Offshore reef discovery on Pātea Bank

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There is a lack of detailed survey data for offshore seafloor habitats in the Taranaki Coastal Marine Area (CMA). This is largely owing to the significant cost and resourcing associated with bathymetric surveying, as well as the challenging west coast sea conditions. Although this knowledge gap is not unique to Taranaki, it is one that needs to be addressed in order to enable informed and effective management of the CMA. The South Taranaki Bight (STB) has received some attention in recent years due to the resource consent applications for sand mining and more recently, interest from the offshore wind industry. However, it remains an area where further investigations are especially warranted.

The STB is a unique ecological area for a number of reasons. With regards to seafloor habitats, rocky reefs are known to exist at unusually far distances from shore; occurring on the relatively shallow, yet wide continental shelf in the STB (Figure 1). This area is also referred to as the Pātea Bank. Some of the reefs on the Pātea Bank are far enough from shore that the impacts of sediment from rivers and coastal erosion are reduced, yet they remain shallow enough for sufficient light to reach the seabed to support microalgae and seaweed growth. Under optimal conditions such as these, rocky reefs provide a stable and enduring habitat, which can support diverse and thriving biological communities.

There is a wealth of local, anecdotal knowledge held for numerous rocky reefs on the Pātea Bank. However, to date there has been a lack of scientific research carried out to formally document and support this knowledge. The North and South Traps are perhaps the most well-known reefs, renowned for their unique physical characteristics and the abundant and diverse biological communities that they support. More recently, a local citizen science project, Project Reef, has embarked on a project to survey and document another reef on the Pātea Bank[1]. The work carried out by this group has highlighted the abundance and diversity of macroalgae, seafloor

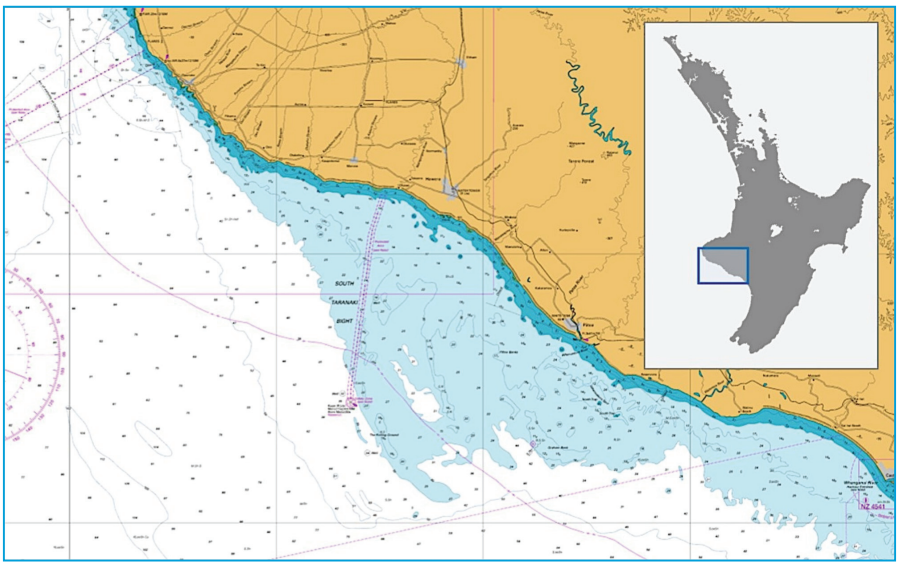

Figure 1: South Taranaki Bight, from LINZ Chart 45. Dark blue area shows 0-10 m water depth, light blue area shows 11-30 m water depth, white area shows > 30 m water depth, CMA boundary (12 nm) shown with thin pink line.

invertebrates (e.g. sponges, bryozoans, anemones) and reef fish found at 'Project Reef' (Figure 2). Taranaki Regional Council was a science partner with the Project Reef team at its inception back in 2016, through the Curious Minds Participatory Science Platform funded by the Ministry for Business, Innovation and Employment (MBIE). In 2019, Project Reef were awarded the Terry Healy Project Award by the NZ Coastal Society, for the contribution the team had made to the marine environment through science, education and community engagement.

Given what is known about the reefs on the Pātea Bank that have been subjected to scientific investigation, there is an obvious need to learn more about the remaining reef systems. However, the vast majority of rocky reefs on the Pātea Bank remain uncharted. Due to their low relief, and scattered nature, previous navigational chart surveys have detected very few reefs in this area.

Figure 2: Sponges, algae and reef fish at Project Reef (photo supplied by Project Reef Team).

(1) See www.projectreefsouthtaranaki.org

Therefore, acquisition of high-resolution bathymetry data is a critical first step for scientific mapping and investigation of these reefs.

In early 2020, after engaging with the Project Reef Team, NIWA decided to incorporate the Pātea Bank into a wider MBIE-funded research project, which was investigating juvenile blue cod habitats.

In June 2020, the *RV Kaharoa* travelled to the Pātea Bank to carry out high-resolution seafloor bathymetry surveying of the Project Reef and several other locations nearby that had been provided by local fishers and divers. A 250 kilometre long track of seafloor was surveyed, covering a total of 61.5 km^2, and taking 30 hours to complete. The survey found a number of low relief reef fields (<2 metres in height), and a couple of taller and more extensive reef structures. Interestingly, based on the survey data, the Project Reef was one of the more subtle seafloor features detected.

In March 2021, the *RV Ikatere* travelled to the Pātea Bank in order to 'ground truth' a subset of the reef structures, and assess the associated biological communities. This survey component was carried out over three days using NIWA's CoastCam (a towed underwater video sled), and baited fish traps.

Because it was not possible to re-visit and 'ground truth' the entire survey area, a Benthic Terrain Model was used to determine likely rocky reef habitat, based on the characteristics of the bathymetry data that was collected in June 2020. Analysis of the data identified numerous features throughout the survey area that were likely to be rocky reefs. Of the 61.5 km^2 surveyed area, 9.3% (or 5.7 km^2) was classified as probable rocky reef (Figure 3). Reef topography varied from scattered, low relief patch reefs and knolls, to extensive linear ridges extending for kilometres in length. Interestingly, likely reef locations that had previously been identified by the Department of Conservation (based on abrupt changes in bathymetry using existing navigational charts), were often not supported by the results of this multi-beam survey, where there was overlap (Figure 3).

The 'ground truth' surveys verified the presence of rocky reef habitat at all fourteen target sites (Figure 3, Figure 4). Median reef depths ranged from 17.3 to 35.5 metres, and reef geologies included mudstone/papa,

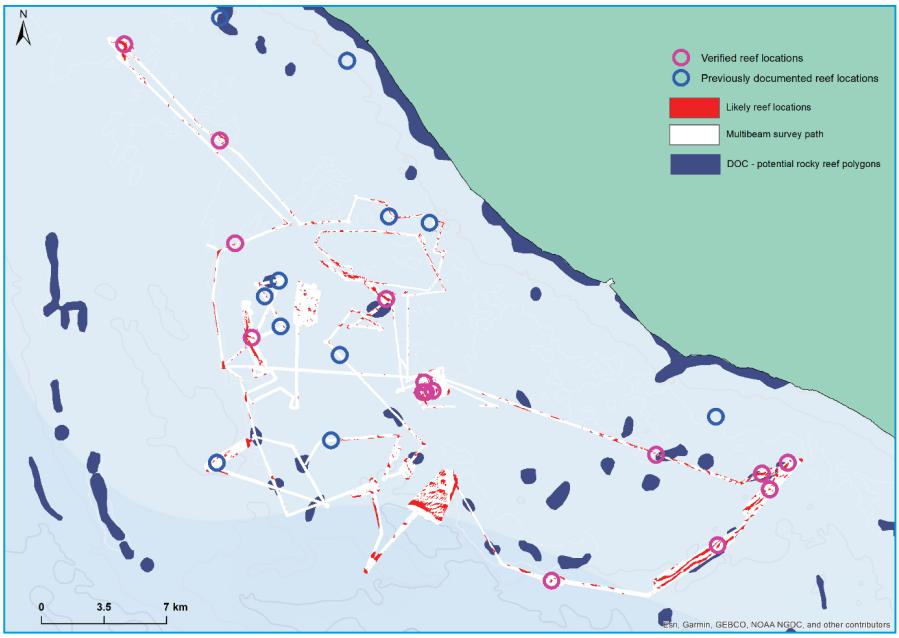

Figure 3: Known and likely reefs (by science survey) of Pātea Bank; circles denote reefs verified with cameras, red polygons are other likely reefs encountered during multibeam sonar mapping, and the blue polygons putative reefs from DOC assessment of abrupt bathymetric changes on old fairing sheets (figure from report).

sandstone and limestone. A range of biogenic habitat features were identified, including kelp forests, sponge gardens, macroalgal meadows, and bryozoan fields. A total of 39 different sponge species and 30 fish species were identified across the fourteen reef sites. Evidence of blue cod nurseries was found at four sites.

A very large data-series was collected during these two surveys, the analysis of which was beyond the scope of the original MBIE-funded research programme (most of the seafloor bathymetry coverage, and multiple video tows). Therefore, the Council applied for an Envirolink Medium Advice Grant in order to fund the analysis and reporting of the entire data-series, thereby ensuring full value was attained from the original surveys. A link to the full report is provided below.

The survey results found that subtidal reef habitat is much more common and widespread on the Pātea Bank than previously documented in the scientific literature. Furthermore, the reefs were found to be associated with extensive areas of important biogenic habitat and abundant reef fish assemblages. This information helps to fill existing knowledge gaps and will support informed and effective decision making into the future. However, it is

Figure 4: Still image captured from towed video footage at one of the verified reef locations showing rocky reef with kelp (Ecklonia radiata) and sponges (Ecionemia alata) present.

important to note that only a small, albeit targeted area within the STB was surveyed as part of this investigation. As such, these results highlight the need for further surveying, as there are likely many more reefs and biogenic habitats that are yet to be discovered.

Acknowledgements

Taranaki Regional Council would like to thank NIWA for carrying out this valuable work, and also acknowledge the important role that the Project Reef team played in initiating, and contributing to this research. Thanks also to the local fishers and divers who made this survey possible by sharing the reef locations which informed the survey design. Lastly, thanks to the MBIE Envirolink scheme for funding the data analysis and report.

Link to the full report

Offshore subtidal rocky reef habitats on Pātea Bank, South Taranaki

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https://www.trc.govt.nz/council/plans-and-reports/research-and-reviews/coastal/

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News you might have missed

Online news can be overwhelming – so much content, but so little time! Continuing our semi-regular news roundup segment, here are some unusual, thought-provoking and obscure stories that might have passed you by…

Coastal erosion

Coastal erosion is an issue in many places (New Zealand included), but a series of pictures over 30 years demonstrates just how rapidly and drastically the process can occur. The story comes from the English town of Hemsby, which has lost up to 40 metres of coastline since 2017 (https://www.edp24.co.uk/news/23393574.hemsby-erosion-pictures-show-30-years-devastation). One resident resorted to dragging his house inland, but is now having to do so again just six years later (https://www.greatyarmouthmercury.co.uk/news/20994363.living-dangerously-lance-martin-back-brink). Still in England, this time in Tenby, cliff erosion is being attributed to an unusual culprit – to find out what, see https://www.theguardian.com/uk-news/2023/mar/06/giant-rats-spark-fears-of-cliff-erosion-in-tenby.

Human impacts

Human impacts on the sea and coastal environments take many forms including, from this crop of stories, undersea cables, beach litter and ship noise.

Undersea cables can create a variety of hazards for marine life, including the not-yet fully understood impacts of EMF (electromagnetic fields). For more, see https://www.bbc.com/future/article/20230201-how-undersea-cables-may-affect-marine-life.

Human litter impacts just about every aquatic environment there is, but what are some of the stranger items washing up on shore? For a selection, see https://www.bbc.com/future/article/20230222-the-strange-items-washing-up-on-beaches.

Finally, a pair of stories on the impacts of noise. In the first, it seems dolphins are increasingly having to shout at each other to overcome human created noise, but in places the level of noise is too much for them to compensate and there can be some unfortunate consequences – see https://www.theguardian.com/environment/2023/jan/12/dolphins-shout-compensate-human-made-background-noise. Meanwhile, on northern Canada's Baffin Island, underwater ship noise – likened to an underwater rock concert – has doubled over the last six years, again with unfortunate consequences – see https://www.theguardian.com/environment/2023/jan/25/inuit-warn-noise-pollution-ships-arctic-narwhals.

Marine life

If you're a fan of giant undersea creatures, especially ones we don't know about, the BBC has recently published a story on efforts to find them. This is being seen as urgent as previously untouched seafloor habitats are succumbing to a myriad of new threats. For the full story, see https://www.bbc.com/future/article/20230209-how-deep-sea-creatures-are-discovered. On a slightly happier note, PhysOrg reports on the results of a new study that highlights the role of the humble mussel in protecting and building coastal ecosystems – see https://phys.org/news/2023-03-focusing-acres-coastal-areas-mussels.html.

Technology

Starting with old technology, the longevity of Roman concrete is well known, but why is this the case? A new study has suggested that the white chunks found in Roman concrete – once dismissed as evidence of sloppy mixing or poor-quality raw material – is, in fact, what gives the concrete both its longevity and the ability to 'heal' itself. Replicating the Roman formula has obvious implications for modern concrete structures, particularly those exposed to adverse conditions. For more, see https://edition.cnn.com/style/article/roman-concrete-mystery-ingredient-scn/index.html.

Turning to new technology, fresh water scarcity is a growing problem in many parts of the world. Desalination is a well known technique to provide fresh water in coastal areas, but many of the current methods of doing this are energy intensive and create potentially damaging brine. A new floating greenhouse structure has been developed that requires no electricity and produces no brine. For more, see https://edition.cnn.com/2022/09/12/middleeast/desalination-manhat-abu-dhabi-scn-spc-intl/index.html.