

CEF Project Number: CEF-605

Project title: Koi carp product trial in dune restoration

Organisation: Coastal Restoration Trust of New Zealand

Milestone 6 – 30th April 2020

Deliverable: Online final guidelines report

Brief guide to potential use of processed koi carp

Background

- Invasive species have caused substantial ecological and economic problems globally.
- In New Zealand a number of invasive fish species occur and are, in some places, particularly abundant. The acknowledged epicentre and only formally defined containment area for invasive koi carp (an ornamental strain of *Cyprinus carpio*) in New Zealand is located in the North Island in the Lower Waikato River Basin.
- Eutrophic conditions combined with a temperate climate and connected shallow riverine lakes and wetlands provide ideal conditions for the proliferation of this and other invasive fish such as the brown bullhead catfish (*Ameiurus nebulosus*) and goldfish (*Carassius auratus*).

Koi carp in the Waikato

- This project is based on use of an invasive fish management programme involving capture from the aquatic habitat and converting into beneficial products to address or support environmental issues and initiatives related to conservation and/or restoration.
- Koi carp were harvested in the lower Waikato using a fixed semi-automated fish cage fitted with a customised mesh shape and size to minimise native fish by-catch while retaining the smallest invasive fish possible.
- Following euthanasia, fish are processed on site in a bacterial digester.

An alternative fertiliser for dune restoration

- Planting trials on dunes have evaluated the use of processed invasive fish as a replacement for imported synthetic fertiliser tablets typically used in small-to-medium scale replanting programmes by restoration managers and community groups.
- The performance of recycled invasive fish fertiliser was compared with artificial tablets for boosting early establishment of two key native sand binders pingao (*Ficinia spiralis*) and spinifex (*Spinifex sericeus*).
- These species were planted in four coastal New Zealand dune systems to compare growth (plant spread and vigour) in response to nutrient additions at the time of planting (i.e. invasive fish and commercial fertiliser tablets vs no fertiliser controls).
- The pelletised invasive fish had a lower nitrogen content than the tablets, so to ensure comparability in trials, 72g of fish pellets was equivalent to a 10g commercial fertiliser tablet.

- In summary, in most cases invasive fish pellets produced a similar boost in plant growth and vigour to that achieved using commercial fertiliser pellets at all four sites and all fertilised plants grew significantly greater with respect to vigour and spread than non-fertilised controls.
- Locally produced invasive fish pellets could be a viable and comparably-performing alternative to commercially available fertiliser tablets for dune restoration planting initiatives.
- Issues around sustainability of supply and concerns with managing a pest fish as a commercial operation require further investigation as part of developing a business case in consultation with all interested parties.

Lure for predator control programmes

- A preliminary investigation of the use of invasive fish material as a lure in trapping programmes was undertaken to control other introduced pests (e.g. introduced rats and mustelids) which have undesirable impacts on native terrestrial plant and animal taxa in New Zealand.
- A combination of egg and rabbit or invasive fish pellet baits were placed in alternating kill traps by a local conservation community group with bait type (rabbit/egg or fish) in the first trap determined randomly.
- Preliminary results after 9 months of trapping suggest that the invasive fish baits are attractive to terrestrial pests, in particular rats and hedgehogs, for which fish bait performs as well or better than the rabbit and egg-based baits currently used
- Based on these results, invasive fish baits appear to be a durable, promising and complimentary lure for controlling rats and hedgehogs in particular, although further ongoing testing will reveal the long-term effectiveness of fish bait for this purpose.

Browsing deterrent

- Koi oil is the liquid condensate that is a bi-product of the processing of the koi carp fish captured in the northern Waikato waterways; it is a concentrated dark brown liquid with a strong fish odour.
- Trials have indicated the effectiveness of this koi oil as a foliar spray to deter browsing of highly palatable planted natives as well as protection options for pasture with scope to deter game birds.
- Treatments applied by low-pressure hand sprayer included koi oil applied at three rates 10% (1 part koi oil:9 parts water), 50% (1 part koi oil:1 part water) and 100%; with and without crop oil or resin; the commercially available egg and resin based product Treepel; and untreated controls.
- Preliminary results indicate even at low concentrations of 1:10 koi to water, browsing damage to simulated planted shrub hardwoods trials has been significantly reduced when applied as a spray treatment to the foliage, and similarly when applied to grass.
- The koi oil was as effective in reducing browsing by sheep of two commonly planted broad leaved native shrub hardwood species karamu (*Coprosma robusta*) and kohuhu (*Pittosporum tenuifolium*) and indirectly the sprayed surrounding exotic pasture.
- Further testing is required to evaluate crop oil or resin mixed with the koi carp liquid condensate to provide a “rain-fast” water-proof effect to extend the effectiveness of the deterrent to browsing when rain occurs.

Nursery fertiliser

- Preliminary evaluation of koi carp fertiliser pellets for use as an additive to potting mixes in a commercial native plant nursery are not likely to provide any added benefits.
- Koi carp fertiliser pellets attract rodents, particularly mice which are a major factor in native plant propagation facilities, especially for seed storage, sowing and early germination stages, including highly palatable key native sand binders spinifex and pingao.
- Time taken to add the koi carp to potting mixes weighted heavy against the benefit of the slightly greener looking plants in several riparian species evaluated.
- Commercial native plant nurseries are likely to be less interested in adopting koi carp as a fertiliser additive to potting mixes as these are commercially prepared in bulk and a substantial sustainable supply of koi carp would be required.
- There could be scope for community and iwi-based nurseries to use koi carp in organic based potting mixes in production of native plants.