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Abstract Booklet

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Assessing variability in shallow groundwater levels and salinity in North Canterbury: A case study of the Ashley Waimakariri and the Ōtākaro Avon regions

The Ashley Waimakariri and Ōtākaro Avon regions, Canterbury, are experiencing the effects of freshwater salinisation and represent two contrasting geomorphic locations. The primary study site for the Ashley Waimakariri region is within a coastal forest located on a coastal plain, north of the Waimakariri River and south of the Ashley River. This region serves as an interesting comparison to the typical marine-terrestrial interface, with the greatest salinisation drivers expected to be wide inundation due to wave run up and storm surges. This is due to its proximity to the coast and limited direct anthropogenic causes within the immediate study area. The Ōtākaro Avon region, an estuarine environment, has experienced the effects relative sea-level rise with the greatest impact occurring on the true right bank of the estuary, within the redzone area established after the 2010-2011 Christchurch earthquake.

As relative sea-level rises, the salinisation effects of inundation due to tidal oscillation and storm surges become amplified. This is compounded with other local salinisation drivers, either natural or anthropogenic. Understanding the long-term effects on shallow groundwater salinisation has been a limited area of study, especially regarding estuarine environments.

This study aims to assess, compare, and contrast long-term (seasonal and interannual) trends in groundwater levels and salinity within these two distinct environments within the Canterbury region, a coastal plain and an estuarine environment. The study utilises field data collected through continuous groundwater monitoring with continuous loggers, processed using statistical correlation, and interpreted alongside current literature. Preliminary results will be shared as part of this presentation. An ultimate outcome of the work is to improve the understanding of long-term trends associated with shallow groundwater salinisation in distinct coastal regions. This research feeds into the broader aspects of the Future Coasts Aotearoa project, potentially influencing decision making at the local, regional, and national level through expanding the current evidence base.

Bio:

I am a current MSc student at the University of Canterbury, studying water science and management. I spent my undergraduate years studying geology and ancient history at the University of Canterbury. When entering post-graduate studies, I decided to diversify into the hydrological sector after enjoying course related to groundwater and geo-thermal activity. My academic research passions involve coastal aquifer systems and geological fault systems. I enjoy being out in the field exploring local environments and experiencing the diversity of New Zealand's ecosystems.

Broad scale warming events versus local climate effects on temperature in the rocky intertidal zone

As temperature is a foundational driver of life, changes in temperature have major impacts on biological patterns. The rocky intertidal zone is one of the most extreme ecosystems on Earth, where stressors from land, air, and the sea interact in complex ways and on small spatial scales (Montie et al. 2023). Temperatures in the rocky intertidal zone are highly variable, affected by local environmental conditions including substrate type, precipitation, wind speed and direction, and solar radiation, as well as tidal regime and wave splash pattern (Coombes 2025, Helmuth et al. 2006, Stillman et al. 2025). As anthropogenic climate change progresses, marine heatwaves are increasing in both frequency and severity (Oliver et al. 2018). Because extreme warming events are documented on broad spatial scales using satellite data, the physical and biological effects on local nearshore ecosystems are poorly understood (Sun et al. 2023). It is unclear how local environmental conditions interact with broader scale warming events such as marine heatwaves, and whether temperatures in the rocky intertidal zone depend more on one than the other.

One of the most vulnerable groups in the rocky intertidal zone are juvenile pāua, marine gastropods that have historically been fished for cultural and sustenance purposes by the Māori people of New Zealand. With the declining rates of pāua recruitment, it is of interest to understand the stressors on juvenile populations and predict how their intertidal habitat may change with increasing temperatures (Gnanalingam et al. 2021, Subritzky 2013). Our aim is to identify what temperatures juvenile pāua experience in the rocky intertidal zone, and which environmental factors most contribute to these temperatures. We hypothesize that intertidal temperatures will be more strongly correlated to local environmental conditions (air temperature, precipitation, and substrate type) than sea surface temperature, and that pāua will experience higher temperatures in the intertidal zone under predicted future climate conditions.

Using robolimpet EnvLoggers manufactured by ElectricBlue, we are recording temperatures in the rocky intertidal zone at multiple sites in the East Otago Taiāpure. Existing LiDAR mapping data of the intertidal zone, combined with our in situ and laboratory logger measurements, will be used to create temperature maps of the intertidal zone under current and predicted future climate conditions.

Bio

Adri Penix is a master's student at the University of Otago, studying the environmental drivers of temperatures that juvenile pāua experience in the rocky intertidal zone. Their interests lie at the intersection between sustainable fisheries and nearshore ecology, informed by their undergraduate work in intertidal invertebrate ecology at the University of California, Davis, and former postgraduate role as a fisheries observer in Alaska.

Developing a UAV monitoring capability for Auckland Council's Coastal Monitoring Programme – Exploring recent changes at Te Henga and Waiwera in Tāmaki Makarau

Auckland's regional coastal monitoring has traditionally focused on beach profile surveys, providing long-term cross-section data to track shoreline change. The increasing availability and reliability of UAV technology now offers a far more information-rich approach to observing our beaches providing beach-wide digital elevation models and high-resolution imagery. However, UAV deployment introduces new challenges, from operational constraints to managing large volumes of spatial data.

In 2024, Auckland Council's Coastal Monitoring Programme began integrating UAV-based data acquisition to modernise our monitoring techniques and enhance both the quality and quantity of information collected across the region. After a period of trialling platforms, refining workflows, and building in-house capability, UAV surveys are now being used to support State of Environment monitoring, pre- and post-storm assessments, and for monitoring the performance of operational and project related responses.

This presentation outlines the development of our UAV monitoring capability, including operational approaches, technical considerations, and lessons learned to date. It will also showcase two case studies: Te Henga (Bethells Beach) where larger scale coastal change is occurring, and Waiwera where a soft solution approach to coastal erosion is being trialled. The repeated drone photogrammetry and aerial imagery will provide new insights to support future coastal management decisions at these sites.

Bio

Aidan is a Senior Coastal Specialist in the Coastal Management Team at Auckland Council, where he works on the Auckland region's Coastal Monitoring Programme. His role spans field monitoring using UAVs, RTK-GNSS, wave buoys and cameras, through to data analysis and reporting, supporting environmental monitoring, storm response and coastal projects across the region. Aidan completed his PhD at the University of Auckland in 2025, investigating rock platform and marine terrace evolution in response to sea-level change and tectonic movement. He also holds a BSc from the University of Auckland and an MSc from Victoria University of Wellington. His background in rock coast geomorphology gives him a long-term perspective on coastal change and a strong interest in developing enduring monitoring systems that can evolve alongside new technologies. Outside of work, Aidan can usually be found mountain biking in the Rotorua Redwoods, or bikepacking and tramping somewhere across the motu.

Matt is a Senior Coastal Specialist, in the Coastal Management Team at Auckland Council. Matt has a BSc and an MSc from the University of Auckland which focused on Coastal Geomorphology and Coastal Management. In his current role, Matt provides technical coastal advice and support across the Auckland Council departments. Specifically, in regards to coastal operational management and response, coastal structure renewal projects, delivery and implementation of Auckland Council's Shoreline Adaptation Plans, coastal policy and planning advice, and the continuing development of the Council's Coastal Monitoring Program. Matt also provides support across Council and to Auckland Emergency Management in regards to coastal storm forecasting and response.

Machine learning approaches for operational infragravity wave forecasts

Infragravity (IG) waves, also known as long-period waves (LPW), are water surface oscillations with periods on the order of 25 to 300 seconds. In the marine industry, they pose significant operational and safety risks, especially in ports and harbours. Even at amplitudes of just 10 to 20 cm, they can induce substantial vessel motions, which in turn negatively impact mooring line loads, cargo operations, and berth availability. Accurate IG wave forecasts are therefore critical to port operations and safety management. After any significant changes to the offshore wave forecasts, nearshore bathymetry, or port infrastructure, the IG wave forecasts regularly require reassessment, and in many cases recalibration.

Traditional IG forecasts rely on empirical equations with a small number of site-specific coefficients calibrated against in-situ observations, which establish a statistical relationship between available offshore wave parameters (and often tidal level) and the IG wave height within the port or harbour. While such approaches are widely applicable, relatively robust, and readily interpretable, their performance is constrained by the predefined model structure and limited number of input variables.

Machine learning (ML) approaches may alleviate some of the above limitations, for example improving site-specific forecast accuracy by using a wider range of impactful input data, or reducing the initial development or recalibration effort due to higher flexibility. However, their application also introduces new or increased challenges related to validation, interpretability, and long-term operational support and maintenance. We present results from several ML IG forecast models developed for sites in NZ and Australia, demonstrating the potential of ML approaches for improving site-specific IG wave forecasts while also highlighting practical considerations and challenges associated with their deployment and long-term maintenance in operational port environments.

Bio

Laura Hughes is an early-career scientist at Earth Sciences New Zealand, where she works on tsunami hazard assessments for Aotearoa New Zealand. Her work primarily focuses on using physics-based synthetic earthquake catalogues for hazard assessments and undertaking probabilistic hazard assessments of landslide-generated tsunamis around Te Moana-a-Toi/Bay of Plenty. She has also contributed to developing new techniques for representing nature-based solutions in tsunami models, helping researchers investigate their potential for hazard mitigation.

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How coastal sediment types influence organic matter degradation beneath kelp mariculture

Coastal sediments are significant reservoirs of organic matter (OM), and OM turnover is central to carbon cycling, nutrient dynamics and ecosystem function. While excessive OM inputs from finfish aquaculture can lead to hypoxia and anoxia at the underlying seafloor. The effects of continuous OM inputs from farmed *Macrocystis pyrifera*, either alone or within Integrated Multi-Trophic Aquaculture (IMTA), remain poorly understood. As seaweed and IMTA farming expands in Aotearoa New Zealand, understanding how sediment type governs OM mineralisation and, in turn, benthic response is increasingly important.

This research compares permeable (sandy) and soft (muddy) sediments across sites on Otago's coastline by measuring oxygen saturation, total alkalinity, dissolved inorganic carbon and nutrient fluxes before and after the addition of kelp OM to the sediments. This work will produce an understanding of how sediment type impacts OM degradation beneath seaweed and IMTA systems, informing sustainable farm siting.

Bio

Alexandra Faulkner is a master's student in the Department of Marine Science at the University of Otago and a recipient of the New Zealand Coastal Society Masters Student Research Scholarship. With a bachelor's degree in applied science in Aquaculture and Fisheries, and a postgraduate diploma investigating enhanced carbonate dissolution of green-lipped mussel shell waste as an ocean alkalisation technique, she brings hands-on experience to her research. Her master's work examines how different coastal sediment types respond to organic matter loading beneath farmed Macrocystis pyrifera-based seaweed and integrated multi-trophic aquaculture (IMTA). Conducted across sites in Otago Harbour and the East Otago Taiāpure, this research will inform guidance for farm placement and management that balances coastal community needs with ecosystem health.

Warming threatens western populations of an iconic habitat-forming macroalgae.

Marine heat waves are already causing substantial kelp losses throughout Aotearoa New Zealand, with southern bull kelp / rimurapa (*Durvillaea antarctica*) populations on the West Coast of the South Island experiencing repeated die-off events. This large, buoyant kelp has distinct northern and southern New Zealand genetic lineages, possibly representing distinct, cryptic species. The lineages may, given their distributions, possess different thermal tolerances, so lost populations of the southern lineage on the West Coast could theoretically be 'replaced' by the northern lineage as the climate continues to warm. Such a replacement would, however, require the northern lineage to be able to reach the West Coast, dispersing against prevailing ocean currents. We used an interdisciplinary approach, combining genetic data, oceanographic modelling, and species distribution modelling (SDM) to test whether rafting rimurapa might be able to reach these decimated West Coast habitats.

Our SDMs indicate that the range of the southern lineage will contract substantially by 2100 under moderate (SSP2-4.5) or high (SSP5-8.5) emissions scenarios, with current West Coast habitats projected to be unsuitable in future. In contrast, the northern lineage is projected to expand its distribution far into the South Island, including the West Coast. However, all attached samples sequenced from West Coast sites have been of the southern lineage. Furthermore, none of the ~26,000 Lagrangian surface particles released from northern sites reached the West Coast, even during high-density releases timed to correspond with major storm events. These findings have substantial implications for management of West Coast marine ecosystems. Without assisted migration of the northern lineage, rimurapa and the ecosystems it supports are likely to be permanently lost from parts of the West Coast in coming decades.

Bio

*Alex Teulon is currently a BSc (Hons) ecology student at the University of Otago, researching how climate change threatens southern bull kelp/rimurapa (*Durvillaea antarctica*) on New Zealand's West Coast. Using an interdisciplinary approach combining genetics, oceanographic modelling, and species distribution modelling, his work examines whether the northern lineage of this habitat-forming species could recolonise West Coast habitats as the southern lineage's range contracts under warming. Alex has also advised on a coastal ecosystem-based climate resilience project in Papua New Guinea and previously served as Co-president of the University of Otago Animal Aquatic Plant Ecological Society (AAPES).*

Exploring Riverine Influences on Shoreline Change Across New Zealand

Sandy beaches make up roughly a third of the world's coastline, and close to a quarter of them are eroding (Luijendijk et al., 2018), so predicting how shorelines move is central to coastal hazard planning. Almost all shoreline models are driven by waves alone (e.g. Splinter et al., 2014). Yet rivers are the other main supplier of sand to the coast, and their influence on nearby shorelines is well established at large deltas (Besset et al., 2019). New Zealand is a useful place to test whether that influence matters on open-coast beaches outside major deltaic systems: its rivers are short and steep, and they carry some of the highest sediment loads per unit catchment area in the world (Hicks et al., 2011), delivered in brief flood pulses. Whether adding river flow improves shoreline predictions remains an open question. We used TabPFN (Grinsztajn et al., 2026), a tabular foundation model well suited to the small sample sizes typical of satellite-derived shoreline records, to assess whether river flow improves shoreline prediction. The model was run twice, once without river variables and once with river variables, while keeping all other inputs and settings identical. Shoreline positions were obtained from satellite imagery (Vos et al., 2019) along 629 transects at five beaches, spanning four regions of New Zealand and four rivers: the Waipapa (northwest), Ngaruroro (northeast), Hokitika (southwest), and Hakataramea (southeast, two beaches). All transects lie within 20 km of a river mouth. Both model variants used recent wave conditions, including onshore- and alongshore-directed wave energy over the previous 30 and 90 days; storm descriptors, including the number of storm days over the previous 30 and 90 days and the time since the most recent storm; temporal features represented by the sine and cosine of the day of year; and the previous shoreline position. The river variant additionally included 30- and 90-day exponentially weighted river flow and their anomalies relative to a training-period day-of-year climatology. Models were trained on 2000–2021 and tested through 2022–2025. Adding river flow reduced prediction error at 78% of the measurement lines, with RMSE falling from 9.2 m to 7.6 m (a 16% improvement), and it raised the median correlation with the observed shoreline from 0.10 to 0.32. Normalized standard deviation changed little (0.68 to 0.69), indicating that although river flow improved the models' ability to reproduce shoreline position and behavioural pattern, neither model captured the full magnitude of observed shoreline fluctuations. Four of the five beaches improved: all 121 transects at the near-mouth Hakataramea beach, 80% at the Waipapa, and 79% at the Ngaruroro, where median RMSE decreased by 35% (6.6 to 4.7 m) and correlation increased from 0.37 to 0.60. The Hokitika was the exception, with performance worsen after river flow was added: only 17% of transects improved, RMSE increased by 12%, and correlation decreased from 0.19 to -0.14. Excluding Hokitika, 87% of transects improved and the median RMSE gain rises to 19%.

To assess the role of each input variable, we applied SHAP (Lundberg and Lee, 2017), which attributes each prediction among the inputs. Grouped into five families, river flow and flood anomalies together account for 27–48% of the model's absolute SHAP attribution comparable to waves and storms combined, while the previous shoreline position accounts for 13–26%. The 90-day average flow is the most influential river input at every beach, suggesting that sustained river-flow conditions may be more informative than individual flood events. Importantly, the models that lean on the river are not always the ones that predict best: at Hokitika, river variables accounted for about one-third of the model's SHAP attribution, yet their inclusion reduced predictive performance, which may reflect limitations in representing the river–shoreline relationship or the use of discharge as a proxy for coastal sediment supply, or model's inability to capture relationship between discharge and shoreline response. This research shows that river discharge provides useful predictive information for shoreline change at many open-coast beaches, although its value varies spatially. River discharge improved predictions at four of the five beaches examined, with improvements observed at 78% of transects overall. Given that river flow is widely available and its future trajectory is itself influenced by climate change, these results support considering river discharge as a candidate input for shoreline forecasting at sites influenced by nearby rivers. Further investigation of river–shoreline interactions will help identify where and under what conditions river discharge provides the greatest predictive benefit.

Bio

Amirmahdi Gohari is a PhD student at the University of Auckland, where he commenced his studies in July 2024. His research, funded by the Our Changing Coast project, focuses on understanding and predicting shoreline change around New Zealand using data-driven approaches. His research is structured around three key areas: predicting short-term (decadal-scale) shoreline evolution using data-driven models at selected regional scales; exploring riverine influences on shoreline change across New Zealand, with a focus on understanding how river discharge and sediment inputs contribute to coastal dynamics; and exploring long-term shoreline projections under climate change, particularly the impacts of sea-level rise on future shoreline evolution.

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‘Restore the Meadows’ seagrass research programme: overview

Seagrass meadows are a critical component of Aotearoa New Zealand's mountains-to-sea ecosystems, supporting biodiversity and fisheries, stabilising sediments, improving water quality, and contributing to carbon storage. Despite this variety of critical ecosystem services, seagrass meadows in many estuaries have experienced decline.

Cawthron Institute's 'Restore the Meadows' research programme was established in 2021 to develop novel techniques for advancing large-scale seagrass recovery. These practices needed to be developed for Aotearoa New Zealand because our seagrass species (*Zostera muelleri*) and environmental conditions often differ from those found overseas. The goal was developing tools for national application, with Te Taihū/Top of the South as the case study region.

A major programme focus has been the development and testing of seed-based restoration approaches, to promote seagrass recovery without heavily impacting donor seagrass meadows. Through laboratory and field investigations, researchers have generated knowledge on flowering patterns; flower collection; seed collection, processing and storage and growing seedlings under nursery conditions. This has provided an essential scientific foundation for future restoration efforts.

The programme has generated a range of outputs, including peer-reviewed publications, technical reports and restoration protocols. Equally important has been the programme's commitment to partnership, knowledge co-development, community engagement and outreach. Working alongside mana whenua, community groups and coastal managers, Restore the Meadows has supported iwi-led projects and a range of citizen science and community engagement activities. These collaborations have strengthened local and national capacity, fostered coastal stewardship, and ensured that scientific findings are translated into practical outcomes.

This presentation gives an overview on the Restore the Meadows journey, demonstrating how integrated research and engagement is establishing a foundation for scaling up seagrass restoration and enhancing the resilience of coastal ecosystems in a changing coastal environment.

The presentation also briefly introduces Cawthron's emerging sister programme 'Restore the Marshes', focussed on salt marshes.

Bio

Dr Anna Berthelsen is a senior marine ecologist within Cawthron Institute's Restoration Ecology Team (Healthy Oceans Group) specialising in developing knowledge and tools to restore and monitor coastal ecosystems. Her expertise spans the ecology of coastal habitats such as seagrasses, saltmarshes, estuaries and rocky reefs, as well as blue carbon and climate change. Anna is co-lead of the multi-year 'Restore the Meadows' research programme, contributing to the development of innovative approaches for seagrass restoration. Her work bridges fundamental research and real-world application, with a particular emphasis on translating science into practical outcomes for coastal communities and environmental managers. A strong advocate for collaborative restoration, Anna works closely with iwi, community groups, government agencies, and industry partners to support ecosystem recovery and coastal stewardship. Through her research and leadership, she is helping build Aotearoa's capability to restore and manage seagrass meadows and other coastal habitats, ensuring these important coastal ecosystems continue to provide ecological, cultural, and climate-related benefits for future generations.

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Supporting Climate Resilience in Pacific Island Countries through Coastal Inundation and Sea-level Rise Risk Tools

Pacific Island Countries (PICs) are on the frontline of climate change, experiencing increasing exposure to coastal and fluvial inundation hazards. Vulnerability is compounded by limited access to decision-ready risk information and constrained institutional capacity to translate risk knowledge into effective planning, investment, and preparedness actions.

To address this challenge, the Pacific Risk Tool for Resilience (PaRTneR) programme has developed climate-driven sea-level inundation risk tools for six Pacific nations. The tools quantify exposure and impacts to populations, buildings, and other assets under present-day and future sea-level rise scenarios. Resulting risk metrics demonstrate how national risk profiles evolve over time under different Shared Socioeconomic Pathway scenarios. Outputs are tailored to support country-specific priorities, including the identification of high-risk areas and informing infrastructure and adaptation planning. Risk information is reported and visualised at asset, island, and provincial or district scales. Two modelling approaches were developed for each country: (1) a deterministic coastal inundation model to assess impacts from individual events, and (2) a probabilistic sea-level rise and annual recurrence interval (ARI) model that combines future sea-level projections with inundation hazard assessments.

The resulting datasets and models are delivered through a centralised web platform and interactive dashboards, enabling rapid access to geospatial risk information and supporting climate-resilient decision-making across Pacific Island nations. In this presentation, we present the tools developed and applications in different sector-based decision making, as well as discuss future research directions driven by country needs.

Bio

Andra Whiteside is a Climate Services Scientist at Earth Sciences New Zealand, with a background in Climate and Environmental Science. She has 10 years of study and work experience in the Pacific focusing on climate change adaptation, climate risk analysis, marine biodiversity management and ocean colour remote sensing. Prior to joining Earth Sciences NZ, she worked in research, tertiary education, and in the development sector in Fiji.

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Designing and Stress-Testing an Adaptation Plan for Whangārei: the Whangārei Urban Flood Strategy Technical Assessment

Whangārei City is at a critical junction – with continued intensity and frequency of high rainfall events and increasing tidal levels it is becoming increasingly apparent the city must plan for a range of interventions to manage urban flood risk in the long term and that conventional approaches will not be sufficient. Beca, Urban Intelligence and NIWA (now ESNZ) undertook the Whangārei Urban Flood Strategy Technical Assessment (WUFSTA) in 2025-2026, comprised of a quantitative risk assessment, identification of potential adaptive actions and pathways, stress-testing of pathways against a range of plausible climate futures, and development of business cases for each pathway that passed the stress-testing hurdle.

Resilience Explorer® was used by Urban Intelligence to undertake a risk assessment. Elements, hazards, contextual information intersected with vulnerability data to identify assets and systems at risk from coastal, fluvial and pluvial flooding, and hotspots for future risk were identified.

Simultaneously, the project team was developing and reviewing potential adaptation actions for implementation across the city. The project team bundled options into adaptation pathways for the CBD and adjacent built up areas.

Pluvial and fluvial flood models were updated to include the proposed adaptive actions and re-run to test their efficacy. A residual risk assessment using Resilience Explorer® demonstrated how proposed interventions change the area at risk from flooding and showed how risk can be transferred from one area to another by certain actions. Finally, eight business cases were developed for adaptation pathways in downtown Whangārei. These business cases will be considered by council and councillors, with some selected for further investigation and detailed engineering assessments.

The WUFSTA project has provided a wide range plausible and future-focussed adaptation pathways for Whangārei. While the city will look very different depending on which is selected, all ensure that Whangārei will continue to thrive into the future.

Bio

Andrew is a climate adaptation scientist and the Technical Director of Climate and Resilience at Urban Intelligence. He brings a proven history of leading and delivering complex projects including risk assessment, adaptation plan development and implementation, and resilience-building for critical infrastructure. Through his work with Urban Intelligence and previously at NIWA, he has collaborated with local and central government and infrastructure providers to develop quantitative tools that help decision-makers identify and adapt to risks across all value domains. He has a PhD in complex systems modelling from the University of Auckland.

(Plankto) Scoping Estuarine Plankton Communities as Bioindicators of Water Quality

Plankton community composition responds quickly to changes in water quality, making it an effective indicator of environmental change. In addition, plankton shifts can reveal nutrient transfer between trophic levels that conventional, more expensive, nutrient sampling misses. Despite these advantages, the application of plankton-based indicators is hampered by time-intensive microscope processing and the taxonomic expertise required. Recent developments of the PlanktoScope (semi-automated microscope) and EcoTaxa (AI-assisted classification software) have streamlined plankton processing and identification. This, along with the relatively low cost, makes this approach suitable for expanding and facilitating both council- and community-led water quality monitoring programs.

We aimed to develop an accessible, plankton-based water-quality indicator using these new tools. To do so, 52 plankton samples from the Kaipara Harbour were compared to simultaneously collected salinity, turbidity, chlorophyll a, and nutrient data. Redundancy Analysis (RDA) demonstrated that plankton community composition can indicate both broad and specific changes in water quality. I.e., the relative abundance of *Lithodesmium* was positively correlated with PO₄ and NH₄, whereas *Pseudo-Nitzschia* was negatively correlated with NH₄, NO_x and turbidity. Using Random Forest and TITAN analysis, these relationships were then used to sort plankton by water-quality sensitivity and create bioindicator groups for good, moderate, and poor water conditions.

Bio

With a broad background in water-related science, specifically within the land-to-sea continuum, I naturally ended up doing a PhD on estuaries at the University of Auckland. Over the last 3 years I have been mucking about in the muddy Kaipara Moana and listening to her story. My primary focus has been on understanding the temporal and spatial variation of mud resuspension within the Estuarine Turbidity Maxima (ETM). That formed the basis for understanding how suspended sediments interact with nutrients within the water column and for uncovering the importance of ETMs for estuarine filtering. This type of research, however, requires expensive sensors and chemical analyses, limiting the potential for upscaling and citizen science applications. Hence, I have also focused on creating a low-budget plankton-based estuarine water quality indicator that could more easily support community-led monitoring initiatives and provide a practical tool for assessing estuarine health. At this NZCS, I will present the results my plankton work, and a related, broader, synthesis of my PhD research on the Kaipara Moana.

Beyond Protection: Integrating Ecology into Coastal Hazard Adaptation

Coastal hazard adaptation is accelerating in response to sea-level rise, coastal erosion, and increasingly frequent storm events. As investment in coastal protection grows, there is a corresponding need to ensure that ecological outcomes are considered alongside engineering performance throughout project planning and design. However, ecological implications are often considered only after key design decisions have been made, limiting opportunities to avoid or minimise impacts on coastal habitats and the ecosystem services they provide.

Developing solutions that address both hazard protection and ecosystem health requires a thorough understanding of the structure and function of coastal habitats. Consideration of habitat connectivity, species life cycles, and sediment dynamics can inform designs that minimise habitat loss, fragmentation, and disruption of ecological processes. Early collaboration with ecologists during project planning can identify sensitive areas, seasonal constraints, and opportunities for habitat enhancement. Long-term monitoring and maintenance plans that incorporate ecological indicators are also critical to ensure that interventions continue to support biodiversity over time.

Additionally, engineering costs and, increasingly, project carbon emissions are routinely quantified during the planning and procurement of coastal hazard mitigation projects. However, the potential loss of carbon sequestration capacity and other ecosystem services provided by coastal ecosystems is rarely considered in decision-making.

Incorporating ecological values into design, such as allowing space for habitat migration or adopting nature-based solutions, can reduce ecological trade-offs and deliver win-win solutions.

Bio

Becky is a marine biologist with over 15 years of experience spanning local government, resource management, and international coastal ecology. She specializes in rocky reef systems and coastal water quality. Her recent work has focused on the impacts of climate change on coastal species and habitats. Becky has a proven track record in managing complex projects, designing and delivering ecological and water quality monitoring programmes, and analysing and interpreting large environmental datasets. She excels at communicating scientific insights to both technical and non-technical audiences. In addition to presenting at professional forums and producing high-quality technical reports, she's provided strategic and technical advice to support coastal management, including consent reviews and the development of national seagrass monitoring guidance.

Anna is a coastal ecologist and resource management scientist with over 20 years of experience working in natural resource management. She is an experienced project manager with technical expertise in marine ecology and estuarine function, water quality, consenting, compliance and impact assessments. Anna has worked on a wide range of assessments on wastewater effects on coastal receiving environments, state and trends of marine and freshwater systems, and has experience across projects relating to aquaculture, hydrology, groundwater, and land science. Anna has considerable experience analysing and interpreting water quality and ecological datasets, and both written and peer reviewed numerous technical reports across a range of disciplines. She is skilled at presenting technical information to non-technical audiences.

Broken waves, new rules? Rock revetment design with an unsubmerged toe

Coastlines are becoming increasingly at risk of erosion due to more frequent and intense wave forces. Continued sea level rise, combined with more frequent storms, present a pressing issue for vulnerable coastal environments. Rock armour revetments are used extensively in shoreline protection and remedial works along New Zealand's (NZ) coastline, providing immediate stabilisation against erosion. Their design is governed by the Van der Meer (1988) formulae, which are internationally recognised and widely accepted within the industry.

However, these formulae assume the toe of the structure remains submerged, such that water depth exists at the toe. This assumption does not hold for many of NZ's coastal environments. NZ coastlines often have wide, dissipative beaches, and the country's emphasis on preserving the natural beach environment means that coastal structures are usually placed on the upper beach. Here, they are primarily driven by swash processes rather than direct wave breaking. Under these conditions, the toe of the structure is intermittently exposed during wave run-up and wave run-down. This research defines these as "beyond shallow" conditions, for which existing design guidance is ineffective.

The current study aims to develop a design approach for rock armour revetments that accounts for swash zone processes rather than relying on conventional deep-water based design methods. The end deliverable aims to be able to be utilised immediately in industry, allowing for clear design guidance, and improving both the reliability and the cost-efficiency of rock armored revetments with an unsubmerged toe. This was achieved by conducting wave flume experiments to accurately replicate swash-dominated coastal conditions in a controlled environment. The experimental setup simulated a rock armour revetment in beyond shallow conditions, where waves break before the structure, causing the toe of the structure to be intermittently submerged and unsubmerged during wave run-up and run-down.

Previous studies indicate that the maximum pressure exerted on rock armored slopes occurs at the point of maximum run-down. The findings of this research corroborate this observation, with damage and armour unit displacement occurring during wave run-down, where downrush velocities approach their maximum values. Further analysis of the experimental data remains, however, there appears to be a correlation between wave runup and damage suggesting that greater run-up extents produce higher downrush velocities.

Bio

Ben Batchelor-Cook – Alongside his Bachelor's Degree (Hons) in Civil Engineering, Ben is the recipient of the Tonkin + Taylor Masters Scholarship in Coastal Engineering which enables him to have part-time employment at Tonkin + Taylor while also undertaking a Masters by research at the University of Auckland. This provides him with the unique opportunity to combine postgraduate research with practical industry experience.

CREST (Coastal Receiving Environment Scenario Tool) for Assessing How to Improve Ecological Health of Estuaries/Harbours

The Coastal Receiving Environment Scenario Tool (CREST) is a digital online application that helps users understand how terrestrial-sourced contaminants connect with estuary or harbour waters. It enables users to assess the current state of the entire estuary, identify catchments contributing the most contaminants to specific areas, and run what-if load-change scenarios. CREST uses a coupled catchment-coastal hydrodynamic model to predict the transport and fate of terrestrial-sourced contaminants, including nutrients, sediment, bacteria and heavy metals. This provides users with a foundation for understanding contaminant behaviour. The models are calibrated with available data or with targeted data collection. CREST offers full spatial and temporal model outputs through an intuitive web interface. Users can explore model predictions from sub-estuary scale to individual locations and compare results against agreed thresholds for each contaminant, supporting detailed local assessments. A unique capability of CREST is its catchment-to-coast connectivity framework, which quantifies how contaminants from individual catchments influence different parts of an estuary or harbour. This source-to-sink understanding enables users to identify where management interventions will achieve the greatest environmental benefit and supports more targeted and cost-effective catchment investment decisions.

A key feature of CREST is its scenario manager, which allows stakeholders to test "what-if" management interventions and quantify the effectiveness of targeted contaminant reduction strategies. It also enables assessment of the impacts of increased contaminant loads. CREST is configured for nine New Zealand estuaries and harbours and is increasingly used to support strategic planning and investment prioritisation. New features are regularly added in response to user feedback. By providing direct access to calibrated model outputs, CREST democratises environmental modelling, allowing stakeholders to investigate management questions independently, interrogate assumptions, explore temporal and spatial variability, and rapidly evaluate alternative futures. CREST bridges the gap between complex numerical modelling and practical environmental management. By placing scientifically robust modelling capabilities directly into the hands of planners, regulators, asset managers, iwi and communities, CREST represents a shift from model-centric to stakeholder-centric environmental decision-making. In this presentation, we will provide an overview of the application and demonstrate the value of a coastal digital twin approach for environmental management and stakeholder engagement. It will show how CREST has supported plan change development in Porirua Harbour and provided evidence of the impacts of a significant historic contaminant source affecting water quality in Nelson Haven, highlighting its practical application.

Bio

Ben Tuckey is a Principal Coastal Scientist with DHI's Marine & Coastal team and is based in Dunedin, New Zealand. He specialises in coastal and estuarine science, with expertise spanning sediment transport, water quality, catchment–estuary interactions, and coastal processes, supported by numerical modelling. Ben has more than 20 years' experience delivering applied science and advisory projects for local government, infrastructure providers, and environmental managers throughout New Zealand. His recent work has focused on understanding the consequences of land-use decisions and the transport, fate, and effects of terrestrial sediment and other contaminants within estuarine and coastal environments. He has led multidisciplinary projects that combine field investigations, data analysis, and modelling to support evidence-based environmental management and planning. His work helps clients navigate complex environmental challenges and make informed decisions in the face of uncertainty. Ben is passionate about translating complex technical information into practical management advice and is committed to advancing sustainable coastal and estuarine management through robust science, clear communication, and collaborative problem solving.

Knowing where detection fails: habitat-extrapolation validation of high-speed underwater imaging for exotic *Caulerpa* surveillance

Exotic *Caulerpa* (*Caulerpa brachypus* and *C. parvifolia*) has spread across the Hauraki Gulf and northern New Zealand since 2021. The area now at risk exceeds what diver and ROV surveillance can cover. At current rates, the question is whether managers observe a spreading incursion or contain it. Faster, validated surveillance may decide which. Under contract to Biosecurity New Zealand, we trialed a high-speed underwater imaging platform to complement existing methods. The platform is towed but actively flown: a pilot instructs a flight computer that holds low altitude as terrain and canopy change, rather than following the tow point. Resolving the fine structure that distinguishes *Caulerpa* demands low altitude, so it flew 0.6 to 1.5 m over open seabed and about 0.2 m above *Ecklonia* canopy. It surveys at 7 to 14 km/h and worked in visibility as poor as 1.2 m, from clear oceanic water to turbid embayments. Over eight days it completed 71 missions and surveyed 97.2 km of seabed, comparable to New Zealand's current annual *Caulerpa* surveillance effort, retaining about 711,000 quality-screened images. Daily coverage exceeds diver and ROV rates by one to two orders of magnitude. Detection used a machine-learning classifier trained on the retained imagery. We separate research-grade from operations-grade reporting. Rather than a single within-domain accuracy figure, we report hold-out experiments that quarantine whole habitats before training, then test on them. Frames from the same short track interval are kept together, so near-duplicate images cannot leak between training and test sets. In-domain detection was consistent (F1 near 0.91). Held-out performance separated into three outcomes. Most habitat extrapolations degraded gracefully: detection stayed sensitive while false positives rose. One oceanic habitat held up fully. One hard-negative site, dominated by other biota, collapsed. This pattern locates the operational envelope: where the tool can deploy now, and where more training imagery is needed first.

The imagery carries more than a detection result. *Caulerpa* cover proved patchy from the metre to the kilometre scale, and that patchiness signals bed maturity, recent disturbance, and the treatment a bed may need. Other features appeared in the same data: eagle rays (*Myliobatis tenuicaudatus*) foraging over *Caulerpa* carpets, with perimeter damage suggesting fragment dispersal; and kelp damage within urchin barrens. Each is costly to survey at scale by conventional means. The same platform and dataset bear on wider conservation monitoring: new marine-pest incursions, the spread of urchin barrens and loss of kelp forest, and marine protected area condition assessment, all at scales current methods struggle to meet. Next steps target the identified gaps: additional habitat imagery, seasonal repeats, and per-environment calibration of detection operating points. Validation of this kind is what would let high-speed imaging carry weight in operational surveillance decisions.

Bio

Brett Kettle is a marine ecologist and a founder of Flying Fish Technologies, a company developing high-throughput underwater survey and machine-learning tools for marine management. He holds a PhD in marine ecology and has forty years of experience across diving and marine operations in the Pacific, Asia, the Middle East, and the United States. His work spans quantitative ecology, impact and damage assessment, emergency response, coastal planning, and marine technology development. He has chaired the Independent Technical Advisory Committee for the Port of Townsville, trained and audited for the Australian Department of the Environment, and served as an expert witness for federal agencies on ship groundings and contested coastal infrastructure. Across this work he has focused on turning field observation into decision-relevant evidence, at the scale and pace that management problems demand. At Flying Fish Technologies he leads applications of towed high-speed imaging platforms and the machine-learning pipelines that interpret the imagery they collect. The exotic *Caulerpa* surveillance trial reported here was delivered under contract to Biosecurity New Zealand. His current interest is in surveillance systems that generate robust observations, testable hypotheses, and faster learning across biosecurity, habitat, and restoration work.

Unravelling Cycles, Trends, and Noise: A Multi-Dataset Approach to Understanding Shoreline Change

Coastal regions are increasingly characterised by competing pressures arising from intensive land use, the high economic value of coastal property, and the significant public and community benefits associated with beaches. These tensions will be further amplified as future sea level rise and climate change increases coastal hazard risk. Poor management of coastal erosion hazard risk has grave implications as structural erosion protection threaten the natural qualities that provide the economic and social values of these environments. These values and conflicts create a complex policy environment in which balancing private interests, public access, and long-term resilience has become a central challenge for future coastal management.

Sandy beaches are dynamic systems, sensitive to subtle environmental changes and human influence, and as such are likely to be some of the most significantly affected by rising sea levels and climate change. Understanding how shorelines have changed in the past—and how they may change in the future—is critical for managing coastal hazard risk. The dynamic nature of sandy shorelines over a range of timeframes complicates the interpretation of datasets and predictions of future behaviour.

Here we describe work by Waikato Regional Council to combine long-term historical shoreline change data derived from aerial imagery with a more frequent (but shorter) beach profile monitoring dataset. Directly integrating these datasets provides additional insight into medium-term cycles of shoreline change and helps to create a more robust conceptual understanding of beach behaviour. By placing recent observations into a longer-term context, the results highlight the importance of recognising natural variability and the challenges and risks that come with extrapolating change into the future in a highly dynamic system.

The outcomes and relevance of retaining the long-term dataset is demonstrated with case studies from the Waikato coast, including the challenges and potential pitfalls associated with determining long term trends when the underlying processes are cyclical, non-stationary, and not fully captured by short datasets. With the availability of high-frequency, remotely collected data now providing new opportunities to build the shoreline change dataset, combining new data with historic information continues to be essential to gaining the best understanding of these dynamic systems.

Bio

Bronwen is an independent coastal science and management consultant (4D Environmental Ltd) with two decades of experience working alongside Regional and District Councils and the private sector across Aotearoa. Her work spans coastal mapping and monitoring, environmental impact assessment, hazard identification and strategic coastal management. She has a particular interest in the tensions between short term hazard mitigation and the long term environmental, social and economic values of natural coasts, and the challenges these pose for communities and decision makers. Dr Stephen Hunt is Senior Coastal and Marine Scientist at Waikato Regional Council, Hamilton. His work focuses on physical oceanography and marine environmental monitoring, supporting evidence-based decision-making across local government and communities.

Monitoring and management of kororā within ports and marinas

In recent years, there has been increasing awareness and public scrutiny of infrastructure projects that intersect with kororā/little penguin^[1] habitat. As climate change intensifies coastal hazards, ports and marinas are increasingly required to strengthen and upgrade seawalls and associated infrastructure to improve resilience and protect assets. This presents a challenge where seabird species are attracted to and inhabit artificial structures, including seawalls and breakwaters, within port environments.

Monitoring kororā within rock walls is more challenging and complex than monitoring within nest boxes or natural burrows. Although kororā are typically at sea during the day, their presence or absence within a rock wall at any given time remains uncertain. Visualising birds and nest contents within the deep crevices of rock walls is difficult, even for experienced practitioners using burrow scopes and trained conservation dogs. However, the presence of kororā sign (e.g., guano, odour, scratching, and feathers) can provide a useful indication of activity, helping to build a general picture of occupancy and to identify likely burrow and moulting locations.

Despite these challenges, construction activities can be undertaken without causing kororā mortalities and can result in positive outcomes. Conservative management and monitoring protocols, combined with a skilled construction team, contribute to successful project delivery. This presentation summarises monitoring and management approaches for kororā and provides an overview of methodologies used to manage the ecological effects of coastal construction on local populations.

Bio

I am an associate ecologist within the ecology and marine science team at SLR Consulting. As a marine ecologist, I provide prepare ecological impact assessments for complex development and infrastructure projects across Aotearoa. I support projects through regulatory and consenting processes, preparing robust, evidence-based assessments and advising on effects management in coastal and marine environments. I have undertaken and assisted the coastal team in Coastal Hazard Impact Assessments for developments throughout the Auckland and Coromandel Region. I have contributed technical expertise on a range of high-profile coastal projects, including preparing and presenting ecological evidence in hearings and Court settings. This includes experience acting as a technical expert in consent and High Court proceedings, requiring clear, defensible interpretation of ecological effects and effective communication to both technical and non-technical audiences. My skills and experience have been recognised by a certification as a General Certified Environmental Practitioner (CEnvP) with the Environment Institute of Australia and New Zealand (EIANZ).

Climate Change Effects on Marine Habitats in the Bay of Plenty

Climate change is expected to alter coastal and marine ecosystems, with implications for habitat distribution, ecological function, and restoration planning. To support coastal management, this project assessed the potential effects of climate change on marine habitats across the Bay of Plenty, including mangroves, saltmarsh, seagrass meadows, soft-sediment habitats, rocky shores, subtidal reefs, dunes and beaches, and biogenic reefs.

The assessment drew on the Bay of Plenty climate change risk assessment undertaken for the region^[1], habitat vulnerability information, and available local studies to identify likely impacts under a range of future climate scenarios. Particular attention was given to current and proposed restoration opportunities, adaptation pathways, and actions that could improve habitat resilience to future climate stressors.

The findings indicate that many Bay of Plenty marine habitats are likely to experience increasing pressure from climate-related changes, highlighting the need for targeted interventions to prevent habitat loss and enhance ecosystem resilience. Existing restoration initiatives provide an important foundation for adaptation; however, restoration efforts are currently concentrated in habitats that are generally more visible, accessible, and of higher public amenity value, such as saltmarshes and dune systems. In contrast, reef habitats, despite potentially significant vulnerability, receive comparatively less restoration effort, reflecting greater implementation complexity, scientific knowledge gaps, and consenting challenges.

This work identifies opportunities to better align restoration investment with climate vulnerability and supports Bay of Plenty Regional Council in prioritising actions that will strengthen the resilience and adaptive capacity of marine habitats under future climate conditions.

Celeste Davies-Calway¹, Dr Stephen Hunt¹, Rick Liefing¹, Jamie Boyle²

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Coastal impacts-based warnings for severe weather events at a local and regional scale

Impact-based warnings turn technical forecasts of weather events into meaningful information for communities and stakeholders. Waikato Regional Council (WRC) currently provides coastal impact information to the community and various stakeholders proceeding and throughout severe weather events. Leading up to and during weather events, coastal experts rely on MetService (MetOceanView) forecasts (storm tide, wave heights, wind speed and direction) to provide an insight into potential impacts. However, this process is somewhat informal where coastal expert knowledge is relied upon to create the messaging for each weather event. Coastal experts at WRC utilise existing knowledge from sea level analysis of tide gauges, and shoreline monitoring, along with informal observations from previous weather events. Monitoring of tide gauges and cameras, during events, ensure forecast conditions align with observed conditions.

The two key impacts for messaging are due to coastal inundation (combined with river flooding) and potential coastal erosion. There is a particular focus given to known 'hotspots' such as inundation prone low-lying areas in Mercury Bay or Firth of Thames, and erosion prone beaches along Waikato's West coast and Coromandel East coast. Although this approach has been successful Waikato Regional Council is working towards a more formal approach to providing coastal impact-based warnings, where a framework is being developed to provide consistent and structured messaging throughout severe weather events. The framework would include expected likelihood and consequences of coastal hazards.

Furthermore, by recording observations of coastal impacts such as erosion or flooding alongside historic wave statistics, and water levels, a more formal and consistent approach to determining impact-based warnings from forecasts can be achieved. Coastal experts at WRC have been using recent weather events over the past few years to gather further observations and to test thresholds, along with messaging, which can be used within the framework. Coastal experts at WRC would greatly welcome collaboration with other councils and research institutes at the local, regional and national level. Our aspiration is to create a consistent framework and messaging for coastal impacts-based warnings across Aotearoa.

Bio

Celeste Davies-Calway is a Regional Resilience Specialist at Waikato Regional Council. She has a passion for analysing technical information and communicating science in meaningful ways to communities. Celeste has previous experience as a water quality Science Technician and regional Consents Officer. She has been within the Regional Resilience team for about four years and her workstreams have a focus on coastal erosion and inundation, natural hazards data, technical assessments and community adaptation. She is starting to move into the river flooding and coastal modelling space. She is actively involved in WRC's severe weather response through the roles of coastal subject matter expert, Regional Flood Liaison Officer, and she is a Regional On-Scene Commander for marine oil spill responses. Celeste holds a Bachelor of Science double majoring in Earth and Environmental Sciences, and a Master of Science in Earth Sciences, specialising in coastal processes, from the University of Waikato.

Charles A. Cox¹, Andrew R. Gorman¹, Pascal Sirguey², Wayne J. Stephenson³, Raphael Krier-Mariani⁴
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From coastal change to sediment connectivity: investigating sediment storage and transport along the Otago coast

Rates of coastal erosion and accretion vary along the Otago coastline, with neighbouring beaches commonly exhibiting contrasting behaviour. Previous research has mapped these patterns of coastal change, but the processes controlling their spatial variability remain poorly understood. In particular, the relative importance of terrestrial sediment supply, offshore sediment storage, and hydrodynamic forcing has yet to be resolved. Research for a PhD aims to develop a regional sediment-connectivity framework for the Otago coast by examining how sediment is transferred from river catchments to the nearshore and inner shelf, and subsequently redistributed by waves and currents. Satellite-derived turbidity observations and river-discharge records are being used to quantify sediment delivery to the coast, while bathymetric and seismic datasets will identify potential offshore sediment stores and transport pathways. A regional WaveWatch III hindcast, forced using ERA5 atmospheric reanalysis and evaluated against available wave observations, is also being developed to characterise spatial variability in wave climate, coastal exposure, and sediment-transport potential.

Analysis of 10 years of Sentinel-2 imagery (2016–2026) spanning approximately 250 km of the Otago coast indicates that the Clutha River is the dominant sediment source, with secondary contributions from the Taieri River and sediment exchange between estuaries and the coastal ocean. A pronounced spring maximum and autumn minimum in coastal turbidity suggest strong seasonal variability in sediment delivery, while wave-driven remobilisation of previously deposited sediment demonstrates the presence of an active inner-shelf sediment reservoir.

These datasets will be integrated with mapping of coastal erosion and accretion to investigate why adjacent coastal sectors can respond differently to similar external forcing. By linking sediment sources, transport pathways, temporary storage, and coastal response, this work moves beyond documenting shoreline change towards understanding the processes governing sediment connectivity. The resulting framework will improve understanding of the Otago coastal sediment system and provide a basis for future coastal hazard assessments, sediment management, and climate-change adaptation planning.

Bio

Charles Cox is a PhD student based in the Geology Department at the University of Otago. His undergraduate program consisted of majors in Geology and Oceanography, with numerous summer projects and independent research projects focusing on both coastal change and landslides. After completing and BSc(Hons) in 2024, looking at earthquake-induced landslides in Fiordland, he shifted back to coastal space for a PhD, focusing on the east coast of Otago. When he isn't working, he is often exploring the coast surfing.

Who let the water out? Tidal exchange impacts on the health and ecological value of two tropical coastal lagoons in Vava'u, Tonga

Coastal lagoons are one of the most valuable ecosystems, providing a variety of ecosystem services and supporting significant marine flora and fauna, coastal communities, along with fisheries and tourism. In Tonga, communities have used lagoons as important food and income sources for centuries. Furthermore, these lagoons support ecologically significant habitats, providing key breeding grounds and nursery areas for many marine taxa. However, despite this clear value, there is a considerable lack of data on the environmental integrity of lagoons in Tonga.

To this end, we investigated the impact of hydrology on the health and ecological value of two contrasting lagoons located on the island of Vava'u under different hydrological regimes. Ta'anea lagoon has restricted flow owing to the construction of a causeway built in 1981, whereas Tefisi lagoon is open to the ocean. To better understand lagoon dynamics, we collected both hydrodynamic data (e.g., water velocity, depth, water level, and flushing times) and biological data (e.g., benthic habitat and water property measurements).

Using a tidal prism model, it was revealed that Ta'anea lagoon had 10 to 70% longer flushing times compared to specific sites in Tefisi lagoon. Additionally, water level loggers deployed on either side of the causeway showed that there was a 90-minute delay on the lagoon side, with an approximate 20 cm reduction in tidal range. Water property measurements clearly indicated that the reduced water flow in Ta'anea lagoon had led to poorer water quality and declining ecological health, whereas Tefisi lagoon had physicochemical conditions similar to open ocean water and higher quality benthic habitat, including intact coral reefs. Benthic habitat composition differed substantially between the two lagoons, with Ta'anea lagoon consisting mainly of dense filamentous mats and cyanobacteria while Tefisi lagoon had markedly lower algal cover and higher proportions of sand, rubble, and live coral.

These findings suggest there are clear differences in physical and biological conditions between Ta'anea and Tefisi lagoons, driven by differences in tidal exchange. This is likely due to the construction of the causeway which has reduced water flow in Ta'anea lagoon. Overall, these results highlight the importance of hydrological connectivity on the health and ecological value of coastal lagoons, with reduced tidal exchange resulting in degraded environmental conditions and poorer quality water.

Bio

Charlie Brinkhurst is a post-graduate student at the University of Otago completing his master's in marine science. He finished a Bachelor of Science in Marine Science degree in 2024 at Otago University. His research focusses on tropical lagoons, looking at the impacts of restricted water flow on health and ecological value. This research covers both physical and biological factors, such as flushing time, water property measurements, and benthic habitat composition, allowing Charlie to learn a broad suite of skills and discover new interests. Charlie is also a lab demonstrator for the MARI112 paper which offers a nice change of scenery interacting with first-year students. In his spare time, Charlie enjoys spending time at the beach and being in the water, whether he is surfing, diving/snorkeling, or going for a walk along the sand.

Corban J. Church¹, Wayne Stephenson¹, Lucia Danzi²

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Risk Tolerance in Communities Threatened by Coastal Hazards

South Dunedin is an area of the coastal city of Dunedin, in the South Island of Aotearoa / New Zealand, and is exposed to several natural hazards including flooding, erosion and tsunamis. In 1923, 2015 and 2024, there were major flood events that cost millions of dollars in damages. Future predictions estimating that the frequency and intensity of hazard events will increase over the next century, leading to discussions about the future of South Dunedin. Risk research suggests that populations exposed to hazards will tend to have mixed perceptions and tolerance for risk. While a high level of perception should lower tolerance and encourage risk mitigation, the opposite is often the case.

Several influencing factors have been identified in past literature, including cognitive and emotional heuristics as well as the appraisal of risks and benefits, yet their exact contribution is unknown. This research aims to fill this gap by investigating the reasons for risk tolerance in coastal communities. To address the research goal, a constructivist research paradigm was adopted to explore how South Dunedin residents construct their perception of risk by using a mixed method approach. A survey was conducted on 20 participants from target suburbs, with five respondents also volunteering for a semi-structured interview.

Results indicate that participants perceived a high level of risk but had high tolerance for it, mirroring findings of past studies. Furthermore, a combination of cognitive and emotional factors was identified as influencing this tolerance. The findings of this research suggest that participants utilised a combination of interacting cognitive and emotional processes to perceive, evaluate, and tolerate the risks. Emotion was identified as a potential influencer of what information participants used and how much impact it had on their tolerance for risk. Furthermore, the high perception and tolerance of risk may have been partially explained by the inclusion of risk evaluation, possibly demonstrating how participants evaluated the benefits to be greater than the high level of risk.

Bio

Corban Church is a postgraduate student from Taranaki, studying a Master of Science in environmental management at the University of Otago. The focus of his thesis is applying psychological theories such as heuristics to better frame risk evaluation as a rational and emotionally influenced process. To do this, he used a mixed methods approach to understand how residents used emotionally guided thinking to weigh the severity of coastal risk against the benefits of living in an area. The goal of his research is to influence how academics and decision-makers frame and incorporate coastal residents' perspectives into their own work.

Cristian Flores Perez¹, Grant Bicknell², Andy Pullar², Thomas E. Fellowes³, Francois Flocard³, Matt Sheppard¹, Jennifer Hart¹

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Aramoana Mole Roundhead Renewal

The Mole at the entrance to Otago Harbour, together with the Long Mac structure, train the entrance to the Otago Harbour. Tidal flows are confined between Taiaroa Head and the Mole to provide a stable, navigable harbour entrance. In addition, the Mole stabilises the eastern end of Aramoana Beach, holding it in position and reducing the transport of sediment into the harbour entrance channel. Construction of the mole began in 1884 and continued in stages until 1964. Materials used over the past 140 years include: local core, underlayer and armour rock; scuttled vessels; and Tetrapod concrete armour units. The Mole is exposed to severe wave conditions during easterly/north easterly storms, resulting in deterioration of the roundhead (seaward end) in particular. It presently requires regular maintenance using locally quarried rock to address storm damage. Port Otago Ltd owns and maintains the Mole. The Port initiated a project to improve the resilience of the roundhead, to reduce maintenance costs and provide for future climate change. Beca Ltd, HEB Construction Ltd, Oceanum and the UNSW Water Research Laboratory provided design, constructability, numerical modelling and physical modelling assistance, respectively. An initial study considered options for the roundhead including: do nothing; maintain (present strategy); rock berm overlay; concrete armour overlay; and a new piled concrete structure. The concrete armour unit overlay was selected to progress to design. Design requirements took into account the exposed environment and included a 1% Annual Exceedance Probability (AEP) design storm and a 0.1% AEP overload storm, derived from numerical modelling and incorporating projected relative sea level rise over a 50-year design horizon. Wave breaking at the toe of the roundhead overlay poses a design and constructability challenge. The design process investigated a number of sub-options for roundhead elements:

- Two concrete armour units were considered: Hanbars and Cubipods®. Armour unit selection considered a range of factors, interlocking versus mass based stability, hydraulic performance and availability to be used as a toe protection were key considerations. Placement methods and installation rates at an exposed site were also evaluated. Finally, suitability for curved alignments, licence and patent requirements were also taken into consideration. A two-layer Hanbar armour system was taken forward to physical modelling as it delivered a more compact design, requiring a lower volume of concrete. Both 13 t and 19 t units were tested in the physical model due to the complex bathymetry and corresponding dynamic wave environment.
- Several roundhead radii were assessed to determine the optimal layout, considering hydraulic performance, cut-and-fill volumes, and constructability (machine reach). A 13 m radius was selected for the mole renewal and carried forward to 70% (developed) design.
- Excavated and piled toe options were assessed during the design process, which included physical modelling testing. The innovative piled toe option was developed to address performance and constructability considerations. It demonstrated improved resilience under design conditions in the physical model compared with the excavated toe.

A refined design was developed that demonstrated satisfactory performance under design storm conditions. It addressed many of the design and constructability challenges but residual matters, such as toe pile durability and constructability, are under review alongside the wider strategic approach for the roundhead.

Bio

Cristian is a Coastal and Maritime Engineer with Beca's Auckland team. He has a BSc in Ocean Engineering and a MSc in Sustainable Civil Engineering (Maritime). His project experience covers New Zealand, Chile and the Pacific Islands and includes hydrodynamic and sediment transport modelling, design of maritime infrastructure and construction monitoring.

Oral Presentation

Why Some Coastal Policy Objectives Endure While Others Fail: Lessons from Tasmania

Integrated coastal policies promise ambitious environmental, social and economic outcomes, yet implementation often falls well short of those ambitions. Understanding why remains a persistent challenge for coastal governance. Drawing on thirty years of implementation of Tasmania's State Coastal Policy 1996, this paper examines why some policy objectives become embedded in planning and management practice while others struggle to endure. Developed alongside Tasmania's Resource Management and Planning System (RMPS) during the emergence of Ecologically Sustainable Development and Integrated Coastal Management, the State Coastal Policy sought to replace fragmented decision-making with a more integrated approach to coastal governance. The research draws on semi-structured interviews with 18 participants involved in the policy's development, implementation and administration across government, statutory authorities, industry and the community sector. Interview data was analysed to identify the conditions shaping implementation over the policy's first three decades. The findings suggest that success depended less on the ambition of individual objectives than on whether implementation pathways aligned with their underlying purpose.

Objectives translated into clear statutory requirements became embedded in routine development assessment and proved remarkably durable, helping prevent ribbon development and inappropriate development on actively mobile coastal landforms. By contrast, objectives relating to water quality, ecosystem protection, weed management, community engagement, cross-agency coordination and climate adaptation relied on sustained leadership, strategic planning, institutional capacity and collaboration. As these enabling systems weakened, implementation became increasingly uneven despite the policy remaining in force. The research also found that, while Tasmania has devoted considerable effort to statutory planning reform over the past two decades, comparatively less attention has been given to the strategic, collaborative and integrative functions originally envisaged by the RMPS and the State Coastal Policy. The result is a policy whose prescriptive regulatory-based provisions remain influential while many of its broader more governance-dependant ambitions have become increasingly difficult to sustain. The findings demonstrate that integrated coastal policies comprise fundamentally different types of objectives requiring fundamentally different implementation pathways. Regulatory objectives can often be sustained through statutory planning systems, while strategic and collaborative objectives depend on enduring governance arrangements capable of maintaining leadership, coordination and institutional capacity. The Tasmanian experience suggests that designing implementation pathways may be as important to long-term policy success as the policy itself.

Bio

Daryl Connelly is Director Liveability and Growth at Tasmania's Central Coast Council, where he leads strategic and statutory planning, economic development and community development. Over a 30-year career spanning local government and regional development, he has held senior leadership roles, including Chief Executive Officer of the Cradle Coast Authority, a regional organisation jointly owned by nine councils with responsibility for natural resource management, tourism and economic development. He has led major planning initiatives, including the \$1.7 million Our Homes, Our Future project - one of Tasmania's largest strategic land use planning projects - and the Ulverstone Waterfront Master Plan. Under his leadership, Council's work has received Planning Institute of Australia (PIA) awards for strategic planning and planning process improvement. Daryl is completing a Master of Planning at the University of Tasmania, complementing his Master of Business and Graduate Certificate in Urban Planning and Design. Drawing on three decades of professional practice, his research focuses on bridging theory and practice and improving the long-term environmental, social and economic performance of coastal places. He has presented at the PIA National Planning Congress and co-convened the PIA Tasmania State Conference.

David Falconer¹

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Managing the coastal marine area under New Zealand's new planning system

New Zealand's new planning system will reshape how the coastal marine area (CMA) is planned, used and protected. National policy direction and national standards will set priorities and consistent requirements, while regional spatial plans will identify the long-term spatial direction for marine uses, infrastructure, natural hazards and environmental management. Regional combined plans will then translate that direction into natural environment and land use provisions for the CMA, supported by consents and permits for activities requiring approval.

This presentation will explain how the system's "funnel" is intended to connect national priorities with regional strategy and local implementation. It will provide an overview of the new system as provided by the Planning Act 2026 and Natural Environment Act 2026 and the key changes from the Resource Management Act 1991 in relation to the Coastal Marine Area. Particular attention will be given to how the new framework can support integrated planning across CMA. The central proposition is that the new system provides an opportunity to establish a more strategic, nationally consistent and outcome-focused framework for managing the CMA.

Bio

David Falconer is the Principal Advisor Marine at the Ministry for Cities, Environment, Regions and Transport. He works on Marine aspects of the new planning system.

Deirdre E. Hart¹, Briar van Vosselen¹

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Closing the Research-to-Practice Loop: Translating Coastal Research into Social Media Science Communication

Background: Effective coastal adaptation depends not only on robust science, but also on communicating that science in ways different people within communities find accessible, engaging and relevant. Three previous University of Canterbury Master's research projects (Carass 2021, Thompson 2022, Barnes 2023), undertaken with local government and coastal communities, consistently identified demand for concise digital science communication that complemented technical reports and community meetings, engaged younger audiences, and highlighted the positive role of dynamic coastal environments in responding to climate change.

Process and Products: Based on these recommendations, a 2025 University of Canterbury GEOG309 service-learning project sought to translate the earlier coastal community and science research findings into practice. Students developed a series of short evidence-based coastal science videos. They worked in partnership with Environment Canterbury for review of the coastal science, while also ensuring the videos aligned with research on hazards-based science communication and the earlier community research. This approach avoided unnecessary participant fatigue by implementing, rather than repeating, previous consultation findings. The project produced a suite of short science communication videos explaining the dynamic nature of Southshore Spit and the role of coastal environments in supporting resilience. Initial dissemination included presentation to Christchurch secondary school students through the Youth Innovation Hub during the United Nations Adaptation Futures 2025 Conference, with broader public dissemination happening progressively through social media and partner organisations.

Reflections: The project demonstrates how undergraduate teaching, previous postgraduate research and regional partnerships can be integrated to translate coastal science into practical community resources. It also highlighted that implementing recommendations from earlier community research does not necessarily remove differing stakeholder expectations regarding consultation, ownership and representation. Rather than viewing differing perspectives as barriers, we argue they provide opportunities to reflect on how coastal science communication can build connections while remaining evidence-based, responsive and accessible. Project experiences reinforce the concept that research translation is a distinct and important a stage of the coastal research process, deserving the same critical reflection as the original research itself.

Bio

Dr Deirdre Hart is a coastal scientist, NZCS Life Member and Associate Dean Academic in the Faculty of Science at the University of Canterbury. She is passionate about coasts, science education, and multidisciplinary research that brings together disciplinary experts, stakeholders and decision-makers. Her work focuses on coastal and hydrosystem processes, ocean tides, multi-hazards, nature-based solutions and climate change adaptation, with a particular interest in building resilience by integrating research, teaching and service.

Briar van Vosselen is a Master of Urban Renewal and Resilience student at the University of Canterbury. She has a keen interest in coastal adaptation and science communication, with a passion for developing local-scale solutions to socio-environmental challenges. Briar's background is in physical geography, environmental science and ecology, which she utilises to approach work with an interdisciplinary mindset, aimed at balancing multiple values and stakeholders. Her master's focuses on combining physical science with socioeconomic and environmental values to develop and implement sustainable adaptation.

Reducing tsunami currents without compromising everyday marina performance: Integrated field measurements and modelling at Tutukaka Harbour

Tutukaka Marina is one of New Zealand's most tsunami-sensitive marina environments. The harbour amplifies long-period wave energy, producing strong currents at the marina entrance that have repeatedly damaged vessels and infrastructure. Previous tsunami modelling showed that reconfiguring the marina entrance could substantially reduce these hazardous currents. However, a safer entrance would only be practical if it continued to provide effective protection and did not adversely affect circulation, sediment transport, flushing, or day-to-day marina operations. To test this, a seven-week field programme was undertaken between October and December 2025. An offshore wave and current recorder and two high-frequency pressure sensors inside the marina captured waves, currents, and water levels across periods ranging from seconds to tens of minutes. The resulting dataset is unusually rich, capturing hydrodynamic processes spanning wave periods from a few seconds to tens of minutes, including swell, infragravity waves, persistent harbour seiche, and a meteotsunami. The measurements were then used to calibrate a suite of complementary numerical models, including SWAN spectral wave modelling, phase-resolving Boussinesq modelling, and coupled hydrodynamic-wave simulations. Existing and proposed marina configurations were assessed under representative seasonal conditions and energetic wind, wave, and long-period forcing.

The observations showed that swell waves are strongly attenuated before reaching the marina basin. In contrast, long-period oscillations persist throughout the harbour and dominate non-tidal variability. A persistent harbour seiche with a period of approximately 20 minutes was the principal driver of currents within the marina. The modelling reproduced the observed wave transformation and resonant response, and showed that the seiche is controlled primarily by the geometry of the wider harbour and continental shelf rather than the detailed marina entrance configuration. The preferred entrance modification substantially reduces and redirects tsunami-induced currents away from vessel mooring areas. Importantly, the new configuration maintains comparable protection from wind waves and swell and produces only modest, localised changes to everyday circulation. Modelled bottom shear stresses indicate no significant new areas of erosion or sediment accumulation, while tracer simulations show that flushing is maintained and in some areas marginally improved.

The study demonstrates that a targeted marina redesign can materially improve tsunami resilience without compromising normal operational performance. The findings are also informing construction methodologies that incorporate living shoreline concepts and opportunities for ecological enhancement alongside the proposed engineering works. The study highlights the value of combining detailed field observations with complementary numerical models to understand and engineer resonant harbour systems.

Bio

Dougal Greer is a Director and Senior Coastal Scientist at ORCAS Consulting, specialising in coastal processes, numerical modelling, and operational coastal forecasting. He has over 20 years' experience delivering coastal engineering and oceanographic studies throughout New Zealand, the Pacific, and internationally. His expertise spans coastal hazards, wave and hydrodynamic modelling, sediment dynamics, marine protected areas, and coastal monitoring. Dougal leads the development of ORCAS' operational forecasting systems and has extensive experience applying numerical models to solve practical coastal engineering and environmental management challenges.

Erin Makepeace.¹

¹Pattle Delamore Partners Limited, Auckland.

Coastal Hazard Risk and Contaminated Sites

While the 2024 Ministry for the Environment Coastal Hazards and Climate Change Guidance does not provide specific guidance on contaminated land management, its risk-based adaptation framework is applicable to contaminated sites, landfills, and other potential contaminant sources located within coastal environments. Coastal processes, including erosion, inundation, groundwater rise, and increased storm activity, may enhance the mobilisation and migration of contaminants, creating potential risks to human health, ecological receptors, and receiving environments.

As coastal communities and infrastructure face increasing climate-related pressures, the assessment and management of contaminated land and landfill sites must form an integral component of coastal hazard planning. This is particularly relevant to the work undertaken by Pattle Delamore Partners (PDP), which includes assessing and managing landfill and contaminated land risks in coastal settings, where climate change may alter contaminant pathways and long-term site stability. Management of these risks should continue to be guided by established contaminated land legislation and technical guidance, while being considered within broader coastal resilience and adaptation frameworks.

Bio

Erin is an Environmental Scientist at Pattle Delamore Partners with over three years of professional experience in contaminated land Investigations, environmental science and geotechnical testing. She holds a Bachelor of Science (BSc) in Oceanography from the University of Otago. Her practical expertise includes soil investigations, landfill gas monitoring and groundwater sampling.

A berm and entrance dynamics model for predicting intermittently open and closed estuary trajectories

Intermittently open and closed estuaries exist in a hydrologic and morphologic balance between catchment inflows, wave climate, sea level and tidal processes over event to decadal timeframes. Evaluating how these sensitive systems may respond to future climate scenarios is a complex balance between these major forcings, as well as water balance parameters such as percolation, evaporation, and storage, and coastal parameters such as wave transformation, berm response, sediment supply and inlet morphodynamics. To address management and predictive questions for IOCEs on the southern Australian coastline, we developed a berm breach and water balance modelling tool to simulate long-term entrance behaviour and estuary water levels under historical and future climate conditions. The IOCE modelling framework combines a customised hourly estuary water balance with simplified berm growth and breach evolution. Estuary water levels are updated using river inflow, rainfall, evaporation, basin hypsometry, offshore water levels, and entrance exchange. Berm and channel evolution are represented using wave-driven equilibrium berm behaviour, and the one-dimensional breach solver DLBreach, (Wu, 2016), which simulates rapid outlet erosion and widening during opening events. The framework can represent natural closures and openings, artificial opening attempts, changing trigger levels, and future forcing scenarios.

The tool was developed and applied to three estuaries in Victoria, Australia, using a comprehensive closure history and breach hydraulic dataset compiled by McSweeney (2018), recently updated to incorporate additional data and evaluate climate change scenarios. The model reproduced key patterns of water level and entrance state behaviour, but required considerable site-specific customisation to represent storage, wave transformation and wave sheltering effects. Wave and offshore water level parameters remained difficult to constrain, while the water balance required adjustments to represent the storage behaviour of wetlands. Results varied spatially depending on the competing effects of increased tidal prism with sea level rise, changes in wave energy and catchment inflows. Interannual variations in annual closure propensity was dominated by hydrology, but under some future climate scenarios some estuaries switched from greater closure to greater openings. The modelling also highlighted the management implications of maintaining existing flood level thresholds for artificial opening, versus allowing the future trigger levels to rise with SLR. Application of these tools to suitable New Zealand estuaries is ongoing. Ongoing testing is combining remotely sensed hapua morphology on the Canterbury coast with suitable water level datasets to estimate exchange and morphologic behaviour.

Bio

Dr. Justin Rogers is a researcher and teacher in the University of Canterbury's School of Earth and Environment, with a background in oceanography and geomorphology and 18 years of hydrodynamic modelling experience across rivers, lakes, reservoirs, estuaries, and the coastal ocean. His research interests focus on connecting fluvial and coastal hydrodynamics and geomorphology, including the movement of water and sediment through rivers, estuaries, and the coastal zone. His New Zealand research has applied large, high-resolution lidar datasets to modelling braided rivers and understanding how altered hydrology affects a river's capacity to transport sediment. His broader work includes numerical modelling, field data collection, and analysis of currents, waves, water levels, and sediment transport.

R. Paul Wolf¹

¹Ocean Wolf, Nelson, New Zealand

A fit-for-purpose taxonomy: Does greater taxonomic resolution improve marine State of the Environment monitoring?

Marine State of the Environment (SoE) monitoring depends on accurate taxonomic identification to assess biodiversity, detect environmental change, and support management decisions. However, the level of taxonomic resolution applied to routine monitoring is often inherited from historical practice rather than evaluated against its contribution to ecological assessment. While increasing taxonomic resolution generally increases processing time, specialist expertise, quality assurance requirements and cost, it does not necessarily improve the ecological interpretation of monitoring data.

Drawing on recent estuarine monitoring projects, legacy datasets, benthic health models, and commercial monitoring programmes from New Zealand, this presentation explores the relationship between taxonomic resolution, ecological information, and monitoring cost. Case studies include species complexes, historical synonymies, qualified identifications (*cf.*), and taxa for which species-level identification substantially increases effort while contributing little additional value to environmental assessment. Conversely, examples are presented where insufficient taxonomic resolution obscures ecologically meaningful differences and reduces the ability to detect environmental change.

The presentation proposes a fit-for-purpose framework in which taxonomic resolution is selected according to four complementary criteria: **taxonomic confidence, ecological information gain, compatibility with legacy datasets, and cost-effectiveness**. Rather than maximising the number of species names reported, monitoring programmes should aim to maximise the ecological information obtained from each level of taxonomic effort. Such an approach has the potential to improve consistency between monitoring programmes, reduce unnecessary analytical costs, and strengthen the scientific defensibility of long-term marine monitoring while maintaining compatibility with existing datasets.

Bio

2012, Diplom in Biology, University of Rostock, Germany 2020, PhD in Marine Biology, University of Wellington, New Zealand, 2020 Hatchery and Nursery manager for experimental abalone hatchery in Kaikoura. 2020-2023 Taxonomist at Cawthron Institute 2023 Director and founder of Ocean Wolf.

Eddie Beetham¹, Josh Bagg¹, Matt Blacka², Peter Quilter¹, Tom Shand³, Richard Reinen-Hamill¹, Jak McCarroll³.

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Application of shoreline roll-over and wave inundation modelling to assess coastal hazards, risk, and adaptation options on a reef island airport

Aitutaki Airport occupies a low-lying sedimentary coral reef island in the Cook Islands and represents a critical piece of national infrastructure supporting community access, tourism, and emergency lifeline connectivity. Assessing coastal hazards at this site requires methods specifically suited to the reef island setting, where conventional approaches developed for sandy or rocky mainland coasts are not directly applicable. This paper presents two key methodological advances developed as part of a comprehensive climate change coastal hazard assessment for the airport, commissioned by Climate Change Cook Islands. The first advance is the adaptation of the ShoreTrans shoreline translation model to simulate reef island morphodynamic response to sea level rise through a roll-over mechanism. Rather than treating shoreline recession as simple horizontal retreat, the model represents the coupled landward migration and vertical accretion of the island crest — a geomorphic behaviour characteristic of sedimentary reef islands responding to rising sea levels. This approach enables differentiation between two distinct hazard modes: undermining, where ocean-side erosion progressively removes land from beneath fixed assets, and smothering, where the migrating island crest buries or displaces infrastructure on the landward side. The model is applied across decadal timesteps under representative IPCC AR6 sea level rise projections.

The second advance is the establishment of a high-resolution wave inundation model using XBeach-Nonhydrostatic to resolve wave transformation across the coral reef, including short-wave dynamics, shoreline runup, overtopping, and overland flow. The reef environment presents particular modelling challenges due to the abrupt bathymetric transitions and strongly depth-limited wave breaking that govern energy dissipation. Model outputs of inundation depth, flow velocity, and discharge are used to derive hazard classifications relevant to airport infrastructure, distinguishing thresholds for operational disruption, scour damage, and structural failure. With rising sea levels reducing reef flat freeboard and wave attenuation, hazard exposure increases substantially across the assessment timeframes, with wave inundation transitioning from rare extreme events to relatively frequent operational risks by mid-to-late century. Together, these methods provide a transferable framework for coastal hazard assessment on reef islands across the Pacific.

Bio

Eddie is a senior coastal geomorphologist at T+T based in Auckland. Eddie specialises in wave modelling and morphodynamics, developing skills as a PhD and postdoc at the University of Auckland researching impacts of climate change to reef island systems. Eddie is stoked to apply this knowledge based and skill set on T+T consulting projects across NZ, the Pacific Islands and Australia.

Testing the Application of Pixel-Based Inundation Frequency Mapping in an Otago Realigned Estuary

Managed realignment is a common coastal wetland restoration method that removes barriers across inlets, allowing for the re-flooding of reclaimed land. This process reinstates tidal flows with the aim of encouraging saltmarsh vegetation re-establishment. These initiatives are driven by increasing recognition of the vulnerability of the coast to sea level rise, and the potential for ecosystem services such as blue carbon storage and erosion mitigation. However, reviews of managed realignments emphasise that the recovery of systems to their former function and extent does not always occur. This is heavily influenced by changes to physical conditions in the estuary, such as inundation frequency relative to elevation. Land use change can compact the surface and alter natural channels, changing inundation frequency and duration post realignment. Consequently, realigned systems may evolve inconsistently with “natural” systems spatially and temporally, impeding saltmarsh establishment.

The increasing availability of satellite data and accessible geospatial analysis platforms mean that large temporal datasets can be analysed using pixel-based methodologies at relatively low cost. In coastal systems, this allows us to analyse changes in the physical setting over time, such as tidal inundation frequency. There is currently no testing of pixel-based inundation frequency methods in shallow temperate salt-turf systems such as those in coastal Otago. The purpose of this research is to test the application of pixel-based inundation frequency mapping in the realigned arm of the Pleasant River estuary. The objectives of this study are to (1) validate different pixel-based indices and identify variables required to accurately map inundation frequency in Pleasant River, and (2) use inundation frequency map outputs alongside additional field data to investigate the failed re-establishment of saltmarsh at Pleasant River post realignment.

Bio

Eleanor Baldi is an Honours student in Physical Geography at the University of Otago. Her research applies and tests pixel-based spectral indices to map inundation frequency in a realigned Otago estuary. Inundation frequencies derived from these methods will be used alongside field data to investigate the failed saltmarsh re-establishment post-realignment. Eleanor’s broader interests include coastal and alpine geomorphology, restoration and conservation, and remote sensing.

A Virtual Reality Simulation Game to Build Ocean Stewardship

This talk presents the Stage 1 prototype of Regen Ocean, developed by Geo A.R., a studio specialising in simulation games for scientific communication and behaviour-change. Regen Ocean is an immersive virtual reality (VR) experience that puts decision-makers directly inside a living ocean, letting them see the real, often delayed consequences of marine management choices as they happen. Built as a "soft digital twin," it is a fictional marine ecosystem grounded in the real ecology of the Hauraki Gulf in New Zealand. The game places players in the cockpit of a research submersible, where they choose interventions to restore a struggling marine system. They watch key species – kelp, kina, snapper and crayfish – respond over simulated time, and confront the kinds of feedback loops, delays and trade-offs that are notoriously hard to grasp from a policy document or a graph.

Designed primarily for professionals in ocean governance, fisheries and environmental planning, and playable on devices ranging from a mobile phone to a VR headset, the project treats accessible immersive technology as a genuine tool for building systems literacy – turning an abstract, often disheartening ecological crisis into something people can experience, experiment with, and ultimately feel is possible to reverse. Simulation games and virtual reality (VR) experiences are useful to improve understanding of complex socio-ecological systems and create ‘safe-to-fail’ environments where players can experiment with future scenarios and witness the long-term impacts of their decisions. If designed collaboratively and used effectively, a marine restoration VR experience can help improve collaboration for coastal resilience as part of a broader restoration program (alongside activities such as education, discussion, and participatory planning). The VR experience can increase the audience of people who can experience the marine environment, strengthen ocean connectedness, enhance dialogue among stakeholders, and support more informed decision-making and action. Later planned project stages of this project include a kaitiakitanga-based version to be co-developed with Māori partners.

Bio

Eleanor Chaos is a Producer – Simulation Games at Geo A.R., developing simulation games for environmental and social impact. She completed her PhD on ‘Priming for Climate Adaptation Decision Making in Organisations Using Serious Games’ through Te Herenga Waka – Victoria University of Wellington in 2026. Her work in games to date has spanned ocean restoration, climate change mitigation and adaptation, and fair, respectful benefit-sharing with Indigenous communities in R&D. Eleanor's practice sits at the intersection of research and play, using immersive and accessible technology to build systems literacy around complex socio-environmental issues. Before moving into games, Eleanor spent over a decade in sustainability, climate adaptation and natural resource management roles in Australia. She has presented at national conferences, and internationally at the Society for Risk Analysis (Lund, Sweden) receiving an Honourable Mention in the Ortwin Renn Prize for Applied Risk Research.

Eligh Z A. Ashby¹, Hamish G. Rennie¹, Severine Bouard¹

¹Department of Environmental Management, Lincoln University – Te Whare Wānaka o Aoraki, Lincoln, New Zealand

Uncertain Shores: An Assessment of Planning and Regulatory Approaches for Transitory Events and Activities on the New Zealand Foreshore.

New Zealand's 11,000 km foreshore is a commons used for everyday activities and organised events, including surf lifesaving competitions, weddings, triathlons, and community festivals. As coastal populations grow and recreation and tourism increase, these activities are placing greater pressure on a resource that is intended to be accessible to everyone. Yet despite the importance of the foreshore to New Zealanders, little research has examined how temporary but recurring activities are formally regulated or how decisions are made about who can use these spaces, when, and under what conditions.

This research investigates the regulation of transitory but recurring foreshore use in New Zealand. It examines which authorities regulate these events and activities on the foreshore, how regulatory approaches vary across New Zealand, the types of activities that are permitted, how competing interests and environmental and social effects are managed, and whether current approaches are fit for purpose for managing a common resource or instead privilege certain groups in accessing and using it.

The research uses document analysis of more than 60 planning and regulatory documents, including legislation, regional and district planning instruments, and local bylaws. This is supported by follow-up questions with local authorities and, where necessary, requests made under the Local Government Official Information and Meetings Act 1987. The findings provide the first national comparison of how temporary but recurring foreshore activities are regulated across New Zealand. In doing so, this research contributes to the conference theme of People by demonstrating how formal planning and regulatory approaches to the foreshore can affect the people who use it and either aid or constrain their access to this commons. It also recognises that 'informal' management practices shape how people use the foreshore, which may conflict with the current formal planning and regulatory approaches. Together, these findings identify opportunities to support more consistent and effective management of New Zealand's increasingly contested foreshore.

Bio

Eligh Ashby is a Master of Planning student in the Department of Environmental Management at Lincoln University. He previously studied environmental management and politics at the University of Otago. His research focuses on the planning, regulation, and management of New Zealand's foreshore, with a particular interest in the governance of commons. Alongside his studies, he sits on the editorial committee of the Lincoln Planning Review, works in local government, and has extensive experience in surf lifesaving as both a professional and volunteer surf lifeguard.

When the Ocean Finds a Path: Improving Coastal Inundation Mapping for Storm Tide Hazards

Coastal inundation resulting from extreme storm tide events is a growing hazard for low-lying coastal land, communities, and infrastructure. Storm tides occur when astronomical tides, storm surge, and wave-related water level contributions combine to elevate coastal water levels and allow seawater to inundate adjacent land. With projected sea-level rise expected to increase the frequency and severity of coastal flooding, there is a growing need for accurate and practical methods to map inundation hazards and support coastal planning and adaptation decisions. MetOcean Solutions/MetService recently completed a coastal inundation assessment for several New Zealand regions to better understand the potential extent and depth of flooding associated with extreme storm tide events. The study combined estimates of extreme storm tide levels derived from coupled wave-hydrodynamic modelling with high-resolution topographic datasets to produce regional-scale inundation maps for a range of storm tide return periods.

Traditionally, coastal inundation mapping has often relied on simple bathtub models, where flooding is calculated by comparing storm tide levels with land elevations. While computationally efficient, these approaches can significantly overestimate flood extents because they do not account for hydraulic connectivity, flow pathways, attenuation of floodwaters inland, or the presence of natural and man-made barriers. To address these limitations, the study adopted an enhanced path-based inundation mapping approach following the methodology of Kasmalkar et al. (2024). The model incorporates hydraulic connectivity by requiring a continuous flood pathway between the coastline and an inundated location. Areas that are topographically isolated or protected by barriers are therefore excluded from predicted flooding. The methodology also incorporates path-based attenuation, representing the gradual reduction in water levels and flood depths as floodwaters travel inland during the relatively short duration of a storm tide event. Compared with conventional bathtub modelling, this enhanced path-based approach produced more realistic inundation extents, removing isolated areas incorrectly identified as flooded and reducing predicted water depths in inland locations. In low-lying regions, attenuation effects substantially reduced both flood depth and flood extent relative to standard bathtub methods, while still identifying areas with direct hydraulic connection to the coast as vulnerable to inundation. This work demonstrates that incorporating hydraulic connectivity and path-based attenuation provides a practical improvement to traditional coastal inundation mapping techniques. The resulting flood hazard information provides a more realistic representation of storm tide flooding and supports improved risk assessment, land-use planning, infrastructure management, and climate change adaptation for coastal communities throughout New Zealand.

Bio

Ellorine is a geospatial specialist with expertise in remote sensing, spatial statistics, and geo-visualisation. She has an MSc (honors) from the University of Otago and was awarded one of three Otago Sciences division scholarships. She has experience using various remote sensing products to study geophysical phenomena. In her MSc, she investigated landscape changes at Fox Glacier using high resolution elevation models derived from stereo satellite imagery and lidar, quantifying glacial and hillslope dynamics and the cascade of sediment through the catchment system. She has interests in automating GIS analyses, open data and software, and science communication. At MetService she works across teams to produce and maintain various geographic datasets used in operational forecast models, consultancy projects, and research. She is a proficient user of ArcGIS, QGIS, Google Earth Engine, and Python.

Georgia Pendred^{1,2}, Emily Tidey¹, Francesca Marzatico¹

¹ Discovery Marine Limited (DML), Tauranga, ² Te Kura Kairūri, Ōtākou Whakaihu Waka, Ōtepoti | School of Surveying, University of Otago, Dunedin

How the Past Informs the Future in Shaping Marine Reserve Boundaries

Marine Reserves mark spaces of habitat protection, yet their boundaries reveal more than lines on a chart. They represent a spatial definition of how societies define, divide, and care for marine ecosystems. In Aotearoa, the creation of Marine Reserves and their spatial definition has been primarily shaped by scientific practice and statutory requirements without taking into account Māori worldviews, contribution from other disciplines - such as surveying - and traditional knowledge systems.

This presentation discusses Marine Reserve spatial definition through a past-future case study approach of two reserves namely Te Hāwere-a-Maki | Goat Island and i Te Au Roa o Te Rākihouia (previously the South-East Marine Protection Network (SEMP)). Five key metrics guided the analysis: surveying methods and data, legal frameworks, iwi inclusion and mātauranga Māori, stakeholder participation and scientific purpose. This presentation focuses on the surveying and legal aspects of the research, which used qualitative interviews and thematic analysis to draw out insights that support enduring marine guardianship in Aotearoa's waters and offer pathways for strengthening marine reserve management from the outset.

Findings reveal a consistent tension between progress and persistence. Progress is evident in the shift toward greater data recognition, moving from no surveying to early spatial integration, the push for inclusive co-management, and the attempt to balance scientific rationale alongside community values. However, this progress is continually challenged by the persistence of tension between conservation needs and indigenous world views.

The research concludes that future boundary design would benefit from guiding principles that position the surveyor as a mediator between worlds, translating data into meanings, and coordinates into collective understandings. Rather than prescribing a singular method, the study proposes principles for inclusive boundary design that connect people, space and diverse systems of knowledge through time.

Bio

Georgia Pendred completed her First Class BSurv with Honours in 2025 at Te Kura Kairūri | the School of Surveying. This 'Reshaping Reserves' project was undertaken for her honours dissertation in her final year. She now works as a hydrographic surveyor with Discovery Marine Ltd (DML) in Tauranga.

Emily Tidey is a Senior Lecturer in surveying and hydrography at Te Kura Kairūri | the School of Surveying. Her research focuses on ways to improve hydrographic data collection for a wide range of uses, including biological and geological marine habitat analysis. Emily was a co-supervisor on Georgia's honours project.

Dr Francesca Marzatico is a lecturer at the School of Surveying. She has over 20 years of experience working in post-conflict settings. Her work centres on co-creation of knowledge around land and natural resources governance with Indigenous Peoples, local communities, and grassroots organisations. Francesca has worked at the interface of diverse knowledge systems around the world, focusing on legal and moral obligations of Antarctic Treaty parties to include Indigenous People, coastal communities and other right holders in the decision making around ice interventions. Francesca was a co-supervisor on Georgia's honours project.

Grace Cinque¹, Liam Baber¹, Emily Tidey¹, Christina Hulbe¹, Yong Chien Zheng¹, Robert Odolinski¹

¹Te Kura Kairūri, Ōtākou Whakaihu Waka | The School of Surveying, University of Otago

Student Coastal Science Honours Projects at Te Kura Kairūri, Ōtākou Whakaihu Waka | The School of Surveying, University of Otago

In their final year of a Bachelor of Surveying (BSurv) students at Te Kura Kairūri/the National School of Surveying at the University of Otago can take the lead on an Honours Project. Honours projects are invite-only and take a full year, helping students develop research skills and providing a platform for an advanced professional or academic career. Recently Grace Cinque and Liam Baber, supervised by Emily Tidey, Christina Hulbe, Yong Chien Zheng and Robert Odolinski have undertaken projects of note to those working in the coastal area:

Grace Cinque – BSurv (Honours) candidate

Pondering the future – a study into Uncrewed Surface Vessels users and applications in Australasia, with test case investigations in ports and inland waters.

Uncrewed Surface Vessels (USV), a relatively new tool, are platforms that can be used to mount a variety of equipment that can help us to understand inland waters and marine environments. Hydrographic surveyors are interested in precise positioning, echosounding and direct measurements of water properties. This research consults USV users in Australasia, including asking about their users, the current applications and the levels of familiarity with aspects such as calibration and safety. It is followed by a case study in Ōtepoti/Dunedin which tests and investigates a portable kit set and a custom USV in a port and an inland environment.

Liam Baber - BSurv (Honours) candidate

Accuracy at the Edge: A comparative analysis of Trimble network real time kinematic positioning services under varying reference station network geometries in coastal Canterbury, New Zealand.

Real-time Global Navigation Satellite System (GNSS) corrections services are increasingly relied upon in surveying and environmental research to generate precise and accurate geospatial data. This data is important in New Zealand's coastal environments to carry out environmental monitoring, bathymetric, and shoreline surveys. This contribution determines the comparative performance of different Network RTK (NRTK) correction services under varying receiver-reference station geometries. It explores the relationship between how Space State Representation (SSR) based corrections services are impacted by relative positions within a reference network by comparison with results using an Observation State Representation (OSR) method. The primary objective is to understand how Virtual Reference Station (VRS)-RTK solutions perform as the receiver moves towards the edge of a network of reference stations it generates corrections from, and hence to inform professionals and researchers alike as to whether or not to consider the reference station geometry when deploying such technologies.

Bio

Grace Cinque and Liam Baber are BSurv (Hons) candidates who have been working on projects in the coastal area over 2026. Grace is focusing on Uncrewed Surface Vessels (USV) with her supervisors Emily Tidey and Professor Christina Hulbe. Liam is testing positioning using Network Real-Time Kinematic Global Navigation Satellite System positioning with his supervisors Dr Yong Chien Zheng and Associate Professor Robert Odolinski.

Adapting with nature; a method for identifying ecological response to sea level rise to identify risks and opportunities within coastal ecosystems.

With funding from Ministry for the Environment, Environment Canterbury undertook a Nature Based Solutions feasibility study considering how coastal wetlands and lagoons could change as sea levels rise to develop solutions that balance ecosystem changes and neighboring land uses. The study focused on two places on the Canterbury Bight: Ōpihi to Ōrāri and Coopers Lagoon/Muriwai.

Our partners, Jacobs, utilised sea level rise predictions were used to evaluate changes in inundation event size and frequency as well as average sea level. This was used to identify predicted changes to coastal geomorphology and groundwater of the study areas. Collaborations were engaged to build physical changes to environment to develop a broadscale spatial approach to explore how these dynamics may influence outcomes for the coastal ecosystems; comprising of river mouths, coastal lagoons, wetlands and open coast.

Our approach, originally established for Bittern within wetlands, considers species tolerances to inundation and was expanded to other species that were considered of importance for ecological, conservation and/or cultural values within the study to establish risks and opportunities to protect or support ecosystem adaptation within nature-based solutions. As the study progressed, further qualitative considerations had to be made to consider potential cascades of effects that may occur to evaluate outcomes for the ecosystem. This approach provided a clear baseline of what sea-level rise could mean for coastal ecosystems and a quantifiable baseline to compare nature-based solutions within the study. This presentation outlines the methods used, the ecosystem changes identified, and the value of broad spatial ecosystem approaches for supporting biodiversity goals as New Zealand adapts to the future.

Bio

Gareth is a Director of Collaborations, a New Zealand based applied science consultancy. His technical area of work is within aquatic science and the resource management system. He has been involved in a number of projects involving ecological assessment and determining impacts and forward planning with habitat change and modification having worked across large earthquake recovery programmes (e.g. Kaikoura) as the Project Ecologist. In this role he had to account for changes in levels and environments to determine how best to design and manage works to enable ecosystem recovery. For the Nature Based Solutions project being presented Gareth utilised his and Collaborations technical experience to develop a method for considering and quantifying habitat for species in a set of future scenarios by considering how the lagoon physical form and catchment land-use may alter the ecosystems of focus in this study.

Vu Thi Thao Hien¹, Pascal Sirguey¹

¹National School of Surveying, University of Otago, Dunedin, New Zealand

Advancing 3D Mangrove Characterisation in Tikapa Moana / Firth of Thames: Integrating Airborne LiDAR and Spaceborne Photogrammetric Mapping

Mangrove forests deliver a wide range of ecosystem services, from coastal hazard mitigation to blue carbon storage. However, the vertical dimension of their structure - canopy height and its temporal trajectory - remains poorly quantified at the landscape scale for temperate systems. In Aotearoa New Zealand, the native mānawa (*Avicennia marina* var. *australasica*) has undergone sustained expansion across northern estuaries, and its management remains contested among local communities, scientists, and iwi. Traditional two-dimensional mapping cannot resolve forest vertical structure, biomass volume, or growth dynamics under accelerating sea-level rise.

This research addresses these gaps by developing a geospatial framework to create sub-metre 3D Canopy Height Models (CHMs) and quantify vertical canopy growth trajectories by comparing multi-temporal Digital Surface Models (DSM vs. DSM) for the rapidly expanding mangrove system in the Firth of Thames/Tikapa Moana. The core methodology focuses on the advanced photogrammetric processing of contemporary Very High-Resolution (VHR) Pléiades Neo tri-stereo satellite imagery, supported by a field GCP campaign. In parallel, this evaluates the reliability of lidar derived Digital Terrain Models (DTMs) in dynamic intertidal zones and assesses existing global canopy models. The results are validated against a concurrent UAV-lidar survey. By combining these 3D structural measurements with spectral indices, this project aims to establish a quantitative baseline for mangrove growth across successional stages, assess the viability of this approach as a lower-cost alternative to repeat airborne lidar surveys, and provide structural variables needed for region-specific biomass equations - supporting blue carbon accounting and evidence-based estuarine co-governance.

Bio

Thi Thao Hien Vu (Helena Vu) is an MSc student in GIS at the National School of Surveying, University of Otago, New Zealand . She holds a Bachelor's degree in Cartography and GIS from the University of Tyumen, Russia. Her postgraduate research focuses on integrating 3D reality capture, satellite photogrammetry, and LiDAR to develop canopy height models for temperate mangrove ecosystems (mānawa) in Tikapa Moana / Firth of Thames . Helena's broader research interests include vegetation modeling, biomass estimation, and blue carbon assessment to support evidence-based estuarine co-governance and coastal resilience.

From the Firth of Thames to Wharekawa: Expanding Long-Term Monitoring of Estuarine Sedimentation

The Estuary-Surface Ultrasonic Distance Sensor (E-SUDS) is an innovative telemetered monitoring system developed by the Physical Coastal and Estuarine Processes Group at Earth Sciences New Zealand. The system provides continuous, high-frequency measurements of bed level, water level, and wave conditions in intertidal environments, enabling reliable monitoring over multi-year periods with minimal site visits.

By capturing subtle changes in estuary bed levels through time, E-SUDS provides unique insights into sediment transport, erosion, and deposition processes. These observations are essential for understanding how estuaries respond to changing sediment loads from their catchments and the impacts of sea-level rise. The long-term datasets generated by E-SUDS support both scientific research and environmental management through enhanced state-of-the-environment monitoring, improved trend detection, and a stronger understanding of the processes driving estuarine change.

Since late 2019, four E-SUDS have been deployed along a ~150 m cross-shore transect in the southern Firth of Thames, spanning the intertidal mudflat to the mangrove fringe. Continuous observations have revealed substantial rates of sediment accumulation ($\sim 50 \text{ mm yr}^{-1}$) and improved our understanding of sedimentation dynamics across tidal, event, seasonal, and interannual timescales.

Building on the long-term observational record from the southern Firth of Thames, the E-SUDS monitoring network has recently been expanded to the Wharekawa Estuary on the east coast of the Coromandel Peninsula. This site provides a unique opportunity to investigate the influence of production forestry on estuarine sedimentation and improve our understanding of catchment-to-coast sediment transfer processes.

In this presentation, we introduce the Wharekawa monitoring programme and discuss how the expanded E-SUDS network will address key knowledge gaps surrounding land-use impacts on estuarine sedimentation. The resulting observations will support the development of robust state-of-the-environment (SOE) indicators and provide evidence to inform regional council policy, catchment management, and estuary restoration initiatives.

Bio

Iain MacDonald is Group Manager of the Coastal and Estuarine Processes Group at Earth Sciences New Zealand and an Honorary Lecturer at the University of Waikato. He is a coastal and estuarine physical processes scientist with more than 20 years of experience investigating sediment transport, estuarine geomorphology, and catchment-to-coast sediment dynamics. His research combines field observations, instrumentation development, data analysis, and numerical modelling to improve understanding of how estuaries respond to natural and human-induced change. Iain led the development of the Estuary-Surface Ultrasonic Distance Sensor (E-SUDS), a telemetered monitoring system that provides continuous measurements of bed-level change, water levels, and waves in intertidal environments. His current research focuses on estuarine sedimentation, land-use impacts, and the long-term monitoring of estuarine change.

Te Au Roa o Te Rākīhouia: Establishing a Biocultural Co-management Model for Marine Protection in Te Tai-o-Araiteuru, the Otago Coastline

Te Au Roa o Te Rākīhouia is the co-managed marine protection network spanning the south-eastern coast of Te Waipounamu. Established through a partnership between Kāi Tahu and Department of Conservation | Te Papa Atawhai, the network protects a diverse range of marine habitats, from estuaries and kelp forests to offshore canyon ecosystems, while recognising the enduring relationship between mana whenua and the moana. Te Au Roa emerged from the work of the South East Marine Protection Forum (SEMP), a process that brought together mana whenua, fisheries interests, environmental organisations, local government and community representatives to develop marine protection measures for the region. Following many years of engagement and negotiation, Te Au Roa o Te Rākīhouia was established to implement and manage the resulting marine reserve network through a co-management model founded on partnership, shared decision-making and intergenerational stewardship.

While marine reserves are not new, Te Au Roa represents a different way of managing them. Rather than relying solely on conventional conservation models, the programme is centred on equitable co-management, integrating mātauraka Kāi Tahu and western science within a biocultural framework. The programme seeks not only to achieve ecological outcomes, but also to strengthen relationships between people and place, support kaitiakitaka, and recognise the enduring connection of mana whenua with their rohe moana. The co-management model recognises Kāi Tahu rakatirataka and kaitiakitaka alongside Crown responsibilities, creating space for both knowledge systems and shared stewardship to shape the future of marine protection. A shared identity grounded in the story of Te Rākīhouia provides a unifying cultural framework for the network and its aspirations.

With marine reserves established on July 1st 2026 the first year of implementation has focused on establishing the foundations necessary for long-term success. Significant effort is being invested in developing governance and co-management arrangements, including a joint Governance Group and three rohe-based Kaitiakitaka Groups that provide local leadership and operational direction. Other achievements include recruitment and training of a nine-person marine ranger workforce, development of place-based outcomes planning and delivery and establishment of ecological baseline monitoring programmes. The programme has also focused on joint communications and engagement approaches, development of a Kāi Tahu-led identity and branding package, and the formal launch of the programme at Ōtākou Marae. This presentation will discuss both successes and challenges encountered during the establishment phase, including the time required to build trusted relationships, establish equitable decision-making structures, navigate differing organisational systems and cultures, and translate co-management expectations into practical delivery arrangements.

As Te Au Roa transitions from establishment to delivery, the focus is increasingly on developing a shared long-term vision between Kāi Tahu and Department of Conservation | Te Papa Atawhai, completing locally led outcomes plans, embedding annual planning and reporting processes, and implementing a biocultural monitoring and reporting framework capable of measuring both ecological and cultural outcomes. Central to all of this is the Te Au Roa ranger team without who none of this would be possible. These initiatives aim to provide a durable model for marine reserve management that reflects local aspirations, supports adaptive management, and demonstrates how marine protection can be strengthened through genuine partnership between mana whenua and the Crown.

The Kamchatka tsunami of 30 July 2025 in New Zealand: did we miss something?

On the 30th of July 2025, a Mw 8.8 megathrust earthquake struck off the Kamchatka Peninsula, causing minimal damage and injuring relatively few people considering its magnitude. If the subsequent tsunami resulted in large wave amplitudes of 5+ m in Kamchatka and the Kuril Islands, and one very large 30+ m run-up height measured in one specific location in Kamchatka, the amplitude of the waves that propagated in the Pacific Ocean were generally smaller than expected for such magnitude. In fact, the reported wave observations and records in other places around the Pacific Ocean show wave amplitudes of less than 2.5 m.

However, despite the relatively small wave sizes, this tsunami has not spared the southwest Pacific Ocean and more particularly New Zealand. Thus, in addition to clear records of tsunami waveforms on the New Zealand DART network and coastal gauges, media reported tsunami activity, including waves and currents, in several regions across the country, such as in North Cape, Christchurch and Tauranga. The largest wave was observed in the Chatham Islands and was estimated at ~0.5m by GeoNet.

In this presentation, we aim to present numerical simulations of tsunami using different published seismic rupture models of the Kamchatka earthquake, comparing the simulation outputs with observations and records, with a particular attention on currents which have been generated in coastal areas around New Zealand. This will help us to assess if the wave amplitudes and currents were generally under the 30 cm threshold of a Beach and Marine Threat and 1.5 m/s for dangerousness for people and navigation, respectively, or if we have underestimated this event in New Zealand.

Bio

Jean Roger is a marine geophysicist holding a PhD in marine geosciences and specializing in the study of tsunami-related hazards. His research focuses on hazard assessment, the analysis of paleotsunami deposits, and the numerical modeling of coastal inundation (including tsunamis and storm surges). His recent work notably examines natural coastal "bioshields"—such as kelp forests and other native vegetation—capable of slowing tsunamis and mitigating their impact on vulnerable communities, as well as the use of data from the SWOT altimetry satellite to deepen the understanding of tsunami physics. In addition to his research activities, he participates in New Zealand's DART deep-ocean tsunami monitoring project and provides consulting services to various government agencies and local authorities; he also serves as vice-chair of the scientific committee for the Coral Sea Natural Park in New Caledonia.

João Albuquerque¹

¹Asset Management Group, Hawke's Bay Regional Council

Why else are we monitoring? Lessons learned from Hawke's Bay

Long term coastal monitoring data are essential for scientific research, engineering design, coastal management and coastal resilience assessment. However, monitoring programs can be difficult to justify during periods of constrained budgets and competing priorities, particularly when their outcomes are not immediate or tangible.

This work presents examples of how long- and short-term coastal monitoring data have been used in Hawke's Bay for purposes other than scientific and engineering applications. These include educating local communities, reducing coastal hazards risks during extreme events and providing evidence for legal proceedings.

The cases presented are meant to demonstrate the practical value of coastal monitoring programs by providing examples of how such data was used to improve the relationship between HBRC and the local communities, help protect coastal areas and prevent financial exposure associated with legal claims.

Bio

From a Computer Science background, João has made his way through a PhD in Oceanography, consultancy and currently works at HBRC. Over the years, his focus has been shifting from theoretic models to the interaction with coastal communities and practical solutions in the coastal space.

Collaborative Coastal Resilience Planning for Outer Atolls in the Marshall Islands

The Republic of the Marshall Islands faces severe coastal resilience challenges across its low-lying outer atolls, where erosion, flooding, overtopping, saltwater intrusion, limited construction resources and difficult logistics directly affect access, food security, land, infrastructure and community wellbeing. This presentation shares early lessons from fieldwork and community consultation undertaken across Majuro, Arno, Mili and Jaluit as part of the Strengthening Coastal Protection and Food Security for Rural Climate Resilience project.

The focus of the fieldwork was to listen to communities, visit priority coastal and flooding hotspots, and understand local issues and locally developed responses before moving into design. Communities identified vulnerable roads, houses, churches, schools, boat landings, food-production areas and access routes, while also explaining how these places are changing through overtopping, ponding, shoreline retreat, saltwater intrusion and storm impacts. Community knowledge was central to understanding both the problems and possible solutions. Local observations highlighted practical responses already being used, including logs placed along the shoreline to trap sand, boats or other available materials used to reduce local erosion, small community-built revetments, and protection of coastal vegetation. Communities also identified the value of native coastal plants such as *kōṇṇat* (*Scaevola taccada*) and *Pandanus* for stabilising shorelines, with *kōṇṇat* recognised as a common dominant shore plant in Marshall Islands coastal strand vegetation.

The consultations also showed how coastal resilience is closely linked to food security and everyday land management. Communities requested practical planting options such as dwarf coconut trees, not only for shoreline and garden resilience, but also to improve access to young drinking coconuts for women, older people and children. On one island, fenced pigs appeared to support better gardens and healthier young coastal vegetation, while elsewhere free-ranging pigs were identified as a barrier to establishing shoreline and food plants. These examples show that resilience measures need to be maintainable and useful to communities, not just technically designed for them.

The presentation discusses how consultation-led fieldwork can help identify priority sites, local constraints and locally acceptable solutions for nature-based and hybrid coastal protection. It also reflects on the implementation challenges that remain, including material availability, aggregate sourcing, landowner support, maintenance capacity, permitting, wartime hazards and outer-atoll logistics.

Bio

João Castro is a Coastal and Environmental Engineer at eCoast Marine Consulting and Research in Aotearoa New Zealand. His work focuses on coastal resilience, flood risk, coastal processes, nature-based solutions and climate adaptation across New Zealand and the wider Pacific. João has experience in hydrological and coastal modelling, site assessment, community consultation and feasibility studies for coastal protection and flood resilience projects. Recent work includes coastal resilience planning in Fiji and the Marshall Islands, where he has supported field investigations, consultation-led site screening, and development of practical nature-based and hybrid adaptation pathways for low-lying island communities. João is originally from Portugal and has a background in civil, hydraulic and maritime engineering.

Testing low-cost GNSS receivers against geodetic positioning and tide-gauges for coastal sea-level monitoring

Dense, vertical-land-motion-corrected coastal sea-level monitoring remains geographically limited, largely confined to regions with geodetic Continuously Operating Reference Station (CORS) networks and co-located tide gauges, infrastructure that is costly to install. This study tests whether a low-cost, dual-frequency, multi-GNSS antenna setup can achieve comparable performance to such geodetic-grade infrastructure. Its performance is validated against two independent benchmarks, a nearby geodetic CORS and a tide gauge for vertical positioning and sea-surface monitoring. Two low-cost antennas are deployed in an L-shape configuration at the New Zealand Marine Studies Centre, Portobello, Otago Harbour. One of the antennas is a zenith-facing antenna, UBL2, for carrier-phase positioning, and another is the sea-facing antenna, UBL1, for GNSS-Interferometric Reflectometry (GNSS-IR), which recovers seasurface height from interference between direct and reflected signals. Tilting the antenna allows it to capture more reflected signals. A geodetic station (DUNT) and two tide gauges (OTAT40 and OTAT41) are located approximately 2 km across the harbour, providing an independent benchmark for both positioning and sea-surface height.

Twelve months of continuous GNSS observations are analysed, the first full annual cycle of joint low-cost positioning and reflectometry data collected at the Portobello site, capturing seasonal effects on sea state and positioning where shorter deployment would miss. Vertical positioning is assessed by processing both DUNT and UBL2 as baselines relative to the geodetic CORS, DUND. As DUNT is a geodetic-grade station located close to the sea surface, its DUNDreferenced baseline serves as the positioning reference against which the UBL2 baseline is compared. Sea-surface height retrievals from the sea-facing UBL1 antenna via GNSS-IR are validated against the tide gauges. Together, these comparisons allow the positioning and seasurface components of the low-cost setup to be characterised against independent geodetic and tidal references. Keywords: GNSS-IR, coastal sea-level Monitoring, low-cost GNSS.

Bio

Joe Eu Heng is a PhD candidate at the School of Surveying, University of Otago, New Zealand, working under the supervision of Yong Chien Zheng, Robert Odolinski and Christina Hulbe. He trained originally as a land surveyor before moving into geodesy, and his work investigates low-cost GNSS receivers for both positioning and sea-level monitoring, using field instrumentation deployed at Portobello. His research centres on whether GNSS Interferometric Reflectometry (GNSS-IR), a technique proven on expensive geodetic-grade infrastructure, holds up on affordable hardware. This question has direct implications for expanding coastal monitoring coverage in under-instrumented regions.

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Coarse clastic morphodynamics of Te Taero a Kereopa/Te Tahuna a Tama-i-ea The Nelson Boulder Bank

Coarse clastic coastal systems (predominantly composed of pebble, cobble, and boulder grain-sizes) remain comparatively under-documented relative to sandy beaches, despite their geomorphic significance and growing relevance for coastal hazard management. This research investigates the morphodynamics of Te Taero a Kereopa/Te Tahuna a Tama-i-ea (the Nelson Boulder Bank), Aotearoa New Zealand, a 13 km gravel barrier composed of pebbles to metre-scale boulders.

Repeat unmanned aerial vehicle–structure from motion (UAV–SfM) surveys were used to track individual clasts and quantify surface change across contrasting ridge and platform environments. Sixty-five to sixty-nine individual clasts were tracked per site over 1–3-month intervals, demonstrating that clasts up to >3 tonnes were mobile under wave conditions well below extreme storm thresholds (maximum H_s during the study = 2.99 m). Clast transport occurred in nearly all directions, though the dominant transport vector and greatest entrainment distances generally aligned with the prevailing oblique incident wave field.

Lorang's (2000) dynamic threshold entrainment equation was then calibrated using the observed largest mobile clasts at each site. When the interlocking parameter K_r was set to 1, the model systematically underestimated entrainment mass thresholds across all clast shape assumptions; however, site-specific calibration of K_r (0.006–0.1) substantially improved performance, although model failure persisted where pre-transport settings strongly modified mobility. These results demonstrate that coarse clastic shorefaces can be far more dynamically responsive than often assumed, and that field calibration is essential when applying entrainment thresholds for hazard assessment or engineering analogues.

Bio

Julion is a Natural Hazard Analyst and coastal geomorphologist who is passionate about the coastal environment. He is currently working to improve the resilience of Otago's communities through the analysis and monitoring of natural hazards and risk. His current areas of focus are coastal hazards, other geomorphic hazards, and flood hazards. His MSc was in Coastal Geomorphology within the School of Geography at the University of Otago. His thesis investigated the contemporary processes and origins of Te Taero a Kereopa/Te Tahuna a Tama-i-ea, the Nelson Boulder Bank, supervised by Wayne Stephenson (University of Otago) and Warren Dickinson (Victoria University). As a passionate outdoorsman, he enjoys surfing, mountain biking, climbing and hiking, which have given him great respect for the environment. He is also a musician. He currently lives in Ōtepoti Dunedin but is originally from Waiheke Island in Tīkapa Moana Hauraki Gulf.

To dock at “The Rock” or not – the Niue Wharf Feasibility Study

Niue, referred to as “The Rock of Polynesia” owing to its geological history as a raised atoll, relies on Sir Roberts Wharf as it’s only maritime gateway. The Niue Wharf Feasibility Study will help the Government of Niue (GoN) and the New Zealand Ministry of Foreign Affairs and Trade (MFAT) understand the best way forward for improving the port facilities at the Sir Roberts Wharf in Alofi. The wharf is the main gateway for the supply of goods, tourism, artisanal fishing, and emergency response. Future upgrades aim to make the wharf safer, more reliable, and resilient. One of the key decisions is whether the lightering of cargo should continue or whether the upgrades facilitate the general cargo ship to berth alongside the wharf, removing the hazardous and timely stevedoring practice. The decision is complex requiring an integrated technical, environmental, social and financial assessment which the study aims to provide for decision makers.

The wharf is a multi-purpose facility with a ramp for vaka (local canoe), a derrick crane for trailer boats and tenders, then a mobile crane is used for the workboat and barge. Due to its exposure, all vessels are removed from the water. Typical sea states present challenges for safely launching and retrieving vessels due to a lack of tranquillity at the berth. This leads to periods of downtime and risky operations as conditions change between entry and exit. In addition, extreme cyclone generated storms have a history of damaging the wharf, which have led to numerous spot repairs and upgrades over time.

For port operations, goods are supplied by a visiting regional cargo ship on a monthly call cycle, staying in Niue on average of 4 days at a time. The ship anchors offshore with containers and goods lightered using a barge and workboat then transferred to the wharf with a mobile crane positioned on the wharf. This stevedoring practice is highly weather dependent, time consuming and can be hazardous.

Port operations are further constrained by the lack of dedicated space for cargo handling and storage, as well as steep access to the wharf. For other user groups, the condition of the wharf and lack of adequate berthing facilities present safety issues. As a multi-purpose facility there is often congestion, particularly during port days in the tourist high season when cargo handling, tourist charters, subsistence fishing, and recreational users are sharing its use with limited delineation between. Key deliverables for the study include three short listed concepts that will be publicly consulted on before selection of a preferred that is taken forward for preliminary design. Early contractor involvement through the design process is key for aligning the designs with practical construction methods and logistics as well as enabling realistic costings for funding agencies.

Bio

Kyra is a recent Civil Engineering graduate from the University of Canterbury. She is currently undertaking an internship with Tonkin + Taylor in their Tauranga office working on the Niue Wharf Feasibility Study alongside gaining experience as a consulting engineer.

Dynamic systems requiring dynamic monitoring: Understanding environmental variability and ecological responses in Otago's Intermittently Closed Estuaries (ICEs)

Intermittently closed estuaries (ICEs) are dynamic lagoonal systems that periodically open and close, making them inherently environmentally variable and challenging to monitor and manage. Because Otago's ICEs remain poorly understood, this study aimed to improve understanding of their marine connectivity and primary productivity. Otago has 44 identified ICEs, 27 of which are considered significant for future monitoring due to their size, ecological value and management challenges. A preliminary assessment of these 27 ICEs was conducted using field surveys and spatial data to characterize barrier bar morphology and connectivity. Nutrient enrichment bioassays were repeatedly carried out on the waters of 15 ICEs to test whether phytoplankton productivity in these systems were nutrient-limited or not. Minimum barrier bar elevation and material composition strongly influenced ICE connectivity, controlling seawater and freshwater exchange and salinity. Substrate composition varied widely, from fine sands to gravel and shingle, with coarser material dominating the high-energy north Otago coastline and finer sands more common around the Otago Peninsula and pea gravels becoming a major constituent of barrier bars of the south Otago coast. Higher bar elevations were associated with reduced opening frequency and lower salinity at the ICE mouth, with a threshold of approximately 1.5 m above MWHS (Mean Water High Springs) separating low- and high-salinity systems. Increasing berm elevation was significantly associated with reduced opening frequency ($P = 0.0003$), while coarser materials increased permeability and exchange. Distinct environmental groupings emerged across the 27 ICEs, driven by geomorphological constraint, marine influence, wetland extent, and catchment modelling revealed marked differences in nitrogen and sediment loads from catchments of ICEs. Net Primary Productivity (NPP) varied markedly among the 15 ICEs sampled. To test whether this variability reflected nutrient limitation, NPP was compared between light (L) and light-plus-nutrient (L+N) treatments at each site on repeated occasions. As we had previously observed in the Taieri Estuary, primary productivity in most of the ICEs was not nutrient limited. Rather most of the ICEs were nutrient saturated. Our investigations revealed that both magnitude of marine influence and of algal primary productivity vary greatly in Otago ICEs, with marine influence being largely determined by both the morphology and grain size of the barrier bar. Though primary productivity varied over orders of magnitude among the ICEs, in most of the ICEs phytoplankton production was often nutrient-saturated, which is consistent with these systems being downstream of fairly developed (and leaky) catchments.

Bio

Ashimi Dilhara Kiriwana Gamage is a PhD candidate in the Department of Zoology at the University of Otago, New Zealand, supervised by Assoc. Prof. Marc Schallenberg, Prof. Ross Thompson, Prof. Gerard Closs, and Dr. Sami Khan (Otago Regional Council). Her research focuses on understanding the ecological functioning and condition of intermittently closed estuaries (ICEs) in Otago, New Zealand. She investigates spatial and temporal variations in water quality, dissolved organic matter (DOM) dynamics, and primary productivity, as well as the influence of catchment vegetation on wetland soil quality and organic matter inputs associated with ICE ecosystems. Ashimi's PhD research integrates ecological and biogeochemical approaches to improve understanding of carbon cycling, ecosystem processes, and environmental drivers influencing ICE condition. Her PhD is funded by the Otago Regional Council (ORC), and her research contributes to the development of monitoring and management strategies for these highly dynamic coastal ecosystems. Her work supports efforts to better understand the ecological values of Otago's intermittently closed estuaries and safeguard their long-term health.

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Recognition and Protection of Surf Breaks in Canterbury: Evaluating Natural Character and Seascape Frameworks

Surf breaks are important coastal features that provide recreational, cultural, environmental, and economic value, and many breaks within Canterbury are of regional and national significance. Recently, Environment Canterbury has undertaken a planning programme to review the Canterbury Regional Coastal Environment Plan to assess whether the management strategies should be more targeted towards surf breaks. In particular, the review assessed the existing plan follows and gives effect to the national coastal policy, including protecting specified surf breaks in Canterbury. Currently, surf breaks of national significance and regionally significant surf breaks are managed through other policy tools, like the preservation of natural character and the protection of landscapes (seascapes), and the objective of this study was to consider preliminary assessments of marine natural character and seascapes.

This study focused on Areas A–F of the Coastal Marine Area, extending from Willawa Point to the Canterbury Bight. Areas assigned Outstanding, Very High, and High classifications for natural character, natural features, and natural landscapes were mapped and compared against the locations of nationally and regionally significant surf breaks. Treating surf breaks as points rather than areas was a methodological limitation, overlooking potential overlap with nearby significant natural character areas.

The analysis showed overlap between surf breaks and areas already identified within the preliminary assessments, capturing most candidate surf breaks, with only eight falling outside the identified areas. Surf breaks on Banks Peninsula were particularly well represented, with several specifically recognised in Outstanding and Very High assessments. Other areas, such as Kaikōura, left out popular and nationally significant breaks during ‘outstanding’ classification. Across all study areas, key surf break values including: wave-forming processes, natural serenity, and native wildlife, were consistently recognised. This indicated that existing planning frameworks already provided a degree of protection for many surf breaks and their associated values, however, more targeted policies could be implemented to ensure their protection. The next phase of research work will consider how climate change, storm events, and sediment transport may also influence the long-term resilience of surf breaks. This will include examining bar transportation and the role that increasing storm frequency will have on bar geometry, which is an important factor in preserving surf breaks and its associated values.

Bio

Kaspar Hayes is a postgraduate geography student with an interest in coastal environments, environmental planning, and the relationship between physical processes and people. Currently studying towards a Master of Science in Geography, his work consists of a combination of human and physical based geographic research, with experience in coding, GIS and research. As part of an internship with Environment Canterbury, he investigated how nationally and regionally significant surf breaks across Canterbury were represented within existing natural character, natural feature, and seascape assessments. This work will be the foundation for his thesis next year, which will aim to improve understanding of how dynamic coastal processes, including sediment transport, storm events, and climate change, impact surf breaks in Canterbury and inform policy measures for their protection.

The Missing Layer for Coastal Flood Mapping: Why Dunes Matter

For decades, coastal hazard mapping has focused on water levels and inundation pathways. However, along many of Aotearoa's developed coastlines, the most important flood defence is neither a seawall nor an engineered structure - it is the dune. On Christchurch's open coast, wide foredunes currently provide a substantial buffer against storm erosion, wave overtopping, and coastal flooding. Yet many hazard assessments treat dunes as static landforms, despite their protective function changing through successive storms, sea-level rise, vegetation dynamics, and landward constraints. This raises a critical question: if the dune changes, how does the hazard change? Using Christchurch's open coast as a case study, we developed a spatial framework to assess how storm erosion and sea-level rise may alter the protective function of dunes over time. The approach combined high-resolution LiDAR, long-term beach profile monitoring, updated storm-erosion statistics, wave runup assessments, and future shoreline projections to evaluate dune performance under both present-day and future conditions. Rather than treating dunes as static landforms, the methodology assessed two critical controls on coastal protection: dune width, which governs susceptibility to storm erosion breaching, and dune crest elevation, which governs susceptibility to wave overtopping.

The analysis highlights that coastal hazard exposure is strongly influenced by changes in dune morphology. As foredunes narrow and crest elevations lower through storm impacts and sea-level rise, their ability to recover between events and provide protection progressively declines. New inundation pathways are opened up along sections of coastline that are currently protected. A key finding is that future flood hazards cannot be understood without considering the evolving condition of the dune itself. In many locations, the transition from a functional dune barrier to an ineffective one occurs well before the complete shoreline retreat occurs that we see on the maps. The findings highlight the need to move beyond hazard mapping that stops at the shoreline. Instead, future coastal hazard assessments should explicitly incorporate dune condition and geomorphic change as key determinants of flood risk. As sea levels continue to rise, understanding when dunes cease to function as effective protection systems may be just as important as understanding where the water will go.

Bio

Kate is a Coastal Scientist based in Ōtautahi, Christchurch. Kate has a technical background in coastal hazards and geomorphology, and works across adaptation projects across Australia and New Zealand, helping communities and local governments more resilient to the impacts of climate change.

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Alkalinity cycling on the east Otago coast

Continental shelves take up CO₂ on annual-decadal timescales compared to the centennial-millennial timescales of deep oceans; therefore, it is critical to gain quantitative understanding of how coastal Total alkalinity (TA) cycling will respond to future ocean conditions. Carbonate dissolution is the main internal source of TA on the east Otago shelf, with recent experiments showing TA production is dependent on the sediment pore-water CaCO₃ saturation state. However, these experiments were only short-term, yielding uncertainty due to non-steady state sedimentary processes and requiring further investigation. Currently a 6-week incubation is being carried out to monitor sediments as they progress through transient states into steady state, investigating the overall long-term flux response. Past and future CaCO₃ saturation states were simulated using HCl and HCO₃ additions, testing if previously observed saturation state dependence holds when transience is accounted for. These findings could support our previous predictions that with future ocean acidification, TA levels will increase in coastal waters therefore increasing CO₂ uptake.

Bio

Kayleigh is a master's student studying marine science at the University of Otago. Her current project focuses on alkalinity in the east Otago coastal zone and is supervised by Sebastiaan van de Velde. Specifically, she is investigating alkalinity sources and creating an alkalinity budget for the east Otago coast. Her bachelor's degree was in chemistry, and she is excited to take on the carbonate chemistry challenge of alkalinity. She loves being in and around the ocean, making ocean chemistry a natural fit for her.

Consenting for Change: Adaptive Management in a Coastal Consent Context

Adaptive management is not new to resource consenting, but it has not always been used in a way that actively plans for future coastal change. As New Zealand moves toward new resource management legislation, there is an opportunity to ask how adaptive management provisions could be used more deliberately to support coastal resilience, manage risk and guide future decision-making. This presentation asks how coastal planning can become more dynamic and adaptive in practice, and the role that monitoring techniques, data and national and regionally consistent programmes will have in supporting more dynamic and resilient coastal management practices and outcomes. This presentation will review how adaptive management conditions have been used in existing coastal resource consents and planning frameworks and consider how they could be strengthened in future practice. Rather than treating consent conditions as tools for managing compliance alone, the presentation will explore how they can be used to establish monitoring requirements, signals, triggers, thresholds and future decision points that help communities, councils and asset owners respond as coastal risk changes over time. Using case studies from across the country the presentation will consider the role of triggers and monitoring of coastal change. Examining challenges in relation to robust and realistic monitoring, conditions and the need for future planning. Posing the question; what happens when a consented coastal structure reaches the end of its authorised life and cannot simply remain in place? Examples, consider different ways adaptive management can be built into consent conditions, plan rules and future development responses, drawing on case studies in coastal protection, coastal development and asset management. The presentation will also look ahead to the new legislative framework and consider whether it will enable more effective adaptive management, or risk introducing new limitations and complexity. It will explore the distinction between large-scale public projects, where adaptive frameworks may be easier to design and implement, and smaller site-specific consents, where future adaptation is often harder to coordinate.

Bio

Lara Clarke is an experienced planning practitioner at Barker & Associates, with specialist expertise in coastal adaptation, climate resilience and complex resource management processes. She has worked across strategic planning, policy and consenting projects, with a particular focus on helping councils, communities and infrastructure providers respond to changing coastal risk. Lara teaches at the University of Auckland's Urban Planning School and is a qualified independent hearings commissioner. Lara has played a key role in Auckland's Shoreline Adaptation Plan programme, supporting place-based adaptation planning across coastal areas with differing hazard profiles, asset pressures, community values and implementation challenges. Through this work, she has developed strong experience translating coastal hazard information, policy direction and community priorities into practical adaptation pathways and planning responses. Her work sits at the interface between statutory planning, technical evidence, engagement and governance. Lara is experienced in working alongside engineers, coastal scientists, mana whenua, council teams, elected members and communities to support robust and implementable outcomes. Lara's contribution to this presentation draws on her practical experience in coastal planning and her interest in how resource consenting can better support long-term adaptation and resilience.

Oral Presentation

Understanding the Role of Nature-based Solutions in Tsunami Hazard Mitigation – a Proof-of-Concept for Modelling Different Ecosystems as Manning's n Roughness Values

With ~15,000km of coastline, Aotearoa New Zealand is vulnerable to tsunami hazards. Nature-based Solutions (NbS), or bioshields, are one approach that can be used to help mitigate the hazards posed by tsunami waves. However, only a few scientific studies have been undertaken in Aotearoa New Zealand to approximate NbS in tsunami models. This makes it difficult to understand how NbS can be effective in mitigating the hazard.

Hard infrastructure, such as seawalls and breakwaters, are currently a more common approach for helping mitigate the effects of tsunami waves, however they are costly and difficult to implement at a country wide scale. Currently, it is easier to quantify the costs and financial benefits of these structures, compared to the equivalent NbS. Therefore, to be able to assess whether NbS can be implemented in similar ways to hard structures for hazard mitigation, we need a quick and effective approach for modelling different ecosystems, of varying dimensions at scale and overtop of our currently available datasets.

In this presentation, we present a proof-of-concept approach for approximating NbS when modelling tsunami scenarios. We will show how NbS can be represented in the modelling software COMCOT using different values of Manning's n roughness, by applying polygons to the presently available digital elevation models. This allows us to quickly, and easily, vary where different ecosystems could be located, and the dimensions of these regions, to optimise the role of NbS in tsunami hazard mitigation. Additionally, we will show how we can approximate how the ecosystems might respond to the resulting tsunami waves by changing the Manning's n of the ecosystem through time. While we cannot explicitly represent different ecosystems, or model the ecosystems destruction through time, this is the first step in being able to investigate the impacts that NbS can have on mitigating the hazard posed by tsunami waves.

Bio

Laura Hughes is an early-career scientist at Earth Sciences New Zealand, where she works on tsunami hazard assessments for Aotearoa New Zealand. Her work primarily focuses on using physics-based synthetic earthquake catalogues for hazard assessments and undertaking probabilistic hazard assessments of landslide-generated tsunamis around Te Moana-a-Toi/Bay of Plenty. She has also contributed to developing new techniques for representing nature-based solutions in tsunami models, helping researchers investigate their potential for hazard mitigation.

Peter L. Renshaw ¹

¹Pultron Composites Ltd, Gisborne.

Marina breakwater construction utilizing glass fibre reinforced polymer (GFRP) bars as concrete reinforcement (rebars).

The Tauranga Bridge Marina suffered significant storm damage within a decade of operation. The rebuild focused on enhanced resilience through the use of corrosion-resistant materials. The marina comprises a floating dock in a site exposed to Northerly storms and wind against tide wave action, which has caused significant damage to the marina. The marina is now protected by a breakwater, assembled from precast concrete panels.

The original steel-reinforced concrete panel option required substantial concrete cover to mitigate corrosion, with panel weights exceeding 17 tonnes. By specifying GFRP rebar, designers reduced the panel thickness and achieved a 3 tonne weight saving per panel. This reduced panel cost, and allowed the installer to use a smaller crane and barge to install the panels, saving the significant cost of leasing a much larger equipment for the duration of the install. The presentation will focus on the following aspects of the project:

- Design differences created by the conversion of the reinforcement system.
- The cost comparison between steel reinforced and GFRP rebar reinforced concrete panels.
- Installation advantages and savings achieved by reducing the weight of the panels.
- The increased lifespan offered by utilization of GFRP rebar.
- The reduction in environmental impact achieved by utilization of GFRP rebar.

Bio

Pete Renshaw is the head of Research & Development at Pultron Composites in New Zealand. He has been involved in the development of pultruded composite products for 34 years. He began his career developing Rockbolts to improve safety in Australian coal mines; this was very quickly followed by the development of Pultron's first GFRP rebar. Pete is a member of the Standards Australia committee responsible for the development of AS 5204 - product standard for FRP rebars. He is a member of the American Concrete Institute ACI 440 committee for FRP rebars and 243 committee for seawater concrete, and the ASTM committee for FRP rebar standards and test methods. Pete is currently chair of the American Composite Manufacturers Association's FRP Rebar council.

From Drone Data to Design Decisions: Coastal Resilience at Katiki Beach

Katiki Beach, south of Moeraki and north of Dunedin, is a dynamic open-coast embayment where State Highway 1 occupies a narrow corridor between farmland, rail infrastructure and the Pacific Ocean, with the road varying between 3.5m and 20m above sea level. Coastal erosion has progressively threatened the stability of the highway, yet the setting does not lend itself to a single simple intervention. The southern portion includes sections of rock armouring and an intertidal mudstone reef platform, while the northern portion is predominantly sandy, backed by vegetated foredune and influenced locally by creeks, underlying rock and changing beach morphology. This presentation tells the story of how a long-running coastal protection programme is evolving from reactive repair toward a more evidence-led resilience pathway. Earlier work at Katiki relied on regular site observations, survey information and practical local knowledge to identify high-risk sections and support targeted remediation. More recent work has combined LiDAR, aerial drone photography, photogrammetry, sand probing, metocean data and coastal processes assessment to improve understanding of where the beach is changing, where the underlying geological control is important, and where protection is most likely to be needed.

The northern Katiki assessment provides a useful case study in translating coastal process understanding into management options. The offshore wave climate is dominated by long-period swell from the southeast and east, with transformation through refraction and diffraction into the embayment contributing to spatially variable exposure. CoastSat analysis of satellite-derived shoreline positions identified strong seasonal variability, with summer advancement and winter recession, but limited evidence of sustained long-term shoreline recession across the study area. This was interpreted alongside observed foredune recession, reef controls, limited longshore sediment transport and dominant cross-shore exchange processes.

The presentation will draw together Lee Paterson's local monitoring and ground model work with Cory Smith's recent options assessment to show how different evidence sources can be integrated into a practical decision-making framework. Options considered include beach nourishment, rock and concrete armoured revetments, geotextile sand container revetments, vertical walls, groynes, nearshore reefs and combinations of these responses. The core message is that resilient coastal infrastructure decisions at places like Katiki need more than a design cross-section. They require a shared understanding of coastal behaviour, uncertainty, constructability, consent flexibility, community access, visual effects, maintenance burden and future adaptability.

Bio

Lee Paterson graduated from the University of Glasgow in 1994 with a BSc in Civil Engineering (with Geology). After a year of travels in 1998 he realised that New Zealand would be a fantastic place to be an engineer. Immigrating in September 2000, just after Nevis Bluff came crashing down severing the highway connection to Queenstown, Lee got a job mitigating landslide hazard risks and has never looked back. As a natural Hazards planning advisor throughout New Zealand, Lee continues to help people make better decisions and consider the future risks to their project. And he also flies drones.

Louise M. McDermott¹, Sarah McSweeney¹, Sophie Horton¹

¹School of Earth and Environment, University of Canterbury, Christchurch, New Zealand

Drivers of Coastal Erosion at Amberley Beach: The Role of Sediment Transport, Hāpua Morphodynamics, and Wave Climate.

Amberley Beach is a high-energy mixed sand and gravel coastline in northern Pegasus Bay that is experiencing the highest rates of coastal erosion in Pegasus Bay, with long-term managed retreat planning already in progress. The Waipara River, a braided river that discharges into the ocean through a hāpua (a small non-estuarine river-mouth lagoon), has previously been considered an important source of sediment for Amberley Beach. As sediment is transported through the hāpua before reaching the coast, understanding how hāpua dynamics influence the delivery of sediment to the coastline, and how waves redistribute that sediment, is essential for understanding sediment connectivity between the river and Amberley Beach. Previous studies have shown that hāpua temporarily store sediment before breaching events, with wave-driven reworking of the resulting marine flood delta returning sediment to the barrier and promoting channel closure. However, the transport of sediment beyond the gravel barrier, and how changes in wave climate may influence its redistribution along adjacent coastlines, has received little attention.

This research investigates how hāpua dynamics, and wave climate interact to influence sediment connectivity between the Waipara River and Amberley Beach by integrating repeated drone LiDAR surveys, bathymetric surveys, continuous water-level, temperature and conductivity monitoring of the hāpua, with historical satellite imagery, and wave climate and river-flow records.

During the monitoring period, a major hāpua breach occurred on 7th July 2026 following heavy rainfall and high river flows. Surveys conducted within seven days before and after the breach provide a novel, high-resolution dataset for investigating geomorphic change and sediment redistribution during a natural hāpua breaching event. This research aims to improve understanding of the interactions between braided rivers, hāpua, and wave-dominated mixed sand and gravel coastlines, providing insights to support coastal management along the Canterbury coast and other similar coastal systems globally.

Bio

Louise is currently completing a research Masters in Environmental Science at the University of Canterbury. Her research aims to improve understanding of how interactions between river-mouth dynamics and wave climate influence coastal erosion along mixed sand and gravel coastlines. A deep passion and curiosity for the natural world led Louise to leave behind her nursing career and complete a Bachelor of Environmental Science with Honours. As a surfer and lover of the ocean and the coast she was naturally drawn to marine biology and coastal geomorphology and therefore majored in coastal studies. Through the support of her supervisors, Dr Sarah McSweeney and Dr Sophie Horton, Louise is gaining valuable skills in coastal monitoring, remote sensing and GIS, while working together with local community and councils to improve coastal adaptation planning. After completing her research Louise hopes to start a career in coastal science or continue her research through a PhD.

Potential for heat hardening to enhance thermal resilience in early benthic juvenile *Jasus edwardsii*

Marine heatwaves (MHWs) are increasing in frequency and intensity under anthropogenic climate change, posing substantial challenges for marine ectotherms. Repeated exposure to elevated temperatures may induce heat hardening, a short-term response that enhances thermal tolerance. However, the capacity for such responses under ecologically relevant temperatures and timeframes remains poorly understood across many species and life stages. Spiny lobsters are valuable for investigating thermal resilience given their ecological and economic importance, and because their physiological performance is closely tied to environmental temperature, making them vulnerable to increasing thermal stress. This study determined the critical thermal maximum (CT_{max}) of early benthic juvenile *Jasus edwardsii* and assessed their capacity for heat hardening under present-day summer maxima and projected end-of-century MHW temperatures, using heat shock protein 70 (HSP70), catalase activity, total protein content, and sheltering behaviour. CT_{max} was $28.2 \pm 0.21^\circ\text{C}$ (SE). Hardened juveniles maintained stable total protein levels following sublethal heat exposure, while non-hardened juveniles showed a significant decline, indicating heat hardening conferred a measurable physiological benefit. These results highlight the possibility for natural buffering, whereby seasonal warming may prime *J. edwardsii* populations against future extreme thermal events.

Bio

Lucy Coyle is a PhD candidate at the University of Otago focused on integrating science to support the aspirations of local and indigenous communities, particularly through science communication and the effective delivery of fisheries data that empowers community-driven action. Her recent work examines the high-value fisheries species *Jasus edwardsii* (rock lobster), looking at historic management, current population status, vulnerability to future environmental conditions, and customary accessibility.

Kororā, Coastal Infrastructure and the Challenge of Biodiversity Compensation: Towards a Standardised Framework for Aotearoa New Zealand

Kororā (*Eudyptula minor*) are increasingly at the centre of conflicts between indigenous biodiversity protection and development of New Zealand's coast. As an At Risk - Declining species, kororā frequently occupy habitats associated with seawalls, revetments, breakwaters, marinas, stormwater infrastructure and other coastal structures targeted for renewal, adaptation and expansion. Project design and construction methods can avoid, minimise or remedy some impacts. However, residual effects often remain in situations where extended habitat exclusion may occur, or habitat loss is permanent. Furthermore, where alternative habitat is either unavailable or unlikely to provide true like-for-like replacement, biodiversity offsetting may be impractical or inconsistent with offsetting principles. Biodiversity compensation therefore often becomes the only remaining mechanism for addressing residual adverse effects on kororā.

Despite compensation being increasingly relied upon, approaches applied to kororā in New Zealand remain highly variable. Existing methods commonly rely on negotiated outcomes, financial contributions, simple multipliers, expert judgement, or default combinations of predator control, nest box installation and habitat enhancement. These approaches may achieve positive biodiversity outcomes, but are often difficult to compare, lack transparency, and provide limited ability to demonstrate proportionality between biodiversity losses and gains. This presentation explores the application of the Biodiversity Compensation Model (BCM, Baber et al. 2021) as a structured decision-support tool for kororā compensation when other effects management options or offsetting are not feasible. The BCM incorporates biodiversity value scoring, impact risk, uncertainty, compensation confidence and temporal discounting to estimate the quantity and type of compensation required to achieve a net positive biodiversity outcome. Unlike conventional multiplier-based approaches, it provides a transparent and auditable record of assumptions and decision-making.

Drawing on recent consent applications, emerging industry practice, and wider offsetting and compensation guidance, this presentation proposes a pathway toward standardised BCM application for kororā. Key topics include development of species-specific habitat and burrow scoring frameworks, treatment of uncertainty and risk, assessment of compensation actions such as nesting structures, habitat restoration, predator control and site protection, and establishment of agreed benchmarks for measuring success. The objective is to help build consensus and improve consistency within the industry by establishing shared assumptions, transparent calculations and common performance measures that can be tested over time. This could move the sector beyond ad hoc negotiation towards a more defensible, repeatable and accessible framework to assist practitioners, applicants, mana whenua, submitters and decision-makers alike.

Bio

Marcus Cameron is Technical Director - Marine Ecology and Water Science at Tonkin + Taylor with over 20 years' experience across CRIs, local government and consulting. He specialises in marine ecological effects assessment, effects management, biodiversity compensation and ecological restoration on projects throughout New Zealand and has extensive experience working with mana whenua, government agencies, industry, and as an expert witness. He has a particular interest in developing tools and frameworks to improve effects management, offsetting, compensation and ecosystem restoration and enhancement, including for species such as kororā (little penguin). Joshua Forrest is an Ecologist at Tonkin + Taylor with ten years of experience specialising in avifauna and herpetofauna across Aotearoa New Zealand. His current focus is on kororā (little penguin) ecology, particularly assessing how construction and coastal infrastructure projects influence kororā behaviour, habitat use, and long-term population outcomes. Joshua has contributed to major projects including Te Ara Tupua, as well as work across Wellington, Auckland, Napier, the West Coast, Nelson and Marlborough. He is experienced in evaluating ecological effects and developing mitigation, offsetting, and compensation approaches that balance project delivery with meaningful conservation gains.

Oral Presentation

Linking offshore wave climate to shoreline change: a multi-method assessment using statistical and machine learning approaches

This study is part of Waikato Regional Council's (WRC) ongoing efforts to improve understanding of how coastal morphology responds to extreme hydrodynamic conditions. Establishing the relationship between storm events and shoreline change is an essential part of improving the design (frequency, location and methods) of Regional Council shoreline monitoring programmes. Furthermore, an understanding of historical shoreline responses to known storm events will enhance Regional Council's ability to provide robust advice on the likely coastal impacts of forecast storms.

This study investigates the correlation between offshore wave conditions and shoreline change at various Coromandel beaches using WRC's long-term shoreline monitoring and MetOcean Solution's offshore wave hindcast data. A range of wave and storm parameters, including significant wave height, wave energy, storm duration, water level, and a combined wave energy-water level metric, were evaluated as predictors of shoreline response using correlation analysis, linear regression, and random forest models.

Wave and storm parameters were calculated over the period between consecutive shoreline surveys, allowing offshore forcing to be directly compared with the corresponding shoreline response. Timeseries were used to identify temporal patterns and periods of significant erosion or accretion, while statistical and machine learning models were applied to assess the predictive capability of the selected parameters. In addition, shoreline changes were recalculated using an alternative dune toe elevation to investigate whether the definition of the shoreline indicator influences the observed relationship with offshore wave forcing.

Wave energy and cumulative storm parameters were found to provide stronger relationships with shoreline change than average wave statistics. Shoreline response varies between beaches, highlighting the influence of local factors beyond offshore wave conditions alone. These findings demonstrate the utility of wave-based storm metrics as practical predictors of shoreline change, while identifying the primary sources of uncertainty that future modelling efforts should address.

Bio

Mariana specialises in coastal oceanography and the numerical modelling of waves, hydrodynamics, and sediment transport. She has experience in projects involving coupled numerical models for coastal process assessment, coastal engineering, port development, coastal erosion, shoreline change, and environmental impact assessments.

Matt Balkham¹, Ed Atkin², Shaw Mead², Kate MacDonald¹, Raphael Krier-Mariani³

¹ Jacobs, Wellington and Christchurch, ² eCoast, Raglan and ³ Dunedin City Council, Dunedin

Computational shoreline evolution modelling and economic evaluation to prioritise investment in coastal risk management, St Clair to St Kilda, Dunedin

The St Clair to St Kilda coastline in Dunedin is a highly valued recreational, ecological and community asset that also provides an important buffer protecting low-lying South Dunedin from coastal hazards. The 2022 St Clair to St Kilda Coastal Plan established a community derived vision, management objectives, and adaptive pathways for long-term coastal management. However, significant uncertainty remained regarding the relative performance, timing and value of potential interventions. To support decision-making, a multi-year programme of work was undertaken that combined computational shoreline evolution modelling, coastal hazard assessment, multi-criteria analysis and economic evaluation. A geomorphological shoreline response model was developed to simulate embayment-scale coastal evolution under sea level rise and alternative management approaches, including seawall realignment, beach renourishment, groynes, offshore breakwaters, dune remediation and coastal setback. Model outputs were integrated with community objectives, risk thresholds, adaptation pathways and cost-benefit considerations to evaluate both the effectiveness and timing of future interventions. The analysis identified key investment decision points associated with erosion, infrastructure exposure, landfill contamination risk and potential inundation pathways into South Dunedin. Importantly, the work demonstrated that different interventions deliver substantially different levels of risk reduction, community benefit and long-term value. By combining physical coastal modelling with economic assessment, the project was able to move beyond identifying technically feasible solutions to building an evidence-based investment case and establishing when interventions are likely to be required. The project highlights the value of integrating coastal process modelling and economics within a Dynamic Adaptive Pathways Planning framework. This approach provides decision-makers with a transparent and defensible basis for prioritising investment, communicating risk, and sequencing adaptation actions under uncertainty. The methodology offers a transferable framework for other coastal communities seeking to plan and fund long-term adaptation to climate change and coastal hazards.

"Moving from adaptation planning to implementation requires more than identifying options. By integrating shoreline evolution modelling with economic evaluation and adaptation pathways, councils can identify which investments provide the greatest benefit, when they are likely to be needed, and how to build a compelling case for action."

Bio

Matt Balkham is a chartered civil and environmental engineer with over 23 years' experience working in natural hazard risk management. He has worked on the St Clair to St Kilda coastline for over 10 years and led the preparation of the coastal plan and subsequently the coastal modelling and economic evaluation work. Matt is also lead peer reviewer for the South Dunedin Future project and Jacobs NZ coastal and adaptation lead.

Megan E. Tuck¹, Aidan McLean¹, Martin Wright², Peter Quilter²

¹Auckland Council, Auckland

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Seeing the Shore Differently: Auckland Council's Coastal Imagery Processing Toolbox

Te Kaunihera o Tāmaki Makaurau | Auckland Council and Tonkin and Taylor are working together to develop a Coastal Imagery Processing Toolbox to use alongside Auckland Council's coastal monitoring cameras. Auckland Council currently have nine coastal monitoring cameras installed across Auckland providing high resolution, time-series imagery of the coast. This dataset is already used extensively for visual assessments of coastal change and post-storm impacts supporting rapid and remote evaluations of erosion, recovery and coastal infrastructure damage or exposure. Beyond visual inspection of the coast, image processing has the potential to provide qualitative and quantitative information about the coastal environment including coastal hazards, changes in beach profile and asset management and beach user information. However, this work can be time consuming and challenging. Many existing tools have been developed to suit specific research questions and case study locations, sit within much larger ecosystems of tools with mixed dependencies, and are reliant on software licensing or costly subscriptions with ongoing maintenance costs. To realise this potential for Auckland Council, Tonkin and Taylor have been contracted to develop a more versatile, user-friendly Python workflow tailored to Auckland Council's coastal camera network and the staff that use this. The Coastal Imagery Processing Toolbox will: • Automate imagery processing, • Create low tide timelapses, • Image stabilisation, • Waterline detection, • Beach profile information. Tonkin and Taylor's approach adopted here combines cost-effective, standardised camera systems with cloud-based data governance and API-enabled workflows that support local storage of processed outputs. This enables a simpler, more practical workflow suited to local government applications. We prioritise accessibility and usability, focusing on straightforward, fit-for-purpose tools that can broadly inform coastal processes, while acknowledging some trade-offs in precision and site-specific optimisation. This presentation will outline the development of the toolbox including, toolbox architecture, processing methodology and early results from implementation across Auckland's coastal camera network. This work demonstrates how automated processing can unlock practical qualitative and quantitative insights from low-cost coastal camera networks, strengthening Auckland Council's ability to monitor coastal change and support evidence-based coastal management.

Bio

Megan is a coastal scientist with extensive experience in coastal processes, morphodynamics and monitoring coastal change. She completed her PhD in Geography at the University of Auckland, where her research explored coastal change across coral reef islands in the Pacific. She also played a key role in the development and publication of New Zealand's Coastal Change Dataset, a critical resource for understanding coastal evolution and resilience across Aotearoa New Zealand. Megan currently leads Auckland Council's Coastal Monitoring programme, overseeing a broad network of monitoring equipment, surveys, and data analysis that provide a regional record of coastal change and support the assessment of storm impacts and long-term coastal trends. Megan is proud to serve on the New Zealand Coastal Society's management committee, through which she co-leads the Aotearoa Coastal Monitoring Community.

Peter Quilter is a Principal Coastal Engineer at Tonkin + Taylor in Auckland, primarily focused on coastal processes, numerical modelling and science communication in New Zealand and the Pacific. He sees fieldwork and modelling as a balanced partnership, building insight into coastal processes and our potential effects on these. Particular focus areas include coastal hazards, effects assessments and coastal water quality. He's driven by a belief that our wellbeing and that of the environment are deeply codependent and takes a pragmatic approach to the inherent uncertainty in coastal systems, favouring solutions that are robust and adaptable over those that chase precision for its own sake. Nothing is more exciting than a problem that 'can't be done'. Peter has a Master of Engineering (Coastal) from the University of Auckland and is a Chartered Member of Engineering New Zealand and proud to be associated with the New Zealand Coastal Society and New Zealand Freshwater Sciences Society.

Feasibility of nature-based coastal protection in remote atoll environments

Low-lying atoll communities in the Republic of Marshall Islands (RMI) face increasing coastal hazard risks from erosion, inundation and wave overtopping. Nature-based solutions (NbS) are increasingly promoted for climate adaptation; however, their application in remote outer atolls remains underexplored. NbS can be applied across a spectrum of scales and intent, ranging from systems-scale and ecosystem-led interventions, where resilience outcomes arise from improved ecosystem health, to site-specific, hazard-led interventions designed to address localised risks. While national adaptation strategies often prioritise system-scale approaches, this project focuses on targeted, site-specific NbS coastal protection to address immediate risks to key community assets such as village centres and transport links.

In these outer (or rural) atoll environment, nature-based coastal protection is considered a viable first step for coastal adaptation. It is considerably more viable than in the urban centre atolls due to greater available space, less acute hazard exposure, and functioning reef ecosystems that underpin sediment supply and coastal stability. Tonkin and Taylor were engaged by the World Bank to assess feasibility and detailed design development of NbS on rural atolls Mili and Arno in RMI. As part of this project, eight priority sites across these atolls were identified for protection based on discussions with local community and site observations. A structured feasibility and option selection process was then undertaken and a long list of NbS options was developed and screened for atoll suitability. These options were evaluated using a multi-criteria analysis (MCA) framework tailored to the atoll context, performance, cost, material requirements, constructability, maintenance, environmental effects, and socio-economic impacts. This MCA was coupled with the outcomes of stakeholder workshops to select viable nature-based strategies for each of the eight sites. Selected options were progressed to detailed design, translating feasibility outcomes into constructible solutions. Collectively, these outcomes provide a replicable, evidence-based approach for identifying and designing nature-based coastal protection solutions in remote Pacific atolls. This presentation will focus on the process adopted in assessing solution feasibility, specific and unique constraints associated with these rural atolls, solutions adopted, and lessons learned.

Bio

Michael is a coastal engineer with Tonkin and Taylor, based out of their Tauranga office. He has 13 years' experience working predominantly on civil and coastal engineering projects around New Zealand. The past 5 years of his career have had a strong pacific atoll focus, particularly in Kiribati and the Marshall Islands, where he has been fortunate enough to spend time and work on several coastal resilience projects in these highly vulnerable countries.

Orientation-Dependent Scour Evolution and Stability Loss of Surface-Mounted Objects on an Erodible Sand Bed

Local scour and sediment erosion exert a strong influence on the stability of objects resting directly on the seabed. Although extensive experimental and numerical investigations of scour around embedded foundations have been conducted, limited studies have investigated the stability loss of surface-mounted objects due to local scour. These structures include ballast blocks, gravity foundations, scour protection devices, and temporary marine infrastructures. It is essential to understand the effect of object orientation on scour development and stability loss for improving the design and risk assessment of offshore structures.

This study investigated the scour evolution and stability loss of a rectangular block ($L \times W \times H = 235 \times 110 \times 50$ mm) and a Cylinder ($D \times L = 100 \times 200$ mm) placed directly on the sand bed ($d_{50} = 0.73$ mm) under steady-state current conditions (Velocity = 0.373 m/s and Water Depth = 380 mm). The stability of the objects at different orientations of the objects with respect to the approaching flow was evaluated. Bed topography was recorded using a 3D scanner to capture the spatial distribution of local scour and the value of critical scour, which caused the onset of instability. In addition, object tilt (Rotation), settlement (Sinking), and linear displacement (Sliding) were recorded for stability assessment.

Data analysis and comparison revealed that the orientation of the objects influences the scour morphology and initiation of instability. Configurations with higher frontal area and centre-of-gravity resulted in stronger horseshoe vortices, leading to deeper scour depths and greater scour volume. This higher scour resulted in accelerated loss of contact area between the object and the surface. This loss of support increased the tendency for overturning and sliding. On the contrary, configurations with lower frontal area and centre of gravity caused shallower local scour with greater stability. For all the configurations, different instability modes, i.e. progressive settlement, sinking, tilting, and overturning, were identified. Bed topographies showed scour progression around the objects and underneath the surface. The findings demonstrate that object geometry and orientation are governing factors in scour-induced loss of stability. Oblique flow directions cause asymmetrical scour, resulting in a greater loss of stability with higher sliding and sinking values. It should be considered in the design and placement of seabed-supported coastal and offshore infrastructures to avoid scour-induced instability.

Bio

Muhammad Adnan is an HDR student at the School of Engineering, Western Sydney University, Australia. They have research experience in the study of local scour around complex piles and tripod foundations. Muhammad's focus is on the experimental investigation of local scour for varying geometries of complex foundations and possible mitigation strategies. Muhammad holds a bachelor's and a master's degree in mechanical engineering, with teaching experience of almost 10 years.

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A Bayesian satellite turbidity calibration algorithm framework with a focus on the Great Barrier Reef, Australia

Monitoring extreme events that are key drivers of coastal hazards such as flood related turbidity pulses and episodic water quality degradation depends critically on the statistical frameworks we use to retrieve them. Optical remote sensing-based turbidity algorithms typically rely on single spectral bands, band ratios, or index-based regression methods optimised for overall point accuracy. These approaches are primarily calibrated to the low turbidity conditions that dominate the available observations while extreme turbidity pulses critical for coastal hazard assessment, sediment transport dynamics, and infrastructure design are often underrepresented and underestimated. Using Sentinel 2 reflectance data (Level 2) matched with in-situ turbidity data from the Great Barrier Reef (Australia), this study develops a Bayesian regression framework based on maximum band ratio (MBR) and a well-established turbidity index called normalised difference turbidity index (NDTI). The model performance is assessed using leave one out cross validation (LOOCV), focusing specifically on prediction at extreme turbidity values rather than point accuracy alone. Preliminary results indicate that baseline model underrepresents uncertainty at high turbidity despite a good overall fit. This finding has direct implications for how remote sensing can be used for hazard and relevant extreme event modelling. The model structure will be extended to a hierarchical structure to test whether group specific structure improves calibration based on water turbidity regimes. By modelling the data generating process rather than predicting the existing values alone, this work aims to reduce overfitting and offer a transferable framework for uncertainty assessment in other remote sensing applications where rare events are disproportionately important while the dataset is dominated by low values. By doing so, this work aims to support long term coastal monitoring using freely available optical datasets and characterise relevant extremes that shape coastal resilience.

Bio

Nasim is a PhD candidate at Massey University, specialising in statistical modelling and remote sensing for coastal ecosystem resilience. With a background in Civil Engineering, her technical expertise includes Python programming, machine learning applications in geoscience, and geospatial analysis (GIS).

Nicola Yuen¹, Dr. Emma Ryan¹, Dr. Marie McEntee¹.

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Living Coasts: Understanding the use of coastal hazard information and decision-support tools for adaptation

Decision-support tools are increasingly used to communicate coastal hazards and information to support adaptation decision-making. Several national-scale open-source coastal datasets and decision-support tools – such as national flood maps and erosion datasets – are now publicly available in New Zealand, creating new opportunities to support adaptation. The effectiveness of these tools depends not only on the availability of quality data, but on how hazard information and uncertainty are communicated and translated into decisions. However, there is limited understanding of how these datasets and tools are accessed, used and applied in practice, or how effectively they support decision-making. This research investigates how different users – including coastal scientists, adaptation practitioners, mana whenua representatives and the public – access, interpret and apply coastal hazard information within adaptation decision-making. Through a stakeholder workshop, surveys and semi-structured interviews, the research evaluates existing coastal decision-support tools and identifies approaches to improve their usability, accessibility and relevance. Preliminary findings from the stakeholder workshop indicate that the primary challenges relate to governance, fragmented data, ownership, long-term maintenance and the practical application of coastal hazard information across diverse user groups. Participants identified a strong need for an integrated, nationally coordinated, multihazard decision-support platform that provides clearer interpretation, communicates uncertainty, and is developed in partnership with mana whenua. We will discuss the governance and communication challenges identified in this research and consider ways forward for improving the uptake and use of coastal hazard decision support tools. The research will develop practical guidance to strengthen the integration, communication and application of coastal hazard information to inform the design of future decision-support tools for climate adaptation.

Bio

I am a Master of Environmental Science (MEnvSci) researcher at the University of Auckland. My research focuses on applying human-centred approaches to improve decision-support tools for coastal adaptation. Alongside my research, I have over a decade of experience leading the design of digital products, understanding user needs to design intuitive tools and communication across government, science and technology, with a background in digital product design, landscape architecture, and environmental science. My interests include nature-based solutions, water-sensitive design, geospatial analysis, and environmental data visualisation. Qualifications: Bachelor of Arts in Design (BA), Graduate Diploma in Landscape Architecture (GradDipLA), Master of Environmental Science Student (MEnvSci).

Designing from ecology up: a bottom-up approach to eco-engineering port infrastructure

Eco-engineering is increasingly used to improve the ecological value of seawalls, revetments, and other coastal infrastructure. In complex coastal infrastructure projects, ecological objectives must compete with engineering requirements, construction constraints, and programme timeframes, and habitat enhancement can therefore sometimes be shaped by available products or engineering solutions rather than by clearly defined ecological objectives. For its recent land reclamation project at Te Awaparahi Bay, Lyttelton Port Company instead adopted a bottom-up approach that began with its objectives for habitat compensation and biodiversity enhancement, and progressively translated these into an ecologically defensible and technically feasible infrastructure design.

The process first quantified the type and extent of hard substrate habitat that would be lost through reclamation. Local ecological surveys, aerial imagery, GIS analysis and independent methods for estimating habitat area were used to distinguish the higher-value intertidal and subtidal habitats requiring compensation. Nearby natural reefs were then examined to identify ecological features poorly represented on conventional rip-rap (consisting of quarry boulders), particularly intertidal pools and other structurally complex microhabitats associated with diverse rocky shore communities.

Commercially available eco-engineering products were assessed against ecological, structural, and operational criteria, and different products were selected for incorporation into different parts of the new revetment. The amount of enhanced habitat required was linked explicitly to the estimated habitat loss. Importantly, the design went beyond like-for-like habitat compensation by also incorporating habitat features that are poorly represented on conventional revetments, creating additional opportunities for biodiversity enhancement. Placement design then had to reconcile ecological principles with engineering constraints including wave exposure, revetment geometry, construction requirements, predicted bund settlement, and future sea level rise. Eco-engineered habitat was distributed along the revetment in multiple smaller clusters, drawing on established principles from conservation ecology, and across relevant intertidal and shallow subtidal shore heights.

The final step was to design monitoring around the original ecological objectives rather than simply documenting colonisation. The monitoring programme compares enhanced habitat with adjacent conventional rip-rap controls and nearby natural reference sites, and evaluates biodiversity uplift, habitat function, ecological trajectory, biosecurity outcomes, and design performance over time. The monitoring design is also intended to generate information that can improve future eco-engineering decisions. Overall, the Bay project illustrates a transferable principle for habitat enhancement on coastal infrastructure: eco-engineering interventions can be designed from the ecological objective upwards, rather than from the available product downwards.

Bio

Oli Floerl is an aquatic ecologist and environmental scientist with more than 25 years' experience in research and consultancy. He is based at LWP Ltd and has previously held senior science and research leadership roles at Cawthron Institute, NIWA, and SINTEF Ocean. His work focuses on marine biosecurity, ecological monitoring, coastal eco-engineering, and the translation of ecological evidence into practical management and infrastructure design. Oli has led projects for central and regional government agencies and across maritime industries, including transport, energy, and aquaculture, in New Zealand and internationally. He has published extensively on marine biosecurity, biofouling management, monitoring, and coastal urban ecology. Oli has a particular interest in developing practical, science-based approaches that help organisations get greater environmental value from monitoring, management, and infrastructure investment.

The power of integration: getting more from existing coastal monitoring

Environmental agencies across Aotearoa New Zealand invest substantially in coastal monitoring for water quality, ecological health, sedimentation, habitat mapping, infrastructure management, consent compliance, and other purposes. These programmes are generally designed and operated independently, even where their field activities, samples, or data could contribute to other management objectives. This raises a practical question: before establishing new monitoring programmes, how much additional value could be obtained from monitoring that is already occurring?

We addressed this question through a regional marine biosecurity case study for Waikato Regional Council. We catalogued 17 highly varied coastal and marine data-collection activities operating across approximately 1,150 km of regional coastline, including dedicated biosecurity surveillance and a range of environmental and other data-collection activities. We assessed their current or potential contribution to surveillance for priority non-indigenous species (NIS), and then examined how the non-biosecurity activities could augment existing dedicated biosecurity surveillance. We considered three forms of integration with these non-biosecurity activities: adding biosecurity observations to existing field activities, applying additional analytical methods to samples already being collected, and collecting additional targeted samples during existing field visits. Regional vessel and aquaculture activity was also examined to identify areas of elevated introduction potential for NIS. Occupancy-model simulations were then used to compare expected surveillance performance under the existing dedicated biosecurity programme and each form of integration while accounting for differences in sampling effort and detection probability.

The existing surveillance programme performed substantially better for moderately prevalent, spreading populations than for small, newly established incursions - an important limitation where early detection is the management objective. Adding observational objectives or analytical methods produced useful but generally context-dependent gains, particularly where existing environmental monitoring was already extensive and well distributed. The largest improvements resulted from collecting additional targeted samples during existing field activities. However, integration could not eliminate all spatial and taxonomic surveillance gaps, and dedicated biosecurity monitoring remained necessary in some areas.

The work provides a practical framework for identifying latent surveillance capacity within existing regional monitoring portfolios. More broadly, it highlights an opportunity to move from retrospective integration towards 'integration by design'; i.e., considering complementary monitoring objectives when programmes are first established or reviewed. Although developed for marine biosecurity, the approach is readily transferable to coastal water quality, biodiversity, ecosystem health, threatened-species monitoring, and other environmental monitoring, and could help realise efficiencies by making existing monitoring effort work across organisational and management boundaries.

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Engineering for Ocean and Mud Waves at Lyttelton Port

Lyttelton Port Company (LPC) is undertaking reclamation works in Te Awaparahi Bay to expand their existing port facilities. Stage 2A of this reclamation includes the construction of two outer bunds with rock armour to provide scour protection along the perimeter of the reclamation area. Haskoning were engaged by LPC to prepare the detailed design for the rock armour (revetment) of the bunds.

A key challenge of the revetment design was to ensure a robust toe that accommodates the ground conditions of the seabed, which generally comprise soft fine-grained sediments that will undergo lateral displacement (mud waving) due to placement of bund fill materials. Ongoing settlement is also predicted to occur, which needed to be addressed in both the reclamation and revetment designs. A design solution was developed which involved locating the revetment armour on a platform of fill material that has settled some distance into the bed to form a bridging layer. An innovative construction methodology was also developed to maximise engineering outcomes while simplifying constructability.

The rip rap revetment design made efficient use of locally available rock material. The adopted rock grading considered wave loadings, the limited quarry yield, and filter requirements with the adjacent bund materials.

The revetment design was ecologically enhanced by incorporating several clusters of EConcrete Coastalock concrete armour units within the rip rap rock matrix. The Coastalock units have been placed in both the intertidal and subtidal zones to provide habitat that supports a range of marine life, particularly kaimoana species of traditional significance to the local community. Design of the eco-engineering aspects of the project involved close collaboration between the design engineer, ecologists, contractors and the client. This ensured that the design is suitably robust, is readily constructable and can deliver the desired environmental and social benefits.

Bio

Amy has over 15 years of experience in the technical delivery and management of coastal and maritime infrastructure projects. Her experience includes coastal protection, ports, marinas, waterfront developments, ferry terminals, and island developments across New Zealand, Australia, the Pacific, Asia, and the Middle East. She combines international experience with a strong focus on climate resilience and practical engineering solutions from inception to construction.

The social context of coastal erosion management in New Zealand: What has changed in 16 years?

In 2010, Blackett, Hume and Dahm published a paper called “*Exploring the social context of coastal erosion management in New Zealand*”, specifically exploring what common factors tend to drive particular outcomes. The paper observes that the outcomes following a coastal erosion event that threatens private property, community assets, or a popular beach are largely the result of how the negotiation proceeds. It hinges on who is involved, what vested interests are present, how resource management agencies behave, and the geomorphic and dynamic characteristics of the physical environment. Our 2010 analysis concluded that:

1. Soft engineering options (e.g., beach renourishment or dune planting) or managed realignment were more likely when cooperative relationships are established, learning and trust are developed, risks are addressed, scientific input is managed, lobby groups are defused, contending interests are reconciled, and records are kept of the negotiation process and agreements reached.
2. Hard engineering options were more likely to appear when communities affected by coastal erosion had articulate, connected and resourceful lobby groups and where there was limited wider community representation. This was exacerbated where doubt regarding the science could be introduced, and decision-makers struggled to navigate the political landscape.

In this presentation, we will reflect on what has changed, and what hasn’t changed, over the last 16 years as coastal hazard and climate adaptation practices and policy have evolved. For example, is there still community conflation of erosion and sea level rise?, Do lobby groups still strongly influence outcomes?” Overall, we argue that the underlying drivers of outcomes remain largely the same, while directive coastal policy exists, it’s very challenging to implement. As such, coastal adaptation still faces significant headwinds, particularly in navigating lobby groups, conflicting or vested interests and balancing public/environmental values versus private good.

Bio

Paula is a Principal Researcher at Urban Intelligence and has over 25 years of experience in research and consulting on the social aspects of climate risk and adaptation. She was a co-author of the NZ Coastal Hazards Guidance for Local Government (2017), the social domain lead for the first NZ National Climate Change Risk Assessment (NCCRA), an expert reviewer on the second NCCRA (Governance domain and cascading risk), and a contributing author to the IPCC 5th and 6th Assessment reports. To date, she has been involved with many risk and adaptation projects (e.g., Clifton to Tangoio Coastal Climate Change Strategy) alongside numerous research projects focusing on cascading risk, community tolerance, and the social aspects of implementing adaptation plans.

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Image Perspectives for Rip Current Identification Education

Educating the public about the rip current hazard continues to be a primary goal of beach safety initiatives worldwide. Previous studies have used photographs and videos to assess community ability to identify rip currents and, in general, have shown rip identification skills to be poor. Exacerbating this problem, several studies have demonstrated that capabilities to identify rip currents in photographs are rarely replicated at the beach. Therefore, a clear need to improve rip current education remains. A key challenge is that the still images and/or videos of rip currents used in educational programs are often captured from visual perspectives that do not typically represent those observed or experienced by beachgoers in-situ. This research evaluates whether rip current type and the visual perspective of imagery shown to beach users influences rip current identification ability.

An online survey was distributed to a representative sample of the Australian population between April and July 2025. Respondents were asked to identify rip currents in 16 photographs and four 15-second videos and to quantify the level of difficulty they experienced in identifying the rip current/s in each. The images and videos were taken from a range of visual perspectives and included different types of rip currents. A total of 1,491 surveys were analysed. The survey gathered views of the general population, at-risk (young males, multicultural and rural communities) and highly skilled respondents (lifeguards/surfers). A second survey was distributed to an international group of 78 coastal scientists, rip current researchers, experienced lifeguards and surf lifesavers, and those responsible for developing and delivering rip current education. Data were collected on rip identification using the same imagery from the first survey, along with the opinions of these experts on the challenges in rip current identification and education. Comparative results highlight differences and similarities.

Rip current identification ability varied by respondent characteristics. Respondents with greater water experience demonstrated higher identification accuracy than those with less experience and from at-risk demographic groups. Identification ability also varied by rip current type and image perspective. Preliminary findings from this ongoing research provide a comparison between expert and community perspectives on the best ways to educate the public about the rip current hazard. Insights will inform future research and guide recommendations for enhancing rip current awareness and improving safety at unpatrolled beaches through more effective identification education.

Bio

Rachel is a PhD candidate, under the supervision of Professor Rob Brander, Dr Amy Peden, Dr Jaz Lawes and Associate Professor Mitchell Harley. Rachel's research is looking at the challenges involved in rip current identification and education. Rachel has a background in geography and social science, completing a Masters of Science at the University of Otago in 2023, where she researched rip current identification ability in photographs and videos.

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¹Earth Sciences New Zealand, Hamilton

Improving Extreme Wave and Wave Runup Estimates for Coastal Hazard Assessment Along the Canterbury Coast, New Zealand

Reliable estimates of extreme waves and wave runup are critical for coastal hazard assessment. We present an updated assessment of wave conditions along the Canterbury coast, focusing on improvements to the wave hindcast, extreme-value estimates, and empirical runup predictions.

Wave conditions from the NZWAVE-ERA5 hindcast were evaluated against long-term observations from the Banks Peninsula wave buoy. Consistent with previous assessments, the hindcast underestimated extreme significant wave heights. A distribution-based bias-correction method using satellite observations substantially improved the representation of the upper tail of the wave-height distribution.

Extreme wave heights were estimated using peaks-over-threshold analysis and a Generalised Pareto Distribution, extending estimates to annual exceedance probabilities as low as 0.2%. Joint-probability analysis using the conditional extremes approach of Heffernan and Tawn (2004) was used to characterise the dependence between storm-tide levels and wave heights, demonstrating that extreme waves and elevated sea levels do not necessarily occur simultaneously.

Wave runup was assessed using 8 empirical formulations for sandy and composite or mixed sand and gravel beaches and validated against available observations of historical events. The validation highlighted substantial variability between formulations and beach types. The best-performing equations were subsequently selected for application in the Canterbury Coastal Calculator.

Bio

Rafael is a physical oceanographer with expertise in the dynamics of coastal, meso- and largescale variability from Equatorial to Polar regions. Their focus is to improve understanding of ocean variability using remote and in situ observations, numerical modelling, and data assimilation. They work at Earth Sciences New Zealand (ESNZ), most specifically within the Coastal and Estuarine Group. At ESNZ, their research targets understanding past and future climate conditions to increase the country's resilience to extreme weather events.

Linking Environmental Forcing to Coastal Cliff Erosion Hazards

A seven-year record comprising approximately 320 weekly LiDAR surveys of a 2.3 km-long, beach-fronted cliff in southern California was used to investigate cliff erosion variability from weekly to interannual timescales and identify persistent alongshore erosion hotspots. Temporal relationships between cliff erosion and environmental forcing—including waves, water levels, rainfall, and groundwater—were examined across different cliff elevations. When considered independently, weekly lower-cliff erosion within the wave-exposure zone correlated most strongly with wave forcing ($r^2 = 0.38$), whereas upper-cliff erosion correlated with rainfall ($r^2 = 0.36$) and groundwater ($r^2 = 0.15$). Models incorporating combined environmental forcing produced stronger relationships, with the greatest lower- and upper-cliff responses occurring at semiannual and monthly timescales, respectively ($R^2 = 0.66$ and 0.58). During El Niño conditions, wave forcing increased by 36% relative to the monthly climatology and coincided with enhanced cliff-erosion activity.

A five-year subset of the LiDAR record (2019–2024), combined with a buoy-driven wave model, was then used to investigate the morphological controls on alongshore lower-cliff erosion. Point-cloud change detection, wave-impact parameterisation, Empirical Orthogonal Function analysis, and a logistic Generalised Estimating Equation framework were applied to distinguish material resistance from spatial variations in wave exposure. Under comparable forcing, deposited talus eroded approximately 5.5 times faster than consolidated cliff material. After accounting for this contrast, alongshore wave-forcing patterns explained 55–65% of the variance in lower-cliff retreat during energetic conditions at spatial scales of 125–200 m. Sensitivity analysis indicated that beach gradient and back-beach elevation contributed 59% and 32% of the alongshore variability in cliff-toe wave forcing, respectively, exceeding the contribution of incident-wave variability by approximately an order of magnitude. A probabilistic model combining mean and dynamic beach morphology identified erosion hotspots with moderate predictive skill (cross-validated AUC = 0.71; spatial $r^2 = 0.75$).

Collectively ^[1,2,3,4,5], this research integrates remote sensing, machine learning, nearshore wave modelling, and meteorological data to provide critical information for managing coastal cliff landslide hazards and developing engineering strategies to reduce risks to the public and coastal infrastructure.

Bio

Raphael is the Lead Coastal Scientist at Dunedin City Council, overseeing the strategic response to climate change and the development of monitoring strategies and engineering solutions for coastal risk mitigation across the district, which covers approximately 150 km of coastline. He has studied a range of coastal processes, including the dissipation of storm waves in the English Channel, Great Britain, using offshore buoys; the morphological response of Narrabeen Beach, Australia, to El Niño and La Niña cycles using nearshore wave hindcasts and beach surveys; and wave transformation over shore platforms in New Zealand using AUVs, pressure-sensor arrays, and current meters. At Scripps Institution of Oceanography, Raphael focused on linking cliff-erosion hotspots to environmental forcing using wave, rainfall, groundwater, and LiDAR data. He employs a range of techniques in his work, combining in situ data on currents, waves, bathymetry, and morphology with numerical wave models to link environmental parameters to coastal geomorphological responses and inform the development of coastal management strategies aimed at mitigating climate change-related coastal hazards.

Managing Legacy Coastal Landfills in a Changing Climate: Integrating Contaminated Land Remediation with Nature-Based Coastal Resilience at Kettle Park, New Zealand

Historic coastal landfills present an increasingly complex challenge as climate change accelerates coastal erosion, increasing the risk of legacy contaminants being released into sensitive coastal environments. The Kettle Park historical landfill, located immediately landward of the St Clair–St Kilda dune system in Dunedin, New Zealand, provides an example of the multidisciplinary approach required to manage these risks while supporting long-term coastal resilience.

The landfill received waste from approximately 1900 until the early 1950s before being capped in the 1960s and converted into public sports fields. Investigations undertaken for Dunedin City Council (DCC) indicate that more than 250,000 m³ of landfill waste and contaminated soil remain within and behind the dune system, including gasworks waste, construction and demolition debris, and asbestos-containing materials. Coastal erosion threatens to expose these buried wastes, with modelling indicating that more than 100,000 m³ could become exposed by 2120 under projected sea-level rise scenarios.

To address this risk, DCC is developing a remediation strategy aligned with the St Clair–St Kilda Coastal Plan. The strategy seeks to improve climate resilience through long-term, nature-based solutions while enhancing public access and amenity. A broad range of remediation options was assessed against twelve remediation objectives before shortlisted alternatives were evaluated using a multi-criteria assessment framework considering technical effectiveness, implementation complexity, adaptability, and environmental, social, and economic outcomes. Partial waste removal combined with dune reprofiling emerged as the preferred approach. Conceptual design is now focused on naturalised dune configurations, including foredune development, to reduce waste exposure risk while strengthening coastal resilience and optimising whole-of-life costs.

Developing the remediation strategy has required addressing interconnected technical, environmental, and planning challenges. Dynamic dune morphology complicates site investigations, while incomplete historical disposal records create uncertainty regarding the nature and extent of buried contaminants. The scale of the landfill makes complete excavation neither technically nor economically feasible, necessitating a risk-based approach that balances environmental outcomes with practical constraints. The strategy must also integrate coastal processes, ecological values, public access, amenity, and wider coastal management objectives. This case study demonstrates the importance of adaptive remediation strategies that integrate contaminated land management with coastal adaptation to deliver long-term environmental and community resilience.

Bio

Rebekah Haughey is a coastal scientist at Tonkin + Taylor Ltd, specialising in coastal hazard assessments and coastal geomorphology. She completed a Master of Science (Research) at the University of Waikato, where her research modelled the influence of mangroves on tidal currents in the Firth of Thames. Based in Christchurch, Rebekah works on a wide range of coastal projects across Aotearoa New Zealand, with a particular interest in understanding coastal processes and developing practical, science-based solutions for coastal communities.

Operational coastal pollution response: the Wellington sewage spill event

On 4 February 2026, a catastrophic failure at Wellington's Moa Point Wastewater Treatment Plant led to the discharge of untreated sewage directly into Tarakena Bay, with partial restoration to the 1.8 km long outfall some 3 days later. Within hours of the event, Calypso Science and Oceanum deployed an end-to-end modelling and visualisation chain to support situational awareness for council and community.

The operational response system had been developed by Calypso Science on Oceanum's cloud computing infrastructure, organised in four stages. First, a New Zealand SCHISM product provides open-boundary elevation and velocities. Second, a Wellington downscaling run couples SCHISM-WWM producing high-resolution currents, elevation, and Stokes drift. Third, OpenDrift, a Lagrangian particles model run, from which surface density fields are exported at 200 m resolution. Fourth, SeaScope Pollution (pollutionmap.seascope.io) displays the results as interactive heatmaps, animated timelines, current and wave overlays. The latter are made freely available for public use.

This case demonstrates that rapid coastal pollution response is feasible when national scale models are operational and the data files are in a state of readiness ready for local downscaling, and when dispersion workflows can be quickly configured and executed on cloud infrastructure, in this case the oceanum.io platform. Here, we discuss the model configuration and assumptions, limitations for public-health decision-making, and transferability to oil spills, search and rescue, and other coastal emergencies across Aotearoa.

Bio

Rémy Zyngfogel is a physical oceanographer and founder of Calypso Science, with over 15 years' experience in coastal hydrodynamic modelling, sediment transport, and Lagrangian particle tracking. He has worked on projects worldwide — including tidal current modelling for major sailing races — and across Aotearoa New Zealand, covering the country's major ports for dredging, navigation, and biosecurity applications, as well as Cook Strait, the Marlborough Sounds, Foveaux Strait, and numerous coastal outfall and aquaculture sites. He is particularly interested in making scientific ocean data accessible to a wider public through SeaScope visualisation tools. He holds an MSc in Oceanography from the National Oceanography Centre, Southampton.

Ruby McKenzie Sheat¹, Corey Hebbard², Peter Meihana², Shaun Williams¹, Jay Hepi¹, Danielle Johnson^{1,3}, James Battersby¹, Cyprien Bosserelle¹, Andrew Lorrey¹

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Strengthening coastal resilience through mātauranga Māori: Insights from Rangitāne o Wairau

Climate change is increasing the frequency and severity of coastal hazards across Aotearoa, creating growing challenges for coastal communities, infrastructure, cultural heritage, and environmental values. Conventional risk assessments typically focus on physical exposure, erosion, inundation, and economic loss, often overlooking the cultural, relational, and intergenerational dimensions of risk that are central to many communities. This presentation shares findings from a collaborative research project undertaken with Te Rūnanga a Rangitāne o Wairau, exploring how mātauranga Māori can inform coastal risk assessment and adaptation planning in their rohe. Guided by kaupapa Māori, the research drew on interviews, place-based discussions, and workshops to identify how Rangitāne o Wairau define and experience risk. Particular emphasis is placed on how the methods and findings provide an exemplar for adaptation, application, and uptake across similar contexts in Aotearoa and the Pacific Islands region.

Drawing on these findings, consequence relationships were derived to translate Rangitāne values, lived experiences, and cultural priorities into a series of tables to inform coastal risk assessments within their rohe. The resulting framework demonstrates an adaptable approach for communities to define the cultural, environmental, and intergenerational consequences that matter most to them and build them into coastal risk and adaptation processes. The findings highlight the importance of Indigenous governance, locally grounded knowledge, and meaningful community participation in strengthening coastal resilience and supporting planning that better reflects the full range of impacts associated with climate-driven coastal change.

Bio

Ruby McKenzie Sheat is an early-career environmental researcher in Te Kūwaha, the Māori research team at Earth Sciences NZ | Te Whatu Ao, specialising in climate hazards, resilience, and adaptation. Working alongside iwi, hapū, and communities, she explores how mātauranga Māori, place-based knowledge, and science can be woven together to support climate adaptation and environmental decision-making. Ruby enjoys working at the interface of science and community, translating complex research into practical insights and tools that support locally led planning and resilience.

Insights on ebb tide delta dynamics from marine vessel journeys

Ebb-tidal deltas (ETDs) front many of Aotearoa/New Zealand's harbours, storing vast volumes of sand within dynamic bar and channel systems. By modulating alongshore sediment supply, these deltas act as primary drivers of downdrift coastal change. Additionally, their shallow depths, energetic wave climate and strong tidal currents make ETDs both severe navigation hazards historically accounting for some of the nation's deadliest maritime accidents.

Exploring vessel bar-crossing activity provides insights into marine safety and deeper understanding of these dynamic systems. However, data on bar-crossings is fragmented and piecemeal, with no single dataset providing a complete record of bar-crossing activity. We explore the potential of mobile phone location data to provide high-resolution insights into maritime vessel activity that would otherwise be difficult to identify. We treat a crossing as a latent spatiotemporal event and examine how it is represented across four incomplete observation systems: AIS vessel trajectories, mobile-device location traces, periodic satellite imagery and Coastguard VHF radio logs. Source-specific methods are used to derive candidate events prior to associating them within a crossing-event ledger based on evidence supporting event existence, timing, direction, pathway and vessel identity, and on how well the evidence from each source conforms.

Using transits of the Raglan and Manukau harbour we develop a framework for integrating AIS, mobile phone data, satellite imagery and Coastguard logs to develop vessel trajectories. The framework demonstrates how heterogeneous and incomplete data can be integrated and provide insights into both the geomorphic behaviour of ETDs as well as the behaviour of boaties crossing the bars. The record of 1000s of bar crossing trajectories highlights the strengths and limitations of the available bar-crossing evidence. The framework provides a basis for establishing vessel trajectories and hazard exposure when crossing harbour bars, while additionally contributing to our understanding of the dynamics of these complex coastal systems.

Bio

Richard Beauchamp is an actuary with many years of experience working for general insurers and in professional services. He is a Fellow of the Institute of Actuaries (London). He is concerned about the impact of climate change on vulnerable communities and eager for science-based insights to be at the heart of government policy and community action. Richard returned to full-time study in 2023, subsequently completing a PGDipSci and MSc in environmental science at the University of Auckland. His recent research has focused on remote sensing and, in particular, the use of mobile phone data (MPD) to provide insights about human mobility where other data is sparse. He has used MPD to describe maritime activity on the Hauraki Gulf and several west coast harbours near Auckland. Like many New Zealanders, Richard has a strong connection with the coast and water. He lives beside the Tamaki estuary in Auckland, where his children became keen sailors and his wife aims to swim year-round. He volunteers with Coastguard. And he is nostalgic for Waihi Beach and the other beaches of his youth, hopeful that future generations will continue to enjoy them and value them more than ever.

Navigating the Grey Zone: Classifying Coastal Outfalls under New Zealand's Wastewater Environmental Performance Standards

New Zealand's Wastewater Environmental Protection Standards (WEPS) introduce nationally consistent performance requirements for treated wastewater discharges, including coastal and marine outfalls. For many existing and proposed schemes, however, the most consequential question may be the first one asked: "what receiving environment category applies?" The distinction between open ocean, high-energy coastal, low-energy coastal and estuary settings affects the applicable standards, the evidence required to support a consent pathway, and the level of confidence needed from design, planning and technical reviewers.

This presentation explores the practical complexity of classifying coastal outfalls under the WEPS, drawing on recent Stantec work with existing clients and wider discussions on coastal outfall performance. Some categories are comparatively clear. Estuaries are generally identifiable from geomorphology, exchange constraints and freshwater influence. Open ocean settings are screened in the WEPS using distance from shore, water depth, and near field dilution performance. Low-energy coastal settings are also relatively intuitive where discharges occur within sheltered harbours, gulfs or recessed embayments with limited exposure to large waves or long-period swell.

The grey zone is high-energy coastal water. The supporting technical documents present the assumed minimum dilutions for each receiving environment category used in the testing of the WEPS but this has not been incorporated into the regulation. The WEPS acknowledges that this category requires interpretation, yet the interpretation has material implications. A purely spatial test risks misclassifying energetic nearshore coasts, while a purely wave-based test may overlook currents, bathymetric sheltering, residence time and contaminant transport pathways. We have considered a multiple-lines-of-evidence framework that may need to include wave exposure, long-period swell penetration, bathymetry, coastal morphology, current regime, flushing, near-field dilution, far-field transport and potential retention. The framework is not intended to replace site-specific judgement. Rather, it provides a transparent basis for determining whether a receiving environment behaves more like a dynamic open coast or a sheltered low-energy coastal waterbody. By working through the four coastal scenarios in the WEPS, open ocean, high-energy coastal, low-energy coastal and estuary, the presentation will identify what is clear, where uncertainty remains, and how coastal engineers, planners and regulators can make defensible categorizations without reducing complex coastal processes to a single arbitrary threshold.

Bio

Ryan Abrey is a Principal Civil Engineer and Civil Team Lead with Stantec, based in Wellington, New Zealand. With over 16 years' experience, he specialises in coastal engineering, resilience planning, shoreline protection, marine outfalls, and climate adaptation. Ryan has led and contributed to a wide range of coastal investigations, design projects, and strategic studies throughout New Zealand and internationally, with a particular interest in integrating engineering solutions with environmental and community outcomes. He serves as Co-Treasurer of the New Zealand Coastal Society (NZCS), supporting the advancement of coastal engineering practice and knowledge sharing within the profession.

Oral Presentation

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Integrating Field Measurements, Satellite Geodesy, and Hierarchical Modelling to Quantify Post-Earthquake Shore Platform Evolution at Kaikōura, New Zealand

The 2016 Mw 7.8 Kaikōura earthquake produced up to approximately one metre of coseismic uplift along the Kaikōura Peninsula, creating a rare opportunity for investigating post-seismic rock coast evolution. However, the extent to which field observations, satellite geodesy, and statistical modelling can be integrated to quantify subsequent shore platform lowering remains poorly understood. This study combines eight years (2017–2024) of Micro-Erosion Meter (MEM) measurements, continuous GNSS observations, and Persistent Scatterer InSAR (PSI) derived from Sentinel-1 imagery to evaluate spatial and temporal patterns of post-earthquake shore platform evolution. Hierarchical Robust Linear Mixed-Effects and Location–Scale Mixed-Effects models were applied to MEM observations to quantify erosion variability across nested spatial scales (platform, bolt site, and measurement point). The models indicate a mean post-earthquake downwearing rate of approximately 2.1 mm/yr, with erosion primarily controlled by elevation, time since uplift, platform position, and morphological zone. Variability was greatest at the MEM point scale, highlighting the dominant influence of microtopography and fine-scale geomorphic processes. GNSS-calibrated PSI datasets reproduced comparable platform-scale spatial patterns, although InSAR-derived vertical displacement magnitudes exceeded MEM erosion rates because they also incorporate regional post-seismic ground deformation. Nevertheless, both datasets consistently identified greater surface lowering on mudstone platforms than on limestone platforms. The integration of field measurements, satellite observations, and hierarchical statistical modelling demonstrates that geomorphic downwearing and tectonic surface displacement can be evaluated within a unified framework. This multi-scale approach extends interpretation beyond the spatial limitations of traditional field monitoring and provides new insights into the evolution of uplifted rock shore platforms. The methodology offers a transferable framework for monitoring coastal change in tectonically active regions and contributes to improved understanding of long-term coastal resilience under continuing tectonic adjustment and future sea-level rise.

Bio

Sakaouth Hossain is a PhD candidate at the University of Otago, New Zealand, where his research focuses on shore platform erosion. By integrating field-based Micro-Erosion Meter (MEM) measurements, GNSS geodesy, and satellite InSAR observations, he aims to advance the understanding of coastal landscape evolution and pioneer innovative methods for tracking long-term Earth-surface change. Sakaouth began his academic career as a Lecturer in 2014 after completing his B.Sc. (Hons) and M.S. in Geological Sciences at Jahangirnagar University, Bangladesh. In 2018, he was awarded the prestigious Australia Awards Scholarship to pursue a Master of Geoscience at the University of Western Australia. His research interests lie at the intersection of coastal geomorphology, remote sensing, spatial statistics, and machine learning applications for sustainable environmental management.

Oral Presentation

Sam R. Davidson¹, Martin Bell², Chris Griggs², Joshu Mountjoy¹, Susi Woelz¹, Kevin Mackay¹

¹Earth Sciences New Zealand, Greta Point, ²Brian Perry Civil Ltd., Wellington

Outcomes from nearshore surveying for coastal infrastructure redevelopment projects, Wellington Harbour

New Zealand's ageing marine infrastructure has been a topic of wide media attention over the last several years, particularly in response to political and climatic forcing factors. In response to these forcing factors, and the lynchpin Wellington Harbour plays in connecting both the North and South islands, significant strategic investments have been made (or are ongoing) to update or replace many aspects of the civil maritime works across the harbour. Two such projects include the Seaview Wharf Energy Resilience Project and Rail Ferry Terminal Modernisation Project, both led by Brian Perry Civil Ltd. The delivery of these projects provides significant economic benefits to Wellington as well as enhanced resilience for critical fuel and transport infrastructure.

Earth Sciences New Zealand were contracted to undertake a series of bathymetric surveys as a part of both these projects which presented a unique set of challenges to overcome as well as providing new insights into harbour seabed dynamics. A total of 32 bathymetric surveys were undertaken across both projects, the majority of which were to monitor pipeline trenching operations alongside Seaview Wharf. Results from these surveys provide insights into short-time scale seabed processes, constrain detection limits in high-precision multibeam echosounders, and underpin operational best-practices when surveying in high-complexity maritime engineering environments.

Bio

Sam is a marine geology technician in the Ocean Geosciences Group at Earth Sciences New Zealand. Sam specialises in multibeam echosounders and geospatial analysis.

Shailey Heller^{1,2}, Susie Wood¹, Kirsty Smith², Kyle Bland³, Steve Urlich¹
Lincoln University¹, Cawthron Institute², Earth Sciences New Zealand³

Reconstructing Microalgal Community Dynamics under Human Pressures in Coastal Ecosystems

Microalgal communities form the base of marine food webs and play an important role in regulating ocean biogeochemical cycles. Under favourable environmental conditions, microalgae can experience rapid population growth, resulting in blooms that increase primary production and the energy available to higher trophic levels. However, some bloom-forming taxa can have harmful effects due to the production of toxins or excessive biomass. Harmful algal blooms (HABs) occur with significant consequences for coastal ecosystems, public health, and marine industries. Understanding the drivers of HABs remains challenging due to the time scale of modern monitoring data sets that cannot account for historical environmental variation and anthropogenic pressures influencing HAB frequency and distribution.

Sediment cores provide multiproxy archives of past environmental conditions and biological communities extending centuries past modern monitoring records. This project analyses three sediment cores collected in the Marlborough Sounds (Whاتمango Bay, Tawa Bay/Onapua, and Deep Bay/Umukuri), representing approximately 500 years of environmental and microalgal community change. Sedimentary ancient DNA metabarcoding was used to characterise historical microalgal communities with a suite of paleoecological techniques, including hyperspectral imaging for sediment and pigment characteristics, radiocarbon (¹⁴C) and lead-210 (²¹⁰Pb) dating to establish sediment chronologies, X-ray fluorescence for elemental profiles, and pollen and charcoal records to reconstruct changes in vegetation, fire, and human land use. These proxies were then statistically analysed to interpret which variables coincide with fluctuations in microalgal community trajectories.

The Marlborough Sounds history of diverse anthropogenic inputs (forestry, aquaculture, and agriculture) and natural ecological shifts (seasonal, abrupt, and gradual environmental forcings) have all influenced the abundance and richness of microalgal communities through time. Establishing a longer-term baseline of coastal microalgal and ecosystem variability through paleoecological techniques provides valuable context for contemporary monitoring contributing to future HAB management and resilience within the Marlborough Sounds.

Bio

Shailey is from San Diego, California, and worked for a marine science education nonprofit before beginning her master's at Scripps Institution of Oceanography in Marine Biodiversity and Conservation. She has also completed research on deep ocean monitoring on the Statsraad Lehmkuhl ship while sailing across the Atlantic Ocean from the Azores to Greenland and comparing different water masses. Additionally, she has worked in ecotourism with sea turtle in Lo de Marcos, Mexico. Her primary interest is in multiple disciplinary research with real-world impacts for coastal communities. Her PhD focuses on historical monitoring of harmful algal blooms (HABs) across New Zealand looking back hundreds of years to better understand how past environmental and anthropogenic variables affected microalgal communities and what this means for future population trajectories.

Reframing the “Why” of shoreline monitoring: Lessons from Waikato Regional Council’s Regional Shoreline Monitoring Programme

Long-running shoreline monitoring programmes are easy to value in principle but harder to sustain when budgets, methods, hazards and policy settings change. Waikato Regional Council’s Regional Shoreline Monitoring Programme began in 1978, initially focused on Coromandel’s east coast beaches, and has since evolved through beach profiles, historical shoreline mapping, coastal cameras, and monitoring at other priority locations including Raglan and Port Waikato. Revisiting the programme’s core purpose is necessary to keep it relevant to climate resilience and coastal management goals.

This presentation steps back from the “how” of monitoring to ask a critical question for councils: what decisions is shoreline monitoring meant to support, where is detail most needed, and how should a legacy programme evolve? Drawing on programme history, statutory context and current applications, we show that shoreline monitoring underpins coastal hazard identification, coastal setbacks, consenting, public reporting, research, and signals and triggers for adaptive pathways planning, including the need to understand both storm-cut impacts and longer-term shoreline trends.

The Waikato case shows that the rationale for monitoring remains strong, but that important gaps remain. Detailed monitoring is spatially biased toward the Coromandel; different coast types may require different metrics and methods; partnerships with hapū and iwi should be strengthened; and communication, accessibility and newer technologies could improve coverage and usability.

For councils across Aotearoa, the key lesson is that effective shoreline monitoring should be explicitly tied to statutory responsibilities, local values and adaptation decisions. Reframing the “why” also provides the foundation for choosing the right metrics, methods and investment priorities for coastal adaptation.

Bio

Dr Shari Gallop (Te Rarawa, Ngāti Maru ki Hauraki) is a Senior Associate – Climate Resilience at Beca, based in Tauranga, New Zealand. A coastal scientist by training, she specialises in coastal hazards, geomorphology, climate change risk assessment, and adaptation. Shari works alongside hapū, iwi, councils, and communities to develop practical and culturally grounded responses to climate change. She serves on the New Zealand Coastal Society Committee and is a Board Member of the Aotearoa Society of Adaptation Professionals | Rōpū Urutaunga Aotearoa (ASAP | RUA). Dr Stephen Hunt is Senior Coastal and Marine Scientist at Waikato Regional Council, Hamilton. His work focuses on physical oceanography and marine environmental monitoring, supporting evidence-based decision-making across local government and communities.

Improving Forecasting of Extreme Inundation Events at the Coast

With the increasing number and intensity of extreme events impacting the coastline worldwide, there is a need for reliable forecasting systems to warn local residents so they can suitably prepare for an event. Historically, the common predictor of an impactful event is the height of waves. Some forecasts also use tidal range on the day of the event. A spring tide, or often the colloquial term, a 'king tide', is often associated with impactful events. As a result, 'false alarms' occur that result in the displacement of people, road closures and a range of restrictions that impact daily lives and local economies. A recent example occurred in early June 2026, when hundreds of seafront residents on Wellington's south coast were evacuated because of a forecasted inundation event. However, as with similar forecasts for Wellington's south coast in the past, using only the forecasted wave height as a predictor of impact in an early warning system proved to be insufficient. This is because extreme inundation is often due to multiple factors occurring coincidentally to create the 'perfect storm' at a particular location on the coast.

The metocean factors that need to occur together include the peak of the forecast swell at the coast (often the peak wave height occurs only for a few hours), the peak of a high spring tide, the peak in wave period (or a persistent high wave period during the peak of the event; wave period is a very influential factor that drives increased water level at the coast due to wave set-up), low barometric pressure and high onshore wind speeds, as well as the optimum wave direction for the site. The metocean conditions are modified by the morphology of the site, the aspect of the coast (i.e., the wave directions that it is open to, which is especially important for narrow embayments and sites with significant offshore seabed features), the nearshore bathymetry (effecting shoaling and depth-limited wave breaking) and the geomorphology of the coast (i.e., sand, gravel, rock, the height of the beach crest, the width of the beach area, coastal vegetation, etc.). Examples of extreme, impactful, inundation events in Aotearoa New Zealand and the Pacific Islands, with different metocean drivers, are described. Analysis of these events has fed the development of a site-specific warning system for a site in the Cook Islands.

Bio

Dr Mead is currently an environmental scientist and Managing Director at eCoast, which is a consulting and research organization, based in Raglan and focussed on applying up-to-date knowledge on physical and biological processes in a holistic approach to coastal, estuarine and freshwater management. Dr Mead has 30 years' experience in research and consulting, has published over 60 peer-reviewed publications, 2 chapters in Marine and Coastal Resource Management: Principles and Practise, and has solely or jointly produced over 850 technical reports. Dr Mead's career is focussed on the application of environmental science for sustainable development and the management of environmentally beneficial projects, and, like his associates with eCoast, he actively seeks ways to provide clients and the community with well-balanced solutions to coastal management and development projects. He divides the majority of his professional time between Raglan NZ and Fiji (where he is a registered EIA consultant with the Department of the Environment).

Towards a Deployable Search and Rescue Web Application for New Zealand

New Zealand's coastal environment — high wave energy, strong tidal and estuarine flows, and numerous large estuaries — demands careful downscaling to correctly resolve the coastal hydrodynamics and waves. Search and rescue (SAR) operations in these waters require rapid, high-confidence predictions of drift trajectories for missing persons or objects, yet the operational tools tailored to New Zealand's complex nearshore environment remain limited. We present the building blocks of a deployable SAR web application for Aotearoa, developed through collaboration with NZ Police and NZ Coastguard to ground the tool in real world operational requirements. The approach combines a high-resolution national-scale hydrodynamic forecast model (SCHISM) covering all major estuaries and harbours, with coupled wave-current configurations (SCHISM-WWM) included where the wave-driven processes are significant. These downscaled current and wind fields drive a dedicated SAR Leeway module within OpenDrift, an open-source Lagrangian model used operationally for national SAR by MET Norway.

The full chain from global-to-local model access through to drift simulation has been packaged into an on-demand backend pipeline, running on cloud infrastructure with scalable compute and web-hosting, and requiring only basic inputs: position, time, and object type. The frontend displays drift probability density fields alongside a search pattern toolbox, developed following US Coast Guard guidelines and in close collaboration with operational end-users. We discuss current capability, operational requirements, and pathways toward full deployment. With this infrastructure foundation now established, the approach is readily extensible to other regions and coastal hazards, including biosecurity, oil spills, harmful algal blooms, Sargassum patches, and iceberg drift.

Bio

Simon has over 15 years of experience as a physical oceanographer, specialising in the modelling and analysis of coastal wave and hydrodynamic processes across open coasts, inlets, ports, and estuarine environments. Proficient in a wide range of numerical modelling tools, he has led numerous complex, multi-disciplinary projects in New Zealand and Australia, including for major commercial ports, providing expert advice on wave agitation, coastal morphological modelling, and coastal risk management. His expertise extends to oceanic dispersion modelling, encompassing oil spill impact assessment, dredging and pollution studies, connectivity analyses, and support for search and rescue operations.

Closure, drainage, and saline incursion in a small intermittently closed river-mouth lagoon in Mid-Canterbury

The Hekeao-Hinds hāpua is an intermittently closed river-mouth lagoon that is impounded behind a mixed sand and gravel barrier along the mid-Canterbury coast. The Hekeao-Hinds river system differs from other existing hāpua research in Aotearoa New Zealand because it is a small, hill-fed river system, where flows are augmented near the coast from farm drains and emergent groundwater. This study characterises the hydrological and marine controls on hāpua morphology including an assessment of the possible fluvial and marine hydrodynamic conditions that initiate entrance closure and/or lagoon drainage, morphological change, and in situ observations of saline intrusion into the freshwater hāpua. A Sentinel-2 MNDWI time series (2017 to 2026, 259 accepted scenes) provided near-continuous tracking of hāpua water extent, which was cross-validated against Planet Labs imagery for defining discrete open, closed, and indeterminate state classification (85 scenes, November 2024 to June 2025). An in situ electrical conductivity, water level, and temperature logger was deployed over a six-month period to identify discrete saline incursion events.

Marine water level was constructed from combining tide forecasts, hindcast offshore wave conditions to infer setup, and inverse barometric effect. Flow conditions were quantified from near-continuous discharge at Poplar Rd, maintained by ECan. Three periods of LiDAR-derived digital elevation models (2010, 2016, 2020) were also differenced to quantify hāpua volumetric change and imagery showed a switch from northern to southern breaches between 2016 and 2018. The DEM of Difference results showed net accretion between 2010 and 2016 and net erosion between 2016 and 2020. The hāpua was classified as open and connected to the ocean for 70% of the manually monitored period. Across the 259 Sentinel-2 scenes spanning 2017 to 2026, 163 (63%) showed detectable hāpua, and only two scenes over the full decade (14 December 2020 and 3 April 2021) fell below the detection threshold, consistent with near-total drainage/hāpua desiccation. Mean detected hāpua surface water area was 4,200 m², with strong interannual variability in both extent and detection frequency. Maximum hāpua extent was 36,900 m² in 2024, indicating that the hāpua expands well beyond its typical footprint in response to high fluvial inflows. Four EC-spike events were identified, recurring at intervals of 50 to 60 days, each lagging peak marine forcing by two to three days. Higher marine water level and lower recent discharge strongly increase the probability of saline incursion. The lag suggests incursion may occur through the barrier subsurface rather than by direct overwash. Modest freshes, as low as approximately three times median flow (~ 2.4 cumecs), were sufficient to suppress an otherwise-expected marine incursion without a significant flood. This work demonstrates that river discharge, and not marine conditions alone, likely controls saline incursion and that even under modest runoff conditions hāpua geomorphology is highly dynamic.

Bio

Sophie Horton is a Senior Lecturer in the School of Earth and Environment at the University of Canterbury focussing on erosion, sediment connectivity, and hydrodynamics at the coast.

Sophie Horton¹, Wayne Stephenson², Mark Dickson³

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Where does back-beach sediment come from? Sediment conveyance on a shore platform at Māhia Peninsula, New Zealand

Shore platforms are usually treated as erosional surfaces, but where a platform is backed by a beach and terrace it also acts to convey sediment between the nearshore and the terrestrial land margin. The provenance, calibre, and direction of that transport are rarely measured directly, so the role of the platform is in supplying, storing, or stripping the back beach is poorly constrained. Here, we quantify cross-shore (shore-normal) sediment transport on a wide platform at Kahutara Point, Māhia Peninsula, New Zealand, using paired directional time-integrated mass samplers (TIMS). Sediment traps were installed at four cross-shore positions from the landward terrace to the seaward edge. Two deployments, each integrating six tidal cycles, were made under contrasting wave climates: 12 to 15 December 2020, and 29 July to 1 August 2023. Each sampler pair was co-located with an RBR Duet3 pressure transducer logging at 2 Hz, and continuous turbidity was recorded on the platform surface in both deployments. Trapped fine-grained material was analysed by laser diffraction particle size analysis and portable XRF. The two deployments occurred mostly during quiescent conditions, albeit with different wave conditions. December 2020 was an intensifying southerly swell, with offshore significant wave height rising from 1.5 to 3.6 m and peak period from 6.3 to 13.2 s; whereas July 2023 was a decaying east to south-easterly sea, with offshore height falling from 2.0 to 1.0 m. Wave height ranged from 0.09 to 0.29 m and the infragravity portion of total energy increased landward, indicating that the inner platform and terrace were dominated by infragravity energy. Total trapped mass was approximately 2.8 times greater in December than in July, but the net transport direction differed between deployments.

In December, net flux was seaward at the terrace and inner platform (up to 14.5 g per tide) and landward at the two outer stations (1.1 to 3.2 g per tide). In July, net flux was seaward at every station and was greatest by the platform edge (18.5 g per tide). Particle size distributions were consistently bimodal, with a silt mode at 6.6 to 14 µm and a sand mode at 65 to 260 µm. Inner-platform samples carried both modes in all conditions, whereas the seaward edge in July was effectively unimodal fine sand (mean 144 to 202 µm; 72 to 80 per cent sand). Turbidity showed anticlockwise hysteresis in all four December tides, with peak suspended load on the ebb, and a strongly muted response in July under falling water levels. These data suggest that sediment conveyance across a shore platform is both spatially and temporally complex. Autochthonous silt is a small constituent of the sediment budget, entrained from the platform surface and exported seaward on the ebb flow. Conversely, offshore-derived net sand movement was onshore under long-period rising swell but offshore under decaying short-period waves. The back beach is therefore supplied episodically by offshore sand when wave conditions are congruent with net onshore movement, although cross-shore temporary storage in runnels and in sea grass adds complexity to overall sediment conveyance.

Stuart Caie¹

¹ Toitū Te Whenua Land Information New Zealand (LINZ)

Mapping Tomorrow's Coast Today

To understand Aotearoa's current and changing exposure to coastal hazards, it is essential to accurately map the near shore seabed and adjacent coast. The existing understanding of coastal hazards is impaired by limited, and low-accuracy coastal mapping data, which makes it hard to know what the sea-level rise, wave action and coastal inundation impacts will be, and where they may occur.

In 2023 Toitū Te Whenua Land Information New Zealand (LINZ) commenced the 3D Coastal Mapping (3DCM) programme which will significantly improve the baseline data upon which resilience to coastal hazards and climate change impacts can be assessed and mitigated. This will enable risk modellers to more accurately predict sea-level rise, and this will contribute to increased infrastructure resilience to natural hazards and hazards exacerbated by climate change.

The Programme consists of two streams of work; installing new or upgrading existing Global Navigation Satellite System (GNSS) equipment at existing tide gauge locations; and mapping up to 40% of the coastline, 200 metres inland extending seaward to a water depth of 25 metres with LiDAR. This equates to approximately 10,000 km².

In late-January 2025 two suppliers started the mapping component and after two seasons of data collection, have completed 46% of the scope. Of the areas completed, data has been published for 25% of the scope. In January 2026, working in collaboration with the Ministry for the Environment, further areas were added to the scope to improve understanding of coastal erosion and flooding.

With the establishment of an Advisory Group in April 2026, the Programme is now looking to partners and stakeholders from across different sectors to consider 'use cases' for the data. Demonstrating how the data supports communities, Māori, businesses, industry, and local/central government make better, risk-informed decisions to prepare for and adapt to climate change, is critical to the success of the Programme. This presentation will provide an update on the Programme, the benefits it is expected to bring and show features of interest revealed in this challenging environment.

Bio

Stuart Caie is a Principal Geospatial Specialist working at Toitū Te Whenua Land Information New Zealand (LINZ) as the Programme Lead for the 3D Coastal Mapping Programme, a National Adaptation Plan (NAP) initiative delivered in partnership with the Ministry for the Environment. The Programme addresses a critical gap in New Zealand's existing coastal data, which has historically been fragmented, incomplete, and of insufficient accuracy to support effective hazard modelling and adaptation planning. By delivering a comprehensive, high-accuracy baseline dataset, the Programme will enable more informed decision-making across government, industry, Māori, and communities. It represents a significant advancement in New Zealand's approach to coastal data collection and management. Stuart joined LINZ in 2006 as a Hydrographic Surveyor, leading the national Hydrographic Survey programme, mapping the seafloor to update the nautical charts for New Zealand. He has led other large programmes of work, including in the Pacific to improve navigation safety.

Oral Presentation

Counter-wind growth of a macrotidal sand spit on the southwestern coast of Korea

A spit is a depositional coastal landform produced by an excess supply of sediments. As such, a sediment surplus is inevitably accompanied by a deficit in the source area when the coastal system is dynamically balanced. The translocation of sediment is driven by longshore currents or drift. A spit is thus a marker for tracking sediment-starved locations, sediment transport pathways, and the direction of longshore drift.

Numerous spits exist along the highly indented shoreline of the western coast of the Korean Peninsula, where is subject to macrotidal regime. Wave climates exhibit strong seasonality influenced by monsoonal wind patterns, with north-westerly winds prevailing in winter and southerly winds in summer. In winter, sediment is resuspended by high waves and transported southward. Interestingly, while most spits grow southward as anticipated, a few develop northward, opposite to the prevailing winds. In this context, we investigated the Ujeon spit to elucidate how it grows northward against the wind. To achieve this, beach profiling surveys were conducted regularly, and surface sediments were collected from the subtidal to the beach zone. Additionally, two Acoustic Doppler Velocimeters (ADV) were deployed simultaneously in the southern and northern intertidal zones, respectively. Furthermore, water sampling campaigns were carried out to quantify suspended sediment fluxes over the tidal cycle.

Ujeon Beach is a macrotidal beach approximately 3 km long and 100–240 m wide, widening toward the north. Multi-temporal aerial photographs indicate that the spit began to develop in the early 1970s and has extended approximately 750 m to date. Grain-size analysis reveals that fine muddy sediments occupy the subtidal zone, indicating no offshore supply to the spit. Beach sands become finer from south to north, suggesting the southern sands serve as the primary source of the spits. Beach profile surveys exhibit shore-parallel intertidal bars that develop toward the north particularly during summer, and decay in winter. Sediment transport toward the north appears linked to the growth and decay of these bars. ADV observations indicate northward-directed wave propagation and alongshore flows occurring during strong wind events, irrespective of the season. Suspended sediment concentrations at the northern station exceeded those at the southern station by more than threefold during stormy weather. It is therefore evident that sediments eroded from the southern beach are transported northward by storm-driven circulation, leading to the anomalous spit growth. This study signifies that an alternative nearshore circulation cell forms during storm events, thereby operating separately from the offshore, southward coastal current-driven flow. These findings provide new insight into nearshore sediment transport dynamics on tidal coasts, with implications for sediment compartment and coastal management.

Bio

Tae Soo Chang is a professor at Chonnam National University, South Korea, specializing in coastal and marine sedimentology in a tidal environment. He earned his PhD in 2005 from the Senckenberg Institute/Universitaet Bremen, Germany, where he studied dynamics of muddy sediments in a back-barrier tidal basin of the German Wadden Sea. He held research positions at the Korea Institute of Geosciences and Mineral Resources (2006-2016) and taught at Korea Maritime and Ocean University (2016-2020) before joining Chonnam National University in September 2020. He currently serves as an editorial board member for Geo-Marine Letters and Ocean Science Journal.

Thomas E. Fellowes¹, Francois Flocard¹, Jennifer Hart², Amy Sheppard³, Cristian Flores Perez², Matt Sheppard², Grant Bicknell⁴, Andy Pullar⁴

¹UNSW Water Research Laboratory, ²Beca Ltd, ³Beca Limited (design phase), ⁴Port Otago Ltd

Physical modelling of the Aramoana Mole breakwater upgrades at Port Otago

The Aramoana Mole is a 1.2 km rock breakwater at the entrance to Otago Harbour that helps maintain the alignment of the navigation channel and vessel access. Constructed in the 1880s, the mole is exposed to energetic waves from the Pacific Ocean. The breakwater has required ongoing maintenance, particularly at the seaward breakwater roundhead, and a long-term upgrade solution is being considered by Port Otago Ltd.

UNSW Water Research Laboratory (WRL) undertook a large three-dimensional (3D) physical modelling program for Port Otago Ltd to investigate the performance of a proposed breakwater roundhead upgrade. Concept designs provided by Beca Ltd comprised Hanbar concrete armour units to be retrofitted to the existing breakwater roundhead. Testing was undertaken in WRL's 3D wave basin at a model scale of 1:35. The model reproduced the upgraded breakwater and surrounding bathymetry, allowing assessment of wave transformation from offshore to the roundhead toe, and of Hanbar armour stability under wave breaking. The model was subjected to a suite of storm conditions, ranging from 10% AEP to 1% AEP and including sea-level-rise scenarios, using numerical wave and water-level conditions provided by Oceanum.

The concept design adopted a double layer of 13 t Hanbar concrete armour units; however, physical model testing showed that these units could be mobilised and extracted from the toe and slope of the roundhead. Design optimisations were subsequently tested, including a roundhead consisting of larger 19 t Hanbar units and a pattern-placed toe unit configuration and with toe piles. These refinements provided improved armour stability under wave breaking and plunging wave attack. These findings highlight the value of 3D physical modelling for breakwater upgrades, particularly where complex bathymetry, wave breaking and localised armour instability are not fully captured by desktop numerical modelling and preliminary design methods alone.

Bio

Tommy Fellowes is a Coastal Engineer at the UNSW Water Research Laboratory, with expertise in 2D and 3D coastal physical modelling, coastal protection and hazard assessment, and the evaluation of coastal infrastructure performance. He has contributed to a wide range of projects across Australia, New Zealand, and the Pacific region.

Post-2023 Storm Remedial Cliff Stabilisation Works: Early performance, planting outcomes and lessons for future consenting decisions

Post-storm cliff instability and the effectiveness of subsequent remedial stabilisation measures have become increasingly important following the widespread slope failures triggered by the Auckland Anniversary Floods and an Ex-Tropical Cyclone Gabrielle in 2023. In response, emergency and remedial works continue to be implemented at numerous sites, typically combining engineering interventions, including soil-nailing, matting and mesh reinforcement systems, together with drainage improvements, to reduce risks to people, property and infrastructure. These engineering measures are often proposed alongside planting programs intended primarily to mitigate the visual and natural-character effects of the stabilisation works.

Here, we document the early performance of consented post-2023 cliff remediation works across Auckland using field inspection data to assess the stabilisation measures, slope response, consistency between constructed works and approved plans, planting establishment and visual integration and maintenance requirements. Prior to remediation, evidence of instability was recorded at all inspected sites (100%). The engineered stabilisation outcomes were generally positive, with 84.6% of sites assessed as having achieved their intended stabilisation outcome. Soil-nails, matting and associated structures were predominantly in good condition, while mesh systems remained largely intact, although isolated defects included loose or deformed mesh and exposed reinforcement. Implementation of consented works was generally consistent with approved plans (76.9% compliance).

Planting outcomes were more variable than those of the engineering measures. Although some sites showed <25% vegetation cover (comprising both native species and weeds) and partial screening of stabilisation structures, soil nails and mesh remained visually prominent at ~80% of inspected sites. This indicates that, at the time of inspection, planting had provided limited visual integration at many sites. We interpret these findings as demonstrating distinct functional roles for engineering and planting measures: soil nails and mesh provide the principal observable mechanism of early slope stabilisation, while planting provides visual and natural-character mitigation that may require longer establishment periods to achieve its intended outcome.

Lessons learned from these inspections emphasise the importance of maintenance conditions, post-construction compliance verification and clear consent conditions to support more effective coastal hazard assessments and future cliff remediation projects across Auckland.

Bio

Dr. Jokotola (Tola) Omidiji is a coastal and environmental scientist with a Ph.D. in Physical Geography from the University of Otago, New Zealand. She is a Senior Coastal Specialist at Auckland Council, where she provides expert technical advice on resource consent applications and compliance matters within coastal erosion hazard areas and the coastal marine area. Her role involves assessing the environmental effects of a wide range of coastal activities, including residential developments, large scale infrastructures, dredging operations, coastal protection works along private and public properties in coastal erosion and instability areas, and marina developments. Her work supports risk-informed decision-making and the development of resilient coastal communities' face of a changing climate and environmental conditions.

Tommaso Alestra¹, Gabe Ross¹, Crystal Lenky², Kirsty Brennan²

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Trial of artificial rock pools at Lyttelton Port: from concept to implementation and evaluation

Marine ecological engineering is increasingly used to enhance biodiversity within marine built environments, but the ecological benefits of these interventions are context-dependent and relatively few applications have been documented in detail in Aotearoa New Zealand. Here we present a small-scale trial of artificial rock pools at Lyttelton Port, in Whakaraupō / Lyttelton Harbour, documenting the full process of design, site selection and performance monitoring to illustrate the pathway from concept to implementation and evaluation.

The pools were based on a simple design that could be fabricated in-house by Lyttelton Port using excess materials. Low-tech solutions and a bit of Kiwi ingenuity were used to obtain structural complexity without specialised casting facilities. A mould made largely from spare carpentry materials created an array of horizontal and vertical surfaces within the pool basin. Bubble wrap and a range of biodegradable elements such as pieces of algal and plant material were used to generate further microhabitat complexity for marine life by texturing the concrete.

Site selection for the installation of the pools was based on an inspection of revetment structures throughout the port and was guided by three criteria: sufficient space for relatively large pools (capable of retaining a substantial amount of water at low tide); sufficient exposure to waves and currents expected to enhance propagule supply and limit sediment accumulation; the presence of diverse subtidal communities providing a potential source of colonists for the pools in the intertidal zone.

Performance monitoring showed that the pools facilitated the colonisation of intertidal revetment habitat by species typically restricted to the adjacent subtidal environment. Two years post installation, the pools supported a higher number of taxa and a distinct community compared to the surrounding revetment habitat. Many taxa showed a strong affinity for the pool habitat, while they were absent or rarely found in the surrounding revetment habitat. These included a diverse mix of macroalgae, oysters, ascidians, bryozoans, as well as decapods, snails, and small fish. Taxa commonly found in the pools included a range of introduced and cryptogenic species commonly found in ports and harbours around the world. Sediment tended to accumulate in the deepest part of the pool basin, but most of the substrate remained sediment-free and available for colonisation.

These monitoring results represent one of the first detailed assessments of the performance of this kind of eco-engineering device in Aotearoa New Zealand, while the broader case study provides practical insights for the development and implementation of similar interventions elsewhere.

Bio

Tommaso is a marine ecologist with a research and consultancy background including ecological impact assessments, surveys and experimental studies across a range of marine habitats in Aotearoa New Zealand and the Mediterranean. One of his areas of interest is marine eco-engineering, including the development and testing of approaches to enhance biodiversity within marine built environments.

Zhonghou Xu¹

¹Earth Sciences New Zealand, Hamilton

DiffSWE2d: a differentiable Shallow Water Equations solver

We present a differentiable Shallow Water Equations solver that is PyTorch-based, for flood and tsunami modelling and parameter inversion problems. The solver uses a structured square model grid and Basilisk B-Flood/BG-Flood style finite-volume method. It is compatible with PyTorch automatic differentiation and can run on either CPUs or CUDA-capable GPUs. The solver has been benchmarked against experimental studies in pluvial flooding and tsunami propagation. Apart from forward modelling similar to numerical solvers including Basilisk B-Flood and BG-Flood, DiffSWE2d can optimise parameters including DEM, roughness, initial water levels via back-propagation to achieve the least error between modelled and measured results. The solver can be extended to integrate neural networks thanks to the PyTorch machine learning ecosystem. DiffSWE2d is piecewise differentiable as it contains numerical operations that are not differentiable to preserve simulation accuracy. Future work will be exploring optional smooth functions to replace branch selection in numerical operations.

Bio

Zhonghou is a Coastal Modeller and Scientist at Earth Sciences New Zealand, specialising in flood modelling, tsunami inundation, and coastal hazards. His work combines physics-based modelling and data-driven approaches to improve the understanding and prediction of coastal and flood hazards. Throughout his career, he has worked closely with councils, government agencies, and communities to support evidence-based decision-making for natural hazard risk management. Zhonghou enjoys collaborating across disciplines to develop innovative solutions for complex environmental challenges. He is passionate about advancing flood and coastal hazard science to help build more resilient communities across New Zealand.

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Acoustic monitoring of Tikapa Moana Hauraki Gulf marine protected areas

The designation of 19 new marine protected areas (MPAs) and the expansion of two existing MPAs in Tikapa Moana (the Hauraki Gulf) in 2025 represents a substantial increase in spatial protection and a unique opportunity to evaluate ecosystem responses to conservation measures. Assessing MPA performance requires reliable monitoring. In the Gulf, conventional survey methods are limited due to depth constraints, cost and variable weather conditions. Passive acoustic monitoring (PAM) offers a promising alternative, capturing the underwater soundscape continuously and with minimal disturbance. As sound plays a central role in the behaviour and ecology of many marine species, and anthropogenic sound is a pervasive but rarely monitored pressure, acoustic monitoring may offer valuable insight into both ecosystem condition and human disturbance.

This project uses PAM to assess how marine soundscapes reflect habitat quality, biological activity, and anthropogenic pressures in temperate coastal ecosystems. Autonomous hydrophones are deployed across a network of recently protected sites, including the Mokohīnau, Hauturu, Tiritiri Matangi, and Ōtata Islands. Acoustic data will be coupled with ecological surveys, both underwater and aerial to investigate the relationship between the soundscape, habitat quality, and biological activity. Machine-learning models will then be developed to detect and classify species-specific and anthropogenic sounds in the acoustic data.

As the recipient of the New Zealand Coastal Society Student Research Scholarship 2026, here I present an overview of my research framework, methodological approach, and early progress of this PhD project. This research will (1) evaluate whether implementation of marine protection is associated with measurable shifts in biological sound and anthropogenic sound, positioning passive acoustics as a practical tool for MPA evaluation; (2) develop tools and resources for consistent, cost effective and scalable monitoring across habitats and time. Together, these outcomes will inform adaptive management and policy in Aotearoa New Zealand and contribute to global frameworks for temperate ecosystem assessment.

Bio

Zoe Starkey is a first-year PhD candidate at the Institute of Marine Science, Waipapa Taumata Rau University of Auckland, and the recipient of the 2026 New Zealand Coastal Society PhD Student Research Scholarship. Her research uses passive acoustic monitoring to examine how marine protection shapes the underwater soundscape of Tikapa Moana / Te Moananui-ā-Toi (Hauraki Gulf) and evaluates the potential of using soundscape monitoring as a conservation tool.



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