THE GOLD CLAM (*CORBICULA FLUMINEA*) INVASION IN THE WAIKATO RIVER:

CROSS-AGENCY IMPLICATIONS FOR FRESHWATER SECURITY, ECOSYSTEM HEALTH, AND CRITICAL INFRASTRUCTURE

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OVERVIEW

Corbicula fluminea in the Waikato River is one of New Zealand's most serious freshwater biosecurity incursions to date.

We will discuss the latest scientific findings on:

* C. *fluminea* distribution,

* population trends,

* ecological and water-quality impacts,

* and feasible management options.

Earth Sciences New Zealand

LAKE KARĀPIRO RESEARCH

LINCOLN AGRITECH LTD

ONGOING RESEARCH

MBIE funded research programme (NIW2475):

- Understanding Impacts – ecological, economic and cultural

- Predict dispersal and future establishment enabling prioritisation of locations for monitoring and early intervention

- Develop a suite on interventions (tools) to reduce the risk of transfer and to manage the clam at different scales
  - decontamination focus in Yr 1

https://niwa.co.nz/freshwater/stopping-gold-clam-its-now-or-never

ONGOING RESEARCH

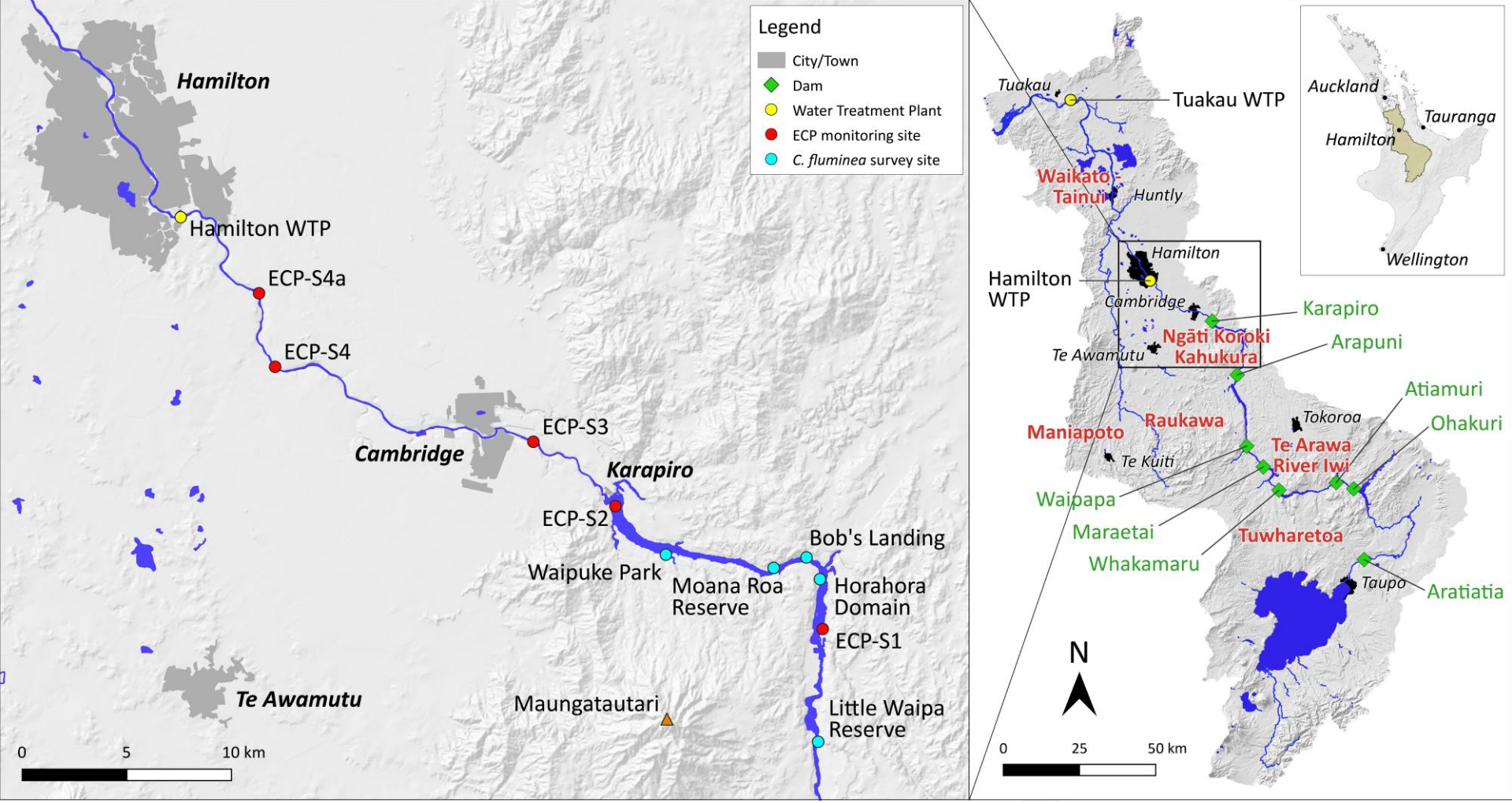
MBIE funded research programme (LVLX2302):

- Understanding Emerging Climatic Pressures (ECP) on Te Awa o Waikato and freshwaters

- CO_2 pressure effects on algae (primary producers) and kākahi, and secondary effects on nutrients (P)

- Forward model and assess impacts and mitigations on restoration of the Awa and NZ freshwaters

https://lincolnagritech.co.nz/emerging-climatic-pressures/



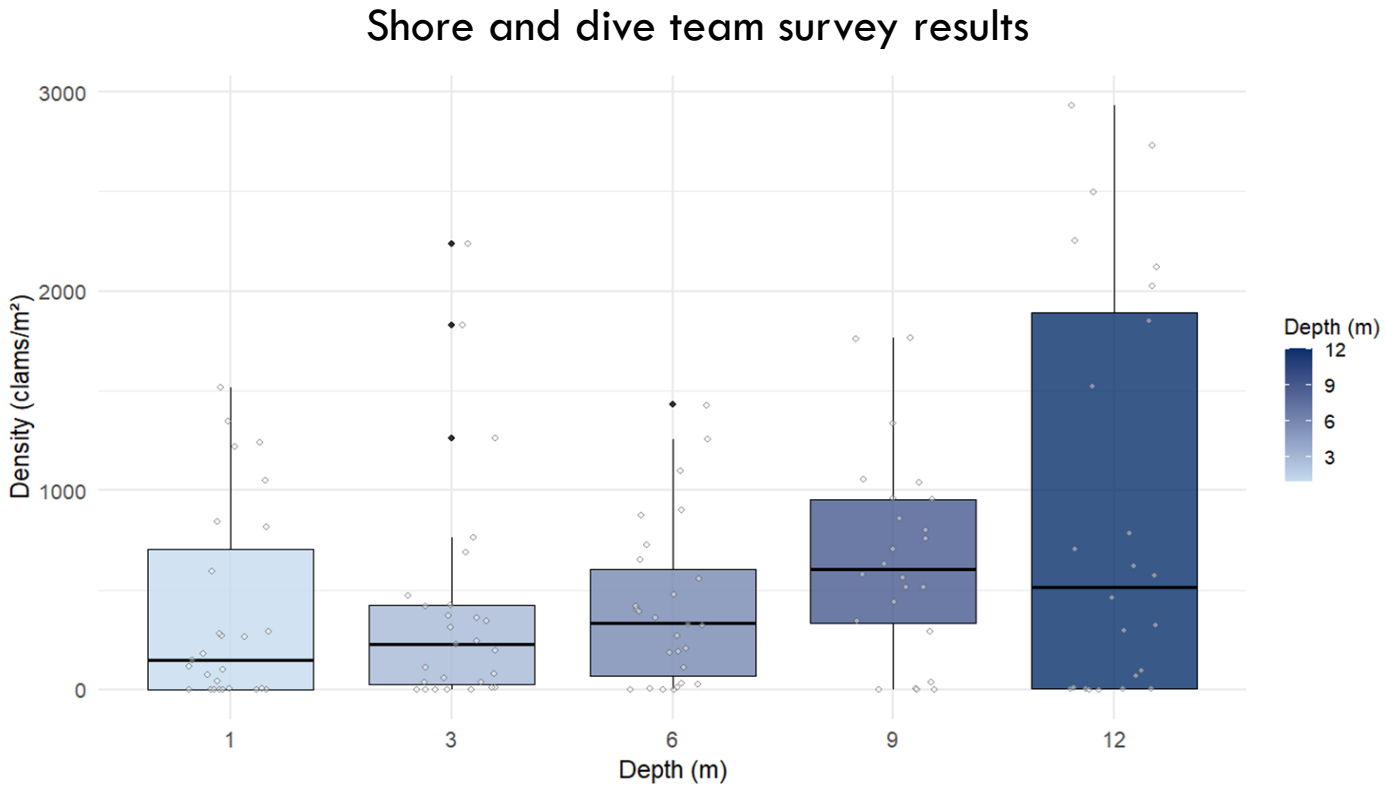
TE AWA O WAIKATO

A BIOSECURITY INCURSION WITHOUT PRECEDENT

Timeline & Spread:

- First detected May 2023 (Bob's Landing, Lake Karāpiro)
- Rapid expansion: Now confirmed from Lake Maraetai to Port Waikato.
- Prolific Breeding: Single hermaphroditic clam produces cs. 70,000 juveniles annually.
- Current Density: 2025 surveys (hotspots of 1,134+ individuals/m^2; deep-water shifts noted at 12–15m)
- Basin-scale modelling of Ca depletion suggests 300-400 ind/m^2

DENSITY AT DEPTH

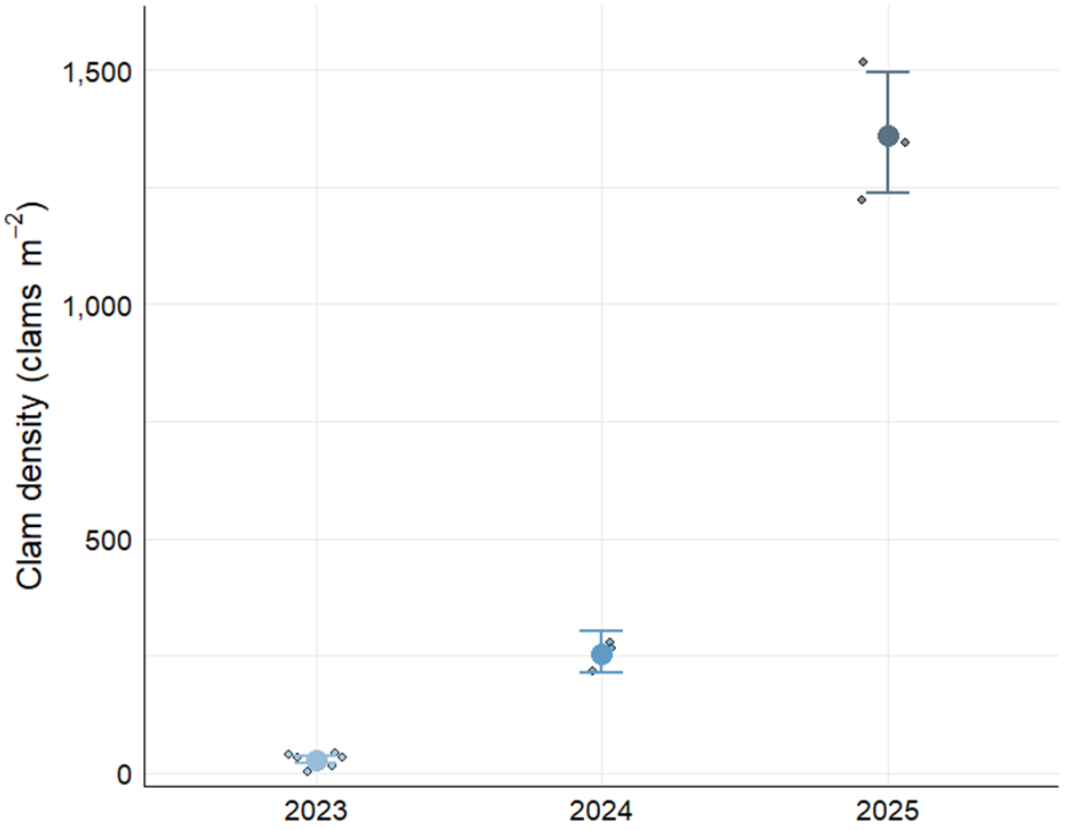


- Dredge samples show that corbicula also occur at greater water depths (30m)

Melchior & Hofstra 2024. https://www.mpi.govt.nz/dmsdocument/64359-Corbicula-fluminea-suppression-trial-step-one-baseline

POPULATION GROWTH

Example from the shallow water at Horahora, Lake Karāpiro

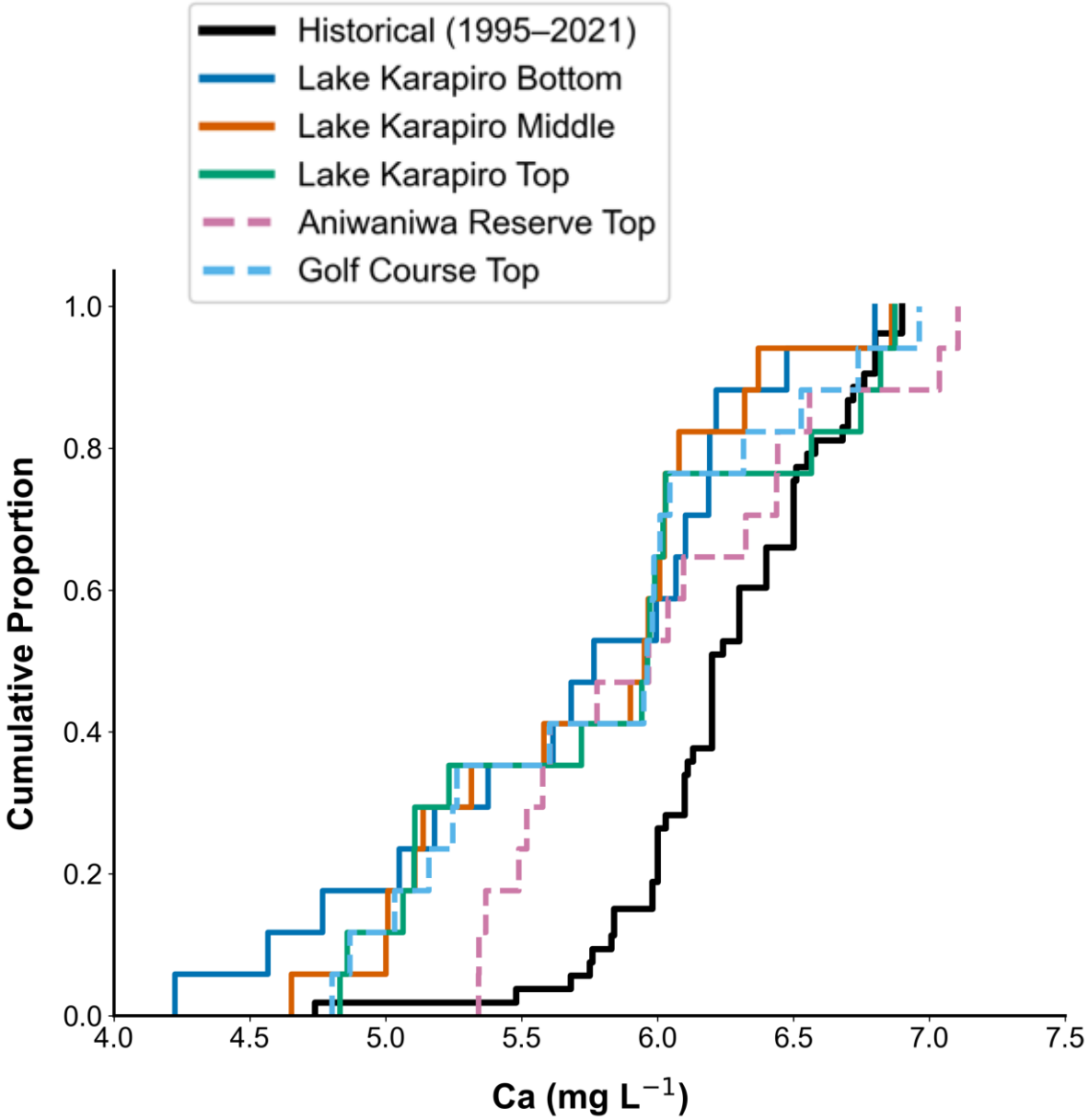


Hofstra & Melchior 2025. Invasive corbicula in NZ. GuardIAS, November 13 &14.

UNPRECEDENTED CHEMICAL CHANGE

Chemical shifts linked to *C. fluminea*:

- Basin-scale Ca and As depletions.
- Alkalinity enrichment (ammonia excretion).



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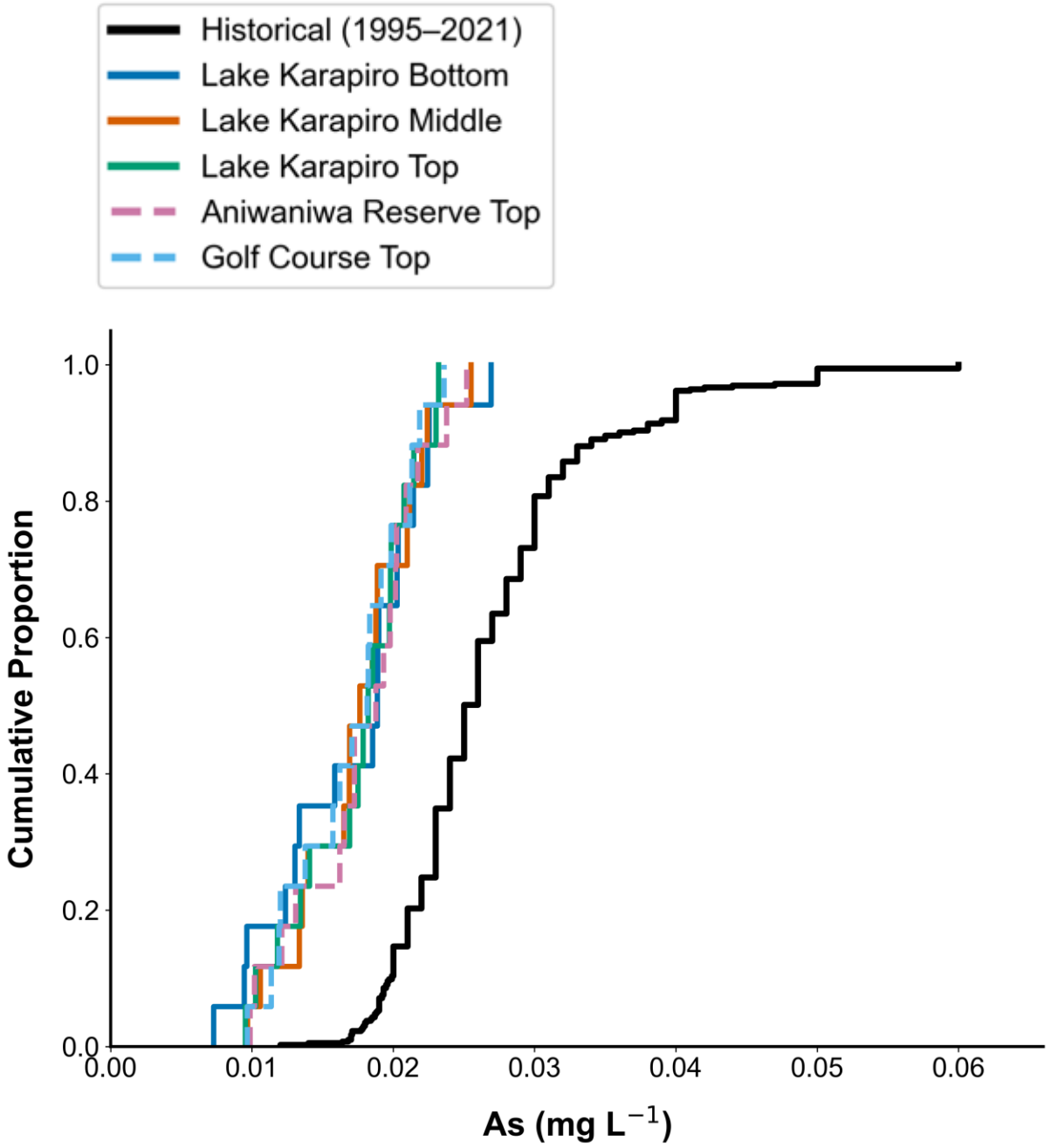

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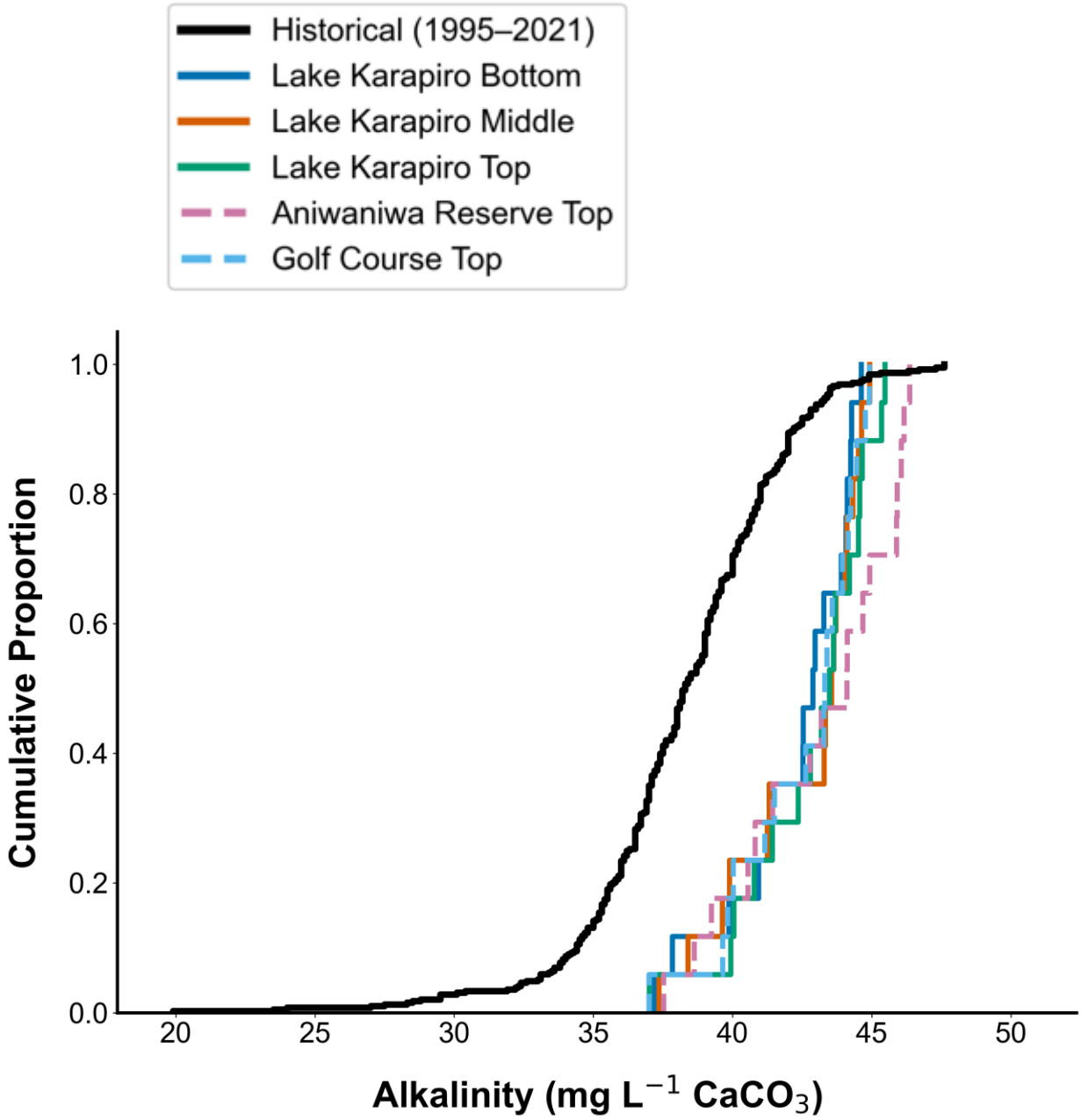

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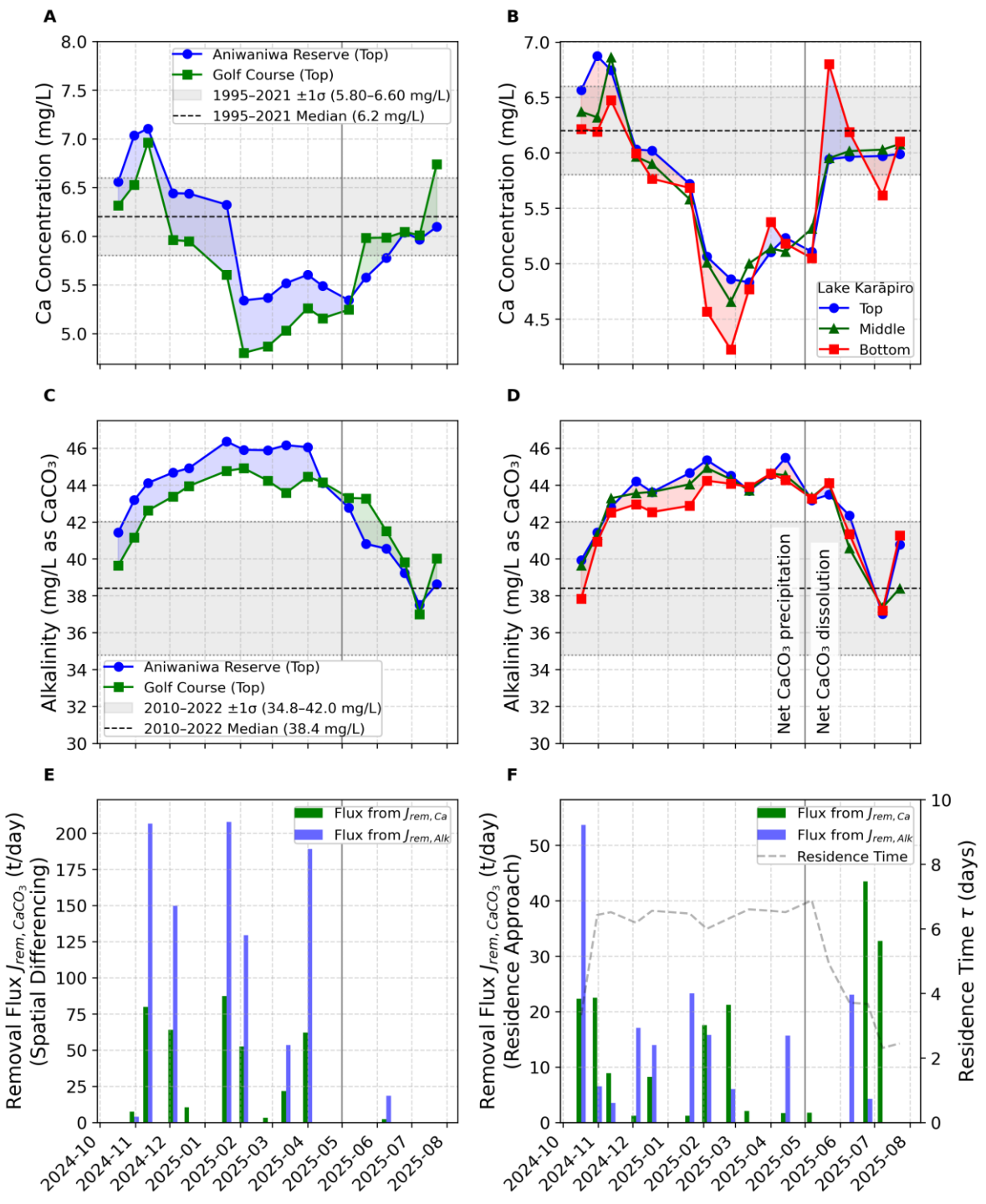

ESTIMATING CLAM DENSITIES FROM CHEMISTRY

Ca and Alk mass removal due to $CaCO_3$ formation

↓

Scale to biovolume using measurements of specimens

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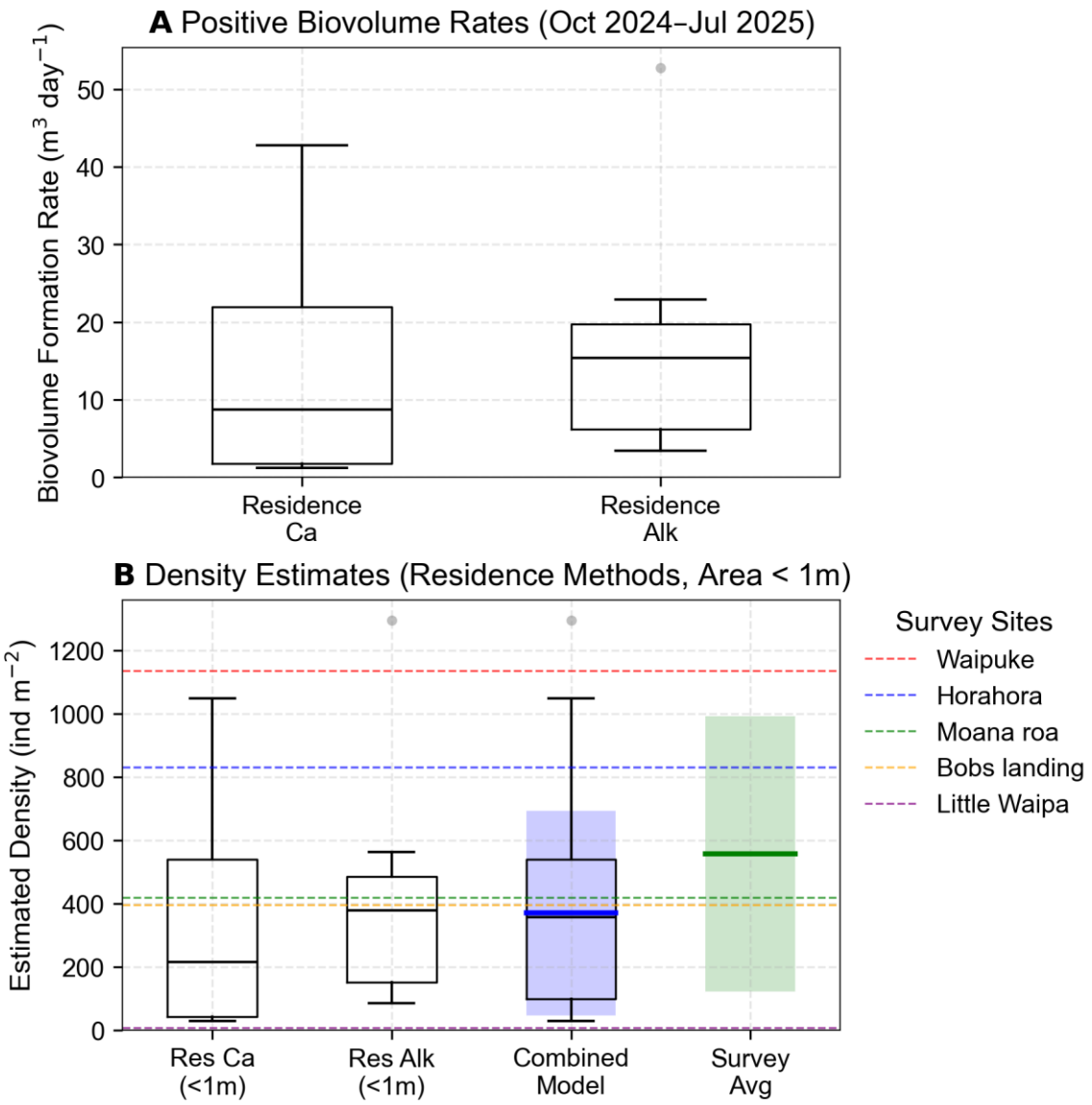
Estimate population density using growth rates and lake hypsometry

CHEM-BASED POPULATION ESTIMATES

Mass balance modelling

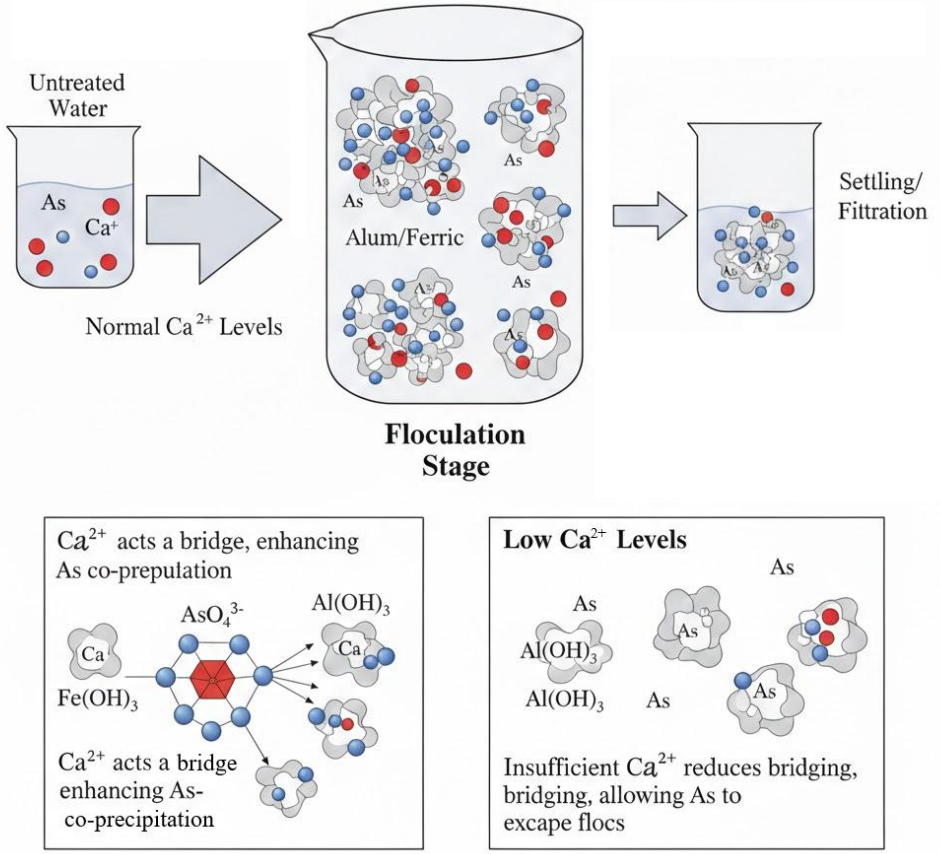
- Ca levels support 4x population density / $CaCO_3$ fixation rates
- Chemical data provides independent means of tracking the invasion
- Basin-scale Ca, As and DO depletions anticipated



THREAT TO DRINKING WATER SECURITY

The Calcium-Arsenic Link (Late 2024 Event):

- Ca Drawdown: Peak summertime clams sequester ~30-50 tonnes of calcium carbonate daily in Karāpiro
- ~ 25% Ca Reduction (2024-25 vs historical)
- Treatment Failure Potential
- Impact: Over 2 million people rely on this water source



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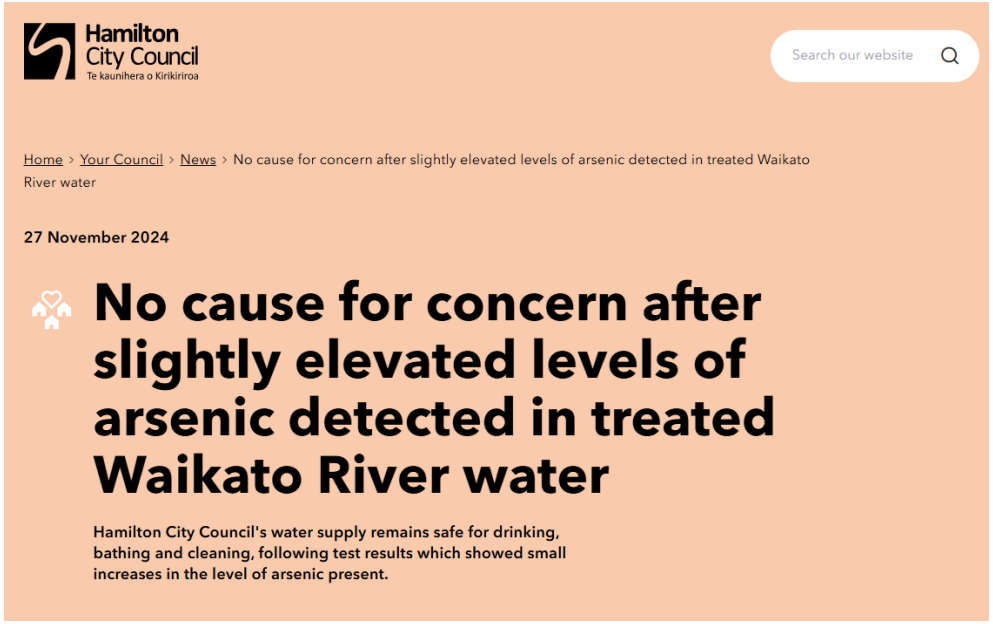
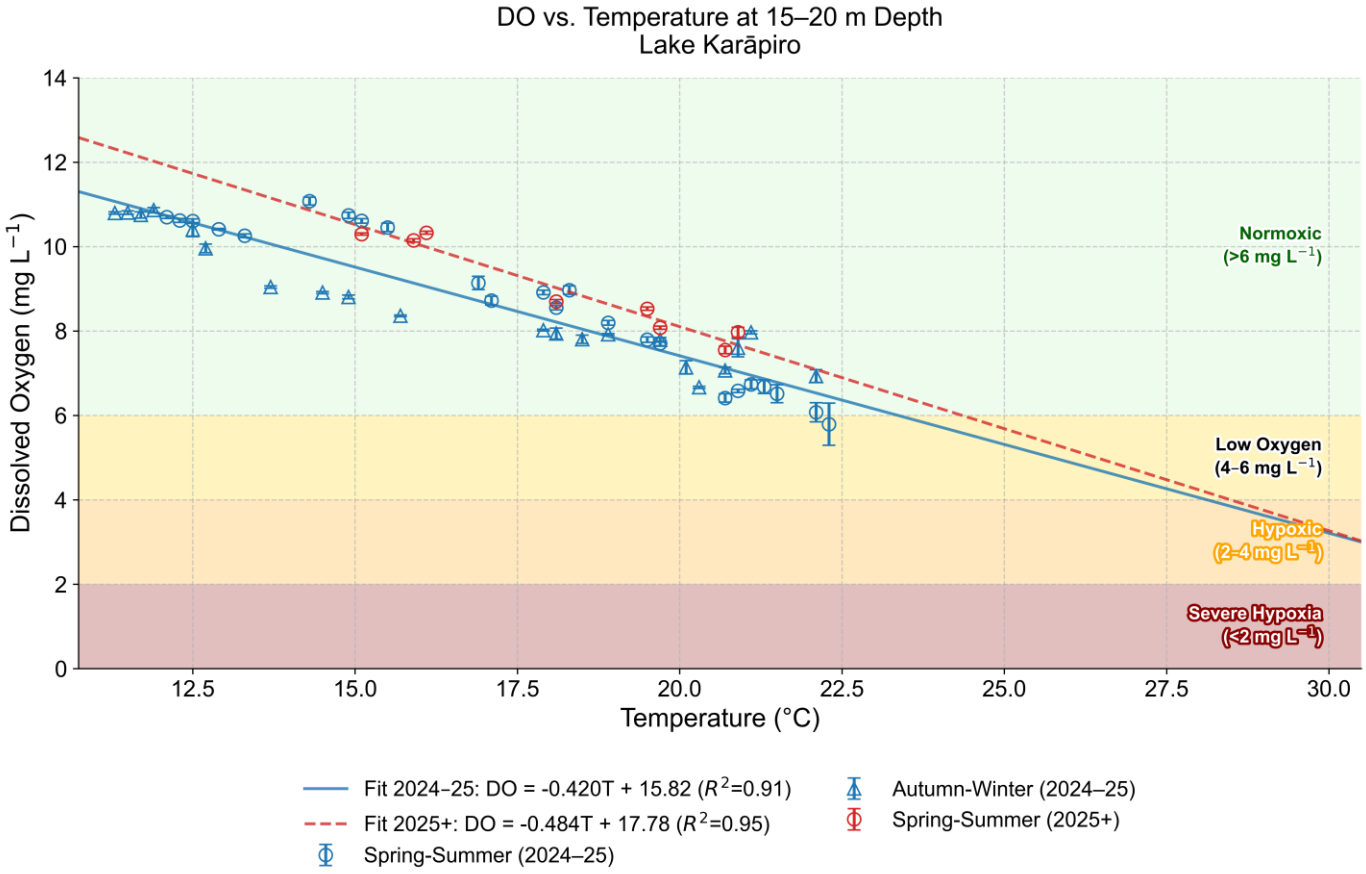


MASS DIE-OFFS: A CLIMATE-DRIVEN TIPPING POINT?

Clam growth depletes benthic oxygen:

- Clam metabolism is temperature sensitive
- Hypoxic events could trigger mass mortality
- Mass die-off could mobilise As(III) from sediment and fuel HABs and fish kills



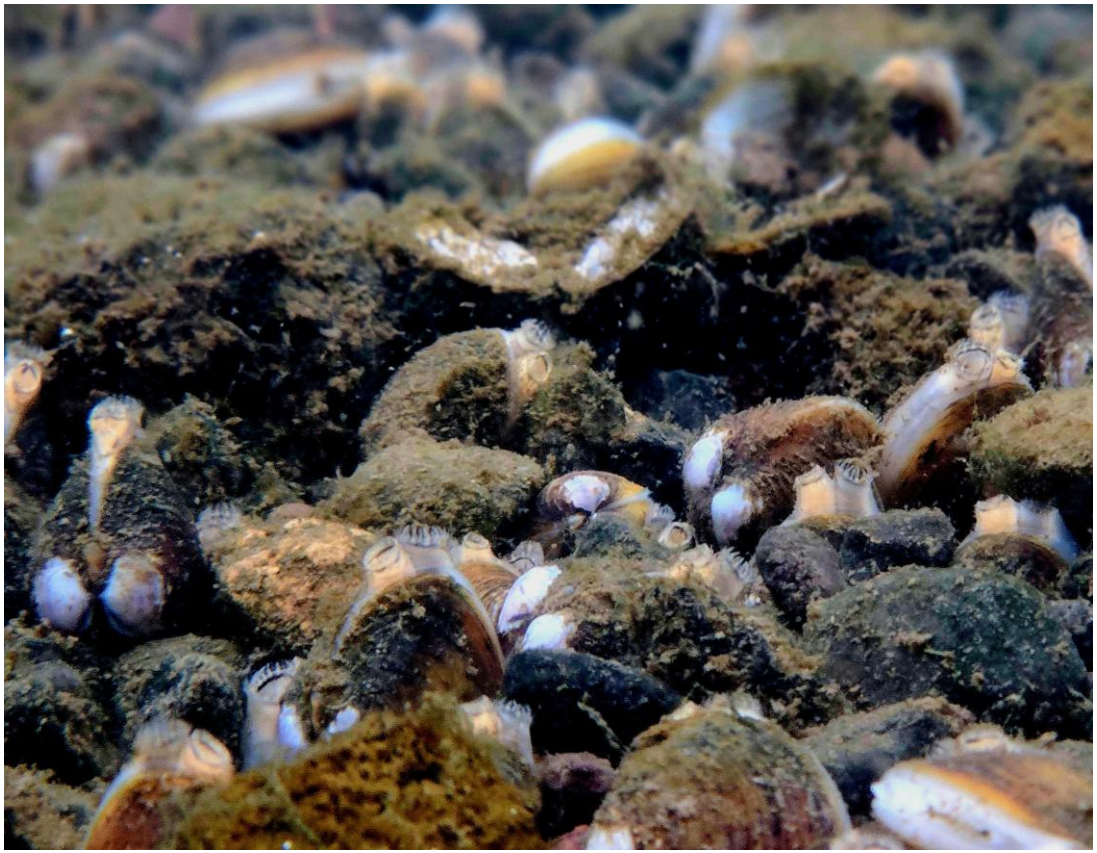
ECOSYSTEM HEALTH & NATIVE BIODIVERSITY

Competitive Displacement:

- Kākahi (Native Mussel) Threat: Gold clams outcompete for phytoplankton and space.

N-cycling

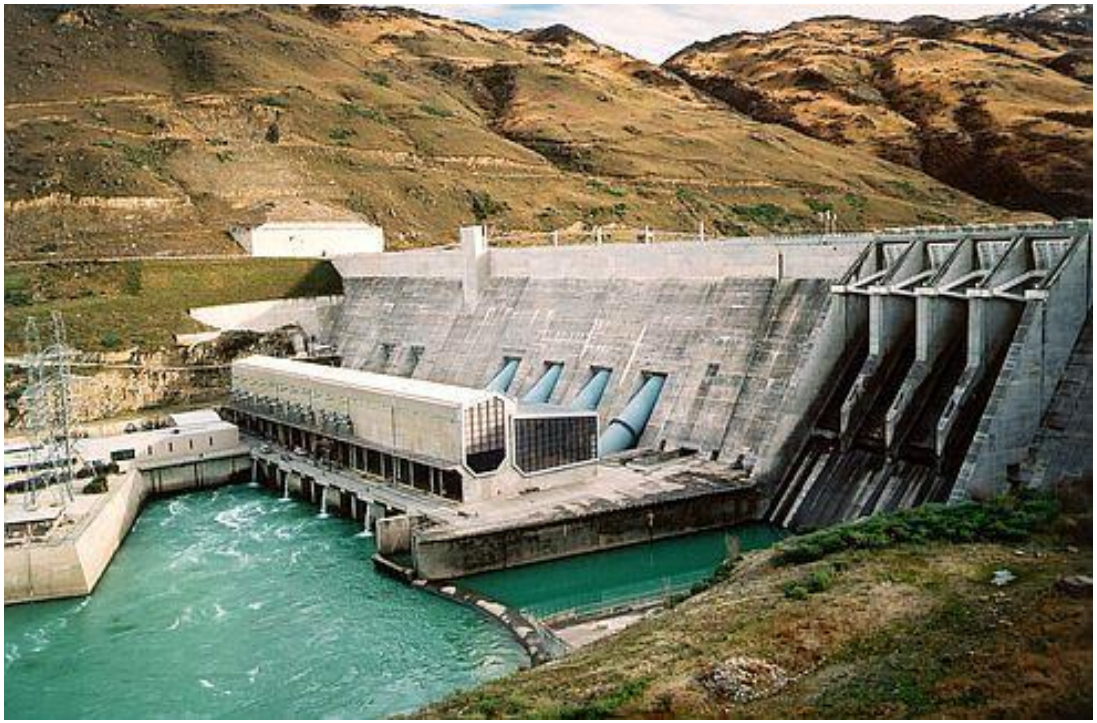
- Nutrient Cycling: High ammonium (NH_4-N) excretion toxic to native plants and fish.
- Algal Blooms: Shifts in carbon/nitrogen ratios increase risk of cyanobacteria blooms.



CRITICAL INFRASTRUCTURE VULNERABILITY

Hydropower & Utilities:

- Generation Risk: Waikato powers 13% of NZ (25% at peak); clams foul intake screens/cooling systems.
- Larvae Mobility: 0.2mm larvae are 'invisible' and bypass standard mechanical filters.
- Economic Cost: modeling indicates multi-million dollar maintenance surges for biofouling removal.



MANAGEMENT & COORDINATED RESPONSE

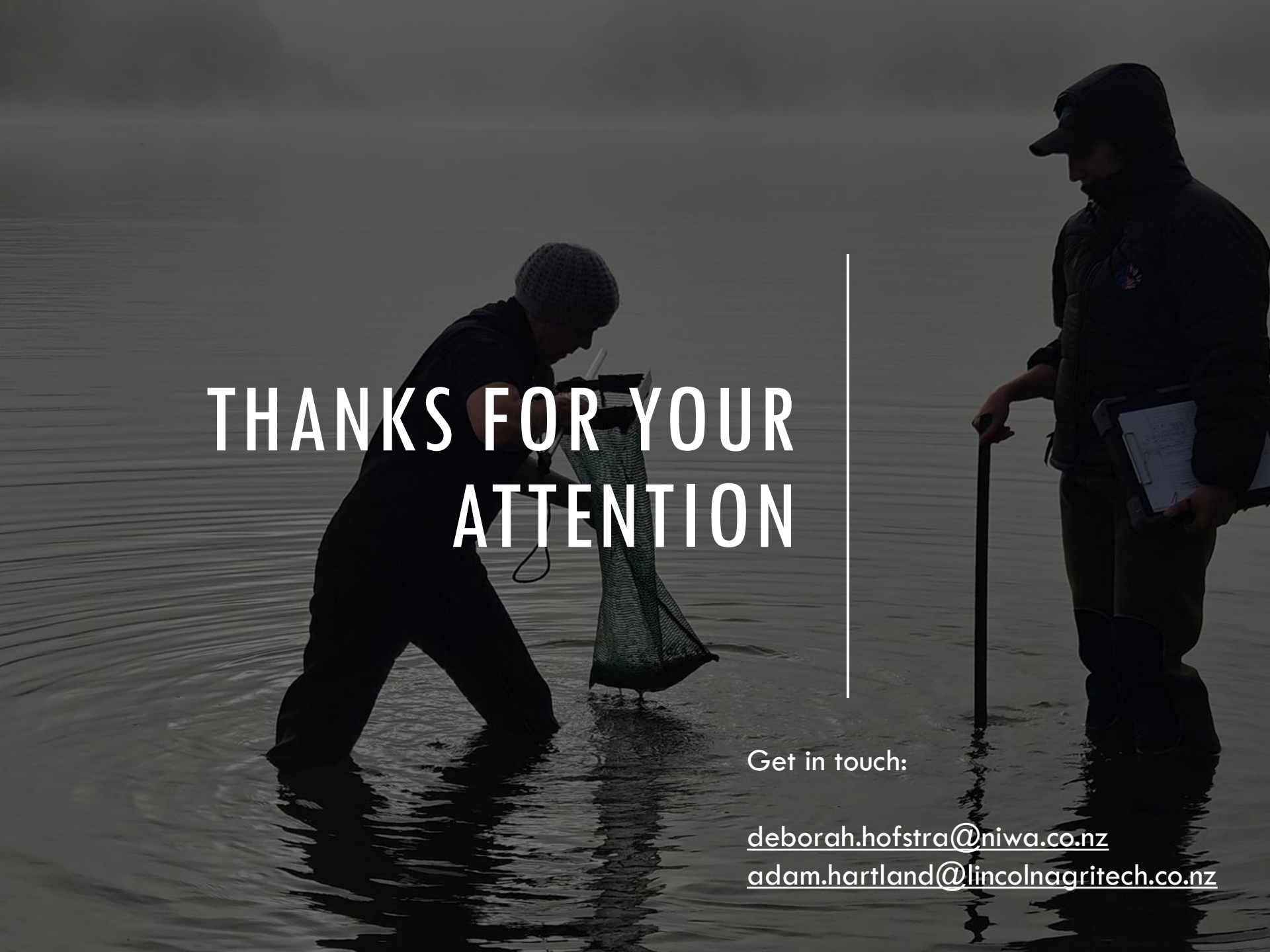
- Containment: Rigorous 'Check-Clean-Dry' for all boats, gear, and dogs.
  - Check-clean-dry ambassadors
  - controlled area notices

- Surveillance and Detection: eDNA, dredging, plankton net samples

- Agency Roles: Taumata Arowai (Water safety), MPI (Containment), DOC (Native species), Regional Council, Mercury/Huntly (Energy security).

SUMMARY

- *Corbicula fluminea* represents an unprecedented threat to the Waikato River and NZ freshwater systems more generally.
- Calcium, arsenic, nitrogen and carbon cycles evidence impact.
- Depletion of benthic oxygen levels increase the risk of mass mortality events, sediment As mobilisation and toxic algal blooms.
- Cross-agency collaboration, monitoring and coordination is needed to avert the worst impacts.
- The species also has the potential to foul hydropower infrastructure, displace native bivalves, and alter food-web dynamics across the North Island.
- Recommended: high-resolution monitoring and emergency protocols for water security



THANKS FOR YOUR ATTENTION

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