Kaikōura earthquake impacts on pāua connectivity

The Kaikōura earthquake in 2016 dramatically disturbed the local coastline. The topography changed completely as vertical displacement lifted underwater habitat and heavy sedimentation blanketed underwater habitats. Altogether the earthquake resulted in mass mortality of pāua and a loss of 21% of pāua habitat.

Aerial imagery showing the seabed exposed by the 2016 earthquake around the Kaikōura peninsula. Image modified from source (https://earthobservatory.nasa.gov/images/89206/powerful-earthquake-exposes-new-land-near-kaikoura).

The affected coastline is home to the recreationally and commercially important pāua fishery, and because of the widespread destruction of habitat, as a precautionary measure Fisheries NZ closed the fishery for five years, resulting in losses of $3 million per annum.

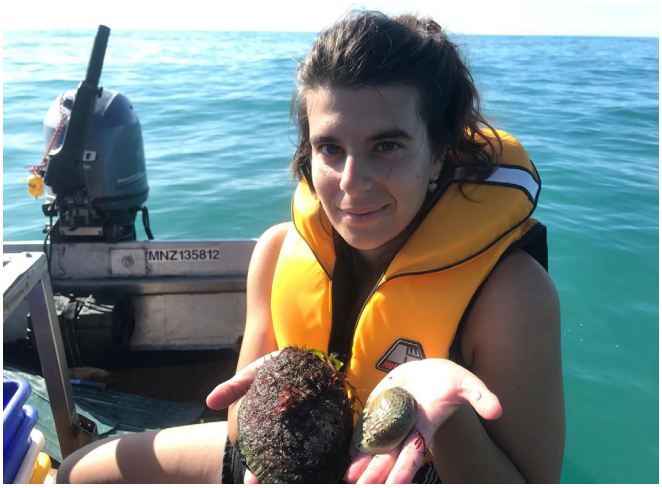
Did the earthquake impact the genetic connectivity of the pāua population?

The changes to the habitat could potentially affect the pāua populations. Pāua larvae tend to swim upwards initially and then drift along the coast for a period of time that changes according to the temperature of the water, but ranges between 5 and 10 days. This means that if the underwater topography (called bathymetry) changes, along with the local pattern of ocean currents, the populations' genetic connectivity may be affected – e.g. by changes in gene flow levels that may result in isolation and/or homogenisation (merging) of subpopulations.

The Moana Project investigated the effects of the earthquake on the population genetic connectivity by looking at the variation at high resolution molecular markers of adult and juvenile pāua from a number of sites along 110 km of coast. The

adults represented the pre-earthquake dynamics of the area; the juveniles were born after the earthquake and represented post-earthquake genetic connectivity.

By comparing the two we hoped to detect whether the earthquake had resulted in any changes. It is however important to remember that because no previous genetic data was available for the pāua populations from Kaikōura, we can't determine if any changes in the genetic connectivity of adults and juveniles are permanent or temporary.



PhD student Giulia Trauzzi holding up adult and juvenile pāua. Giulia carried out the genetic connectivity work.

High levels of genetic connectivity of populations post-earthquake

Our findings suggest that the pāua populations in the Kaikōura region are historically very large and they are characterised by low inbreeding levels. No major difference between the genetic connectivity of the adults and that of the juveniles became apparent from our data.

Each population appears to be genetically very well connected to the others forming a more or less homogenous group. Both adult and juvenile pāua from Cape Campbell appear to be slightly different from the others genetically suggesting the presence of possible barriers to the movement of pāua larvae between the Cape and the other locations.

Our data suggest that factors such as the large populations of pāua in the region, the high levels of genetic connectivity of the populations (a result of the transport of pāua larvae along the coast), low inbreeding levels and variable spawning may have counterbalanced the devastating effects of the 2016 earthquake on the populations.

However, long-term genetic studies are required if we want to understand if the genetic connectivity patterns found are stable through time, and if we want to examine their consequences for the future sustainable fishing of pāua in the region.