POTENTIAL FOR ADAPTATION OF NZ GREENSHELL MUSSELS TO A HIGHER CO_2 WORLD

RA 5.1 of CARIM - Coastal Acidification: Rate, Impacts & Management: An Integrated NZ Project

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***Perna canaliculus* adults**

INTRODUCTION

As part of the larger CARIM project (See Law et al. poster #100). We are investigating the capacity for New Zealand's endemic mussel species, *Perna canaliculus,* to adapt to changing carbonate saturation.

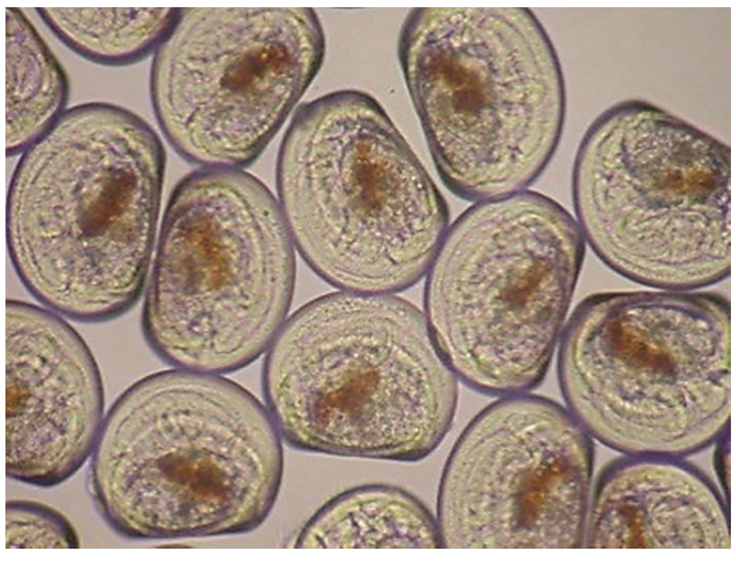
Greenshell mussels are important socially, economically and environmentally, and currently make up the largest proportion of NZ's aquaculture exports[1].

We are using family lines from an existing multi-generational selective breeding programme at the Cawthron Institute to screen for the most extreme phenotypes in relation to susceptibility to an elevated CO_2 environment.

These extreme phenotypes (extremely *susceptible* vs extremely *resilient*) will then be used to carry out a suite of experimental studies examining the mechanisms underlying resilience and adaptation to ocean acidification.

METHODS

The first step is a screen of multiple family lines of Greenshell™ mussels, where "families" are created through single parent crosses of individual males and females to produce multiple families for assessment. These families are raised during the first 48 hrs of embryonic development under an acidification scenario designed to polarise the response of development to first veliger "D" stage. The results are analysed using a pedigree-based mixed model quantitative genetic approach.



4 day-old *P. canaliculus* 'D' veliger larvae

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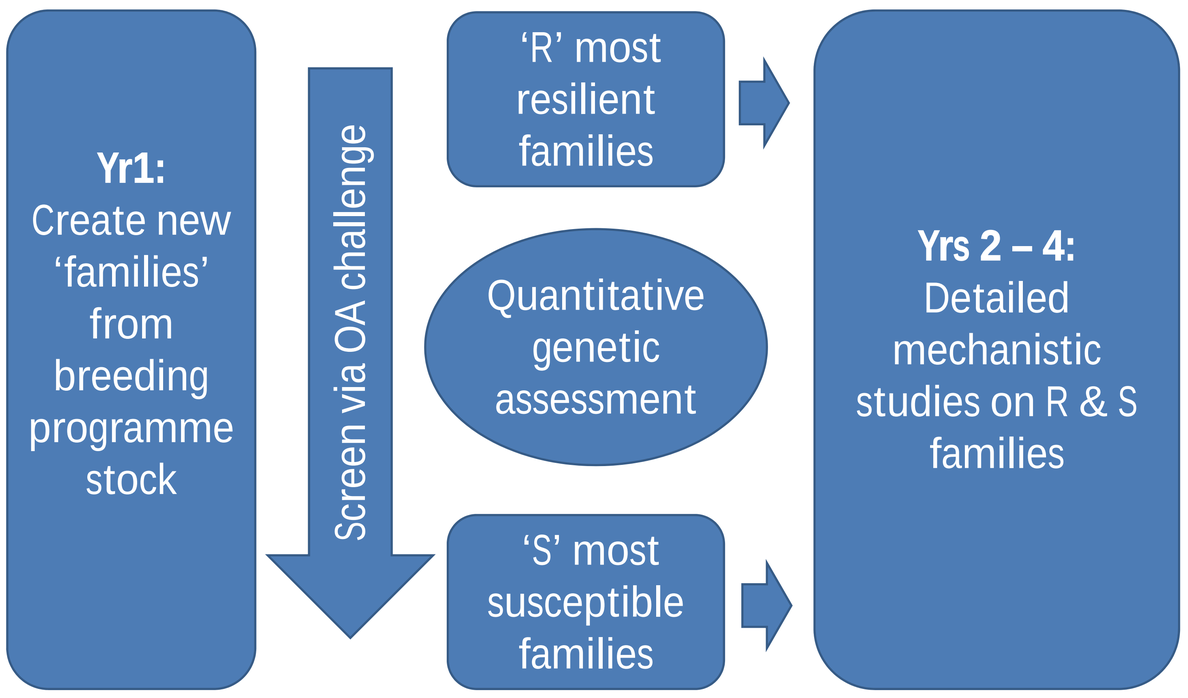
Using this approach we will estimate the degree to which existing genetic variation in current populations may allow natural selection and rapid adaptation to a changing CO_2 environment.

The families with the most extreme phenotypes (resilient 'R' and susceptible 'S') will then be used as the biological material to undertake more detailed studies on the mechanisms underlying 'resilience' and allowing adaptation to occur.

Over the next 4 years, these studies will include assessment of carry-over effects of sexual maturation of female mussels under OA scenarios, and metabolomic and transcriptomic assessment of perturbations experienced under acidified conditions comparing differences between 'S' and 'R' families.



RESULTS

The results of this section of the CARIM project will be combined with similar work on another iconic NZ mollusc, the pāua (Blackfoot abalone, *Haliotis iris)* using pedigreed family lines developed by NIWA and OceaNZ Blue. Context for lab trials will be provided by direct investigations of the rate and magnitude of coastal acidification around NZ. Together these results will create new knowledge on the physiological and genetic basis for vulnerability and resilience to coastal acidification, and help to establish whether these key NZ species have the capacity for adaptation to the rates and magnitude of acidification likely to occur in the NZ coastal environment in the near future. It will also help to identify if there are mechanisms that can be exploited to help select for resilient lines to help future-proof NZ aquaculture production against impacts of OA such as have been observed in shellfish hatcheries of the Pacific Northwest of the USA[2,3].

REFERENCES

1. Anon. 2014. New Zealand Seafood Exports. Report 7: Seafood exports by product type. Calendar year to December 2014. Seafood New Zealand, Wellington, pp. 118
2. Feely RA *et al.* 2012 Scientific Summary of Ocean Acidification in Washington State Marine Waters NOAA OAR Special Report No. 3934 (NOAA-OAR 2012)
3. Ekstrom JA *et al.* 2015 Vulnerability and adaptation of US shellfisheries to ocean acidification. Nature Climate Change DOI: 10.1038/NCLIMATE2508