MATAORA KEI RUNGA I TE TAPĀTAI
LIFE ON THE EDGE

12-15 November 2019 | Invercargill, New Zealand

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Front Cover: Te Rere scientific reserve on the Catlins coast. Photo by Christine Liang.

Te Hunga Takutai o Aotearoa
NEW ZEALAND
COASTAL SOCIETY

Conference Chair Welcome

Nau mai haere mai ki o Murihiku - Welcome to Murihiku/Southland!

The theme of this year's annual New Zealand Coastal Society (NZCS) conference is Life on the Edge - Mataora kei runga i te Tapātai. For us in Murihiku this means living with the challenges, changeability, beauty, and diversity that comes from living on the edge of the great Southern Ocean and the challenges and opportunities that this creates. From the striking fiords representing the raised sides of Te Waka o Aoraki in Fiordland, to the pounding surf coast of Te Waewae Bay where Tākitimu's voyage came to an end; life clings on, however precariously, adapting and thriving. This diversity and tenacity resonates throughout the coastline with a sense of adventure and kaitiakitanga/guardianship in those who reside here. The concept of life on the edge ties past, present and future as we reflect on the roots that have held us strong, but also as we look to the future and how we must adapt to protect, and flourish within, the coastal environment.

The 2019 conference in Invercargill aims to celebrate the bountiful islands and diverse stretch of coast that is Southland, the challenges faced in these environments, and the people and species that call this unique part of the world, home.

Not only does this theme resonate with the Southland Coast, but it also reflects the challenges and opportunities of life on the coast throughout New Zealand.

We have an incredible team of NZCS members and volunteers, who have worked hard over the last few months to put together a programme chock-full of fascinating talks and events. The next three days present an amazing opportunity to meet new people, catch up with friends, learn from each other, and come away with an appreciation of Murihiku's incredible, uncompromising coastal environment. Our only hope now is that the weather holds…

Please come and see either of the Conference Chairs (Matt or Bryony), or any of the Local Organising Committee if you require assistance in any way. We sincerely hope you enjoy your time in Waihōpai/Invercargill, Murihiku/Southland, and visit again soon.

Ngā mihi nui,

Matt Hoffman and Bryony Miller

NZCS 2019 Conference Committee Co-Chairs

Sponsors

The New Zealand Coastal Society (NZCS) would like to thank the following conference sponsors, without whom this conference and the ongoing success of the society would not be possible:

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New Zealand Coastal Society

Who is the NZCS?

NZCS members represent a wide range of coastal science, engineering, management and planning disciplines. They are employed in the engineering and environmental consulting sectors, in local, regional, and central government, in research institutes, in the tertiary education sector and in schools.

NZCS is a technical group of the Institution of Professional Engineers New Zealand (IPENZ). The multi-disciplinary nature of coastal management in New Zealand means many of our members are from areas other than engineering. There are no entry criteria for the society and we welcome membership enquiries from anyone with an interest in the coast.

Our Mission

To take a leading role in facilitating robust discussion and nationally coordinated interactions to better manage and learn about our coastal and marine environment.

Our Vision

Sustainable management of New Zealand's coastal and marine environment underpinned by sound science, engineering and policy practice, comprehensive monitoring, involved communities and effective national networks.

Our Values

The NZCS will promote this vision by being: visionary and innovative; communicative and effective; non-political and impartial; leading edge and strategic.

What We Do

- Hold an annual conference
- Host regional seminars and networking events
- Publish the Coastal News magazine
- Provide a regular email digest to members with upcoming events, news and job opportunities
- Facilitate networking between individuals and professional groups
- Support coastal research and study with student scholarships, awards and prizes
- Coordinate with universities and other research organisations
- Assist with the production of coastal publications (e.g. books, best practice guides, educational material)
- Support the development of best practice and informed comment on coastal management issues
- Host the biennial Australasian Coasts and Ports conference
- Raise public awareness of coastal issues through activity, press releases and publications.

NZCS Management Committee

The Management Committee is responsible for the policy and administration of the New Zealand Coastal Society. The committee members are elected each year at the AGM which is held at the society's annual conference.

Chair	Paul Klinac
Deputy Chair	Mark Ivamy
Treasurer	Eric Verstappen & Michael Allis
National Regional Coordinators	Natasha Carpenter
Website/Social Media Coordinator	José Borrero
Coastal News and Special Publications Coordinator	Don Neale
Central Government Representative	Amy Robinson
Awards and Scholarship Coordinators	Craig Davis
University/Education Coordinators	Murray Ford
Young Professional Coordinator	Hugh Leersnyder
Professional Development Coordinator	Sam Morgan
NZCS Administrator & Communications Coordinator	Alison Clarke & Rebekah Haughey
Coastal News Editor	Charles Hendtlass

Invercargill/Murihiku 2019 - Conference Organising Committee

Bryony Miller (co-chair)	e3 Scientific
Matt Hoffman (co-chair)	Porirua City Council
Luke McSoriley	WSP Opus
Sorrel O'Connell-Milne	Environment Southland
Rebecca Amundsen	Invercargill City Council
Tapuwa Marapara	Southern Institute of Technology
Christine Liang	Southern Institute of Technology
Alison Clarke	Pattle Delamore Partners Ltd

NZCS Annual General Meeting

The New Zealand Coastal Society Annual General Meeting (AGM) for 2019 will be held at Transport World during the annual conference on Wednesday during the lunchtime break. Everyone is welcome to attend this meeting.

Transport World (Engine Room/Driver's Den)
Wednesday 13 November 2019
12.30 – 1.30 pm

If you are interested in becoming an NZCS member, please see either a Management Committee Member or Conference Committee Member for more information. If you are interested in being nominated to be an NZCS Management Committee member in 2019, please see a current committee member before the AGM.

Conference Information

Oral presenters

Please note that the use of personal laptops for presentations will not be permissible. Presentations must be provided to a representative of the NZCS by the morning of the presentation day. Presentations can be brought to the conference registration desk at the Transport World, Invercargill each morning until 8.30 am (note: conference laptops are Windows-based not Mac). Please bring your file on a memory stick with the presenter's name as the file name for ease of loading. Please also bring a copy of your presentation as a pdf that you will allow the NZCS to place on its website (with no copyright issues), or email it beforehand to nzcsconference@gmail.com. Please ensure your memory stick is virus free.

The allocated time for your talk is 15 minutes plus 5 minutes for discussion and questions. Keynote speakers and workshop presenters will be individually advised of their time allocations. Due to the tight timeframe, we emphasise the importance of starting and finishing on time. Session chairs have been instructed to ensure that you do not go over your allocated time. There will be a 3-minute and a 1-minute flash card to indicate that you need to wrap it up. Speakers are required to sit in the front of the room (for fast changeover of speakers).

Each room is equipped with a computer with data projector, pointer and various microphones. Please familiarise yourself with audio/visual equipment at your speaking venue during a break. There will be a helper on hand if you require assistance during your talk. All presentations must be PowerPoint files (2003– 2010). Please note that the software currently on the presenter PCs is Windows 2010, but according to the Microsoft web page, there are no compatibility issues running a PowerPoint 2013 presentation in 2010. Projectors are not widescreen, so for optimal

display the presentation should be 4 x 3 aspect ratio. Any video or audio files are a separate file. If your presentation has been formatted on a MacOS computer, please bring your laptop with you in case you need to make changes (not for use during the conference presentation).

We recommend that all oral presenters bring a backup copy of their presentations in the event of any unforeseen circumstances.

Poster presenters

Posters can be A0 or A1 size. Please bring your posters to the Transport World registration desk during the Wednesday morning pre-conference registration session between 8:00 am and 9:30 am*. There you will be given pins or tac and directed to your poster space. The poster viewing session is scheduled for each of the coffee and tea breaks during the three conference days. All poster presenters are requested to stand near their posters during this session. All delegates will be free to view posters at their leisure on other days. It is the responsibility of poster-owners to remove their posters by 1:30 pm on the Friday. Any posters remaining after the conference may be disposed of and not returned to owners. If you will not be attending the full conference, it is your responsibility to arrange someone else to remove your poster on your behalf.

* There is space available at the conference icebreaker event being held at The Handlebar for presenters to display their posters should they wish to do so, please feel free to bring them along on Tuesday evening. The organising committee will arrange for your posters to be transported to the conference venue (Transport World) ahead of the conference kick-off on Wednesday.

Support

During the conference, you can get help from the conference administrator who will be based at the registration desk at Transport World. If you have any last-minute needs or dietary requirements, please contact a conference organising committee member or staff at the registration desk.

Delegate conference presentations, if supplied, will be available in the form of PDF files for download from the members' area of NZCS website early next year.

Conference Prizes

General presentation prizes will be awarded in the following categories at the end of the talks and poster sessions at Friday lunch:

- best student oral presentation and runner-up
- best overall oral presentation and runner-up
- best overall poster.

Everyone who presents in the sessions corresponding to these categories is eligible for prizes. Presentations will be ranked by a panel of audience member judges according to the criteria:

- Clarity and content
- Results demanded by the evidence
- Ability to distil the essence of a project from the trivial
- Logical sequence, clear and visible visuals
- Audibility, coherence, interest and delivery (for oral presentations).

eCoast Sustainability Award

Carrying on a tradition started in 2017, eCoast Consulting and Research will once again award the NZCS 'eCoast Sustainability Award'. This award recognizes the conference presentation/paper that best embodies the principles of 'coastal sustainability'. The winner will be announced at the conference dinner.

Coffee/Tea Breaks and Lunches

All coffee/tea breaks plus Wednesday and Friday lunches will be held at the Refuel Station/Balcony at Transport World. Lunch on Thursday will be provided as a packed lunch to be taken on the field trips.

Please Note: Special Dietary requirement options are available for requests made in advance.

Moving Between Venue Rooms

Due to the full programme, minimal time has been allocated for moving between rooms after each presentation. Please try to plan presentations you will attend within each session and transition promptly.

Getting Around Town

Free parking is available around the perimeter of the building at Bill Richardson Transport World, or on nearby residential streets. Classic Motorcycle Mecca, where the Icebreaker function will be held, is located within central Invercargill, where there will also be ample free street parking (hour metered parking spaces are free after 6 pm).

Terry Healy Project Award

The Terry Healy Coastal Project Award acknowledges the achievement of a project which has made a significant contribution to New Zealand's coastal and marine environment. The award is intended to commend a coastal project for its overall commitment to excellence working within the coastal zone and promoting the NZCS vision and values.

The award intends to raise community awareness of the importance of the coastal zone and to encourage coastal planners, engineers and management practitioners to strive for excellence. This inaugural award will be presented at the conference dinner. Details of the finalists are outlined below.

Project Reef Life, Taranaki

The vision for this regionally and nationally recognised project is to conduct a long-term study of offshore South Taranaki reefs, and to use science, technology, engineering, art and community involvement to strengthen Taranaki youth and the Community's ocean literacy and build an asset/repository of knowledge for now and into the future.

The survey work has initially focussed on one target reef - 11km offshore and depth 23 metres. Six survey methods are employed: A prototype in-situ camera developed by the Project, taking short video bursts night and day, benthic surveys of the reef, involving a diver transect method, fishing surveys (conducted by Hawera High School and Patea Area School), baited underwater video, acoustic surveys and plankton trawls.
The Project runs through the South Taranaki Underwater Club and Project partners are the Hawera High School, Patea Area School, Te Kaahui o Rauru and the Te Runanga o Ngati Ruanui Trust. The Project engages with scientists in New Zealand and overseas and species observations are uploaded to 'I-naturalist NZ'.

The Project has had coverage in newspapers, magazines, school journal, TVNZ, museums, radio, mural, PSP Curious Mind videos, public talks around NZ and it's social media outlets – a website, Facebook, Instagram and YouTube. In early September it will be the feature of an AUT documentary filming and in 2020 a permanent exhibit at Puke Ariki.

Project Reef Life has taken a leading role in the South Taranaki community in terms of building knowledge of the largely un-mapped local offshore rocky reefs and the bio-diversity to be found on them. A considerable bank of knowledge resides in local diver and fishermen's heads, and the Project has benefitted from these insights – and the continual observational comments fed into the Project. The importance of utilising marine scientific expertise from outside the region has been a point of focus and a large number of important connections have been made. The importance of sharing knowledge with policy makers, such as the Taranaki Regional Council and the

Environmental Protection Authority has been recognised, and important contributions to both parties has been made. The Project remains apolitical.

As far as the Project can determine, they are the first to conduct diver-led benthic surveys of reefs in the South Taranaki. It would appear the Project is somewhat unique in terms of studying a reef so far offshore - 11 km.

High school students have been involved in a number of marine studies – from doing fishing surveys, to analysing baited underwater video (BUV) footage and benthic survey photographs. The students are confident in assembling a BUV, and the hope is for them to deploy it on a future trip. Most recently students were sponsored by the Project to do an 'introduction to scuba-diving' lesson. The Project's marine scientist has regular engagements and we invite 'guest speakers' – such as MPI officer, for an otolith extraction class and to talk about his work and a PADI certified instructor to talk about diving and his personal experiences. Students have presented their scientific work to the Education and Science Select Committee.

The local high school has in 2019 adopted a 'project based learning model' "Te Wera", for a group of Year 9's - with 'Project Reef Life' chosen for study. In the final term the students are developing research questions based around the local marine environment.

The Project has developed a number of pieces of equipment – purpose built to contend with the challenging environmental conditions in which research is done. One of the biggest hurdles are the currents, and diving is timed for slack tide, which gives a narrow window of opportunity for survey work etc.

A purpose built in-situ camera, which remains at the reef, taking video night and day – run by battery, so needs to be retrieved. A purpose built, robust, secchi disk has been made (after a 'normal built one' had the disk stripped off in the current!). A purpose built benthic frame, versions 1 & 2 – with version 2 being "high pressure ¼ inch 316 grade stainless tube" designed to be easy to manoeuvre in the current, negatively buoyant, does not reflect light (like version 1 made of PVC did) and can be disassembled and put into a carry tube. A baited underwater video (BUV) frame, modelled on a DOC one, but with various smart improvements in design.

The Project has embraced art as an effective means of communication and a way to involve the community. Creative Community funding assisted with the painting of a mural of the reef, depicting fish life, sponges, bryozoans, hydroids and algae. . .and of course a couple of divers! Currently the Project is working with Patea Area School students and local engineers, for another art piece – seven poles with corten-steel marine based shapes which will be installed late 2019.

The Project has presented to all ages, from kindergarten, primary schools, high schools, universities, parliamentarians, community groups and via our social media and TED-x talk, the world!

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Networking Events

Conference Ice-breaker

Join us for a cold beverage and tasty canapes at the Classic Motorcycle Mecca, Australasia's premier motorcycle museum.

The Handlebar – Classic Motorcycle Mecca, 25 Tay Street, City Centre, Invercargill
6:00 – 8:30 pm, Tuesday 12 November 2019

Urban Solutions – Young Professionals Breakfast

The NZCS conference breakfast aims to provide students and early-career professionals with an opportunity to network with, and 'pick the brains' of, invited mentors who have 'been there, done that' in the coastal scene. Following the success of past conference student breakfasts, we have expanded to include early career (<5 years) coastal professionals. Most invited mentors are in positions that involve recruiting, so they are able to provide insights into what they are looking for in potential coastal employees and to offer a range of career examples and advice. The breakfast event is also an opportunity to network with people at the same early career stage. A selected range of food and beverages will be provided. Registration for this event is free and open to all students and early professionals registered for the NZCS conference.

The Balcony, Transport World, 491 Tay Street, Hawthorndale, Invercargill
7:30 to 8:45 am, Thursday 14 November 2019

Conference Dinner

The conference dinner will be held at Bill's Shed at Transport World. Come join us for some drinks followed by a delicious dinner and great entertainment.

Bill's Shed, Transport World, 491 Tay Street, Hawthorndale, Invercargill
6:30 pm – late, Thursday 14 November 2019

Field Trips

Conference field trips are on Thursday afternoon from 1:30pm to 5:00pm. The buses for all three field trips will be leaving from and returning to Transport World (Tay Street). Please remember to collect your packed lunch from Transport World before leaving for the field trips.

1. Waituna Lagoon Road Trip

Enjoy a trip to the Waituna Lagoon, one of the best remaining examples of a natural coastal lagoon in New Zealand and discover the environmental challenges this Ramsar site faced from land use changes and the subsequent restoration successes with a multi-disciplinary approach. For the ornithologists, November will be the middle of bird breeding season and this unique coastal lagoon is home to many nationally and internationally important avifauna. A local expert will provide a guided walk and talk at the site.

2. Journey to Aotearoa's End

Travel to Bluff and visit South Port NZ Ltd, New Zealand's southern-most commercial deep-water port, to discuss coastal processes, dredge disposal and port operations during a guided bus tour of Island Harbour. Then experience a cultural welcome at the world's southern-most marae, Te Rau Aroha Marae. Local cultural speakers will kōrero about their whānau tītī island heritage over a cuppa and some kai, before heading to Bluff Hill for some spectacular scenery and chance to view and discuss the restoration successes with the Motupōhue Trust. And of course, no trip to Bluff is complete without a quick photo opportunity at Stirling Point, the southern-most point of mainland New Zealand.

3. Keeping it Local and Getting Amongst it

Explore the local New River Estuary with expert scientist, Nick Ward, then head out to Bushy Point nature reserve where you will have the opportunity to get your gumboots on for a little restoration planting with the local Otatara Landcare Group and Southland Community Nursery. An optional stop for a cuppa at the Cabbage Tree will see you right for the grand finale at the iconic 'World's Fastest Indian' Oreti Beach for a unique chance to try your hand at Toheroa digging and perhaps a swim – for the brave?!

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Field trips – Keeping Safe

Please note that the field trips will involve several hours away from the conference venue and will visit locations outdoors in environments that require you to be responsible about ensuring your own health and safety. Please ensure that you:

- Have appropriate clothing to deal with the very variable weather conditions that can be encountered, from waterproof and warm clothing to hats and sun block.
- Wear footwear appropriate for walking and providing proper grip on wet slippery surfaces.
- Have any medication and/or food/drink you may need on a trip of some hours.
- Keep within safety barriers, adhere to safety advisory signs and instructions, take care when crossing roads and keep a safe distance from hazards like steep drop-offs, fast flowing water or other areas that might present a safety risk.
- Inform the field trip co-ordinator (Bryony Miller) before you leave of any special medical conditions or needs for which you may require assistance.

If you don't have the right clothing, please ask a committee member or the field trip co-ordinator before you leave on the trip, so that assistance can be provided in finding appropriate gear.

Have an enjoyable, safe and healthy field trip!

Oreti Beach. Source: Anthony Ye, SIT Environmental Management student.

Conference Venues

The conference venue is Transport World, which is located at 491 Tay Street Invercargill. The following pages provide a general summary of event locations. Please check the detailed programme provided in this booklet for the timing and location of each individual session. Also see overleaf for venue photographs and maps.

- **Conference icebreaker evening:** The Handlebar - Classic Motorcycle Mecca, 25 Tay Street
- **Oral presentation and workshop streams:** Concurrent streams will be held at Transport World in the following rooms:
  - Engine Room/Driver's Den
  - Progress Zone
  - Innovation Station
- **Poster session:** Displayed in the gallery leading to the conference rooms at Transport World
- **Registration desk:** The Handlebar at the Classic Motorcycle Mecca during the Icebreaker. Refuel Station at Transport World during the conference
- **Mihi and conference opening:** Engine Room/Driver's Den, Transport World
- **Plenary sessions:** Engine Room/Driver's Den and Progress Zone, Transport World
- **Morning/afternoon teas:** Engine Room/Driver's Den, Transport World
- **Thursday/Friday lunches:** Refuel Station/The Balcony, Transport World
- **AGM (Wednesday lunchtime):** Engine Room/Driver's Den, Transport World
- **Conference dinner and pre-dinner drinks:** Bill's Shed, Transport World
- **Young professional's breakfast:** The Balcony, Transport World

Transport World, Invercargill.

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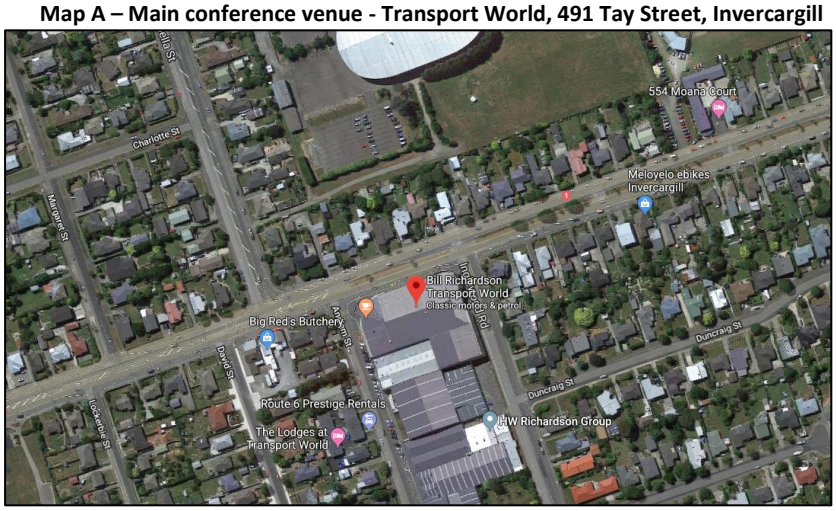
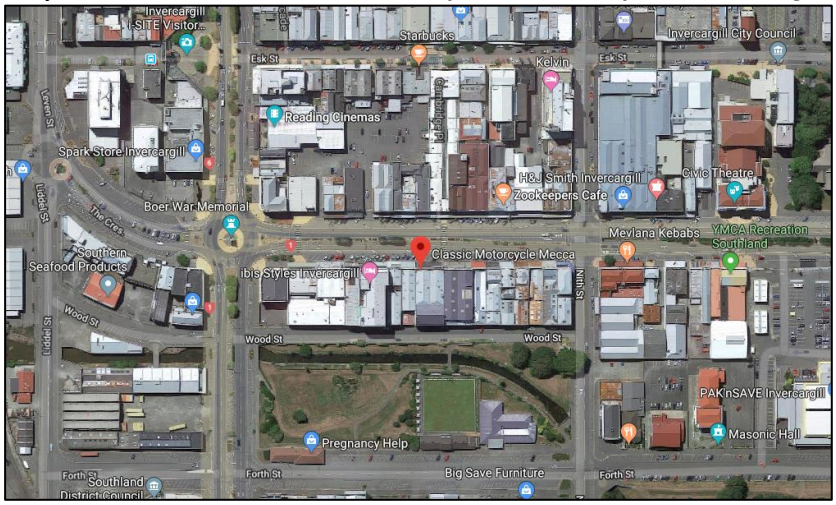
Venue Maps

Map A – Main conference venue - Transport World, 491 Tay Street, Invercargill

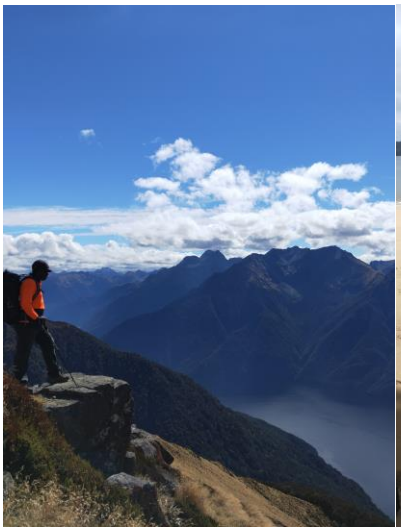


Map B – Ice breaker venue - Classic Motorcycle Mecca, 25 Tay Street, Invercargill

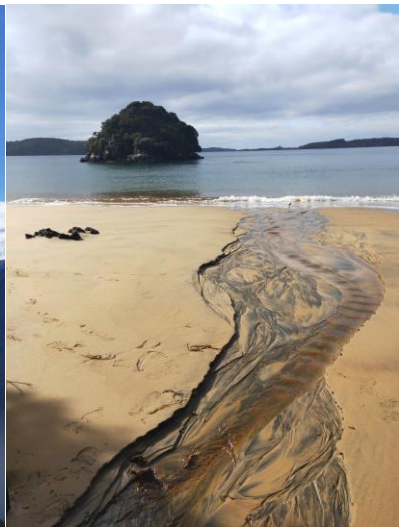


While you're here…be sure to visit:

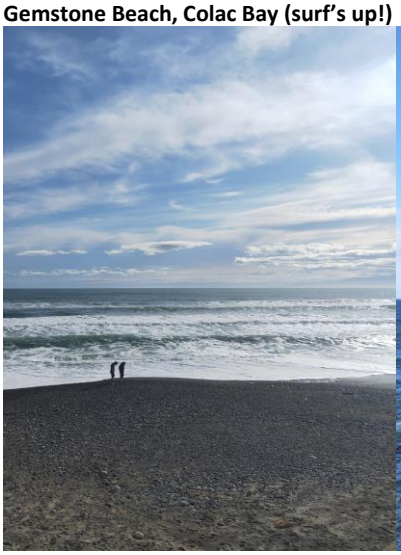
Fiordland National Park



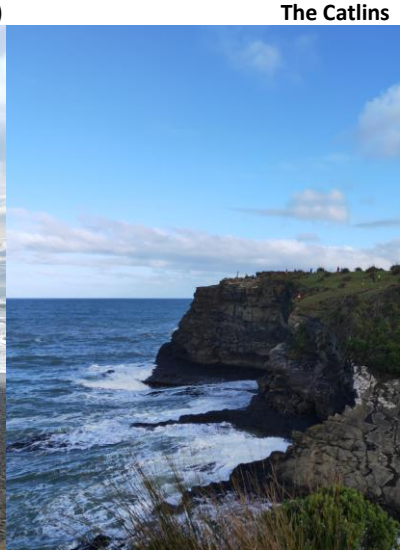
Stewart Island



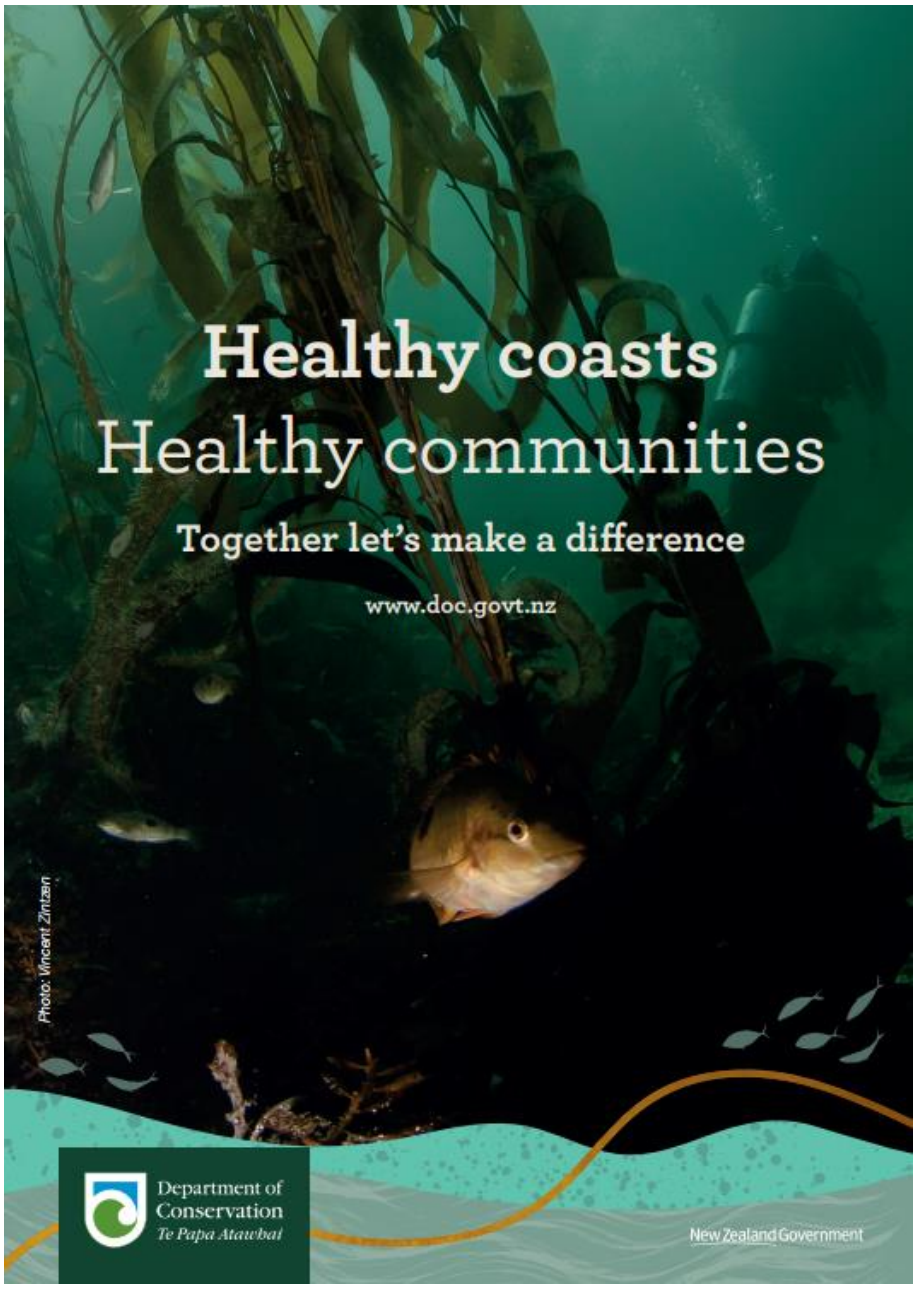
South coast: Riverton Rocks, Gemstone Beach, Colac Bay (surf's up!)



The Catlins



Photos by Christine Liang.


Healthy coasts
Healthy communities
Together let's make a difference
www.doc.govt.nz
Photo: Vincent Zintzen
Department of Conservation
Te Papa Atawbai
New Zealand Government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Conference Themes

Coastal Science

This theme examines the state and evolution of scientific knowledge of the New Zealand coast. Presentations are sought that provide overviews of different aspects of coastal science and research in New Zealand, that explore gaps in our knowledge, and that support the management and planning of coastal resource use. Possible topics could include oceanographic processes, coastal geomorphology and morphodynamics, estuarine processes, coastal ecology, and marine geology and resources.

Coastal Hazards

This theme focuses on the management of, and adaptation to, coastal hazards and the underpinning science, planning and engineering. Coastal storms, erosion, flooding, tsunami and sea level rise as well as man-made hazards (e.g. oil spills) are among the possible subtopics considered for this theme. Other possible areas of interest include coastal monitoring and hazard research techniques.

Sea Level Rise, Climate Change and Resilience

The shorelines are constantly changing - what can we learn from past experience? What about the future and the looming spectre of climate change and associated sea level rise? This issue is of great concern and importance to coastal communities. The conference welcomes contributions discussing current efforts aimed at addressing and adapting to changes that may be brought on as a result of the changing climate.

Coastal Engineering

This theme is focused on evolving trends in coastal engineering and the challenges that are being faced in on-going pressures between “living with the coast” and “defending the coast”. Some of the topics that could be covered in this theme include: new innovations and techniques for managing the coast, engineering challenges in the coastal zone and design studies or case histories of engineering works.

Coastal Planning and Integrated Management

The use of natural resources combined with other land and marine use pressures can interfere with the carrying capacity of coastal zone ecological and social systems. This theme explores subjects such as the competition for coastal space, integrated coastal zone management, shoreline management, sustainability, and

stakeholder engagement. What are the scientific, engineering and planning inputs that we need to help shape decisions for coastal uses?

Coastal Communities, Cultures and Livelihoods

Many New Zealand communities rely on the coast for their economic, social, cultural, and spiritual wellbeing. Tangata whenua are the kaitiaki of the coast, so the abundance and quality of wāhi tapu, wāhi taonga, and mahinga kai directly affects the welfare of iwi, hapū, and whānau. This stream examines the opportunities and threats faced by all communities living, expressing their culture, and making a livelihood on the coast, and how they respond to these challenges in a constantly changing environment.

Conference Presentation Sessions

In line with the NZCS vision, the 2019 conference themes encourage cross-disciplinary contributions from the broad range of practitioners interested in and influencing New Zealand's coastal environment. Our Conference Organising Team aligned all oral presentations into the following sessions:

- Sea level rise
- Coastal hazards
- Coastal Engineering
- Ocean and modelling
- Water quality
- Coastal science
- Coastal planning
- Ecology and ecosystems
- Coastal communities

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NZCS Conference Programme 2019

Tuesday 12 November 2019	
18:00– 20:30	**Ice Breaker Reception**, Handlebar, 25 Tay Street, Invercargill

Wednesday 13 November 2019			
DAY 1	**New Zealand Coastal Society Annual Conference 2019, Invercargill**		
start	**end**		
8:00	9:30	**Registration and Tea/Coffee** (Refuel Station/The Balcony, Transport World)	
9:30	10:00	**Mihi Whakatau** **Welcome and Conference Opening** by NZCS Chair **Paul Klinac**	
10:00	10:50	**KEYNOTE ADDRESS: Dr Rebecca McLeod** *The Story of the Fiordland Marine Guardians* Sponsored by **Ministry for Primary Industries**	
10:50	11:10	**Morning Tea** (Engine Room)	
DAY 1		**SESSION 1**	**TITLE**
start	**end**	**Stream 1**	**Sea Level Rise 1**
11:10	11:30	Jozaei et al.	Resilience and vulnerability: oxymorons in the coastal vulnerability discourse and the way forward to more resilient New Zealand coastal communities
11:30	11:50	Blackett et al.	Serious games to empower climate change adaptation – A demonstration of three games.
11:50	12:10	Bell et al.	New Zealand's Coastal Flooding Exposure Under Future Sea-level Rise
12:10	12:30	Bell et al.	Framework for Aotearoa New Zealand's 1st National Climate Change Risk Assessment
start	**end**	**Stream 2**	**Ecology and Ecosystems 1**
11:10	11:30	Cummings et al.	Anticipating climate change effects on New Zealand coastal fisheries
11:30	11:50	Cryer	National surveys of recreational harvest in New Zealand: what do they catch and what else are they up to?
11:50	12:10	Van Halderen	Rāhui and Rangatiratanga: Investigating rāhui as a customary fisheries management tool

12:10	12:30	Roberts et al.	Applying Spatially-Explicit Risk Assessment to Maui and Hector's dolphins conservation management
start	**end**	**Stream 3**	**Ocean and Modelling**
11:10	11:30	Suanda et al.	The MOANA project ocean hindcast: Data access and model-data comparisons
11:30	11:50	Greer et al.	Understanding the Dynamics of Plastics in the Coastal Environment
11:50	12:10	Neale et al.	"Waste of Our Time" – a lesson in plastic pollution and landfill management from the South Westland clean-up 'Operation Tidy Fox'
12:10	12:30	Collins et al.	Oceanic flow patterns and their influence on dispersing material on the west coast of the Manawatu-Whanganui Region.
12:30	13:30	**Lunch/AGM** (Engine Room)	
13:30	14:25	**Panel Discussions (Estuaries and Climate Change)**	
DAY 1		**SESSION 2**	**TITLE**
start	**end**	Stream 1	**Sea Level Rise 2**
14:30	14:50	Beetham et al.	Accounting for morphodynamics in assessments of coastal vulnerability to sea-level rise: lessons from Tuvalu
14:50	15:10	Mead	Climate Change Resilience in Eastern Tongatapu
15:10	15:30	Todd	Climate Change Resilience: the Temaiku Land and Urban Development Project in Kiribati
start	**end**	**Stream 2**	**Ecology and Ecosystems 2**
14:30	14:50	Walker et al.	Per- and Poly-fluoroalkyl Substances (PFAS) in fish and macroinvertebrates within the Waitemata Harbour
14:50	15:10	Cave	The March 2019 Fanworm Incursion Gisborne Harbour
15:10	15:30	Gibson	Black petrels, from coast to coast to forest
start	**end**	**Stream 3**	**Coastal Science 1**
14:30	14:50	Krier-Mariani et al.	A new wave of observations on the rocky edge and its hydrodynamical repercussions
14:50	15:10	Bryan et al.	Using Colour Information from Sentinel-2 to Evaluate Estuarine Health: Preliminary Trial

15:10	15:30	Flowers et al.	Life in a dimming world: Effect of light availability on intertidal benthic primary production
15:30	16:00		**Afternoon Tea** (Engine Room)
DAY 1		**SESSION 3**	**TITLE**
start	**end**	**Stream 1**	**Water Quality**
16:00	16:20	Gower et al.	Drones for coastal water quality sampling: A novel solution for sampling in challenging situations
16:20	16:40	Davies-Colley et al.	Rapid boat survey of contaminated river plumes in coastal waters using PUFTS (Portable Underway Flow-Through Sampler)
16:40	17:00	Ivamy	Tsunami Response and Recovery – Local lessons from the Great East Japan Earthquake
start	**end**	**Stream 2**	**Ecology and Ecosystems 3**
16:00	16:20	Battershill	Can we move coastal ecosystems away from the edge? Marine spatial planning, marine reserves and resilience enhancement in New Zealand and Australia.
16:20	16:40	Morgan	What will become of our coastal fringe habitats and systems?
16:40	17:00	Kingsley	Retraction of eroded Spartina alterniflora in Yancheng Nature Reserve- a threat to Red-Crowned Crane Habitat
start	**end**	**Stream 3**	**Coastal Science 2**
16:00	16:20	Jones et al.	Bridging the gap: An operational framework for implementing best practice guidelines in environmental modelling
16:20	16:40	Clark et al.	Environmental metabarcoding as a novel tool for coastal management
16:40	17:00	Glover at al.	Habitat mapping of Macrocystis pyrifera (M.pyrifera) along nearshore coastal Southern Otago, New Zealand

Thursday 14 November 2019

DAY 2	**New Zealand Coastal Society Annual Conference 2019, Invercargill**	
start	**end**	
7:30	8:45	**Student Breakfast** (The Balcony, Transport World)
8:00	8:55	**Registration** (Refuel Station, Transport World)

8:55	9:50	**KEYNOTE ADDRESS: Dr Cliff Law** *Coastal Acidification: Rate, Impacts & Management* Sponsored by **NIWA**	
DAY 2		**SESSION 4**	**TITLE**
start	**end**	**Stream 1**	**Coastal Hazards 1**
10:00	10:20	MacDonald et al.	Can 1m of uplift offset 1m of Sea Level Rise? An investigation into the post-earthquake response of mixed sand and gravel beaches, Kaikoura, New Zealand
10:20	10:40	Shen et al.	Experimental studies of tsunamis generated by submarine volcanic eruptions
10:40	11:00	Borrero	Field Survey and Preliminary Modelling of the Tsunami Generated by the 22 December 2018 Eruption of Anak Krakatoa Volcano
start	**end**	**Stream 2**	**Ecology and Ecosystems 4**
10:00	10:20	Duder	The Hauraki Gulf - SOS, or the Turning Point?
10:20	10:40	Jackson et al.	Downtown Public Space marine ecological enhancements
start	**end**	**Stream 3**	**Coastal Science 3**
10:00	10:20	Tidey et al.	250 years of navigation, map making and Belonging
10:20	10:40	Meissner et al.	Navigating New Zealand to a thriving Blue Economy
10:40	11:00	McKenzie	Insights into surfing as a nature based blue space physical activity that not only promotes wellbeing but is moving the maxim; live to surf to surf to live.
11:00	11:20	**Morning Tea** (Engine Room)	
DAY 2		**SESSION 5**	**TITLE**
start	**end**	**Stream 1**	**Coastal Hazards 2**
11:20	11:40	Hart et al.	Multi-hazard prone coasts – where are we now, and where to from here?
11:40	12:00	Todd et al.	Avon-Heathcote Ihutai Estuary Edge Inventory: Assessing the condition of structures along the Eastern Edge post CES
12:00	12:20	Montgomery et al.	The role of mangroves in coastal flood protection: A New Zealand perspective

12:20	12:40	Serrano	Understanding hydrological hazards risks for assets and operations in oil and gas terminals: BP natural hazards risk screening with Lyttelton as case study.
12:40	13:00	Knook et al.	Value engineering of coastal revetments by combined physical and numerical Modelling
start	**end**	**Stream 2**	**Coastal Communities**
11:20	11:40	Bennett	Retaining Mātauranga Māori (as Mātauranga Māori).
11:40	12:00	Coombes	Recognising Mana Whenua values through the removal of moorings from Ōkahu Bay, Auckland
12:00	12:20	McCarter	Consenting and community engagement processes
12:20	12:40	Simons-Smith	Going with the drift…wood – flexibility in coastal management, Ōhinepouwera (Karitāne Sand Spit)
12:40	13:00	Smith	Bushy Point – a Coastal Habitat Restoration Project
start	**end**	**Stream 3**	**Coastal Science 4**
11:20	11:40	Olufson	Components and Costing of Managed Retreat in a Coastal Setting
11:40	12:00	Beya et al.	Concept Design for the Hawke's Bay Coastal Strategy Short Term Pathways
12:00	12:20	Shand	Assessment of the effects of engineering works at a surf break at Mangamaunu, Kaikōura
12:20	12:40	Albuquerque et al.	The past and future wave climate of New Zealand: from hindcasts to projections
12:40	13:00	MacDonald et al.	Sensitivity analysis of a Delft3D fine-sediment transport model: Case study Wairoa Estuary and Tamaki Strait
13:00	13:30	**Lunch** (Refuel Station)	
13:30	17:00	**Field Trips**	
18:40	19:30	**Pre-Dinner Drinks**	
19:30	LATE	**Conference Dinner and Awards**	

Friday 15 November 2019	
DAY 3	**New Zealand Coastal Society Annual Conference 2019, Invercargill**

start	end		
8:00	8:55	**Registration** (Refuel Station, Transport World)	
8:55	9:45	**KEYNOTE ADDRESS: Graeme Blick (LINZ)** *Mapping New Zealand 2025* Sponsored by **Tonkin + Taylor Ltd**	
9:45	10:20	**Morning Tea** (Engine Room)	
DAY 3		**SESSION 6**	**TITLE**
start	**end**	**Stream 1**	**Coastal Engineering**
10:20	10:40	Sheppard et al.	Downtown Ferry Basin Redevelopment: Concept Development
10:40	11:00	Rivers	Utilising a Coastal Asset Inspection App to Manage Auckland's Coastal Assets
11:00	11:20	Soltau	Auckland Rocks. Or does it.
11:20	11:40	Wolf	Is shoreline protection against rising sea levels and erosion, with stabilization and regeneration of the ecosystem a realistic dream for New Zealand?
start	**end**	**Stream 2**	**Coastal Planning**
10:20	10:40	Eaves et al.	Coastal zone management, a case for integrating economic impact modelling and Robust Decision Making with scenario planning.
10:40	11:00	Atkin	The New Zealand Association for Surfing Research and Management Guidelines for Surfing Resources
11:00	11:20	Robichaux et al.	Implementing adaptive coastal risk management across scales
11:20	11:40	Davis et al.	Biosecurity management on Aotea: Great Barrier Island. Feasibility study for an on-island hull cleaning and maintenance facility.
start	**end**	**Stream 3**	**Coastal Science 5**
10:20	10:40	Davis-Calway et al.	Video analysis of the change in horizontal position of the frontal sand dune toe/vegetation line
10:40	11:00	Stewart et al.	Using radium isotopes and hydrodynamic modelling to investigate groundwater associated nutrients into Tauranga Harbour (New Zealand)

11:00	11:20	Tablada et al.	Sediment dynamics in a wave-exposed tidal flat
11:20	11:40	Nguyen et al.	Stabilizing effects of exposure on cohesive sediments from an intertidal mudflat
11:40	12:00	Dodd et al.	Changes at the Mouth of the Avon-Heathcote Estuary - a 2019 Update
12:00	12:30	**Conference Closing and Awards**	
12:30	13:30	**Lunch** (Refuel Station)	
13:30		**CONFERENCE CONCLUDES**	

Poster Presentations
Displayed in the gallery leading to conference rooms at Transport World

Harnessing Wave Energy: Feasibility of Utilising Point Absorbers and Attenuator Converters to Generate Sustainable Electricity in New Zealand
Bond et al.

Turning Tides in New Zealand intertidal research: a baseline study of Ulva Island intertidal zones
Warren et al.

Local scale sea level rise exposure assessment: an exploratory approach
Boyle et al.

Plastic Problems: Investigation of Microplastic Concentrations in Invercargill City Waterways
Edginton et al.

Shore platform generation on tectonic coastlines: are they preserved and for how long?
Horton et al.

Surveying and Marine Science: using bathymetric data to complement marine science investigations in Port Pegasus, Stewart Island
Morrison et al.

Morphology and Tidal Asymmetry Changes in the Avon-Heathcote Estuary
Rogers et al.

Swimming with dolphins? Investigating the effect of current legislative actions to mitigate human-dolphin interaction on existing resident and visiting bottlenose populations in the Bay of Islands
Sherbanowski et al.

Student Hydrographers Professional Coastal Science Projects at the School of Surveying, University of Otago
Tidey,et al.

Keynote Presentations

Te Hunga Takutai o Aotearoa
NEW ZEALAND
COASTAL SOCIETY

Wednesday 13 November 2019

Dr Rebecca McLeod

Chair, Fiordland Marine Guardians

The Story of the Fiordland Marine Guardians

Dr Rebecca McLeod has been a Guardian since 2012. She was awarded a PhD in Marine Science from the University of Otago and has received high profile honours and awards that recognise her scientific accomplishments and strengths in communication. She is a keen scientific and recreational diver and boatie and is passionate about New Zealanders getting into the great outdoors and being able to 'fish for a feed'.

Dr McLeod has extensive knowledge of Fiordland, from the rainforests to its unique marine environment, having conducted ecological research in the area for many years. She is a science advisor with experience in the academic, commercial and public service sectors, most recently advising New Zealand's Antarctic Science Programme.

The Fiordland Marine Guardians were formally established under the Fiordland (Te Moana o Atawhenua) Marine Management Act 2005, they had a very specific task of implementing the many management components required under this new legislation. Fourteen years later, what role do the Guardians play in looking after the expansive Fiordland Marine Area? Are the group, and others like them, still relevant and worth investing in? Rebecca will explain how the Guardians work with the community and government agencies to address issues and risks to the original vision for this special part of Aotearoa, with some examples of the matters that the Guardians are currently focused on.

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Dr Cliff Law

Principal Scientist-Marine Biogeochemistry, NIWA

Coastal Acidification: Rate, Impacts and Management

Cliff is a Principal Scientist at NIWA where he leads the Ocean - Climate Interaction Group and also a Professor at the University of Otago, teaching undergraduate courses on marine chemistry. His expertise is in marine biogeochemistry with research interests in marine trace gases, phytoplankton production and controls, and the impacts of ocean acidification and climate change. Cliff is recognised as a world expert in marine biogeochemistry, coordinating and contributing to several international and national research projects. For the past ten years he has researched the impacts of changing ocean chemistry that result from the increased uptake of carbon dioxide.

The declining pH of coastal waters is driven by the increasing burden of CO2 in the atmosphere, and also the supply of nutrients and organic matter in freshwater. This represents a threat to ecosystems and economic interests in the coastal zone around New Zealand, via its impacts on ecosystems and key species such as shellfish. The MBIE-funded Coastal Acidification: Rate, Impacts & Management (CARIM) is a national project which has regional foci in the Firth of Thames, Nelson Bays and Karitane, a rocky shore north of Dunedin, and associated impact studies on paua, Greenshell mussel, and Snapper larvae. This presentation will provide an update of findings from CARIM and related New Zealand research, and summarise the current trends, threats and potential options for addressing coastal acidification.

Sponsored by NIWA

Te Hunga Takutai o Aotearoa
NEW ZEALAND
COASTAL SOCIETY

Friday 15 November 2019

Graeme Blick

Chief Geodesist, Land Information New Zealand

Mapping New Zealand 2025

Graeme obtained his Bachelor of Surveying from Otago University in 1980. He worked for GNS Science before spending time at the University NAVSTAR Consortium in Boulder Colorado utilising GPS to monitor crustal movements on several international projects. In 1995 he moved to Land Information New Zealand (LINZ), New Zealand's National Survey and Mapping agency. He is the Chief Geodesist and Group Manager of the Positioning and Resilience Group where he continues to work on and manage the development and implementation of the geodetic system in New Zealand and develop a new resilience programme of work for LINZ.

Mapping NZ 2025 is LINZ's 10-year programme to deliver the mapping, data and expertise needed to address some of the most significant challenges facing NZ—such as climate change, urban growth and water. Our vision is seamless land and sea mapping, from Aoraki/Mount Cook to the edge of the continental shelf. The programme includes initiatives, leadership and investment. It builds on core LINZ expertise in mapping and charting and brings in new technologies and data partnerships with other organisations.

Mapping NZ 2025 is built around six major components:

1. Developing tools to enable seamless linking of land and sea datasets.
2. Elevation and Imagery partnerships to better map the land and features on the land.
3. Improving NZ's bathymetric or depth information to benefit marine safety, our communities, environment, and the marine economy.
4. Mapping the coastal zone to improve its management and our knowledge of the impacts of sea-level rise and tsunami inundation.
5. Coordinating improved access to NZ's Marine geospatial data
6. Working internally to better utilise Earth observation data to provide precise and complete images of what's happening to NZ's built and natural environments.

Graeme's presentation will give an update LINZ's progress and future plans on this ambitious programme of work. It will focus on our coastal mapping project, including the tools to integrate land and sea datasets.

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Abstracts: Oral Presentations

Te Hunga Takutai o Aotearoa
NEW ZEALAND
COASTAL SOCIETY

Day 1, Session 1, Stream 1:
Sea Level Rise 1

Wed 13th Nov 2019, 11:10-11:30, Stream 1: Sea Level Rise 1

Javad Jozaei[1], Rob Bell[1], Paula Blackett[1], Scott Stephens[1], Hannah Jozaei[2]
[1]National Institute for Water and Atmospheric Research (NIWA), Hamilton
[2]Morduch University, Western Australia, Australia

Resilience and vulnerability: oxymorons in the coastal vulnerability discourse and the way forward to more resilient New Zealand coastal communities

In the last few decades, the vulnerability approach has been a key approach in evaluating the susceptibility of social, ecological and physical systems to drivers of change including climate change and natural disasters. Assessing and measuring system vulnerability is a complex matter and does not follow "one size fits all'. A system's vulnerability is a variable that depends on several internal and external factors. Internal factors are defined as a system's properties that constitute its sensitivity and adaptiveness, such as adaptive capacity and resilience. External factors are characterised as the features of stress factors (drivers) that determine the severity and exposure of the risks (i.e. longevity, intensity, predictability vs uncertainty, ongoing change e.g. sea-level rise).

Despite the broad application of the vulnerability assessment methods in climate change and natural hazard context, its incorporation to inform decision-making and policy development in practice has always been challenging. The challenges, particularly in the context of social vulnerability, include: inconsistencies in the understandings of vulnerability concept; difficulties in identifying and measuring social vulnerability surrogates or indices; lack of consideration for social and cultural equity issues; complex dynamics of social systems particularly in a changing environment; and uncertainty of the future change that influences system vulnerability. Research suggests that conventional quantitative approaches in social vulnerability assessment could not appropriately address these problems, hence, the outcomes could potentially generate simplistic and inaccurate conclusions.

Arising from a need expressed in the MfE coastal guidance (2017), Pillar 3 of the second phase of Resilience to Nature's Challenges (RNC2) is developing a forward-looking vulnerability assessment framework to sit alongside a conventional risk assessment. The vulnerability assessment would account for complex dynamics of New Zealand's coastal communities and their four well-beings (including

environmental connectivity), plausible drivers of incremental and unknowable changes, and transformative mechanisms to reclaim coastal resilience in the face of climate change. However, there is unlikely to be a silver bullet for tackling the complexity of NZ social vulnerability assessment (SVA) methodology to the uncertain impacts of climate change -particularly ongoing sea-level rise. Developing a responsive SVA framework will require collaborative, innovative and dialectical methodologies that go beyond the conventional prescriptive approaches and encourage "out of the box thinking".

Therefore, in this presentation, we aim to open up a constructive conversation about the features of a potentially effective SVA process that informs adaptive decision-making and policy development in practice. Particularly, we will be focusing on the relationships between resilience and vulnerability concepts, and argue how different understandings of resilience could influence the perception of system vulnerability. We discuss the common understanding of resilience in the conventional vulnerability discourse, which focuses on "specific resilience" (resilience of what to what?); resilience as the flip side of vulnerability, and with a focus of adaptive capacity on adaptability and transformation (e.g. coordinated retreat or change in land-use). Whatever SVA methodology is devised for Aotearoa-NZ needs to weave in Te Ao Māori perspectives and befit the dynamic adaptive pathways planning (DAPP) approached used in the MfE coastal guidance.

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Te Hunga Takutai o Aotearoa
NEW ZEALAND
COASTAL SOCIETY

Wed 13th Nov 2019, 11:30-11:50, Stream 1: Sea Level Rise 1

Paula Blackett[1], Kate Davies[2] Ben Davies[2] Alex Fear[1] Paula Holland[1], Nick Cradock-Henry[3], Jordan Luttrell[1], Javad Jozaei[1] and Carla Muller[1]
[1]NIWA, Hamilton, [2] Davies Environmental, Salt Lake City, US, [3] Manaaki Whenua Landcare Research

Serious games to empower climate change adaptation: A demonstration of three games

Climate change is already affecting communities and livelihoods in New Zealand through increased temperatures, prolonged droughts and more frequent extremes. However, a gap remains between public understanding and scientific knowledge about climate change and adaptation action. We suggest that serious games are a way to bridge this gap. Serious games are effective tools to facilitate long-term strategic thinking in individuals and groups because they create a safe place to experiment with navigating through complex and contested environmental issues. In short, a game allows complex environmental information from different sources (e.g., flood models sea level rise scenarios, alternative options, economic cost, social implications) to be combined in a simple way so players can choose a course of action and then experience the implications of their choices over time. For players, this creates an experience that reflects reality without generating decision paralysis through unnecessary detail. In addition to better understanding the choices available, games empower target communities, individuals, councils or groups with new knowledge to decide and act in their own situation. In this session, we will demonstrate three games and provide you with the chance to experience them for yourself. The games are:

Flood Adaptation game: On your dairy farm both your family home and business are at risk from flood events that will increase in magnitude over time. You have choices to make about how to respond to the risk. Do you take your chances with the river or do you save up to move your assets?

Sea Level rise adaption game: Your bach is positioned in a beautiful beachfront location. However, the sea is rising, and you have a few choices to make regarding your future - what is important to you and what risks are you willing to take?

Coastal futures: This is an online game where you are responsible for decision making in a small coastal town. The residents are not shy in expressing their adaptation preferences. What choices will you make? What pathways will you take? Will you remain in office?

Each game is designed based on compelling narratives representing real situations, allowing players to consider, experience and reflect on decision-making under uncertain and changing conditions. Join us for a game or two!

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Wed 13th Nov 2019, 11:50-12:10, Stream 1: Sea Level Rise 1

Ryan Paulik[1] **Rob G. Bell**[2], Scott A. Stephens[2], Sanjay Wadhwa[2]
[1]NIWA, Wellington, [2] NIWA, Hamilton

New Zealand's Coastal Flooding Exposure Under Future Sea-level Rise

This study presents New Zealand's exposure to 1% annual exceedance probability (AEP) coastal flooding under present-day and future higher sea levels. Coastal flooding is determined from the 1% AEP extreme sea-level elevations (ESL1) created by a combination of tide, storm-surge, mean sea-level anomaly and wave setup. High and low resolution DEMs were used to map ESL1 land inundation for present-day mean sea-level (MSL), and +0.1 m sea-level rise (SLR) increments up to +3m above MSL. Exposed elements at risk (i.e. populations, built assets and land cover) enumerated for land inundated in each ESL1 scenario. At national level, a linear trend of increasing ESL1 exposure is observed as sea-levels rise. At region and territory levels, exposure exhibits non-linear behaviours with average exposure rates accelerating and decelerating exposure in response to SLR up to +3m above MSL. Population and built asset exposure in regions and territories with major coastal urban areas such as Hawkes Bay (i.e. Napier City) and Canterbury (i.e. Christchurch City) increase rapidly as sea-levels rise to +0.9m above present-day MSL. This information provides researchers and practitioners with locations to focus more detailed investigation on the potential impacts and management implications of coastal flooding under future sea-level rise.

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Wed 13th Nov 2019, 12:10-12:30, Stream 1: Sea Level Rise 1

Rob Bell[1], Anne Bardsley[2], Acushla Sciascia[3], Wendy Saunders[4], Shaun Awatere[5], Roger Fairclough[6], Bapon Fakhruddin[7] and Emma Lemire[8]
[1]NIWA, Hamilton, [2]University of Auckland, Auckland, [3]Māpuna Consultants, [4]GNS Science, Avalon, [5] Manaaki Whenua – Landcare Research, Hamilton, [6] Neo Leaf Global, Wellington, [7] Tonkin + Taylor, Auckland, [8]Ministry for the Environment, Wellington

Framework for Aotearoa New Zealand's 1st National Climate Change Risk Assessment

The Ministry for the Environment set up an expert Panel in April to develop a fit-for-purpose climate-change risk assessment framework befitting the growing challenges we face in Aotearoa-New Zealand (A-NZ) from climate change. Arotakenga Huringa Āhuarangi – A Framework for National Climate Change Risk Assessment for Aotearoa New Zealand was published in September. It will provide the framing for the 1st national-scale assessment of risks arising from climate change across the four well-beings and several domains/sectors (underway in September) and which risks are prioritised for addressing proactively in the National Adaptation Plan that is proposed in the Climate Change Response (Zero Carbon) Amendment Bill.

An outline will be given of the framework, through which Te Ao Māori perspectives are weaved, along with alignment to the Living Standards Framework and the National Disaster Resilience Strategy. The risk methodology is geared towards the national scale, aggregating risks across seven climate zones across A-NZ, and comprises a 3-stage assessment process: i) Risk screening to isolate the key risks nationally; ii) Detailed assessment for those risks brought forward from the screening; iii) Assignment of an "urgency" rating for risks requiring adaptation actions (which could also be more targeted research if there is an insufficient evidence base for an emerging risk). A summary of the potential coastal risk exposure for A-NZ from available information sources will be provided, drawing out some common threads.

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Day 1, Session 1, Stream 2: Ecology and Ecosystems 1

Wed 13th Nov 2019, 11:10-11:30, Stream 2: Ecology and Ecosystems 1

Vonda Cummings[1], Carolyn Lundquist[2], **Mary Livingston**[3]
[1]NIWA Wellington; [2]NIWA Hamilton; [3]Fisheries New Zealand, MPI Wellington

Anticipating climate change effects on New Zealand coastal fisheries

New Zealand's coastal and oceanic waters support a valuable seafood sector, which contributes significantly to the country's annual economy. Significant risks are posed to this sector from CO_2-and climate-induced changes to their surrounding environment. We synthesise NZ-specific information on changes in physical and oceanographic parameters projected for the coming decades (including temperature, pH, salinity, oxygen, circulation). We then evaluate the current state of knowledge of how 32 NZ fisheries species, ranging from shellfish fisheries, inshore fisheries, middle-depths and deepwater species, are influenced by these parameters. This information is then used to determine potential risks to these fisheries in the coming decades. Finally, through detailed case studies of paua, snapper and hoki, we combine scientific data and fisher expertise in an expert evaluation of these species' vulnerabilities and, importantly, their adaptation potential. Knowledge of how environmental changes might affect different species is essential so that decisions can be made around the potential implications of change to that fishery and the management options available to mitigate them.

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Wed 13th Nov 2019, 11:30-11:50, Stream 2: Ecology and Ecosystems 1

Martin Cryer
Fisheries New Zealand, Nelson

National surveys of recreational harvest in New Zealand: what do they catch and what else are they up to?

Marine recreational fishing is socially, economically, and culturally important for New Zealanders and is managed by Fisheries New Zealand. Between October 2017 and September 2018, the second of our National Panel Surveys was conducted to estimate the harvest of marine recreational fishers. The first was conducted in 2011/12. Both surveys were tested and corroborated using distinctly different on-site surveys.

Panels of fishers were randomly selected using face-to-face interviews at over 30,000 households and about 7,000 panellists were recruited to each survey. Their fishing effort and catch were monitored closely over 12 months using frequent contact by text message and carefully designed computer assisted telephone interviews.

About 28% of dwellings were found to have at least one fisher in 2017/18 (down from 32% in 2011/12) and it was estimated that about 348,000 New Zealanders were at least occasional fishers (down from 422,000). These fishers made about 1.8 million fishing trips in 2017/18 (down from 2.3 million) and caught an estimated 7 million finfish and 4 million shellfish (down from 8.7 million finfish and 8.3 million shellfish). Snapper was the most commonly-caught species, especially in northern fisheries, but other species like blue cod were more important in southern fisheries, particularly in Southland.

Declining fishing effort and total catch have been seen in several other developed nations, but the Southland region bucked the trend in New Zealand with 14% more fishers in 2017/18 than in 2011/12 and an increase in the estimated catch of blue cod from 51 tonnes (84,000 fish) to 67 tonnes (139,000 fish).

Access to a randomly-selected panel of 7,000 fishers enabled us to gain significant insight into New Zealand fishers and their behaviour. Fishing is overwhelmingly a social activity, with less than 5% of fishers fishing alone. About half fished with the family, and about 40% with friends. More than half of fishers use electronic fish finders, and about 40% are now using GPS. Almost one-third caught their bag limit at least once in the year, and about 40% saw one of our fisheries officers. Over 20% of fishers reported being troubled by seabirds trying to steal their baits or eating fish they had released.

We are continuing to monitor the panel and, given the rapidly advancing capabilities of smartphones and other technology, trialling other methods of reporting. We anticipate running another national survey in about 2022/23.

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Wed 13th Nov 2019, 11:50-12:10, Stream 2: Ecology and Ecosystems 1

Lisa van Halderen
Marine Science Department, University of Otago

Rāhui and Rangatiratanga: Investigating rāhui as a customary fisheries management tool

Marine fisheries contribute globally to food security, and trade while sustaining the social and cultural wellbeing of local communities. Fisheries worldwide have shown signs of declining catch due to anthropogenic factors such as habitat destruction and overfishing. Almost one third of the world's fisheries are overfished. The collapse of a fishery has significant biological impacts but also has localised socioeconomic impacts on the communities that rely on the fisheries for food and wellbeing. Fisheries management systems have historically focused on single species management; however, fisheries management systems need to incorporate conservation, social, economic and cultural goals in order to be successful. The ecosystem-based management (EBM) approach is becoming more commonly used and local community management can be considered an extension of EBM where the ecosystem includes fishers. The traditional knowledge of local indigenous communities can inform the management of fisheries and in Aotearoa New Zealand, this knowledge is referred to as mātauranga Māori. This knowledge system is centralised in te ao Māori (a Māori worldview), informing the management of fisheries resources and shaping Māori identities. Te Tiriti o Waitangi guaranteed rangatiratanga (sovereignty), the exercising of Māori fishing rights, and the protection of taonga (treasures), which has also been interpreted as mātauranga Māori.

In a fisheries management context, rāhui or temporary closures are used to prohibit or restrict access to marine resources, applying principles of kaitiakitanga (environmental guardianship) in order to protect and enhance the fisheries resources. The practice of rāhui has been translated into fisheries legislation under Sections 186A and 186B of the Fisheries Act 1996, making provisions for a two-year closure on a fishery. This research investigated whether traditional rāhui or legal rāhui made provisions for rangatiratanga and the right to exercise kaitiakitanga. Is there a management tool that incorporates the principles of rāhui, makes provisions for rangatiratanga and is recognised within a legal framework? Interviews were conducted with tangata tiaki in Whareponga, East Cape where a traditional rāhui was in place, and in Karitāne, in the East Otago Taiāpure (EOT), north of Dunedin, where a legal rāhui was implemented. While the traditional rāhui in Whareponga was adaptable and provided for rangatiratanga, the legal rāhui in the EOT was inflexible and the legal process did not make full provisions for rangatiratanga. However, proposed changes to fishery regulations in the EOT will provide for the principles of rāhui, provide for aspects of rangatiratanga and allow for kaitiakitanga that is protected by law.

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Wed 13th Nov 2019, 12:10-12:30, Stream 2: Ecology and Ecosystems 1

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Applying Spatially-Explicit Risk Assessment to Maui and Hector's dolphins conservation management

To assess and manage fisheries risks across large numbers of non-target populations, potentially impacted by multiple threats, fisheries managers are forced to make difficult decisions in the context of poor and/or sparse information. Thus, innovative methods are required to enable maximum use of available data. To this end, MPI has developed the Spatially Explicit Fisheries Risk Assessment (SEFRA) framework. The SEFRA method provides a transparent and statistically rigorous means to estimate cumulative impacts and population-level risk even where impact events are rarely observed. Moreover, it accurately accounts for uncertainties in the model.

Within this framework, fisheries-related deaths are a function of spatio-temporal overlap (a proxy for encounter rates between species and fishing effort), and capture rates per encounter, estimated from fisheries observer data. A customised adaptation of this method, also incorporating non-fishery threats, is being used to inform the update of the Maui and Hector's dolphin Threat Management Plan (TMP). Accounting for multiple threats paradoxically produces more rigorous estimates than working on single threats. Risk for each threat is expressed as the ratio between the number of deaths and a 'population sustainability threshold' (PST), representing the capacity of the population to sustain impact.

This presentation will illustrate the SEFRA method with reference to the new Maui-Hector's dolphin model and will demonstrate the means by which model outputs have been used to design spatial management options under the new dolphin TMP. The SEFRA method is also being applied to other protected species, including New Zealand sea lions and fur seals, and across all New Zealand seabirds.

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Day 1, Session 1, Stream 3: Ocean and Modelling

Wed 13th Nov 2019 11:10-11:30, Stream 3: Ocean and Modelling

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The MOANA project ocean hindcast: Data access and model-data comparisons

The Moana Project aims to gather and archive New Zealand ocean data into a standard accessible format and deliver open-access, high fidelity numerical circulation models to ocean stakeholders. The project is a collaboration between the New Zealand MetService, NIWA, Otago, Victoria, Auckland, Waikato Universities, the fishing industry, and community partners. A 25-year, 5-km resolution, ocean hindcast for New Zealand has recently been released and made openly accessible to the public.

In this presentation, we provide a brief overview of the data-sharing and model access protocols for this product. In addition, preliminary results of evaluating numerical model output to the long-term daily water temperature record from Portobello Marine Laboratory are presented. This New Zealand-wide model presents a first step towards generating accurate circulation predictions on regional coastal scales. This work is a contribution to the Moana Project (www.moanaproject.org) funded by the New Zealand Ministry of Business Innovation and Employment.

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Wed 13th Nov 2019, 11:30-11:50, Stream 3: Ocean and Modelling

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Understanding the Dynamics of Plastics in the Coastal Environment

The problem of marine plastic pollution is now a well-documented phenomenon. Numerical modelling studies aimed at quantifying the extent problem have tended to over-estimate the amount of buoyant ocean plastic when compared to surface measurements. These estimates indicate that a large amount of marine floating plastic is unaccounted for. While some may be accumulating on the sea floor, a large amount can be found beached on global coastlines.

While there is clearly considerable variability in the quantity of beached plastic between different locations and over time, the mechanisms that explain these differences have been surprisingly elusive.

In this current study large scale beach clean-up datasets were analysed to provide general insights into the meteorological, oceanographic and anthropogenic processes that account for these differences. Statistical and machine learning approaches were used to provide a comprehensive analysis of these datasets and establish linkages between explanatory factors and plastic abundance. The processes that govern plastic beaching are complex, dynamic and interdependent but the results of this study provide a first pass at understanding this process. The investigation identified factors that accounted for between beach variation (local population and fishing activity offshore) and within beach variation (wave height and plastic abundance offshore). A larger set of variables was used to create a neural network which can be used to predict the relative abundance of beached plastic.

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Wed 13th Nov 2019, 11:50-12:10, Stream 3: Ocean and Modelling

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"Waste of Our Time" – a lesson in plastic pollution and landfill management from the South Westland clean-up 'Operation Tidy Fox'

Needing to clean up storm-scattered landfills is a "waste of our time" that could be better used for more proactive waste & environmental management. And plastic rubbish is the "waste of our generation" that needs careful attention to ensure that the problems it creates are not passed to our next generations. A recent New Zealand case study gives us some important lessons.

In March 2019, a storm caused major damage in South Westland and washed out half of the Westland District Council's old Fox Glacier landfill. More than 10,000m^3 of plastic waste and other debris were spread down 13km^2 of riverbed and 64km of coastline, in environments of high natural value and difficult access.

After an initial stage of emergency response by several agencies, Operation Tidy Fox was set up to remove all visible rubbish from the affected area. Over a period of 60 days, dozens of Dept of Conservation staff and Defence Force personnel and more than 1000 volunteers collected the equivalent of 14,550 domestic rubbish bags by hand-picking rubbish from the river and coast, involving 5400 person days and over $500,000 in costs. The Operation ended in July 2019, but unknown volumes of rubbish remain hidden - buried in the Fox River bed and lost at sea - and the 15,000m^3 of remaining landfill is vulnerable to further floods.

The incident was a very clear example of the effects that catchment activities can have on the coastal environment, from the mountains to the sea. Coastal impacts were hard to measure, but they included landscape and natural character impacts as well as potential threats to wildlife, aquatic species and water quality.

Operation Tidy Fox was a very successful response in the circumstances, and it served to generate greater awareness and broad discussion about the wider issues of landfills and plastics in New Zealand. Landfills elsewhere on the West Coast and more than 100 others around New Zealand are at risk from coastal erosion and sea level rise, with many more landfills exposed to river erosion, storm events and natural hazards. Plastics and other durable wastes from these and other sources are very difficult to manage once they enter the natural environment.

The big lessons from Operation Tidy Fox are that:

- New Zealand's vulnerable landfills need some urgent attention, and
- Plastic pollution is best managed by reducing its production in the first place.

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Wed 13th Nov 2019, 12:10-12:30, Stream 3: Ocean and Modelling

Charine Collins, Helen Macdonald
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Oceanic flow patterns and their influence on dispersing material on the west coast of the Manawatu-Whanganui Region

New Zealand's marine and coastal environment is of significant ecological, socio-economic and cultural value. Safeguarding the natural character and ecosystem processes within the coastal zone requires a better understanding of the dispersal of material (e.g. sediments, nutrients and biological material) within the coastal zone. Like all coastal ecosystems, the transport of material into and out of the coastal zone of the Greater Cook Strait is heavily influenced by physical conditions (ocean currents, winds, tides).

A high-resolution (1km) Regional Ocean Modelling System (ROMS) simulation of the Greater Cook Strait region, with the addition of passive tracers, was used to show how the modelled flows propagate material into and out of the Manawatu-Wanganui Region's western Coastal Marine Area (CMA). Passive tracers were released at three sites across the western end of Greater Cook Strait as well as at the three main rivers terminating in the CMA - the Manawatu, Whanganui and Rangitikei Rivers. The model was run for several seasons to obtain a representative picture of the oceanic flow off the west coast of the Manawatu-Wanganui region.

Tracers originating at the western end of Greater Cook Strait is rapidly transported to the Manawatu-Wanganui Region's western CMA within the eastward flowing D'Urville Current. The south-eastward flow that dominate in the CMA rapidly transports the tracers out of the southern boundary of the CMA.

Tracers entering the Manawatu-Wanganui Region's western CMA from the three main rivers are mainly transported southward out of the CMA inshore of the 50m isobath. Furthermore, modelling results show that the dispersal and transport of material originating from the rivers is highly influenced by the large-scale circulation of Cook Strait.

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Day 1, Session 2, Stream 1:

Sea Level Rise 2

Wed 13th Nov 2019, 14:30-14:50, Stream 1: Sea Level Rise 2

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Accounting for morphodynamics in assessments of coastal vulnerability to sea-level rise: lessons from Tuvalu

Coastal settlements worldwide face considerable risk from erosion and inundation with global sea-level rise (SLR). In this context, assessments of coastal vulnerability often focus on erosion or inundation in isolation, without considering how coastlines will morphodynamically adjust to changing boundary conditions. Predicting future morphodynamic change is a complex challenge and in a modelling context requires a trade-off between representing the high-resolution physical processes involved, and the decadal time-scales of environmental change. We present results from a series of experiments focused on understanding the vulnerability of atoll islands to SLR and highlight the importance and complexity of representing morphodynamics.

Initially, we examined island vulnerability to SLR by simulating wave transformation, runup and overtopping under the assumption of a static island morphology. This approach was useful for identifying SLR thresholds for wave driven flooding, but results were limited by not accounting for how the shoreline adjusts to overtopping events. To account for morphodynamics, we evaluated the phase-resolving morphodynamic model XBeach-G against flume data and used the calibrated model to simulate future change on Fatato Island, Tuvalu when exposed to different SLR scenarios. A comprehensive sensitivity analysis was undertaken to understand model behaviour and island response under different wave conditions and equilibrium timescales.

Results identified an important morphodynamic feedback that can enhance coastal resilience or amplify vulnerability to flooding. Model outputs under typical wave conditions identified waves overtopping the island crest at low levels of SLR (spring high tide + 0 - 0.3 m). Moderate overtopping events were associated with sediment transport from the beach to the island crest, resulting in vertical accretion that maintained a positive freeboard and mitigated an increase in flooding. However, crest lowering occurred when exposed to overtopping from large waves or rapid SLR. Overtopping of the island crest at a rate less than 10 L m^{-1} s^{-1} was associated with vertical accretion and maintenance of island freeboard. Overtopping above this critical threshold was associated with crest lowering and produced a negative

feedback that amplified vulnerability to flooding. Similar morphodynamic responses are likely on gravel beaches in New Zealand and the same modeling techniques and challenges apply. Understanding morphodynamic feedbacks can provide important insight for strategically managing risk and guiding adaptation at the coast.

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Wed 13th Nov 2019, 14:50-15:10, Stream 1: Sea Level Rise 2

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Climate Change Resilience in Eastern Tongatapu

On Tongatapu, trial projects combining hard and soft engineering to provide climate change resilience were developed in order to learn more about the efficacy of their application in different physical environments and compare the design parameters in a temperate context versus a tropical coral sand coast. At a tidally dominated site, groynes with varying permeability placed at varying intervals along the beach were trialled, while detached breakwaters of varying lengths at varying intervals were trialled at a more exposed wave-dominated site. Both trials included beach renourishment and planting of coastal species, as well as a detailed monitoring programme.

Five years after implementation, several important findings have emerged. In the tidally-dominated location, semi-permeable groynes with a spacing that agrees with temperate design parameters (i.e. groynes should be spaced at ~3x their across-shore length) were found to be very effective at retaining renourished sand and widening the beach. Detached breakwaters at the wave-dominated site have also proven to be very effective at sand retention and the creation of a buffer zone, as well as being very cost effective and allowing for better coastal access and amenity. This European Union (EU) funded, SPC supported project (The Pacific Community's Global Climate Change Alliance: Pacific Small Island States (GCCA: PSIS) was the proud recipient of the 2019 Energy Globe Award, recognised for its outstanding work and contribution towards advancing peer to peer learning in climate change adaptation among Pacific communities.

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Wed 13th Nov 2019, 15:10-15:30, Stream 1: Sea Level Rise 2

Derek Todd
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Climate Change Resilience: the Temaiku Land and Urban Development Project in Kiribati

Kiribati, an island republic in the Central Pacific, is one of the world's most economically and physically vulnerable countries, consisting of 33 low lying coral atolls. The capital, Tarawa, and its people are increasingly impacted by sea level rise and the frequency of storm surge inundation.

Jacobs was commissioned by New Zealand Government, Ministry of Foreign Affairs and Trade for the Government of Kiribati, to assess the feasibility of reclaiming 300 Ha of inhabitable land by dredging sand from the lagoon and transforming it to an urban development for up to 35,000 people, resilient to predicted 2200 sea levels. The investigations comprised coastal engineering, urban and landscape design and environmental and social impact assessment. Through an integrated and consultative investigation and design process the team delivered a solution focused on triple bottom line sustainability. The project is the first large scale climate change adaption project of its kind for small island nations and has culminated in the President of Kiribati presenting the Project at the UN World Climate Change Forum, CoP23.

This presentation provides an overview of the Temaiku Land and Urban Development, including the integrated approach of coastal engineering design, the landscape and urban design and environmental and social impact assessment.

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Day 1, Session 2, Stream 2: Ecology and Ecosystems 2

Wed 13th Nov 2019, 14:30-14:50, Stream 2: Ecology and Ecosystems 2

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Per- and Poly-fluoroalkyl Substances (PFAS) in fish and macroinvertebrates within the Waitematā Harbour

PFAS compounds, such as perfluorooctanesulfonate (PFOS) and perfluorooctanoic acid (PFOA) are a group of manufactured chemicals used since the 1950s. PFAS are used in a wide range of industrial and commercial products including aqueous film forming foam (AFFF) used for fighting fuel fires. Recently PFAS have gained increasing scientific, regulatory and media interest due to their widespread use, their environmental persistence and because some PFAS (primarily PFOS and PFOA) display bio-accumulative properties. Biomagnification (accumulation of PFAS through diet) of these compounds can also occur in apex predators. The marine environment is commonly the receiving environment for multiple PFAS sources such as wastewater effluent, landfill leachate and stormwater runoff.

Investigations into PFAS contamination of the environment are relatively recent, particularly in New Zealand. Pattle Delamore Partners Ltd (PDP) have been investigating this group of contaminants in the New Zealand environment since 2015. PDP have carried out two sampling investigations targeting marine biota, including fish and macroinvertebrates within Waitematā Harbour. These investigations were carried out within the receiving environments of two known sources of AFFF containing PFOS and PFOA have been used historically. Sediment samples were also collected to complement the biota samples. Biota and sediment were also collected from one urban reference site within the Waitematā Harbour, and one semi-rural reference site outside of the Waitematā Harbour.

In this paper we will discuss the results of tissue analysis for PFAS in macroinvertebrates and fish collected within the Waitematā Harbour and reference sites. The results will be discussed in terms of applicable New Zealand human health and ecological guidelines. The results will also be compared to international studies that also investigated the accumulation of PFAS in marine biota sediment. These international studies include a combination of two large urban harbours and receiving environments of two overseas firefighting training areas where AFFF containing PFOS and PFOA has been used historically.

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Wed 13th Nov 2019, 14:50-15:10, Stream 2: Ecology and Ecosystems 2

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The March 2019 Fanworm Incursion Gisborne Harbour

On the 6th of March 2019 the yacht Wahoo on a voyage from Auckland to Brazil suffered a man overboard emergency off Tolaga Bay, East Coast. The crew member was rescued and the yacht towed to Gisborne Marina where it was found to be infested with Mediterranean fanworm (*Sabella spallanzanii*).

The fanworm is well established in Waimata harbour including the marinas as well as in Whangarei Harbour. Fanworms form very dense colonies. They can grow to more than 600mm in length and have the potential to starve our native marine species of food and living space. The fanworms' larvae settle on boat hulls where they grow into adult worms and get transported to new locations when the boat sets sail. Because the fanworms grow very quickly, they can quickly colonise new areas.

The fanworm is an exclusion pest under the Tairawhiti Regional Pest Management Plan and Gisborne District Council and MPI had previously invested a significant sum clearing the harbor after a previous incursion. An emergency response was therefore initiated and the vessel urgently lifted from the water to eliminate the risk.

Addressing the issue was made more complicated as it was not clear who was in charge of the vessel; the crew contracted to deliver the boat to Brazil, or the owner in Brazil. The state of the boat, its' capability for the planned voyage, the adequacy of the food and water supplies, the competency of the crew, and the presence of military grade firearms on board also raised significant concerns. Engaging with the contract crew was a frustrating exercise and their only concern was to leave port as fast as possible and it was necessary for Maritime New Zealand to detain the boat to ensure that it was not returned to the water. Ultimately the crew refused to co-operate. Initial conversations with the owner in Brazil were also unhelpful as he was unclear why the boat was in Gisborne, why it had been seized, and why the crew had not made the boat ready for a sustained sea voyage. These issues were successfully addressed once he arrived in New Zealand.

The incursion provided valuable lessons in how to manage a marine biosecurity threat and was a real test of the emergency procedures under the regional pest management plan. It also provided a good insight to the risks posed by events such as Tuia 250 voyage which will see a flotilla of vessels visiting the region. Immediate changes were made within council with the key change being the appointment of an officer with direct responsibility for marine biosecurity within the Integrated Catchment Group in Council.

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Wed 13th Nov 2019, 15:10-15:30, Stream 2: Ecology and Ecosystems 2

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Black petrels, from coast to coast to forest

Black petrel (*Procellaria parkinsoni*) burrows have been found as far inland as the Kaimanawa ranges and Tongariro, leading to the hypothesis that these birds played an important role in the transportation of nutrients from the coastal environment to their forest breeding sites. Once widespread throughout much of New Zealand, we find the black petrel now breeding exclusively in the Hauraki Gulf on Little Barrier (Toi) and Great Barrier Island (Aotea Island).

In their reduced range, black petrels were found to be the New Zealand seabird most at risk from their interactions with commercial fisheries. Foraging in the outer Hauraki Gulf and in pelagic waters near continental shelf breaks or sea-mounts, black petrels are often observed in large concentrations behind fishing vessels during their breeding season. To add complexity to this issue, not only do black petrels forage in New Zealand waters, they migrate to South America once the breeding season is over looking for food in productive waters off the coast of Ecuador and Peru. Partnership was needed to focus conservation and broaden the scope of monitoring efforts.

The Black Petrel Working Group (BPWG) was formed in partnership between the Ministry for Primary Industries (MPI), Department of Conservation (DOC), Southern Seabird Solutions Trust (SSST), Iwi, fishing industry members and non-government organisations. Fishers became active members in the conservation of black petrels, with SSST leading expeditions to Mt Hobson to familiarise crew with the birds outside of the context of fishing. This collaboration lead to members of the BPWG voluntarily participating in a trial of electronic video monitoring.

To assess the validity of new data being collected a review of the electronic video monitoring trial was conducted. It was found that 89% of seabird capture events were detected during camera footage review (94% with multiple reviews). These data could then be paired with GLS and GPS tracking data, demography data from colony surveys and fishing records both domestic and international to create an accurate assessment of the risk these birds encounter and help inform management moving forward.

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Te Hunga Takutai o Aotearoa
NEW ZEALAND
COASTAL SOCIETY

Day 1, Session 2, Stream 3:

Coastal Science 1

Wed 13th Nov 2019, 14:30-14:50, Stream 3: Coastal Science 1

Raphael Krier-Mariani[1], Wayne Stephenson[1], Sarah Wakes[2], and Mark Dickson[3]
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A new wave of observations on the rocky edge and its hydrodynamical repercussions

Understanding wave transformation on shore platforms represents a key element in rock coast geomorphology. Wave transformation has mainly been investigated using single linear arrays of instruments deployed in a shore normal direction, which establish important hydrodynamical concepts in cross shore wave transformation. However, this approach has limitations for understanding nonlinear processes impacting wave propagation. Measurements of wave refraction, reflection and longshore propagation constitute an important source of information for models of rock coast geomorphology. The aim of this research is to investigate the relationship between platform morphology, wave directionality and energy dissipation. The morphological aspect of the research is focusing on shore platform edge shape for which an edge detection method was developed. The hydrodynamical aspect of the research focuses on directionality and energy variations of gravity (0.051Hz-0.13Hz) and infra-gravity (0.0019Hz -0.05Hz) waves.

The experimental design necessary to achieve the research aim was developed on a type B shore platform at Waianakarua (South east coast, South Island). For platform edge detection, a drone survey was carried over a low elevation type B shore platform at spring low tide. Using the digital surface model obtained from Pix4D, the platform edge was identified using a combination of filters on elevation and change of gradient. A sensitivity analysis was carried out to define the best combination of filters, resulting in a point cloud closely matching the location of the platform edge. The platform edge was finally defined by applying a smoothing spline fitting (with smoothing parameter= 0.54) to the point cloud. To asses multi-directional wave transformation, high resolution wave data were collected for a month using an array of 14 pressure sensors and two directional wave recorders anchored to the platform, the largest field deployment yet accomplished on a rocky shore platform. Offshore incident wave height, period and direction were also recorded using an ADCP deployed in 10 m of water, 850 m seaward of the study site. Non-directional spectral analysis was used to investigate the energy level of gravity and infra-gravity waves

over the entire platform. Results show that wave energy distribution strongly decreases from the edge to the centre of the platform. These results are supported by the directional spectra analysis showing strong refraction of incident waves induced by the platform edge. During a recent deployment at Mahia Peninsula (east coast North Island), this new approach was applied to various types of platform edge shapes. Data were collected during one of the largest storm events in the region over the last decade (Offshore Hs = 5-6m). These data will not only be used to assess the impact of shore platform edge on wave propagation, but also to assess the subsequent impact on the toe of the terrace using pre and post storm surveys. This unique dataset and approach will be used to establish a conceptual model for rocky shores, linking shore platform morphology, wave dynamics and cliff toe position.

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Te Hunga Takutai o Aotearoa
NEW ZEALAND
COASTAL SOCIETY

Wed 13th Nov 2019, 14:50-15:10, Stream 3: Coastal Science 1

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Video analysis of the change in horizontal position of the frontal sand dune toe/vegetation line

Beach morphology is highly variable in nature and is constantly changing due to climatic variation. Wave action during storm conditions and wind action during fair weather periods, causes movement of sand to occur, resulting in erosion and accretion of the beach and sand dunes. Beach morphodynamics have been measured for a long time period, using the common and reliable method of beach profile surveying. Studies have been mainly focused on the highly-variable shoreline and offshore bar positions, rather than further up the beach, along the frontal sand dunes. However, the dune toe position (the front of the frontal sand dune or vegetation line) may hold important information that can be used to decide setbacks of houses along beach fronts and used for hazard risk assessment of determining coastal hazard zones.

Video analysis is a potentially viable method that could be used to measure the horizontal variability of frontal sand dunes. A camera located at the south end of Tairua Beach, New Zealand, as part of the NIWA-based 'CamEra' Network (in collaboration with WRC) was used for capturing the changes in the horizontal position of the sand dune toe/the vegetation line of the frontal sand dunes. The camera takes 600 images over a 15-minute time period every half an hour during daylight hours and the images are averaged to produce one 'time exposure' image. One image per month, within the 20-year dataset, was selected and the image was rectified using Matlab software. Trials with many example images showed that vegetation was best detected using a combination of red-blue light ratio and overall intensity. From the combination of these characteristics, three classes were distinguished which defined the 'dune' area that was covered with dense vegetation, the 'transition zone' which consisted of sparse vegetation (usually located near the vegetation line at the front of the sand dune) and the 'sand' area which consists of the majority of the beach. Once the parameters for the classes were determined using samples of pixels from areas of sand dune and sand, the entire sand dune and beach area of the image was classified. Positions within the image where there was a transition from the 'dune' or 'transition zone' class to the 'sand' class was used to determine the location of the horizontal position of the sand dune toe/vegetation line.

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Wed 13th Nov 2019, 15:10-15:30, Stream 3: Coastal Science 1

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Life in a dimming world: Effect of light availability on intertidal benthic primary production

In shallow coastal ecosystems, benthic primary producers fuel food-webs and influence nutrient fluxes across the sediment-water interface. Within New Zealand estuaries, there are two dominant types of benthic primary producers; microphytobenthos (MPB) and seagrass (*Zostera muelleri*). Light is an important variable regulating primary production and varies across multiple temporal scales due to weather, tidal stage and season. Nutrient uptake during photosynthesis means that these primary producers regulate fluxes across the sediment-water interface and by oxygenating the sediment can enhance nutrient cycling processes such as nitrification. Increased delivery of land-based sediments into coastal waters can however raise water column turbidity, diminishing light availability. For intertidal habitats, this reduced light availability during immersion may potentially be offset by low tide production when light levels are higher and the effects of water column turbidity are removed. Despite its importance, there is little published data on how light availability influences benthic primary production and associated nutrient fluxes, which is limiting efforts to model coastal ecosystems. To build this scientific knowledge, we measured seasonally photosynthesis-irradiance (P-I) curves in seagrass and MPB dominated habitats using benthic incubation chambers where a gradient in light availability was created using shade cloth. Chambers were deployed at high and low tide and during high tide sampling, nutrient fluxes across the sediment-water interface were also measured.

Preliminary results from the modelled P-I curves indicate similar maximum production rates during high and low tide for the seagrass habitat (e.g. 5834 vs. 5117 µmol O_2 m^{-2} h^{-1}, respectively), confirming the importance of emmersed production in this habitat. Comparatively, production rates in the MPB habitat were found to be greater during submerged conditions (2734 vs. 1291 µmol O_2 m^{-2} h^{-1}, respectively), possibly due to nutrient availability. For both habitats, rates of productivity were generally found to be higher during the summer months, likely linked to seasonal variations in primary producer biomass. Ultimately, the results of this study will assist in identifying light thresholds of benthic primary producers and demonstrate how changing light regimes influences nutrient processing and fluxes. This research will underpin modelling efforts to predict the effects of anthropogenically driven habitat degradation. Such information can inform decision makers in pathways to protect and restore coastal environments and the valuable services they provide.

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Te Hunga Takutai o Aotearoa
NEW ZEALAND COASTAL SOCIETY

Day 1, Session 3, Stream 1: Water Quality

Wed 13th Nov 2019, 16:00-16:20, Stream 1: Water Quality

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Drones for coastal water quality sampling: A novel solution for sampling in challenging situations

Water quality sampling at a range of offshore distances is important for understanding coastal water quality issues and risks to human health from contamination such as wastewater overflows. Safeswim, Auckland Council's website for informing the public about water quality at swimming beaches throughout the region, also benefits from ongoing sampling to validate the models behind the platform.

However, sampling in deep water can be hazardous to staff, expensive and logistically challenging. Traditional offshore sampling methods, including using boats and helicopters, involve significant hazards (e.g. drowning), incur substantial cost, and are difficult to deploy rapidly enough to capture the impacts of weather-related pollution events. Efforts to understand, and ultimately improve, coastal water quality are therefore hampered by the shortcomings of existing sampling techniques.

In this presentation we describe an innovative method for collecting water samples from deep water using a drone, that addresses many of the challenges other methods face. Using a relatively inexpensive waterproof drone and standard sampling equipment, we demonstrate the collection of water samples for enterococci analysis from up to one kilometre offshore at six popular Auckland beaches. The method allows for rapid deployment and sampling in response to heavy rain events, capturing data when it is needed most, while eliminating hazards to staff associated with working over deep water.

This novel method is helping refine the Safeswim model and increase understanding of crucial coastal water quality issues in the Auckland region. With multiple alternative applications, the method has the potential to transform the way water quality sampling is done in challenging situations.

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Wed 13th Nov 2019, 16:20-16:40, Stream 1: Water Quality

Rob J. Davies-Colley[1], Mark Gall[2], Dave Bremner[1]
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Rapid boat survey of contaminated river plumes in coastal waters using PUFTS (Portable Underway Flow-Through Sampler)

Most contamination of coastal waters and estuaries in New Zealand results from land runoff via rivers of mud, nutrients, faecal microbial contaminants and urban toxics. The behaviour of land-sourced contamination in the coastal zone is challenging to study as it tends to be dominated by storm-flow events, changing rapidly in space and time. Here we outline the development [and demonstrate the use] of a PUFTS for use on small boats to:

- study the behaviour of highly non-conservative contaminants (notably microbes) in relation to conservative or near-conservative water mass tracers (e.g., salinity, CDOM)
- assist with hydrodynamic modelling of coastal mixing
- 'sea-truth' remote sensing of coastal water quality and river plumes.

There are several examples (or designs) of so-called 'ferry-box' systems in use on larger vessels. Ferry-box systems, originally deployed (as the name suggests) on ferries to obtain otherwise hard-to-get oceanographic data, are built around constant pumping of ambient surface water to a system of water quality sensors while the vessel is underway. Traditional ferry box systems are quite complex with be-spoke data acquisition system (DAS) and take considerable time to 'permanently' wire and plumb. We required a portable system with minimal setup, for rapid response to river storm-flow events.
For river plume surveys, we greatly simplified a prototype PUFTS to its core – a pump and plumbing feeding a highly efficient vortex (centrifugal) de-bubbler prior to the water quality sensors monitored continuously using a YSI EXO2 sonde. Sonde sensors include: salinity (conductivity), temperature, turbidity, chlorophyll *a* fluorescence and fluorescence of coloured dissolved organic matter (CDOM). The new cut-down version of PUFTS, built into a Pelican® case for ease of transport, can be deployed in less than an hour. The sonde hand-held interface logs position (GPS) with other sensor data at 1 sec intervals, and sensors are automatically wiped every 5 or10 min. Discrete water samples are taken at intervals or at points of interest such as fronts for laboratory analyses to verify or locally calibrate the sonde sensors (e.g., turbidity to beam attenuation or SPM) or, crucially, for attributes (such as faecal microbes) for which sensors are lacking. The cut-down PUFTS will be presented with an outline of current applications in NIWA research on muddy, microbially-contaminated, river plumes. We anticipate broader future applications including calibrating or validating hydrodynamic models and sea-truthing optical remote sensing of coastal water quality.

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Wed 13th Nov 2019, 16:40-17:00, Stream 1: Water Quality

Mark Ivamy and H. Nomoto
Bay of Plenty Regional Council

Tsunami Response and Recovery – Local lessons from the Great East Japan Earthquake

The Great East Japan Earthquake of 2011 caused a significant tsunami along the north east coast of Japan. The tsunami claimed the lives of approximately 20,000 people and caused widespread damage. Eight years on and 95% of the recovery projects are complete across the Tohuku region. This presentation shares the finding s of a two day study tour to the Iwate prefecture, which had the largest number of casualties and evacuees. The focus of the tour was to meet local people responsible for the immediate response, evacuation and recovery within community groups and also the education and government also. The presentation will share their learnings on disaster preparedness and key challenges to recover from such a catastrophic event.

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Day 1, Session 3, Stream 2: Ecology and Ecosystems 3

Wed 13th Nov 2019, 16:00-16:20, Stream 2: Ecology and Ecosystems 3

Chris N. Battershill
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Can we move coastal ecosystems away from the edge? Marine spatial planning, marine reserves and resilience enhancement in New Zealand and Australia

Arguably many coastal ecosystems are near or at a tipping point. At the same time there is increasing pressure for more intensive use of resources across a range of sectors, especially along our urbanised coasts. The solution to effecting acceptable environmental compromise is through experimental assessment of likely ecological effects, in response to planned developments, combined with long term spatial planning. Two Australasian case studies will be presented that demonstrate how environmental concerns may be mitigated by 1) planning for environmental effects likely in response to establishment of new oil and gas processing hubs in north west Australia and designing mitigation protocols to limit damage based on experimentation; and 2) planning for future coastal developments in the Hauraki Gulf, northern New Zealand, invoking arguably the world's most comprehensive public participatory marine spatial planning process factoring in environment, economics, society and cultural concerns. Drawing across these experiences suggests a framework for future approaches to managing our coastal marine estate. Of significance are close linkages that evolve from unlikely sectors. Strongest appear to be a potential harmony among marine conservation, fisheries and aquaculture interests.

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Wed 13th Nov 2019, 16:20-16:40, Stream 2: Ecology and Ecosystems 3

Sam Morgan
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What will become of our coastal fringe habitats and systems?

The composition of our coastal fringe habitats is a balance between coastal processes and catchment dynamics. But as sea-level rises how will our coastal fringe habitats to adapt to the changing conditions. This discussion aims to explore some of the clues out there and identify some of the changes that we can expect to see.

Recent subsidence events (geologically) in the Hawkes Bay, Bay of Plenty and California have demonstrated changes akin to rapid sea level change. The ecological change associated with these events these has been documented both geologically and ecologically and provide insight as to how our coastal habitats might change.

Further research around Holocene barrier beach behaviour has demonstrated resilience within dune and beach systems to fluctuations in sea level position and sediment supply. This information may provide context around future beach behaviour and possible implications for current and future management options.

Examples of contemporary management issues at McGregors Bay and Little Shoal Bay will be examined as a means applying this knowledge.

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Wed 13th Nov 2019, 16:40-17:00, Stream 2: Ecology and Ecosystems 3

Okoye Onyedikachi Kingsley, Ali Adaeze Angela.
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Retraction of eroded Spartina alterniflora in Yancheng Nature Reserve- a threat to red crowned crane habitat

Yancheng National Nature Reserve area is predominately mapped out and prohibited from any anthropogenic pressure for over wintering of red-crowned birds and endangered bird species. The trend of Spartina alterniflora salt marshes habitat in this reserve were monitored closely with remote sensed multispectral and hyperspectral satellite imagery from 2009-2018, results shows that wave action along the shoreline causes erosion of the salt marsh, which leads to formation of a cliff. These causes changed the growing trend of Spartina alterniflora from seashore to inward the reserved area towards Suaeda Salsa habitat, which is the preferred breeding habitat for red-crowned cranes. This paper shows how the retraction of Spartina alterniflora are invading Suaeda salsa vegetation and also predicts how much of Spartina alterniflora vegetated area to be lost to erosion in the near future.

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Te Hunga Takutai o Aotearoa
NEW ZEALAND
COASTAL SOCIETY

Day 1, Session 3, Stream 3: Coastal Science 2

Wed 13th Nov 2019, 16:00-16:20, Stream 3: Coastal Science 2

Hannah Jones, Deniz Özkundakci, Stephen Hunt
Waikato Regional Council, Hamilton

Bridging the gap: An operational framework for implementing best practice guidelines in environmental modelling

Environmental models are increasingly relied upon to inform natural resource management. Models have tended to become increasingly complex, often incorporate a broad range of disciplines, and may be integrated across domains. It is easy for a non-modeller to remain unaware of the limitations, uncertainties, omissions and subjective choices in such complex models. The risk is then that too much confidence is placed on the outputs and/or predictions of the model. There is also a danger that models may be used outside of the context they were intended for, increasing the likelihood of drawing invalid conclusions.

We have previously identified and documented challenges associated with the use of predictive modelling in the environmental and resource management decision-making process. All of the legal challenges to models related to the scientific components of the model (e.g., assumptions, input data, and parameters), model evaluation or application. Despite numerous publications that describe best practice for modelling from a technical perspective, it appears that these guidelines are not always being followed. A principal reason for this appears to be a disconnect between the modellers and those who have to use the model output to guide decision-making. There is a need to bridge this gap between modellers and those that manage modelling projects for environmental decision-makers.

Here we outline an operational framework that aims to facilitate the implementation of appropriate best practice guidelines in environmental modelling, thus improving the defensibility of the modelling work, as well as providing a structured approach to improving understanding between modellers and those that commission and use the model to make decisions. The framework accounts for multiple factors that can influence the 'success ' of applied modelling studies, including project scoping, setting expectations of what can actually be achieved with a model, and increasing the understanding on the technical aspects of the modelling process for the decision-maker or their representatives throughout the project. The framework will also enable modellers to clearly and completely document and communicate the choices made in the modelling process (and the implications of these). Finally, the framework attempts to enable a better understanding for the need for models versus alternative lines of evidence, such as monitoring and experimental studies.

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Wed 13th Nov 2019, 16:20-16:40, Stream 3: Coastal Science 2

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[1]Cawthron Institute, Nelson, [2]University of Waikato, Hamilton, [3]University of Auckland, Auckland

Environmental metabarcoding as a novel tool for coastal management

At present, health of our coastal environments is primarily determined by assessing changes in the abundance and diversity of the larger animals inhabiting the sediments. The current method involves morphological identification of these animals under microscopes, a time consuming and expensive process that relies on expert taxonomic knowledge. Focusing on the 'visible' organisms also neglects the contribution of the 'invisible' but critically important smaller organisms (e.g. bacteria, microalgae and meiofauna), which are known to be sensitive indicators of environmental change.

Recent advances in molecular sequencing technologies allow for species diversity to be assessed rapidly from the genetic material contained in small amounts of sediment using a technique known as environmental DNA (eDNA) metabarcoding. Metabarcoding allows identification of a wide spectrum of organisms by matching short, taxa-specific gene fragments to a reference sequence library. Because standardised protocols for specific applications can be developed and the results audited, metabarcoding could become a cost-effective, reliable and rapid option for environmental assessments.

As part of a project funded by the Sustainable Seas National Science Challenge, we use environmental metabarcoding to examine the response of communities (bacterial, eukaryotic and microalgal) to nutrient enrichment in two estuaries. These controlled experiments provided an excellent opportunity to test the applicability of new eDNA metabarcoding techniques for detecting nutrient enrichment effects in coastal environments. This research represents a critical first step toward the development of molecular-based monitoring tools that could provide a more comprehensive and standardised approach to monitoring estuary health with rapid turn-around times and lower costs.

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Wed 13th Nov 2019, 16:40-17:00, Stream 3: Coastal Science 2

Madeline Glover, Chris Hepburn, Matthew Desmond, Emily Tidey, Anne-Marie Jackson
University of Otago

Habitat mapping of *Macrocystis pyrifera* (*M.pyrifera*) along nearshore coastal Southern Otago, New Zealand

Anecdotal evidence describes the presence of large *Macrocystis pyrifera* (*M.pyrifera*) kelp forests along the southern Otago coastline which are now no longer present. There are many different hypotheses why these kelp forests have disappeared but most attribute the loss to an increase in sedimentation in coastal waters due to the downstream effects of gold mining, agriculture, industrialisation, and urbanisation. Anecdotes describe kelp forests that supported *Jasus edwarsii*, *Haliotis iris, Evechinus chloroticus* and *Odax pullus*. Anecdotal evidence such as this, has been shown to be important for inferring historical conditions when there are no long term data sets available. Natural fluctuations and disappearance of entire beds is not uncommon in well studied Californian kelp beds, however, it is important to determine if *M.pyrifera* forests along the Otago coast disappeared due to anthropogenic implications such as discharged waste waters, agriculture or mining or if it is attributed to natural changes such as El Nino cycles, storms, and rainfall. By understanding the drivers of loss we are better informed to restore these once productive ecosystems.

This project aims to investigate the distribution of *M.pyrifera* along the southern coast of Otago from Green Island to the Clutha River. There are three key questions and objectives of this project, (1) determine the historic extent of kelp forests along the coast south of Green Island (2) estimate potential periods of change and their triggers, (3) determine and quantify the presence of potential habitat that may remain in the study area. The study design as such will then be divided into answering these three components, (1) interviews, sounding sheets and satellite/photo imagery of the coastline to record historic growth, (2) interviews, Otago Regional Council river discharge data, and Otago Coastal Hazard Reports to determine periods of change and triggers, and (3) multibeam and dive surveys to record areas where habitat may still be suitable to *M.pyrifera* growth.

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Day 2, Session 4, Stream 1: Coastal Hazards 1

Thurs 14th Nov 2019, 10:00-10:20, Stream 1: Coastal Hazards 1

Kate MacDonald, Deirdre Hart, Sebastian Pitman
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Can 1m of uplift offset 1m of Sea Level Rise? An investigation into the post-earthquake response of mixed sand and gravel beaches, Kaikoura, New Zealand

Following a large earthquake, a coastline can be significantly warped, resulting in an instantaneous change in relative sea level. The 7.8 M_w earthquake in Kaikoura on the 14th of November 2016 prompted an instantaneous approximate 1m uplift around the Kaikoura Peninsula and the mixed sand and gravel beaches which line the adjacent coastline. The short-term response of mixed sand and gravel (MSG) beaches to instantaneous relative sea level fall is poorly understood, however long term analysis of these beach types suggest that erosional trends can initially be masked by the uplift, but over time the dynamic high energy coast reworks itself to re-establish its pre-earthquake beach profile.

GNSS surveying was used to document the response of MSG beaches two years after the Kaikoura earthquake to relative sea level fall. Classification of Kaikoura MSG beaches into 'within-type' variations using pre-earthquake profile data gave insight to the various coastal processes acting along the coastline, and helped to further inform how the beaches may respond over a longer time scale in the warped environment.

The results of this study showed that Kaikoura beaches could be classified into three within-type variations, in which they could be seen to be responding to the earthquake in similar ways when resurveyed in both 2017 and 2018. Volume increase, progradation and berm redevelopment relative to sea level occurred at all sites that were resurveyed two months after the earthquake, but two years later the responses between within-type variations changed. Conceptual response pathway models for erosional and accretional trending beaches were developed using the results from the GNSS surveying collected in this study to inform the longer-term response of these beaches.

This presentation will cover results which indicate that at the coastal interface, 1m of uplift does not offset the expected 1m of SLR as the beach profile slowly returns to is pre-earthquake extent. While properties landward of the interface may now be more resilient against coastal inundation, the edge is only likely to be temporarily more resilient to coastal erosion due to the fast and dynamic responses of the high energy MSG environment.

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Thurs 14th Nov 2019, 10:20-10:40, Stream 1: Coastal Hazards 1

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Experimental studies of tsunamis generated by submarine volcanic eruptions

Volcanic tsunamis are rare but are devastating disasters when they happen. As an example, Krakatau volcano is a large and active volcano that erupted in 1883 and generated a destructive tsunami with a maximum wave height of 45 m; 36,800 people lost their lives in this disaster. In December 2018, a much smaller eruption produced another tsunami, which killed 431 people. One reason for the occurrence of these catastrophes is that waves generated by the eruptions can spread the devastating effects to distant places, where increasing coastal populations magnify the risk. Tsunami waves commonly cause more significant damage than the eruptions themselves.

Pyroclastic flows, caldera and flank collapses, and submarine volcanic eruptions are the typically most common mechanisms for initiating volcanic tsunamis. In this study, we focus on underwater volcanic eruptions and their tsunami generation potential. Previous studies of similar mechanisms have focused on the characteristics of the jet or plume motion as a proxy of the eruption, such as plume-jet front heights. However, few studies have investigated the mechanisms of wave generation and subsequent propagation on the water surface. In the present study, we conducted a series of physical experiments, in which non-condensing gas was injected into a tank with an initially still water surface. Then, we analysed the impact of the different initial conditions (water depths, initial gas pressures, and eruption durations) on the wave characteristics in order to explain the relationships between them. We also compare our experimental results with those of an underwater volcanic eruption in Lake Karymskoye in 1996, which enables us to classify that eruption as a shallow-water one. This study helps us further understand the unseen mechanism of submarine volcanic tsunamis.

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Thurs 14th Nov 2019, 10:40-11:00, Stream 1: Coastal Hazards 1

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Field Survey and Preliminary Modelling of the Tsunami Generated by the 22 December 2018 Eruption of Anak Krakatoa Volcano

On December 22, 2018, an eruption and partial collapse of the Anak Krakatau volcano generated a tsunami in the Sunda Strait. The tsunami caused catastrophic damage and more than 400 deaths in the provinces of Lampung (Sumatra) and Banten (Java). An international tsunami survey team (ITST) deployed from 4 to 9 February 2019 focused on the islands in the Sunda Strait: Rakata, Panjang, Sertung, Sebesi and Panaitan. The team interviewed eyewitnesses, documented flow depths, runup heights, inundation distances, and impact on the natural and built environment.

The largest tsunami impacts occurred on the steep shorelines of the small islands within 5 km of Anak Krakatoa with maximum runup of 85 m on Rakata and 83 m on Sertung. On Sebesi Island, located 15 km northeast of the source, tsunami runup heights remained below 10 m. In contrast, tsunami heights of 10-15 m were observed on Painatan and in the Ujung Kulon National Park located 50 km southwest of Anak Krakatau. The runup distributions on the islands encircling Anak Krakatau highlight the directivity of the tsunami source with volcano's collapse occurring towards the southwest. Inundation and damage were mostly limited to within 400 m of the shoreline given the relatively short wavelengths of the slump-generated tsunamis. A significant variation in tsunami impact was observed along the shorelines of the Sunda Strait with tsunami heights rapidly decreasing with distance from the point source. Preliminary numerical modelling using a 'hot start' initial condition with a dispersive Boussineq-type numerical model satisfactorily reproduce the observed tsunami propagation patterns and measured wave amplitudes.

This event has lessons for New Zealand in that the tsunami caught locals off guard, this despite the history and six-months of eruptive activity in the lead up. This highlights the need for community-based education and awareness programs as an essential life-saving tool in locales at risk from locally generated tsunamis.

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Day 2, Session 4, Stream 2: Ecology and Ecosystems 4

Thurs 14th Nov 2019, 10:00-10:20, Stream 2: Ecology and Ecosystems 4

John Duder
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Auckland's Hauraki Gulf – SOS, or the Turning Point?

A voyage on the Gulf usually shows blue seas and green islands, but where are the birds, and even more so the fish? Twenty years ago the HG Marine Park Act 2000 lead to the HG Forum, formed from the constituent local authorities, iwi representatives, government authorities and other interest groups.

The Forum was charged with addressing the serious decline in fish stocks, and the marine ecosystem, including associated bird life. Despite 3 yearly reviews, most recently 2017, preceded in 2016 by Sea Change, Tai Timu Tai Pari, little had been achieved, with an acknowledged dearth of communication and leadership from Council(s) and Ministries.

However change may have started; new Ministers and the current Forum chair and Deputy are fronting up, with the appointment of Alex Rogers as Executive officer to the Forum.

The Forum go approval in May from constituent Councils to 2 key proposals:

- To place at least 20% of the Gulf area under some form of protection; e.g. reserve, no fish-take etc
- To restore 1000 km^2 of reefs and kaimoana beds to address the devastation from dredging, trawling and sedimentation.

The Sea Change spatial plan supports those initiatives with comprehensive actions under 16 categories.

It is not all gloom; the Gulf islands are relatively well managed by numerous trusts, with focus on predator eradication. Whale strikes have been reduced by lowering of ship speeds. But the birds must have fish, and there's the rub.

This paper summarises the history of decline, reviews the current critical state of several parts of the marine ecosystems, and over views the strategies being developed to improve matters.

It may take years to rebuild fish stocks; but hopefully the Forum will be able at least to show progress and changed attitudes to visitors to the Americas Cup in 2021.

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Thurs 14th Nov 2019, 10:20-10:40, Stream 2: Ecology and Ecosystems 4

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Downtown Public Space marine ecological enhancements

The Downtown Public Space (DPS) is one of a suite of projects to progress the Downtown Infrastructure Development Programme (DIDP) in the downtown waterfront area of Auckland, prior to AC36 and APEC 2021. The project constitutes a tidal shelf of interconnected spaces, a Pōhutukawa coastal forest connecting the tidal shelf to Quay Street, open apertures to the sea below and small outcrops. A floating pontoon (with a dual safety function) is also incorporated into the design.

This presentation will give a high level overview of the DPS project as an excellent opportunity to establish and promote the concept of 'living' systems in Auckland's urban marine environment. This approach is increasingly being adopted overseas, e.g. the New York State 'Billion Oysters' Project, but there are few, if any, examples in New Zealand.

In terms of appropriate species, Green-lipped mussels (*Perna canaliculus*) are preferred, based on their historical abundance in the Hauraki Gulf, before over fishing caused stocks to collapse in the mid-1900s. Successful translocations of Green-lipped mussels have already been undertaken in the Hauraki Gulf, as part of the Revive our Gulf mussel reef restoration project. Green-lipped mussels are filter feeders and can help to improve water quality by filtering contaminants, nutrients and sediment out of the water column.

To inform the long term deployment of marine ecological enhancements in the DPS, trials are to be deployed prior, with the intention of monitoring replicates of vertical and horizontal lines and floating buoys, seeded with Green-lipped mussels. Survival success and the rate of establishment of non-native species on the lines will inform the extent and type of full deployment in the DPS. In addition to Green-lipped mussels, the additional substrate provided also creates space for settlement of other native species, including native kelps, and contributes to increasing biodiversity in the area.

As seen in other heavily impacted, urban marine areas, there is an elevated risk of invasion by pest species. This means that the native species that may grow naturally in this area may be excluded, or eventually overtaken by invasive species such as the Asian kelp Undaria (*Undaria pinnatifida*) and the Mediterranean fanworm (*Sabella spallanzanii*). Despite this risk, the intention is to use the installations as an excellent opportunity to educate the general public about the detrimental outcomes of the introduction of invasive species.

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Day 2, Session 4, Stream 3:

Coastal Science 3

Thurs 14th Nov 2019, 10:00-10:20, Stream 3: Coastal Science 3

Emily Tidey, Kara Jurgens, Jean-Louis Morrison
Te Kura Kairūri/National School of Surveying, University of Otago

Tuia: 250 years of navigation, map making and belonging

It is 250 years since the first encounters between Māori and Captain Cook's European crew in 1769. This important moment in our shared history will be commemorated all over Aotearoa in late 2019. Tuia means 'to weave or bind together' and more information on commemoration events can be found at the Ministry for Culture and Heritage website: https://mch.govt.nz/tuia-encounters-250.

Te Kura Kairūri (the National School of Surveying at the University of Otago) has been commemorating the geospatial aspects of the first encounters. As surveyors and spatial scientists, we wish to celebrate our professional 'ancestors'.

Emily and students have investigated New Zealand charts, voyage diaries and spatial data to consider the development of hydrography and nautical charting over the last 250 years in New Zealand. In addition, we surveyed the hydrographic community of New Zealand to build a picture of the profession today which we contrasted with hydrographers of the past. Among our interesting findings was that many professional hydrographers have worked with data collected by Cook during his voyages, highlighting the longevity of his charting work. In this conference presentation we discuss highlights from our work on this project.

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Thurs 14th Nov 2019, 10:20-10:40, Stream 3: Coastal Science 3

Anna M. Meissner, Rachel Gabara
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Navigating New Zealand to a thriving Blue Economy

Our future relies on a clean and healthy ocean, to provide food, generate jobs, deliver energy and provide communication highways. The ocean helps regulate the climate and supports biodiversity. However, the ocean is vulnerable and today many marine habitats and species are under serious threat from the effects of climate change, over-fishing, pollution and unsustainable use. Organisations call for actions, but where do we start?

Knowledge is the basis of our actions and policies to ensure protection of our ocean, responsible management of marine resources and sustainable future economic growth. Land Information New Zealand (LINZ), through the New Zealand Hydrographic Authority (NZHA), collects hydrographic data for navigational safety vital for maritime transport. NZHA recognises hydrographic data and the information derived from it has value beyond the original investment. This data can play a crucial role in understanding changes occurring in our oceans and can offer opportunities for fostering blue growth. To protect our ocean, unleash the power of innovation and balance production and sustainable use, partnerships between government, local communities, researchers and private investors are needed.

NZHA has been reaching out to organisations interested in marine geospatial information and facilitated the establishment of the NZ Marine Geospatial Working Group (NZMG-WG) in February 2019. The NZMG-WG brings together stakeholders from the public and private sectors and research institutions to identify opportunities of partnerships and put knowledge into action to meet the challenges facing our ocean. To unlock the value of marine geospatial information, understanding what data exists and how it can be accessed is of high priority. In recent months, cross governmental partnerships have been established to contribute towards a national marine data inventory and enhance our collective knowledge. This stocktake will facilitate gap analysis for future investments and data acquisition and represents a first step to improving accessibility and discoverability of marine geospatial information to unleash the power of innovation and business.

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Thurs 14th Nov 2019, 10:40-11:00, Stream 3: Coastal Science 3

Duncan McKenzie
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Insights into surfing as a nature based blue space physical activity that not only promotes wellbeing but is moving the maxim; live to surf to surf to live

Modern times present modern problems and some of these problems are compounded by increasing time spent inactive, indoors and on devices. In her book 'Natures Fix' Florence Williams reminds us that we are more disconnected from nature than any generation before us, yet we are increasingly burdened by chronic ailments (such as depression, loneliness, anxiety and obesity). Conversely, researchers have shown the many benefits of physical activity and in recent years have outlined benefits for health and wellbeing associated with outdoor settings. For example, forest bathing (Shirin Yoko) participants report reduced blood pressure, resting heart rate and cortisol levels. Contact with nature has shown to replenish cognitive attention and help to improve feelings of vitality, connectiveness and wellbeing.

One natural environment that promotes wellbeing is the coastal or 'blue space' environment. In New Zealand surfing has experienced significant growth in participant numbers in recent years and in many ways this growth can be linked to a "perfect wave" of factors that contribute to health and wellbeing. As coastal marine users, surfers and the surfing community can offer insight into health and wellbeing and provide an example of how this aquatic activity can help people cope with modern world stress.

Surfers know the value of surfing. Surfing can be a cure-all, a good way to de-stress, a blast, a stoke, an all-round great activity. Experiencing the peace of surfing with only the sea and waves for company can be a form of mindful meditation. For a surfer, getting into the water with a group of friends can feel like medicine. However, for some it is more than this, surfing is becoming an actual medical therapy. Researchers are exploring the therapeutic effects of surfing and applying these to current world health maladies. The value of treatment that address a patient's holistic wellbeing while recognising the unique and broad benefits of surfing is gaining traction in our medical, social and political communities. Because of surfing's unique and not so unique set of advantages, we may no longer simply live to surf, but surf to live.

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Day 2, Session 5, Stream 1: Coastal Hazards 2

Thurs 14th Nov 2019, 11:20-11:40, Stream 1: Coastal Hazards 2

Deirdre E. Hart[1], Sebastian Pitman[1], Do-Seong Byun[2]
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Multi-hazard prone coasts – where are we now, and where to from here?

Since 2010, New Zealand has experienced several major 'coastal quake' disruptions to coastal environments. Natural and built components of coastal cities and rural centres have been affected, including in Christchurch, Kaikoura and Wellington. Over this time we have also adopted the second generation *New Zealand Coastal Policy Statement* (2010) and started to employ new Government guidance regarding *Coastal Hazards and Climate Change* (2017). Questions arising include: 'Where are we now' in terms of processing and integrating these complex experiences?; and What more is needed to inform future directions?

This paper begins by highlighting some of the temporary and lasting effects of the Canterbury, Kaikoura and Wellington coastal quake experiences for open coast, hydrosystem and Lifeline linkage settings. This summary is used to reflect on ways of viewing coastal resources and hazards. Secondly, we explore the potential and limitations of current multi-hazards science for translating coastal quake lessons into improved hazard assessment and management practices. Case study analyses of coastal city flooding and erosion are illustrated. Key multi-hazard questions posed are: How can one kind of event alter the antecedent conditions of another kind of event?; What might be different if two kinds of event occur together, and how likely are they to occur together?; and How can multi-hazard interactions be represented in hazard assessments in a New Zealand context?

This paper suggests that reflecting upon our experiences of 'coastal quake' interactions, including the dynamics of response, recovery and rebuild phases, could help transform our approach to planning and managing coastal settlements, in particular for climate change adaptation. Key take-home messages include the importance of thinking through how elements of the coastal environment intersect with wider systems beyond our expertise. Also key is to know your data and its limits. Multi-hazards thinking reminds us that in coastal systems interactions are key; experts are learners; and it is crucial to remember the 'why' when investigating a specific coastal issue.

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Thurs 14th Nov 2019, 11:40-12:00, Stream 1: Coastal Hazards 2

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Avon-Heathcote Ihutai Estuary Edge Inventory: Assessing the condition of structures along the Eastern Edge post CES

The community of South New Brighton is a suburb of Christchurch located on a 5km long sand spit between the ocean coast and the Avon-Heathcote Estuary. A total of 55% of the eastern estuary edge contained coastal structures including council constructed gabion baskets, reno mattresses and revetments, and over 1.5km mixture of privately owned seawalls and revetments built to various standards.

During the 2010-11 Canterbury Earthquake Sequence (CES) the land was significantly altered through subsidence, liquefaction, lateral spread and uplift, resulting in 198 properties along the estuary edge being red zoned in 2012 and coastal protection walls along the estuary edge being destroyed or badly damaged. In the eight years following the CES the community have reported that erosion and flood hazards around the estuary edge have worsened due to the changed land form and loss of protection. Over this time the community have campaigned for the level of flood and erosion protection to be returned to what it was pre-the CES. Christchurch City Council have now initiated this 'earthquake Legacy' project and as the first stage commissioned Jacobs to undertake an Estuary Edge Condition Inventory to provide factual information of the current and former condition of the structures and land around the edge to determine the cause and magnitude of changes to the levels of protection against inundation and erosion.

The inventory involved collecting field data on current land and structure elevations and position using GNSS surveying, and on current condition using smart data forms photographs, drone imagery. This information was compared to historical records, and pre-earthquake LiDAR surveys and aerial photographs. Changes in shoreline position and elevation, along with current condition ratings were mapped and all information was compiled a comprehensive spatial database in GIS.

The study examined the relationship between structure type, condition, elevation and shoreline erosion since the CES. This presentation will present the results of the study, and how the council are using them to highlight priority areas and identify potential options for the restoration of the estuary edge under the earthquake legacy project.

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Thurs 14th Nov 2019, 12:00-12:20, Stream 1: Coastal Hazards 2

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The role of mangroves in coastal flood protection: A New Zealand perspective

Mangrove forests have been shown to provide coastal protection by reducing waves, moderating currents, stabilizing sediments, and lessening potentially damaging storm winds. However, the interaction between storm surge and mangroves is less understood with some studies showing peak water level reductions on the order of 0.5 m per km of forest, and other work demonstrating negligible flood reduction. Existing work on the protective benefit of mangroves with respect to coastal inundation have generally been limited to water level observations and numerical simulations of hurricanes impacting the south-eastern United States (US). Although these existing studies are valuable, fundamental understanding of key problem variables is lacking. Additionally, the applicability of results from the US in which wide forests of low topographic gradient are impacted by large hurricane driven storm surges to New Zealand where relatively small mangrove forests are impacted by smaller flooding events is unknown. Improved understanding of the interaction between coastal flooding and mangroves is required for New Zealand land managers to make informed decisions with respect to mangrove forests.

The interaction of mangroves and coastal flooding is investigated using a numerical model of Pahoia in Tauranga harbour. Mangroves inhabit a ~1 km wide flat intertidal region bisected by steep-sided channels. Water flux through the area is dominated by channels and therefore mangrove properties (vegetation density) has less influence on flood attenuation than channel dimensions. Using a combination of field data, a simplified analytic solution, and numerical approach we demonstrate that mangroves can reduce water conveyance and act as a water storage mechanism providing an effective form of coastal flood protection if water flows through the vegetation and forests are sufficiently wide/dense to restrict water exchange during a storm.

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Te Hunga Takutai o Aotearoa
NEW ZEALAND
COASTAL SOCIETY

Thurs 14th Nov 2019, 12:20-12:40, Stream 1: Coastal Hazards 2

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Understanding hydrological hazards risks for assets and operations in oil and gas terminals: BP natural hazards risk screening with Lyttelton as case study

Within the context of increased climate variability and climate change, there is a growing recognition of the benefits arising from the understanding of natural hazards. Private organisations and businesses are investing in understanding their exposure and vulnerability to natural hazards and the impacts of a changing climate.

WSP Opus undertook an investigation to assist BP to understand these risks and help improve their operational resilience at seven terminals across New Zealand. This was undertaken in a staged approach to allow prioritisation of investigations at high-risk terminals and to adapt or change the delivery programme as required.

The initial stage consisted of a screening process to evaluate the existing hazards, which involved working alongside BP to understand historical incidents and vulnerability of assets. The hazards reviewed included coastal inundation and erosion, fluvial and surface water flooding, slope stability (including drainage blockages and road closures), groundwater levels and tsunamis.

Subsequently, a second stage consisted of a detailed assessment aimed at understanding the causes and likelihood of previously prioritised hazards. For efficiency, this assessment used available topographical and hydrological data, which was obtained from various sources including Ports, Regional Councils, local authorities and other private organisations. This was supplemented with new analysis such as seawall inspections using 3D models from a UAV (Unmanned Aerial Vehicle) survey, and the set-up of an adaptable XBeach-X model to run plausible future simulations.

Finally, we assessed the consequences of these hazards on the risk to local and nationwide operations. This included understanding the potential impacts of more extreme events (i.e. those of relatively low probability, but high consequence on assets and operations). This assessment will be used to inform investments into business continuity and to ensure the safe and effective operation of the terminal facilities.

The presentation will give an overview of the project approach and will present the advantages of staging a hazard risk assessment. The Lyttelton terminal will be presented as a case study highlighting the benefits of this approach. Finally, we will also explain the approach taken to assess coastal erosion and inundation though site observations, data analysis, modelling and collaboration with stakeholders

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Day 2, Session 5, Stream 2: Coastal Communities

Thurs 14th Nov 2019, 11:20-11:40, Stream 2: Coastal Communities

Raewyn Bennett
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Retaining Mātauranga Māori (as Mātauranga Māori)

Alongside the global surge of indigenous consciousness, the discourse of Indigenous Knowledge has become a popular topic of academic research and discussion in relatively recent times, despite its obvious antiquity. In respect of Mātauranga Māori, the Māori way of viewing the world and the kete thereof containing the knowledges of the first peoples of Aotearoa, it is possible to identify the convergence of some major strands of advocacy by Māori. We need to acknowledge also that the ascendancy of Mātauranga Māori in academia has been assisted by the anti-colonial theoretical framework, kaupapa Māori. Without an established alternative to Western dominated theories, i.e. kaupapa Māori, it is arguable that Mātauranga Māori would have gained the traction that it has.

I am ahi kaa to a small coastal settlement, Maketu, in the Bay of Plenty. My main Iwi are Ngati Pikiao, Ngati Makino and Ngati Whakaue. My formative years were influenced by Maori grandfather, a traditional fisherman. Before the diversion of the Kaituna River, our estuary Ongatoro, had been the 'pantry' for a largely subsistence Maori community. We have no land. The river was diverted in 1957 to satisfy farming imperatives and gradually lost its kaimoana abundance, mostly because of the sand infill, as the volume of freshwater became insufficient to flush out the incoming sand. Farming drains discharging into the estuary and loss of wetlands have not helped.

From the perspective of a pipi picker, retaining control of Matauranga Maori, is critical to our place in the sun. I draw on my experiences of various impacts on our coastal village in identifying red flags on the potential abuse of Matauranga Maori.

I hold that just as Te Reo Maori survival is critical to our identity and well-being and survival as Maori, so is our traditional ecological knowledge. The experiences I draw on, which include referencing Matauranga Maori, include:

- Interviewing kaumatua for the successful NZ Maori Council Fisheries case and making a note on how much of our fisheries knowledge was disappearing.
- The 2011 Rena ship disaster in Maketu, in which I am still involved.
- The present 14 million Kaituna Re-diversion funded by the BOPRC.
- Alongside the Kaituna re-diversion, developing and trialling a Matauranga Maori monitoring form on the estuary.

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Te Hunga Takutai o Aotearoa
NEW ZEALAND
COASTAL SOCIETY

Thurs 14th Nov 2019, 11:40-12:00, Stream 2: Coastal Communities

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Recognising Mana Whenua values through the removal of moorings from Ōkahu Bay, Auckland

The recent removal of the moorings from Ōkahu Bay is the result of a Ngāti Whātua o Ōrākei submission to the proposed Auckland Unitary Plan. The operative plan includes a new rule that makes moorings within the bay a prohibited activity. The process that led to the inclusion of that rule, and the subsequent implementation of the rule, provides useful insights for other coastal planning processes.

Ōkahu Bay is of great cultural significance to Ngāti Whātua o Ōrākei. The removal of the moorings has been a goal of the iwi since the moorings were established in the 1930s. The recreational, water quality, ecological, visual and landscape effects of the moorings had significant effects on the cultural values of the bay.

When the Auckland Unitary Plan was notified in 2013, the Ōkahu Bay Mooring Zone made moorings a permitted activity. The Ngāti Whātua submission sought the removal of the zone and the iwi presented extensive evidence at the hearings in 2015. The Independent Hearings Panel's recommendations were released in 2016 and included the requested provisions. The regional coastal plan part of the Auckland Unitary Plan became operative on 31 May 2018 and the moorings needed to be removed 12 months later.

In June 2019 all 154 mooring owners had arranged a new mooring licence location, but 30 moorings remained in the bay. The final mooring was removed on 2 August 2019. This process was achieved without any formal enforcement action, and with only limited controversy regarding the effects on the mooring owners.

The inclusion of this new rule required a decision to adversely affect existing uses where it had significant wider benefits. Removing the moorings has been an important step in the restoration of Ōkahu Bay and its surroundings, both ecologically and culturally. The removal has improved the recreational use of the bay and will benefit the wider community.

Some of the learnings from this process include: the power of a prohibited activity in removing consenting options for affected parties; the need for new plans to have an implementation plan with clear ownership within council; the need to respond to Mana Whenua submissions with an understanding of the wider statutory context and with an understanding of Mana Whenua connections to water spaces and their ongoing use and restoration.

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Thurs 14th Nov 2019, 12:00-12:20, Stream 2: Coastal Communities

Sarah McCarter
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Consenting and community engagement processes

Quality engagement processes are essential to good coastal management outcomes. The general wisdom is that highly participatory processes are best suited to developing acceptable and effective solutions for the complex issues which affect our coastline. These include engagement methods which support collaboration or involvement, and respond to the different values of areas affected by coastal issues and the worldviews of the communities that live or interact with these places are strongly preferred in.

However, implementation of the solutions that are developed through these processes typically requires resource consent under the Resource Management Act 1991 (RMA). This statutory process is undertaken in a formal framework which may not lend itself as well to collaboration. Extensive engagement prior to lodgement of resource consent applications can assist in addressing the more constrained nature of the statutory process, however the RMA decision-making framework establishes clear priorities for information to be considered by decision makers. For example, formal submissions have more weight than informal feedback received prior to lodgement (i.e. notwithstanding any previous input prior to lodgement, to be involved in the hearings process, people need to lodge a submission); and non-statutory plans developed on a collaborative basis are considered as 'other matters' when considering an application for resource consent.

This means that engagement needs to be done purposefully with intended outcomes and risks clearly articulated at the beginning of the project, linking engagement to the matters which will determine an application. This presentation explores the tools available to plan, design and implement engagement processes. In particular, stepping through strategic engagement and consent planning which works within the constraints imposed by the more formal decision making framework, but maximises the weight of these engagement processes at the outset.

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Thurs 14th Nov 2019, 12:20-12:40, Stream 2: Coastal Communities

Tom A. Simons-Smith
Dunedin City Council, in partnership with Kāti Huirapa Rūnaka ki Puketeraki

Going with the drift…wood – flexibility in coastal management, Ōhinepouwera (Karitāne Sand Spit)

Planning and decision-making processes need to be flexible if they are to provide genuine opportunities for communities and Iwi to shape project direction and outcomes. While there is a growing recognition that Iwi and community input is important and valuable, there are far fewer cases where this input is shown to influence project outcomes.

A small piece of work at Ōhinepouwera (Karitāne Sand Spit), north of Dunedin saw the Dunedin City Council (DCC) working with Kāti Huirapa Rūnaka ki Puketeraki (Puketeraki) and a local engineering company on ways to encourage sand trapping on the spit to reduce wave impact on the landward reserve, road and properties. The engineering recommendation was to use large wooden posts, heavy gauge wire, cloth and geosynthetic materials to maximise sand trapping potential and withstand wave impact. When working through these options with local knowledge holders and stakeholders, it became clear that a more environmentally friendly option would be a better fit with the values of the local community and the natural character of Ōhinepouwera.

An important part of the engagement was making sure everyone involved understood that anything placed on the sand spit could breakdown during storm surge and/or flood conditions, with the potential benefits of sand trapping being far less certain. It was found that a structure that would not damage or pollute the environment if it broke down would be preferred to a traditional wind cloth fence, even if its ability to trap sand was significantly lower.

From this notion, a low-impact 'driftwood' fencing option was developed, and in July 2019 the driftwood structure was built by 50 local volunteers – surfers, fishermen, local residents and representatives of Puketeraki Rūnaka, with the age of volunteers ranging between 6 and 75. All wood was sourced from the beach and dune area and was material that had washed up during floods and high tides. The wood was simply collected and repositioned to create a windbreak. Because the work aligned with local values, Puketeraki was happy to lead the initiative. Puketeraki arranged site access and used waka to ferry people to the sand spit. DCC and Puketeraki continue to support one another to monitor and maintain the structure and are looking to supplement the work with native plantings.

This small project helps highlight the importance of ongoing engagement and relationship-building between council and Iwi and is a great example of how communities can help steer intervention towards more sustainable and appropriate results when provided with the opportunity to do so.

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Thurs 14th Nov 2019, 12:40-13:00, Stream 2: Coastal Communities

Barry Smith
Otatara Landcare Group

Bushy Point – a Coastal Habitat Restoration Project

The process of inundation in a shallow sea in warmer times, to a cold high above sea level alpine environment during the ice ages, to inundation, to now just above sea level. This has been the story of Otatara for many thousands of years.

AD 1150. The Maori arrived in the area and used the resources for subsistence survival without changing the bio diversity of the area a great deal.

AD 1850. The arrival of the European settlers changed that and with a pronouncement: "We have arrived in a land of plenty with a climate better that that which we left. There are resources here, trees for timber and firewood with the added advantage that we will be able to turn that worthless forest into productive profitable farm land, so let us to it…."

AD 1999. BUGGER! We got it all wrong!
The land is not suitable for farming and we have nearly lost the biodiversity of a truly magnificent place. Enter the Otatara Landcare Group. Local People who have dedicated themselves to helping people preserve what we still have. Not only do we talk the talk, we also walk the talk. We have taken it upon ourselves to turn a worthless 14.9 Ha piece of grazing land into productive and profitable (for biodiversity) native forest.

This story so far has been 20 years in the making, along with 15,000 volunteer hours and 30,000 native plants in the ground.

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Day 2, Session 5, Stream 3:

Coastal Science 4

Thurs 14th Nov 2019, 11:20-11:40, Stream 3: Coastal Science 4

Sam Olufson
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Components and Costing of Managed Retreat in a Coastal Setting

Many coastal communities around the world are facing increased risks due to sea-level rise as global climate continues to warm. As a result, adaptation options that remove this risk from coastal communities require understanding to ensure their effective implementation when required. Managed retreat is one option that achieves this through the relocation and selective abandonment of at-risk structures and community facilities. This study deconstructs managed retreat into its component parts in order to understand what the adaptation option might comprise in different coastal contexts and creates an economic framework to cost these component parts. Managed retreat components are identified and grouped into stages to develop a novel 'tailored pathways' approach for implementation of components. This approach involves the use of signals and trigger points to adjust the activation of managed retreat components for when they are most appropriate and effective in specific coastal contexts. An economic framework was developed which identifies potential costing methods, determines which costing methods are relevant for different managed retreat components, provides indications as to what the costs are likely to be, and groups costs as either economic or transfers. This study provides information relevant to coastal planning and for decision making on adaptation options that can complement the use of the dynamic adaptive pathways planning approach recommended in the Ministry for the Environment Coastal Hazards and Climate Change Guidance.

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Thurs 14th Nov 2019, 11:40-12:00, Stream 3: Coastal Science 4

Jose F. Beya, Cindy Asmat. Hawkes Bay Regional Council, Napier

Concept Design for the Hawke's Bay Coastal Strategy Short Term Pathways

The fourth stage of the Clifton to Tangoio 2120 Coastal Strategy requires a refinement in the cost and concept design for the short-term preferred pathways selected by the community panels in the third stage.

Most of the design has been recently finished and it comprises engineering solutions for four main areas: i) Extension of the recently completed 480 m revetment at Clifton; ii) Groynes and nourishment at Haumoana and Te Awanga; iii) Nourishment for the northern cell in Westhsore, Bayview and Whirinaki; iv) Stopbank (Sea dyke) at Pandora (still at planning stage).

For Haumoana and Te Awanga, 4 alternatives including a range up to 64 new groynes between 20 m and 80 m of effective length, initial nourishment volumes up to 800,000 m3 and nourishment rates between 45,000 and 60,000 m3/y have been proposed with capital construction costs ranging from 3.6 to 200 million NZD.

For the northern cell, solutions including additional gravel nourishment between 23,000 and 33,000 m3/y on top of the existing 15,300 m3/y, can be achieved at an extra 1.6 to 2.3 million NZD/y in construction cost. These figures are highly uncertain as future prices will likely be affected by the proximity of sustainable sources.

Additionally, the disposal of suitable sandy material from the Port of Napier and Inner Ahuriri Harbour dredging will continue to be placed in the Westshore nearshore area, providing an added benefit to the coast at no extra cost to the community. Other alternatives such as the reestablishment and maintenance of the lost sandy beach at Westshore through sand nourishment were also assessed at a much higher capital and operational cost.

The solution for the Pandora area needs to be in line with the new Napier City Council Master Plan. The approximately 2,000 m of protection against inundation in this area requires a combination of engineering solutions from compacted earth sea dykes, sheet-pile walls, road raising, new revetments, concrete crown walls, land filling and raising of the SH2 highway which makes this a complex project.

For the Clifton revetment, the recently completed works allowed a more accurate estimate of the cost to complete the 630 m remaining (1.9 million NZD of additional construction cost). However, if nourishment as a mitigation for the downdrift effects is taken into account, the Net-Present-Value cost can increase in near 30%.

The outcome of this design will allow the other streams of the coastal strategy to continue with the planning and decision making. The results of the funding models and community consultation will ultimately determine whether the preferred pathways will be finally implemented, if lower levels of protection for the same pathways, or even different pathways may become the optimal affordable solutions.

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Te Hunga Takutai o Aotearoa
NEW ZEALAND
COASTAL SOCIETY

Thurs 14th Nov 2019, 12:00-12:20, Stream 3: Coastal Science 4

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Assessment of the effects of engineering works at a surf break at Mangamaunu, Kaikōura

Surf breaks, particularly those of high quality, are a limited resource and of great importance to the local and broader surfing community. They provide not only a recreational activity but a sense of identity to local surfers and can increase tourism by bringing travelling surfers to the area. While engineering works are not a preferred option within the active coastal zone, they are at times unavoidable. A framework has been developed to test the potential physical effects of engineering works on a surf break. This framework includes a baseline assessment of the surf beak based on field investigations, discussions with local surfers and various modelling approaches; an effects assessment which includes identification of the physical elements which define the use and enjoyment of the surf break; development of methods to quantitatively test the potential for adverse effects on each of these elements; and finally a risk assessment which includes the likelihood, consequence and overall level of effect. This paper presents this framework together with a case study of its use at Mangamaunu, north of Kaikōura on the north east of New Zealand's South Island.

Mangamaunu is a right hand point break with waves peeling along a cobble and boulder seabed off Mangamaunu Point. A large earthquake occurred in November 2016 and caused parts of the coastline to be uplifted by up to 3 m and numerous large slips to close State Highway 1 and the Main North Rail line north and south of Kaikōura. Along with the recovery project to re-open critical infrastructure, improvement works were proposed including a shared pedestrian and cycle path along the coast. At Mangamaunu Point, there is a narrow corridor between the backshore cliffs and coastal edge which also includes the state highway and main rail line. This would result in the shared path needing to extend onto the upper beach in two locations with some form of coastal works required to provide support and protection.

The impact of these coastal protection works on the surf break have been assessed through development of a framework for undertaking robust, evidence-based effects and risk assessment for surf breaks. Underpinning this approach is engagement of the local community and users throughout the process including defining how the surf break works, what is of value, how this should be tested and what the results mean in terms of level of effect. For Mangamaunu, as a result of the effects assessment and likelihood of various effects, a decision was made by the New Zealand Transport Agency not to progress the shared use path under the current consents.

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Thurs 14th Nov 2019, 12:20-12:40, Stream 3: Coastal Science 4

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The past and future wave climate of New Zealand: from hindcasts to projections

Time series of wave parameters (wave climate data) are fundamental to a number of applications including the design of nearshore and offshore structures, navigation and the assessment of coastal risks and hazards. Together with satellite altimeters and buoys, validated wave hindcasts are the typical source of wave climate data due to their spatial and temporal availability.

However, most hindcasts provide wave data as an unimodal set of integrated wave parameters, even in cases where the sea state is composed of two or more simultaneous wave systems – which often occurs in New Zealand waters. Furthermore, in the context of climate change, statistics based on the current wave hindcasts might not be representative for the future wave climate.

Here we provide three 20-year time-slices of high resolution, past and future wave climate data for the New Zealand waters. We developed one wave hindcast and a set of historical and projected wave climatologies from 3 global climate models (GCM) and two projected pathways. The hindcast consists of partitioned WAVEWATCH-III results from a 20-year (1993–2012) global wave model which were calibrated using a state-of-the-art directional wind-sea and swell wave height correction method based on satellite data. The corrected partitions were then used to reconstruct the multimodal wave spectra along the boundaries of a SWAN grid that encompasses the whole New Zealand area. Waves were downscaled in non-stationary mode with CFSR wind forcings through 4 levels of nested grids, storing both partitioned and integrated parameters. The historical simulations were obtained from a 13-year (1993–2006) downscale of wave data from three GCM (ACCESS1-0, CNRM-CM5 and MIROC5). The future wave climate database consists of two 20-year (2026–2046, 2080–2100) time slices of ensembles of wave climate projections from the same three GCMs and two different representative concentration pathways (RCP 4.5, RCP 8.5).

The partitioned perspective of the wave climate of New Zealand allows us to investigate the nearshore shadowing effects of small islands during multimodal sea states and also to separately analyze the main characteristics of the wind-sea and swell waves for a number of different events/time scales. At the same time, an assessment of the anomalies between the past and future GCMs provides us insightful information about the potential changes in the future wave climate of New Zealand. Both datasets will be of great value to a number of future studies, such as flooding, beach erosion, risk assessment and the mitigation of coastal hazards.

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Thurs 14th Nov 2019, 12:40-13:00, Stream 3: Coastal Science 4

Iain T. MacDonald, Glen M. D. Reeve
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Sensitivity analysis of a Delft3D fine-sediment transport model: Case study Wairoa Estuary and Tamaki Strait

Dispersal and settling of fine sediments within the aquatic environment can have detrimental effects on water quality (including visual clarity and light penetration), benthic ecosystem health and bed-sediment quality. Being able to manage the multiple environmental effects of fine-sediments and interactions with other stressors hinges on, amongst other things, our ability to model fine-sediment dispersal and settling.

Working with Ngāi Tai ki Tāmaki in the Wairoa Catchment (Clevedon) and the inner Hauraki Gulf, we are investigating catchment-to-estuary fine-sediment behaviour. This knowledge will be encapsulated in hydrodynamic and sediment transport models of the Wairoa Estuary and Tamaki Strait (WETS). This modelling suite will be used to quantitatively transform catchment sediment loads into environmental effects in the receiving waters.

A coupled hydrodynamic and sediment transport model will contain at least half a dozen model parameters. Each parameter regulates the "strength" of the process that it helps to describe. While at times we are interested in what is going on at the individual process level, we are typically more interested in the interaction between all of the processes, which ultimately governs the predictive skill of the model as a whole. Specifying the model parameters is therefore a critical step. Model parameters are not often selected in any rigorous and systematic fashion. Typically, only a few combinations of model parameters are ever tested, which means that only a very small proportion of the model parameter space is ever explored.

In this presentation, we provide the results from a comprehensive sensitivity test of the WETS sediment transport model to a wide range of model parameters. To support this undertaking, we have collected a field dataset that measured currents, waves and sediment transport in the WETS region. The results presented here focuses on our ability to reproduce observations of suspended sediment concentrations collected at multiple sites in the model domain.

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Day 3, Session 6, Stream 1: Coastal Engineering

Fri 15th Nov 2019, 10:20-10:40, Stream 1: Coastal Engineering

Amy Sheppard, Grant Pearce
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Downtown Ferry Basin Redevelopment: Concept Development

The Downtown Ferry Basin has been the central Auckland hub for ferry services since the late 1800's. It has continued to grow and develop with the increasing demand for ferry services throughout the Waitemata Harbour and Haruki Gulf. The present-day ferry basin commuter and tourist services cater for over 7 million passengers a year. Auckland Transport forecast that this will increase to 14 million within 15 years. Due to its close proximity to the train, bus and future light rail services, the Downtown Ferry Basin plays a significant role in creating an effective and efficient central transport hub in the downtown precinct.

The redevelopment of the ferry basin to meet present day and future requirements has been considered by Auckland Council, Auckland Transport, and their predecessors for some time. It is acknowledged in a number of studies dating from 2009 to 2017. The previous studies, and strategic considerations, concluded that the ferry infrastructure should be redeveloped on Queens Wharf West.

Tonkin + Taylor were appointed at the beginning of 2018 to undertake the concept development of the ferry basin by relocating the existing Piers 3 and 4 to Queens Wharf West whilst considering future demand. An extensive study was undertaken to determine the best arrangement for the new ferry berths considering Auckland Transport requirements and the constraints of the ferry basin. To fully understand the feasibility of the proposed options a number of workshops were held with stakeholders including ferry operators and Ports of Auckland. In collaboration with Navigatus (a risk management consultancy specialising in maritime), New Zealand Maritime School and ferry operator Fullers, navigation simulations were run on a number of berthing arrangement options and later in the study as a refinement of the preferred arrangement.

This presentation will discuss the project requirements and constraints, development of new berthing arrangement options, refinement of the preferred option and outline the progression to detailed design. An update to the current status of the project will also be provided.

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Te Hunga Takutai o Aotearoa
NEW ZEALAND
COASTAL SOCIETY

Fri 15th Nov 2019, 10:40-11:00, Stream 1: Coastal Engineering

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Value engineering of coastal revetments by combined physical and numerical modelling

On 14 November 2016, an earthquake comprising a complex sequence of ruptures with a combined magnitude of 7.8 occurred near Kaikōura, on the east coast of the South Island, New Zealand. This earthquake resulted in significant damage to State Highway 1, Main North Rail line and related infrastructure. The rebuild of the coastal route and subsequent resilience and improvement works required coastal protection structures along extensive sections of coastline. These comprised both seawalls and rock revetments. The initial concept designs were developed using uncalibrated numerical models and empirical formula. Figure 1 shows a schematic of the design steps undertaken to assess rock sizes and crest levels for the coastal structures. It was estimated that a substantial volume of imported rock was required due to the limited size of locally available rock.

Because the costs for using imported rock were estimated to be 3-5 times more than using local (river-sourced) rock, it was decided to undertake physical model tests to refine the coastal revetment designs. Physical model tests were undertaken by Manly Hydraulics Laboratory and measured the cross-shore wave height transformation, stability of rocks and overtopping volumes. It was found that the numerical model simulating the cross-shore wave height transformation over-predicted the wave height by 20-25% in the nearshore before calibration. Both the overtopping tool and empirical rock sizing method were found to compare well against the physical model results as long as the input wave height is correct. Designs were then undertaken on a site-specific basis using calibrated and verified numerical and empirical methods. This resulted in a significant reduction in rock volumes required.

Additional physical model tests were later run to further optimise the revetment design and usage of local rock. Revetments comprised of three and four armour and under layers were tested to increase permeability with further reduction in required rock size achieved. By undertaking physical laboratory tests the revetment design was refined and costs/volumes substantially reduced.

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Fri 15th Nov 2019, 11:00-11:20, Stream 1: Coastal Engineering

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Utilising a Coastal Asset Inspection App to Manage Auckland's Coastal Assets

As sea level rises and urban development continues to expand, the number of public and private assets at risk from coastal flooding and coastal erosion are rising New Zealand-wide. In response, the number of coastal defence structures around New Zealand is rapidly increasing. As new structures are constructed, and older historic structures deteriorate, councils are left with an increasingly challenging task to monitor and maintain their coastal assets. For New Zealand's fastest growing region, with 3,200km of coastline and over 1,500 coastal assets to manage, Auckland has a formidable task ahead. As such, Auckland Council are currently in the early stages of implementing a tablet-based coastal asset inspection app, that takes advantage of modern technology to improve the efficiency of coastal asset inspections. Using a portable tablet allows mobile data collection as well as making any required information easily available on site. The app also captures georeferenced information enabling convenient capture of geospatial data.

6 months into the programme, and with over 100 assets inspected, already significant efficiencies have been achieved and many lessons learnt. This presentation will cover these, including updates from the upcoming 2 months. Observations from the 100+ inspections of structures, ranging from wharves, jetties, sea walls, revetments and groynes, will be presented and consideration of the relative durability of various construction materials will be commented on.

The app has enabled far greater quantities of data to be captured far more rapidly than would have been achieved through conventional inspection methods. Key considerations for those looking to develop their own app and some app-specific limitations of the chosen software will be summarised. The next steps for the app will be described, and the wide-ranging future uses of the data collected.

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Fri 15th Nov 2019, 11:20-11:40, Stream 1: Coastal Engineering

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Auckland Rocks. Or does it.

The Auckland region has an undeniably complex coastline. Two oceans, different wave climates, three enormous natural harbours. A tidal range of typically 2.5m. Soft, sedimentary geology with dunes, sandy beaches, and high cliffs.

This environment has created a coast that is feature rich and attractive for coastal development. The resulting pressures have squeezed the coastal margin, with private property, public infrastructure, and public reserves encroaching into the active littoral zone. The result is that natural variability in coastal process now poses a hazard to property, infrastructure, or reserves.

In response, coastal engineers have hauled out the coastal defences: rock revetments, and concrete, masonry and timber seawalls, groynes. Rigid structures that do not respond to coastal change and are susceptible to failure if the design conditions are exceeded.

The coast of sandy beaches and dunes, soft crumbling cliffs, and pohutukawa trees at the high-tide line has turned into one armoured by rock structures. Hard rock – basalt and andesite, hauled in from quarries located at the extremities of the Auckland region – can be seen on most beaches. Residents concerned about erosion demand engineered solutions and see rock structures as reliable and solid.

This presentation will contrast the perception of idyllic natural character of the coastline, with the current reality of the natural character in the Auckland region, which is becoming one of engineered hard rock structures. Every bay and headland now has a least one rock revetment or seawall. This trend runs counter to developing international trend of designing with nature, where the resilience of sandy beaches as coastal defence is being recognized. Is New Zealand behind on the curve? Three recently completed coastal remediation projects in the Auckland region suggest otherwise. Three projects will be discussed, where beach nourishment is a key feature of the coastal defence.

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Fri 15th Nov 2019, 11:40-12:00, Stream 1: Coastal Engineering

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Is shoreline protection against rising sea levels and erosion, with stabilization and regeneration of the ecosystem a realistic dream for New Zealand?

New Zealand has one of the largest coastlines in the southern hemisphere and globally in relation to the total land mass. Facing rising sea levels and stronger gustily seas as a consequence of climate change, the protection of our shorelines against the increase of sea level and erosion is now a major task. For New Zealand there seems to be the one principal "go to" method for securing shorelines with the construction of Sea Walls. However, these Sea Walls can have negative impact on ecosystem and biodiversity as well as tourism. A healthy ecosystem and stable biodiversity are particularly important for the fishery industry as well as eco-tourism. Therefore, there is a need for more inclusive and sustainable approaches in coastline protection.

In various other countries (e.g. United States, Italy, Indonesia), they have tried and successfully implemented the use of artificial and biogenic reefs to secure ecosystem and shoreline. Additionally, within the recent years the design of Sea Walls has evolved to more complex structures which can better harbor various sessile and mobile species. It is about time that New Zealand with its large coastlines catch up with other countries in coastal protection by promoting collaboration between coastal engineers, coastal planers, government and marine biologist and supporting research into this area. New Zealand could become a leader in sustainable coastal protection.

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Te Hunga Takutai o Aotearoa
NEW ZEALAND
COASTAL SOCIETY

Day 3, Session 6, Stream 2:

Coastal Planning

Fri 15th Nov 2019, 10:20-10:40, Stream 2: Coastal Planning

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Coastal zone management, a case for integrating economic impact modelling and Robust Decision Making with scenario planning

The availability of coastal natural capital to the environmental-economic system declines as sea levels rise, populations grow, and industries expand. Limitations in natural capital, particularly land supply, require society to adjust traditional ways of living to provide for ecosystem sustainability and the economic wellbeing of coastal communities long-term. Scenario planning is useful in this regard as a strategic planning method that adjusts traditional mindsets to enable the development of plausible future pathways. Groups or organisations develop divergent scenarios and test outcomes against a set of objectives. In this case, GIS analysis, economic impact modelling and Robust Decision Making are used to develop scenarios for coastal communities affected by sea-level rise and increasing storminess in order to define resilient futures through a managed retreat.

The development of scenarios in this study involves three steps. First, GIS analysis of current coastal hazard zone occupation and land-use zoning are compared against projected hydrologic change. Second, an economic impact modelling assessment using MERIT examines the flow-on effects of asset exposure to socio-economic wellbeing, government expenditure, and industry performance. Third, Robust Decision Making in Python provides the analytical framework to process time-varying model outputs using a 'least regret' matrix and logical bounding parameters. The study area focuses on the sub-regional coastal environment from Tongoio to Clifton in Hawke's Bay. It also encompasses the Heretaunga Plains and the hinterland surrounding Napier and Te Awanga for land-use planning. The area allows society to build resilience to coastal hazards by incorporating managed retreat into existing long-term plans while also allowing space for future intertidal ecosystems and coastal environments.

To date, scenario planning has shown a large deficit in natural capital, inadequate land-use zoning and a need for financial leadership from government to enable coastal managed retreat. Current council long-term plans meet economic growth but fail to accommodate coastal inundation and ecosystem evolution. Greater conversion of natural capital and new land-use zoning is useful albeit expensive. Intensification of current land-use is, therefore, a priority over greenfield developments to preserve productive soils and lower the cost of borrowing capital. The central government will

be required to intervene as a 'direct investor' through climate bonds and climate leases due to the large scale and cost of adaptation. The central government issued climate bonds are a worthy approach to generate future capital sustainably to fund managed retreat. Central government intervention can then adopt a multi-region approach to deploy resources as required with the backing of bonds.

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Fri 15th Nov 2019, 10:40-11:00, Stream 2: Coastal Planning

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The New Zealand Association for Surfing Research and Management Guidelines for Surfing Resources.

New Zealand leads the world in the surfing resource management. In October 2015 a 3-year, Ministry for Business, Innovation and Employment (MBIE) project entitled *Remote Sensing, Classification and Management Guidelines for Surf Breaks of National and Regional Significance* was initiated (www.surfbreakresearch.org). The project team established remote camera monitoring stations at 5 of New Zealand's most popular surf breaks to collect baseline data in order to manage our surfing resources in the best way possible for New Zealand and its visitors. A major output of the project was the development of guidelines which addressed a clear requirement for comprehensive methods and frameworks that could be applied to sustainably manage New Zealand's surfing resources.

In order to continue the work of the research project since its conclusion, the New Zealand Association for Surfing Research has been established. The not for profit, trust based entity has taken responsibility for the camera systems, associated database and guidelines. The aim is to bring together New Zealand's leading scientists, public servants, academics, surfing experts and others. The overriding vision is to keep New Zealand at the forefront of surfing resource management. The NZASR will be a subgroup of the international ASR (iASR) which is being established through a global collaborative effort.

The aims of the NZASR include: reviews and updates of the Management Guidelines for Surfing Resources to keep them relevant to the latest research; inform the next iteration of New Zealand Coastal Policy Statement; establish surf break research goals that will benefit New Zealand, by providing a centralized, supportive body to aid in research funding applications, and fund and guide student research projects; promote the sharing of surf break research data and learnings to an international audience to aid global efforts to manage surfing resources. The data portal established as part of the MBIE project will host surfing research datasets from all over the planet; and, engage with and educate local authorities about surfing resource management. The group will aim to establish a new surf break monitoring site annually – targeting New Zealand's Surf Breaks of National Significance and threatened surf breaks first and foremost.

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Fri 15th Nov 2019, 11:00-11:20, Stream 2: Coastal Planning

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Implementing adaptive coastal risk management across scales

The *Ministry for the Environment's Coastal Hazards and Climate Change Guidance for Local Government* has provided coastal engineers and project managers with a framework for creation of dynamic adaptive planning pathways to manage coastal risks given the changing climate. This *Guidance* can be used across scales to include not only region-level planning but also for project-level adaptive management. Successfully implementing long term plans for communities or structures requires engineers to consider the wider social, cultural and economic environments alongside the conventional physical design parameters.

Fuzzy cognitive mapping (FCM) can be used to assess key influencing factors across disciplines shaping projects and long-term plans. These maps depict three project phases – conceptualization, engagement and execution – and the institutional, social, technical, cultural and financial environments in which projects exist. The FCM framework has been used to analyse a series of projects and risk management strategies in Hawke's Bay, NZ to tease out factors underpinning successful project implementation or project abandonment.

Results from the analysis of the FCMs populated with case study data emphasize the importance of considering the wider environments in which projects exist. This parallels the key takeaways of the *Guidance* well, and these lessons learned can be applied to projects ranging from local amenities (e.g. boat ramps) to region-level planning (e.g. the Clifton to Tangoio Coastal Hazard Strategy 2120). Adaptive management plans for structures or communities must be informed by an understanding of risks and uncertainties, community values, realistic monitoring protocols and triggers, and the flexibility to adjust the plan if needed.

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Fri 15th Nov 2019, 11:20-11:40, Stream 2: Coastal Planning

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Biosecurity management on Aotea: Great Barrier Island. Feasibility study for an on-island hull cleaning and maintenance facility

The lack of an on-island hull cleaning and maintenance facility at Aotea, Great Barrier Island has been highlighted as an issue during recent Auckland Council hull surveillance activities. Several vessels were found to have marine pests on their hulls including the notifiable and unwanted organism *Sabella spallanzanii* (Mediterranean fanworm). Vessel owners and operators who clean vessel hulls on beaches and tidal areas present a biosecurity risk as Aotea remains relatively marine pest free. These activities can also be in breach of policy including the current Auckland Unitary Plan (Operative in Part) (AUP (OiP)) hull biofouling rules and the objectives of the Coastal Plan.

The management of marine biosecurity for moored vessels was considered in terms of the local Aotea fleet and visitor vessels. The status quo is not achieving the desired biosecurity outcome and there is an opportunity to improve local fleet access to antifoul facilities. This would assist in enabling the local fleet to meet marine biosecurity requirements in other regions.

Morphum Environmental Ltd (Morphum) was engaged by Auckland Council to facilitate a stakeholder engagement programme to ascertain whether an on-island hull cleaning and maintenance facility would be desirable and if there was an on-island facility, would it be used. This feed in from the Aotea community provided the basis for the options, feasibility and location assessment.

This study outlines blue design principles for coastal infrastructure and Auckland Council's objectives for biosecurity management. This study is considered important to address the marine biosecurity risks and in support of potential and current regulatory policy including the Unitary Plan hull biofouling rules.

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Day 3, Session 6, Stream 3: Coastal Science 5

Fri 15th Nov 2019, 10:20-10:40, Stream 3: Coastal Science 5

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Using Colour Information from Sentinel-2 to Evaluate Estuarine Health: Preliminary Trial

Estuaries around New Zealand are increasingly modified by humans, changing the water quality, morphology, and circulation patterns. Regional councils around New Zealand are tasked with monitoring changes, and preparing management plans to address adverse effects. A wide range of monitoring strategies are used, for example: in situ water sampling, sediment bed level monitoring, observations of sediment properties, vegetation surveys, benthic sampling for infaunal diversity and biomass, and continuous sampling of e.g. waterlevel, temperature, salinity. Many of New Zealand's estuaries are classified as barrier-enclosed, with vulnerable shallow lagoon environments. The geomorphology of back-barrier lagoons tends to be complex, with networks of drainage channels, which are often altered by human modifications. One of the consequences of this complexity is that the ecosystem characteristics change over very short distances, making it expensive and labour-intensive to sample adequately using traditional ground-based surveys. Moreover, the temporal resolution of data makes it difficult to monitor and detect ecological shifts (such as caused by tipping points).

Sentinel-2 is a two-satellite constellation that has been operational since 2015 (2a) and 2017 (2b) and its data is made freely available by the European Space Agency. Sentinel-2's multispectral instrument (MSI) collects imagery at 13 wave bands with a revisit period of 5 days. MSI's spatial resolution (10 to 60 m) makes it suitable for monitoring lakes, large rivers and estuaries.

Here we derive dominant wavelength of four areas in Tauranga Harbour using a method that was developed to monitor lakes using water colour. The four regions differed by water level and habitat and showed distinctive colour properties which changed predictably with time, with subtle shifts from more green to more yellow associated with season. Correlation with tide and time of year were used to separate between seasonal, episodic and tidal water quality signatures. Our results show promise for efficiently capturing ecosystem changes over space and time at scales that would be challenging to observe using other methods. Future work will be directed towards interpreting colour dynamics in terms of habitat and ecological changes to see how they relate to traditional estuarine state indicators.

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Fri 15th Nov 2019, 10:40-11:00, Stream 3: Coastal Science 5

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Using radium isotopes and hydrodynamic modelling to investigate groundwater associated nutrients into Tauranga Harbour (New Zealand)

Submarine groundwater discharge (SGD) is one of the key pathways that connects land and sea, delivering freshwater, nutrients, carbon, metals, and other chemical constituents to coastal waters. Due to the large coastline to land area ratio, steep topography, permeable sediments and high rainfall, oceanic islands have the potential for disproportionally large SGD fluxes into the ocean compared to river inputs. Since SGD is driven under different timescales and processes (saline porewater through sediments and fresh groundwater from aquifers), it can provide a continual source of nutrients to coastal water bodies. This has previously received very little attention in New Zealand, mainly due to the difficulty in measuring this diffuse process.

We have used naturally occurring radioisotopes (radium) as tracers to identify areas of groundwater discharge ('hotspots') into Tauranga harbour. We have also estimated the amount of groundwater and associated nutrients discharging into the harbour at the system scale. It was found that the input of nutrients into the harbour from groundwater discharge was orders of magnitudes greater than the inputs from rivers. Salinity variations and flushing times were simulated over a range of climatic conditions using a high-resolution hydrodynamic model (Delft 3D). Seasonal and Interannual variation in the patterns of high rainfall and drought can alter flushing rates and the amount of surface/groundwater exchange within the harbour. Higher rainfall and freshwater supply from rivers can lead to faster flushing times and inputs of nutrients from land. However, during periods of little rainfall the flushing times of the system increase. This may promote the chemical transformations of captured nutrients in the sediment/water column.

Continual loading of nutrients from groundwater and sediments coupled with longer flushing times, may help sustain the development of algal bloom events in the harbour. A combination of novel modelling techniques has provided a powerful tool for the prediction of harbour flushing times over changing spatial and temporal scales. Understanding the response of coastal systems to (1) groundwater input and (2) changing hydro-climatic conditions, are very important for water quality management and its implications for algal bloom events.

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Fri 15th Nov 2019, 11:00-11:20, Stream 3: Coastal Science 5

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Sediment dynamics in a wave-exposed tidal flat

Sediment accumulation rates in New Zealand estuaries have increased ten-fold following large-scale catchment deforestation that began in the mid-1800s. This increased sedimentation has led to rapidly prograding shorelines such as occur in the southern Firth of Thames (Waikato, North Island). Intertidal flats have been progressively colonised by mangroves since the early 1960s as the flats accrete above mean sea level and today mangroves occupy a 1 km-wide zone for former sand flat in the upper intertidal. Field data from an instrumented transect spanning from the fringe of the mangrove forest, across the intertidal mudflats into the shallow subtidal waters of the Firth are used to analyse the sediments dynamics of the present-day mudflats. Suspended sediment concentration (SSC) values driven by waves and tides appeared to progressively increase from offshore to onshore as the water depth decreased. Detailed analysis of environmental variables during both calm conditions and an episodic, stormy event showed a correlation between SSC and estimated significant wave height and peak period although SSC values remained relatively high across the transect even in fair weather. Analysis of hydrodynamic measurements (e.g., current speed) allowed to infer sediment fluxes across the flat over calm and storm conditions contributing to an understanding of the long-term evolution of the intertidal flats of the Firth.

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Te Hunga Takutai o Aotearoa
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Fri 15th Nov 2019, 11:20-11:40, Stream 3: Coastal Science 5

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Stabilizing effects of exposure on cohesive sediments from an intertidal mudflat

Sediments on intertidal flats regularly emerge and submerge due to changes to water level. As a result, the water content of sediments might change during exposure. This study examined changes in erosion properties of cohesive sediments (erosion threshold, τ_{cr} N m^{-2} and erosion rate, *ER* g m^{-2} s^{-1}) associated with sediment water content and chlorophyll-a level (Chl-a, µg g^{-1}) caused by different exposure duration and weather conditions (air temperature, solar radiation, wind speed and humidity). Sediment cores were collected from an intertidal flat in the Firth of Thames in different seasons between 2017 to 2019, and sediment erosion properties determined by the EROMES device. The EROMES system includes the Perspex tubes that were used to collect sediment cores, a propeller to generate bed shear stress, a baffle to prevent cyclical flow and an optical backscatter sensor (OBS) to record the concentration of sediment in suspension every second. We investigated the erosion properties of immersed sediments exposed to controlled air temperatures of 0, 8, 25 and 40°C for 6 h. Meanwhile, long-term exposure experiments examined the variation in erosion properties during neap tides (after 1, 4 and 10 days exposed to ambient air temperatures). Results showed that cohesive sediments became more resistant to erosion when exposed to air as a consequence of decreased water content. The water content of exposed sediments decreased by 3 – 145% (sediment water content was 312%, at submerged state), a rate which was a function of increasing temperature. The τ_{cr} of exposed experiments was 1.2 to 2.2 times higher, whereas *ER* decreased 1.2 to 6.5 times. A higher level of Chl-a significantly increased erosion resistance of cohesive sediments, which caused 1.6 – 4.2 times higher τ_{cr}, and 8.2 – 19.2 times lower *ER*. Based on the outcomes of this research, a numerical model was developed to determine the long-term changes in the intertidal flats caused by differences in erodibility. The model will also allow us to run climate-change scenarios, which can be used as a basis for planning adaptation strategies.

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Fri 15th Nov 2019, 11:40-12:00, Stream 3: Coastal Science 5

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Changes at the Mouth of the Avon-Heathcote Estuary - a 2019 Update

The geomorphology of coastal areas around the NZ tend to be complex systems driven by various processes. By combining historical data with modern techniques, we can better understand what processes are occurring and what this means for the system. Understanding the morphodynamics of an urban coastal environment is important for assessing flood and erosion risk. Our work attempts to investigate changes to flooding and erosion risk by surveying the fluctuating morphology at the Avon-Heathcote Estuary (AHE) mouth. Findlay & Kirk (1988) and Mcfadgen & Goff (2005) deduce that the AHE tidal prism has been growing for ~400 years. The Canterbury Earthquake Sequence (CES) reduced the tidal prism of the AHE by ~1.5×10^6 m^3 (Measures et al. 2011) via a combination of uplift and increased sediment supply. To help understand the ongoing changes to the estuary since the CES a data gathering program, including beach profiles, RTK surveys, single-beam echosounder data, drone photography and photogrammetry, was undertaken in April & May of 2019 in the AHE inlet region.

Our fieldwork returned valuable data that was analysed against Measures et al. (2011, 2013) These were the main findings; a fluctuating shoreline on the New Brighton spit; the cyclic north-south meander of the channel; the main channel deepening; a secondary flood channel scouring out; and the erosion of multiple sand bars. Also, sediment from the channel erosion may have been deposited onto the adjacent Clifton Beach which has grown wider. A vegetation-line analysis indicates shoreline accretion on the seaward side of New Brighton Spit between 2004 and 2019, and erosion within the estuary. This is further supported by the beach profile survey results which also show erosion along the mudflats on the Northeast side of the estuary.

Comparing the new 2019 data with previous years shows that in general the estuary seems to be undoing the morphology changes resulting from CES. The earthquakes may have caused a setback in the growth of the tidal prism but the equilibrium does not appear to have changed. In terms of flooding and erosion we believe the CES uplift has not significantly affected the risk to coastal suburbs however they still face inherent risk from their location. The morphology of the estuary mouth is an important indicator of the general state of the system and so should be watched and monitored especially in the face of sea level rise and climate change. We hope our work can contribute to the ongoing coastal management strategy for Christchurch.

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Te Hunga Takutai o Aotearoa
NEW ZEALAND
COASTAL SOCIETY

Abstracts: Poster Presentations

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Harnessing Wave Energy: Feasibility of Utilising Point Absorbers and Attenuator Converters to Generate Sustainable Electricity in New Zealand

The ocean surrounding the coastline of New Zealand experiences formidable wave and swell conditions, which holds the potential of generating massive amounts of energy if captured and converted effectively. Harnessing the inexhaustible energy created by these waves could play a vital role in New Zealand's pledge for increased sustainable electricity generation, in light of the government's intention to pass a Zero Carbon Act. This research focuses on the feasibility of implementing a wave energy converter in the Foveaux Strait near Oreti beach, as a means for contributing to the power supply in Invercargill. In particular, small-scale wave energy converters (WEC) are investigated in this study. These devices could potentially set the precedence for larger wave energy farms with the capability of supplying Invercargill and surrounding towns with renewable energy.

This research identifies several feasibility factors that include but are not limited to: current electricity supply and demand for Invercargill; Southland's oceanic and climatic conditions; current wave energy device designs and potential environmental and regulatory considerations. The results from the research are analysed and discussed with the aim of establishing the preferential wave energy device for the region and to provide considerations in terms of both benefits and limitations. The methodology consists of comprehensive desktop research that explores academic journal and government publications relating to WEC systems and regulations, as well as an analysis of information from wave energy organisation and wave energy company websites. The research highlights the numerous variations in design of WECs internationally. Unlike the somewhat uniform design of photovoltaic solar systems and wind turbines, wave energy devices are diversified in engineering design and operate in different oceanic conditions.

The results from this research suggest that the ideal WECs at this stage include the point absorber and the attenuator. Both devices are relatively mature in theoretical design and there has been extensive research conducted on the capability of these devices to generate electricity. They have demonstrated an ability to generate a considerable amount of clean energy while posing minimal environmental risk. Upon successful implementation of one device, more devices can be added to create a wave energy farm.

There are several barriers that have been identified for the commercialisation of a WEC in Southland, including the competition from other renewable energy options and the immaturity on the global market for wave energy. Nevertheless, the environmental benefits and reduction of greenhouse gas emissions through the capture and conversion of wave energy should be further researched as a feasible avenue for sustainable electricity generation.
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Turning tides in New Zealand intertidal research: a baseline study of Ulva Island intertidal zones

Large areas of New Zealand's rocky coastlines are lacking in significant ecological datasets, despite the potential of these for use by scientists and environmental managers. The intertidal zones of shorelines are exposed to frequently fluctuating tides and are home to a unique subset of relatively easily quantified species – given that most are slow-moving or sessile. Intertidal organisms are highly indicative of changes in surrounding marine and terrestrial environments, thus making them ideal indicators of environmental change. This study quantified intertidal macro-algae and macro-invertebrate species on Ulva Island rocky intertidal shorelines, in order to fill ecological data gaps present in the knowledge base of the area. Five intertidal sites were surveyed using a transect-quadrat method to determine the existence, abundance and distribution of marine intertidal species in shoreline zones, in order to establish a quantitative baseline state. The sites interlapped with the waters of Te Wharawhara marine reserve and the mātaitai area of the surrounding inlet. These waters are important nursery habitats for valued species of fish, kina, and bivalve molluscs – significant both in a commercial context and in terms of mahinga kai. These areas therefore hold huge value to environmental managers, kaitiaki, and researchers alike.

Across the study sites, a total of 3159 individuals were counted, encompassing 31 different species of macro-algae species and macro-invertebrates. Based upon this data, the existence, abundance and distribution of species across high, mid and low tidal shoreline zones were identified. Species diversity was calculated using the Simpson's Diversity Index and all sites were found to have high diversity scores (SDI = 0.77-0.90), indicating good ecosystem health. High tidal zones were typically less biodiverse and hosted fewer species. The mid tidal and low tidal zones had considerably more algal area covered, and these areas supported a wider range and abundance of macro-invertebrate species. The high abundance of particular species (Diloma spp., Petrolisthes elongates, and Actinia tenebrosa) may be useful for determining keystone or 'forecasting' species of the Ulva Island intertidal ecosystem in the establishment of long-term monitoring programmes. Taking into account the relative ease of quantification of intertidal organisms, there is a vast potential for the data gap to be filled by citizen science initiatives (e.g. the Marine Meter Squared project). Future intertidal, terrestrial and marine monitoring and management in the Paterson's Inlet area and similar intertidal environments throughout New Zealand could benefit from this contribution of baseline data as well as continued monitoring of ecological biodiversity.

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4.5% less space: if sea level rises, what's in the way?

Auckland Council have initiated work as a 'first-pass' potential exposure assessment to begin understanding the associated risks of increased sea levels and more frequent coastal inundation events both regionally and locally. Our approach builds on similar exposure work undertaken at various national and regional levels (e.g. Simonson & Hall, 2019; Tait, 2019; Steele, Williams and Dawe, 2019) and is guided by MfE's *Coastal Hazards and Climate Change: Guidance for Local Government* 10-step decision cycle (MfE, 2017).

Using a range of sea level rise scenarios, we have used a desktop approach to examine the horizontal excursion of water inland and the spatial intersection of underlying entities of interest (e.g. terrestrial systems, land use, buildings, infrastructure, roading). The research comprises two parts; 1) to examine the proportion of datasets potentially affected regionally, and 2) initiate work to define and map what 'local scale' might look like within the region, develop a method for ranking what areas are potentially more exposed, and examine proportions of dataset as exposed.

Some key results so far indicate 2.5% of the land area of the region could be affected by a 1 in 100 year storm (1% AEP) and up to 4.5% with 3 m of sea level rise. Prime soils are the most exposed of the land use capability (LUC) classes across all sea level rise scenarios, and elite/prime soils are disproportionately exposed. Under larger sea level rise scenarios and coastal inundation combined with sea level rise, the number of buildings exposed is greater in the urban core and periphery than in outlying rural areas. We have also found that while impacts from rising seas may not be a widespread risk within the Auckland region particularly on a proportional scale, but at the smaller scale, some areas may be significantly affected. For example, we found several chenier ridge systems are at risk of a lack of potential translation space where they are 'hemmed in' by existing infrastructure or residential development.

This study presents one methodology for analysing potential exposures against a range of social, physical and natural indicators within the impacted coastal inundation areas but has not quantified how vulnerable Auckland's coastal communities and environments are given the projected sea level rise scenarios. Our exposure analyses is intended to facilitate the risk assessments (as risk is a function of exposure, hazard and vulnerability). Further work is planned to incorporate updated sea level rise data to build on this research, facilitate further identification of key criteria for ranking methods and provide better understanding of how potential exposure contributes towards risk, alongside vulnerability and hazards.

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Plastic Problems: Investigation of Microplastic Concentrations in Invercargill City Waterways

Coastal ecosystems are a major source of biodiversity, natural resources, a focal point for biogeochemical cycling, and are a magnet for human habitation. Without a doubt, these environments are one of the most valuable but degraded ecosystems on earth – resilience is already lowered due to impacts such as coastal developments, eutrophication of water ways, and over-fishing. Plastic pollution is currently at the forefront of concern and the impacts of microplastics may exacerbate existing degradation of coastal ecosystems. The longevity of plastic is estimated to be hundreds to thousands of years, meaning that, apart from what has been incinerated, the vast majority of all plastic ever made still persists in the environment. Plastics make up between 60% and 80% of all marine debris and are identified alongside climate change as a contributing factor in biodiversity loss around the globe.

Microplastics are classified as small plastic particles no larger than 5mm, which have either been originally manufactured to that size (e.g. personal care products, medicines) or fragmented from larger plastic debris. Over the past decade, studies have revealed that microplastics are wide-spread, common within the coastal environment. Microplastics have the potential to cause harm to biota, poses a threat to public health and causes biodiversity loss. The small size of the plastic particles makes them available to organisms throughout the food web and their composition makes them prone to adhering to waterborne organic pollutants and toxins. Microplastics can originate from ocean-based sources, but it is believed that 80% comes from terrestrial sources. Thus, it is important to investigate city waterways as pathways for microplastics in order to tackle the issue of these hazards in marine and coastal environments.

Microplastic studies are being conducted around the globe but minimal research has been performed in freshwater city environments. This research focuses on two inner city streams in Invercargill city as pathways for microplastics to reach the coastal environment. Particle samples were collected using a 333µm plankton net placed in the upper water column of the streams. An oxidisation and density separation method was applied to separate and determine the amount of microplastics in the samples. The research has shown that microplastic particles are present in both streams, with 11 out of 16 samples showing presence of microplastics. These waterways lead to the ocean and will be contributing to plastic pollution of valuable ecosystems. This study highlights the need for mitigation and management strategies in the area of plastic pollution in inner-city waterway as they are a point source for pollution.

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Shore platform generation on tectonic coastlines: are they preserved and for how long?

Shore platforms are geologically the youngest unit of marine terraces that act as the shoreline expression of tectonic and geomorphic controls. The evolution and preservation of platforms is dependent on a suite of erosive processes that operate on the terrestrial-marine interface, but their preservation potential is limited due to the interplay of the erosive potential exerted on the platform, and the underlying resistivity of the lithology and its structural expression. It is the interplay between these site-specific lithological characteristics and climatic conditions that determine the overall marine terrace erosion rate, and whether such features will be preserved in the geologic record. Tectonism plays a critical part in platform generation in that it exposes fresh material and the development of new marine platforms. The freshly exposed surface is subject to mechanical weathering, but also provides a newly available surface for biological erosion agents to colonise, and a chemically reactive surface conducive to element exploitation. Do these new fresh surfaces erode at the same rate as a surface that has been exposed to the elements for hundreds to thousands of years? Or does the exhumation of fresh material respond quickly to numerous erosive processes before reaching a static erosion rate?

The 2016 Mw 7.8 earthquake uplifted the intertidal shore platforms of Kaikōura Peninsula by 0.8–1 m, exposing the once sub-tidal sea-floor to a tidal regime. This uplift provides a rare opportunity for post-earthquake observations to determine platform down-wearing and back-wearing immediately after an uplift event, and comparison to 40-year pre-earthquake record. The Kaikōura shore platforms are backed by a number of marine terraces that have developed through uplift events over the Holocene. It is not yet fully understood, however, how many earthquakes have occurred to reach the contemporary coastal morphology of the Peninsula and what may affect marine terrace preservation over the Holocene. The objective of this study is to understand processes of current and future shore platforms and marine terrace development at Kaikōura, compared to the recent tectonically quiescent at Māhia Peninsula (east coast, North Island). Last uplifted in the early Holocene, the shore platform at Kahutara Point likely has slower rates of erosion since the last uplift event, with four observable terraces. Auroa point (short distance northwards from Kahutara Point), however, has a sequence of five distinguishable marine terraces and, therefore, yields the two-fold question: to what extent and under what conditions have marine terraces been eroded spatially and temporally; and do older terrace sequences preserve all historic uplift events?

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Surveying and Marine Science: using bathymetric data to complement marine science investigations in Port Pegasus, Stewart Island

In February 2019, we undertook a marine science expedition to Port Pegasus, Stewart Island to investigate the Holocene climate evolution of the area. To do this the Geology and Marine Science Departments ran seismic lines using a CHIRP and Boomer, and collected box and piston cores. Additionally, the School of Surveying were invited to concurrently conduct a multibeam survey. The Port Pegasus area is an attractive location because it is a shallow estuary, compared to the deep fiords of Fiordland, making it easier to extract cores. Furthermore, Port Pegasus is between Fiordland and the Auckland Islands, where previous records have been collected, enabling a more complete model to be formed of the Holocene epoch climate. In order to determine this, geochemical and geotechnical analysis is currently being undertaken on the cores. The cores are also being dated to see if they include evidence of the last Glacial Maximum.

As a School of Surveying student project, this poster concentrates on the hydrographic aspects of the multibeam data collected and how these compliment the marine geophysical and geotechnical investigations. To accomplish this, the first objective was multibeam data collection and a consideration of how methods used in Port Pegasus differ from conventional hydrographic surveys. This was because the survey was conducted in an ad-hoc manner. Secondly, the raw data needed to be processed. This involved checking noise artefacts, undertaking a patch test and the investigation of various tide reduction options including the application of tide data collected from a tide gauge deployed in the area, along with tide data recorded from the NIWA Dog Island tide gauge. Thirdly, the data was analysed to verify the accuracy of the data. This was calculated through the determination of uncertainties, along with analysis of overlapping lines.

This hydrographic work will complement the marine science investigations by characterising the bathymetry and backscatter in Port Pegasus. The data will be presented in a way that aids other scientists in the identification of any ancient rivers and sills which may be evidence of the Holocene climate of the area, and point to other locations for coring in the future.

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Morphology and Tidal Asymmetry Changes in the Avon-Heathcote Estuary

The morphology of the Avon-Heathcote Estuary (AHE) was altered by the Canterbury Earthquake Sequence (CES), which uplifted much of the tidal lagoon by 0 - 0.4 m, reducing the tidal prism by ~12-18% (Measures et al 2011). The abrupt CES changes follow a theorized 400-year period of gradual subsidence (Hughes et al. 2014) and tidal prism increase (Findlay & Kirk 1988). GNS (2014) notes that more lines of evidence are required regarding whether estuary morphology has reached a post-quake equilibrium. Measures et al. (2011) postulates a reduction in inlet cross-sectional area as a possible response. The question of whether the estuary will tend to infill or erode has great relevance to the surrounding suburbs' resilience to sea level rise. This poster presents recent beach and bathymetric survey results at the AHE mouth and a detailed analysis of in-estuary tidal water level data to evaluate the morphological equilibrium of the estuary relative to hydraulic and sediment asymmetry relationships.

The size of the inlet relative to the estuary volume (Hume and Herrendorf 1988, de Ruiters 2019) and the height and extent of tidal flats relative to the channels (Dronkers 1986, Friedrichs and Aubrey 1988, Friedrichs 2010, Friedrichs 2011) can cause the tide to rise and fall at different rates - this is tidal asymmetry, for which multiple researchers have proposed non-dimensional ratios. Wind waves within the estuary can also contribute to sediment transport asymmetry (Hunt 2016). Friedrichs (2011) notes that "the morphological response of most tidal flats is rapid relative to the decade-plus timescales of engineering works, climatic fluctuations, and sea-level rise," and we hypothesize that the uplift and sediment supply associated with the CES can be analysed relative to asymmetry relationships, tide observations and recent surveys to understand the timescales of estuary morphological response, and look for any 'tipping points' towards infill-favouring morphology or hydraulics.

Tidal height data and DEM analysis within the AHE, corroborated by model results (Measures and Bind 2013), indicate an estuary that is flood-dominant except for the deep inlet channel, which is ebb-dominant. The AHE cannot be described as either convex-up or concave-up in hypsometric form, potentially due to heterogeneity of sediment types and sources and fetch considerations. Most asymmetry ratios indicate flood dominance, and a small reduction in flood dominance was found using a 2011 or 2013 DEM as compared to pre-CES data.

A series of harmonic analyses were conducted to look for the timescales of post-CES morphology adjustments. Small changes to in-estuary tidal constituents show an increased frictional effect for 3-4 years post-CES. This signal in the M2 and M4 tidal

constituents reverted to pre-CES magnitude at the two bridges after a period of 2-3 years, indicating that a hydraulic equilibrium was reached around 2013. Survey results indicate that the inlet channel and some flood tidal delta regions have eroded back towards pre-CES dimensions. The CES does not appear to have shifted asymmetry relationships, with a 2019 survey showing estuary channels deepening towards their pre-CES cross-sectional area, rather than continuing to infill. The long-term trend of in-estuary tidal prism increase, while interrupted by uplift and deposition, appears to have resumed. The potential 'respite' from sea level rise provided by uplift appears to be short-lived due to the energetic environment within the estuary. Up-to-date surveys and interpretation relative to the physical processes shaping the form of New Zealand's coastal waterbodies, including potential tectonic changes, must be emphasized when managing coastal hazards.

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Swimming with dolphins? Investigating the effect of current legislative actions to mitigate human-dolphin interaction on existing resident and visiting bottlenose populations in the Bay of Islands

The common bottlenose dolphin (*Tursiops truncatus)*, or terehu, is one of nine species of dolphin that are found around New Zealand, with the largest population living in the Bay of Islands. They are a nationally endangered species and have been recognised to live in pelagic and coastal environments. In the wild, sharks and killer whales are common natural predators of the terehu, but aside from natural predators, many populations are susceptible to private and commercial ecotourism vessels, due to their coastal nature. The presence of ecotourism vessels interferes with the dolphins' instinctive behavioural patterns, alongside a number of boat strikes in high boat activity areas.

Due to declining numbers of terehu returning to the Bay, a total ban of both private and commercial individuals swimming with the dolphins has been put in place during July this year. The goal of the ban is to mitigate current shifts in dolphin social behaviour and decrease vessel interactions, in an attempt to relieve stress on the already declining population size. Our marine biodiversity, of which the terehu is a part, is a taonga to New Zealand. Thus, it is important to continuously monitor the effects of the ban and other legislative actions to mitigate human-dolphic interaction – data from this research holds huge value to environmental managers and tangata tiaki alike.

Currently, population monitoring for terehu is in place as part of Department of Conservation initiatives in the Bay of Islands. However, population fluctuations in response to current legislative actions to mitigate human-dolphin interaction in the Bay of Islands is still yet to be investigated, as the total ban has just come into action. Further, existing research does not approach analysis from an integrated DoC and iwi perspective. I will represent the Department of Conservation as a Summer Ranger, as well as Patukeha and Ngatikuta (local iwi representative and perspective), in a pūtahi of interest groups, in order to study the effect of legislative actions on existing resident and visiting bottlenose populations from 2019-2020. This data will be comprehensively compared to previous population data analyses to determine population fluctuations, in relation to new authority actions that have been implemented into the Bay of Islands community. Findings will provide information on whether legislative action and authority presence on marine ecotourism and private vessel have indeed influenced terehu population and behavioural patterns.

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Emily Tidey, Robbie Columbus, Kara Jurgens, Rian Mayhead, Jean-Louis Morrison, Robert Odolinski

Te Kura Kairūri/National School of Surveying, University of Otago

Student Hydrographers Professional Coastal Science Projects at the School of Surveying, University of Otago

In their final year of a Bachelor of Surveying (BSurv) or Bachelor of Science (BSc) students at Te Kura Kairūri/the National School of Surveying at the University of Otago have the opportunity to take the lead on a 'Professional Project'. The aim of this paper is to provide students with the opportunity to apply and integrate relevant and already-learned skills, knowledge, theories, tools and techniques within the context of a specific real problem-solving environment and project as may be experienced in the workplace. Their projects are representative of the kind of professional report work done in a government agency, surveying practice or consulting firm.

Recently several students - who are also taking advanced hydrography papers - have undertaken projects of note to those working in the coastal sphere:

Robbie Columbus used low-cost multi-constellation RTK GNSS receivers connected to a cellphone to measure the tide on a floating structure. He demonstrated the quality of the data from this inexpensive equipment and considered how it allows densification of measurement for minimal cost, providing benefit to everyone working in the marine environment.

Kara Jurgens investigated historic wreck surveying using multibeam echo sounders. She undertook analysis of the multiple options available to users of modern multibeam systems - such as high-density mode, watercolumn data and different frequency options - and discussed their use and relevance to understanding underwater structures.

Rian Mayhead analysed Unmanned Surface Vessels (USV) in the context of hydrography. While he considered their practicality as measurement tools and undertook analyses on the expected measurement uncertainties and data processing considerations, importantly he also considered the often overlooked legal implications of their remote operation.

Jean Louis Morrison worked with scientists from the Departments of Geology and Marine Science at Otago in a study of the Holocene environment of Port Pegasus, Stewart Island. He collected, processed and analysed multibeam data in the area and worked closely with the other scientists to consider how to best prepare and present bathymetric and backscatter deliverables.

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Panel Discussions

Panel Discussion Tahi: Estuaries and Managing Cumulative Effects

Panellists

- Nick Ward, Freshwater and Marine Science Leader, Environment Southland
- Dana Clark, Marine Ecologist – Coastal Ecology and Management, Cawthron Institute
- Candida Savage, Marine Ecologist, University of Otago

Moderator: Sam Morgan

When: Wednesday 13th November 1:30 pm – 2:25 pm

Location: Engine Room/Driver's Den, Transport World

Background:

The 1-hour workshop structure is:

- Overview of the key aspects and approaches in the Coastal Hazards and Climate Change guidance
- Observations, reflections and feedback from the roadshow and the guidance team debrief in October
- A time for questions to the author panel and sharing early implementation experiences.
- Where to from here?

Panel Discussion Rua: Responses to Sea Level Rise

Panellists

- Galvin Gilder, Hazards Mitigation Planner, Environment Southland
- Marcus Roy, Team Leader – Resource Management, Southland District Council
- Rob Bell, Principal Scientist – Coastal and Estuarine Physical Processes, NIWA

Moderator: Paul Klinac

When: Wednesday 13th November 1:30 pm – 2:25 pm

Location: Progress Zone, Transport World

Background:

Communities have three options to address the threats posed by climate change, coastal hazards, and sea level rise: avoid, protect, or adapt. Communities impacted by coastal hazards generally seek to protect their private property, and look to Councils to assist in this outcome, which was an all-too-common outcome historically with often-unintended consequences.

The protection approach is often in conflict with national policy direction set by the New Zealand Coastal Policy Statement, and several large Councils who have recently declared a 'climate change emergency'. Further, local government generally is beginning to recognise that the protection approach is not sustainable over the long term and often has poor environmental outcomes.

Coastal hazard adaptation plans are being developed, but slowly, and not always systematically. There is perhaps a tension between the short-term goals sought by communities, and the long-term view needed to address the effects of climate change. This panel session will seek to explore these challenges, including future options to ensure appropriate management of New Zealand's coastal environment.

Notes