Climate change impacts on kuku, pāua and scampi

The Moana Project examines how climate change is likely to affect our oceans, to help Aotearoa New Zealand's fishing and aquaculture industries plan for the long-term future.

Using scenarios to model ocean temperature changes

The Intergovernmental Panel on Climate Change (IPCC) has determined likely climate change scenarios. Called shared socioeconomic pathways (SSPs), these scenarios predict how warm the earth will get under different levels of greenhouse gas emission – i.e. what would happen if we reduce emissions in coming decades or if we continue emitting greenhouse gases at current or higher rates in years to come.

In the Moana Project, we modelled what would happen to ocean temperatures from present day to 2100 under steady (SSP2-4.5) and high emission scenarios (SSP3-7.0).

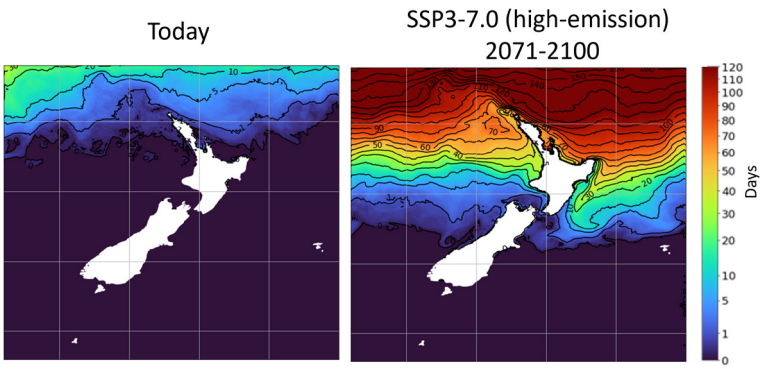
Coupling temperatures with species tolerances

Combining the projected ocean temperatures with species tolerance data, we created scenarios for three important kaimoana species: kuku (green-lipped mussels), pāua and scampi.

The important kaimoana species kuku (green-lipped mussels), pāua and scampi may be adversely affected by ocean warming.

The results show that under a high-emission scenario (SSP3-7.0), temperature stress will likely affect kuku / green-lipped mussels (*Perna canaliculus*) in the upper part of the North Island towards the end of the century.

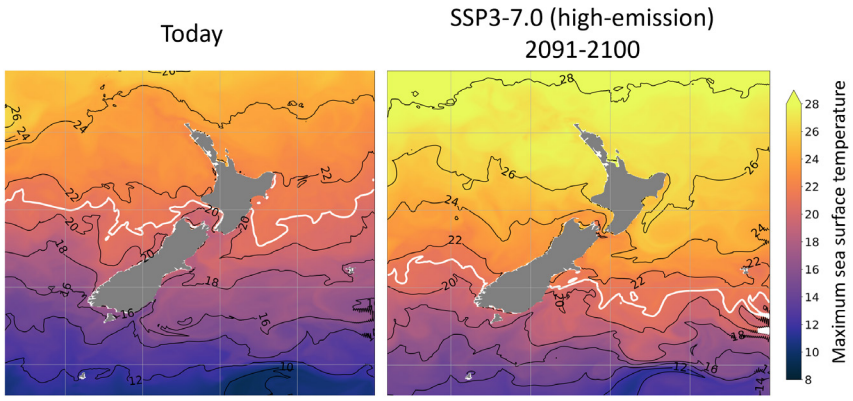
The risk of impacting the species is much lower at a steady-emission scenario (SSP2-4.5). The temperature stress can lead to low levels of mortality and will likely impact growth.



Kuku / green-lipped mussels get stressed at water temperatures above 24˚C, and low-level (5%) mortalities occur when they are exposed to such high temperatures for more than 30 days. The figures show the number of days per year the sea surface temperature will exceed 24˚C today (left) and in the time period 2070-2100 under a high-emission scenario (right).

Blackfoot pāua (*Haliotis iris*) show mortalities when water temperatures reach 27-29˚C, but growth is stunted at much lower temperatures.
In fact, blackfoot pāua cannot reach the commercial size of 125mm when water temperatures exceed 21˚C.

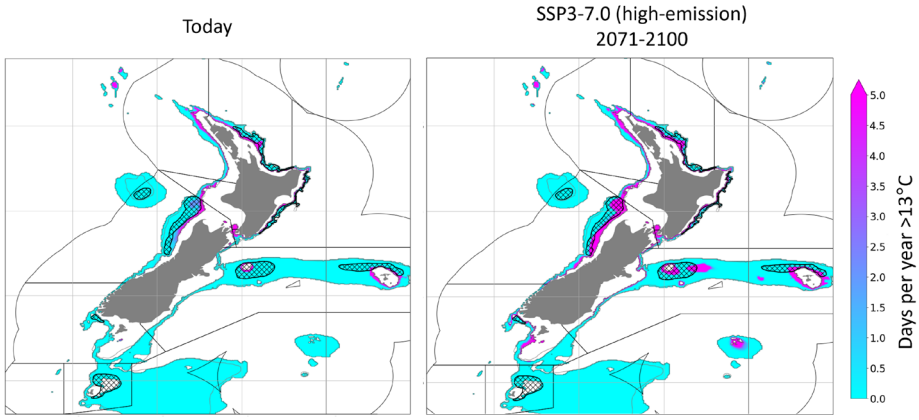
In a high-emission scenario, the lucrative pāua fishing grounds off the east coast of the South Island may no longer yield pāua of commercial size towards the end of this century.



Blackfoot pāua can reach commercial size when the maximum ocean temperature does not exceed 21°C, shown here as a white line, south of which temperatures stay within the species tolerance.
Present day (left) pāua can reach commercial size in the South Island and the southernmost part of the North Island; towards the end of the century only the southernmost part of the South Island will likely yield harvestable pāua under a high-emission climate change scenario (right).

Scampi (*Metanephrops challengeri*) require muddy habitat of 150-700m depth where temperature does not exceed 13°C.

Currently, temperature stress is not likely a problem at that depth, but in a future of climate change, temperatures too hot for scampi will start encroaching on current scampi fishing grounds.



Towards the end of the century, scampi fishing grounds may experience temperatures too hot for the species. Figures show days per year that seafloor temperature in the scampi depth range exceeds 13°C, the threshold for scampi health, today (left) and towards the end of the century under a high-emission scenario (right). Hatched area shows existing fished scampi grounds.