Conservation and restoration of tuna in the Waikato

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MORPHUM environmental

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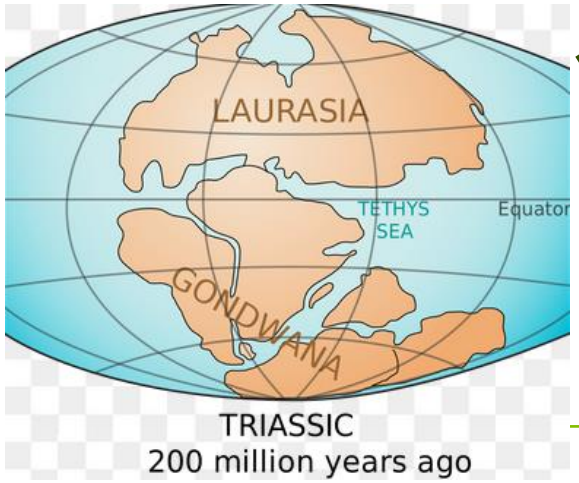
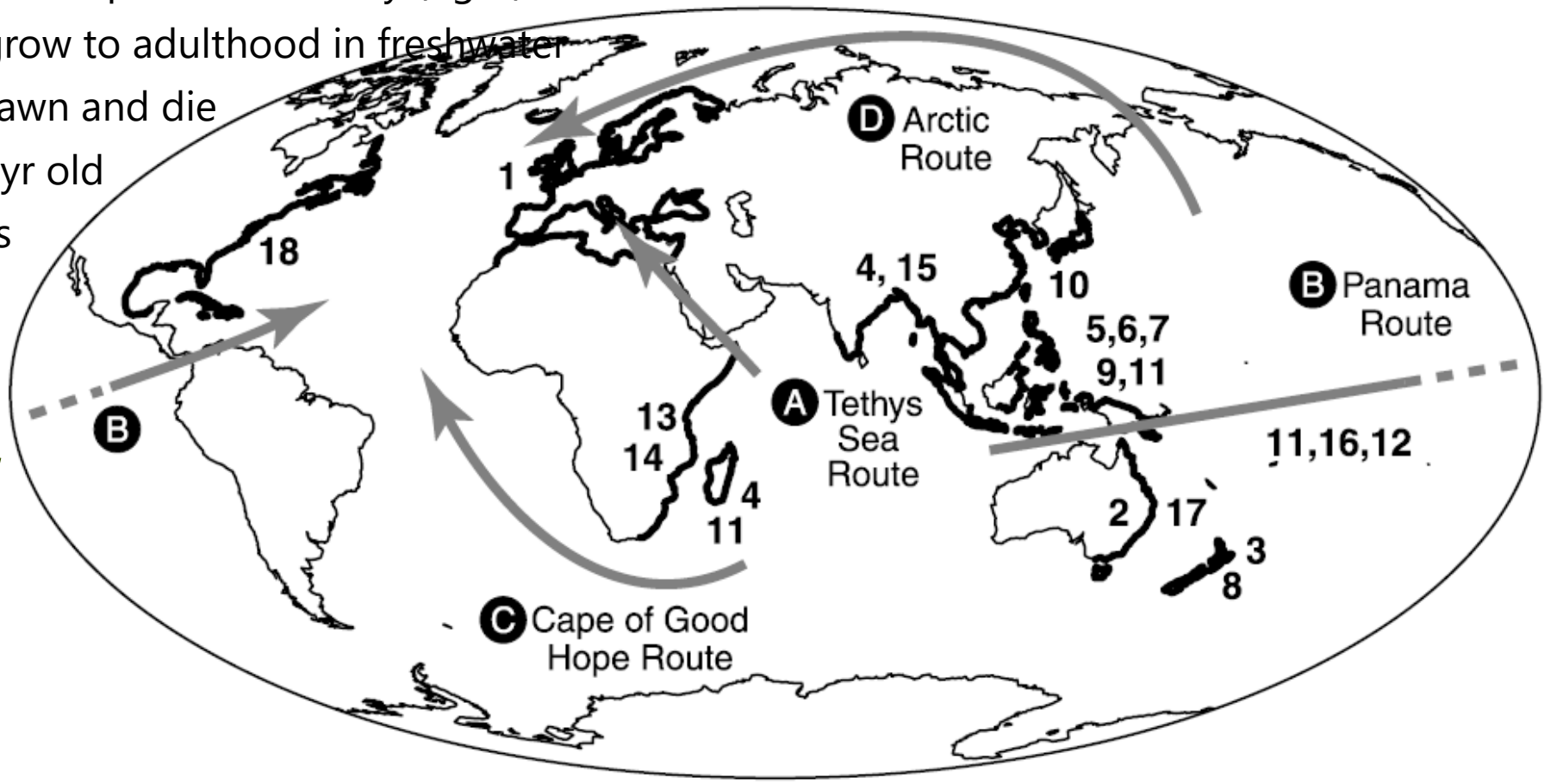
THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Longfin tuna from Lake Ohinewai

Worldwide geographic distribution of the genus *Anguilla*

- All freshwater eels belong to the genus *Anguilla,* 19 species worldwide
- Thick black lines – where the tuna species are today (right)
- Eels (tuna in te reo) live and grow to adulthood in freshwater
- Adults return to the sea to spawn and die
- Tropical genus, 83-44 million yr old
- Grey arrows – dispersal routes
- Tuna in America, Europe, and Japan are in decline
- Continental drift

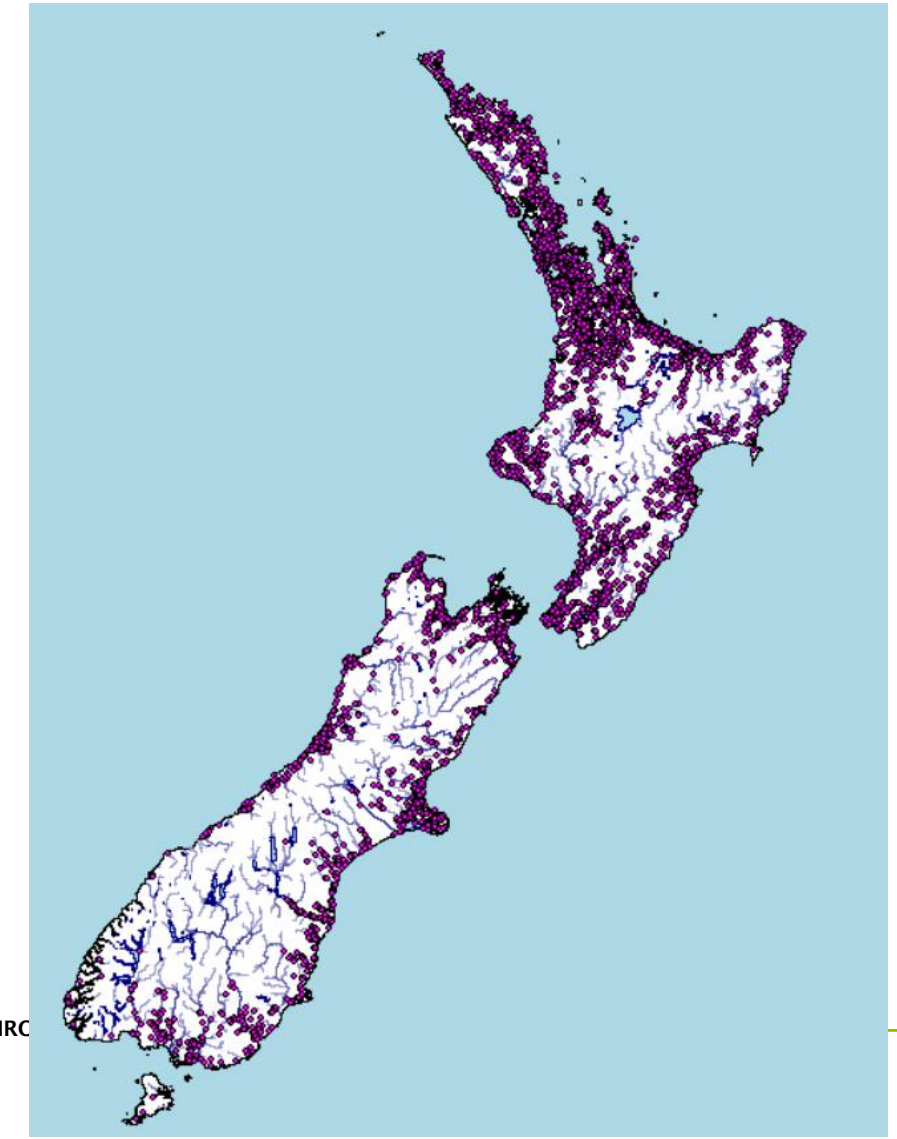




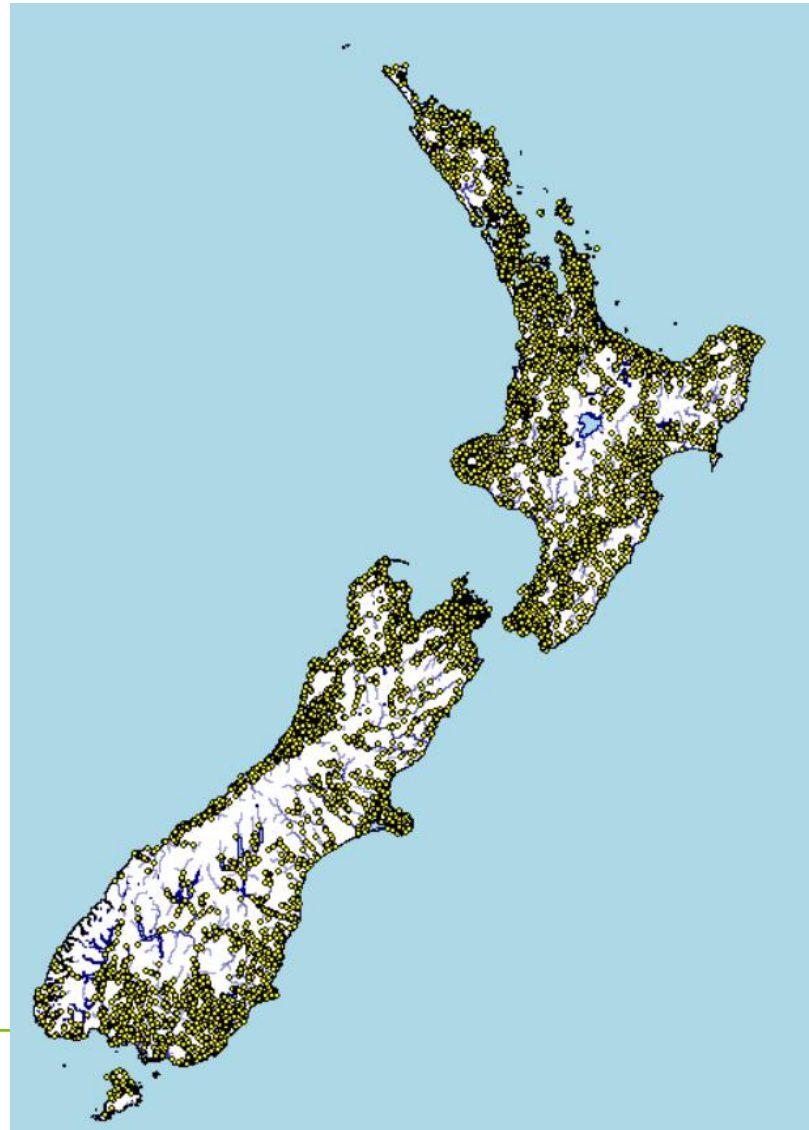
Minegishi et al. 2005. Mol. Phylogen. Evol. 34:134–146

Tuna in Aotearoa/New Zealand

Shortfin tuna *Anguilla australis*
Mainly in the NI in pasture streams and lakes



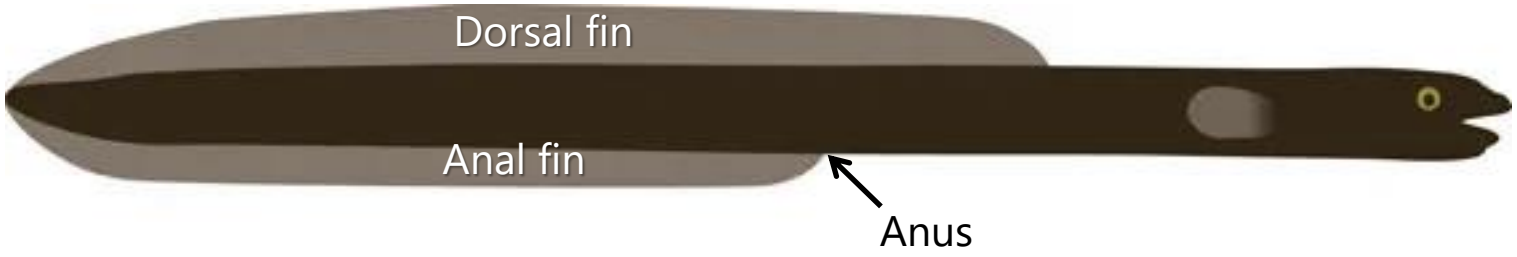
Longfin tuna *Anguilla dieffenbachii*
Throughout the country, dominate the SI and forested streams



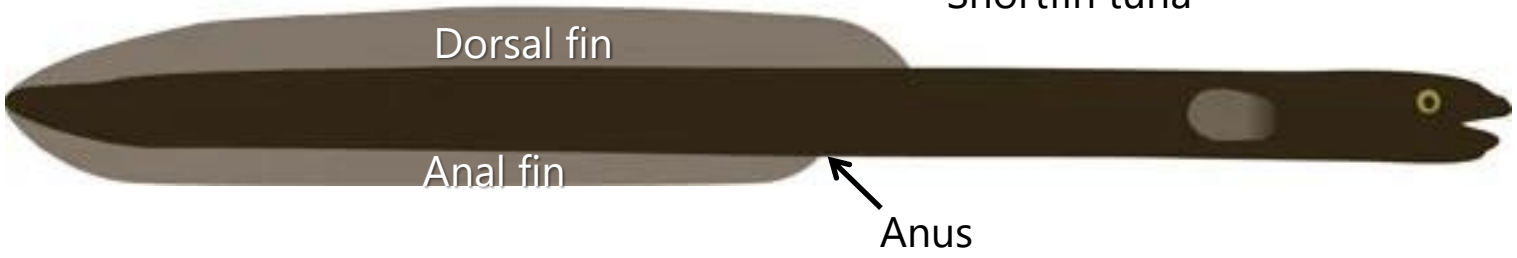
Telling the NZ species apart

- The two main species of tuna found in New Zealand are the longfin *(Anguilla dieffenbachii*) and the shortfin (*Anguilla australis*)
- On a longfin tuna, the dorsal (top) fin extends a lot further forward than the anal (bottom) fin (more than a body width). The dorsal fin of a shortfin tuna extends only a little further forward than the anal fin (less than a body width)

Longfin tuna (often larger than shortfins)



Shortfin tuna



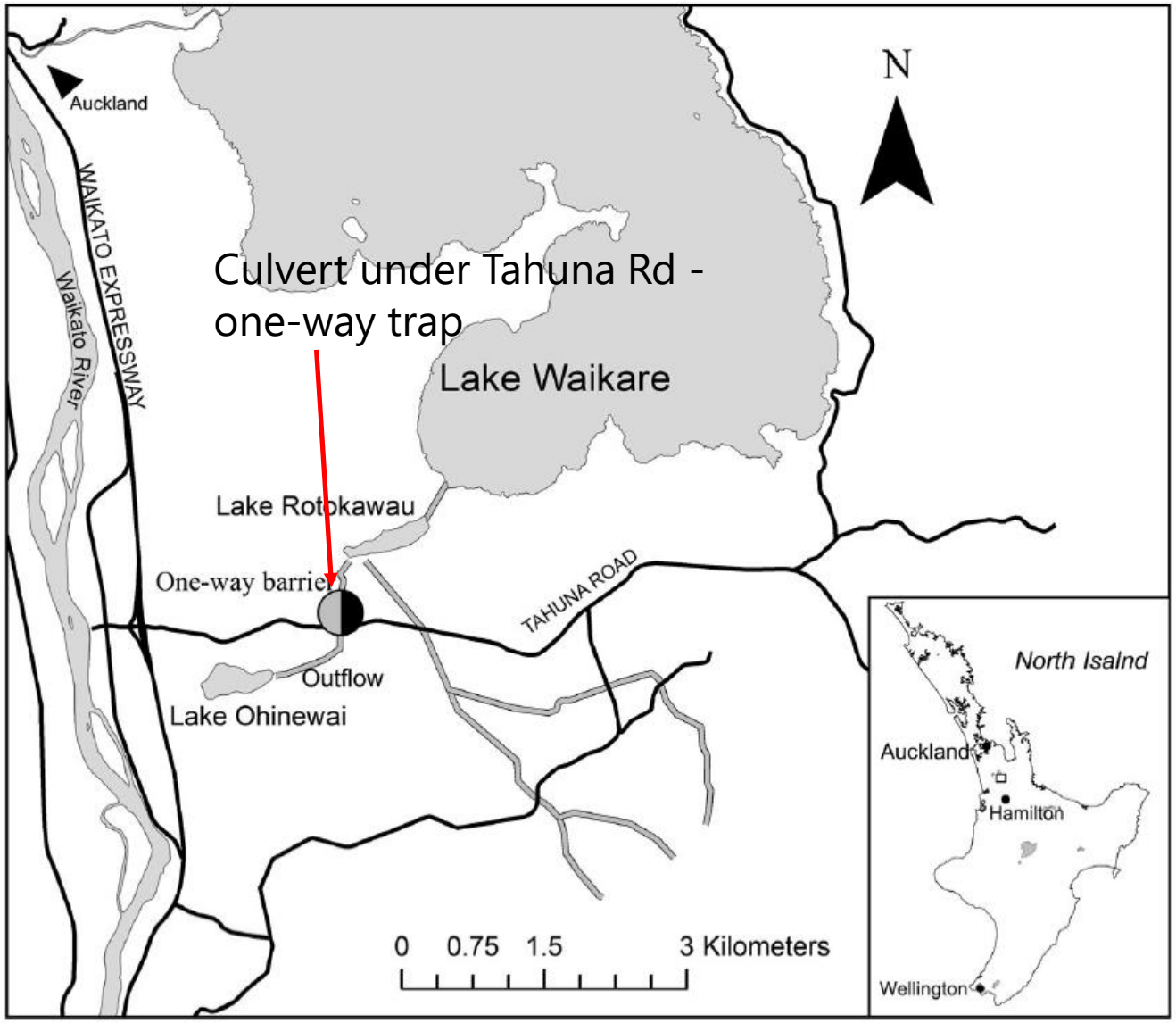
https://www.doc.govt.nz/nature/native-animals/freshwater-fish/eels/freshwater-eels-in-new-zealand/

Effect of invasive fish on tuna

- Tuna are a taonga (treasured) species
- Still recruit well to rivers and lakes despite habitat change and commercial fishing
- Tuna are vulnerable to overfishing because of their long life cycles
- Time to female maturity ~20 years for shortfin, ~40 years for longfins
- Invasive fish species dominate Waikato lakes - koi carp (*Cyprinus rubrofuscus*) comprise 60-80% of the fish biomass
- At the University of Waikato we undertook a biomanipulation (removal) of invasive fish in Lake Ohinewai to see the response of tuna

Lake Ohinewai in the heart of the Waikato

- Lake Ohinewai
  - 16.8 ha surface area
  - 331 ha catchment area
  - 750 m length, 270 m wide
  - Dairying land use
  - Tempero et al. (2018) NZJMFR 53: 397-415



Lake Ohinewai nvasive fish removal 2011 to 2016

- We used mark-recapture to estimate the total proportion of the fish removed (fish, mark, release, fish again and count the marked fish)
- In 2011 we removed ~3 tonnes of invasive fish, tuna returned
- The remaining ~1 tonne reduction by 2012 was carp outmigration through the one-way barrier
- A further 0.5 tonne of invasive fish biomass was removed 2012-2014
- Fished again in 2016 to see the response

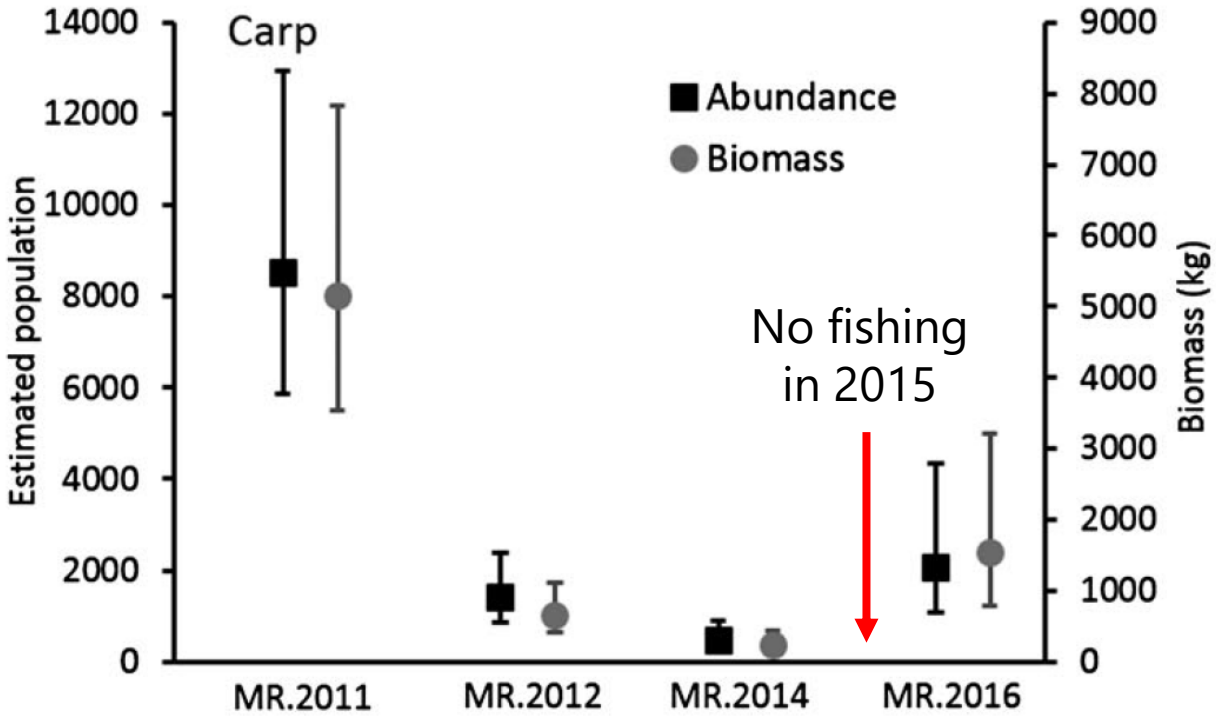
35-mm gaps between hinged fingers allow juvenile natives into the lake

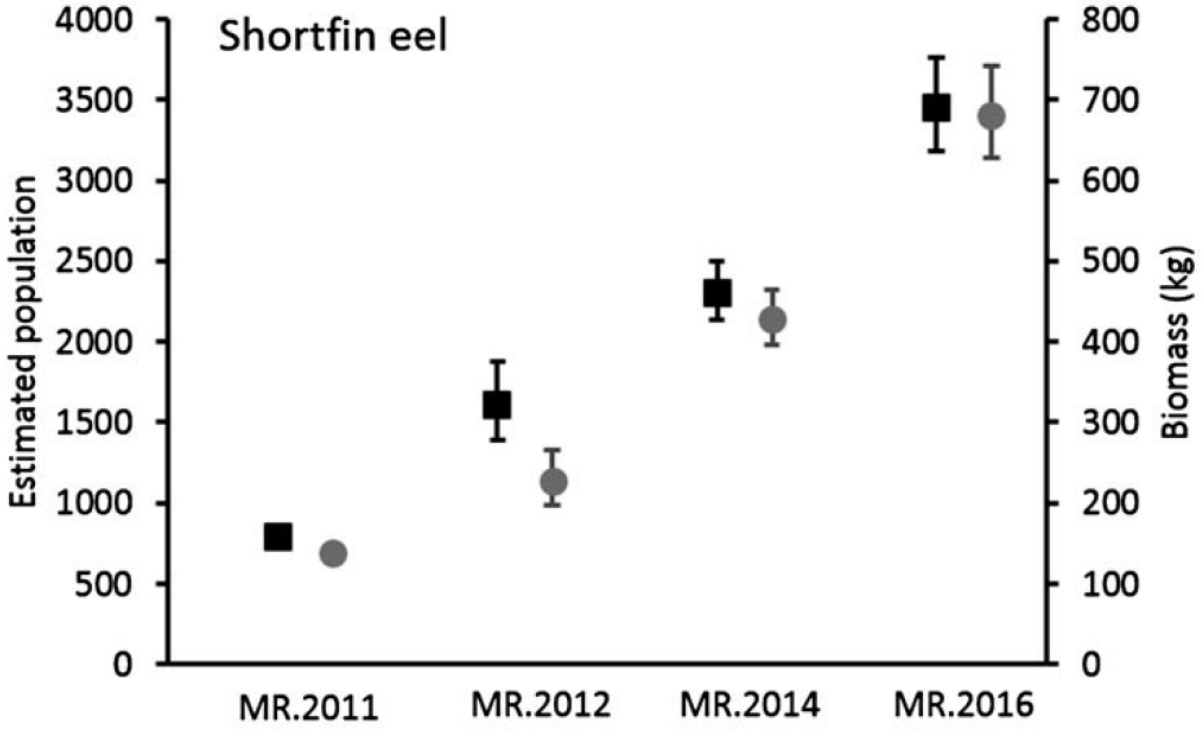
Fingers hinged one way to allow large fish to leave - adult tuna out to spawn

Koi carp removal and shortfin tuna response

Koi carp biomass 308 kg/ha in 2011 reduced to 14 kg/ha in 2014 (5174 kg to 235 kg – almost a 5-tonne lower). With no fishing in 2015, the carp increased

Shortfin tuna 8 kg/ha in 2011 increased to 41 kg/ha in 2016 (134 to 689 kg)





Tainui's fishery regulations – a major advance

- Teaching field trips to Lake Waahi – increasing numbers of large longfins 2018-2020 (none caught in 2007 and 2011)
- Fisheries bylaws for the Waikato-Tainui Fisheries Area – introduced in Apr 2014
- Support the joint government-iwi commitment to restore and protect the Waikato River for future generations
- Waikato-Tainui (Waikato River Fisheries) Regulations 2011 allow Waikato-Tainui to exercise traditional management practices
  - Can't take female migrant longfin eels (migrating downstream to the sea spawn)
  - Minimum weights 300 g for shortfin tuna, 400 g for longfin tuna (300 g in the rest of NZ)
  - Maximum weight of 2 kg for commercially harvested longfin tuna (slot limit) – 4 kg in the rest of NZ
  - Rahui - seasonal closure of commercial harvest of tuna from Whangamarino Wetland streams during the tuna heke (migration) 1 Mar to 31 May
  - Rahui - fisheries closed after a human death.

- https://www.beehive.govt.nz/release/waikato-tainui-fisheries-bylaws-approved


Longfin tuna in Lake Waahi

Tuna Health Indicators

- Morphum was engaged do devise Cultural Health Indicators with Waahi Whanui Trust to monitor tuna in Lake Kimihia. Waahi Whanui Trust will provide an iwi perspective, Morphum – knowledge transfer
- Capture tuna in 10 fine-meshed fyke nets set overnight
- Record individual weights and lengths for about 200 tuna. Count the invasive fish and tuna in each net

Six indicators proposed:

1. Species composition, i.e., proportion of longfin tuna. Assesses recovery of longfin tuna populations.
2. Mean individual weight of tuna by species. Assesses food availability.
3. Size-frequency distribution. Assesses recruitment of juvenile tuna to the lake and the proportion of larger tuna.
4. Catch rates from fyke netting in both number of tuna per net per night and total weight of tuna per net per night for each species. Useful for comparison with other locations in the Waikato and nationally.
5. Relative condition factor (RCF) - observed weight of individual tuna as a percentage of the expected weight. This indicator shows how well-fed and healthy the tuna are.
6. Proportion of invasive species such as catfish and goldfish, also be caught by fyke netting. Shows the likely extent of competition with invasive fish

Hicks, B. 2023. Fish populations of Lake Kimihia from 2006 to 2012: Historical data and interpretation. Morphum Environmental Ltd.

Lake Kimihia fishing 16-17 Nov 2023

- Ten unbaited 3-mm mesh fyke set 3-4pm 16 Nov, left overnight
- Hauled 9-10am on 17 Nov

Lake Kimihia fishing 16-17 Nov 2023

- All tuna identified to species by net
- Tuna weighed and measured in the first 3 nets– 204 tuna
- All fish in the other 7 nets identified and counted
- All tuna released alive and well
- Total count of fish 586
- 403 shortfin tuna in total, 245-795 mm long, 32 g to 1.3 kg
- 40 shortfin tuna per net
- 1 longfin tuna – 810 mm long, 1.9 kg
- 178 invasive fish – 136 catfish, 25 goldfish, 12 rudd, 5 koi carp
- Total weight of invasives – 24.6 kg
- 18 invasive fish per net

Conclusions

- Monitoring tuna with fine-meshed fyke nets in Lake Kimihia works well
- From initial results, the tuna population in Lake Kimihia looks very good despite the number of invasive fish
- There was a good size range of shortfin tuna
- The large longfin tuna in Lake Waahi was a great discovery

The future

- Removal of invasive species can be a good idea but only if further invasions are prevented by a barrier
- Invasiv species removal is hard work that needs effort and repetition
- Eradication by fishing alone is very unlikely
- One-way gates are useful but not a complete solution – juvenile koi can sneak through the gaps meant for native fish

Acknowledgements

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NGAA MIHI NUI KI A KOE!
THANK YOU ALL!

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