



Lake Ecosystem Restoration
New Zealand



THE UNIVERSITY OF
WAIKATO
Te Whare Wānanga o Waikato

Ohau channel diversion wall: fisheries research

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*Presentation to the Rotorua Te Arawa Lakes
Programme*

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Blair, J.B. 2012. Factors controlling common smelt abundance and rainbow trout growth in the Rotorua lakes, New Zealand. PhD thesis, University of Waikato, Hamilton. 196p.

Blair, JM, I Ostrovsky, BJ Hicks, RJ Pitkethley, P Scholes. 2013. Growth of rainbow trout (*Oncorhynchus mykiss*) in warm-temperate lakes: implications for environmental change. Canadian Journal of Fisheries and Aquatic Sciences 70: 815–823.

Blair, JM, BJ Hicks, R Pitkethley, N Ling, I Ostrovsky, D Rowe. 2013. A bioenergetic assessment of the influence of stocking practices on rainbow trout (*Oncorhynchus mykiss*) growth and consumption in a New Zealand lake. Freshwater Biology 58: 967–985

Blair, JM, BJ Hicks, R Pitkethley and N Ling. 2012. Diet of rainbow trout in Lake Rotoiti: an energetic perspective. New Zealand Journal of Marine and Freshwater Research 46(4): 557-565.

Before the wall was built...

The risks of construction of the wall to the trout fisheries was unknown, but we speculated that:

1. Rainbow trout and smelt migration between the lakes could be prevented by the wall;
2. Loss of movement of smelt between the lakes could cause the rainbow trout fishery (both wild and hatchery) in Lake Rotoiti to collapse;
3. Fish populations of the Ohau Channel could be reduced by the wall

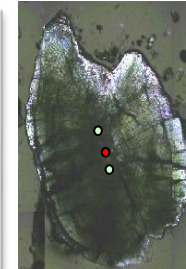
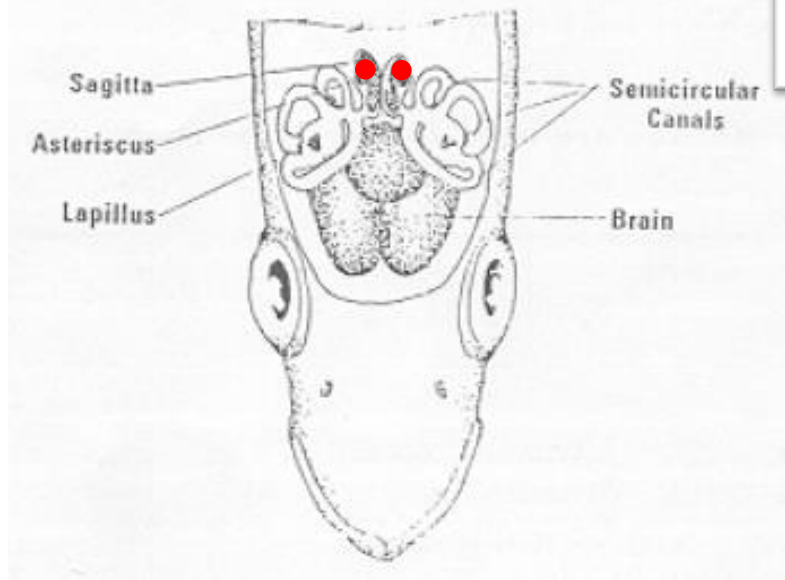
Our solutions

To answer these questions, we:

- Evaluated trout and smelt movement between the lakes by examining the chemistry of the ear bones (otoliths)
- Did a comprehensive study of trout diet and growth in Lake Rotoiti
- Evaluated whether smelt spawn in Lake Rotoiti
- Conducted regular fish monitoring in the Ohau Channel, starting in 2007, the year before wall closure (June 2008) – results to 2015

Otoliths – shell-like structures in the fish's head

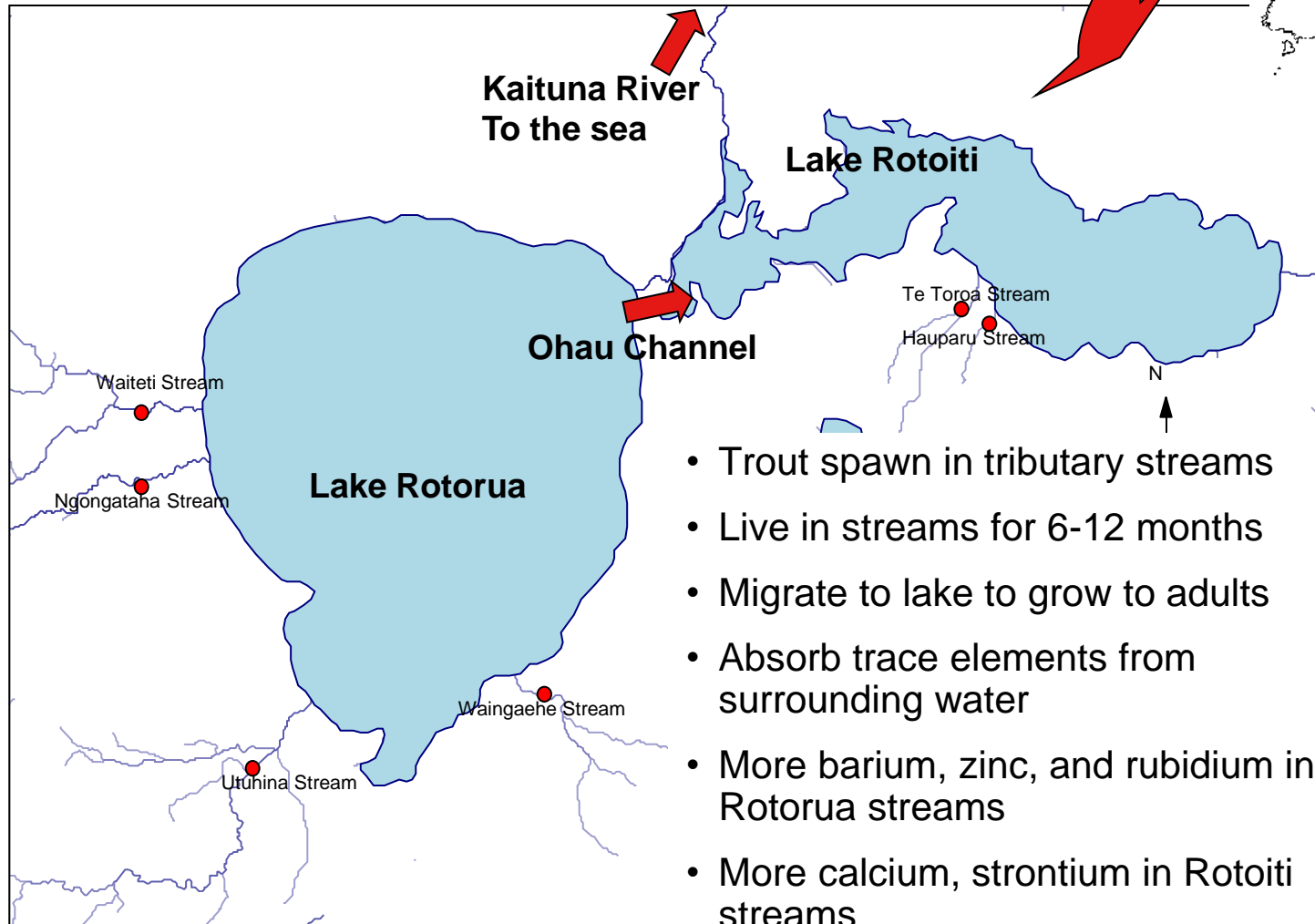
Red dots indicate otoliths



Matt, Jen, and Ray Tana in the laser ablation suite

Riceman, Matthew S. 2008. The use of otolith microchemistry to investigate natal origins and movement of lacustrine wild rainbow trout (*Oncorhynchus mykiss*) and common smelt (*Retropinna retropinna*). MSc thesis, University of Waikato, Hamilton. 99 p.

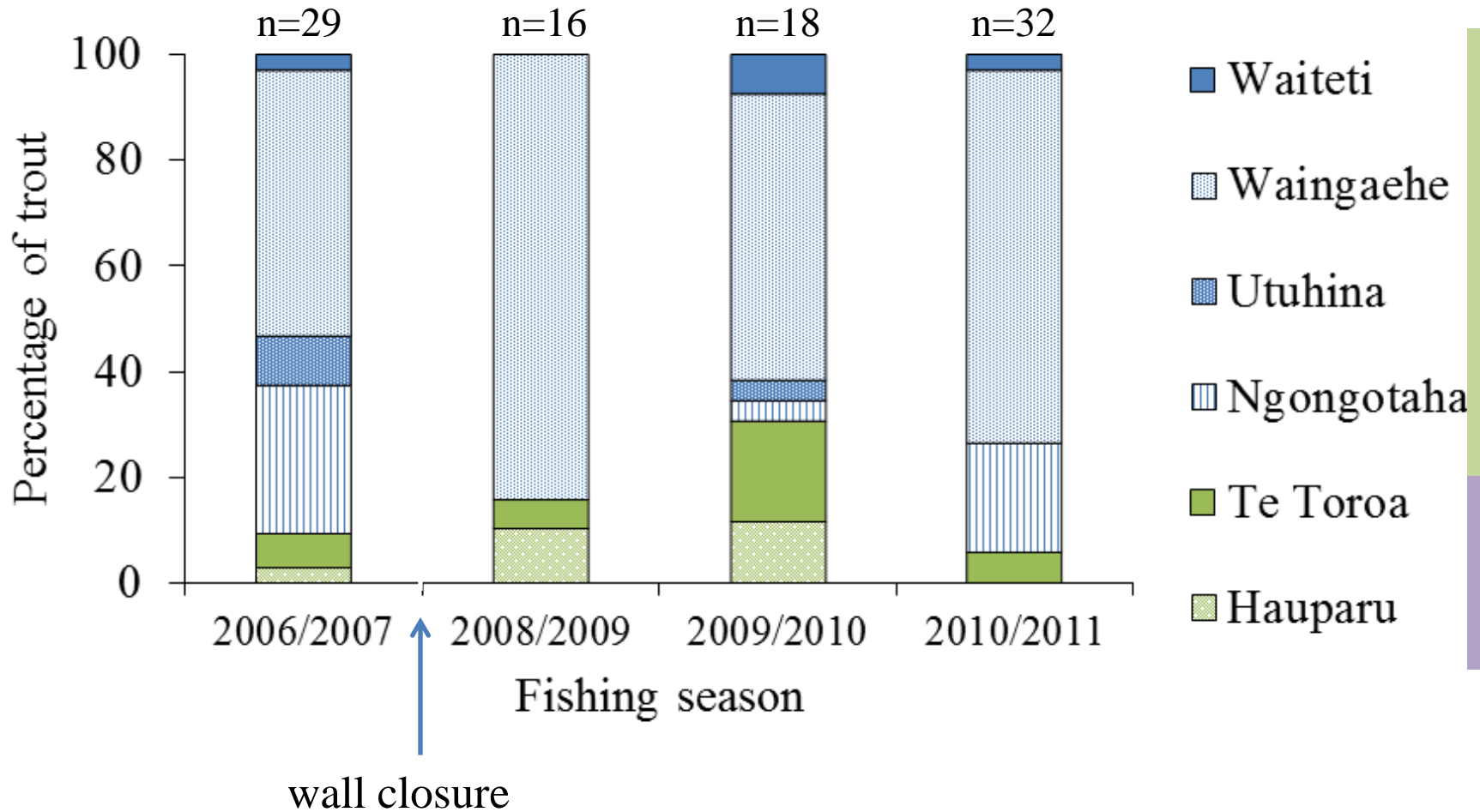
Trout spawning



Spawning stream of adult trout caught in

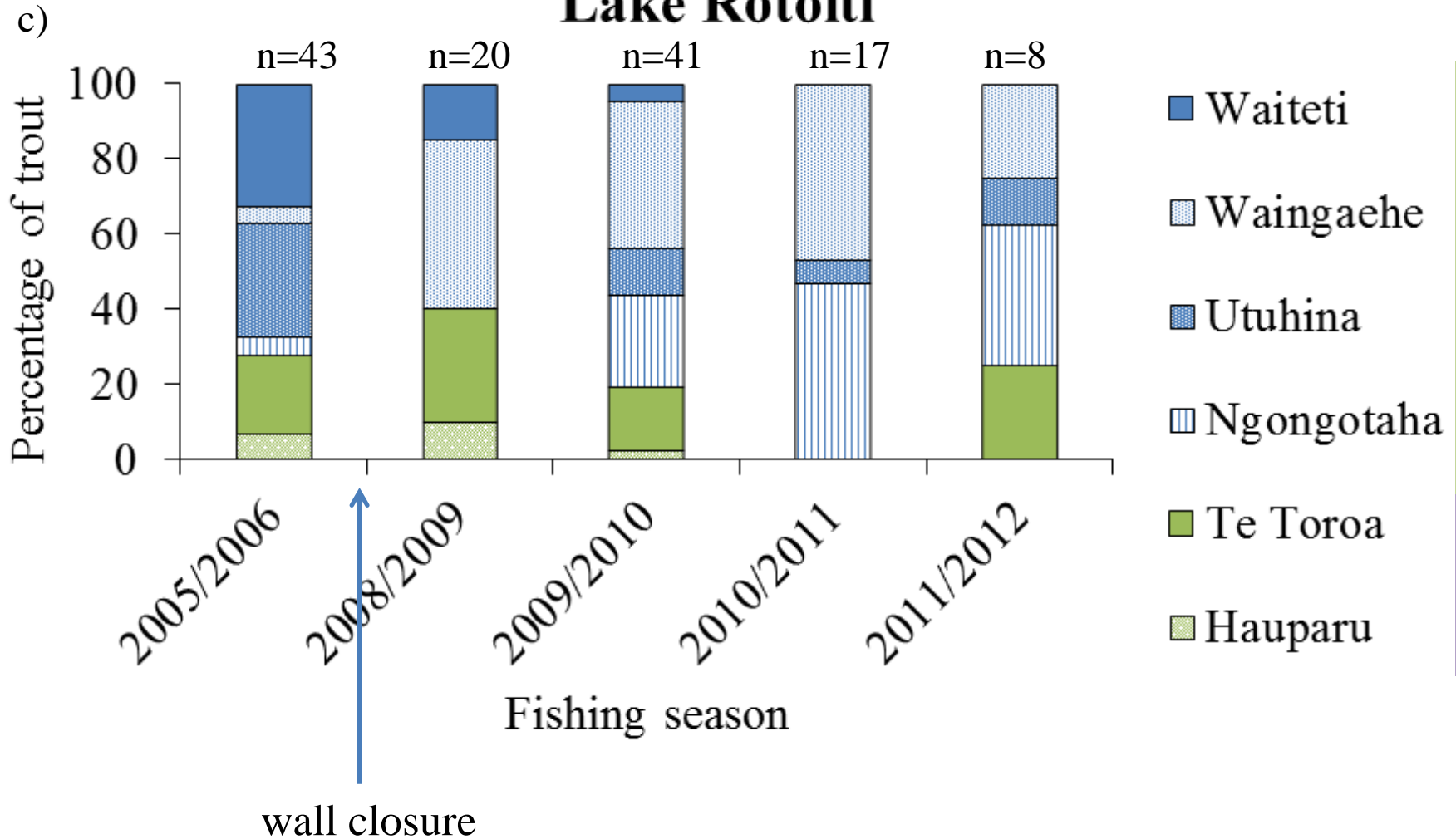
b)

Lake Rotorua



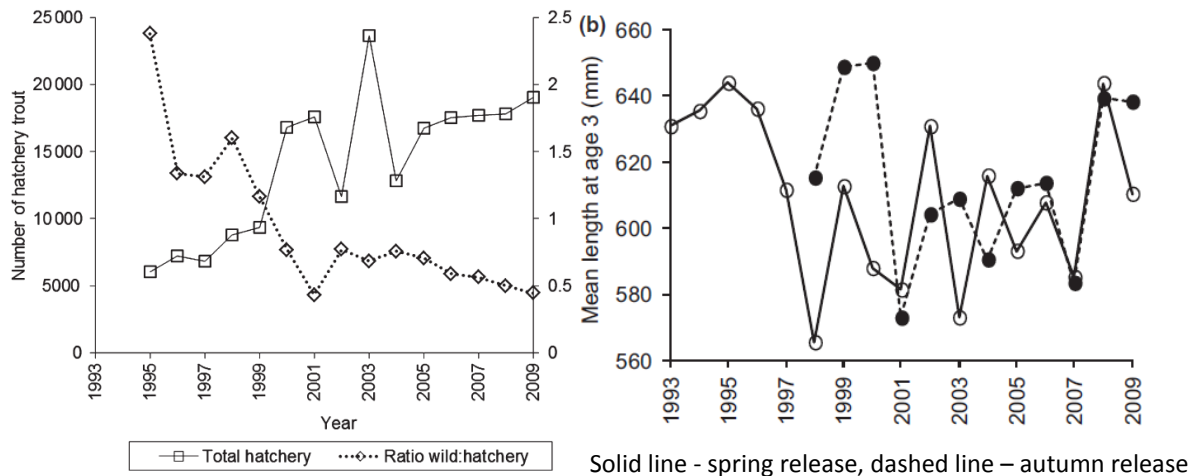
Spawning stream of adult trout caught in

Lake Rotoiti



The role of smelt in trout production

- Rotoiti has the fastest trout growth rates of the Rotorua lakes - 199 mm/year at 480 mm¹
- Largest trout too – 639 mm at 5 years of age
- Smelt comprise 78% of the diet of Rotoiti trout²
- Hatchery releases dramatically increased in 2000³



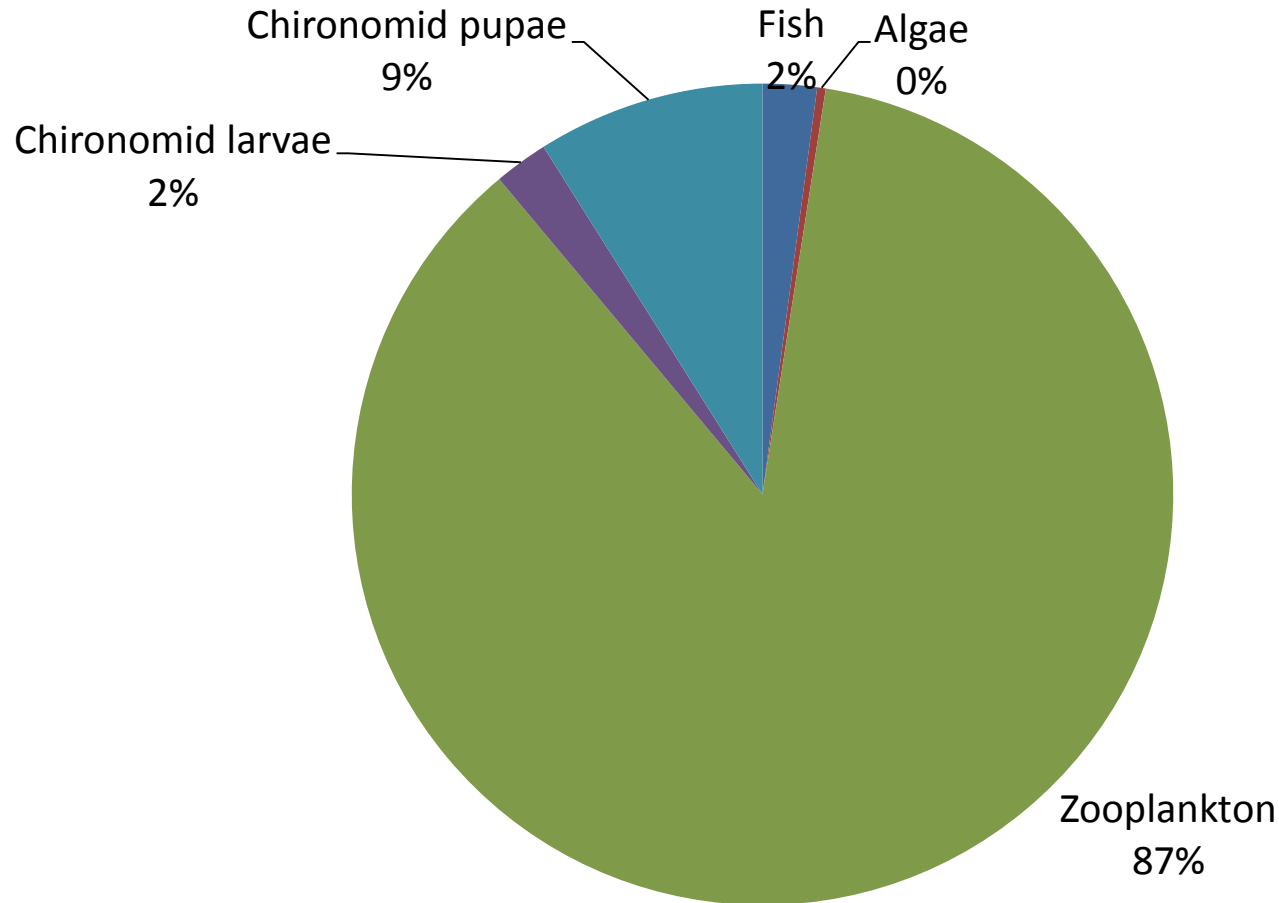
¹Blair et al. 2013. Canadian Journal of Fisheries and Aquatic Sciences 70: 815–823

²Blair et al. 2012. NZ J Marine and Freshwater Research 46: 557-565

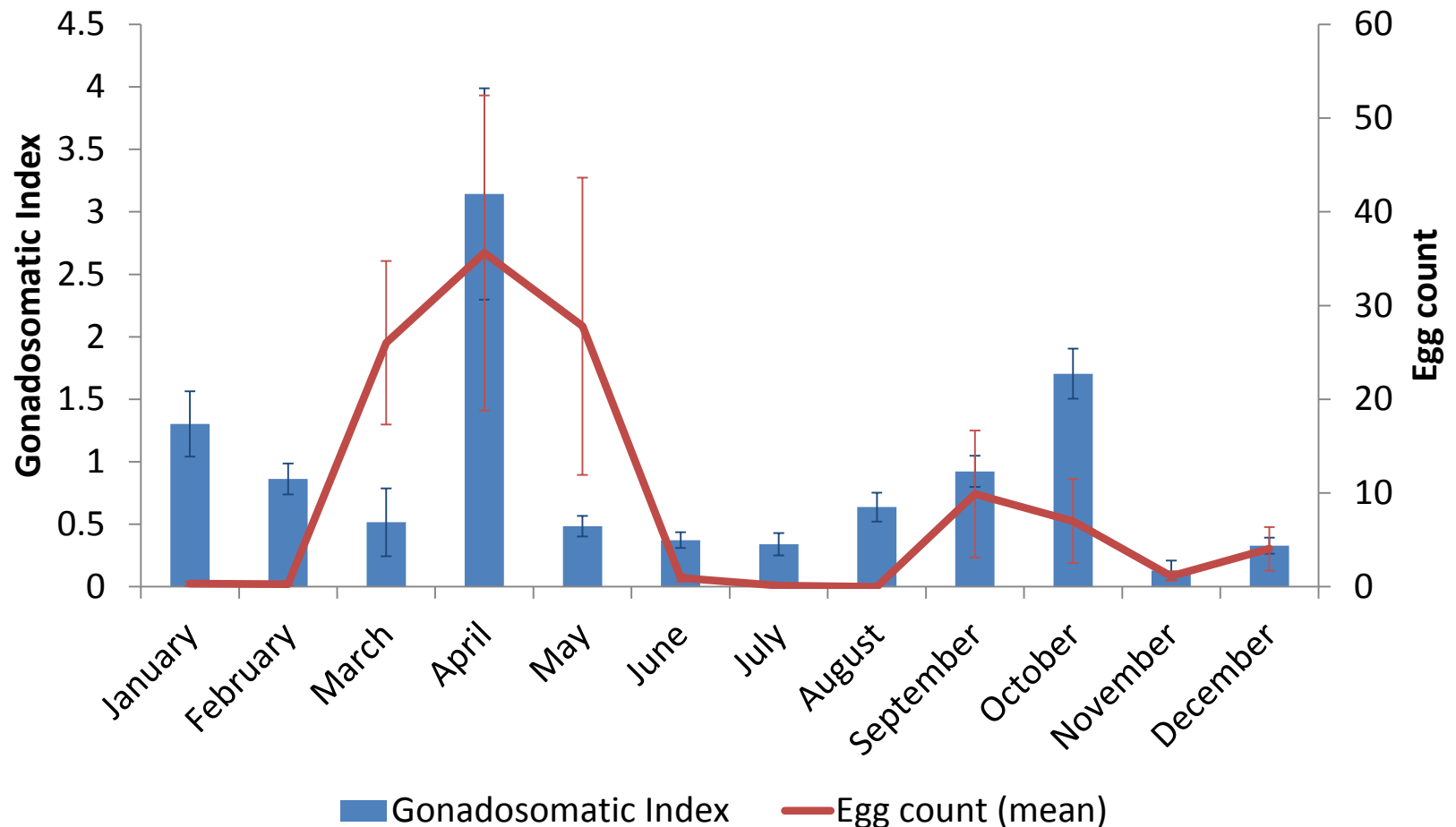
³Blair et al. 2013. Freshwater Biology 58: 967–985

Smelt in Lake Rotoiti

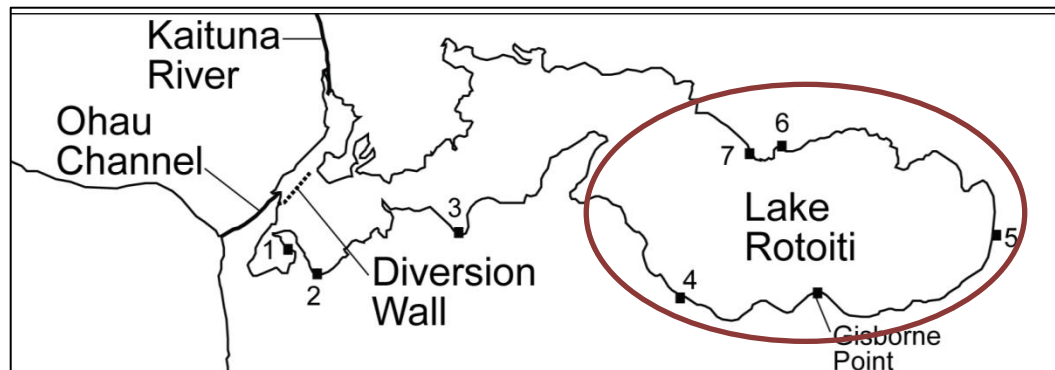
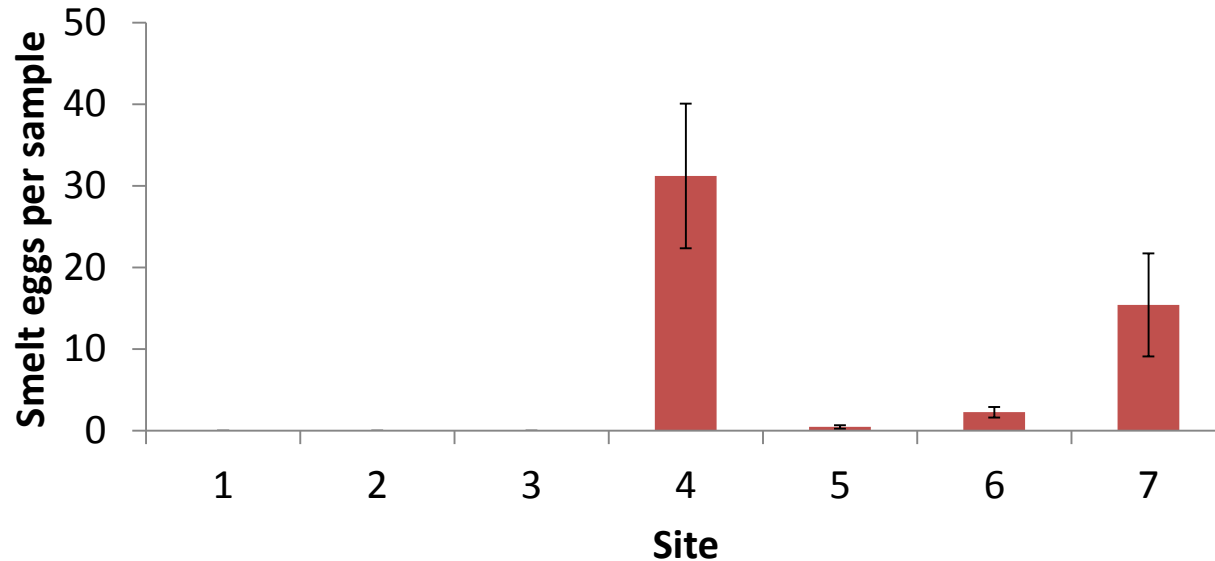
- Smelt in the main water body eat zooplankton



Smelt spawning in Rotoiti - timing



Smelt spawning in Rotoiti - location



Boat electrofishing



Fred Whata



Preparing to fish



Longfin eel, 1.035 m, 3.6 kg



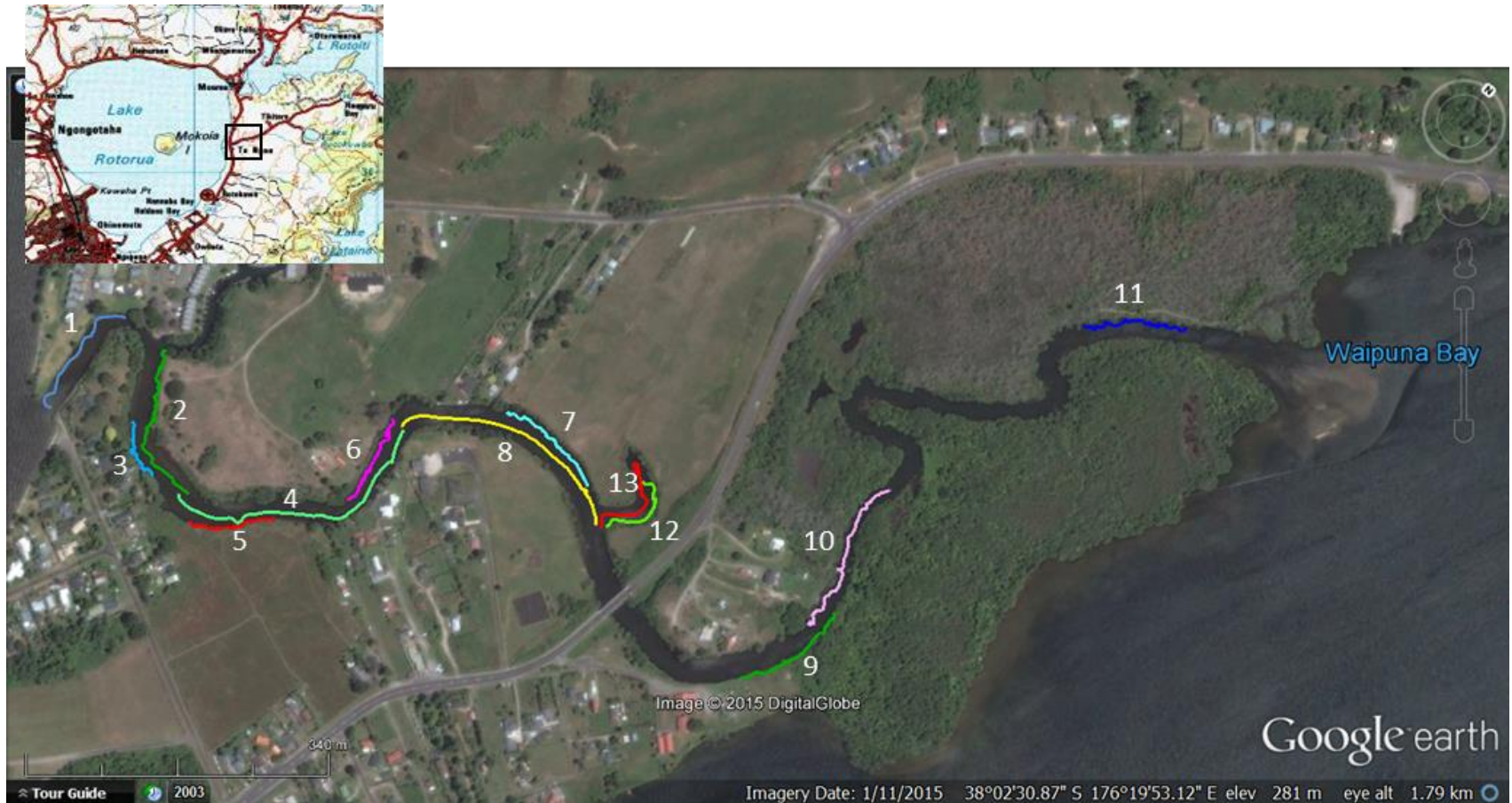
Consequences for goldfish



Ray Tana with longfin eel

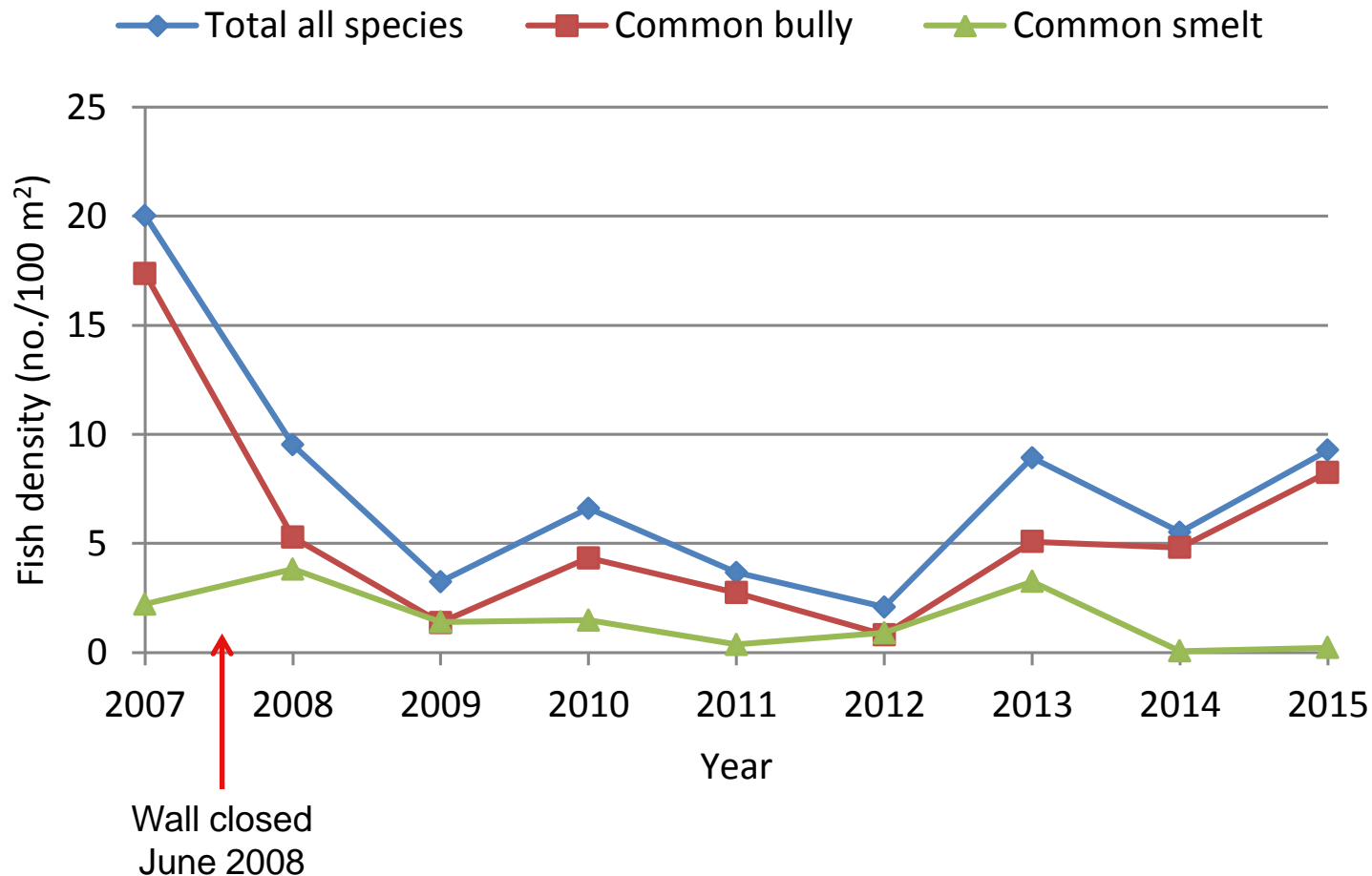
Boat electrofishing sites 2 Dec 2015

- Sites fished typical of other years – min. 10 sites, ~200 m long



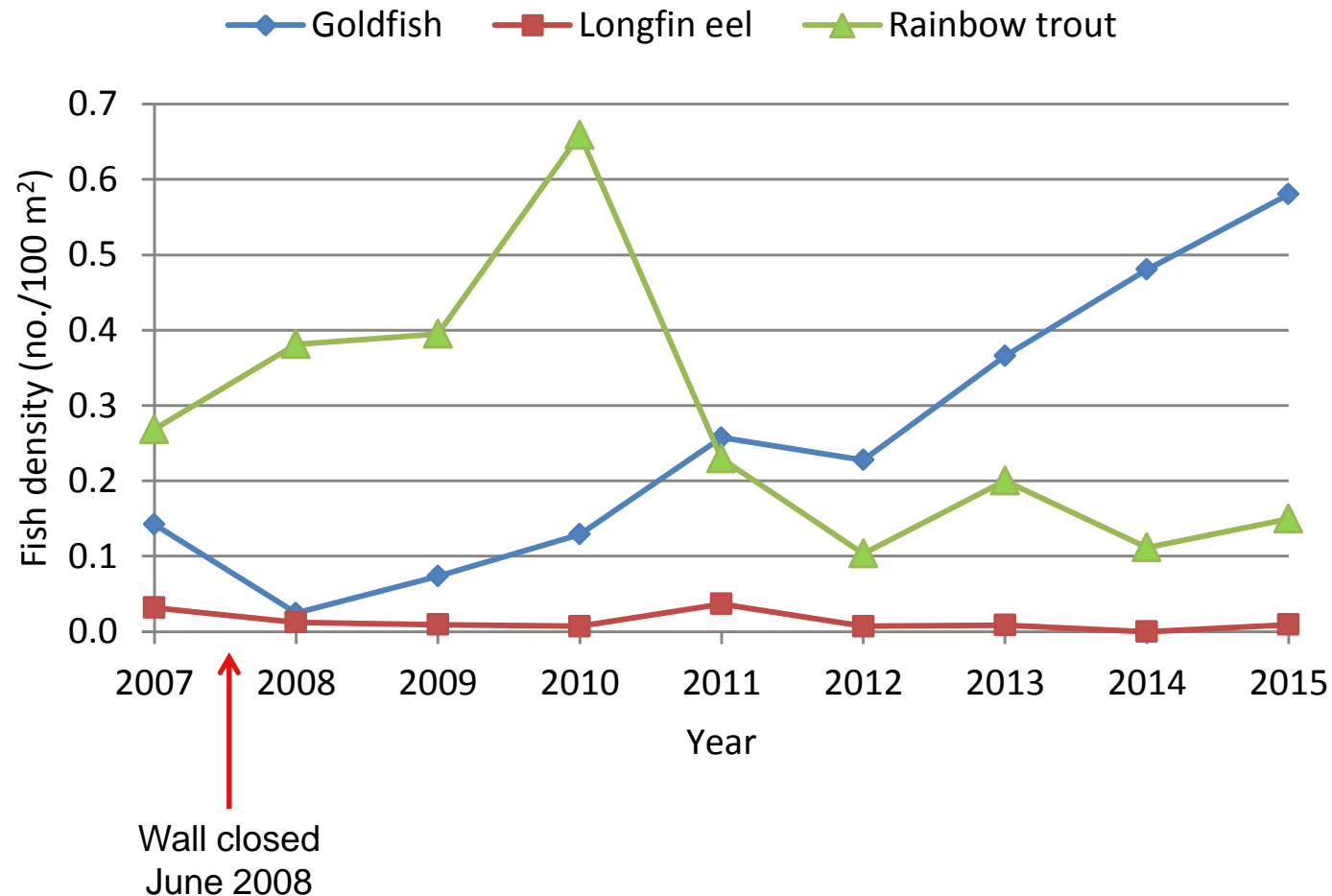
Most abundant fish species

- Boat electrofishing conducted on one day between 27 Nov – 13 Dec each year. Total catch 301 – 1,267 fish
- Common bully, common smelt most numerous



Less abundant fish species

- Goldfish, longfin eel, rainbow trout



Conclusions

1. The wall has not prevented trout movement between the lakes
 - Rainbow trout moved freely between the lakes before wall construction and continue to do so after wall construction
 - Before the wall the main spawning streams for wild Rotoiti rainbow trout were tributaries of Lake Rotorua
 - Majority of wild Rotoiti rainbow trout still come from Rotorua
2. Common smelt movement was more difficult to establish by otolith microchemistry but the two lakes appear to have independent smelt reproduction
 - Beaches in Lake Rotoiti, especially at its eastern end, support smelt spawning adequate to maintain the smelt population in the lake
 - Trout production in Rotoiti (wild and hatchery fish) is not dependent on the movement of smelt from Lake Rotorua
3. Fish abundance in the Ohau Channel is quite variable
 - does not appear to have been affected by wall construction
 - not a strong conclusion because we have only a single year of monitoring before wall was completed



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Thank you for listening!

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