Coast

Intertidal rocky reefs are an iconic feature of the Taranaki coastline, providing habitat for a range of organisms that thrive in challenging coastal conditions. The seaweeds and animals that inhabit these reefs are an important part of the wider ecosystem, providing a food source for birds, fish and people. We monitor these habitats to improve our understanding of them, and identify changes over time.

Rocky reef systems are dynamic environments. Habitat complexity, wave exposure and sand inundation are three inter-related factors that have a major influence on the communities inhabiting rocky reefs. Reefs with high habitat complexity have a variety of substrates and spaces for a greater range of seaweeds and animals to occupy.

Manihi Reef, near Oaonui, has a range of boulders, rocks, cobbles and pools that provide a high level of habitat complexity. Wave exposure can shape rocky shore communities by limiting which seaweeds and animals are able to settle and become established, based on how much wave action they can tolerate. Waihi Reef, near Hāwera, is subjected to high wave exposure because of the short, steep profile of the reef, which gets battered by waves.

Sand inundation also has a pronounced and immediate impact, smothering and scouring rocky reef communities and reducing habitat complexity.

6
reef communities
surveyed twice per annum since 1994

½
monitored reefs are significantly affected by
sand inundation

83%
of reefs show a **declining long-term trend** in number of species

63%
of mussel samples collected from Waiwhakaiho Reef were **contaminated with norovirus**
Between 2015 and 2020

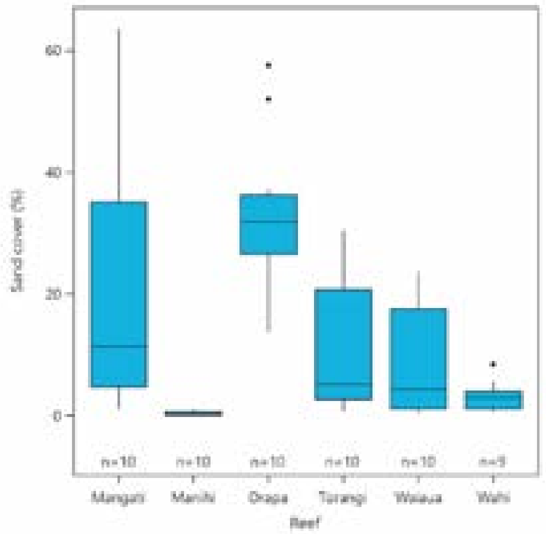
What we know

Since 1994, the Council has been surveying six reef communities in spring and summer each year: Tūrangi Reef at Motunui; Orapa Reef at Waitara; Mangati Reef near Bell Block; Waiaua Reef at Greenwood Road (west of Oākura); Manihi Reef near Oaonui; and Waihi Reef near Hāwera.

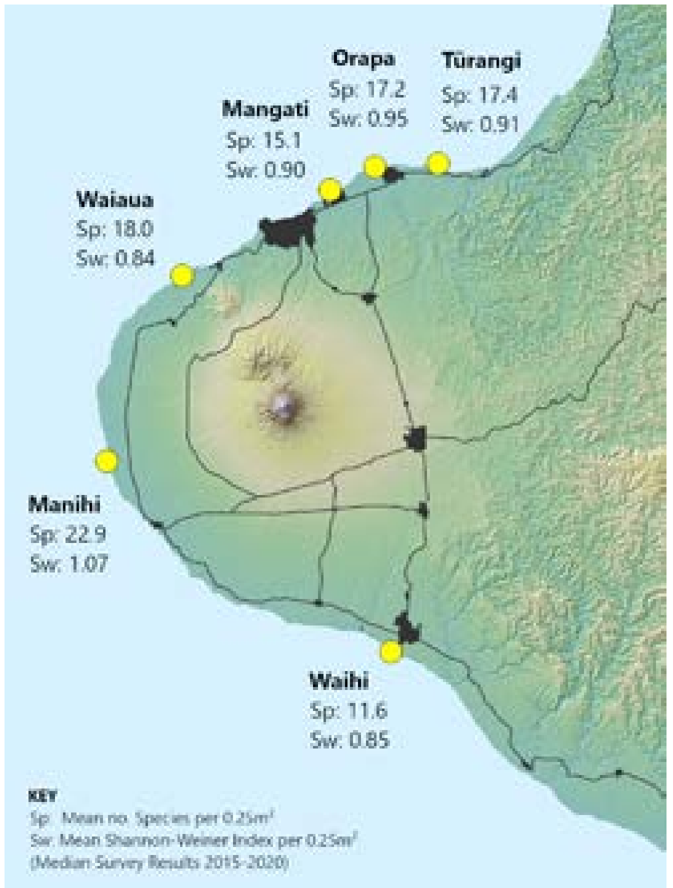
Biological diversity

Diverse biological communities are typically more resilient to stress, and are often indicative of environmental quality and ecosystem health. The Council uses two key metrics to assess the overall diversity of reef communities: the mean number of species, and mean Shannon-Wiener diversity index. The mean number of species refers to the average number of species found within 0.25m² of reef during a survey. The mean Shannon-Wiener diversity index considers how balanced the community is, by factoring in the number of species, as well as the relative abundance of each of those species.

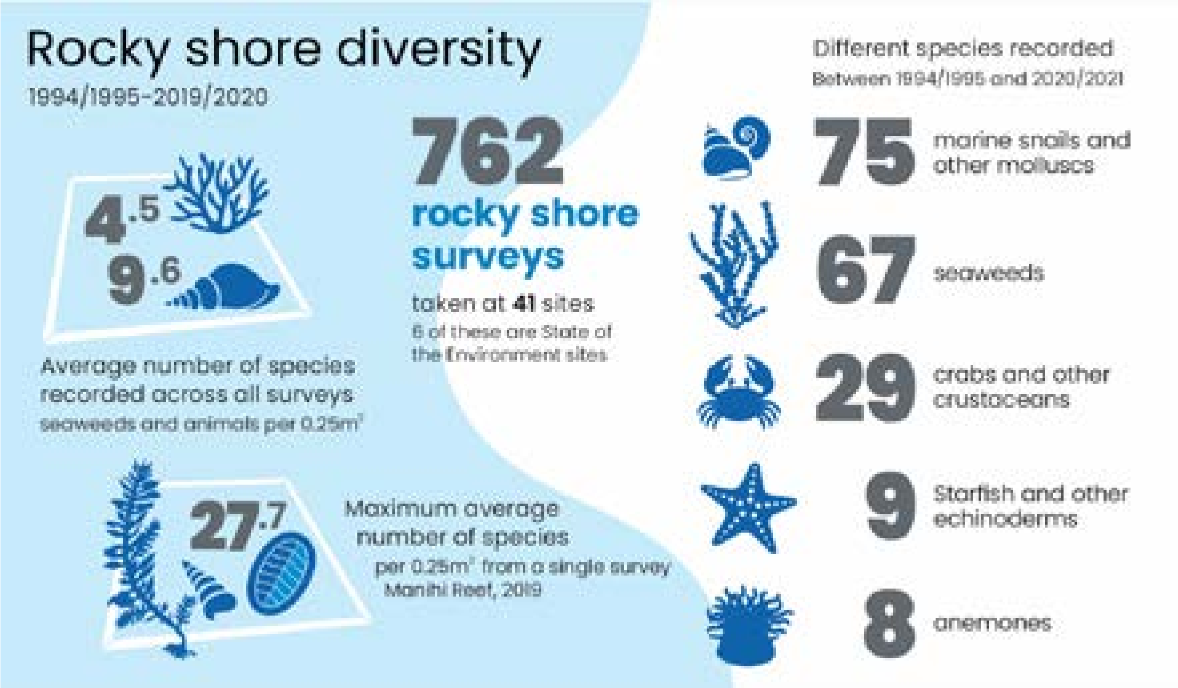
Results from 2015 to 2020 were consistent with those of previous surveys, and reflect key differences in intertidal rocky reef habitat and exposure around the Taranaki coastline. Manihi Reef had the greatest diversity of species and nearly double the number of species as Waihi Reef, which had the lowest number of species across all six sites. Waiaua Reef had the lowest Shannon-Wiener diversity index, despite having the second highest average number of species. At the three northernmost reefs, Tūrangi, Orapa and Mangati, diversity scores for both metrics were more comparable. Over the five-year period, sand cover was typically highest at Mangati and Orapa Reefs, but virtually absent at Manihi Reef.



Box and whisker plots showing the range in sand coverage at the different monitoring sites between 2015 and 2020.



Median survey results from the six State of the Environment monitoring sites between 2015 and 2020.



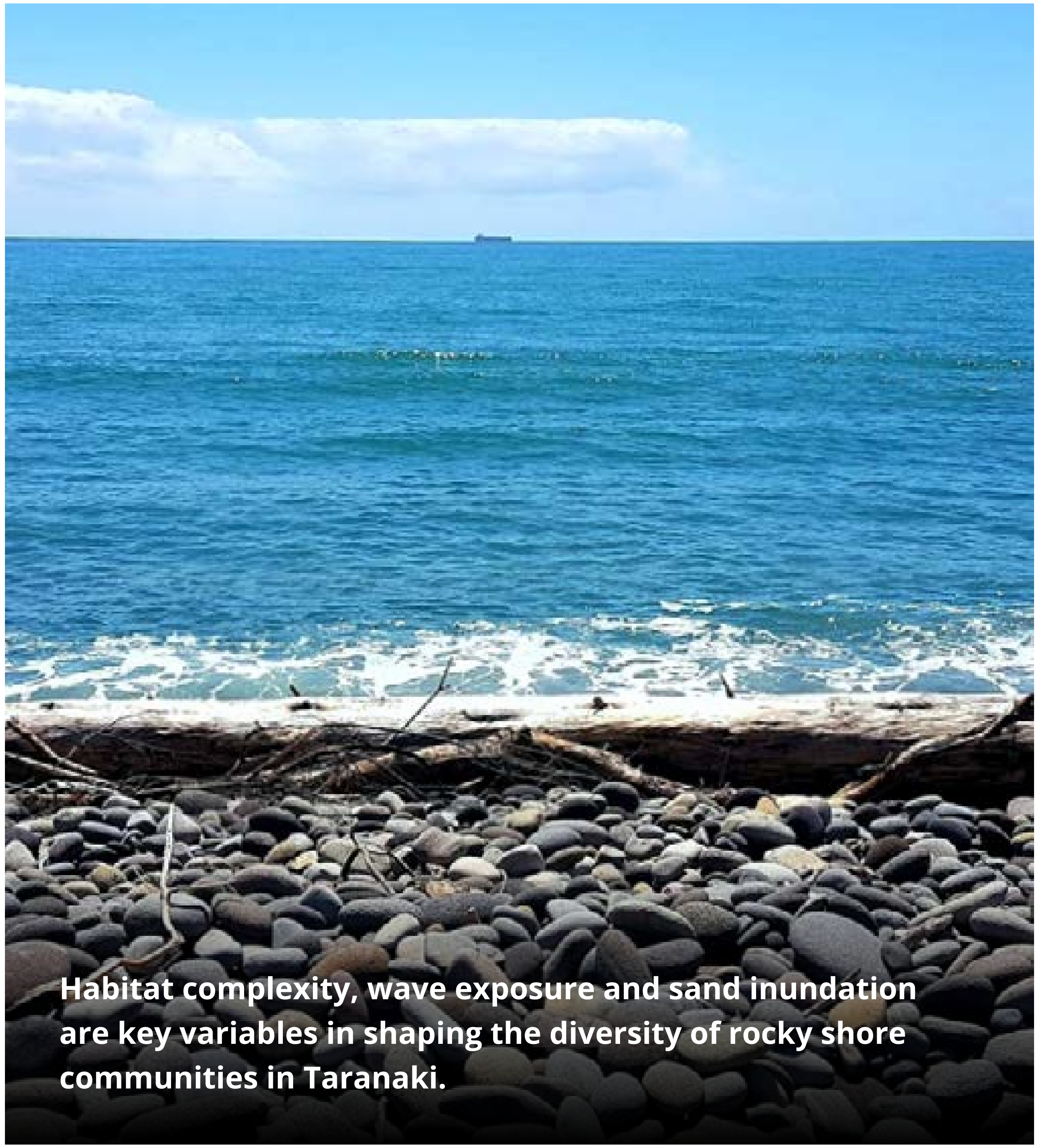
Long-term (1995-2020) trends were assessed with and without correction for sand cover, in order to determine whether any may be attributed to the impact of sand inundation. The results showed that sand cover negatively influenced trends in the average number of species found at three sites. At Mangati and Waiaua Reefs, trends were no longer decreasing when sand cover was taken into account, and at Orapa Reef, an indeterminate trend became an increasing trend. All three of these sites have been subjected to significant sand inundation events in the past. Waihi Reef, another site impacted by sand inundation, had a very likely decreasing trend that did not change following a correction for sand inundation, suggesting that this decline is being driven by other factors. A very likely increasing trend was found for the Manihi Reef site, and no trend was found for Tūrangi Reef. The trend with the greatest rate of change was the sand-adjusted trend at Orapa Reef, which was increasing by 1% per year. This rate of increase equates to the average number of species found at this site increasing by one every seven years.

Likely decreasing trends in Shannon-Wiener diversity index were found at two sites, and very likely decreasing trends were found at three sites. When sand correction was applied to the data, decreasing trends became increasing trends at Mangati and Orapa Reefs; reaffirming the influence of sand inundation events at these sites.

Short-term variability may be driven by sporadic events such as periodic sand inundation, or other cyclical patterns such as climatic cycles, or recruitment variability of different rocky shore species. Over the short term (2011-2020) period, very likely increasing trends in the mean number of species were identified at five out of six sites, and a likely increasing trend at just one site, Waihi Reef. The annual rates of change in these trends ranged from 2% at Waihi Reef to 8% at Waiaua Reef; much higher than those of the long-term trends.
In some instances, adjusting for sand cover lessened the magnitude of the trends. Five out of the six short-term trends for Shannon-Wiener diversity index were very likely increasing, while there was no trend found at Waihi Reef.

Given the major role that habitat complexity, wave exposure and sand inundation play in shaping rocky shore communities on the Taranaki coast, it can be difficult to determine subtle changes that may be attributed to human activities. Although more noticeable impacts have been detected in the past, this monitoring programme has not

linked any changes in rocky reef communities to human activities, such as wastewater discharges, in recent years. A separate Council monitoring programme however, has demonstrated the effects of wastewater contaminants in nearby shellfish on the rocky shore.



Habitat complexity, wave exposure and sand inundation are key variables in shaping the diversity of rocky shore communities in Taranaki.

Canny canine nose helps protect penguins

Penguin detector dog Rua with handler Jo Sim.

You may be unaware of the company you're keeping when you're on the New Plymouth Coastal Walkway or fishing from the breakwater at Port Taranaki.

Not only are there likely to be kororā, or little blue penguins, deep in crevices between the rocks all around and under you, but they are probably in numbers that would surprise you.

Rua the penguin detector dog knows. Handler Jo Sim has put him to work along the North Taranaki coastline, from the New Plymouth CBD out to Waitara, and at Port Taranaki.

"If people join me, they're always very surprised at how many we find," she says. "It surprised me, too, when I first started doing this work."

Kororā are particularly vulnerable to disturbance, so the information gathered by Jo and Rua is vital for their protection. For example, under the Council's new Coastal Plan, any work on maintaining and altering coastal structures in Taranaki should have 'no adverse effects on significant indigenous biodiversity' including kororā. First, find your kororā.

It is also valuable information at district level, where it can be fed into decisions on planning, recreation and even dog control bylaws.

Horowhenua-based Jo and Rua, with apprentice pup Miro, don't limit themselves to burrowing seabirds. They specialise in a wide range of native bird species, including kiwi. The human-canine team is in hot demand all over the motu and they've even worked in the Chatham Islands.

So how do you train a dog to find penguins? Or any species, for that matter? With a great deal of patience, says Jo. She trains her own animals, to the standard required to win accreditation by the Department of Conservation.

The first step is obedience training, then introducing the concept of indicating the presence of the target species. After that, the dog is introduced to the target's scent.

"With penguins, it's relatively easy because they have a strong and distinctive smell. I use penguin feathers, mainly."

Nine-year-old Rua has proved to be brilliant, Jo says – especially considering she was unsure about taking him in when he needed a new home. Miro has also shown good promise but at just a year old, "he still has some growing up to do".

But what's in it for the dogs? Surprisingly, it's generally reward enough to see the bird at the end of the trail. "They're so happy just to see it – their delight is obvious," says Jo. "Penguins are a bit of a challenge, though, because they're way down in their burrows and the dogs won't see them. So I've started using treats when we're looking for penguins."

Apart from the numbers found, there's one other aspect of their kororā quests that has surprised Jo: finding penguins and paradise ducks as nesting neighbours.

"It's more in embankments than in boulder banks – you peer down a burrow expecting to see another penguin, and a big white duck head stares back up at you."

Shellfish monitoring

Green-lipped mussels are filter-feeders, which means they filter seawater and consume the plankton and tiny particles of organic matter. During this filter-feeding process, mussels can end up ingesting and accumulating environmental contaminants that may also be in the water. Their ability to accumulate contaminants can lead to them becoming unsuitable for human consumption, but this also means they can be used as a bio-indicator for environmental monitoring purposes.

The Council monitors mussel reefs in the vicinity of the New Plymouth and Hāwera wastewater outfalls in order to assess potential impacts of the discharges over time. Norovirus and heavy metals have been the main contaminants of interest over the last five years.

Norovirus

Noroviruses are infectious to humans and can cause vomiting and diarrhoea when ingested. Municipal wastewater contains varying levels of norovirus, which can then pose an environmental health risk when the wastewater discharges into the sea. Norovirus infections can result from ingesting contaminated seawater; however, there is a higher risk of infection from consuming raw shellfish.

Between 2015 and 2020, five out of the eight mussel samples collected from Waiwhakaiho Reef were contaminated with norovirus, although mostly at low concentrations. Over the same period, all seven samples collected from Tiromoana Reef, just north of Bell Block, returned negative results. These differing results are likely related to the distance of the two sites from the outfall. Although there was no norovirus was detected at Tiromoana Reef during the monitoring period, it has been detected in the past.

Mussels were also collected from three reefs between Denby Road and the Tangāhoe River Mouth in relation to the Hāwera wastewater outfall. Based on the nine sampling occasions over the five years to 2020, at least one of the three sites was affected by low levels of norovirus 56% of the time, and two or more sites were affected 33% of the time.

Proportion of mussel samples collected near New Plymouth (left) and Hāwera (right) that tested positive for norovirus between 2015 and 2020.

Heavy metals

Heavy metals exist naturally in the environment at low levels, but can become toxic above certain concentrations and pose a health risk when they accumulate in kaimoana. Potential sources of heavy metals include human wastewater and waste products from industrial processes discharged into the environment.

In Taranaki, these discharges are monitored and regulated to prevent negative impacts at the coast. However, wastewater discharges are not the only source of elevated metals in the environment. When it rains, stormwater washes metal contaminants from land (particularly in urban environments) into rivers, streams, and eventually the coast via diffuse run-off pathways and piped stormwater discharges.

From 2015 to 2020, New Plymouth mussels were tested for metals at East End Beach, Waiwhakaiho Reef and Tiromoana Reef, and Hāwera mussels were tested at two sites at the southern ends of Waihi and Pukeroa Reefs. All mussels had concentrations of metals well within the applicable food safety guidelines.

What we’re doing

Pātea Reef research

Research is underway to help improve our knowledge of subtidal reefs in the South Taranaki Bight (STB) through a combination of community and Council-led initiatives.

During 2020-2021, NIWA researchers visited South Taranaki waters to undertake mapping of the seafloor of targeted areas using acoustic multi-beam technology. Biological information was collected through videos and images of the different reefs using an underwater tow camera system. All up, roughly 76 hours of survey vessel time was spent in the STB, producing high-resolution bathymetry data for a number of previously uncharted reefs, and assessments of the biological communities for a subset of those.

The Council has supported this research by securing funding through the regional council Envirolink scheme for NIWA to collate, analyse and report on the survey data to ensure this valuable information is accessible for the Council and the community going forward.

In the past, subtidal reefs in Taranaki have received little scientific attention. The community-led citizen science initiative Project Reef has been working hard to bring these important habitats to the attention of the researchers and the wider public.

Where we’re heading

Impacts of a changing climate

In order to understand the future of rocky reef communities in Taranaki, it is helpful to look back in time. We know that sand supply to the coast increased following a major erosion event on the mountain in 1998, which turned sections of rocky shoreline into sandy beaches. Erosion has been ongoing, with another significant event in 2008. Researchers have linked these erosion events to a possible increasing trend in storm intensity, based on increasing flood peaks observed in stream flow monitoring data.

A recent study by Rapizo and others (2020) also found evidence to suggest that the Taranaki wave climate has changed over the last 40 years, including an increasing trend in significant wave height during storm peaks. The influence of these factors is likely to continue changing over time, as will that of other factors such as sediment and nutrient run-off from land, invasive species, and global issues such as sea level rise, ocean warming and ocean acidification.

Ongoing monitoring and further investigation will be critical for understanding how local rocky reef communities respond, and how we best manage them going forward.