



# Climbing Upstream: The Migration Struggle of Diadromous Freshwater Fish in the Hunua Ranges of New Zealand



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## Introduction

- In NZ, 74% of freshwater fish are at risk or threatened<sup>1</sup>.
- Physical waterway barriers created by infrastructure, such as culverts, restrict freshwater fish from accessing upstream areas<sup>2</sup>, contributing to declines in freshwater fish biodiversity<sup>3</sup>.
- This can be particularly detrimental for **diadromous species**, which migrate from saltwater to freshwater as juveniles<sup>1</sup>.
- The installation of fish passages can help facilitate upstream migration if fish climbing ability is sufficient for passage use<sup>4</sup>.

### Objectives:

- 1) Compare the diversity and relative abundance of freshwater fish **above and below culverts** with installed fish passages in the **Hunua Ranges**. Compare to data from before passage installation (2016).
- 2) Determine the abundance and distribution of **galaxiids** in areas upstream of the Mangatāwhiri Reservoir in the Hunua Ranges.

## Design/Methods

Used electrofishing to survey freshwater fish present upstream and downstream of five culverts, and at two sites without culverts above the Mangatāwhiri Reservoir, in the Hunua Ranges.

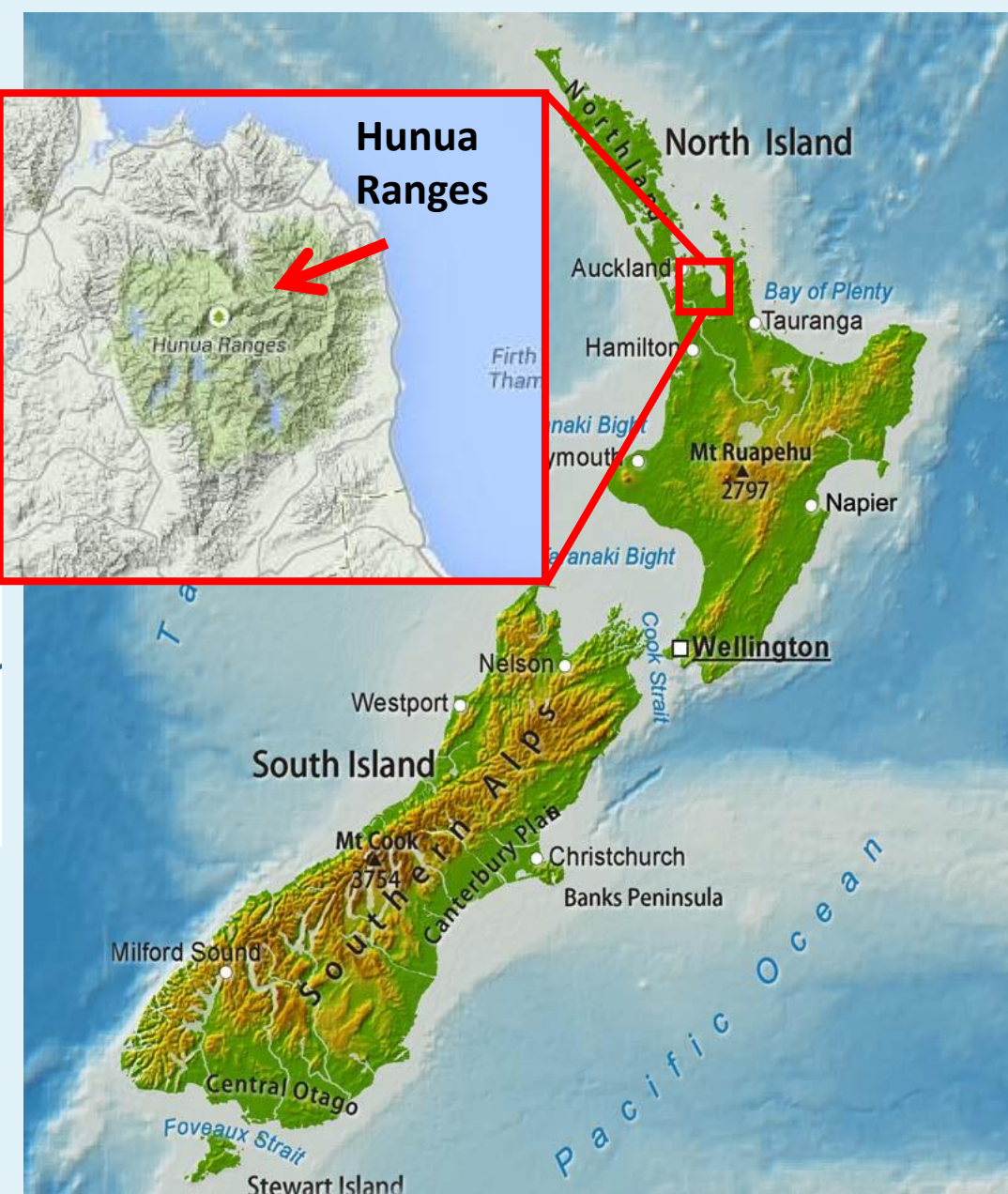
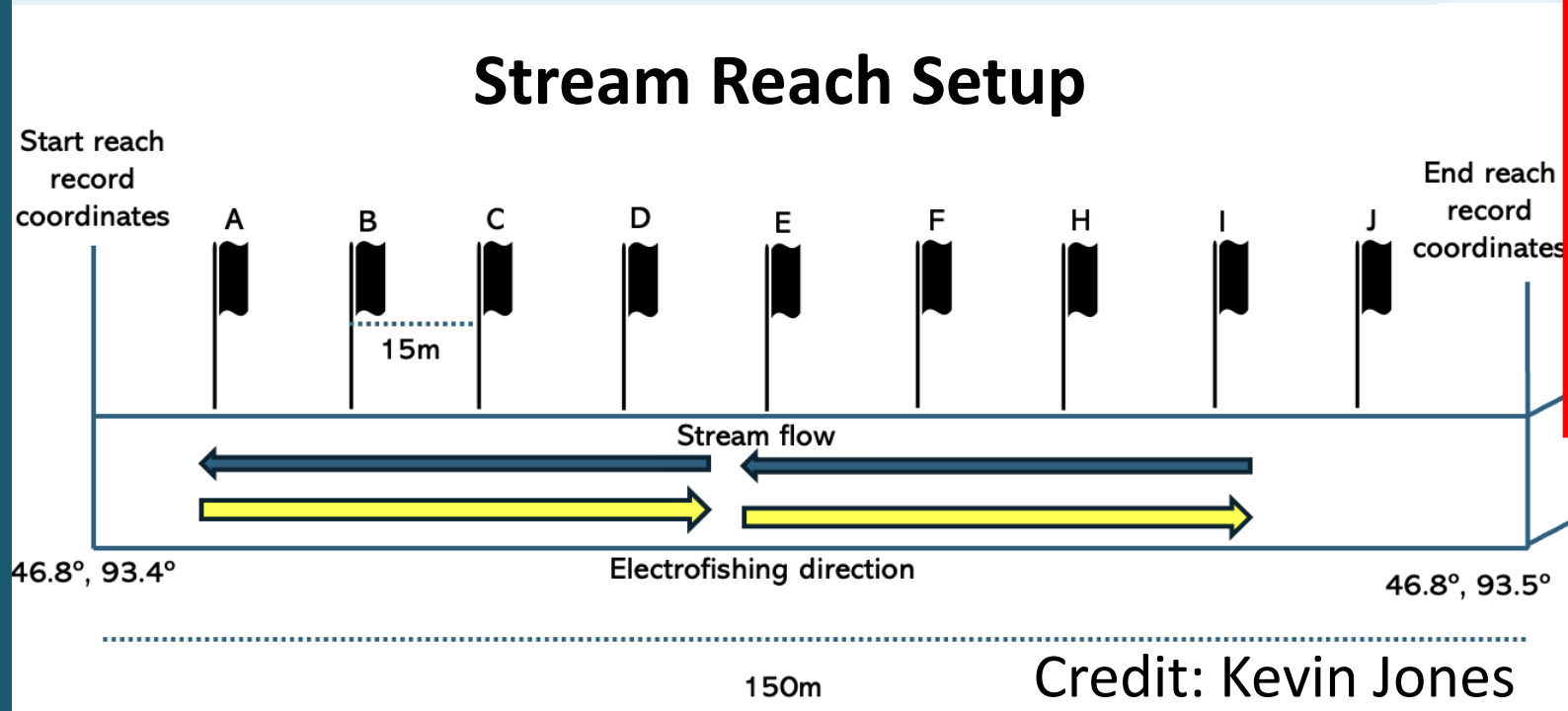


Figure 2. Hunua Ranges study location.

Fish captured during electrofishing surveys were identified and then measured using a photarium (for fish under 20cm total length) or meter stick.



Figure 3. Species caught in surveys: (A) galaxiids, (B) bullies, and (C) eels.



## Results/Discussion

**Banded kōkopu and Cran's bullies have increased in abundance. Longfin eels and common bullies have decreased in abundance.**

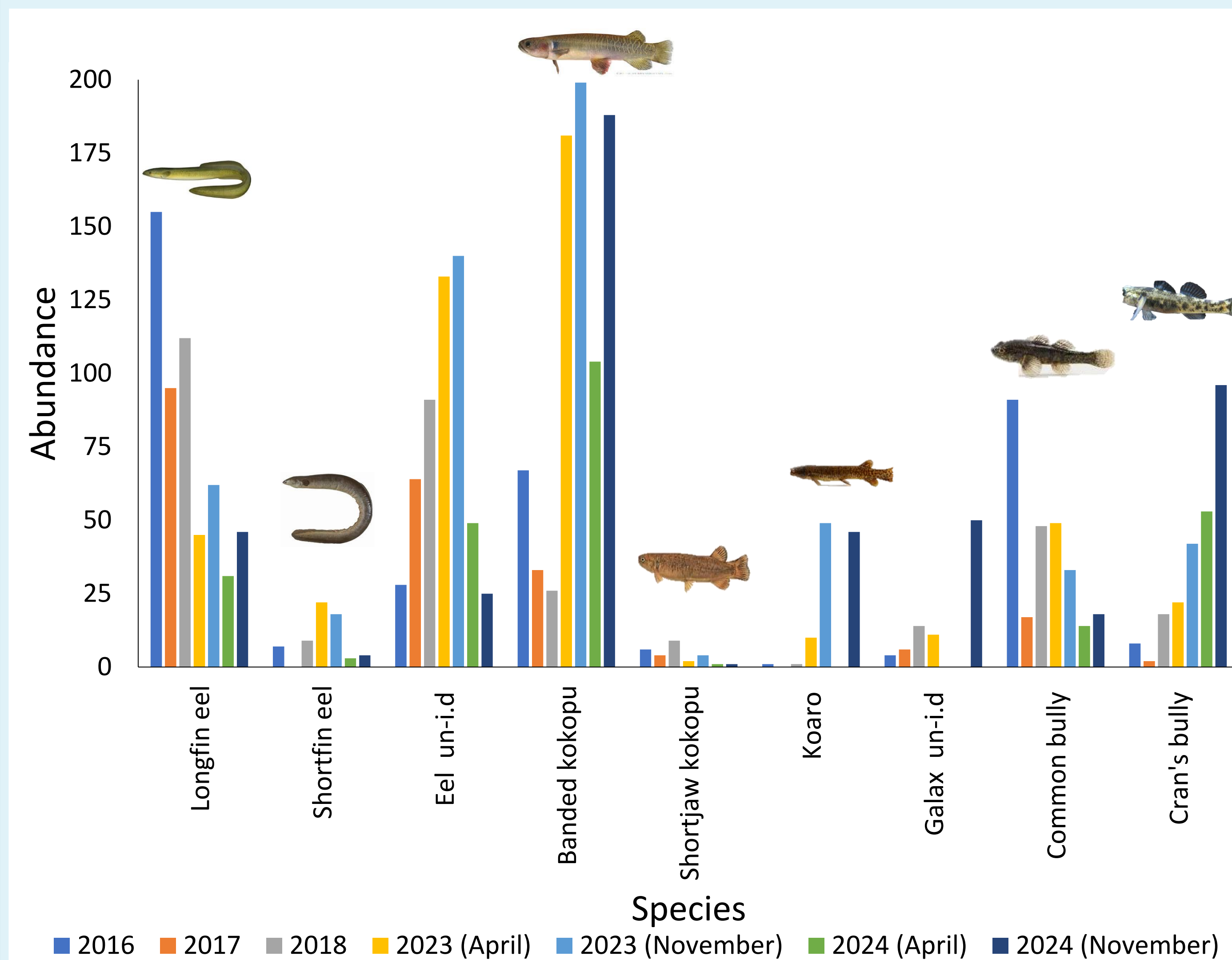


Figure 4. Total species abundance recorded from electrofishing surveys across all sites in the Hunua Ranges between 2016 and Nov. 2024.

**Cran's bully abundance upstream of culverts has been steadily increasing since 2016, indicating restricted movement due to fish passage ineffectiveness for weaker climbers.**

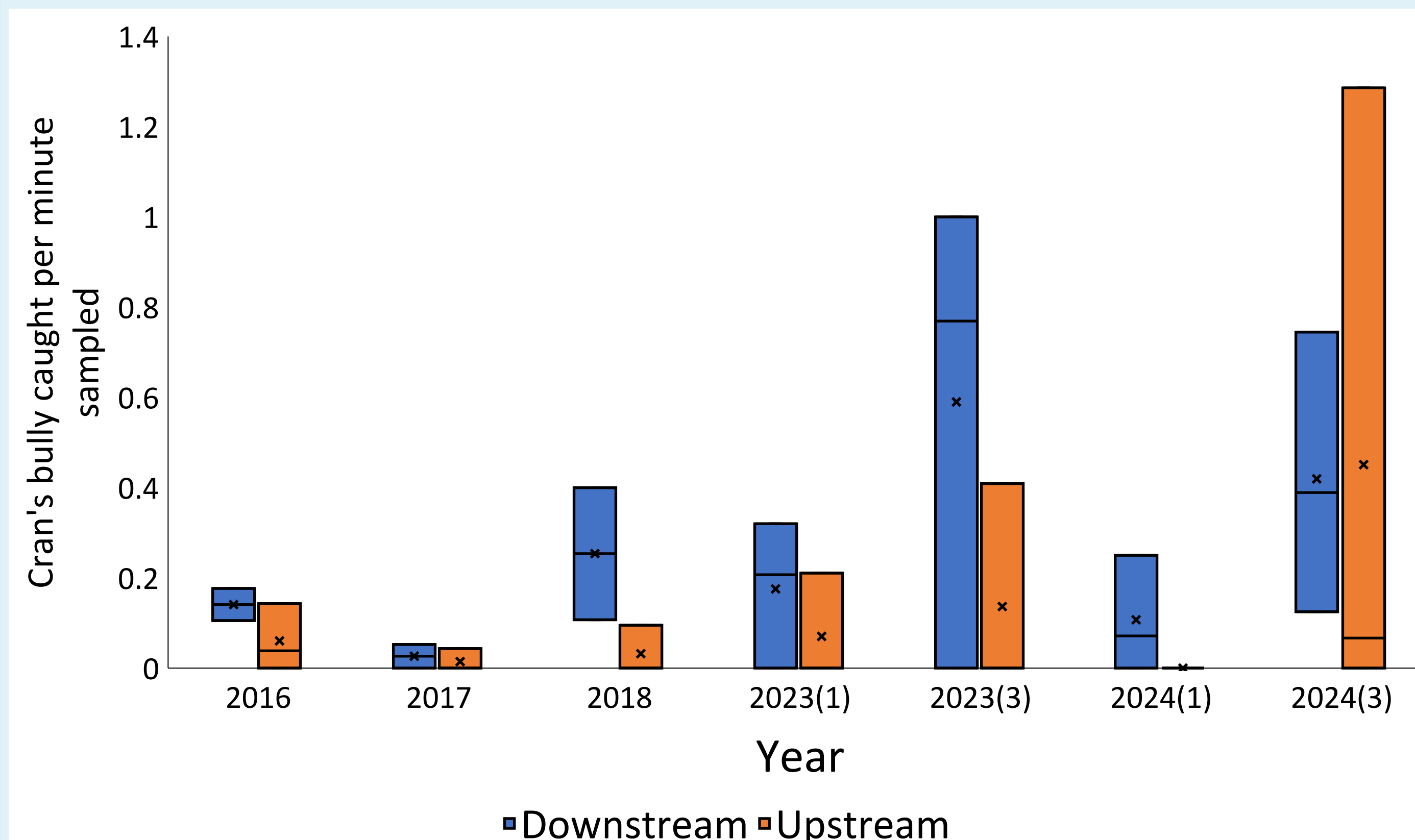


Figure 5. Surveyed abundance of Cran's bullies, considering total fishing time, across the Mangatāwhiri and Wairoa catchments in the Hunua Ranges between 2016 and Nov. 2024.

**Banded kōkopu length was significantly smaller above the Mangatāwhiri Reservoir in 2024, indicating the possibility of a lacustrine (landlocked) population.**

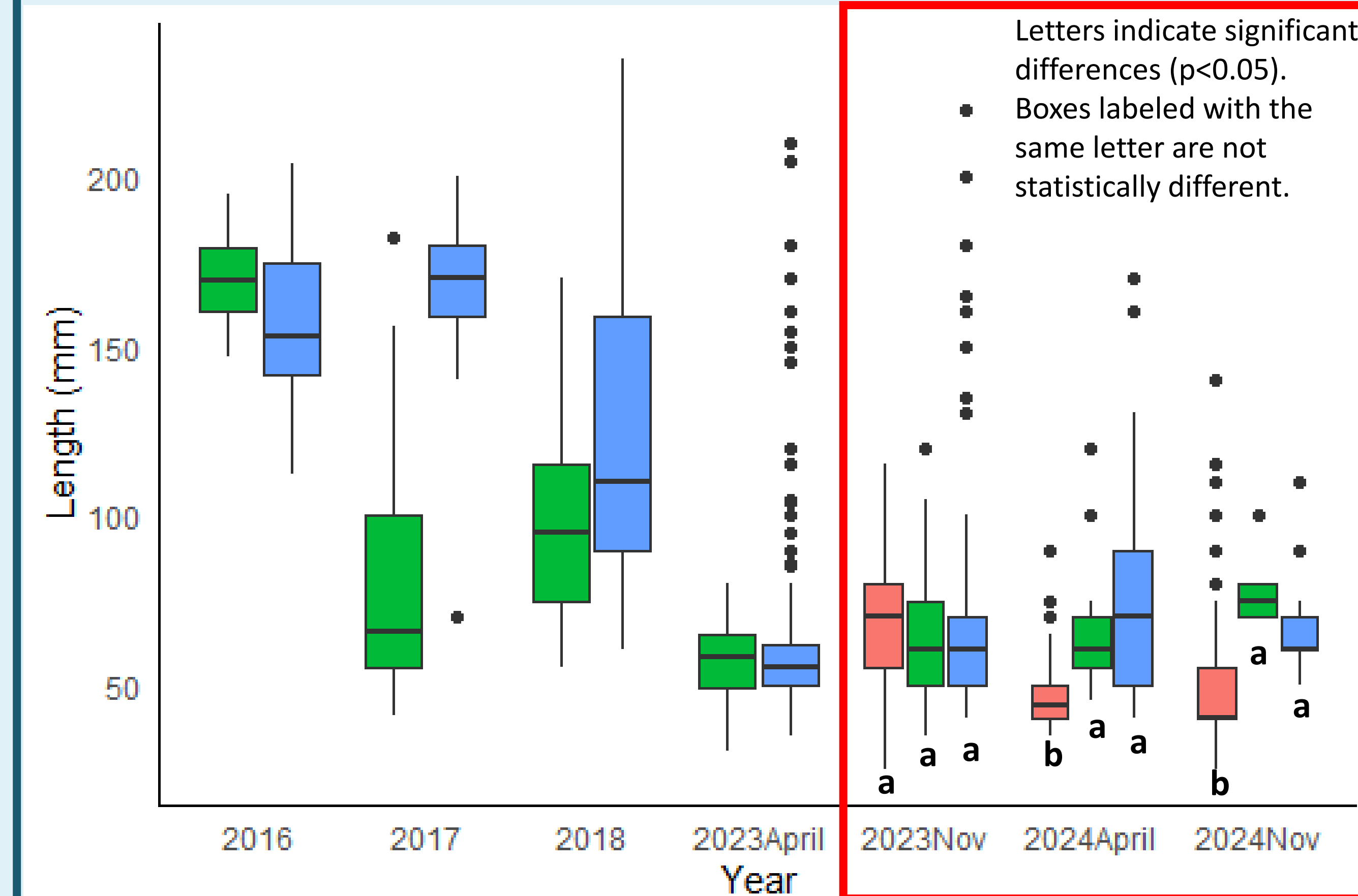


Figure 6. Range of banded kōkopu length in the Hunua Ranges between 2016 and 2024.

## Conclusions

- The delayed upstream movement of Cran's bully (nonmigratory) and the decline in Common bully (diadromous) indicates that the current fish passages in the Hunua Ranges are impacting species differently depending on their behavior.
- Banded kōkopu, a diadromous species, may have formed a lacustrine (landlocked) population in the Mangatāwhiri Reservoir, meaning the population is not migrating to the ocean to breed. This is in opposition to previously observed physiology for banded kōkopu.

## Next Steps

The Hunua Ranges Fish Project will continue after a five-year break. EcoQuest study-abroad students will then conduct the same electrofishing surveys across two years and compare observed trends to previous data. Our current recommendation, which was given to Auckland City Council, is that fish passages in the Hunua Ranges need improvements to better facilitate migration. However, further study is necessary.

## References

1. Elston et al. (2015). "The Plight of New Zealand's Freshwater Biodiversity."
2. Doehring et al. (2012). "Facilitation of Upstream Passage for Juveniles of a Weakly Swimming Migratory Galaxiid." *New Zealand Journal of Marine and Freshwater Research* 43 (3303-3313).
3. Franklin and Bartels (2012). "Restoring Connectivity for Migratory Native Fish in a New Zealand Stream: Effectiveness of Retrofitting a Pipe Culvert." *Aquatic Conservation: Marine and Freshwater Ecosystems* 22 (4): 489-97.
4. Stevenson and Baker (2009). "Fish Passage in the Auckland Region: A Synthesis of Current Research." Prepared by NIWA for Auckland Regional Council. Auckland Regional Council Technical Report 2009/084.

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