been significant ecological change with marked loss of the previously abundant charophyte and emergent kuta communities and marked fluctuations in water clarity.

Management recommendations

It is recommended that lake native biodiversity value monitoring is undertaken every five years and that pest plant surveillance is undertaken at access points for new incursions of aquatic weeds every year.

Previous recommendations included an eradication programme for lagarosiphon using endothall in Ngatu. Consequently, this lake has been selected as a Freshwater Improvement Fund (FIF) (Ministry for the Environment) project for the control of lagarosiphon using the herbicide endothall dipotassium. Preliminary investigations following the early September herbicide treatment indicate that lagarosiphon has collapsed in the lake (L. Forester pers. comm.). Further post-monitoring of submerged vegetation is recommended.



Lagarosiphon fragments collected from Ngatu (Lisa Forester, 25 September 2020).

Continued management of other marginal weeds and water lilies towards eradication is recommended.