Te Hunga Takutai o Aotearoa
NEW ZEALAND COASTAL SOCIETY

Coastal News

Newsletter of the New Zealand Coastal Society: a Technical Group of Engineering New Zealand

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Lurking in the deep...

The sub-tidal reefs on Pātea Bank are relatively unique in Aoteraoa, unusually distant from the shore, and far more numerous than previously imagined. To find out more, see the article beginning on page 3.

Photo: Project Reef

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Word from the Chair

Kia ora koutou katoa, welcome to the first edition of the *Coastal News* for 2023. Although we're only a few months into the year, it feels like a lot has happened already. Our thoughts go out to all of those who have been affected by some of the recent high-impact weather events, particularly Cyclone Gabrielle. Some of these impacts are mentioned briefly in our News from the Regions updates. We look forward to learning more about these impacts in future issues of *Coastal News*, but for now we acknowledge that there are many regions still dealing with the effects of these storms. We wish everyone all the very best for what is likely to be a long recovery.

Reflecting on 2022, we can look back on a very busy year at NZCS. Our annual conference was held on Waiheke Island in November, coinciding with the release of our fifth Special Publication, which we hope you have all enjoyed. Our 30th conference also gave us the opportunity to gather in person for the first time since 2019 – a very special occasion and well overdue. Andrew Allison provides a review of this conference in this issue. We would like to extend a particular thank you to the local organising committee who did a stellar job in organising such a successful conference in a remote location – great work team!

As we start 2023, we'd like to acknowledge Mark Ivamy, who is stepping down from his role as co-Chair of NZCS. Mark's leadership skills and passion for the coast made him a fantastic person to work alongside, and he has set a high bar for this year's committee. We will miss Mark's insights and broad smile around the committee table. We are happy to share that Sam Morgan has stepped up

into the Deputy Chair role, and are also excited to welcome Sarah McSweeney (University of Canterbury) and Shari Gallop (University of Waikato, PDP) to our management committee. Sarah takes up the University and Education Coordinator role, while Shari and Bryony Miller will work together as part of the newly established Te Komiti Māori. See page 19 for an overview of our Management Committee members and their portfolios for 2023. We also welcome our new Canterbury-based Regional Representatives, Kate MacDonald and Tommaso Alestra, on page 15.

In this issue of *Coastal News*, you'll find articles on subtidal reefs on the Pātea Bank, how mangroves function as eco-engineers, and what it will take to improve the state of the Hawke's Bay marine environment. NZCS PhD Scholarship winner Benjamin Jones (University of Auckland) discusses the vulnerability of coastal archaeological sites to erosion and how this might affect future management plans. In our University and Education news, Christo Rautenbach (NIWA) shares about the application of artificial intelligence to rip current detection. We also hear about kayaking for science and some new laboratory experiments on breakwater repair options.

We hope you enjoy this issue!

Amy Robinson and Colin Whittaker
NZ Coastal Society Co-Chairs

About the NZCS

The New Zealand Coastal Society was inaugurated in 1992 'to promote and advance sustainable management of the coastal environment'. The society provides a forum for those with a genuine interest in the coastal zone to communicate amongst themselves and with the public. The society's mission is to take a leading role in facilitating robust discussion and nationally-coordinated interactions to better manage and learn about our coastal and marine environment. The society currently has over 400 members based in New Zealand and overseas, including representatives from a wide range of coastal science, engineering and planning disciplines, employed in the consulting industry; local, regional and central government; research centres; and universities.

Membership applications should be sent to the NZCS Administrator Renée Coutts (nzcoastalsociety@gmail.com).

Offshore reef discovery on Pātea Bank

Thomas McElroy, Taranaki Regional Council

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

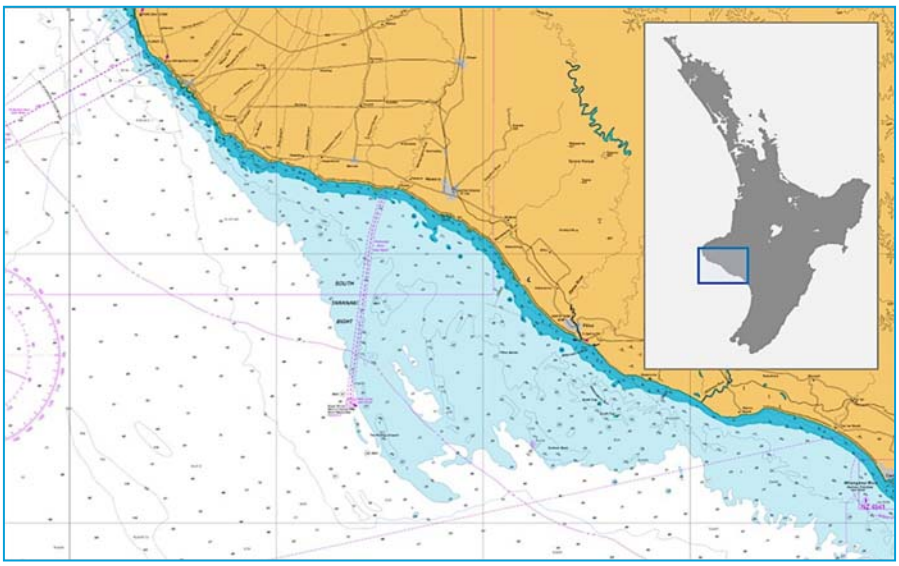

Figure 1: South Taranaki Bight, from LINZ Chart 45. Dark blue area shows 0-10 m water depth, light blue area shows 11-30 m water depth, white area shows > 30 m water depth, CMA boundary (12 nm) shown with thin pink line.

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, 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.

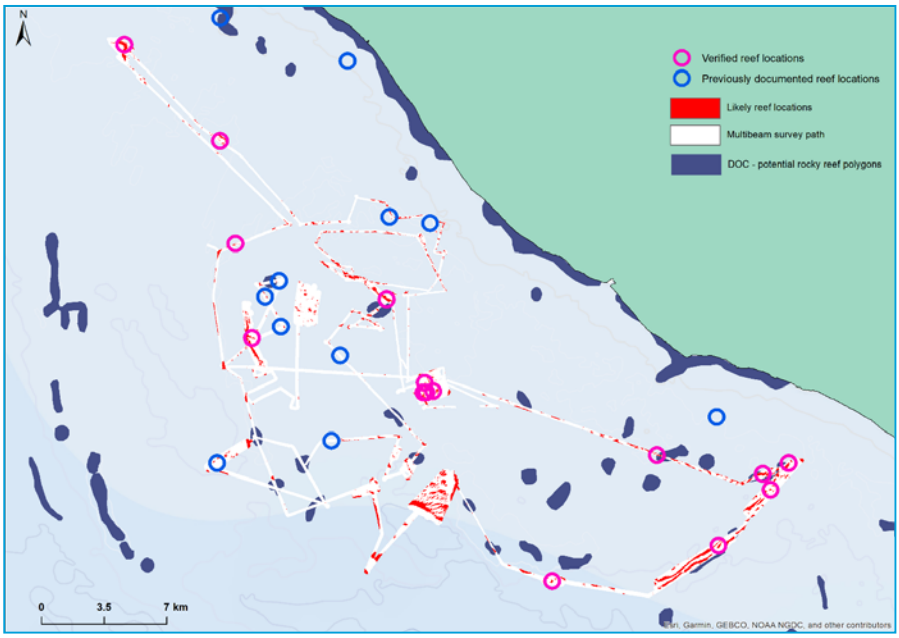

Figure 3: Known and likely reefs (by science survey) of Pātea Bank; circles denote reefs verified with cameras, red polygons are other likely reefs encountered during multibeam sonar mapping, and the blue polygons putative reefs from DOC assessment of abrupt bathymetric changes on old fairing sheets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

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

Prepared for Taranaki Regional Council, September 2022

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

Relevant contacts

Thomas McElroy (Contributing author, TRC) – thomas.mcelroy@trc.govt.nz
Karen Pratt (Project Reef) – connectivity.karen@gmail.com
Mark Morrison (NIWA, lead report author) – Mark.Morrison@niwa.co.nz

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.

Sustainability in action: mangroves as eco-engineers

Gordon S Maxwell and Brenda Fung

The term sustainability appears in almost every article, paper or political statement one sights these days. Wisely, the President of Engineering New Zealand, Dr Tim Fisher, highlights a vision for New Zealand based on 'resilient, sustainable economies and communities' (EG, September, 2022). For over 30 years the New Zealand Coastal Society has brought much needed focus to the huge and diverse shoreline of Aotearoa. Ecologists and engineers, especially, hold the key that can continue to translate this vision and focus into pragmatic reality; for what is needed most of all today are ways to measure sustainability and case studies of sustainability in action.

In this article we look at a novel yet interesting and hugely practical case study of how the foresight, wisdom, and imagination of a civil engineer ensured the sustained use of mangroves to protect human-made stop banks beside the Piako and Waihou Rivers of the Hauraki Plains. These twin rivers once brought estuarine and marine waters to what were flood plains of this region of Waikato. Without mangroves on the seaward and estuarine sides of the stop banks, coastal erosion was and is an ever-present challenge. Mangroves function as bio-engineers that sustain and maintain the stop banks. The stop banks function to protect the valuable dairy farms of the productive Hauraki Plains from tidal invasion. Figures 1, 2 and 3 illustrate these mangrove eco-engineers in action. A long history of optimistic pioneering in measures to drain the once semi-stagnant waters of this region of New Zealand was described years ago by Gillespie (1948).

More recently, a plant pathogen that was associated with mangrove dieback was found in the mangrove forest ecosystem near Pipiroa, beside the Piako River (Maxwell, 1968; Maxwell, 1971). This microbe is closely related to the causal organism of kauri dieback, as they both belong to the genus *Phytophthora*, a plant destroyer of global significance (Newhook, 1959; Newhook and Podger,1972; Beever 2010; and Hood, 2021). The discovery of this pathogen in mangroves was unwanted bad news to what was the Hauraki Catchment Board (HCB) back in the 1960s and 1970s, which had responsibilities in preventing tidal invasion of the Plains (see the dedication at the end of this article).

Very recently, these mangroves of the Thames Estuary and the twin rivers of the Hauraki Plains, the Waihou and Piako, were the focus of a public debate on mangroves. A parliamentary sub-committee was set up to investigate the issue. The main finding was that most citizens did appreciate the values of mangroves in terms of biodiversity, fisheries protection and stop bank protection, despite some minority counter viewpoints (Maxwell, 2018).

Climate change can be expressed in many ways. One frequently used line on climate change is that of sea-level rise. In the context of our Hauraki Plains case study, this aspect shot into stunning focus when tidal invasion of coastal land hit the news back in January 2018 (*Waikato Times*, January 24, 2018). Coastal roads along the western side of the Coromandel Peninsula and farmland near Miranda on the eastern side of the Firth of Thames experienced a tidal invasion event. This was a costly event and the evidence of salt water shock on pasture was visible, especially where mangrove stands were meagre. Tidal invasion events have been recorded before in the history of the Hauraki Plains. Reports of a shark stranded in a cow

Figure 1: Human (for scale) on the stopbank points towards the seaward mangrove belt; vehicle is adjacent to low lying farmlands of the Hauraki Plains. The Piako River flows just seaward of the mangrove belt (Photo: Gordon S Maxwell).

Figure 2: Stopbank protected by mangrove forest beside the Piako River on the Hauraki Plains, Waikato region, February 7 2023 (Photo: Gordon S Maxwell).

shed near the stop banks of the Piako a kilometre from Pipiroa exist (Maxwell, 1971). Mangroves feature in Māori culture and are valued. Indeed, the Māori name for the New Zealand mangrove is *Manawa*, which heralds an ecosystem respect system in which *Manawa* means heart. *Manawa* is like the mother of the harbour for fisheries (Kennedy, 2018).

Today, some 64,000 ha of valuable farmland worth NZ$34,265 per ha exists on the Hauraki Plains. In modern math terms the value can be expressed as 2.216946 e 9 in $. Expressed in English rather than obscure maths, this equates to some 2.2 billion dollars worth of property: a colossal figure. The mangrove belts on the estuarine and seaward side of the stop banks which decorate the Plains, are providing an ecologically based service which is of massive economic importance. This importance of mangroves can be measured in many ways, of which fisheries (Paphavasit et al, 2009) and stop bank protection are perhaps the two top examples. In the southern islands of Japan's Okinawa archipelago, shelter from cyclones (typhoons) is another (Maxwell, 2006).

The case study described above provides a much-needed example of how we can put a dollar value on what some books and scientific papers describe as 'the goods and services' of ecological and biological resources. For far too long we have just made comments and claims relating to the value of natural resources. Figures are rare or absent. The UK Sustainability Development Strategy of March 2005 highlighted the idea that we must respect natural resources to allow ecosystems to provide the life and economic support systems to do their job; in short people and their economies must have a strategy of 'living on earth's income rather than eroding its capital'.

As shown by Maxwell and Fung (2015) sustainability can be applied even in ultra-urban environments like most of high-rise Hong Kong. Here in one of the world's top financial hubs, climate change and sustainability has penetrated corporate business plans and statements. The concept has relevance and power. In an earlier edition of *Hong Kong Engineer* (once known as *Asia Engineer*) Irene Or advocated that we avoid allowing the word sustainability to be some sort of panacea without real meaning (Or, 2000).

What better way to inject real meaning into the twin terms of sustainability and sustainable development than quantifying

Figure 3: Waihou River edge, Firth of Thames in skyline, mangrove belt, stopbank and dairy cattle on farmland protected by the stopbank/mangrove system (Photo: Gordon S Maxwell).

their value. Our case study of the immense value of mangrove trees and shrubs to the farmlands and coastal settlements of the Hauraki and Coromandel regions does this. And does so in dollars. Engineers and those who are attracted to those professional orientations that see the values of our remarkable New Zealand coastline such as coastal geomorphologists, mangrove ecologists and foresters and conservationists are the sort of people that can help sustain our coastal environment for all in Aotearoa.

The adaptations inherent within Manawa, our New Zealand mangrove, *Avicennia marina*, offer a natural system to sustain a process of adaptation in the face of sea-level rise. This was the very theme highlighted by Lucy Brake in the NZCS Special Publication 5, *Coastal Adaptation*, of November 2022[1].

Dedication

This article is dedicated to the memory of former Chief Engineer of the Hauraki Catchment and Regional Water Boards, RW Harris, DSC, BE who with wisdom and foresight created a Hauraki Catchment Board Scholarship to support the MSc (Hons) research needed to save the mangroves and stop their mortality in the environs of Marshalls Flood Gate, near Pipiroa beside the Piako River (see Maxwell, 1971). These Boards were absorbed into the Waikato Regional Council. The value of mangroves as eco-engineers remains.

(1) *Coastal Adaptation: Adapting to coastal change and hazard risk in Aotearoa New Zealand*, available on the NZCS website www.coastalsociety.org.nz

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NZCS Regional Representatives

Northland	**Laura Shaft** lauras@nrc.govt.nz	***Hawke's Bay***	**José Beyá** jose@ihbeya.com
Auckland	**Lara Clarke** lara.clarke@aucklandcouncil.govt.nz	***Gisborne***	**Murry Cave** Murry.Cave@gdc.govt.nz
	Matthew McNeil Matthew.McNeil@aucklandcouncil.govt.nz	***Taranaki***	*Currently vacant*
	Andrew Allison andrew.allison@niwa.co.nz	***Wellington***	**Verity Taylor** VTaylor@tonkintaylor.co.nz
	Eddie Beetham EBeetham@tonkintaylor.co.nz		**Holly Blakely** hblakely@tonkintaylor.co.nz
Waikato	**Jamie Boyle** jamie.boyle@tcdc.govt.nz	***Upper South***	**Lisa Marquardt** lisa.marquardt@pdp.co.nz
	Joshua Sargent js535@students.waikato.ac.nz	***West Coast***	**Don Neale** dneale@doc.govt.nz
	William Dobbin William.Dobbin@stantec.com	***Canterbury***	**Kate MacDonald** Kate.MacDonald@jacobs.com
Bay of Plenty	**Jonathan Clarke** JClarke@tonkintaylor.co.nz		**Tommaso Alestra** Tommaso.Alestra@boffamiskell.co.nz
	Scott Murray SMurray@tonkintaylor.co.nz	***Otago***	*Currently vacant*
	Alison Clarke alisonc@4sight.co.nz	***Southland***	**Sorrel O'Connell-Milne** sorrelomilne@gmail.com

Investigating coastal archaeological vulnerability in Aotearoa New Zealand

Benjamin D Jones

Coastal erosion poses a significant threat to archaeological sites in Aotearoa/New Zealand, as it can result in the permanent removal of these invaluable cultural and historical places. According to Heritage New Zealand, any place in Aotearoa associated with human activity that occurred before 1900 and provides or may provide evidence relating to the history of New Zealand through investigation by archaeological methods is considered an archaeological site. Approximately 12% (9054) of all known archaeological sites in Aotearoa are situated within 1 km of sandy coastlines.

The coastal areas of Poupouwhenua Bream Bay, Marsden Pt, Northland have been under the watchful eye of Patuharakeke kaitiaki who are committed to monitoring the eroding archaeological sites and the taonga they contain. The increasingly severe weather conditions we are experiencing and expecting are painting a picture where the future of these precious cultural treasures may be lost. To mitigate such losses, the Patuharakeke Taiao unit, as part of their larger Cultural Landscape Management Plan, has set out objectives to map and ground truth archaeological sites, and conduct further investigations and link their stories to them through story maps and cultural landscape mapping. Such an approach can help ensure the middens' survival for future generations.

My PhD research at the University of Auckland is being undertaken in collaboration with the Patuharakeke Iwi Trust board with the objective of studying an eroding midden to gain insights into the effects and prospects of such sites in the face of coastal erosion. To analyse an exposed foredune midden, excavation, sampling, and stratigraphic section drawing were implemented using standard archaeological techniques (Figure 1 and Figure 3). Additionally, planform coastal change analysis was conducted over approximately 80 years, utilising both aerial and satellite imagery (Figure 3).

The key findings from the investigation were threefold:

1. Radiocarbon dating revealed midden 1 (Figures 1-3) is nearly two hundred years old (~180 y BP). The vegetation history contained within the midden showed 87% of local coastal vegetation at 180 BP was either Manuka, Kanuka or Pohutukawa, where Ti tree scrub dominated. Pohutukawa is particularly important to the local community and gives credence to local regeneration efforts and this finding indicates that these species have historically occurred in these coastal spaces.

Figure 1: (A) Kirstin Roth is shown excavating a potential seal bone (Photo: Simon Bickler). (B) A drone photo capturing the excavation and slumping to the south. (C) Also taken by drone, this shows the position of the midden in the foredune, facing north (Photo: Aaron Apfel). (D) A top-down view of the excavation. (E) A cleaned-up section of the eroding midden, facing west (Photo: Aaron Apfel). (F) Bugie Carrington, Xvavier Watson, and Matthew Barrett conducting a GPR survey of coastal dunes to provide further subsurface context.

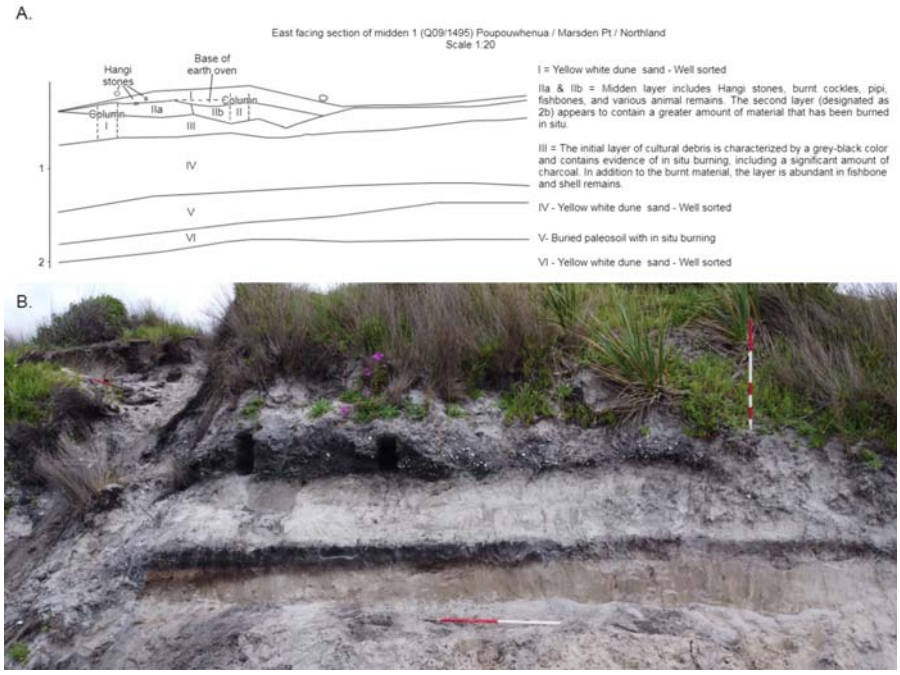


Figure 2: (A) The illustration shows the various layers of the foredune undergoing erosion, as well as the column sampling procedure utilised for 14c dating. (B) Stratigraphy of the east-facing foredune illustrated above, which features a midden layer (upper black layer).

2. The combination of historical coastal change analysis and radiocarbon dating from the midden was a novel approach in our research. The midden proved to be a valuable tool in determining the maximum landward extent of historic trends of coastal erosion. This is because the preservation of an archaeological site within a foredune indicates that coastal erosion has not progressed landward of the site location since the creation of that site. In this way, dating foredune archaeological sites can temporally extend historical analyses of coastal change based on aerial photography, such as that undertaken in this study (Figure 3).

   Using the middens as a reference point, we were able to analyse Marsden Point beach change between 1942 and 2021 (Figure 3). The analysis indicates a declining pattern in the distance between the shoreline and the centroid of the midden over time. Specifically, the distance has decreased from approximately 42 meters in 1942 to around 3 meters in 2020. By examining the age of the well-preserved midden, it has been determined that the coastline has not advanced towards land beyond midden 1 for a minimum of 180 years. Persistent foredune erosion over the past ~80 years has led to the exposure of these archaeological sites, indicating a continued and persistent trend of coastal retreat.

   The finding of chronic foredune erosion is significant, as it suggests that the issue is not merely a short-term phenomenon, but a long-term process that poses an ongoing threat to cultural, social, economic and ecological features along the coast. This information can help inform coastal management strategies, by highlighting the need for proactive measures to mitigate and adapt to the effects of erosion and ensure the preservation of important sites.

3. The ongoing erosion of the dunes is a worrying issue, particularly when severe storms such as Cyclone Gabrielle strike (Figure 4). Analysis of the site post-Cyclone Gabrielle indicated that further erosion has occurred and resulted in the removal of midden 2 (Figure 3) and a significant section of midden 1 (the Marsden Point shoreline, affected by Cyclone Gabrielle, has been made publicly available through the Coastal Change Portal, data.coastalchange.nz). Consequently, erosion has progressed to the extent that even the midden deposited in 1800 is now being affected.

   The research and excavation findings provide crucial insights into the geomorphological processes of the coastal environment, where archaeological and cultural sites contribute to our understanding of coastal change. The study highlights the importance of collecting information and

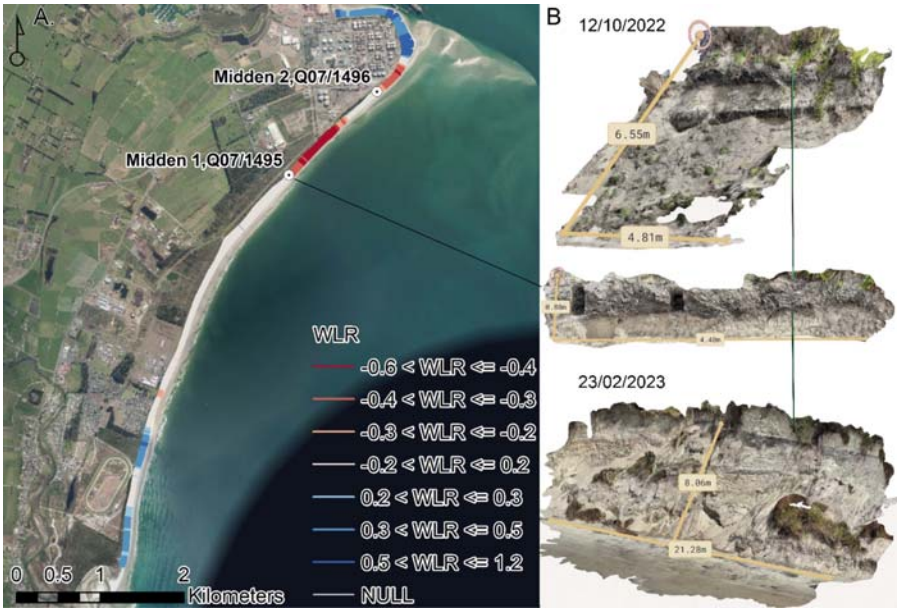


Figure 3: Location of middens on the coast of Poupouwhenua Bream Bay. (A) A weighted linear regression (WLR) analysis conducted to determine the rate of ~80 years coastal change along the coast of Poupouwhenua Bream Bay. (B) 3-D scans of the midden 1 (Q09/1495) within the foredune, before and after Cyclone Gabrielle. The Marsden Point shoreline, affected by Cyclone Gabrielle, has been made publicly available through the Coastal Change Portal (data.coastalchange.nz).

kōrero contained in middens before they succumb to the effects of ongoing coastal erosion. The sites not only help us learn about the past, but also act as valuable teaching tools to educate the local community about coastal landforms and cultural heritage.

During the excavation, we seized the opportunity to engage with the Patuharakeke youth and organised an outreach day for high school students to join us and learn about the excavation process. A range of teaching stations were set up in the field to explore different aspects of the excavation, including coastal geomorphology, faunal analysis, drone survey, ground-penetrating radar (GPR), 3D scanning, and section drawing (Figure 2).

This kind of community engagement is critical to building awareness and understanding of the importance of preserving coastal environments and cultural heritage sites. The findings from the excavation and the outreach event not only advance our scientific knowledge, but also help build relationships with local communities and support ongoing efforts to promote cultural and environmental conservation. The students were highly engaged, and the questions and reflections they brought up were thought-provoking. They inquired about the preservation of these sites, the knowledge that can be gained from middens, and the dynamic nature of coastal change. It was an excellent opportunity to share knowledge and encourage future generations to be mindful of their cultural and natural heritage.

Acknowledgements

We owe much of the success of this excavation and resultant findings to the local help we received from the Patuharakeke Taiao unit Kaitiaki and Iwi Trust board, including Mere Kepa, Julianne Chetham, Ari Carrington, Xzavier Watson, and Bugie Carrington, and volunteers Matthew Barrett, Kirstin Roth, Aaron Aphel, Simon Bickler, and Lovleen Acharya Chowdhury.

Additionally, I am grateful for the support of my supervisors, Mark Dickson, Emma Ryan, Murray Ford, and Daniel Hikuroa, and the funding and access provided by The University of Auckland, The Resilience to Nature's Challenges National Science Challenge (Coastal Programme), Department of Conservation (DOC), and the New Zealand Coastal Society. Their contributions were instrumental in making this project a success.

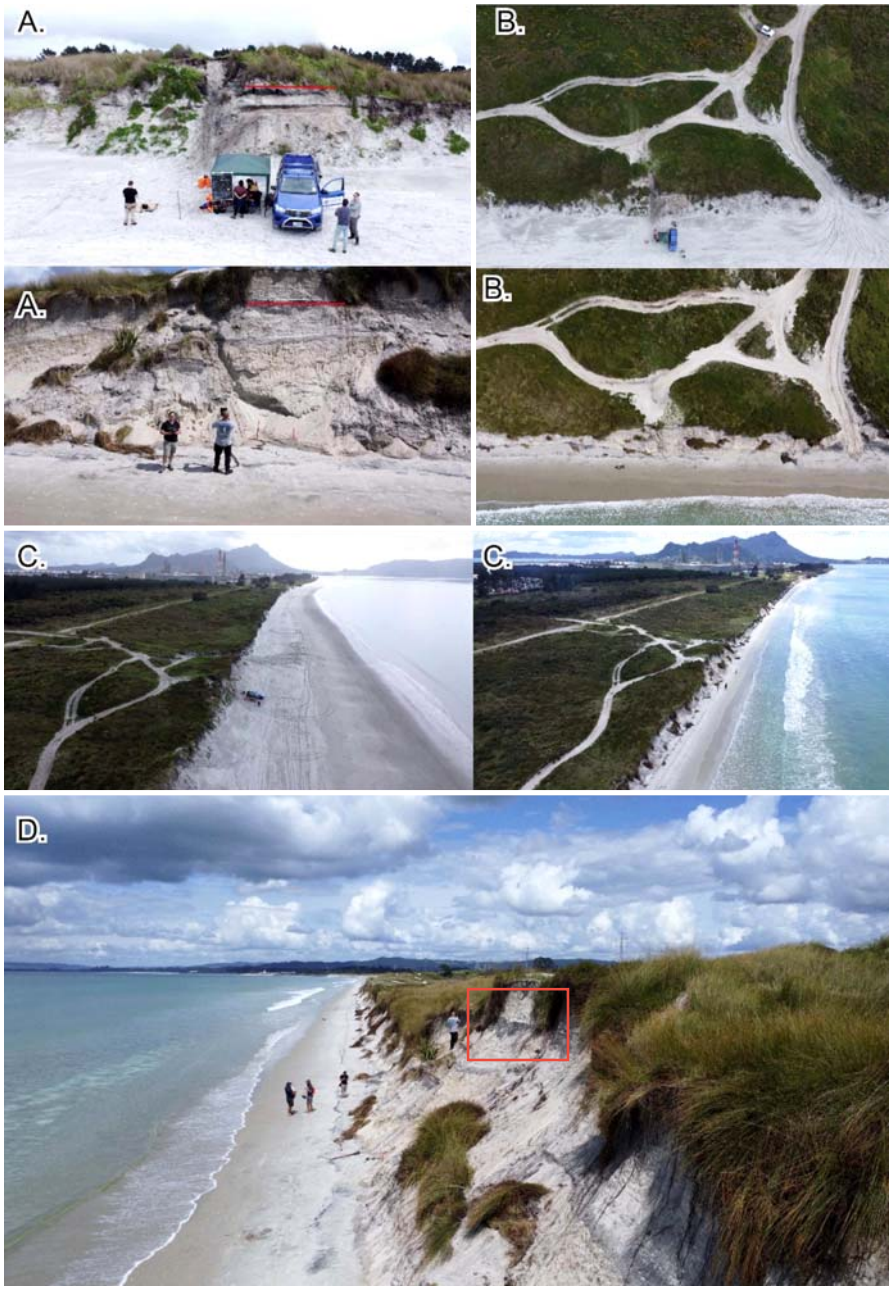


Figure 4: The illustration displays the effects of Cyclone Gabrielle on Poupouwhenua/Breambay in multiple perspectives: (A) A comparison of pre (2022)- and post-cyclone (2023) conditions, with an increased exposure of midden 1 and its removal from the foredune. (B) A top-down perspective, highlighting the loss of the coastal berm and vegetation. (C) An oblique landscape perspective facing north, showing the modified slope of the foredune following the cyclone. (D) The final view illustrates the angle of the foredune and the slumping of vegetation as the dune adjusts to post-cyclone conditions, with a visible black layer (in the red box) representing the slowly eroding midden.

Editor's note

You might have noticed that this issue of *Coastal News* has arrived somewhat later than is usual. This was due to the impacts of the January Auckland flooding event and February's Cyclone Gabrielle – most of the contributors to this issue are based in the upper North Island and many were impacted directly, either personally or through their work. The NZCS and the *Coastal News* Editor are grateful to all those who were still able to contribute, despite the trying conditions and extensive impacts, and we wish them a speedy recovery.

Review: NZCS Annual Conference 2022

The 30th annual conference of the New Zealand Coastal Society was held at Palm Beach Resort on Waiheke Island from 22-25 November 2022, bringing the coastal community together in person for the first time since our Invercargill conference in 2019.

We had a record number of presenters, a great poster session, and four outstanding keynote adresses from Mark Dickson, Marama Muru-Lanning, Raewyn Peart and Paul Kench.

As well keeping up to date with current research and coastal practice, NZCS2022 was a great opportunity to network and see new and exciting coastal locations. As always, the Eric Verstappen Young Professionals Breakfast was a great opportunity for students and early career coastal scientists and planners to pick the brains of established professionals, helping them to forge a path through the first tricky post-study years.

One fieldtrip took attendees to the contrasting northern and southern shorelines of Waiheke, taking in the recreational amenity, coastal process and hazard challenges faced on the motu. The second fieldtrip explored the coastal infrastructure and marine environment of the island, taking in the contentious Kennedy Point marina, Te Matuku oyster farm and some local vineyards.

For those not presenting on the Friday, the event culminated with the Thursday evening conference dinner at Wild on Waiheke, with dinner, drinks, conversation and great banter.

Well-deserved congratulations go to our award winners:

- *Best poster* – Cate Ryan
- *Best student presentation* – Lovleen Chowdhury
- *Runner-up student presentation* – Charline Dalinghaus
- *Best presentation* – Laura Robichaux
- *Runner-up best presentation* – Monique Eade.

Thanks to Connon Andrews and the organising committee for making the event happen, NZCS's own Belen Rada for her awesome photography, and many thanks to our sponsors: NIWA, Boffa Miskell, eCoast, DML, Journal of Marine Science and Engineering, 4Sight Consulting – Part of SLR, Tonkin and Taylor, and Jacobs.

Looking forward to NZCS2023 in an as-yet unknown location!

Andrew Allison
NZCS Auckland Regional Representative

All photos: Belen Rada

News from the regions

Auckland

Lara Clarke, Matthew McNeil, Andrew Allison and Eddie Beetham, Regional Representatives

Cyclone Gabrielle

Cyclone Gabrielle, which had transformed into an extra-tropical storm, significantly impacted the Auckland Region on 12-13 February 2023. The Auckland east coast was subjected to strong onshore winds, storm surge and elevated water levels in the order of 400 mm, and large waves. This event combined with the effects of a prior storm event on 28-29 January. This resulted in damage to a number of coastal assets, coastal erosion, and large coastal slips.

Auckland Council is working on repair or reconstruction of the affected coastal assets, with some sites requiring a temporary short-term response.

Impacts from Cyclone Gabrielle: Murrays Bay (top left and right); Snells Beach seawall (bottom left); and Kennedy Park staircase (bottom right).

Orewa sand transfer

With sand levels on Orewa Beach low following a series of storm events over summer, the impacts of extra-tropical cyclone Gabrielle in February resulted in further significant beach erosion. This triggered an immediate full-scale sand transfer.

Approximately 14,000 m^3 of sand was transferred from the southern end of the beach, and 1,500 m of sand 'scraped' from the lower intertidal area, to replenish sand levels in front of Orewa Reserve and Kinloch Reserve. Working around the tides, works took eight days to complete, utilising three motorscrapers.

Orewa sand transfer: Post storm event erosion (top left and right); Post sand transfer works (bottom left and right).

Bay of Plenty

Jonathan Clarke, Josie Crawshaw and Scott Murray, Regional Representatives

The Great White Shark App

A Great White shark tagging project is underway in Tauranga Harbour lead by Dr Riley Elliot with the Sustainable Ocean Society, which began tagging sharks this summer.

There are currently three sharks tagged, and an interactive website has been set up for the public to track locations of the sharks in real time. There are some significant migrations that have been observed so far, with two of the three tagged sharks making a migration from Tauranga Harbour up to the tip of Northland and, at time of writing, sitting outside Doubtless Bay.

www.sustainableoceansociety.co.nz

Tracking sea level rise in BOP estuaries

The Bay of Plenty Regional Council have worked with NIWA to install 12 Rod Surface Elevation Tables (RSETs) in Athenree Estuary and Ohiwa Harbour. RSETs are used to monitor sediment surface elevation trends in coastal wetlands, relative to rates of sea level rise. These were installed across mangrove and saltmarsh habitats, and will provide supporting information into the estuarine wetland monitoring programmes and Future Coasts research programmes.

https://niwa.co.nz/natural-hazards/research-projects/future-coasts-aotearoa

Sulphur Point Marine Facility gets green light

Tauranga City Council (TCC) have reclassified a small part (7000 m^2 or 6% of the park's land area) of Marine Park at Sulphur Point to allow for the development of a marine research and education facility. Development of the facility is expected to provide increased

tertiary and post-tertiary education options and support important research into our marine environment and the effects of climate change.

Entities that can demonstrate the capability to establish and operate a marine research and education facility are now able to apply to lease the land through a tender process from February 2023.

www.tauranga.govt.nz/exploring/facilities/reclassification-of-part-of-marine-park-sulphur-point

Wellington

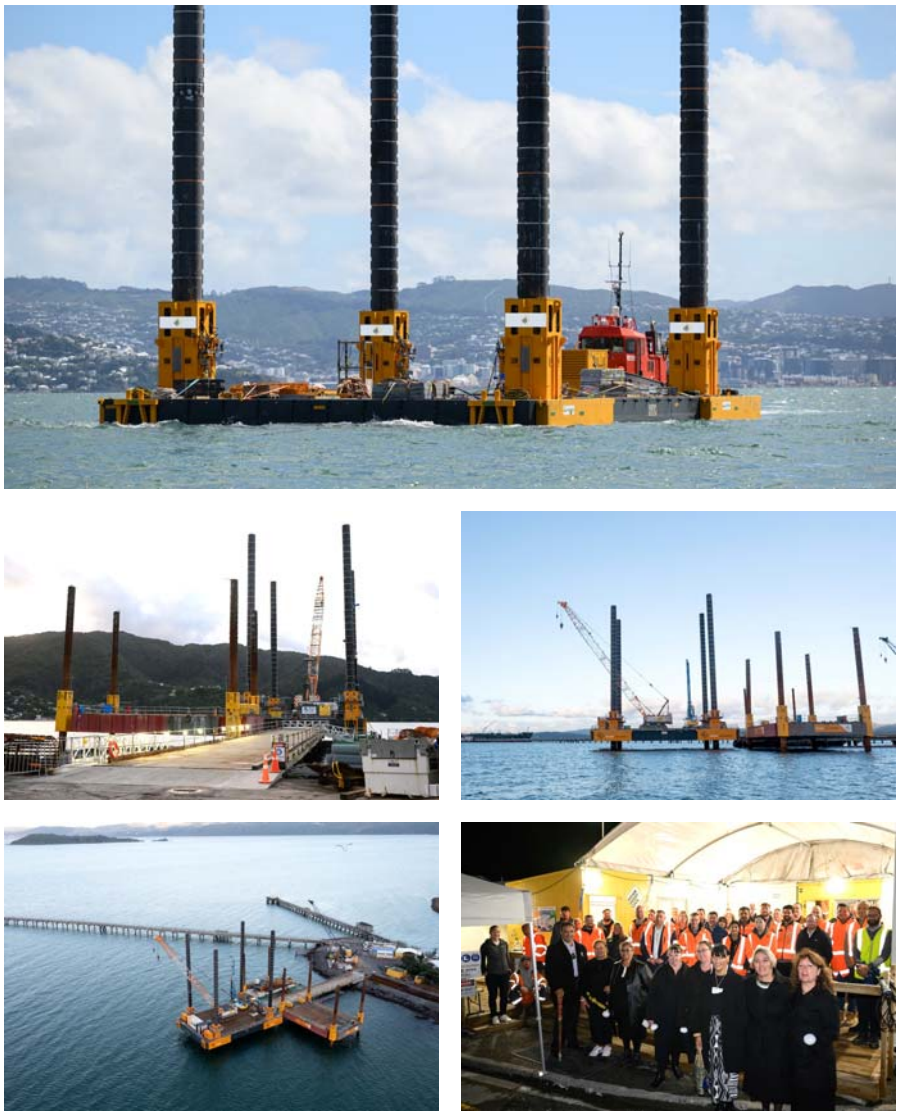
Ryan Abrey and Verity Taylor, Regional Representatives

New jack-up barge for Wellington Harbour

Brian Perry Civil's new 400 t deck capacity jack-up barge (JUB), *Manahau*, will be put to work in Wellington harbour supporting the delivery of the Seaview Energy Resilience Project. The new barge was blessed and formally named in a traditional dawn ceremony at Seaview Wharf in Wellington.

The name *Manahau* was chosen because it brings a mauri (life force) of resilience and strength to BPC's jack-up barge fleet. Te Āti awa Taranaki Whānui kaumata Kura Moeahu, who led the ceremony, said the karakia called on the elements to protect the barges and the people working on them.

The new barge's 38.5 m legs are 14.5 m longer than the legs on BPC's barge *Tuapapa*. Seaview Project Manager Lee Griffiths says the new JUB can be locked with *Tuapapa* to create a floating platform 60 m x 20 m. "It will give us one of the biggest floating barge capacities in New Zealand, and the largest jack-up capacity by some 150 t," Lee says. The Seaview project will improve the resilience of fuel delivery to the lower North Island.



Jack-up barge Manahau in Wellington harbour (top, middle and bottom left) and the naming ceremony at Seaview Wharf (bottom right) (Photos: Brian Perry Civil).

Southland

Bryony Miller, Regional Representative

Harbour seagrass health monitoring underway

e3Scientific are currently monitoring the health of three subtidal seagrass (*Zostera* spp.) beds in Bluff Harbour via Before-After Control-Impact (BACI) dive surveys. This is being carried out to assess any impacts of the capital dredging programme South Port NZ Ltd are planning to complete this year, commencing in April and likely to be completed in July/August 2023.

In order to assess potential impacts, baseline surveys of the seagrass beds were completed in March and August 2022 to capture seasonal variability, and included biomass, blade, percentage cover and sediment sampling within three fixed transect sites (two potential impact sites and one control site).

Further dive surveys were completed in March 2023, again during the dredging operation and within one month of the dredging completion at these three sites.

This data aims to assess any alterations to these seagrass beds or the benthic composition from the dredging activity and also has useful applications in assisting to add to some of the knowledge gaps regarding *Zostera* spp. subtidal beds in southern New Zealand.

e3Scientific diver collecting seagrass cores in Bluff Harbour (Photo: Bryony Miller).

New regional representatives for Canterbury

Following the retirement of Justin Cope and Deepani Seneviratna as NZCS regional representatives for Canterbury, we are pleased to welcome aboard Kate MacDonald and Tommaso Alestra as their successors in this role.

Kate MacDonald is a senior coastal scientist at Jacobs, based in Christchurch. Kate's interests are in coastal adaptation projects with coastal communities, coastal geomorphology, and coastal hazards. Kate joined the society six years ago as a student at the University of Canterbury where she completed a Masters in Environmental Science, looking at the coastal geomorphic response in mixed sand and gravel beaches to the relative sea level fall in the 2016 Kaikōura Earthquake. In her spare time, Kate enjoys hiking, swimming and exploring the great coastal sites Canterbury has to offer!

Tommaso Alestra is a senior marine ecologist at Boffa Miskell, based in Christchurch. Originally from Italy, he moved to New Zealand in 2010 and completed a PhD in Ecology at the University of Canterbury in 2014. Tommaso is currently involved in assessing the effects on the marine environment of a wide range of infrastructures and in the application of eco-engineering methods to promote marine biodiversity. He is particularly interested in the role that nature-based solutions for coastal hazards can play both as part of these projects and in the context of climate change adaptation in Aotearoa New Zealand. In his spare time, Tommaso loves spending time with his family, exploring the country and enjoying the outdoors through diving, fishing, surfing and tramping.

Kate MacDonald

Tommaso Alestra

Exploring New Zealand's estuary health on-line

Last year, LAWA (Land, Air, Water Aotearoa), in collaboration with local authorities, set up a new LAWA topic, called Estuary Health. Data from 391 monitoring sites across 80 different estuaries nationwide have been collated, helping scientists and decision makers understand the state of an individual estuary's health and to track changes over time. The estuaries range from a few hectares to tens of thousands of hectares and stretch from the deep south to the far north. The data is presented from 2010 onwards, and as the monitoring sites are long term, these data records will grow over time.

The topic website (www.lawa.org.nz/explore-data/estuaries/#/tb-national) presents state-of-the-environment monitoring of a number of key estuary indicators, including mud content (fine silt and clay particles), sediment contaminants (including metals and organic contaminants), and estuary macrofauna.

These indicators have been selected for the Estuary Health topic as they provide meaningful information about estuary conditions and are monitored in a consistent way by regional and unitary councils across the country.

In some regions, other indicators that are monitored include sediment nutrient concentrations, sediment organic matter, Chlorophyll a content, and sedimentation rates.

Some broad patterns can be gleaned from the current monitoring data. For example:

- estuaries closer to human populations and activities are muddier and more contaminated than those in less modified landscapes;
- concentrations of metal contaminants are usually higher in estuaries close to cities; and
- high mud content is the biggest stressor of estuaries in rural locations.

These patterns show that estuary health can vary greatly, not just across the country, but within regions as well.

The interactive maps on the website allow the user to dive into a region of interest, and visualise spatial patterns across estuaries, and investigate trends over time. This increases the visibility of some of the estuary monitoring conducted by regional and territorial authorities in a visual, public-friendly interface.

Initially a collaboration between New Zealand's 16 regional councils and unitary authorities, LAWA is now a partnership between the Te Uru Kahika-Regional and Unitary Councils Aotearoa, Cawthron Institute, the Ministry for the Environment, the Department of Conservation and Stats NZ, and has been supported by the Tindall Foundation and Massey University.

For more, visit the LAWA website at www.lawa.org.nz.

NZCS archive & downloads

The NZCS website houses an extensive archive of the Society's publications, including back issues of *Coastal News* (from issue 1, 1996 to date) and 'hot topic' reprints of significant articles from previous issues; newsletter author and article indexes (updated yearly); an author's guide to writing articles for NZCS publications; and copies of the five NZCS Special publications (published 2014-2022).

All these can be accessed at www.coastalsociety.org.nz under the 'Media>Publications' tab on the main menu.

University and education news

Rip current prediction tool

Christo Rautenbach, NIWA

Surf Life Saving New Zealand (SLSNZ) has already helped developed the 'Safeswim' website and associated products in collaboration with Auckland Council, Northland Regional Council, Auckland regional Public Health Services and Watercare (https://safeswim.org.nz). This website is aimed at providing live information on water quality and swimming conditions at your favourite swimming spots. However, recent studies have clearly revealed that trained and untrained beach goers still struggle to identify rip currents. This physical coastal phenomenon is still the leading cause of coastal drownings.

The research and the resulting tools presented in the full paper (see below) will enable knowledge intensive decision-making abilities of where it's safe to swim on beaches. These include empowering lifeguards as well as the public – especially on unpatrolled beaches or beaches with long expanses. There is no greater value than human life and this technology is directly aimed at reducing loss of life from rip currents.

The final product will be disseminated through the Safeswim infrastructure and leverage the existing investments and tools. Not only will the lifeguards be enabled but the public will become skilled rip current detectors through the help of drone, expert interpretation (coastal scientists/the project team), and artificial intelligence technology. Complex, natural phenomena is thus made into easy-to-understand information, which, if correctly applied, becomes knowledge.

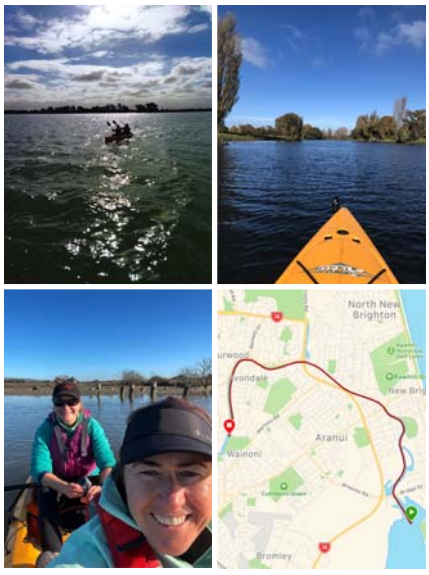
The AI method deployed in this proposal has also already been proven to be a Minimum Viable Product (MVP) with a peer reviewed publication. NIWA and SLSNZ also signed a Memorandum of Understanding (MoU) in 2021, enabling efficient collaboration. Part of this agreement was that NIWA has invested part of their Strategic Science Investment Fund (SSIF) to support the development of the present proposal methodology as well as the MVP. SLSNZ has also already invested in the development of a beach hazard forecasting tool, in collaboration with Plymouth University (in the UK). Initial trials of this tool proved the tool to be bespoke and useful in the New Zealand context. Currently this tool is being rolled out to other beach types for further testing and validation by lifeguards. The rip identification tool (the present proposal) will thus also be used for the operational validation of the forecasting tool and thus build a direct co-funding link and leveraging/strengthening the existing technologies and investments.

The full paper, *Interpretable deep learning applied to rip current detection and localization*, is available at: www.mdpi.com/2072-4292/14/23/6048

Kayaking for fun and science

Amandine Bosserelle, PhD student, University of Canterbury

Monthly kayaking trips on the Ōtākaro/Avon River from South New Brighton Domain to Kerrs Reach at the rowing clubs (about 8 km) were organised in 2022 by Amandine Bosserelle (CNRE/Waterways, Canterbury University) both for fun and a bit of science. Thanks to the support (mostly rowing power) of PhD candidates from Waterways (University of Canterbury) – Irene Setiawan, Justin Rogers, Alice Sai Louie and Rachel Teen – and Cyprien Bosserelle at NIWA, we collected continuous records of electrical conductivity in the centre of the channel at the surface and bottom of the tidal river. This was to establish the location and movement of the freshwater/saltwater wedge and groundwater influence (thank you to John Revell and Pete Wilson for the equipment support).



Combining fun and science on the Ōtākaro/Avon River (Photo: Amandine Bosserelle).

Kayaking gives a unique opportunity to investigate and observe the city, the birds and wildlife (spotted was a freshwater black flounder or patiki), and the water quality from the river perspective.

More kayaking science adventures will start in the second half of 2023 on the Ōpāwaho/Heathcote River or the Puharakekenui/Styx River.

For more information, please email amandine.bosserelle@pg.canterbury.ac.nz.

Laboratory investigation of repair methods for hydraulically damaged rock revetments

Seth Smith, Masters in Coastal Engineering student, University of Auckland

Aotearoa New Zealand has one of the longest coastlines in the world, and a substantial length of this is developed into hard coastal protection structures – 150 km in Auckland alone, (5% of Auckland's coastline, or 11% if excluding the wild west coast). These structures have arisen from a decision to reclaim parts of the coastal edge for ports, transport or amenity, from a need for certain assets and infrastructure to be located at the coastal edge, and as a consequence of early decisions to develop too close to the coastal edge. Many of these coastal structures are unconsented or require reconsenting, are approaching or exceeding their design life, or were designed for lower wave climates and lower sea levels.

While longer-term adaptation planning may result in structures being removed or replaced, in the short-term term, guidance is required for repair and upgrade options for existing structures, and on the optimal timing of this work.

This study, being undertaken under the Resilience to Nature's Challenges National Science Challenge, with support from Tonkin + Taylor Ltd, aims to use laboratory experiments to better understand the

effectiveness of repair options for wave damaged rock armoured structures (revetments and breakwaters). Additionally, these experiments aim to predict the progression of wave induced damage, and the performance of structures with existing damage. The physical model experiments for this study are currently underway at the Fluid Mechanics Laboratory at the University of Auckland.

The laboratory testing will assess three different repair options: spot repairs, partial armour overlays, and full armour overlays. Each repair method will be repeated using three different armour units: a base rock size, a larger sized rock grading, and concrete amour units (Hanbars). This has been done to determine the effect (if any) of different shaped and sized armour units on structure performance – which are assumed to introduce zones of weakness within the structure. Each test consists of 6-8 wave trains of increasing wave height. The aim of the experiments is to help answer the following three questions:

1. When is the best time to implement a repair or upgrade of a rock revetment?

   How effective is a repair after significant damage has occurred to the existing structure (repair at the later stage of the structure's life), and is it more effective to implement an armour overlay before any damage has occurred? An indicative net present value will also be calculated to better quantify the best time to repair.

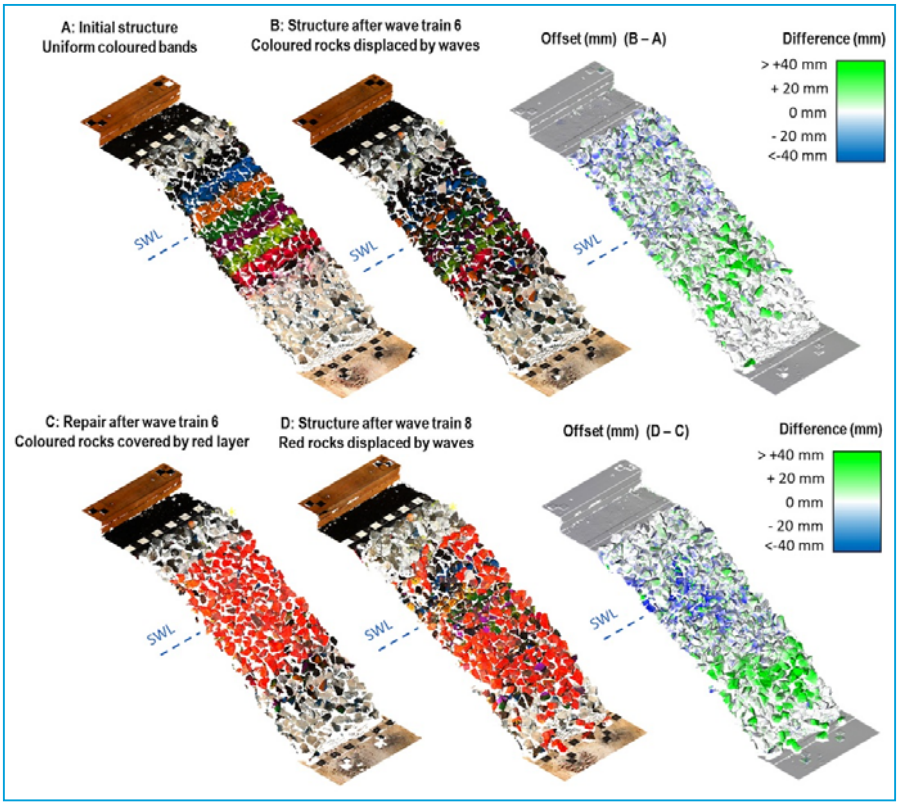
2. How does damage accumulate and progress?

   Different configurations of wave trains will be used to assess if wave induced damage changes based on large waves occurring at the beginning, middle, or end of the structure's life.

3. What is the best repair option?

   The third question will use the laboratory experiments to quantify performance differences of different armour overlays under wave action. Additionally, the study will implement a carbon calculator and basic construction costing as additional metrics to compare repair options, with specific interest in the comparison of rock armour units and concrete armour units.

   These additional metrics have been prompted by dwindling availability of large rock, reduced site access, and high carbon emissions from the transport of rock material during construction. These factors have caused concrete armour units to become more attractive as a repair option, due to increased flexibility in construction and transport; however, the high carbon emissions of the concrete material need to be fully realised in a growing climate emergency. A full lifecycle analysis will be included within this study.



Wave induced damage progression on a rock revetment, with repair implemented after severe damage. Eight scaled wave trains increasing from Hs = 0.08 m to 0.15 m (model scale).

The end goal is to provide guidance to engineers and clients when adapting coastal infrastructure, specifically rock revetments, which are a primary coastal protection structures used to reduce wave induced land erosion.

In New Zealand, we have an abundance of aging infrastructure that will need repair in a growing climate emergency, and the idea of this study is to provide design engineers with more quantitative support to aid in the design and selection of repair options for damaged rock revetments.

For more about this project, email Seth Smith at: ssmi941@aucklanduni.ac.nz

Accessing weblinks in the printed newsletter

Web links are an invaluable source of further information for readers, but in the printed version of *Coastal News* we can't include active links as we do in the pdf version.

We realise that manually copying long strings of seemingly random characters can be frustrating for readers, so for each issue we now produce a pdf file of live links – this can be found on the NZCS website at www.coastalsociety.org.nz/publications.

To make things even easier, you can access the pdf file by using the QR code to the right. The file contains every link published in each newsletter, organised by the pages where they appear, and all are active (clickable) links.

Reducing the impact on Hawke's Bay's marine environment

A study investigating the level of change needed to improve the state of Hawke's Bay's marine environment highlights the magnitude and frequency of interventions required for the seafloor ecosystem to recover.

The two-year regional study was part of a Sustainable Seas National Science Challenge in collaboration with Hawke's Bay Regional Council and the Hawke's Bay Marine and Coast Group.

It tested three scenarios involving reductions in bottom trawl fishing, reductions in sediments from rivers and introducing more closed fishing areas.

None of the scenarios came close to returning the seafloor habitat to its baseline condition of 200 years ago but compared to the current day, the options could double or triple the seafloor habitat.

The aim of the study was to provide a holistic approach to local marine management using the principles of ecosystem-based management.

While the study focused on Hawke's Bay's marine habitat, most of New Zealand's coasts and oceans are subject to similar pressures from the land and sea.

A NIWA marine ecologist, Carolyn Lundquist, was the lead researcher for the study.

She said improving the state of the Hawke's Bay's marine habitat would require a 'ki uta, ki tai' approach, from the mountains to the sea.

"There are a lot of connections between freshwater and marine habitats. What's happening on the land has a big impact on what happens in the marine environment."

"The scenarios we modelled showed that the things we need to do, to make improvements, are in our grasp but we need to go big, we need to work on all the things putting stress on the marine habitat."

Research provided to the study showed sediments from nine river catchments flowing into the bay had significantly increased in the past 200 years.

Sediment in streams is natural but if levels are too high it can disrupt ecosystems by blocking out light and smothering important habitats.

Excessive sediments delivered to the marine environment can turn the seafloor to mud, reducing habitat for microorganisms and invertebrates.

There is a closed fishing area within 2 km of the Mahia coastline. There are four areas that have different levels of fishing closures in the Hawke's Bay region (Photo: HBRC).

Fencing off waterways, riparian planting near streams and using natural or constructed wetlands could all help reduce the level of sediments heading into rivers and consequently, Hawke's Bay's marine region.

Intense bottom trawl fishing also has the potential to disturb the seafloor habitat and lower the survival of benthic species.

Reducing fishing and increasing the number of closed fishing areas were among the options modelled in the scenarios, along with reducing sediments from rivers.

The scenarios were run over a 50-year timeline to estimate the scale of the recovery of the seafloor habitat in response to the changes.

The team designed what they thought were three very different scenarios in terms of the amount of fishing reduction, sediment reduction and/or closed areas, but all tended towards a similar result in seafloor recovery.

It is estimated that prior to European contact, the coverage of mature habitat on the seafloor was around 40%.

It is currently estimated to be about 12%. All three scenarios landed at about 17% but if there were no restorative interventions, it would further decrease to about 9% in 50 years.

The results of the study will help the Hawke's Bay Regional Council to demonstrate how the health of the Hawke's Bay marine environment has changed since the introduction of industrial fishing and land clearance.

It will provide information on the scale and combination of changes that would be required to support a healthy and functioning marine ecosystem that supports an abundant and sustainable fishery.

The information from this study will support exploring potential management and policy options for Hawke's Bay's marine environment.

It will help Incorporate ecosystem-based management into the development of the Hawke's Bay Regional Coastal Plan - Kotahi,

A satellite photo of sediment plumes after major regional rainfall in 2018 (Photo: HBRC).

being developed by the Hawke's Bay Regional Council.

FAQs

What is EBM?

Ecosystem-based management (EBM) is a holistic approach to managing the marine environment and its resources. It considers the best way to manage competing uses and demands without degrading the marine environment.

What is the Hawke's Bay Marine and Coastal Group?

This is a collaborative group brought together to understand what information would be needed to support management of the Hawke's Bay marine environment. It includes recreational and commercial fishers, tangata whenua, local industry and port, and government agencies and is chaired by Hawke's Bay Regional Council science staff.

Why are biogenic habitats/benthic structure important in the marine environment?

Benthic (or seafloor) structure is the physical structure on the seafloor that animals and plants use as habitat. Some of that structure is created by organisms themselves and those habitats are called biogenic habitats. Many species form biogenic habitats, and they serve different purposes to keep an ecosystem functioning well. Larger biogenic organisms stablise the seafloor. For example, seagrasses and hururoa, or horse mussels, can settle on sediments and don't need hard rock to start growing. Other species such as sponges, shellfish and tube worms help filter the water column to remove excess nutrients.

Not only is the physical structure on the seafloor important, plants in this zone are an important part of the carbon cycle because they help to take carbon out of the atmosphere.

How many closed fishing areas are there already in Hawke's Bay?

There are four areas that have different levels of fishing 'closures': (1) The Springs Box near Clive is a voluntary area that can be closed to bottom trawling over summer; (2) The Wairoa Hard closed to net fishing; (3) within 2 km of the Mahia coastline is closed to commercial fishing; and (4) the 'no-take' Te Angaiangi Marine Reserve.

For more on this story, contact Dr Carolyn Lundquist, Principal Scientist - Marine Ecology at https://niwa.co.nz/user/887/contact

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About the authors

Thomas McElroy leads the Freshwater and Coastal Team at the Taranaki Regional Council (TRC). Prior to this role he was the Coastal and Marine Scientist at TRC, and was also involved in Project Reef in the early years.

Gordon S Maxwell lives and works in both New Zealand and Hong Kong with roles involving ecological assessment, mangrove restoration, University teaching and farming; **Brenda Fung** is a Sustainability Manager in a big Hong Kong company. Both have worked together on matters environmental for a number of years.

Benjamin D Jones is a PhD student at Auckland University investigating the impact of sea level rise and erosion on coastal cultural heritage and archaeological sites. Originally from South Africa, he has previously worked as a professional archaeologist in Aotearoa and in Australia. He was a recipient of a NZCS Research Scholarship in 2022.

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