What's at stake?

Understanding the impacts of non-native species in New Zealand's changing ocean

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RA2

Measuring effects of marine NIS on indigenous marine biodiversity and ecosystem function

Identify a suite of marine NIS present in NZ that

- Provide opportunities to test hypotheses about relationships between NIS and Biod/Ecosys Func
- Represent an array of NIS types / functional forms
- Are feasible to use in experiments, including manipulations of density (removals, additions)

The four focal marine NIS (agreed at stakeholder/researcher workshop):

1. **Asian date mussel – *Arcuatula (Musculista) senhousia***

The four focal marine NIS (agreed at stakeholder/researcher workshop):

2. Mat forming tunicate – *Pyura doppelgangera*

The four focal marine NIS (agreed at stakeholder/researcher workshop):

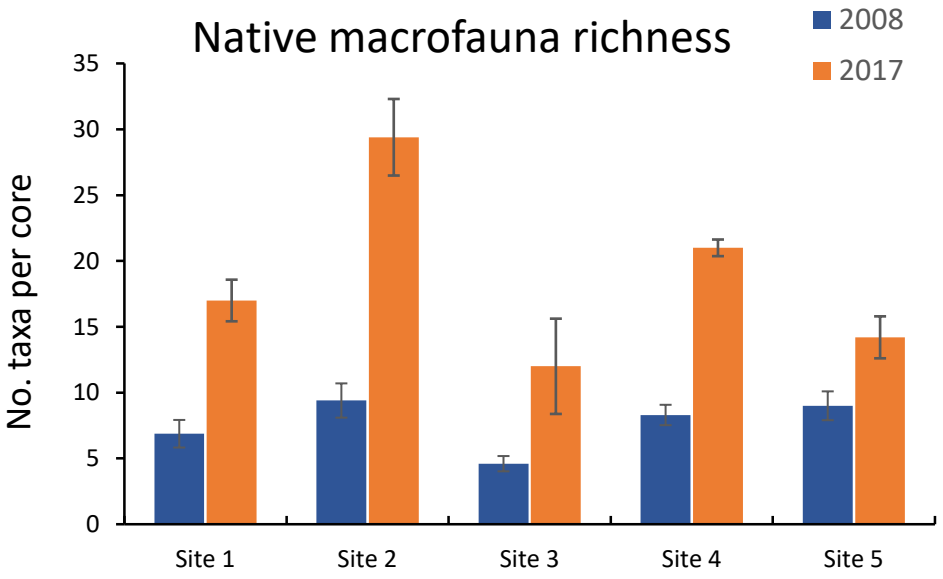
3. **Asian paddle crab – *Charybdis japonica***

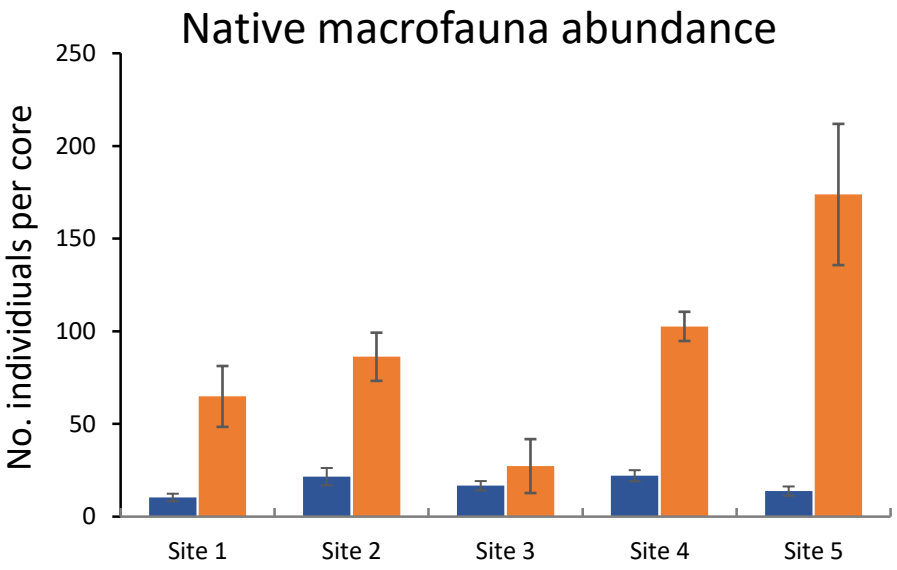
The four focal marine NIS (agreed at stakeholder/researcher workshop):

4. **Mediterranean fan worm – *Sabella spallanzanii***

1. Asian date mussel – *Arcuatula (Musculista) senhousia*

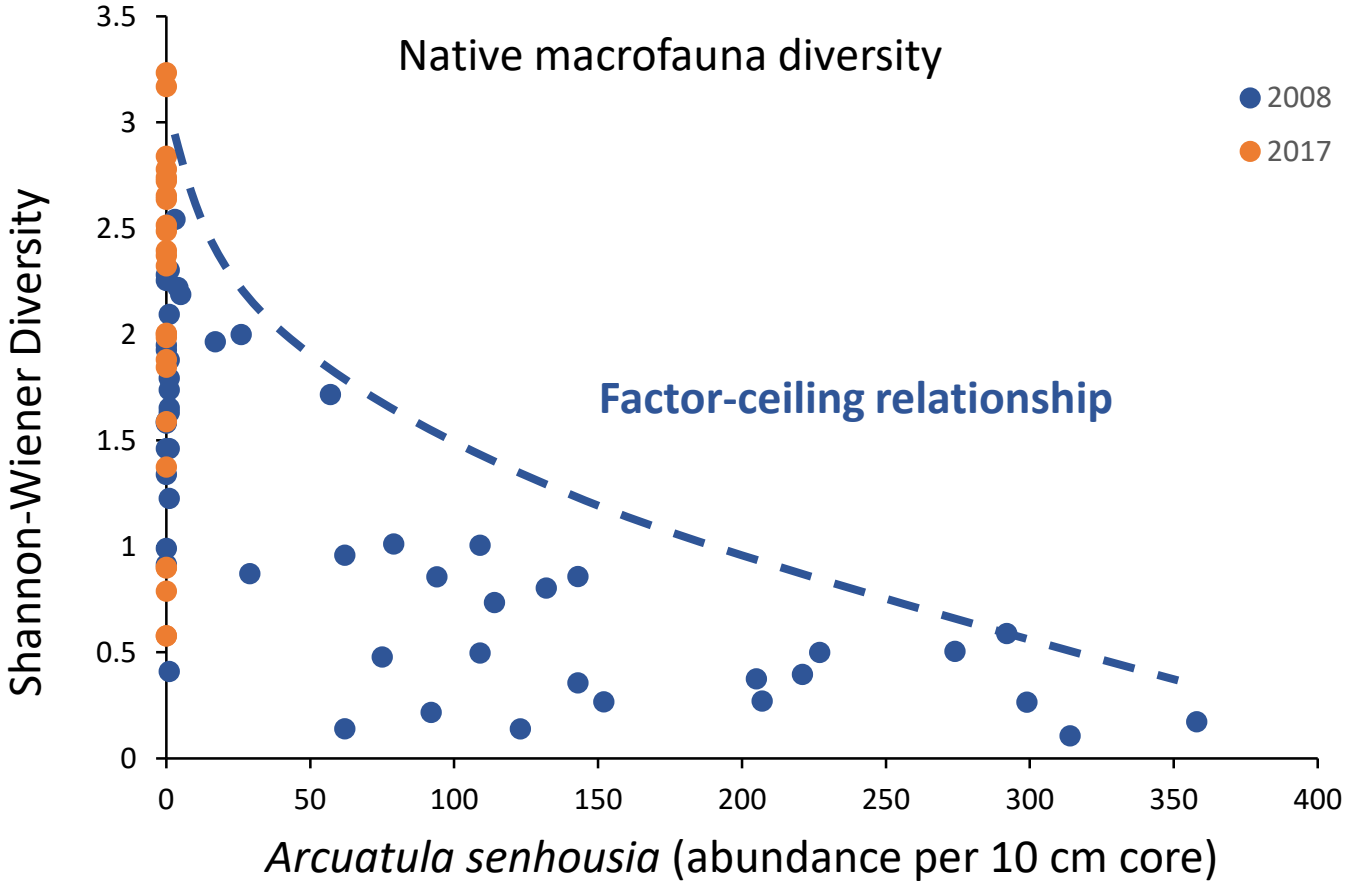
- Re-surveyed five subtidal sites that had varying densities of *Arcuatula* in 2008
- *Arcuatula* absent at all five survey sites in 2017 (i.e., boom-bust life history)
- Disappearance of *Arcuatula* coincident with increase in native richness/abun.





1. Asian date mussel – *Arcuatula (Musculista) senhousia*

- Patterns of diversity are not controlled exclusively by *Arcuatula*
- However, high *Arcuatula* abundance appears to limit diversity



2. Mat forming tunicate – *Pyura doppelgangera*

- Hypothesis: *Pyura* competes/displaces green lipped mussels (*Perna*)

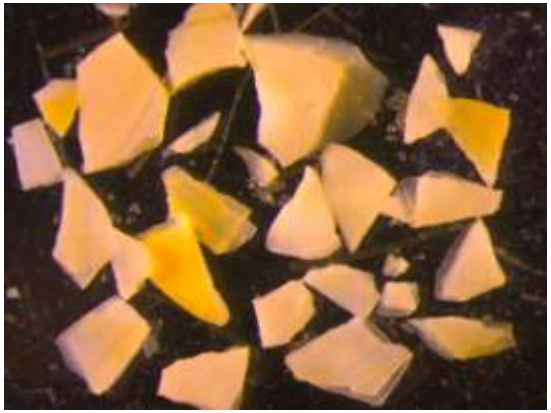
2. Mat forming tunicate – *Pyura doppelgangera*

- Observations and experiments at two rocky sites in Ahipara Bay
- Transplantation of *Perna* to plots with high (80%) and low (30%) cover of *Pyura*, and to control plots outside of *Pyura* beds
- Encroachment of *Pyura* into plots being monitored over time.

3. Asian paddle crab – *Charybdis japonica*

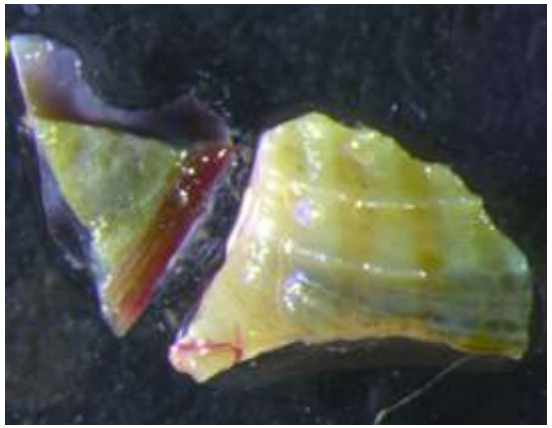
- Large caging experiment (with/without crabs) on a Cockle Bay sandflat
- Impact on functionally/culturally important intertidal species assessed

Wedge shells



Macomona liliana

Cockles



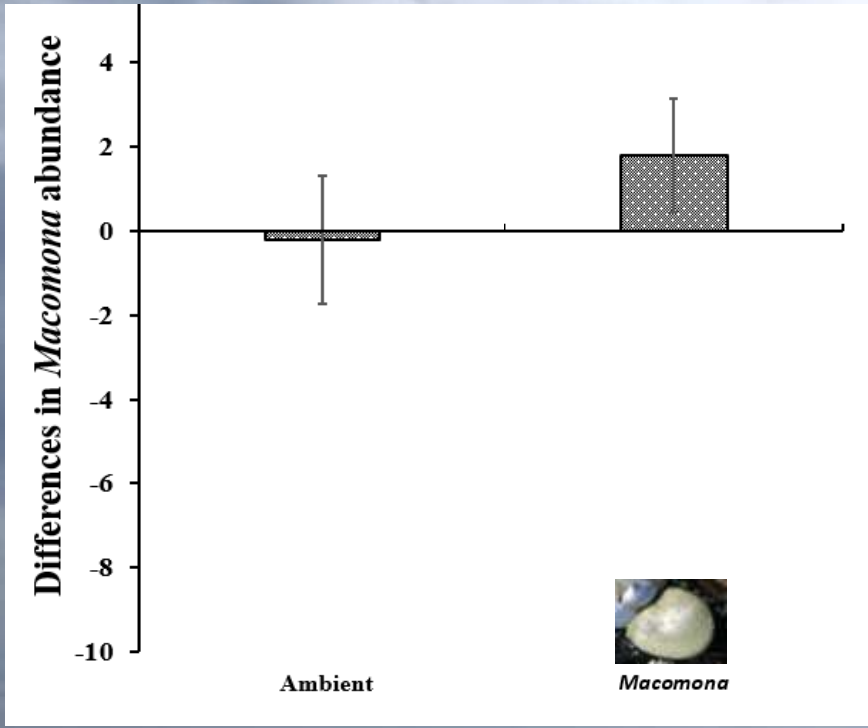
Austrovenus stutchburyi

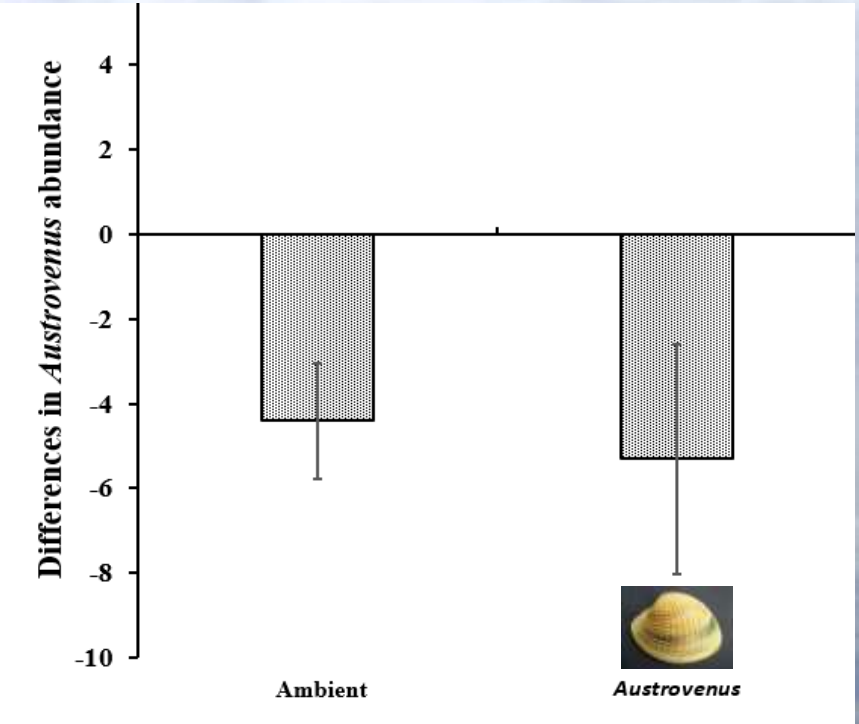
3. Asian paddle crab -- *Charybdis japonica*

- Paired design: adjacent cages with and without live adult *Charybdis*
- Cages with natural ambient macrofauna, and those with added bivalves

3. Asian paddle crab -- *Charybdis japonica*

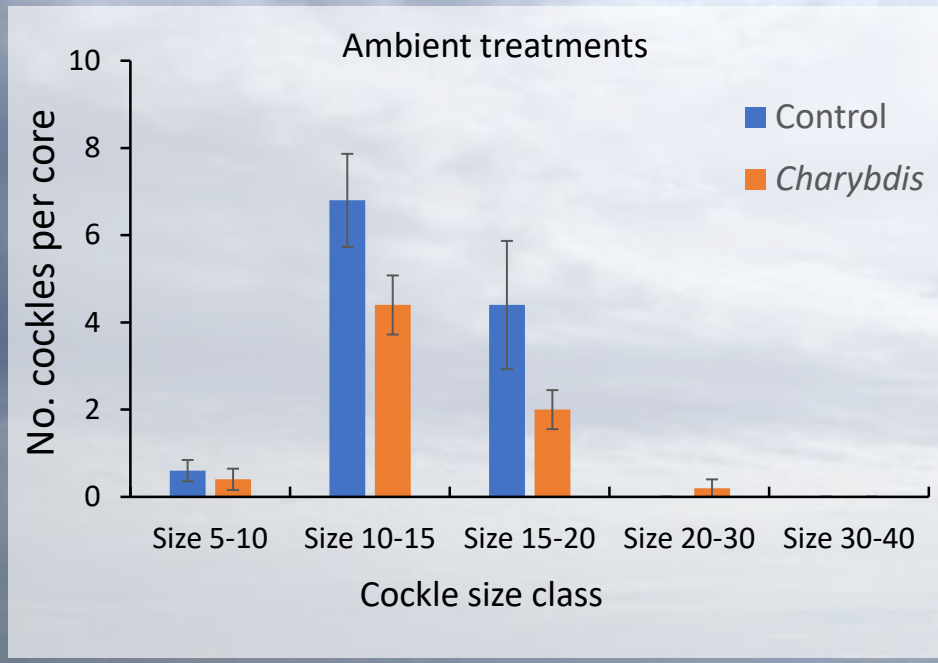
- Differences in bivalve abundance in paired cages with and without crabs

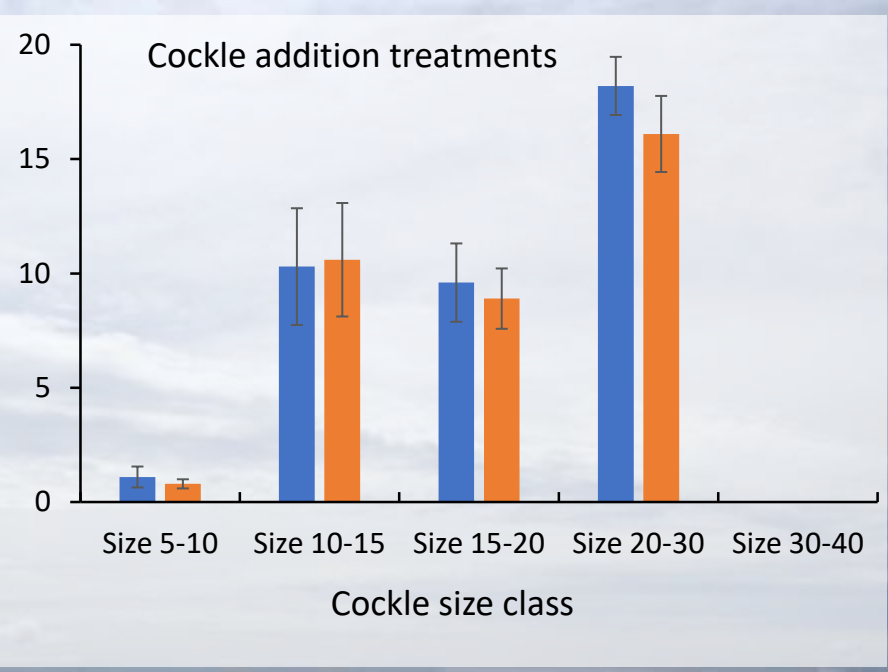




3. Asian paddle crab -- *Charybdis japonica*

- For cockles, perhaps a slightly elevated risk of mortality due to *Charybdis*
- Larger sized bivalves may be preferred, but overall low consumption rate





4. Mediterranean fan worm – *Sabella spallanzanii*

- Large experiment 9-12 m water depth, Rangitoto Channel
- Created plots with 0 to 50 *Sabella*/m^2 in September 2017
- Plots with similar densities of "fake" *Sabella* to assess physical effects only
- Changes in sediment characteristics, macrofauna, and ecosystem function (O_2 metabolism, nutrient regeneration, denitrification) were measured during a detailed benthic flux chamber experiment in March 2018

4. Mediterranean fan worm – *Sabella spallanzanii*

- Second experiment at same site in Rangitoto Channel
- Found clumps of *Sabella* of varying density
- Light and dark chambers deployed next to, and 1 m away from, clumps
- Sediment and macrofauna sampling, collection of the Sabella clusters

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