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

Issue 75 • July 2021

Sounding out the shallows...

Recent NIWA research aims to provide a new tool for real-time monitoring of New Zealand's estuaries. Find out how in the article beginning on page 3.

Firth of Thames mudflats/mangroves (Photo: Chris Eager)

ISSN 1172-6938

www.coastalsociety.org.nz

Te Hunga Takutai o Aotearoa
NEW ZEALAND COASTAL SOCIETY

CONTENTS

Contents numbers and blue web links in this pdf are active (clickable).

Word from the Chair

Tēna koutou

Connecting with members through the extended NZCS Webinar Series has been a highlight of 2021 so far. A big thank you to all who facilitated and presented at these sessions. The second half of 2021 will see a move toward more face-to-face events around the country. We encourage you all to support these regional events to keep up to date with advances in coastal management and meet like-minded professionals.

The NZCS website now provides easy access to a selection of previous *Coastal News* articles as 'hot topics'. There is also an index to search the archive of *Coastal News* articles back to issue one from July 1993. Keep an eye out in the weekly email digest for articles from the archive that still provide valuable information in today's environment. The website also now has access to the Webinar series and other presentations under the media page.

In June the NZCS was pleased to sponsor the second Australasian Young Coastal Scientists and Engineers Conference. We supported a regional hub at the University of Waikato, and Mark Ivamy and Professor Karin Bryan were invited to join the closing panel discussion on the 'Future of Coastal Science and Engineering'. Also, big congratulations to one of our student members, Akuhata Bailey-Winiata, who was awarded for his conference presentation on the climate change risk to coastal marae.

NZCS is proud to continue its tradition of supporting students who improve our coastal knowledge through our scholarship awards. Congratulations to our scholarship winners for 2021:

- Cassandra Newman (MSc Student Research Scholarship) – Using historic and 3D drone imagery for coastal erosion analysis at historic landfill sites on sandy coastlines in Southland New Zealand
- Dus Nguyen (PhD Student Research Scholarship) – Wind flow dynamics and sand sedimentation through coastal foredune notches.

A big congratulations also goes to Zoe Luffman from Marlborough Girls College, who is the Seaweek Ocean Champion for 2021. Zoe has been leading beach clean ups in her local area from age seven, and now in her final year of school aims to inspire younger students to step up and protect their beautiful coastlines. Zoe is planning to start a science degree next year leading to a career in conservation biology.

This issue of *Coastal News* brings you a number of biodiversity stories, including the Project Reef South Taranaki project delivering learning outcomes for students from Hāwera High School. Aotearoa has recently felt the power of Tangaroa and the impacts are well covered for the Gisborne and Coromandel regions by Murry Cave and Jamie Boyle.

Lastly, the Coastal and Ports local organising committee have been busy pulling together a fantastic programme for the 2021 conference in Christchurch this year. There are a strong number of abstracts from both Australia and New Zealand, and we look forward to seeing you there from 30 November to 3 December.

Noho ora mai (look after yourself)

Amy Robinson and Mark Ivamy
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 300 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).

Sounding out the shallows

Christopher Eager, Richard Yates, Iain MacDonald and Andrew Swales (NIWA Hamilton)

The big picture

Estuaries are major sinks for contemporary and legacy fine sediments eroded from the land. Catchment deforestation and subsequent large-scale land use change over the last ~170 years have resulted in increased soil erosion and sediment loads in rivers, which in turn have led to a ten-fold or more increase in sedimentation rates within New Zealand's estuaries (e.g., Hunt, 2019, Swales et al., 2020). Consequently, this increase in sedimentation rate has accelerated the process of estuarine infilling leading to the formation of extensive muddy intertidal flats.

In our northern estuaries (i.e., Bay of Plenty, Waikato, Auckland, and Northland), mangrove forests have responded to this sediment pulse by opportunistically colonising the intertidal flats to form the extensive mangrove forests we see today (e.g., Swales et al., 2015). This expansion contrasts with a global trend of mangrove-forest loss primarily due to human activities (Horstman et al., 2018). While public perception of mangroves is often divided, these forests provide important ecosystem services, including enhancing the resilience of low-lying coastal areas to inundation and erosion by storm surges (Montgomery et al., 2019).

The effects of sea level rise (SLR) will have increasing impacts on lowland freshwater and estuarine systems. The future resilience of coastal wetlands will largely depend on their capacity to keep pace with SLR by accreting sediment (Swales et al., 2020). Research has highlighted the transitional region between the mangrove fringe forest and mudflat as a hotspot for change and complex hydro-sediment dynamics (Mullarney et al., 2017; Lovett, 2017; Haughey, 2017).

Adapting to the effects of SLR in estuaries, including coastal wetlands, will depend on our ability to predict how these systems will respond under a range of scenarios. Future decisions will need to be guided by robust models underpinned by quantitative measurements of sediment dynamics and geomorphic response in sedimentation hotspots.

Good vibrations

NIWA research being conducted in the southern Firth of Thames will inform model development to predict the bio-geomorphic evolution of intertidal habitats over event- to decadal-scales. The study is a collaboration with researchers from the University of Twente, Netherlands, led by Dr Erik Horstman, Mangrove-RESCUE. A key component of this work are arrays of acoustic sensors and cameras continuously measuring sedimentation and erosion of the tidal flat and fringing mangrove forest. Sensors include the Estuary-Surface Ultrasonic Distance Sensor (E-SUDS), a dual-purpose instrument developed by NIWA, to provide high-frequency bed and water-level measurements (see Figure 1).

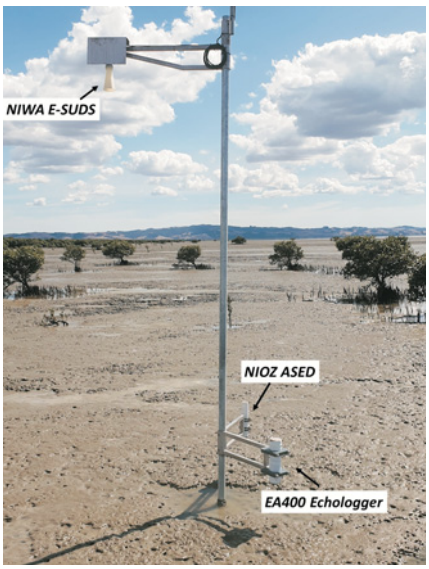


Figure 1: NIWA E-SUDS and echologgers deployed on the intertidal mudflat in the Firth of Thames.

The E-SUDS utilises ultra-sonic technology to measure distances from a down-looking transducer mounted above the water surface. This aerial deployment allows the E-SUDS to measure water levels when inundated and the tidal-flat surface when exposed at low tide. Distance from the sensor is calculated from ultrasonic returns from a footprint of ~1m diameter, thereby integrating measurements to remove effects of small-scale bed variations (such as ripples). High-frequency measurements (6 Hz) are made at 10 minute intervals, with data telemetered to NIWA (see Figure 2). The high sampling rates and stand-alone low power solar set-up allow for resolution of dynamic intertidal processes across multiple time scales (seconds to years).

Currently, the E-SUDS and two other types of acoustic sensors (to measure bed levels) are deployed at four sites along a cross-shore transect (see Figure 3 inset). The transect covers a range of intertidal environments from bare mudflat to sparse mangrove fringe

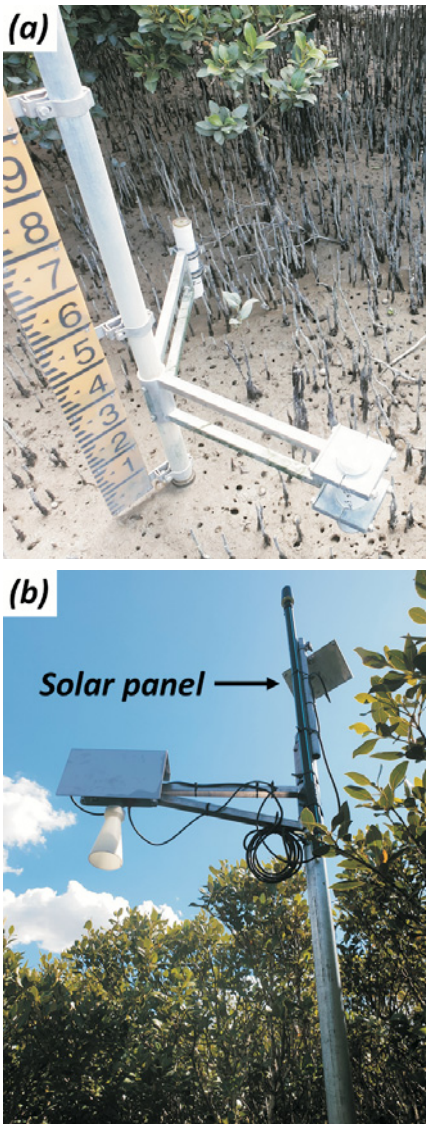


Figure 2: (a) close up of echologgers deployed above sparse mangrove roots (pneumatophores) in the fringing region between bare mudflat and forest; (b) close up of telemetry system for NIWA E-SUDS.

to mature mangrove forest. The sensors are also located in close proximity to Rod Surface Elevation Table (RSET) stations jointly operated by NIWA and WRC since 2007. The RSET are being used to monitor long-term sedimentation and geomorphic development of the mangrove forest. This data will also enable the acoustic measurements to be considered in the context of long-term surface elevation changes including effects of subsidence (Swales et al,. 2016; 2019).

Preliminary results from the E-SUDS are promising (see Figure 3). The high-frequency measurements provide a rich dataset and highlight bed-level evolution alongside water levels and tidal inundation periods between the sites. Further validation and testing of the sensors will continue to quantify sensor accuracy and the influence of variability in bed-level across the footprint of the sensor.

The data will be used to resolve long-term bed elevation changes and the morphological evolution of these rapidly changing regions. Furthermore, the data will be utilized by PhD student Rik Gijsman (University of Twente) to develop a process-based model that will be used to study how the observed dynamics affect the longer-term development of both the surface elevation as well as the vegetation cover of the mangroves in the Firth of Thames.

The model can serve as a predictive tool for future mangrove development, including the impacts of natural or human-induced changes. Finally, the E-SUDS hopes to provide a cost-effective technology, linking acoustic sensors and cameras, to provide a new tool for real-time monitoring of New Zealand's estuaries.

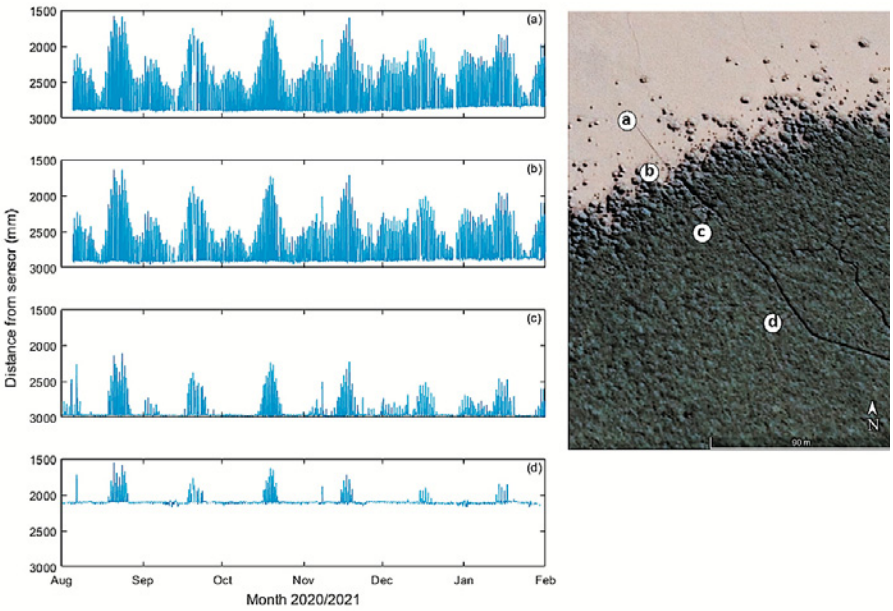


Figure 3: Six months of one-hour averaged data from the ongoing NIWA E-SUDS deployment. The y-axis shows distance from the sensor, which is given by the water surface when inundated, and bed surface when exposed. Sites are shown in the inset and are taken along a transect including (a) bare mud flat; (b) sparsely populated mangrove fringe; (c) densely populated fringe; and (d) the fully developed mangrove forest.

Acknowledgements

This research is supported by the MBIE Strategic Science Investment Fund (Contracts FWCE 2004, 2104), Waikato Regional Council, and the Dutch Research Council (NWO - grant no. 15899). We thank Mark Smith (NIWA Hamilton) for engineering support.

References

Haughey, R (2017). *Modelling the hydrodynamics within the mangrove tidal flats in the Firth of Thames*. University of Waikato MSc thesis.

Horstman, EM, et al. (2018). The dynamics of expanding mangroves in New Zealand, in *Threats to mangrove forests*, 23-51.

Hunt, S (2019). *Summary of historic estuarine sedimentation measurements in the Waikato region and formulation of a historic baseline sedimentation rate*. Waikato Regional Council Technical Report 2019/08, ISSN 2230-4363. https://www.waikatoregion.govt.nz/services/publications/tr201908/

Lovett, NJ (2017). *Sediment transport in the Firth of Thames mangrove forest, New Zealand*. University of Waikato MSc thesis. https://hdl.handle.net/10289/11568

Montgomery, JM, et al. (2019). Attenuation of storm surges by coastal mangroves. *Geophysical Research Letters* 46(5): 2680-2689.

Mullarney, JC, et al. (2017). A question of scale: How turbulence around aerial roots shapes the seabed morphology in mangrove forests of the Mekong Delta. *Oceanography* 30 (3): 34-47.

Swales, A, et al. (2015). Mangrove forest evolution in a sediment rich estuarine system: opportunists or agents of geomorphic change? *Earth Surface Processes and Landforms* 40: 1672-1687.

Swales, A, et al. (2016). Evaluating deep subsidence in a rapidly accreting mangrove forest using GPS monitoring of surface-elevation benchmarks and sedimentary records. *Marine Geology* 380:205-218.

Swales, A, et al. (2019). Landscape evolution of a fluvial sediment-rich Avicennia marina mangrove forest: insights from seasonal and inter-annual surface-elevation dynamics. *Ecosystems* 22: 1232 1255.

Swales, A, et al. (2020). Estuaries and lowland brackish habitats. In: Hendtlass, C and Neale, D, *Coastal systems and sea level rise*, NZCS Special Publication, pp 55-63.

NZCS newsletter archive & downloads

Back issues of *Coastal News* (from issue 1, published in 1996, to the most recent) are available to download from the Society's website at www.coastalsociety.org.nz (under the 'Media>Publications' tab). Also available are 'hot topic' reprints of significant articles published in the newsletter, author and article indexes for issues 1 to 71 (these will be updated each year), an author's guide to writing articles for *Coastal News*, and downloadable copies of the four NZCS Special publications – *Rena: Lessons learnt* (2014); *Adapting to the consequences of climate change* (2016); *Shaky shores: Coastal impacts & responses to the 2016 Kaikōura earthquakes* (2018); and *Coastal systems & sea level rise: What to look for in the future* (2020).

Season/s of the storm surge

Murry Cave, Gisborne Regional Representative

Introduction

In 2019, Gisborne District Council, along with Hawkes Bay Regional Council, commissioned NIWA to prepare a regionalised climate change projections and impacts report for Tairawhiti and Hawke's Bay. We wanted to be able to have a robust document that provided the framework for being able to assess climate change risks at a more granular level so that it would help inform decision-making at a regional planning level.

The population of Gisborne/Tairawhiti is predominantly coastal from the very low-lying village of Muriwai, Gisborne City and the suburbs of Awapuni, Wainui and Okitu, then heading north, Makarori, Tatapouri, the summer camping areas of Turihaua Point to Pouawa, Tolaga Bay, Tokomaru Bay, Waipiro, Te Araroa and Hicks Bay. While the study looked at more than coastal impacts, the risk to these coastal communities is from sea level rise and changes in the frequency and intensity of storm surge/tide events. The study was timely, as coastal erosion events over the last few years have become more apparent and are now being recognised as a signal that change was already happening and appears to be accelerating.

A tipping point

Sea level rise and coastal erosion is not new but has been creeping up without us realising it. This is highlighted by the long-term changes to annual mean sea level (MSL) as seen from the tide gauge data at Gisborne Port (see Figure 1). This is not likely to be impacting on coastal erosion as yet, but the 14+ cm of mean sea level rise since 2010 will have had an incremental impact on the coastal environment and, particularly, it may be affecting shallow aquifers that are unconfined at the coast and saltwater wedges in rivers and wetlands.

In the context of a 4 m+ storm-tide surge, however, it will be hard to attribute any impact of a 14.5 cm AMSL rise to any particular event at this stage. Over time, however, it is anticipated that as sea levels rise so too will the probability that current high-water marks will be exceeded. Thus, any coastal area where present-day mean high-water spring which is exceeded by only 10% of all high tides will be exceeded by 100% of all high tides by 2060. Further, a present-day rare storm-tide event (0.2% annual exceedance probability [AEP] with a 500 year average recurrence Interval [ARI]) would become an event with a 20% AEP (5-year event) after a relative sea level rise. The NIWA assessment suggests that the sensitivity to coastal erosion along the coast will increase from moderate to high and the widths of areas susceptible to coastal erosion will increase to an estimated 60 to 180 m by 2115.

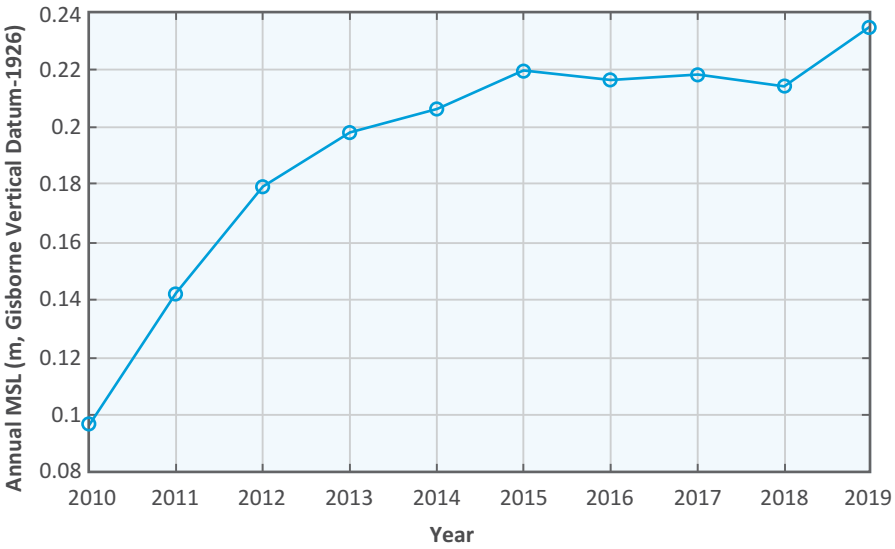


Figure 1: Annual mean sea level at Gisborne port based on the 2010 to 2019 digital record.

A present day problem

While sea level rise may not yet be enough to be driving significant erosional change in the coastal environment we are starting to see more erosion effects resulting from more frequent severe storms. Unfortunately, there has been little recent published work on coastal erosion in the region to draw on. Work was undertaken between 1994 and 2008 to assess areas sensitive to coastal erosion and this helped define the areas susceptible to coastal erosion in the Tairawhiti Regional Management Plan. The early work variously identified areas of risk around Te Araroa, central Tolaga Bay, central Poverty Bay, and south of Young Nicks Head (Gibb 1994). Further work was done to update the areas sensitive to coastal erosion at a reconnaissance level in 2015-16 (Tonkin and Taylor 2016) and an assessment of northern Poverty Bay was undertaken in 2017 (Tonkin and Taylor 2017).

From 2017 until the present day, however, the region has experienced a significant number of adverse weather events annually and this had led to a renewed focus on the risks to the coastal zone.

September 2019 storm surge

Wainui Beach

Dune erosion at the south end of Wainui Beach has been an ongoing issue for many years. Sea walls of varying quality have been built in the past, but have deteriorated over time (see Figure 2). There has been strong interest from the local community in maintaining and upgrading these seawalls, but the Council has been unable to get consents for new walls. A severe regional

Figure 2: South Wainui Beach, Gisborne showing the old retaining wall and damaged gabions prior to the storm surge.

storm surge event in September 2019 resulted in significant erosion of the beach frontage of several houses (see Figure 3) and also damaged a set of council-owned steps and retaining wall at the mouth of Wainui stream. Because there was a risk that the storm surge would continue to erode the dunes on which the houses were built and the risk to a septic tank, an emergency revetment wall was put in to stabilise the area until the situation could be resolved (Figure 3). Ultimately the residents obtained a resource consent allowing them to replace the badly damaged retaining wall with an equivalent structure.

Storm surge impacts at the mouth of the Mangahauini River

Following the September 2019 regional storm surge event, it became apparent that a playground and picnic reserve at the mouth of the Mangahauini River in Tokomaru was subject to undercutting and erosion. Analysis indicated that the river mouth had a long-term sinistral skew bias discharging to the sea up to 100 m to the north of the river. This was driven by the dominance of sediment supply from two active slips and Waiotu stream located to the south of the Mangahauini, which formed a bar at the mouth.

Periodic storm surges have been observed crossing the bar at the river mouth prior to the September 2019 storm surge but there are only limited prior reports of significant inundation. Cyclone Bernie in 1982 was the most significant, throwing driftwood as far as Beach Road, but there were no reports of significant erosion associated with the event (Gibb 2008). A storm in December 2017 resulted in seas overtopping the bar at the river mouth but because of the volume of material on the bar, the reserve was not affected. The 2019 assessment established that sediment supply transported along the beach and periodic storm surge were the main driver of river mouth morphology. The 2019 event was driven by the same major storm surge that affected Wainui, but the impact and resulting 2 m of erosion of the riverbank at the reserve (see Figure 4) suggests that the surge was stronger at Tokomaru Bay and the barrier bar was unable to protect the riverbank. Sentinel satellite imagery immediately after the event suggests that the storm surge pushed sediment on the barrier bar inland reducing the run-up distance and increasing the exposure of the bank to wave action.

Figure 3: Drone footage of the eroded area showing the remains of the old retaining wall, and the temporary rock revetment. Geotextile was placed along the top of the bank in an attempt to protect it from further erosion.

Figure 4: Playground and picnic reserve at the mouth of the Mangahauini River, Tokomaru Bay. Around 2 m of erosion occurred during the storm surge event.

Turihaua Point to Pouawa Summer Camping area

As a result of the September 2019 storm surge it was becoming apparent that coastal erosion was having a significant affect regionally and in 2020 a study was undertaken to assess the risk for areas immediately north of Gisborne where it is a tradition for many people to set up camp for the summer. An area of particular risk was at Turihaua Point, where erosion was putting State Highway 35 at risk.

An assessment using historical aerial photographs and satellite imagery established that since 1966 the area had eroded by 46 m at the eastern end and 16 m at the western end. An assessment of the annual rate of change suggests that erosion is accelerating with 0.5 m of erosion occurring annually between 1966 and 2012, rising to 0.72 m annually between 2012 and 2018, and 2.65 m between 2018 and 2020.

As a result, the capacity for the site to support summer camping had been greatly reduced and all sites suitable for caravans or tents were at high risk during a storm surge event or severe southerly storm (see Figure 5). In June 2021, Council held a regulatory hearing to amend the Freedom Camping bylaw to replace the existing summer camping provisions. These deal with broader issues than just the erosion at Turihaua Point and may only go some way to reduce the risk to campers.

Figure 5: Caravan set up at the summer camping area at Turihaua Point showing the channels formed in the low cliff that direct water towards the campers during high sea events. (Inset) Channel cut in the sea cliff immediately behind the caravan showing recent collapse of top soil and the discolouration from salt burn of the grass.

2020-21 Tolaga Bay

Over the summer a storm surge resulted in severe erosion on the northern bank of the Uawa River mouth. This was not reported to Council at the time, and it is uncertain when the event occurred but there are some suggestions of late January, which is consistent with reports of heavy rain and strong winds on the 29th January 2021.

Fortuitously there is a significant number of drone maps for the Uawa river mouth and Tolaga Beach because of the monitoring of slash following the June 2018 storm. This shows that, not surprisingly, the river mouth is prone to change over time, although satellite imagery from 2003 to 2019 shows that the northern bank has not experienced any erosion events since 2003.

Erosional scour was evident as far back as June 2020, which is not entirely surprising as the drone flight was taken immediately after a significant flood event in the catchment. But this event differs from the summer storm surge that resulted from erosion from strong sea waves which eroded north along the beach affecting areas not exposed to river flooding (see Figure 6). Furthermore, the June 2020 erosion occurred in forestry slash within the beach and did not result in erosion of the dune system. Between June 2020 and March 2021,

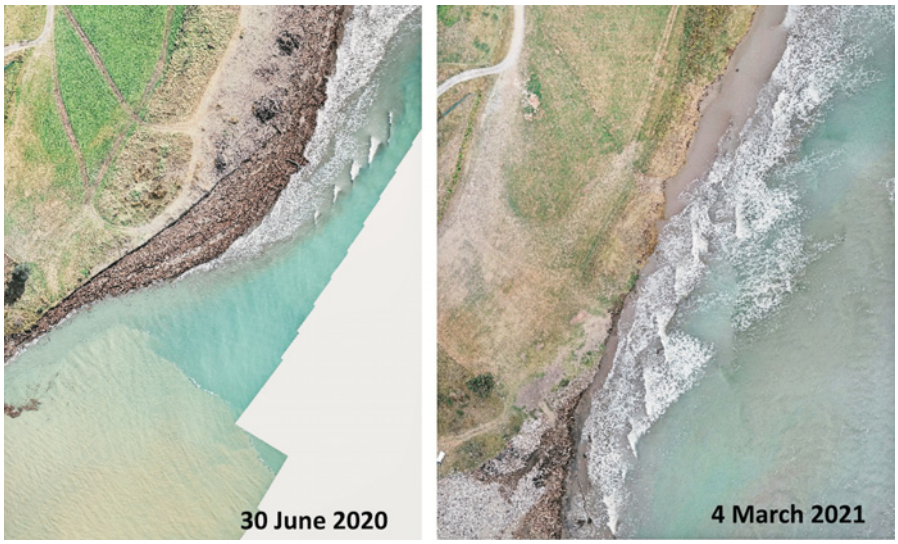


Figure 6: Drone Maps of the mouth of the Uawa River 30th June 2020 showing the scour associated with a major river flood the previous week (left) and the same area in March 2021 showing erosion of the shoreface north of the river mouth (right).

however, the shorefront north of the river mouth experienced erosion of between 15 and 26 metres and this grew to between 33 and 56 metres by the end of June 2021.

Conclusions

2021 has ended up being the year of storm surge bringing 5 m waves to Tokomaru Bay to Gisborne City. In May one event lasted seven days and resulted in further erosion at Tolaga Bay and beached a yacht that was anchored in an exposed position in the bay (see Figure 7). In June the storm which flooded Tokomaru Bay also resulted in a storm surge that demolished what was left of the playground and picnic reserve. At Turihaua Point to Pouawa, over a metre of the foreshore dunes was eroded away.

The question is whether or not this is a new normal under future climate change or, as Gibb (2008) observed, are we presently just in a decade of storms? It is, I am guessing too soon to tell. The prudent approach is to feed these results into Council's climate change adaptation planning as is timely as the Tairawhiti Regional Management Plan is presently being reviewed.

References

Cave, M (2019). *Risk assessment Mangahauini River mouth, Tokomaru Bay*. Gisborne District Council Report.

Cave, M (2020). *Issues associated with the retaining wall and steps, true right bank of Wainui Stream*. Gisborne District Council Report.

Cave, M (2020). *Beach erosion and risk assessment, Turihaua Point*. Gisborne District Council Report.

Gibb, J (2008). *Assessment of the 2008 Tokomaru Bay Coastal Hazard Zone, Gisborne District*. Coastal Management Consultancy Ltd report CR 2008/2 for Gisborne District Council.

Niwa (2020). *Climate change projections and impacts for Tairawhiti and Hawkes' Bay*. Report for Gisborne District and Hawkes Bay Regional Council.

Tonkin and Taylor (2016). *Update of areas susceptible to coastal erosion hazard*. Report for Gisborne District Council.

Tonkin and Taylor (2017). *Coastal erosion mapping for northern Poverty Bay*. Report for Gisborne District Council.

Figure 7: Yacht aground after breaking loose from its anchor, May storm surge, Tolaga Bay.

News you might have missed...

In *Coastal News* 69 (July 2019), we published an article on the threat of erosion and inundation to old coastal dump sites. As an update to this, a recent study identifies at least 321 old landfills as being at risk, but also notes that there is a 'dearth of information' to identify many others. The link also features an interactive map showing currently known locations (see https://www.stuff.co.nz/environment/124123042/more-than-300-old-dumps-at-risk-of-coastal-erosion-and-flooding).

While on the subject of potential threats, a recent study suggests there is a one in four chance of a tsunami-causing quake occuring offshore from central New Zealand in next 50 years (https://www.stuff.co.nz/science/125690408/one-in-four-chance-of-big-potentially-tsunamicausing-quake-offshore-from-central-nz-in-next-50-years).

Turning to something more positive, a BBC Future Planet article looks at how seaweed could potentially play a significant role in fighting climate change, sending carbon to the seafloor and deacidifying oceans (see https://www.bbc.com/future/article/20210406-how-kelp-can-help-solve-climate-change). On a related note, the BBC site also features a short video introducing a 2020 Netflix documentary in which filmakers establish a surprising one-year relationship with an octopus in a South African kelp forest (see https://www.bbc.com/news/avembeds/56728381/vpid/p09dgd7c). Still underwater, a three-star Michelin chef in Spain is promoting marine grains derived from eelgrass as a potential 'superfood' – not only healthy and tasty (apparently), but environmentally friendly too (see more at https://www.theguardian.com/environment/2021/apr/09/sea-rice-eelgrass-marine-grain-chef-angel-leon-marsh-climate-crisis). Finally, what might seem a 'fluff' piece about the 'loneliest whale in the world' reveals a very different truth… to find out what, see https://www.theguardian.com/environment/2021/jul/13/loneliest-whale-in-the-world-search

Towards sustainable offshore aquaculture

Michelle Simone[1], David Plew[2], Kay Vopel[1]

Aquaculture produces around 50 per cent of the global aquatic food budget (FAO, 2020), and has grown into an important activity for both the Australian and New Zealand economies. Most fish farming activities currently occur in coastal environments where farmers have ease of site access for day-to-day farm maintenance and fish harvest (see Figure 1). However, the scale of coastal fish farming is largely constrained by the amount of fish waste the local ecosystem, including the seafloor underneath fish farms, can sustainably process. This is leading to global efforts to expand fish farming into offshore waters where greater water depth and more energetic conditions in surface water will reduce the amount of fish waste deposited below the farms.

Sustainable development

Expanding fish farming into offshore waters is key to further development of the marine or 'blue' economy and address the growing global food demands. Although offshore waters bring a multitude of new obstacles in marine engineering and farm operations, it allows the opportunity for innovation and development in a rapidly changing industry. The Blue Economy Cooperative Research Centre (BE CRC) in Australia and Seafood Innovations Ltd. (SIL) in New Zealand have taken this opportunity to break ground on this new sector with a large-scale collaborative effort that connects industry and science to unlock innovation for sustainable development.

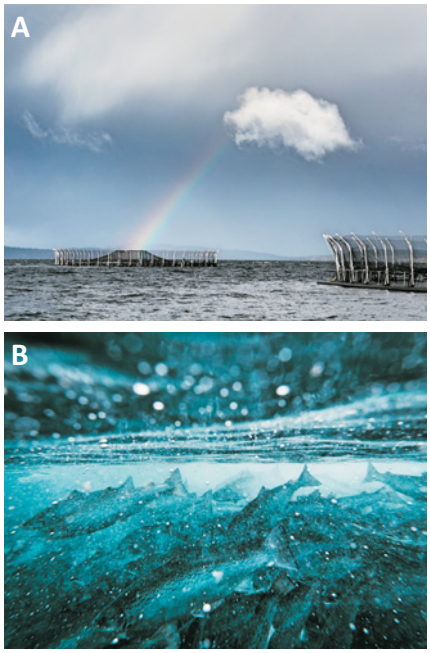


Figure 1: (A) Fish pens off the coast of Tasmania, Australia; (B) Farmed salmon feeding near the water's surface off the coast of Tasmania, Australia (Photos: Tassal Group Limited).

(1) Auckland University of Technology, School of Science, Auckland, New Zealand; (2) National Institute of Water and Atmospheric Research, Christchurch, New Zealand

Sustainability in this context refers to the ability of the industry to maintain a viable blue economy without negatively affecting the equity of the environment. A fundamental assumption underlying this new development is that enhanced dispersion and assimilation of fish waste in deeper and more dynamic waters will reduce the organic enrichment of the seafloor underneath farms, ultimately reducing the potential for ecosystem perturbation. Although this is a logical assumption, to be able to say this with certainty, we must be able to quantify the ecological effect, or lack thereof.

Looking to the seafloor for answers

Sedimentary ecosystems, which make up the offshore seafloor, have an amazing capacity to decompose organic matter such as fish waste from farming activities. Their biogeochemical characteristics directly reflect the quality and quantity of organic waste being deposited and decomposed.

However, because offshore sediment ecosystems are naturally adapted to low levels of organic input, we seek to understand how organic enrichment will affect these ecosystems. To do so, we measure the biogeochemical responses.

Unfortunately, the methods we use in shallow coastal environments, which are naturally relatively rich in organic matter, are not suitable in the offshore environment. This has led the BE CRC/SIL to focus on the development of tools and techniques that are capable of measuring seafloor ecosystem responses to small inputs of organic waste.

The BE CRC/SIL has assembled a diverse and unique team, led by Auckland University of Technology (AUT), consisting of biogeochemists, experimental ecologists, ecosystem modellers, policy makers and fish farmers across Australia and New Zealand. It is their intention to address our current inability to accurately quantify the

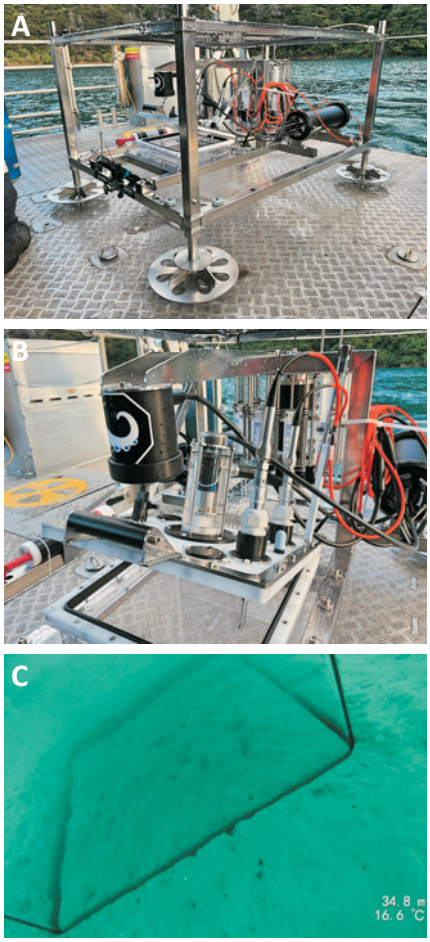


Figure 2: (A) A seafloor lander ready for its first deployment in New Zealand waters. (B) The lid of the acrylic incubation chamber holds various optical and electrochemical sensors that detect changes in the chemistry of the enclosed bottom seawater. We use such changes to compute the sediment-seawater exchange of reactive solutes – a proxy for ecosystem functioning. (C) A photo taken during a trial deployment on the 35 m deep seafloor showing the incubation chamber enclosing 900 cm^2 of seafloor for a 19-hour incubation.

environmental performance of aquaculture in deep, offshore waters, to ultimately test the assumption that operating in deeper water will lessen the impact of fish waste on sedimentary ecosystems. This collaborative effort is designed to ensure that we have suitable environmental impact assessment tools available for the sustainable expansion of the blue economy.

A key objective of this project will be to develop robust tools that can predict the potential response of the sedimentary environment to varying intensities of fish farming in Australia and New Zealand, which ultimately could be implemented worldwide. The development of such a predictive capability requires the support of a combination of focussed field and laboratory studies.

Once complete, these predictive tools can support the current regulatory requirements for environmental monitoring and reporting and will also be able to inform future regulatory frameworks for offshore aquaculture, including resource management and site selection. This ability to have reliable environmental forecasting is invaluable for responsive farm management, which will help ensure the sustainability of the expansion offshore.

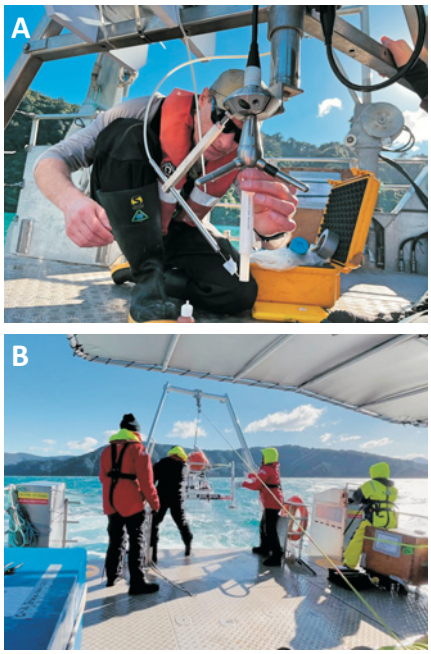


Figure 3: (A) The measuring head of the eddy-covariance lander consists of an acoustic doppler velocimeter and an oxygen sensor (micro-optode). This device provides a non-invasive measurement of the sediment oxygen consumption. (B) To test deployment and measurement protocols, the project team co-deployed both landers, the eddy-covariance and the chamber lander, in 82 m water depth off the coast of New Zealand.

Project participants

- Auckland University of Technology (AUT)
- University of Tasmania (UTAS)
- Tassal Group Limited
- The New Zealand King Salmon Pty Limited
- Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- Tasmanian Department of Primary Industries, Parks, Water and Environment (DPIPWE)
- Griffith University
- East China Sea Fisheries Research Institute, Chinese Academy of Fishery Sciences
- National Institute of Water and Atmospheric Research (NIWA).

Acknowledgements

Thanks are extended to the Blue Economy Cooperative Research Centre (BE CRC) and Seafood Innovations Ltd. (SIL) for the financial support and all the project participants for their input.

Source

FAO (2020). *The state of world fisheries and aquaculture 2020. Sustainability in action*. Rome. Licence: CC BY-NC-SA 3.0 IGO.

NZCS Conference 2021/Australasian Coasts & Ports 2021

Te Pae, Christchurch – 28 November - 1 December 2021

The Local Organising Committee, under the auspices of the New Zealand Coastal Society, Engineers Australia's National Committee on Coastal and Ocean Engineering, and PIANC Australia and New Zealand, invite you to attend Australasian Coasts & Ports 2021; an amalgamation of the 29th New Zealand Coastal Society Conference; the 25th Australasian Coastal & Ocean Engineering Conference; and the 18th Australasian Port and Harbour Conference.

The Australasian Coasts & Ports Conference series is the pre-eminent forum in the Australasian region for professionals to meet and discuss issues extending across all disciplines related to coasts and ports.

Our Conference theme 'Te oranga takutai – Adapt and Thrive' recognises the dynamic coastal environment that we live in and the need for coastal communities to be resilient and adaptable to thrive. Ōtautahi Christchurch and the wider Canterbury region are outstanding examples of this, with major seismic events having caused rapid and significant changes to the coastal environment and substantial damage to public and private assets and infrastructure. These events provide an ideal laboratory to examine the ongoing physical and built environment adjustments, and the possibilities for building stronger, more resilient and vibrant communities.

Australasian Coasts & Ports 2021 will bring together engineers, scientists and planners, academics, practitioners and those in the construction industry to focus on the present and future challenges of adapting coastal communities to thrive in dynamic coastal environments. Opportunities will be provided, in particular, to focus on challenges and solutions for port resilience, impacts and responses to catastrophic events, as well as to explore how local and indigenous values can be effectively represented in coastal management.

Australasian Coasts & Ports 2021 will feature engaging keynote speakers, incorporate numerous concurrent streams for technical presentations, trade exhibitions, half-day field trips, and the opportunity to network with colleagues in a vibrant social programme.

For more information, including the programme, special topics and key dates, see: http://www.coastsandports2021.co.nz

Life members recognised

Don Neale, NZCS Publications Coordinator

The history and tradition of the NZCS is founded on its membership. Five of those members – John Duder, John Lumsden, Terry Healy, Terry Hume and Rob Bell – have been given lifelong recognition of their contribution to the Society and to coastal management in New Zealand/Aotearoa. The NZCS committee recently agreed that these life memberships deserved some tangible recognition, so five carved toki pounamu were commissioned to represent the strength, beauty and traditions of the society. During the last few months, Society representatives have presented the toki in a series of small events throughout the country.

The connection of pounamu to the coastal environment is a very strong one. According to Ngai Tahu tradition, the origins of pounamu are told in a legend about Poutini, a taniwha who transformed a beautiful wahine named Waitaiki into the essence of pounamu and laid her down within the Arahura River, on the West Coast of the South Island. Poutini is said to now swim up and down this coast – Te Tai o Poutini – protecting both the people of the region and the mauri (life force) of Pounamu.The toki were specially produced for the occasion by Waewae Pounamu based in Hokitika. The stone from which they were carved has been formally blessed by tangata whenua, and this helps to ensure the wairua of the stone and each taonga is maintained. Each toki comes with a unique code number that allows its whakapapa to be traced back to the stone from which it was carved and the area from which the stone was collected. Each toki was presented in a harakeke kono crafted by Hokitika weaver Anne Daniel.

Arahura River, the source area of pounamu from which the toki were carved.

One of the toki pounamu presented to the five life members.

The Society treasures the close connection that these taonga give to the original source and the kaitiaki/guardians of the pounamu resource. Presentations of the toki were made at a series of small events. John Duder and Terry Hume received theirs at a convivial afternoon tea with NZCS reps Don Neale and Andrew Allison, at John's home overlooking the Hauraki Gulf (see photo). Rob received his toki at a recent gathering of NZCS members (see *Coastal News* 74), and John Lumsden was presented with his by Justin Cope and other members of the NZ Coasts and Ports organising committee. NZCS Co-chair Amy Robinson kindly presented Terry Healy's toki to his wife, Judy-Ann.

Our five life members have given a great deal to the Society over the years.

John Duder, a specialist in water resources and coastal engineering, deservedly became the first Life Member of the Society at the 2006 Conference in Kaikoura. This was a fitting tribute, given in recognition of his substantial contribution to the Coastal Society as well as to science and engineering in relation to the New Zealand coast. John was a member of the NZCS Management Committee from 1992-1999 and chaired the Society during 1994-1997.

John Lumsden was our second life member, receiving the award at the annual conference dinner in Tauranga in 2007. John was the Society's founding chairman in 1992, and remained on the committee almost continuously until 2007. John applied his extensive knowledge, as a coastal engineering and management consultant, to progress the Society and to oversee the production of *Coastal News*. John is truly a foundation stone of the Society who was instrumental in progressing the Society to where it is today.

The late Terry Healy became a life member in 2010, acknowledging his substantial contribution to our understanding of New Zealands' coast over the past 40 years, from his position as Waikato University's Research Professor of Coastal Environmental Science.

Dr Terry Hume is one of our founding members and was given life membership in 2012. With over 40 years' experience as a marine geologist and coastal oceanographer (principally with DSIR, NIWA and as a private consultant), Terry has been at the forefront of research on New Zealand's coastal environment.

Rob Bell is our most recent life member (see *Coastal News* 74), and his exceptional contribution spans the engineering and science of climate change and coastal hazard/risk and coastal oceanography.

The strength of the organisation today is due in no small part to the abilities and enthusiasm of people like these five who have ensured that the Society is properly established on solid foundations. We truly appreciate the efforts of these and many others who keep the Society going strong.

Terry Hume and John Duder receiving their toki pounamu at a convivial afternoon tea overlooking the Waitematā Harbour.

John Lumsden receiving his toki pounamu with (L-R) Deirdre Hart, Justin Cope, John Lumsden, Hamish Rennie and Martin Single.

Coastal erosion mapping exposes erosion issue at Tiwai Point

Murray Ford[1]

The Tiwai Point aluminium smelter near Bluff is owned by New Zealand's Aluminium Smelter (NZAS), which is in turn owned by Rio Tinto and Japan's Sumitomo Chemical Company. The smelter has been operating for nearly 50 years on the Tiwai Point site. With regularity, NZAS renegotiates power-pricing agreements with Meridan Energy and the New Zealand government, with the shutdown of the smelter always on the table unless favourable power pricing agreements are reached. The most recent set of negotiations has the plant scheduled for closure in December 2024. As the user of 13% of New Zealand's electricity and a significant contributor to the local economy, employing about 1000 people, this will no doubt send ripples through the local and national economy. Likewise, the shutdown and decommissioning of the smelter will have a lasting and unresolved environmental legacy on the site.

One of the critical environmental issues with the smelter's operation has been the storage of waste within coastal landfills. Of particular concern are the safety and long-term viability of a site ~1.5 km east of the smelter used to house >200,000 tonnes of spent cell liner (SCL) waste. The SCL waste contains various waste by-products from the smelter, including cyanide. One of the key concerns surrounding the SCL material is the location of the storage facility, which sits just behind the dunes, ~100m from the beach. The closure of the smelter and subsequent decommissioning and clean-up of the site has received a lot of attention within the media over the last year. The plant closure, and particularly the potential risk of erosion of the SCL storage facility, have spurred on work by the coastal theme of the Resilience to Natures Challenges (RNC2) National Science Challenge at the University of Auckland to understand the behaviour of the beach at Tiwai Point.

As part of the RNC2 coastal theme, we are mapping New Zealand's coast using remote sensing methods. We've assembled a national-scale collection of aerial photos of the coast, which are processed, and shorelines mapped through time. We have developed several 'super sites' or areas of scientific, community or government interest within the project. At these super sites, we supplement the traditional aerial photo mapping of coastal change with records generated from high-resolution satellite imagery from commercial satellites, providing us with a high-frequency record of shoreline position over the last 10 to 15 years.

Given the importance of the Tiwai Point SCL waste issue, we accessed as much cloud-free high-resolution imagery from the Maxar constellation of satellites as was available, a significant problem in a cloudy part of New Zealand. Commercial imagery provided us

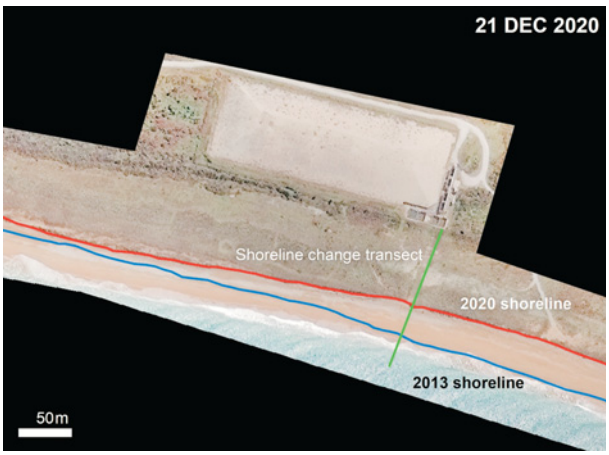


Figure 1: The shoreline position in May 2013 and December 2020 in front of the spent cell liner waste storage facility. Note the position of the transect along which shoreline change is presented in Figure 2.

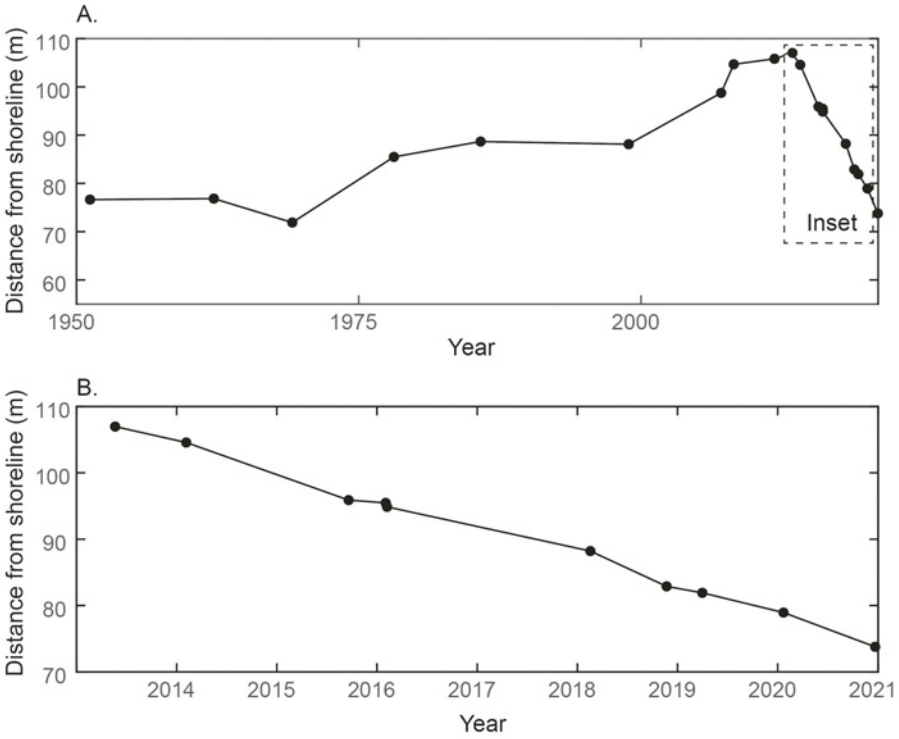


Figure 2: The distance between the shoreline and spent cell liner waste storage facility as measured along the transect shown in Figure 1.

(1) School of Environment, The University of Auckland

with a high-frequency record of shoreline change between 2008 and 2020, comprised of shorelines digitised from 13 separate satellite images. In total, the combined aerial photograph and satellite record provide shoreline positions from 19 unique dates since 1951, a level of detail that is largely unmatched in New Zealand records. Such detailed records are a necessary prerequisite to detect recent changes in shoreline behaviour, the types of which we're likely to see as sea-level rise accelerates.

The record of shoreline change at Tiwai Point shows a complicated pattern of alternating accretion and erosion sections of the beach, which are generally more pronounced east of the smelter. The key focus of our work to date has been on the shoreline in front of the SCL waste storage site. The shoreline in front of the SCL storage site accreted by ~30 m from 1951 to 2013. Of concern has been the recent erosion since 2013, which has wiped out decades of accretion with the shoreline now a few metres closer to the waste facility than it would have been in 1951. The SLC storage site is now only 70-80 m from the beach.

If the recent erosional trend continues, which is uncertain, it's only a matter of ~20 years before the site is in immediate danger.

The RNC2 team will be keeping a close eye on Tiwai Point, hoping to access regular commercial satellite images of the site and expand our focus to New Zealand's other large coastal industrial facilities.

May 2021 Coromandel swell event

Jamie Boyle, Waikato Regional Representative

A significant storm event impacted the east coast of the Coromandel from Sunday 23rd of May through to Saturday 29th of May. This storm was a rare event where (as measured by the Bay of Plenty Bowentown wave buoy) east-direction significant wave heights were over 2 m during this period, maximum wave heights of approximately 6 m, and wave periods were between 10 to 13 seconds and occurred in conjunction with king tides. The king tides that occurred were forecast by NIWA as being within the top 5% to 1% of all highest tides. Storm surge was not too significant at approximately 250 mm. Maximum wind gusts from the east and south-east over this period were in the range of 25 to 30 knots.

The interesting thing with this storm, and after a relatively calm summer period where the beaches had healthy reserves of sand, was that the initial peak in the swell on Sunday 23rd did not induce all the erosion straight away but removed the sand reserves in the intertidal and upper beach. Then once the king tide level began to rise and the swell peaked again on Thursday 27th, water levels were able to reach the toe of the dunes and this is when the majority of the erosion occurred.

With all these factors combined, some severe coastal erosion and minor inundation was experienced. Most of the coastal erosion was observed at south Pauanui Beach, south Whangamata Beach and harbour, and Whitianga (pictured in Figure 1), where significant lengths of shoreline eroded back between 5 m and 15 m in places. Several beach accessways were either partially damaged or destroyed, and which now have steep entry points and will require realignment or nourishment to resolve.

For coastal inundation, Brophy's and Buffalo Beach and Tairua were impacted during the high tides (pictured in Figure 2). Brophy's Beach experienced overtopping over a few days, with Sunday 23rd having the largest impact. A hoggin path running along landward behind the geotextile bags was severely damaged in places, and several geotextile bags were damaged and/or moved by wave overtopping. Wave runup extended approximately 20 m inland and flooded SH25 for a few hours each time. Inundation of the reserve around Taputapuatea Stream was also experienced, with minor wave runup across SH25 for short periods of time. Local roads around the Tairua Marina area were inundated several times and large amounts of debris were washed up and presented some risk to passing motorists.

Figure 1: Impacts of the swell event on east coast shorelines. (A) Shoreline erosion at southern Whangamata Beach (Pipi Rd reserve area); (B) Brophy's Beach geotextile wall; (C) Whangamata harbour reserve erosion; (D) southern Pauanui Beach; (E) and (F) damaged beach accessways Whangamata.

Figure 2: Coastal inundation impacts along the east coast. (A) Flooding of local roads around the Tairua Marina area; (B) Brophy's Beach wave overtopping; (C) Inundation of the reserve around Taputapuatea Stream.

News from the regions

Auckland

Lara Clarke, Matthew McNeil and Andrew Allison, Regional Representatives

Auckland Region Coastal Management Plans

The Auckland Council is developing Coastal Management Plans (CMPs) for the Auckland Region, intended to apply a long-term sustainable approach to the management of the Auckland Region's coast over the next 100 years.

The pilot CMP covering the Whangaparaoa Peninsula is now underway, with community engagement beginning in March. This has involved three public presentations covering the basics of coastal management planning, coastal hazards, and coastal engineering and adaptation strategies in practice. A public open day was also held in May.

Starting in June, Auckland Council and Tonkin and Taylor will be working through the development of adaptive strategy options for the Whangaparaoa Peninsula coastline with a community reference group.

Completion of the pilot will enable the engagement process to be trialled, and lessons learnt applied to the roll out of the remaining Coastal Management Plans for the Auckland Region.

Coastal erosion study

The Auckland Council released the report, *Predicting Auckland's exposure to coastal instability and erosion*, in March 2021. This report identified areas susceptible to coastal erosion and instability. Auckland Council are now developing GIS lines showing those susceptible areas, to shortly be released on Auckland Council's public GeoMaps.

Auckland recreational wharves and pontoons

The Auckland Council has commissioned subtidal structural inspections on six recreational wharves in the region, to be undertaken from the water by divers. These wharves have been targeted as potentially presenting a health and safety risk, being overdue for detailed subtidal inspections. These structural inspections may result in wharf maintenance or renewal works.

Active recreational wharf and pontoon repair and renewal projects are also currently being undertaken at Weymouth in the Manukau Harbour, Hilders Park, Island Bay and Hinemoa Reserve in the Waitemata Harbour, and Ti Point in the Whangateau Harbour.

Bay of Plenty

Jonathan Clarke, Kieran Miller and Josie Crawshaw, Regional Representatives

Ngā Poutiriao ō Mauao to restore Waipatukakahu on Mauao and re-establish cultural heritage site

Ngā Poutiriao ō Mauao is to begin works to restore Waipatukakahu puna or stream on Mauao and re-establish the historical site to its traditional cultural purpose. As part of the restoration project, representatives of Ngā Poutiriao ō Mauao (Mauao Joint Administration Board) will remove a number of exotic trees from along Te Ara Tūtanga or Base Track. This includes four large oak trees that currently grow on this very old puna site on the southern flank. In line with the 2018 Mauao Historic Reserve Management Plan, exotic trees are to be progressively removed from Mauao given its status as a special ecological area. As the oak trees are deciduous, the leaf fall and seedling growth stops the flow of this important puna, which would naturally pool at the base.

Due to the importance of this historic site, landowners wish to restore the Waipatukakahu waterflow and have the site returned to its original cultural purpose as being a place for weaving. Ngā Poutiriao ō Mauao chairman, Dean Flavell, said that as representatives of the traditional owners and guardians of Mauao, they care deeply for the maunga and do not wish to further degrade the Waipatukakahu, which translates to mean 'the stream where flax garments are made'. The area will be replanted with three mass pa harakeke plantings made up of different types of harakeke unique to this area for weaving.

Opotiki's Harbour Project a finalist in LGNZ awards

LGNZ recently announced the finalists in the 2021 LGNZ EXCELLENCE Awards. These awards recognise and celebrate outstanding work by local councils around the country to promote and grow the well-being of their communities. Ōpōtiki District Council Chief Executive, Aileen Lawrie, said that it was amazing news to be listed as a finalist. The winners of each of the categories will be announced at the Fulton Hogan conference dinner and the LGNZ EXCELLENCE Awards ceremony on Friday 16 July in Blenheim. The Mayor said she will be waiting to hear the winner with bated breath.

Motiti Protection Area start date

A start date has been confirmed for the new Motiti Protection Area. From 11 August you can no longer anchor on, or take any marine life from, the three offshore reef systems making up the Motiti Protection Area.

The Environment Court ruling that required the Bay of Plenty Regional Council to introduce the new Motiti Protection Area rules came about after a complex five-year legal case, which spanned across multiple courts. The ruling looks to address the imbalance in marine indigenous biodiversity at the three offshore reef systems surrounding Motiti Island.

Bay of Plenty Regional Council General Manager of Regulatory Services Sarah Omundsen says regardless of how it came about, it's a good outcome for the environment.

"The new rules will apply to everyone equally, including customary, recreational and commercial fishers, divers, those spearfishing, even if you're catch and releasing. We recommend anyone who goes boating in this area becomes familiar with the extent of the protection areas on our website," says Ms Omundsen.

Ms Ormundsen says she is aware the 'no anchoring on the reefs' part of the rule has generated some good discussion in the community and that the regional council is

not trying to keep recreational divers away.

"The Motiti Protection Area rules, which the courts have instructed us to put in place, have been established under the Resource Management Act and state plants or animals cannot be damaged. The problem with anchoring is that both the anchor and chain are heavy. Dropping this equipment onto reefs within the marine protection area could potentially damage the vulnerable reef ecosystems that the rules have been introduced to protect," says Ms Omundsen.

"Boaties are still able to anchor in the general area just not on the reefs themselves. There are also other alternatives to anchoring on the reefs, such as moorings or designating safe anchoring areas, and we are keen to work with groups or businesses to look at pathways for making this happen," says Ms Omundsen.

For more information on the Motiti Protection Area or to access the GIS coordinates visit www.boprc.govt.nz/mpa

Hawke's Bay

José Beyá, Regional Representative

East Rd corner revetment (update from issue 74)

Hastings District Council (HDC) has started the construction of the proposed 100 m long revetment. Construction has been delayed by the recent high-waves events.

Clifton to Tangoio 2120 Coastal Hazards Strategy (update from issue 74)

Additional workshops with community panels have been carried to further refine details of the concept design proposed by councils.

The managed retreat assessment has been carried out by Tonkin and Taylor and a workshop with the community panels took place in June 2021.

Mr Raynor Asher QC finalised his report that reviewed the purpose of the strategy, the current relevant legislation like Resource Management Act, Local Government Act, council functions, and the options to achieve a successful outcome. His recommendation was that the Hawke's Bay Regional Council was best placed to take charge of all aspects of the prevention and mitigation of coastal hazards on the Clifton to Tangoio coast. This includes making decisions about rating for these works and collecting those rates, the implementation of all decisions including supervising works, and the control of all maintenance. Previously, councils have been unable to resolve the leadership of this process. This report is seen as an important step in the progress of the coastal strategy.

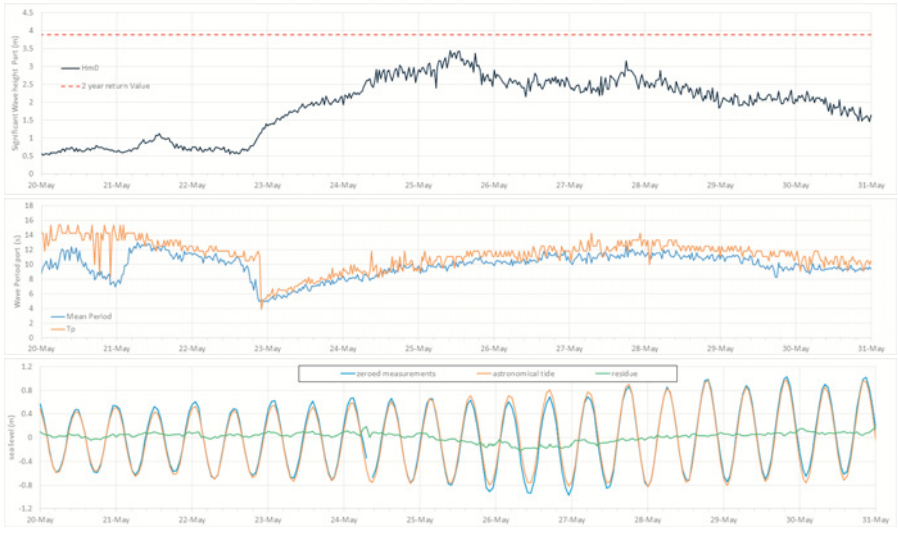
Further community workshops on triggers and signals are planned for 2021.

High waves event – end of May 2021

A significant high-waves event has impacted the coast of Hawke's Bay causing alarm in the most sensitive areas along the coast. Minor overtopping and erosion was experienced at Haumoana, Te Awanga and Clifton. The sacrificial gravel embankment at Westshore was severely damaged, including two complete breaches and the thinning of its crest (see Figure 1). Emergency repair works were undertaken. The Port of Napier was closed for a significant amount of time, with one of the employees noting this as "the longest period the port has ever been closed". An analysis of the wave data recorded by the Port shows that this event did not exceed the two year return value, but its duration was significant.

Figure 1: Breach of the sacrificial gravel embankment at Westshore caused by the swell event in May 2021.

Figure 2 (below): Wave and sea level data recorded by Napier Port during the May-2021 swell event.



Erosion damage was reported at Pourerere beach, and significant amounts of seaweed beached along with minor erosion at Mahanga. The total amount of energy dissipated at the coast and the offshore direction of the waves (from the east) may be responsible for the damage caused. Time-lapses of the event at Westshore can be found at: https://westshorecamnapier.blogspot.com/

Taranaki

Thomas McElroy, Regional Representative

Phase 1 of the Tui oil field decommissioning process now complete

New Plymouth Underwater Limited (NPUW) has had a busy Q1/ Q2 in 2021 with the decommissioning of the *FPSO Umuroa* (a floating production, storage and offloading vessel), ending a 12-year relationship with BW Offshore NZ. The *FPSO Umuroa* was operating at the Tui oil field, located 50 km off the west coast of Taranaki, from 2007 until 2019.

The full decommissioning process has been divided into three phases. Phase 1 was the removal of the *FPSO Umuroa* from location, while Phases 2 and 3 cover the decommissioning of the oil field itself, including the removal of the subsea flow lines and plugging and abandonment of the wells (scheduled to begin in 2022).

During Phase 1, completed in May 2021, NPUW provided 24-hour diving/rigging and marine services and were responsible for the

landing and recycling of the nine moorings totalling 9,000 metres of mooring chains weighing approximately 3,000 tonnes.

Over 80,000 incident free hours were committed to this project from NPUW. NPUW are proud to have supported this project over such a long period.

For more infomation, contact Mike Sharp: mikesharp@newplymouthunderwater.co.nz

An update from Project Reef

'Project Reef South Taranaki' has joined the Tindale Marine Research Charitable Trust inshore tagging programme. Students from Hāwera High School were the first to be involved – tagging seven blue cod and three snapper on a charter boat fishing survey trip in May. Three of the tagged fish have New Zealand length records pending. A few weeks after release, two of the blue cod were recaptured.

A Year 9 Hāwera High School student with the 79.5 cm snapper tagged and released – a pending Junior Length Record for this catch (Photo: South Taranaki Fishing Charters).

The Project was excited to take their first e-DNA samples at the Project Reef as part of the *Wai Tūkwhera o te Taiao – Open Waters Aotearoa* programme run by the Environmental Protection Authority (EPA) and Wilderlab NZ Ltd. The results were informative but also highlighted the benefits of sharing New Zealand marine species DNA sequences into public repositories, such as GenBank.

The Project applied to the Wildlife Conservation Society's Underwater Exploration programme and were successful in their application for a Trident Underwater Drone – this arrived in June and is yet to be deployed. Follow this link for more information: https://marine.wcs.org/Underwater-Exploration.aspx

The Project team have been working since 2017 with Puke Ariki museum on a permanent exhibition of 'Project Reef'. Part of the exhibit is now open, with the reef diorama to open later in 2021.

During May 'the Taranaki Story' was launched (a comprehensive toolkit/website aimed at boosting the region's profile in New Zealand and around the world) with 'Project Reef' featuring. See https://taranakistory.taranaki.co.nz/assets/501351

The work of the Project was also shared at an event in Aotea Utanganui, Pātea for World Biodiversity Day.

For more infomation, contact Karen Pratt: connectivity.karen@gmail.com

Coastal plan guidance for protecting Kororā

Kororā (or Little Blue Penguin) are known to burrow along much of the Taranaki coastline, with nesting 'hotspots' often found near river mouths and other sheltered parts of the coast. These hotspots often overlap with urban areas where boulder ripraps and other man-made structures are present. Boulder ripraps provide an ideal nesting habitat for Kororā as they are able to fit through the gaps and safely burrow into the soil behind them. However, their safety can be jeopardised when maintenance is carried out on these structures.

Coastal structure maintenance is a permitted activity under Rule 36 in the Proposed Coastal Plan for Taranaki, provided the associated conditions are met. One of these conditions is that the maintenance shall not cause any adverse effects on significant indigenous biodiversity (which includes Kororā).

Since the notification of the proposed plan, Taranaki Regional Council officers have identified opportunities to further assist plan users undertaking permitted maintenance activities to ensure good outcomes for the Kororā.

To enhance awareness and encourage education, Council officers have identified areas around Taranaki where Kororā hotspots are located and included them on the publicly accessible Biodiversity portal with an accompanying fact sheet (for more, see www.trc.govt.nz/seabird-areas).

The Council has also prepared guidance material on how plan users conducting permitted maintenance through the proposed plan should undertake that activity, having specific consideration to the vulnerabilities of Kororā and how best to avoid disturbing them. This material will be distributed to all consent holders who have structures that may require the use of the permitted maintenance rule and will also be available generally to the public through the Council's web page: www.trc.govt.nz/MaintenanceKorora

For more infomation, contact Grace Marcroft: Grace.Marcroft@trc.govt.nzz

Wellington

Ryan Abrey and Verity Taylor, Regional Representatives

CentrePort works

The Thorndon Container Wharf works involves ground resilience work and then the reinstatement of an additional 125 m of operational width for CentrePort's two ship-to-shore gantry cranes. The Kaikōura earthquake caused significant damage to the container wharf, with part of it having to be demolished. The port's two gantry cranes were out of action for 11 months, with only geared ships able to load/unload containers. Customers were forced to utilise other ports and reported increased transport costs of up to 400 percent as a result of not being able to utilise CentrePort.

CentrePort was well insured and a total of $28m was spent on temporary repairs in 2017, which enabled 125 m of container crane movement across the width of the berth. The latest project ($38.6m) will double the operational width of the cranes to 250 m and is expected to be completed in early 2022. This will enable CentrePort to meet future customer requirements.

Thorndon Container Wharf reinstatement works (Photo: CentrePort).

Eastern Bays Shared Path

The Eastern Bays Shared Path project has now received the go ahead and construction is likely to be completed in stages over a five-year period, starting with the Sunshine Bay and Windy Point section towards the end of this year.

The project aim is to develop a safe and integrated walking and cycling facility on Marine Drive to connect communities along Hutt City's Eastern Bays, and to provide links to other parts of the network (current and future) for recreation and tourism purposes.

The project consists of 4.4 km of cycleway, requiring 2650 m of seawall upgrades and 430 m of revetment structures, along with beach nourishment. The project is forecast to cost approximately $30 million in total, with $15 million coming from the COVID-19 Response and Recovery Fund, approximately $7.5 million from Waka Kotahi (the New Zealand Transport Agency), and approximately $7.5 million from the Hutt City Council.

Further information, including maps and visualisations, can be found on the Hutt City Project Site at: http://www.huttcity.govt.nz/Your-Council/Projects/cycleways-and-shared-paths/eastern-bays-shared-path/

Wellington Harbour dredging

Work by CentrePort to remove a buildup of sand in Wellington Harbour was completed at the end of April. The buildup was created by propellor wash in the stretch of water between Pencarrow Head and Seatoun, meaning that deep draft ships had to deviate from the normal entry and exit routes of the harbour.

While the original plan was to remove 22,000 m^3 of sand to return the channels to their original depth, this was increased to 30,000 m^3 after further surveying showed a larger-than-expected buildup, with the excavated sand being deposited at a site near CentrePort's Thorndon Container Wharf. The last time shipping channel maintenance was carried out in Wellington Harbour was in 1968, when 264,000 m^3 of material was removed.

Dredging vessel The Albatros operating in the Wellington Harbour entrance, removing 30,000 cubic metres of sand build up from critical shipping channels, 23 April 2021 (Photo: CentrePort).

Sanctuary to Sea update

CentrePort has recently become a strategic partner in Zealandia's 'Sanctuary to Sea' project, joining the six existing partners and numerous community groups in the ecological restoration of the Kaiwharawhara Stream catchment. The catchment has its headwaters in the Zealandia sanctuary, and is the largest stream system in Wellington City, one of only a few with a natural estuary mouth into the harbour.

The Sanctuary to Sea project, started in 2017, aims to improve fish habitats throughout the catchment, enhance fish migration between the estuary and the sanctuary, and improve forest corridors for birds leaving the sanctuary. CentrePort's CEO, Derek Nind, says the port has an important part to play to protect the Kaiwharawhara estuary, as it is a critical part of the catchment, especially for the passage of fish species.

The other strategic partners in the project are the Department of Conservation, Greater Wellington Regional Council, Taranaki Whānui, Wellington City Council, Wellington Water Ltd, and Morphum Environmental Ltd.

For more on the project, see https://www.visitzealandia.com/Whats-On/ArtMID/1150/ArticleID/105

CentrePort chief executive Derek Nind and Zealandia chief executive Paul Atkins at the mouth of the Kaiwharawhara Stream at CentrePort in Wellington (Photo: CentrePort).

Southland

Bryony Miller, Regional Representative

Surf breaks of regional significance are being identified as part of a review of the Regional Coastal Plan, which sets out how Environment Southland manages the coastal marine area. The current Coastal Plan was notified in 1997 and as a result is out-of-step with current legislation, particularly the requirements of the New Zealand Coastal Policy Statement. A strategic direction for the review has been adopted and lays the foundation for developing an effective and efficient Coastal Plan.

In addition, fourteen discussion papers have been prepared covering topics including public access, historic heritage, structures, water quality and aquaculture. There will be opportunities for the public to contribute to discussions and provide feedback on many elements of the Coastal Plan development before it is notified for formal public consultation in 2022.

From *ES EnviroSouth* magazine.

University news

Ecosystem-based management

The Sustainable Seas National Science Challenge (SSNSC) is focused on providing the underpinning research to help bring about ecosystem-based management (EBM) for Aotearoa New Zealand (for more, see www.sustainableseaschallenge.co.nz).

One of the research themes is investigating what legal, policy and practice changes are needed for this to occur. A multi-disciplinary team of researchers led by Associate Professor Elizabeth Macpherson of the University of Canterbury has just published a comparative review in *Marine Policy* of different countries' experiences with implementing EBM and the following is a short summary:

'Hooks' and 'Anchors' for relational ecosystem-based marine management

There remains uncertainty about the legal and policy tools, processes and institutions needed to support ecosystem-based marine management (EBM).

Our interdisciplinary study of ecosystem-based language and approaches in the laws and policies of New Zealand, Australia and Chile uncovered important lessons for implementing EBM around the need to accept regulatory fragmentation, provide effective resourcing, respect and give effect to Indigenous rights, and avoid conflating EBM with conventional approaches to marine spatial planning.

We have suggested a new way of thinking about EBM as a 'relational' process; requiring laws, policies and institutions to support its dynamic process of dialogue, negotiation and adjustment.

We argue that relational EBM can be best supported by a combination of detailed rule and institution-making (hooks) and high-level norm-setting (anchors). With its focus on relationships within and between humans and nature, relational EBM may enable new ways to secure cross-government collaboration and community buy-in, as well as having inbuilt adaptability to the dynamics of the marine environment and the impact of climate change at different scales.

(Macpherson, E, et al. (2021) *Marine Policy*, 130: 104561)

For more information about this publication or on the wider project, please contact Associate Professor Elizabeth Macpherson (elizabeth.macperhson@canterbury.ac.nz) or Dr Steve Urlich at Lincoln University (steve.urlich@lincoln.ac.nz).

Coast2Cast podcast series

Following a virtual get together, in which they discussed how interesting the #Coast2Coast #zoominar had been and how much they were learning without having to travel to conferences, Giovanni Coco (The University of Auckland) and Ana Concejo (University of Sydney) have started a new online venture.

Beginning as a collaboration between a few coastal specialists in Australia and New Zealand, as a way to keep exchanging ideas during the Covid-19 lockdowns, the project has now grown to a fortnightly gathering with international speakers and an ever-growing audience.

It was soon decided that this collaborative venture should be extended into a podcast. The format is an interview with selected coastal scientists, engineers and oceanographers from around the world to learn a bit more about their life and interests, along with some general research topics. The idea is that, as covid madness continues, students and scientists around the world can still 'meet' coastal scientists and hear directly from them. Eight podcasts are now available to listen to, with more planned for the future.

Ana and Giovanni would welcome suggestions for new scientists to interview, as well as any feedback on the podcasts so far (they can be contacted at: ana.vilaconcejo@sydney.edu.au and g.coco@auckland.ac.nz).

You can listen to #Coast2Cast in Spotify (https://open.spotify.com/show/5IBPIFKDqNnbyGHBCNeqSm?si=5Av368PuTrOjOlrI1Vp7LA), or directly on the at #Coast2Cast podcast page at https://coast2cast.podbean.com

Coast2Coast seminar

Dr Shari Gallop (Senior Lecturer at the University of Waikato's Tauranga campus) presented a Coast2Coast seminar about her research on the science of returning freshwater to estuaries, focusing on her work in Te Awa o Ngātoroirangi (the Maketū Estuary) where the Bay of Plenty Regional Council managed a project to return about 20% of the Kaituna River flow to the estuary after it was diverted out in 1956.

She also discussed the importance of positioning as a researcher, and some of the challenges in learning to bridge mātauranga Māori (Māori knowledge) and western science in our discipline of coastal science (you can watch the talk here: https://www.youtube.com/watch?v=CRCxl-K028o).

Shari is supervising a PhD student (Mojgan Razzaghi) who is looking at the hydrodynamic response of the estuary to this freshwater diversion, and has a new masters student Billie Scott (Ngā Puhi) who is planning to focus on ecological impacts on shellfish.

New book release

The book *Advanced numerical modelling of wave structure interactions* has just been published by CRC Press. Co-edited by Dr Pablo Higuera (Lecturer in Coastal Engineering at the University of Auckland), Dr David Kelly (CEFAS) and Dr Aggelos Dimakopulos (HR Wallingford), and including contributions from 16 world-leading authors, this book aims to serve as a reference guide and state-of-the-art review for the wide spectrum of numerical models and computational techniques available to solve some of the most challenging problems in coastal engineering.

Within nine chapters the authors provide an integral overview on classic topics, ranging from wave generation, propagation and breaking, turbulence modelling and scour, to hot topics such as fluid and structure interactions or multi-body interactions. All the topics covered in the book are explained fundamentally from a numerical perspective and also include practical examples and applications.

For more information see: https://doi.org/10.1201/9781351119542

Experimental study of tsunami generation by short-lived underwater volcanic eruptions

Yaxiong Shen[1], Colin Whittaker[1], Emily Lane[2], James White[3], William Power[4] and Paraskevi Nomikou[5]

This article describes part of a wider study on modeling tsunami generation by volcanic eruptions, a summary of which was published in Coastal News 74 (March 2021).

Underwater volcanic eruptions inject hot magma into cold ambient water. The interaction between magma and water creates steam explosions that can displace a large amount of water and even initiate a tsunami. As these eruptions are hidden beneath water, and submarine volcanic tsunamis are less common than earthquake-generated tsunamis and landslide-generated tsunamis, the hazards of underwater volcanic tsunamis are often underestimated by researchers. In order to improve the knowledge about this unseen mechanism, our team has been working on a research project titled 'Volcanoes can make waves too: a new understanding of tsunamis generated by volcanic eruptions', funded by a Marsden Grant from the Royal Society of New Zealand (Grant number: NIW1703).

In this part of the study, we injected compressed air from a submerged vent into a tank filled with water to model an underwater volcanic eruption in the laboratory. The gas eruption generates a fountain on the free surface, which forms the precondition for subsequent wave generation. We observe three main shapes of fountains on the water surface in our experiments: (a) dome-like; (b) finger-like; and (c) transitional shapes between them (see Figure 1). A finger-shaped fountain accompanied by a large number of splashes normally occurs at a shallow-water depth and/or in an eruption with intense source strength, while a dome-shaped fountain occurs at a relatively deep water depth and/or with a relatively weak source strength. These fountain shapes are consistent with field observations such as the Myojin-Sho eruption in 1952 and the subaqueous eruptions in Lake Karymskoye in 1996.

(1) University of Auckland; (2) NIWA; (3) University of Otago; (4) GNS Science; (5) National and Kapodistrian University of Athens.

Tsunami waves are mainly generated by the collapse of the fountain generated on the water surface by the gas jet. Comparing the results of different experiments, we find that for an eruption of a given source intensity, the maximum wave heights first increase and then decrease as water depths increase from shallow to deep (see Figure 2). To explain this phenomenon, we put forward an effective scaled water depth and categorise underwater eruptions into three types: deep-water eruptions, intermediate-water eruptions, and shallow-water eruptions. In deep-water eruptions, most of the energy is dissipated within the water column before the plume reaches the surface, and negligible waves are generated. In intermediate-water eruptions, reductions in water depth reduce the loss of energy to the water column, leaving more energy available for wave generation. This causes an increase in wave heights as water shallows, up to a point. In sufficiently shallow-water cases, the water depth is so small that almost all of the energy from the eruptive jet or plume passes through the water and is dissipated into the air, so there is only small wave-making potential, even with relatively intense source strength. Therefore, there exists a 'critical' water depth at which an eruption with a given source intensity will generate the largest waves. These results are significant because they show the most dangerous conditions for tsunamis generated by submarine volcanic eruptions. The riskiest conditions need to be better accounted for in future tsunami risk assessments.

References

Shen, Y, et al. (2021). Laboratory experiments on tsunamigenic discrete subaqueous volcanic eruptions. Part 1: Free surface disturbances. *Journal of Geophysical Research: Oceans*, 126, e2020JC016588. https://doi.org/10.1029/2020JC016588

Shen, Y, et al. (2021). Laboratory experiments on tsunamigenic discrete subaqueous volcanic eruptions. Part 2: Properties of generated waves. *Journal of Geophysical Research: Oceans*, 126, e2020JC016587. https://doi.org/10.1029/2020JC016587

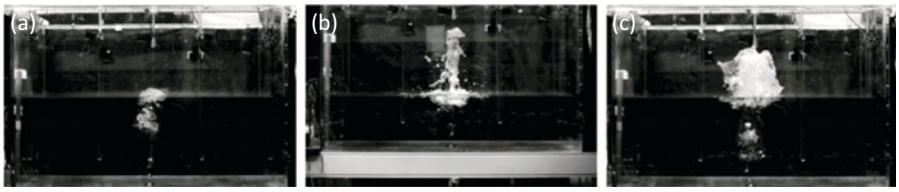


Figure 1: Three fountain regimes observed in the underwater gas jet experiments. (a) dome regimes; (b) finger regimes; (c) transitional regimes.

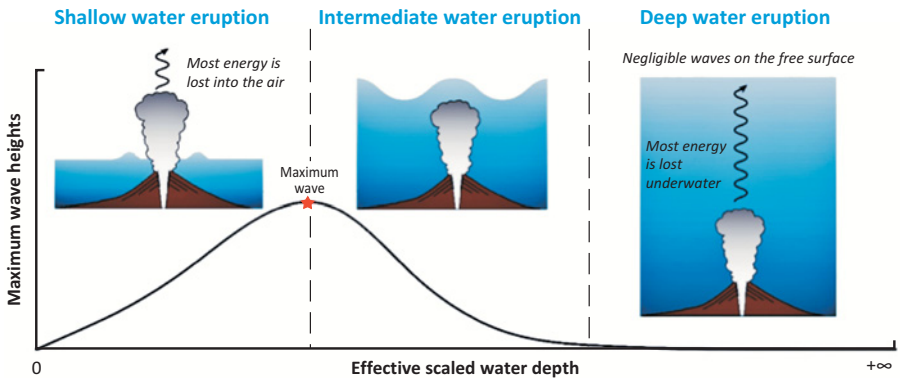


Figure 2: The variation of maximum wave heights with effective scaled water depths.

NZCS Management Committee

Co-Chairs
Mark Ivamy & Amy Robinson
mark.ivamy@boprc.govt.nz
arobinson@doc.govt.nz

Deputy Chair
Colin Whittaker
c.whittaker@auckland.ac.nz

Treasurer
Mike Allis
michael.allis@niwa.co.nz

Deputy Treasurer
Renee Coutts
nzcoastalsociety@gmail.com

National Regional Coordinators
Ana Serrano & Rebekah Haughey
Ana.Serrano@boprc.govt.nz rhaughey@tonkintaylor.co.nz

University & Education Coordinator
Colin Whittaker
c.whittaker@auckland.ac.nz

Website & Social Media Coordinators
Jose Borrero & Renee Coutts
jose@ecoast.co.nz nzcoastalsociety@gmail.com

***Coastal News* & Special Publications Coordinators**
Don Neale & Ana Serrano
dneale@doc.govt.nz Ana.Serrano@boprc.govt.nz

Central Government Representative
TBA

Awards & Scholarship Coordinators
Craig Davis & Jose Borrero
craig@daviscoastal.co.nz jose@ecoast.co.nz

Professional Development Coordinator
Connon Andrews
connon.andrews@beca.com

Membership Portfolio
Rebekah Haughey
rhaughey@tonkintaylor.co.nz

Administration & Communications Coordinators
Renee Coutts
nzcoastalsociety@gmail.com

***Coastal News* Editor**
Charles Hendtlass
cellwairmonk@gmail.com

For member profiles, see: https://www.coastalsociety.org.nz/about-us/management-comittee

NZCS Regional Representatives

Northland	**Laura Shaft** lauras@nrc.govt.nz
Auckland	**Lara Clarke** l.clarke@gns.cri.nz
	Matthew McNeil Matthew.McNeil@aucklandcouncil.govt.nz
	Andrew Allison andrew.allison@niwa.co.nz
Waikato	**Ryan Morrison** ryan.morrison@waikatoregion.govt.nz
	Jamie Boyle jamie.boyle@tcdc.govt.nz
Bay of Plenty	**Jonathan Clarke** JClarke@tonkintaylor.co.nz
	Kieran Miller Kieran.Miller@boffamiskell.co.nz
	Josie Crawshaw Josie.crawshaw@boprc.govt.nz
Manawatu-Wanganui	**Claire Murray** Claire.Murray2@ghd.com
Hawke's Bay	**José Beyá** Jose.Beya@hbrc.govt.nz
Gisborne	**Murry Cave** Murry.Cave@gdc.govt.nz
Taranaki	**Thomas McElroy** thomas.mcelroy@trc.govt.nz
Wellington	**Ryan Abrey** ryan.abrey@stantec.com
	Verity Taylor VTaylor@tonkintaylor.co.nz
Upper South Island	**Lisa Marquardt** lisa.marquardt@mfe.govt.nz
West Coast	**Don Neale** dneale@doc.govt.nz
Canterbury	**Justin Cope** justin.cope@ecan.govt.nz
	Deepani Seneviratna Deepani.Seneviratna@ecan.govt.nz
Otago	**Tom Simons-Smith** Tom.Simons-Smith@dcc.govt.nz
Southland	**Bryony Miller** bryony.miller@e3scientific.co.nz

About the authors

Christopher Eager is a coastal technician specialising in estuarine nearshore hydro-sedimentary dynamics and biogeochemical processes. He is based within the Coastal and Estuarine Physical Processes Group at NIWA Hamilton and has been involved in coastal and marine research both in New Zealand and abroad over the last decade.

Murry Cave is the principal scientist for Gisborne District Council, and despite moving to Gisborne four and a half years ago for a quieter life has found himself being kept busy dealing with natural hazards and environmental risk issues, including co-ordinating the new tsunami modelling, coastal erosion issues, mud volcanoes, new landslide dammed lakes, flood hazard mapping and landslide risk.

Michelle Simone is a Research Fellow in the School of Science at Auckland University of Technology (AUT). Her research expertise in benthic biogeochemical responses to anthropogenic disturbances is being applied in her current role at AUT, where she is investigating the depositional footprint of the blue economy.

The New Zealand Coastal Society would like to acknowledge our corporate members for their support:

4SIGHT CONSULTING · WSP · Bioresearches A Babbage Company · NIWA Taihoro Nukurangi · May + Partners · Environment Canterbury Regional Council Kaunihera Taiao ki Waitaha · Taranaki Regional Council · Beca · DML Discovery Marine Ltd · ENGEO · OCEL Consultants NZ Limited · Tonkin+Taylor

Advertising in *Coastal News*

Coastal News is published three times a year and distributed to the Society's 300 members and corporate members, as well as being publicly available on the NZCS website. There are a range of advertising opportunities available, from small notices to a full page. If you are interested in placing an advertisement, download the NZCS Advertiser's Guide from www.coastalsociety.org.nz/view/publications or email the NZCS Administrator at nzcoastalsociety@gmail.com for further details.

Disclaimer

Opinions expressed in *Coastal News* are those of the contributing authors and do not necessarily represent those of the editor, the NZCS management committee, or the New Zealand Coastal Society. While every effort is made to provide accurate and factual content, the publishers and editorial staff, however, cannot accept responsibility for any inadvertent errors or omissions that may occur.

Contributing to *Coastal News*

We welcome contributions for forthcoming issues of *Coastal News*. Please contact the Editor, Charles Hendtlass, at cellwairmonk@gmail.com if you'd like to submit an article, contribute a news item, have content suggestions or a photo to share, or to give some feedback on the newsletter.

The submission deadline for the next issue is 30 September 2021.

A Contributor's Guide is available for download from the Society's website at www.coastalsociety.org.nz (under the 'Publications' tab). This provides information on the style and format requirements when writing for NZCS publications. An index of articles previously published is also available for download.