RECOVER
Reef Ecology and Coastal Values Earthquake Recovery Project

UC UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

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Kia Ora!

Welcome to the *Recover* newsletter Issue 5 from the Marine Ecology Research Group (MERG) of the University of Canterbury. *Recover* is designed to keep you updated on our MBIE-funded earthquake recovery project called RECOVER (Reef Ecology, Coastal Values & Earthquake Recovery). This 5th instalment covers the question of how much of the coast was uplifted and by how much, recent lab work on seaweed responses to stressors, and more on our drone survey work to quantify earthquake impacts and recovery along 130 km of coastline in the intertidal zone!

How much of the coast was uplifted and by how much?

Although Covid19 set back some of our planned fieldwork, we put the lockdown period to good use to characterise some of the core earthquake impacts on the coast. One key questions is 'how much of the coast was uplifted and by how much?'. Knowing this helps us to extrapolate the results from small-scale field surveys to the wider coast, which in turn is the best method for gauging the extent of impacts and how the recovery is looking overall. Being able to report the results as the 'length of coastline' affected is an intuitive option for comparing one place to another, but have you ever heard of the 'Infinite coastline paradox'? Google it up!

Infinite Coastline Paradox— the coastline does not have a well-defined length because measuring it depends a lot on the scale of the measurement device.

In our case we have some very high resolution data for the whole coast, which means we can take into account all of the nooks and crannies. This is important because if you're a small guy, like a paua, all of those intricacies are relevant to your available space. Another aspect is which part of the shoreline we're talking about, and in this case we did the assessment for the position of Mean High Water Springs (MHWS). We also looked at two periods of time—the immediate earthquake effects and whether there have been any changes since. This is important since our RECOVER project began two years after the quake and we have been following changes since. The results can be shown lots ways, as in Figure 1. This shows the degree of uplift within four major substrate types that are associated with characteristic habitats and together make up the whole coast.

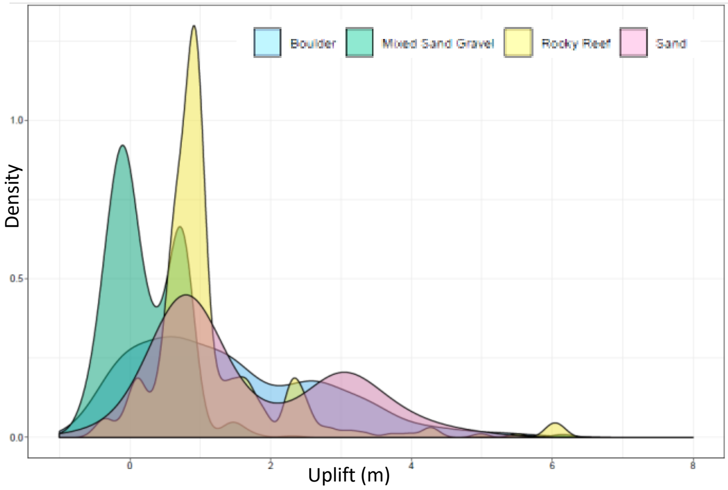


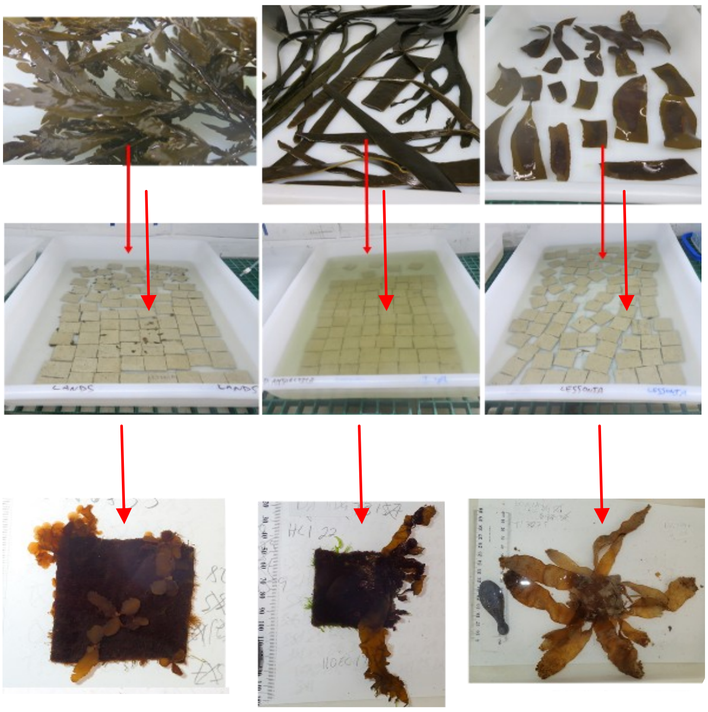
Figure 1. A plot of the amount of uplift ('density') that was experienced by each of four substrate types across the coast from Oaro to Waipapa Bay according to metres of coastline at the position of pre-quake MHWS (high tide). Shane Orchard

In the coming months we will be interpreting results from our field survey sites against these 'big picture' trends to evaluate how the recovery is going. We also confirmed that most of the changes have occurred during the initial earthquake, at least south of Waipapa Bay. However, in other work we are following the erosion of uplifted reefs—which is significant in some areas. See the next issue of *Recover* for an update!

Lab studies on seaweed recovery

Following on from *Recover* issue 4, Dan Crossett and Robyn Dunmore from the Cawthron Institute have had some interesting results from lab experiments set up to test the effects of temperature, turbidity and light on juvenile large brown seaweed growth and survival. We found distinct differences in species' early life stage responses. *Landsburgia quercifolia* was more tolerant of a wider range of conditions, with similar growth and survival across treatments. In contrast, *Durvillaea antarctica* (rimurapa or bull kelp) was the least tolerant and was strongly affected by increases in temperature and turbidity, with high mortality and slow growth. While *Lessonia variegata* could survive in the full range of conditions, its growth was significantly constrained with increasing temperatures, and by the lowest light and highest turbidity treatments.

Landsburgia *Durvillaea* *Lessonia*



Growth Assessments—showing examples of the best growth observed (above) and poor growth (below)

Figure 2. Schematic of the laboratory experiments to assess seaweeds' tolerance to stress. Dan Crossett

These species-specific responses are important for understanding not only how areas around Kaikōura may recover post-quake, but also how these species may respond to an altered environment under climate change, with higher temperatures, and potentially increased sedimentation and associated lower light levels due to more storm events. In the next step we want to see how different juveniles raised in stressed conditions respond once transplanted into the natural environment, in aspects such as growth and survival.

Drone survey progress

Over the last summer our drone survey team was busy optimising methods for measuring change in the coastal environment change. We now have a comprehensive set of 3D models and imagery from 30+ field sites. Advantages of drone technologies include the ability to cover more ground and a greater range of habitats than we can manage in ground-based surveys alone, yet the resolution of these methods is impressive. Each model covers several hundred metres of coast and the size of each pixel is < 1 cm on the ground! We are using the drone data to assess intertidal area changes which are potentially some of the most important and long-lasting earthquake impacts e.g. where the area of characteristic zones has been reduced from their pre-quake size. Within these areas we are using photogrammetric methods to follow seaweed recovery, building on earlier trials of options for this type of analysis (see *Recover* issue 3).

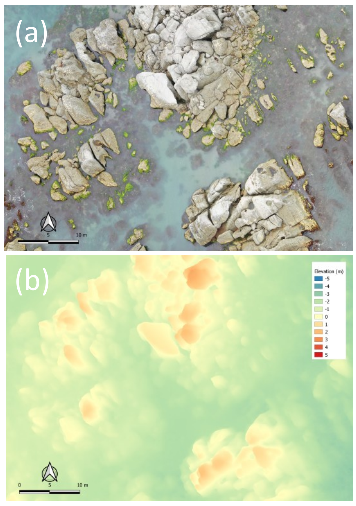


Figure 3. Two views of a remote-sensed scene near Waipapa Bay. (a) ortho-rectified image with a pixel size of 0.7 cm. (b) digital elevation model produced from the same dataset. Note that the usable data can include shallow submerged areas (if the water is clear!) Shane Orchard

— thanks for tuning into *Recover!*

Resources

Tait, L. et al. (2019). Unmanned Aerial Vehicles (UAVs) for Monitoring Macroalgal Biodiversity: Comparison of RGB and Multispectral Imaging Sensors for Biodiversity Assessments. *Remote Sensing 11*(19), 2332. doi:10.3390/rs11192332

www.sciencelearn.org.nz/resources/2856-kelp-forests-after-the-kaikoura-earthquake

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