Exclusion and Removal of Pest Fish from Lake Ohinewai – Fact Sheet

Linking lake restoration with end users for positive environmental outcomes

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Lake Ecosystem Restoration New Zealand

Lake Ohinewai

Many of the shallow lakes in the lower Waikato River floodplain have significantly degraded water quality as a result of nutrient and sediment enrichment from non-point sources. Pest fish species such as koi carp, goldfish, and catfish have exacerbated lake decline by resuspending lake sediments and uprooting submerged macrophytes. This this resulted in a collapse of submerged macrophytes and progression from clear-water oligotrophic state to a eutrophic (algal-dominated) state.

Lake Ohinewai is a shallow (4.5 m depth), moderately-sized (16.8 ha) riverine lake, with a 331 ha catchment that is primarily flat and dominated by intensive pastoral farming. A single outlet drain leads to Lake Waikare and passes through a circular road culvert 930 m from the lake outlet. The water quality of Lake Ohinewai has deteriorated significantly and the lake has been devoid of aquatic macrophytes since the 1990s. This decline coincides with increasing populations of koi carp (*Cyprinus carpio*).

Koi Carp Exclusion

The presence of a single outlet from Lake Ohinewai provided an opportunity to exploit the behavioural instinct of koi carp to periodically migrate.

A one-way barrier was installed across the outlet allowing fish within the lake to exit, but preventing adult fish from entering (Figure 1). The barrier did not prevent juvenile fish from entering the lake, but it was hoped that exclusion of adult koi carp would reduce disturbance of the lake bed and assist recovery of the lake.

Figure 1. Pest fish exclusion barrier installed on the Lake Ohinewai outlet. The barrier is designed to allow one-way passage of pest fish species out of the lake. Photos: Adam Daniel

Carp Biomass Reduction

Installation of the one-way barrier and associated fish removal efforts from Lake Ohinewai have reduced the koi carp population from an estimated 373.6 kg/ha in January 2011 to 10.4 kg/ha in December 2014, a 97% reduction in koi carp biomass.

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Pest Fish Removals

A total of 3494 kg of pest fish was removed from Lake Ohinewai, including 3003 kg of koi carp, 233 kg of catfish and 257 kg of goldfish. Pest fish removals were undertaken on six occasions between December 2010 and December 2014. In addition, mark-recapture programmes were conducted on three occasions in order to estimate the remaining biomass (Figure 2). Removal methods used included boat electrofishing, fyke netting, automated feeder-traps and beach seining.

The single largest factor responsible for the decline in the koi carp population appears to be the installation of the one-barrier on the Lake Ohinewai outlet. An estimated 208.6 kg/ha (55.8%) of koi carp were removed by this passive method in a six month period.

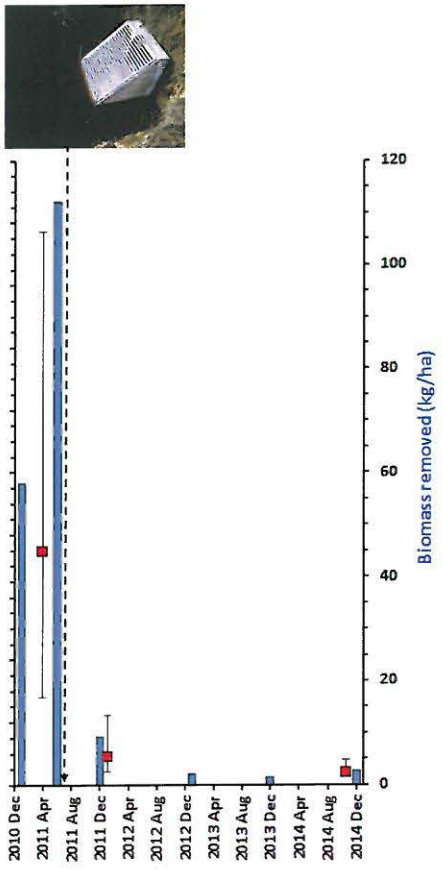

Figure 2. Pest fish (koi carp, catfish, goldfish) biomass estimates (red squares ± 95% CI) and removals (blue bars) from Lake Ohinewai. The one-way barrier was installed on the lake outlet in mid-2011.

Effects on Lake Ecology

Prior to the reduction in pest fish biomass, Lake Ohinewai was devoid of submerged aquatic vegetation. Following a 95% reduction in pest fish (koi carp, catfish, goldfish) biomass there has been some limited establishment of exotic marginal aquatic species such as parrot's feather (*Myriophyllum aquaticum*) and *Ludwigia* sp. Increases in shortfin eel condition have also been observed (Figure 3), inferring that competition for resources has declined.

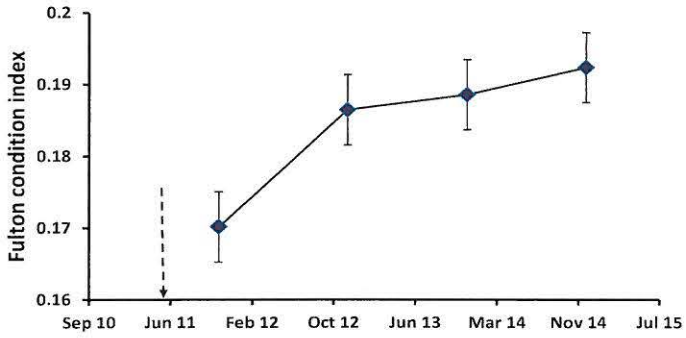

Figure 3. Fulton condition index of Lake Ohinewai shortfin eels (± SE). Arrow indicates installation of one-way fish barrier.

Improvements in water clarity have not occurred following the biomass removals (Figure 4). However, ecological modelling indicates that biomass removals need to be supported by catchment remediation measures such as sediment detainment structures and riparian planting to reduce nutrient and sediment loading. Significant improvements in water quality are most likely to occur through management approaches that address both internal and external nutrient sources.

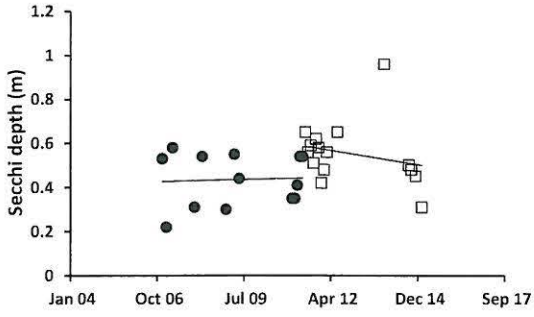

Figure 4. Lake Ohinewai Secchi disk measurements of water clarity prior to (black circles), and following (open squares) installation of the one-way barrier.