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NEW ZEALAND MARINE SCIENCES SOCIETY 56TH ANNUAL CONFERENCE

4 – 6 JULY 2017, CHRISTCHURCH

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NEW ZEALAND MARINE SCIENCES SOCIETY ANNUAL CONFERENCE

4 – 6 JULY 2017
UNIVERSITY OF CANTERBURY
CHRISTCHURCH - NEW ZEALAND

MONDAY 3 JULY

17:00	**Icebreaker** (including early check-in) at The Atrium, School of Biological Sciences, University of Canterbury

TUESDAY 4 JULY

8:00	Check-in		
9:15	Mihi whakatau & University of Canterbury Welcome		
9:30	**Plenary: Assoc Prof. Te Maire Tau (A1)**		
10:30	BREAK		
SESSION	**Marine Mammals 1 (A1)** **Chair: Liz Slooten**	**Biosecurity 1 (A2)** **Chair: Graeme Inglis**	**Ecosystem Function (A3)** **Chair: Islay Marsden**
11:00	The price of piscivory: Body size vs. dietary specialisation in Antarctic killer whales (*Orcinus orca*) **Regina Eisert**	Managing marine pests before they get here: New Zealand's Craft Risk Management Standard for Biofouling **Tracey Bates**	Managing Manukau Mangroves: what are the social-ecological trade-offs of removing and preserving mangroves? **Amrit Dencer-Brown**
11:15	Estimating Biological Parameters of Long-finned Pilot Whales in New Zealand Waters: Insight from Strandings **Emma Betty**	Mediterranean fan worm – a case study of collaboration to manage a marine pest **Kathy Walls**	Minimum light thresholds for seagrass indicated by continuous data from multi-year rehabilitation trials **Fleur Matheson**
11:30	Underwater noise from pile driving and its impact on Hector's dolphins in Lyttelton harbour, New Zealand **Eva Leunissen**	Marine sweeps: update on the national Marine High Risk Site Surveillance (MHRSS) for 2016–17 **Chris Woods**	Site-dependent seagrass ecosystem resilience to nutrient enrichment **Rebecca Gladstone-Gallagher**
11:45	An observed decline in the mark rate of Hector's dolphins (*Cephalorhynchus hectori*) after area-based protection **Lindsay Wickman**	Surveillance for the Mediterranean fanworm (*Sabella spallanzanii*) and club tunicate (*Styela clava*) in environmental samples using real-time PCR assays **Susie Wood**	Rising tides, cumulative impacts and cascading changes to estuarine ecosystem functions **Teri O'Meara**
12:00	Penguins – marine sentinels on the way out? The importance of managing regional threats in the face of climate change **Ursula Ellenberg**	Using high throughput sequencing to characterise bacterial and eukaryotic marine biofouling assemblages and screen for invasive species **Ulla von Ammon**	The influence of sediment characteristics on estuarine benthic microalgae (BMA) community structure **Yuriy Malakhov**
12:15	Advancing photo-identification of cetaceans: Exploring the application of computer vision for individual recognition **Krista Hupman**	Bilge water as a vector for the spread of marine pests: a morphological, meta-barcoding and experimental assessment **Lauren Fletcher**	Does primary production in emerged estuarine sediments provide resilience against increasing turbidity? **Tarn Drylie**
12:30	LUNCH		

SESSION	Marine Mammals 2 (A1) Chair: Regina Eisert	Biosecurity 2 (A2) Chair: Leigh Tait
13:30	Effects of noise on the communication space of individual marine fauna **Rosalyn Putland**	The importance of data bias and choice of metric in estimating the rates of spread of invasive marine species **Graeme Inglis**
13:45	Diversity and distribution of cetaceans in the Otago submarine canyons **William Rayment**	Dynamic range models to forecast impacts from invasive marine species **Kimberley Seaward**
14:00	Migration of Oceania humpback whales across a large ocean basin **Leena Riekkola**	Marine urban sprawl in New Zealand – risks and opportunities **Oliver Floerl**
14:15	A prey survey to understand nutritional stress in New Zealand sea lions **Jim Roberts**	80 years in Waitemata Harbour: The arrival of new species and continued changes in benthic ecology **Michael Townsend**
14:30	Marine Mammal Speed Talks (5 mins): **Karen Stockin** **Liz Slooten** **Maria Jesus Valdes**	**Workshop** – Tools for assessment of risk **Workshop Supporter**
15:00	BREAK	
15:30	**Plenary: Dr Vonda Cummings (A1)**	
SESSION	**Aquaculture (A1) Chair: Chris Woods**	**Genetics (A2) Chair: Phil Ross**
16:30	Mapping Global Marine Aquaculture Potential **Rebecca Gentry**	Bleaching severity in reef building corals is phylogenetically heritable **David Aguirre**
16:45	Multi-strain probiotics enhances immune capacity and alters metabolic profiles in the New Zealand black footed abalone (*Haliotis iris*) **Roffi Grandiosa**	Multispecies analysis reveals emergent patterns of genetic diversity across the Indo-Pacific Ocean **Libby Liggins**
17:00	From Humans to Molluscs: Target Specific Bioactive Delivery Using Microcapsules **Ali Seyfoddin**	Building the molecular phylogeny of New Zealand marine bony fishes: a first step toward understanding phylogenetic diversity across latitude and depth **David Eme**
17:15	Delivery of probiotics to aquaculture: challenges and strategies **Seyedehsara Masoomi Dezfooli**	Life at the edge: a population study of green turtles (*Chelonia mydas*) in temperate New Zealand **Dan Godoy**
17:30	**Poster & Networking Session** (Undercroft)	
19:00	Day Concludes	

Photo: Regina Eisert

WEDNESDAY 5 JULY

9:15	Housekeeping		
9:30	**Plenary: Prof. Ian Wright (A1)**		
10:30	BREAK		
SESSION	**Biodiversity (A1)** **Chair: Mads Thomsen**	**Estuarine Processes (A2)** **Chair: Hannah Jones**	
11:00	Host variety enhances diversity: the role of multiple secondary habitat-forming seaweeds in facilitating estuarine invertebrate communities **Alfonso Siciliano**	Changing types of organic detritus influences nitrogen cycling rates in temperate estuary sediments **Josie Crawshaw**	
11:15	Incorporating uncertainty in habitat suitability models to inform biodiversity prioritisations for vulnerable marine ecosystems **Carolyn Lundquist**	Denitrification activity in New Zealand estuaries: A synthesis of environmental factors that control variability **Emily Douglas**	
11:30	Disappearing forests: loss, survival and potential ecological implications of Kaikoura's earthquake on bull kelp populations **Luca Mondardini**	Carbon and nitrogen stocks in New Zealand estuarine and coastal habitats **Richard Bulmer**	
11:45	Functional biodiversity of fish along a depth gradient: a study from the Kermadec Islands and Great Barrier Island **Elisabeth Myers**	Denitrification along a gradient in Mahurangi Harbour: do macrofauna matter most? **Drew Lohrer**	
12:00	Complexity in nutrient cycling highlights the significance of habitat variation in coastal soft-sediment ecosystems **Jenny Hillman**	Modelling the impacts of seasonal variability in freshwater input into the Waikouaiti Estuary, Otago **Brett Beamsley**	
12:15	LUNCH / AGM (A2)		
SESSION	**Kaikoura 1 (A1)** **Chair: Sharyn Goldstien**	**Estuarine management (A2)** **Chair: Hannah Jones**	**Technology (A3)** **Chair: Travis Horton**
13:30	**Introduction**	The New Zealand Estuary Trophic Index (ETI) Tools **John Zeldis**	Assessment of a 'recreational' grade echo-sounder to provide quantitative information on the distribution and relative abundance of small schooling fish **Tom Brough**
13:45		Demonstrating the New Zealand Estuary Trophic Index (ETI) Tools **Amy Whitehead**	Drones for Good: Adapting an off-the-shelf Quadcopter for Aerial Photogrammetry **Stephen Dawson**
14:00	A high-resolution record of coastal deformation in the 2016 Mw 7.8 Kaikōura earthquake **Kate Clark**	The rise and fall of the Ahuriri Estuary, Napier **Anna Madarasz-Smith**	The Moana Project – An Ocean-Atmosphere Knowledge Infrastructure for New Zealand **Peter McComb**
14:15	Top-to-bottom sediment flushing of the Kaikoura Canyon during the 2016 Kaikoura Earthquake **David Bowden**	Tracking the source of estuarine contamination **Pete Wilson**	Satellite observation of water quality in New Zealand's territorial waters, 2002–2017 **Matt Pinkerton**
14:30	Hutton's impact **Lindsay Rowe**	Rapid habitat surveys and finer scale sampling of estuaries on Great Barrier Island **Sarah Hailes**	Technological Tools for Saving Whales **Travis Horton**
14:45	Kaikoura earthquake marine science recovery package **Rich Ford**		**Technology discussion-based panel workshop**
15:00	Impacts of the Kaikoura earthquakes on fisheries, and how fisheries management is responding **Mark Geytenbeek**		
15:15	Paua and the Kaikoura earthquake: Industry research and management responses **Tom McCowan**		

15:30	BREAK	
SESSION	**Kaikoura 2 (A1)** **Chair: Sharyn Goldstien**	**Fisheries (A2)** **Chair: Nathan Walker**
16:00	Preliminary insights into the effects of the Kaikōura Earthquake on sperm whales **Marta Guerra**	Why are river mouth visits important to adult kahawai? **Kimberley Maxwell**
16:15	Charting the loss and recovery of intertidal community structure and function following a cataclysmic coastal uplift event **Shawn Gerrity**	Assessment of the risk of commercial surface longline fisheries in the southern hemisphere to ACAP seabird species **Nathan Walker**
16:30	Subtidal reef changes **Robyn Dunmore**	The development of multispecies models for evaluating predator-prey effects on the assessment of hoki, hake and ling on the Chatham Rise, New Zealand **Jingjing Zhang**
16:45	Habitat cascades destroyed in the Kaikoura earthquake **Mads Thomsen**	Spatial and Temporal Changes in Inshore Fishing Effort and Habitat Use **Fabrice Stephenson**
17:00	Consequences of earthquake uplift on rocky reef primary productivity on the Kaikōura peninsula **Leigh Tait**	Ecosystem indicators for fishery management: 24 years of Chatham Rise data **Rikki Taylor**
17:15	**Q&A**/Panel discussion	Towards ecosystem-based fisheries management in New Zealand **Anne Wietheger**
17:30	Networking @ The Foundry (all welcome)	
19:00	Day Concludes	

THURSDAY 6 JULY

9:00	Housekeeping		
SESSION	**Macrofauna/bivalves (A1)** **Chair: Drew Lohrer**	**Physiology (A2)** **Chair: Islay Marsden**	**Coastal 1 (A3)** **Chair: Mike Hickford**
09:15	Gone But Not Forgotten: Legacy Effects of a Bivalve Foundation Species in New Zealand Estuaries **Travis Foster**	Ciguatera poisoning in the Kingdom of Tonga: the ecology of the dinoflagellate origin **Phoebe Argyle**	Cross-trophic level effects of the introduced kelp *Undaria pinnatifida* on mussel reefs: influence on mussel consumption and recruitment **Tommaso Alestra**
09:30	The effects of thin mud deposits on the behaviour of a deposit-feeding Tellinid bivalve: Implications for ecosystem functioning **Lisa Mccartain**	Ontogenetic changes in *Perna canaliculus* shell material – a precursor to geochemical tagging of larvae **Craig Norrie**	The effects of coastal turbidity on kelp forest productivity **Caitlin Blain**
09:45	Changes to *Austrovenus stutchburyi* growth rate since early human settlement in New Zealand: an indication of the extent of human impact on estuarine health **Susan Wells**	Fish rest where they see best – the effect of light intensity on snapper behaviour and physiology **Esme Robinson**	Intertidal habitat use by eagle rays – are all sandflats created equal? **Helen Cadwallader**
10:00	Transport and retention of benthic marine invertebrate larvae in a large semi-enclosed meso-tidal estuary **Bradley Monahan**	First detection of gas-bubble disease and Rickettsia-like organisms in toheroa (*Paphies ventricosa*) **Phil Ross**	The Secret Language of the New Zealand Paddle Crab – Sound production and associated behaviours in the New Zealand paddle crab, *Ovalipes catharus* **Ashley Flood**
10:15	Speed Talk (5 mins): The role of streams in determining toheroa distribution and abundance **Jane Cope**	Damage to disaster: Cause and effect of tail fan necrosis in lobsters **Hua Zha**	Changes in natural phytoplankton community composition from STFZ and SASW waters under future ocean conditions **Linn Hoffmann**
10:30	BREAK		
SESSION	**Governance 1 (A1)** **Chair: Sharyn Goldstien**	**SETAC 1 (A2)** **Chair: Sally Gaw**	**Coastal 2 (A3)** **Chair: John Pirker**
11:00	Collaborative Coastal Management when the earth shakes – the Kaikoura model tested **Gina Solomon**	**Keynote: Kevin Thomas** Contaminants of emerging concern in the marine environment	Abrasion Resistance of New Zealand Chitons **Bryce Peebles**
11:15	Incorporating mātauranga māori into decision making **Doug Jones**		Pacific oyster coculture growout assessment and fucoidan yield of New Zealand native intertidal brown seaweed *Hormosira banksii* (Turner) Decaisne **Candace Loy**
11:30	Marine conservation in a sea of alternative facts **Andrew Wright**	Emerging Organic Contaminants (EOCs) in aquatic food species – do they get in? **Peter Cressey**	Legacy effects of marine larval development for whitebait: bigger fish to fry? **Mike Hickford**
11:45	The new Ross Sea region Marine Protected Area: New Zealand's contribution to an international research and monitoring plan **Ben Sharp**	Distribution of personal care products and steroid hormones in Lyttelton Harbour, New Zealand **Sally Gaw**	Speed Talks (5 mins): **Mareike Babuder** **Nadjejda Espinel** **Bailey Lovett** **Ryan Koverman** **Phil Ross** **Suong Nguyen** **Sam Mc Cormack** **Aimee Van Der Reis**
12:00	"..water your own yard if you crave green grass" – industry's investment in innovative research **Mark Edwards**	Double trouble? The effects of microplastics and triclosan on the green-lipped mussel *Perna canaliculus* **Samantha Webb**	
12:15	Industry-led efforts to reduce catches of small fish in a mixed fishery in Hawkes Bay, New Zealand **Emma Jones**	Assessment of trace metal pollution in New Zealand estuaries: Integrated use of biochemical, physiological and reproductive biomarkers in New Zealand mud snail *Amphibola crenata* **Nuwan De Silva**	
12:30	LUNCH		

SESSION	Governance 2 (A1) Chair: Kim Kelleher	SETAC 2 (A2) Chair: Kevin Thomas	Trophic (A3) Chair: Will Rayment
13:30	Testing the efficacy of ship strike mitigation for whales in the Hauraki Gulf, New Zealand **Philippa Ebdon**	Metals in New Zealand pelagic squids **Alexandra Lischka**	Plankton food web structure and trophic flows in the Chatham Rise **Moira Decima**
13:45	Science meets mitigation: Analysing observer data from seismic surveys collected under New Zealand's Code of Conduct **Simon Childerhouse**	Updating the ANZECC water quality guidelines for copper and zinc **Chris Hickey**	Phytoplankton growth, microzooplankton grazing and the fate of primary production in contrasting oceanographic conditions of New Zealand open-ocean waters **Andres Gutierrez Rodriguez**
14:00	Unlocking NZ's EEZ data **Matthew Dean**	Testing the ability of biotic indices to track environmental stressor gradients using a national estuarine dataset **Anna Berthelsen**	Fly South: foraging locations of the Hutton's shearwater *Puffinus huttoni* **Della Bennet**
14:15	Beneath the waves of Tōtaranui: world-class hydrography, bathymetry and habitat information from Queen Charlotte Sound **Steve Urlich & Rebecca Batten**	Multiple stressor effects in marine ecosystems: responses of estuarine taxa and functional traits to sediment, nutrient and metal stress **Dana Clark**	Seasonal habitat use and trophic ecology of bronze whaler sharks (*Carcharhinus brachyurus*) in New Zealand **Melissa Kellett**
14:30	**Q&A**	Ammonium toxicity in seagrass *Zostera muelleri*: seasonal difference? **Moyang Li**	Parasitism of diatoms in the Chatham Rise subtropical convergence zone East of New Zealand during summer **Karl Safi**
14:45		Clarifying murky waters: new science initiatives to assess sedimentation effects of deep-sea mining in New Zealand **Jennifer Beaumont**	Particle capture capabilities in juvenile green-lipped mussel (*Perna canaliculus*) **Dyahruri Sanjayasari**
15:00		**Q&A**	Drivers of Community Structure and Food Web Architecture in Temperate Reef Fish **Jacquetta Udy**
15:15			Interannual and seasonal variability of export fluxes across the Hauraki continental margin, 1996-97 and 2015-16 **Scott Nodder**
15:30	BREAK		
16:00	**Plenary: NZMSS 2017 Award Recipient (A1)**		
17:00	Closing		
18:00 18:30	Transport to dinner departs University of Canterbury Conference Gala Awards Dinner @ The Tannery (dinner begins at 7pm)		

FRIDAY 7 JULY

9:00 – 12:00	Science Communication Workshop (Kirkwood KE04/KE05/KE06)
9:00 – 17:00	Marine Mammals & Matauranga Workshop (Biology Rm. 275)

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WELCOME FROM THE NZMSS PRESIDENT

It is my great pleasure as President to welcome everyone to this year's New Zealand Marine Sciences Society conference "Mahi Ngātahi: Working together for better management into the future".

As a tight-knit marine sciences community in a small country we all understand the value of working together. We have a proud track record of collaborative research projects and our achievements have been recognised world-wide.

Reflecting on past conference programmes and themes, it is very exciting to see the increasing connections between research, resource managers and communities with interests in our coastal and marine areas. Not long ago a past NZMSS President called for us to step out of our silos and reach across to find the common ground in our science needs. I think we have come a long way over the past few years and projects like the National Science Challenges and the management applicability of many MBIE-funded projects illustrate this trend. At the same time we continue to carry out 'traditional' research projects that are so important to maintain our scientific capability as a nation and underpin the more applied projects.

Most large research projects now have technical advisory groups, stakeholder steering groups, outreach components or other fora to connect researchers with resource managers, iwi, NGOs, communities, industries and other stakeholders. Research findings are increasingly communicated in easy-to-understand and relevant ways that make them more accessible to New Zealanders.

Let's keep this momentum going. Let's keep talking to each other and continue to improve our understanding of our respective science needs. Let's be smart about scoping research projects that have the science calibre to get the academic kudos researchers aim for but at the same time provide real tangible value to resource managers and communities.

Thank you so much for attending our 2017 conference. I hope you will enjoy the wide range of presentations, workshops and networking opportunities.

A big thank you also to our conference organising committee, our conference organiser, our sponsors and everybody else who helped make this conference happen. A lot of work goes into planning a conference and without you there would be no conference.

Hilke Giles, President, NZMSS 2017

CONTENTS

COMMITTEE LIST

Islay Marsden, University of Canterbury (Conference Chair)
Lesley Bolton-Ritchie, Environment Canterbury (Deputy Chair)
Phoebe Argyle, University of Canterbury (Student Rep)
Liz Brown, University of Canterbury
Nuwan De Silva, University of Canterbury (Student Rep)
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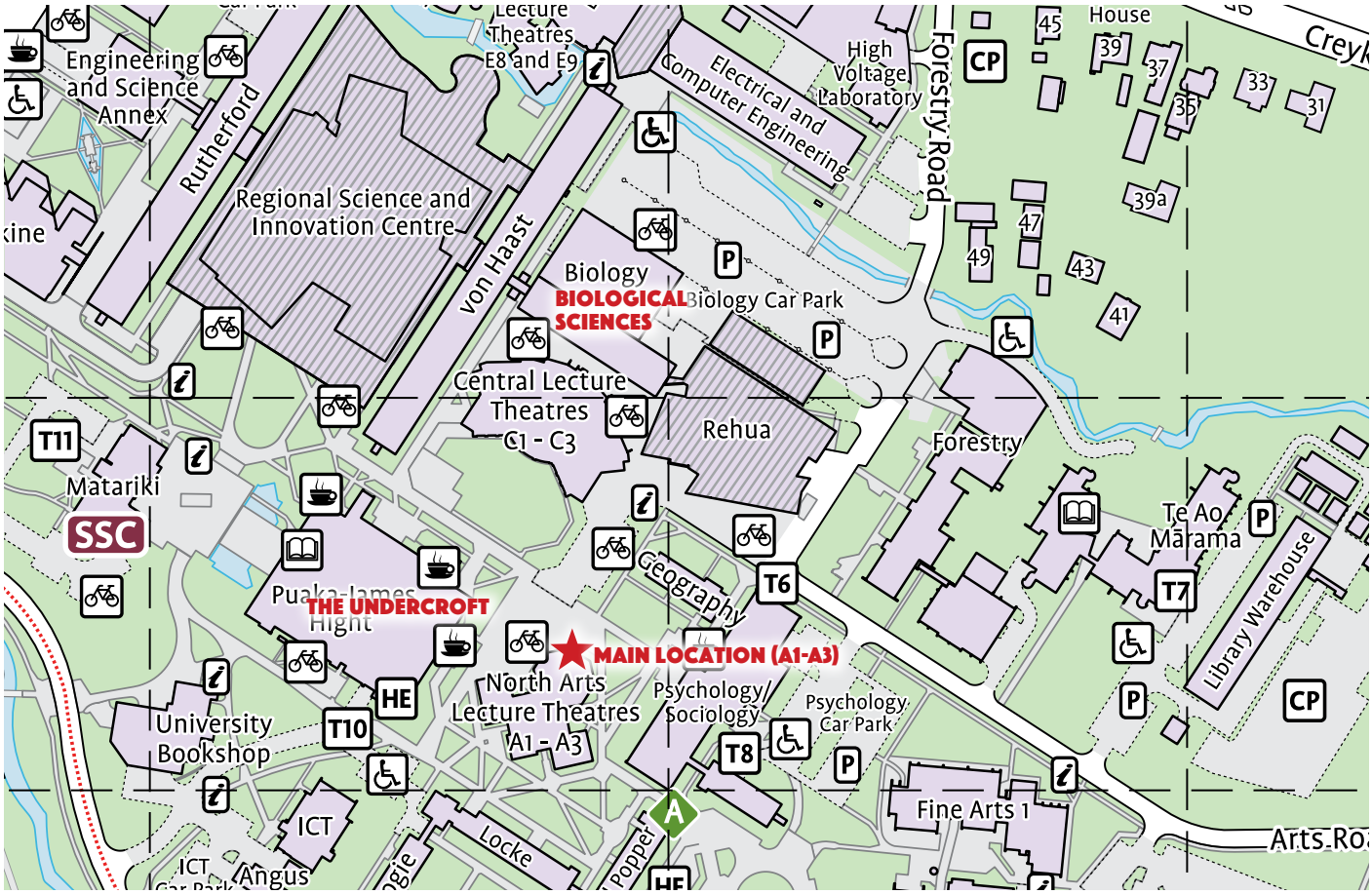

CONFERENCE VENUE

University of Canterbury, Christchurch (University Drive – off Clyde or Ilam Roads)
The main conference will be held in the North Arts lecture theatres (A1/A2/A3) adjacent to the Central Library. The Undercroft is below the library and will provide the location for all catered breaks as well as the poster and exhibition space. Monday's Icebreaker will be held in The Atrium (ground floor of nearby School of Biological Sciences).

www.canterbury.ac.nz/maps

GALA AWARDS DINNER JULY 6TH

The Tannery (3 Garlands Road, Woolston)
Welcome to the east! Come and dine in an old industrial precinct from the 19th century now home to a hub of creativity and hospitality. Enjoy The Tannery's stunning architecture and ambience as we celebrate the last evening of the conference complete with awards!

There will be plenty of parking as well as bus transportation to/ from the University of Canterbury (90 Ilam Road) with returns at approximately 10:00pm, 10:45pm, 11:30pm and midnight.

EMERGENCY & EVENT CONTACT INFORMATION

Emergency: Dial 111

Campus Security mobile no: 0800 823 637

Event Manager: Kerry South, South Events +64 (0)21 024 77 554

Event email: conference@nzmss.org

Medical: Campus Health Centre, 90 Ilam Rd, Ph. 03-364 2402

PARKING

The University has kindly offered the Law carpark for delegates to park. No tickets will be required as long as you are parked in this area (please see map). Campus parking is limited so if arriving by car we advise you to come early. Outside of the Law carpark the streets surrounding the University have limited car parking with some city council time limits. Campus parking charges apply 8:00am-5:00pm Monday through Friday. Visitors may park in designated COUPON parking areas by displaying an all-day parking coupon attached to the driver's window. An all-day parking coupon (useable only once) costs $7.50 and can be purchased at Cafe 101 nearby. Some short-term parking serviced by pay-and-display units may be available at a cost of $2.50 per hour, up to four hours.
www.canterbury.ac.nz/campus-services/parking/visitors.shtml

CHECK-IN HOURS

Monday July 3rd 5.00pm (Icebreaker, School of Biological Sciences Atrium). In North Arts foyer: Tuesday July 4th 8:00am, Wednesday July 5th 8:00am & Thursday July 6th at 8:30am.

CATERING

Teas and lunches will be offered for all three conference days in the Undercroft underneath the library a short walk from the North Arts building where presentations are held. Caterers have been provided with delegate dietary information from registration and every attempt has been made to meet all the dietary needs of delegates. Please let the event management staff (Kerry & Deborah) or catering staff know if you have any questions or need assistance. Specific dietary requirements will be placed on a separate table and labelled.

TRANSPORT

CYCLING

Conference attendees have access to two sources of inexpensive short-term loan cycles in Christchurch to help encourage sustainable transport (and fitness).

1. UC Student Association can provide hire bikes for free to attendees (first come, first served - only ten available!) The cycles come with a helmet and lock but no lights. Bring your own lights to use overnight. Pickup available from UCSA (ground floor Central Library building) 9am-5pm with conference name badge and driver's licence ID.
2. Nextbike offers short term rental bikes with five locations around the city. Register for $4 on their website (30 minutes free with registration, $4/hr or $20/24hrs). Use your smartphone app or call to confirm pickup and dropoff points. Helmets and locks included.

BUS

The 'Purple Line' runs from the city centre through Hagley Park and along Riccarton Road before stopping at the University of Canterbury on Ilam Road (approx. 35 min travel time plus 5 min walk to venue). Other bus lines that run to or near the University of Canterbury include the Orbiter, Yellow Line, 120 & 130. www.metroinfo.co.nz

AIRPORT TRANSPORT

For buses, shuttles and taxis from/to the airport as well as around Christchurch visit: www.christchurchairport.co.nz/en/parking-and-transport/public-transport/

Note: Taxi pick-up points #6 and #10, within the University campus, are the closest taxi stands to the venue.

CAR HIRE

There are many reputable car hire companies in Christchurch. Follow links here for details. https://tinyurl.com/yb9ae2po

INTERNET ACCESS

Guest Wifi access will be provided to delegates at no extra charge. Network

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To connect to the Canterbury University visitor network simply browse for wireless networks and connect to the one named UCvisitor. You may be prompted with a security warning that it is an unencrypted network which you will need to acknowledge to continue connecting. Once connected to UCvisitor you can open a web browser and attempt to load any webpage. The UCvisitor network gateway webpage will load automatically. Follow the directions on the gateway webpage to login with your username (uc6007) and password (832890).

DON'T FORGET!

- Please turn off your mobile phones during conference sessions. No recording of presentations is permitted.
- Name badges should be worn at all times. Be sure to pick yours up at the check-in.

VENUE POLICY

All visitors to the University of Canterbury must adhere to the University of Canterbury health and safety policies. Delegates are asked to follow any instructions provided by the organisers so that the organising committee can ensure these policies are met.

ENVIRONMENT

Recycle, reduce, reuse! Delegates are asked to decrease the environmental impact of this event by using the appropriate bins provided for waste and recyclables. No conference satchel will be offered so delegates are encouraged to bring their own bag if needed.

CAMPUS ACCOMMODATION

The Rochester and Rutherford is a Hall of Residence (77 Ilam Road) so please note if you are staying there that keys can be picked up during office hours Monday July 3rd at the Hall's office. From 4:30pm Monday keys must be picked up from check-in desk. If you anticipate a late check-in please contact the event manager to make arrangements. Breakfasts will be provided at 7:30am. The conference wifi code can be used by those staying at the Rochester and Rutherford.

NEED HELP?

Look for UC Student Volunteers wearing red shirts or Kerry and Deborah from South Events or committee members (identified on their name tags).

Photo: Regina Eisert

PRESENTERS' INFORMATION

Please familiarise yourself with the following information before your scheduled presentation time.

TALKS

Presentations will be 15min long including time for questions (12+3min is the preferred format). Please ensure your presentation is uploaded at least two breaks in advance of your presentation time. Each room will feature standard audio-visual equipment, data projector (format 16:9), lectern and computer. To upload your presentation, please go to the room you are presenting during a break with your presentation on a USB flash drive. A member of the organising team or volunteer will be available to assist you at the start of the day and at breaks.

If you have videos or animations in your presentation, please ensure you have embedded the files in your presentation and copied and transferred the video file together with your PowerPoint presentation. Without doing this, your video will not function. WMV or AVI file types are recommended. APPLE MAC USERS – please ensure your presentation can run on Windows.

POSTERS

All posters are to be A0 portrait format (32.7 x 45.4 inches or 83.0 x 115.4cm) and will be displayed throughout the conference. There will be a dedicated poster session on Tuesday 4 July at 17:30 in the Undercroft during which presenters are encouraged to be available for questions. Materials for hanging posters will be provided.

CHAIRPERSONS

Thank you for your assistance. Please check for written chair instructions at the lectern in the lecture theatre or from the registration desk.

JUDGES

If you are willing to assist with judging student presentations please see the registration desk or speak with coordinator Lesley Bolton-Ritchie.

PRIZEGIVING

NZMSS and student presenter awards will be presented after the conference at the Gala Awards Dinner.

PLENARY SPEAKERS

PROFESSOR IAN WRIGHT

is the Deputy Vice-Chancellor (Research and Innovation) at University of Canterbury since August 2016. Ian has a significant personal research career, coupled with extensive experience in research and technological leadership and management, having previously worked at the National Institute of Water and Atmospheric Research in Wellington, New Zealand. His personal research has included study on submarine arc volcanism, submarine hydrothermal venting, carbon capture and storage, and seafloor methane emissions. At NIWA he was the Centre Leader for Coasts and Oceans, and then spent eight years at the National Oceanography Centre / University of Southampton in the United Kingdom. His time in the UK included four years as Director of Science and Technology at the National Oceanography Centre (NOC), and a member of the UK Natural Environment Research Council Science Board. During his time at NOC, he led groups including all facets of marine science, including global scaled ocean modelling, underwater autonomous vehicle development, and chemical micro-sensor development. With his return to New Zealand in 2016, Professor Wright is responsible for research and innovation across the entire University of Canterbury, and sits on a number of New Zealand National Science Challenges governance groups, and on the boards of Brain Research New Zealand and the Medical Technologies Centres of Research Excellence, as well as the Canterbury Medical Research Foundation, and New Zealand Research Institute.

ASSOCIATE PROFESSOR TE MAIRE TAU

is the director of the Ngāi Tahu Research Centre at the University of Canterbury. He took up this position in 2011, having previously been a Senior Lecturer in History at the University. Te Maire belongs to Ngāi Tahu, the principal tribe of the South Island, and lives in Tuahiwi, the largest village of that tribe.

During his years as an undergraduate and later as a postgraduate student at Canterbury, Te Maire helped iwi leaders with their land claim to the Waitangi Tribunal, with a particular emphasis on traditional food-gathering practices. As a specialist historian on oral traditions, tribal genealogies and indigenous knowledge systems, Te Maire was used as an expert witness and historian for the settlement of the Ngāi Tahu Claim – the largest settlement in its day between Māori and the Crown for lands wrongfully taken. Since then he has had a number of publications dealing with oral traditions and the relationship between indigenous knowledge systems and how they intersect with western science.

DR VONDA CUMMINGS

is a marine ecologist at the National Institute of Water and Atmospheric Research (NIWA) in Wellington. She has a particular interest in the functioning of coastal benthic communities and the environmental drivers that influence them. Most recently her research has focused on the future changes predicted with warming and acidification of our oceans, and the implications for key components of NZ and Antarctic ecosystems. Vonda has been actively involved in Antarctic research since 2000, visiting the continent on many occasions, and is currently a deputy director of the NZ Antarctic Research Institute (NZARI).

SOCIAL FUNCTIONS

ICEBREAKER

The Atrium, School of Biological Sciences, University of Canterbury
17:00 Monday 3 July

Canapes and beverages will be served.

POSTER RECEPTION

Undercroft (below library)
17:30 Tuesday 4 July

Canapes and beverages will be served.

NETWORKING @ THE FOUNDRY (ALL WELCOME)

17:30 Wednesday 5 July

A drink ticket on entry and nibbles provided.

CONFERENCE GALA AWARDS DINNER @ THE TANNERY

18:30 Thursday 6 July

18:00 transport departs the University of Canterbury at 90 Ilam Road

Come and dine in an old industrial precinct from the 19th century now home to a hub of creativity and hospitality. Enjoy The Tannery's stunning architecture and ambience as we celebrate the last evening of the conference complete with awards! There will be plenty of parking as well as bus transportation to/from the University of Canterbury via the city centre with several returns from 10pm - midnight.

WORKSHOPS

Optional Friday workshops will take place at the University of Canterbury on Friday July 7th following the conference. Pre sign-up required.

MARINE MAMMALS & MĀTAURANGA

Friday July 7th @ 9.00am-5.00pm
Rm 275 School of Biological Sciences

Goals of this workshop will include:

- Improving integration of traditional knowledge, citizen science, conservation science, and academic research on marine mammals in NZ.
- Bringing together 'holders of knowledge' (traditional, academic, non-academic)
- Agreeing on specific protocols/best practice e.g., data collection, sightings, stranding response
- Facilitating new collaborations.

Catering provided.

SCIENCE COMMUNICATION WORKSHOP

Friday July 7th @ 9.00am-12.00pm
Kirkwood KE04/05/06

Targeted at all marine science professionals as your science communication skills are critical in today's world. The workshop will cover three core areas: visual, writing and social media and its focus will be on communicating science to the community.

Facilitators will include Victoria Metcalf, Matt Walters and Simon Pollard

Have you been told you need to have a public profile, or heard of Twitter but don't know what to do with it, or signed up but not entirely sure how to optimise Twitter time? Get up to speed with networking via social media in this hands-on fun workshop. We'll cover why and how to enter social media gracefully. We'll also delve into different ways to use Twitter and and other tools to effectively manage your social presence. (Victoria Metcalf).

Deciding to communicate (Matt Walters)

Using his experience as a science communicator in media, writing, lecturing and documentary advising, Simon suggests ways to explain science to make people realise it is an important part of the things they are interested in and care about. (Simon Pollard).

Morning tea will be supported by SETAC and the Chemistry Department at University of Canterbury.

SETAC
AUSTRALASIA

AWARDS

Student presenters are eligible for the awards below. Recipients will be announced at the conference dinner on Thursday July 6th.

Awards include:

- NZMSS Best presentation supported by University of Canterbury
- NZMSS Runner up presentation supported by Cawthron Institute
- Talk: Best use of quantitative methodology supported by Ministry for Primary Industries
- Talk: Best use of quantitative methodology runner up supported by Ministry for Primary Industries
- Poster: Best use of quantitative methodology supported by Ministry for Primary Industries
- Marine Protected Areas Award supported by Department of Conservation
- Technology Award supported by Zebra-Tech
- Best Applied Environmental Science presentation supported by the Coastal Special Interest Group
- Collaboration Award supported by Lyttelton Port of Christchurch

ORAL PRESENTATIONS

Bleaching severity in reef building corals is phylogenetically heritable

Dr. Paul Muir[1,2], Dr. Paul Marshall[2,3], Dr. Ameer Abdulla[2,3,5], **Dr. David Aguirre[6]**

[1]Queensland Museum, 78-102 Flinders St., Townsville, [2]Global Change Institute, University of Queensland, Australia, [3]Centre for Biodiversity and Conservation Science, University of Queensland, [4]Reef Ecologic, Queensland Australia, [5]Global Marine Programme, International Union for Conservation of Nature, [6]Institute Of Natural and Mathematical Sciences, Massey University, Auckland, New Zealand

Mass coral bleaching related to unusually high seawater temperatures is one of the greatest threats to the future of coral reefs globally. During the peak of the most severe bleaching event on record we investigated effects for an entire coral assemblage and found that susceptibility to bleaching showed strong phylogenetic effects. Using a novel estimate of species vulnerability, we predict how the assemblage is likely to respond to repeated bleaching events and identify several species at risk of local extinction.

Cross-trophic level effects of the introduced kelp *Undaria pinnatifida* on mussel reefs: influence on mussel consumption and recruitment

Dr. Tommaso Alestra[1], Dr. Mads Thomsen[1], Mr. Paul South[2], Prof. David Schiel[1]

[1]University of Canterbury, [2]Cawthron Institute

There is limited information about the impacts of introduced macrolgae on organisms at higher trophic levels as most studies focus on plant-plant interactions. We tested the effects of biogenic macrohabitats created by canopies of the introduced kelp *Undaria pinnatifida* on intertidal mussels' vulnerability to predation (by fish and crabs) and recruitment. In a caging experiment, we compared juvenile mussels' mortality in the presence and absence of predators in four habitats: 1) mussels + *Undaria*; 2) *Undaria*; 3) mussels; 4) bare space. Mussel survival was similarly affected by the predators in all habitats, with 100% mortality after four weeks. When predators were excluded, mussel survival was around 80% in all habitats. In a subsequent recruitment experiment, we used collectors to measure mussel settlement in the same four habitats. We found no differences among habitats in the abundance of primary and secondary settlers of four Mytilid species, and in the diversity of mobile invertebrate assemblages. Our results improve our understanding of the implications of *Undaria* invasions as this is one of the few studies to focus on the interactions between *Undaria* and native consumers and the first to test the impact of *Undaria* on cross-trophic interactions between sessile and mobile animals.

Ciguatera poisoning in the Kingdom of Tonga: the ecology of the dinoflagellate origin

Ms. Phoebe Argyle[1,2]

[1]*University of Canterbury,* [2]*Cawthron Institute*

Ciguatera poisoning, an illness caused by bioaccumulation of microalgae toxins, has been observed for many decades in nations around the Pacific. This is the first study of the causative genus, *Gambierdiscus*, in the Kingdom of Tonga. Data was collected at 5 sites around Tongatapu in collaboration with the Tongan Department of Fisheries. Habitat surveys, water quality measures were conducted to characterise the environment. To assess the diversity and distribution of *Gambierdiscus*, microalgae samples were collected off macroalgae and via settlement on artificial substrates. Live microalgae samples were brought back to New Zealand for isolation and culture. *Gambierdiscus* species were detected using DNA amplification and species-specific qPCR methods and were found to be present at all sites, with a total number of six species found. Thirteen isolates were successfully established into cultured, representing three species. Toxin production of clonal cultures was assessed using LC-MS/MS. Consistent with prior research, the *G. australes* isolate was found to produce maitotoxin and maitotoxin-3, with the *G. honu* and *G. pacificus* isolates producing only maitotoxin-3. This research has shown these toxic algae to be more prevalent than anticipated and provides a benchmark for further studies of ciguatera ecology in Tonga.

Resilience and Tipping Points of Rocky Reef Habitats – Turbidity

Ms. Mareike Babuder[1], Prof. David Schiel[1], Dr. Leigh Tait[2]

[1]*University of Canterbury,* [2]*NIWA*

Accumulating stressors have profound impacts on abundances and diversity of species in coastal ecosystems. In some cases even small changes can lead to depth and/or range shifts or, in extreme cases when a stressor exceeds a species' tolerance-limit, local extinctions. Canopy- forming macroalgae are important habitat-formers on rocky shores that increase biodiversity and productivity, and provide a range of ecosystem services. However, macroalgae can be sensitive to suspended sediments which alter light quality and reduce availability, although some have adaption strategies that allow them to cope with highly variable light regimes. In this phase of my PhD-project I am testing how suspended sediments affect photosynthetic efficiency of seven common canopy-forming brown macroalgae using incubation chambers and oxygen probes in laboratory and field experiments. I expect that species occurring deeper and adapted to low light intensities will be more efficient under turbid conditions compared to species occurring at lower depth. My PhD project is part of the Sustainable Seas Challenge, aiming to quantify stressors and identify tipping points ultimately to (a) predict future coastal community diversity and functionality and (b) provide underpinning science to managers, stakeholders and policy makers who can use our data to help set environmental thresholds and targets.

Managing marine pests before they get here: New Zealand's Craft Risk Management Standard for Biofouling

Ms. Tracey Bates[1]

[1]*Ministry for Primary Industries*

Biofouling on vessels is the primary pathway for the introduction of non-indigenous marine species into New Zealand. Once established here, these species can pose a significant risk to our marine environment. With marine biosecurity in particular, the best line of defence is prevention, as once a marine pest gets here, it is extremely difficult and costly to eradicate. To manage the biofouling pathway, the Ministry for Primary Industries (MPI) has issued new border requirements on levels of fouling, set out in the Craft Risk Management Standard (CRMS) for Biofouling on Vessels. These rules require all vessels to arrive in New Zealand with a "clean hull." To allow for education and uptake of the rules, the CRMS has been introduced with a four-year lead in, and will become mandatory for all vessels entering New Zealand in May 2018. When the CRMS comes into force, it will be New Zealand's primary tool to manage the risk of biofouling on vessels at border. This presentation gives an update on the implementation of the CRMS leading up to this date, and the tools and processes MPI will use to direct border management for all arriving vessels with respect to hull biofouling.

Modelling the impacts of seasonal variability in freshwater input into the Waikouaiti Estuary, Otago

Rachel Ozanne[1], **Brett Beamsley**[2]

[1]*Otago Regional Council,* [2]*MetOcean Solutions*

Regional Councils set minimum flow-levels and water allocation limits for rivers.

To determine safe limits for the Waikouaiti River, Otago Regional Council commissioned a modelling study of the Waikouaiti Estuary. The study assessed the difference that flow levels would make to the summer flushing characteristics when the natural riverine input into the estuary is at its lowest.

To capture the complexity of the Waikouaiti River hydrodynamics, MetOcean Solutions established a 3D SCHISM finite-element model for the estuary, which was calibrated and validated using in situ measurements. This model was combined with an Eulerian tracer method to examine the dilution of fresh water within the estuary.

The modelling showed that the range of summer flows has negligible effect on the overall hydrodynamics of the estuary. The tidal flows are so strong that they, rather than the river input, dominate the estuary hydrodynamics in the summer. Flushing rates vary between minimal at the estuary mouth, to more than 10 tidal cycles for the upper reaches. Further, modelling predicted ponding of more saline water in deeper areas within the river reaches, while fresh water was confined to the surface layers.

The modelling highlighted important aspects of estuarine function which will help the Council manage the area.

Clarifying murky waters: new science initiatives to assess sedimentation effects of deep-sea mining in New Zealand

Dr. Malcolm Clark[1], Dr. Vonda Cummings[1], Dr. Craig Stevens[1], Dr. Scott Nodder[1], Dr. Ashley Rowden[1], **Dr. Jenny Beaumont[1]**, Dr. James Bell[2], Ms. Dianne Tracey[1]

[1]NIWA, [2]Victoria University of Wellington

There is continuing interest in offshore minerals around New Zealand, and in recent years there has been exploration for ironsands, phosphorite nodules, and seafloor massive sulphides. However, two recent applications for seabed mining were declined, a key reason being uncertainty about the effects of sediment plumes created by disturbance to the seafloor.

Two new scientific projects, funded through the MBIE Endeavour Fund and the Sustainable Seas National Science Challenge, will address the effects of sedimentation using field surveys and laboratory-based experiments.

The Endeavour project involves disturbing an area of the seabed to generate a sediment plume, which will be monitored, and effects on benthic communities examined by pre-and post-disturbance sampling. Further surveys in 2019 and 2021 will determine longer-term resilience and recovery dynamics of the communities.

Laboratory-based work under both projects will involve exposing deep-sea taxa (e.g., corals, sponges and dog cockles) to various levels and duration of suspended and settled sediment to reveal acute threshold effects as well as sub-lethal chronic effects.

In combination, the two projects will provide information on the concentrations and distances over which impacts of suspended sediment on benthic communities become 'ecologically significant', and inform management options to ensure the environmental sustainability of seafloor mining.

Estimating Biological Fly South: foraging locations of the Hutton's shearwater *Puffinus huttoni*

Della Bennet[1], Assoc. Prof. Travis Horton[1], Dr. Sharyn Goldstien[1], Prof. James Briskie[1]

[1]University Of Canterbury

The Hutton's shearwater *Puffinus huttoni* is endemic to Kaikoura, New Zealand. These endangered birds only breed naturally within the Seaward Kaikoura Mountains. Until recently, research on this species has included monitoring population size, conserving the alpine colonies and establishing a new population at a lowland site, with little known about the birds while at sea. To identify foraging areas, determine diving depths, and measure trip durations, we deployed time-depth loggers and GPS devices during the 2017 chick-rearing season on 23 Hutton's shearwaters. We found that shearwaters traveled from their breeding grounds to feed 100 – 300 km south of Kaikoura, adjacent to the coast of Banks Peninsula. Trip durations varied from two to 21 days (mean = 7), while maximum dive depths ranged from three to 32 m (mean = 13.5 m). However, flight paths and durations varied between individuals, and it is not clear whether the patterns we observed were affected by recent earthquakes in the area, or by other fluctuations in the environment. Mapping the spatial and temporal distribution of Hutton's shearwaters at sea will be fundamental to their conservation, as such information can reveal potential areas of conflict with fisheries and other users of the marine environment.

Testing the ability of biotic indices to track environmental stressor gradients using a national estuarine dataset

Dr. Anna Berthelsen[1], Dr. Javier Atalah[1], Dana Clark[1], Eric Goodwin[1], Jim Sinner[1]

[1]*Cawthron Institute*

In response to the need to assess environmental health of marine benthic habitats, there has been a proliferation over the past 20 years of biotic indices based on soft sediment macroinvertebrate communities. However, indices may not be readily transferrable between regions due to differences in factors such as species identity or ecology, and environmental stressor type or range. In New Zealand, some indices developed overseas have been tested, and some indices have been locally developed for certain regions and/or particular stressors in estuarine intertidal habitats. However none of these have been consistently tested across a range of environmental stressors/variables at a national scale, a step towards selection of indices for within-country assessment and comparison. Using a new national dataset compiled from regional council data for 2001-2017, we tested the ability of several overseas and locally developed biotic indices to track environmental stressor gradients in New Zealand estuaries. The influence of other variables, such as region and estuary typology, on index vs stressor relationships was also investigated. Simple and multiple regression analyses were used to determine the ability of environmental stressors and other variables to explain variation in biotic index values.

Parameters of Long-finned Pilot Whales in New Zealand Waters: Insight from Strandings

Emma Betty[1,2], Dr. Sinead Murphy[3], Bethany Hinton, Dr. Barbara Breen[1], Dr. Karen Stockin[2]

[1]*Auckland University of Technology,* [2]*Massey University,* [3]*Galway-Mayo Institute of Technology*

Long-finned pilot whales frequently mass-strand in high numbers on the New Zealand coast, however, there is a lack of population-level information available to assess their conservation status. The current study presents basic biological parameters estimated from post-mortem data collected at New Zealand stranding events between 1978 and 2014. Using a Gompertz growth model, asymptotic lengths were calculated as 592cm for males and 437cm for females. Using the sum-of-fraction immature method, males are estimated to attain sexual maturity (ASM) at 12.2yrs and 467cm TBL, and females at 6.6yrs and 370cm TBL. Maximum ages of 31 and 40yrs were obtained for males and females, respectively. Estimates for ASM are in line with those reported from the Western North Atlantic, but lower than the Eastern North Atlantic. A pregnancy rate of 21% was determined, which is significantly lower than reported for North Atlantic populations. However, the estimation of biological parameters alone does not enable an assessment of the conservation status of New Zealand long-finned pilot whales. Population distribution, abundance, trends in abundance and biological parameters, and knowledge of factors affecting population dynamics (e.g. fluctuations in prey availability and effects of pollutants), are required not only to establish an effective management framework, but also to provide context for biological information collected from strandings.

The effects of coastal turbidity on kelp forest productivity

Caitlin Blain[1], Dr. Nicholas Shears[1]

[1]*Institute of Marine Science, University of Auckland*

Kelp forests are one of the most productive marine communities worldwide. However, anthropogenic stressors put the health and resilience of kelps, and the ecosystem services they provide, under threat. One often overlooked effect of climate change on subtidal ecosystems is a predicted increase in turbidity associated with increased storm activity, coastal erosion, and sediment runoff. The Hauraki Gulf provides a natural turbidity gradient to examine how variation in turbidity affects kelp. We monitored the growth and productivity of the kelp *Ecklonia radiata* at nine sites throughout the Hauraki Gulf to compare its morphology and physiological performance at different light levels. Despite decreases in benthic irradiance from outer to inner gulf sites, biomass accumulation was consistent in plants across all sites. In contrast, estimates of net primary production modelled using photosynthetic parameters declined with increasing turbidity. Our results indicate that plants at turbid sites allot the majority of assimilated carbon to lamina growth whereas those from high-light sites produce up to three times the carbon required to maintain growth. These preliminary findings suggest that, though *E. radiata* exhibits phenotypic plasticity across the Hauraki Gulf, kelp at turbid sites may be less resilient to additional stressors due to lower potential primary productivity.

Top-to-bottom sediment flushing of the Kaikoura Canyon during the 2016 Kaikoura Earthquake

Dr. Joshu Mountjoy[1], Philip M Barnes[1], Jamie Howarth[2], **David A. Bowden**[1], Alan Orpin[1], Jason Patton[3], Ashley A. Rowden[1], Scott Nodder[1], Aaron Micallef[4], Helen Bostock[1], Geoffroy Lamarche[1]

[1]*National Institute of Water and Atmospheric Research,* [2]*Victoria University of Wellington,* [3]*Humboldt State University,* [4]*University of Malta*

Earthquake-triggered canyon flushing is the periodic – 10^2 to 10^3 yr timescale – "cleaning out" of canyon sedimentary systems. Canyon flushing is a primary process for transporting sediment from land to the deep ocean. Sediment is transported in turbidity currents that can travel hundreds of kilometres at speeds >5 ms^{-1}, eroding and depositing sediment, and building the largest sedimentary bodies on earth in the form of deep sea fans. We have direct evidence from repeat bathymetric surveys, repeat video transects and sediment coring for a full top-to-bottom canyon flushing event in the Kaikoura Canyon during the November 2016 7.8 $_{Mw}$ Kaikoura Earthquake. This earthquake triggered widespread submarine landslides at the canyon rim, eroded a significant volumes of sediment from the canyon floor and transported sediment at least 300 km along the Hikurangi Channel. The event appears to have completely removed one of the highest biomass benthic ecosystems identified anywhere in the world. We are analysing this unique dataset to derive a frequency for canyon flushing events in the Kaikoura Canyon to understand long term sediment transfer processes and rates and the impact on ecosystem structure.

Assessment of a 'recreational' grade echo-sounder to provide quantitative information on the distribution and relative abundance of small schooling fish

Tom Brough[1], Prof. Steve Dawson[1], Dr. Will Rayment[1], Prof. Elisabeth Slooten[2]

[1]Department of Marine Science, University of Otago, [2]Department of Zoology, University of Otago

In coastal ecosystems, small schooling fishes have an important role linking upper and lower trophic levels and are key prey for marine top predators. Despite their importance, few studies have assessed their distribution and abundance. In this study, we used a 'recreational' grade echo-sounder (Lowrance Elite-7) to provide quantitative information on the spatial and temporal distribution and relative abundance of small schooling fish at Banks Peninsula. Between 2015 and 2017, 303 approximately 30 minute hydro-acoustic surveys were undertaken at 10 nearshore locations in winter and summer. Acoustic data were ground-truthed with visual observations of schools made by drop-cam and at the surface with photography. Analysis of volume backscatter data allowed for the detection of schools in 63% of surveys. In winter, 40% of surveys detected fish schools compared to 76% in summer. Strong temporal pulses of fish abundance occurred throughout the study area in summer but seemed to occur more frequently at locations such as Akaroa Harbour, Flea Bay and Long Lookout Point. The simple, inexpensive echo-sounder provided a feasible, repeatable method for sampling the patchy distribution of small schooling fish. These data will be key for modelling habitat preferences of threatened top-predators at Banks Peninsula.

Carbon and nitrogen stocks in New Zealand estuarine and coastal habitats

Dr. Richard Bulmer[1], Dr. Hilke Giles[3], Dr. Carolyn Lundquist[1,2]

[1]NIWA, [2]University of Auckland, [3]Waikato Regional Council

Coastal and estuarine habitats (including saltmarsh, mangrove, seagrass meadows, shellfish beds, and other soft sediment habitats) are hot spots for carbon and nitrogen storage (or stocks), a fundamental ecosystem service. However, studies measuring carbon and nitrogen stocks typically measure stocks in one habitat in isolation (e.g. mangroves or saltmarsh). Without measuring stocks across habitats, it is very difficult to accurately estimate how changes in habitat types may affect carbon or nitrogen stocks at the landscape level (i.e. what happens to stocks if mudflat replaces shellfish habitat?). This is particularly important given that management activities (such as resource extraction, dredging, catchment sediment management) and future impacts (such as climate change) are likely to modify the spatial distribution of habitats in estuarine ecosystems and have consequences for carbon and nitrogen stocks and ultimately environmental and ecological health. Here, we discuss the result of a pilot study in the Waikato Region (Tairua Estuary). This study has revealed that carbon and nitrogen stocks in New Zealand estuarine habitats (saltmarsh and mangrove) are significant but highly variable spatially. Further, the value of non-vegetated habitats (such as sand and mudflats) appear to be underestimated, considering their large areal extent within estuarine and coastal systems.

Intertidal habitat use by eagle rays – are all sandflats created equal?

Ms. Helen Cadwallader[1], Prof. Chris Battershill[1], Dr. Phil Ross[1], Dr. Malcolm Francis[2]

[1]*University Of Waikato,* [2]*National Institute of Water and Atmospheric Research*

Knowledge of spatial and temporal distribution patterns is valuable for species conservation and management. Unfortunately, for many marine species, this information is scarce, and species management poorly informed. Worldwide, sharks and rays are under threat, in part due to habitat loss and degradation. In New Zealand, stingray habitat, particularly harbours and estuaries, is increasingly threatened by anthropogenic development and habitat modification. Little is known about the habitat use of New Zealand stingray species, rendering management and protection of key habitats a challenge. To address this uncertainty, spatio-temporal habitat use patterns were investigated in the New Zealand eagle ray (*Myliobatis tenuicaudatus*). The distinctive excavations created by eagle ray feeding activity are used to quantify feeding effort in a number of intertidal sandflat areas and surveys of infaunal biodiversity used identify relationships between feeding activity and prey distribution. Data are presented for an eleven-month period, showing a seasonal and locational difference in pit density and suggest that all sandflats are not created equal. Results suggest that the structure of infaunal assemblages may be influencing the feeding effort of rays in unexpected ways.

Science meets mitigation: Analysing observer data from seismic surveys collected under New Zealand's Code of Conduct

Dr. Simon Childerhouse[1], Dr. Dave Lundquist[2], Dr. Andrew Wright[2], Mr. William Arlidge[2], Ms. Lesley Douglas[1], Ms. Jane Kennedy[1]

[1]*Blue Planet Marine,* [2]*Department of Conservation*

All seismic surveys in NZ EEZ waters are a permitted activity as long as they comply with the DOC's *2013 Code of Conduct for Minimising Acoustic Disturbance to Marine Mammals from Seismic Survey Operations* (the Code). Data from Government-approved observers aboard seismic vessels collected under the Code are submitted to the DOC at the end of each survey. We undertook a preliminary analysis of 26 seismic surveys spanning the period 2013-2015 and used this data to provide a review of marine mammal sighting data, mitigation actions, and operational issues. 1,159 cetacean detections were made across 36 different taxa, plus an additional 1,550 fur seal sightings. Overall, this analysis is a useful preliminary investigation of the effectiveness of current requirements to monitor for marine mammals near seismic survey vessels and implement mitigation measures to reduce potential effects, and down time associated with these actions.

Multiple stressor effects in marine ecosystems: responses of estuarine taxa and functional traits to sediment, nutrient and metal stress

Ms. Dana Clark[1], Dr. Joanne Ellis[2], Dr. Javier Atalah[1], Mr. Weimin Jiang[1], Mr. Caine Taiapa[3], Prof. Murray Patterson[4], Jim Sinner[1], Dr. Judi Hewitt[5]

[1]Cawthron Institute, [2]King Abdullah Univeristy of Science and Technology, [3]Manaaki Te Awanui, [4]Massey University, [5]NIWA

Sediment, nutrient and metal loading to estuarine and coastal environments is increasing hence there is a growing need to predict ecological responses to such change. Maximum abundance models of 20 macrobenthic taxa and 22 functional traits were developed for sediments, nutrients and metals to predict how taxa and ecosystem function respond to key stressors. The abundance of most taxa declined in response to sedimentation and metals while a unimodal response was often associated with nutrient loading. Optimum abundances for both taxa and traits were at relatively low stressor levels, highlighting the vulnerability of estuaries to increasing stressor loads. Individual taxa were more susceptible to stress than traits, reflecting the redundancy inherent within functional groups and that functional traits may be less sensitive for detecting changes in ecosystem health. Multiplicative interaction effects were more common than additive ones, with multiplicative effects identified for most taxa and traits modeled. The observed sensitivity of most taxa to increasing sediment and metal levels and the documented interaction effects between multiple stressors have important implications for understanding, predicting and managing the ecological consequences of eutrophication, sedimentation and contaminants on coastal ecosystems.

A high-resolution record of coastal deformation in the 2016 Mw 7.8 Kaikōura earthquake

Dr. Kate Clark[1], Dr. Edwin Nissen[2], Dr. Sharyn Goldstien[3], Dr. Jamie Howarth[1], Dr. Ursula Cochran[1], Dr. Pilar Villamor[1], Shawn Gerrity[3]

[1]GNS Science, [2]University of Victoria, [3]School of Biological Sciences, University of Canterbury

Extensive coastal uplift was one of the more apparent impacts of the 2016 M_W7.8 Kaikōura earthquake. Within days of the earthquake, a survey team of geologists and marine biologists were in the field to observe and measure the coastal deformation, and airborne lidar was acquired along 90 km of the coastline. We present a high-resolution record of coseismic coastal deformation compiled from post-earthquake field measurements of coastal uplift using displaced low-tidal biota, differencing of pre- and post-earthquake airborne lidar, and satellite geodesy. This dataset, extending along ~110 km of coastline, reveals highly variable metre-scale vertical displacements and is one of the most complex records of coastal deformation observed globally in recent times. Sharp changes in coastal deformation are recorded at the surface ruptures of the Hundalee, Papatea and Kekerengu faults, while lower amplitude variability in coastal uplift reflects distributed deformation near the major fault surface ruptures, minor fault surface ruptures and slip on nearshore faults subparallel to the coastline. Along parts of the Kaikoura coastline, marine terraces record evidence of previous coseismic uplift indicating that over timescales of >1000's years, earthquake-driven uplift is a recurrent process shaping the Kaikoura coastline.

The role of streams in determining toheroa distribution and abundance

Jane Cope[1], Willem de Lange[1], Conrad Pilditch[1], Shade Smith[2], James Williams[3], Phil Ross[1]

[1]University of Waikato, [2]Triplefin Environmental Consulting, [3]NIWA

Toheroa (*Paphies ventricosa*) were once abundant on the west coast of Northland, until extensive harvesting led to their collapse. Despite 40+ years of protection, populations have, for unknown reasons, failed to recover. Poaching, vehicle impacts, climate change, algal blooms, predation and changing land use have been suggested as explanatory factors. However, testing these hypotheses has been difficult as little is known of their habitat requirements. In Northland, there is an association between toheroa and streams. The reasons for this association are unknown, but a reduction in freshwater flow has coincided with further declines in toheroa abundance. This research examines the mechanisms behind this toheroa-stream association with a focus on determining how streams modify beach habitat. Specifically, we focus on: the influence of streams on beach topography and recruitment dynamics; whether streams provide a temperature buffer and refuge against desiccation; and the effect of land use effects on water quality.

Changing types of organic detritus influences nitrogen cycling rates in temperate estuary sediments

Miss Josie Crawshaw[1], Dr. Teri O'Meara[2], Dr. Candida Savage[1], Dr. Marc Schallenberg[3]

[1]Department of Marine Science, University of Otago, [2]Department of Marine Science, University of Otago, [3]Department of Zoology, University of Otago

Estuaries are highly valued for their nitrogen recycling capacity, reducing the nitrogen load before export to the ocean. Organic detritus inputs to estuaries can enhance the process of denitrification through carbon resource supply to denitrifiers, however, research into the influence of the quality or source of carbon is limited. We hypothesise that changes in the organic detrital source available to denitrifying microorganisms may change the denitrification potential of the estuary, and therefore the ecosystem service it provides in terms of nitrogen removal.

We used a flow-through tank to measure fluxes in dissolved nitrogen (NO_3, NH_4), oxygen and nitrogen gas in the water column under five different organic detritus depositions. Control sediments were nitrogen fixing, and inputs of the carbon sources decreased the rate of nitrogen fixation, in some treatments flipping them to nitrogen removal by denitrification. The rate of oxygen uptake appeared to drive the switch between nitrogen fixation and denitrification, and an oxygen uptake threshold appears to exist where this switch occurs.

Our research will provide insights to hotspots of denitrification associated with organic matter detritus, and to provide direction for management of how shifting carbon sources may influence the nitrogen cycling capacity of estuarine sediments.

Emerging Organic Contaminants (EOCs) in aquatic food species – do they get in?

Peter Cressey[1], Andrew Pearson[2]

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EOCs are a miscellaneous group of chemicals that may enter the environment as a result of human activities. There has been considerable focus on their occurrence in human waste material and the environment, and the resulting impacts on ecosystem health. There has been rather less focus on the potential of these compounds to accumulate in aquatic human food species and enter the human food chain.

This presentation will consider the available evidence for the occurrence of EOCs, including flame retardants, plasticisers, surfactants, perfluorinated compounds, musk fragrances, personal care products, pharmaceuticals, steroid estrogens and others, in human foods of aquatic origin and the contribution this route of exposure may make to dietary exposure to these substances. The toxicity of these substances was also considered, in association with occurrence data, to develop a qualitative human health risk ranking for these substances in the New Zealand aquatic environment.

Drones for Good: Adapting an off-the-shelf Quadcopter for Aerial Photogrammetry

Prof. Stephen Dawson[1], Mr. M. Hamish Bowman[2], Ms. Eva Leunissen[1], Dr. Pascal Sirguey[3]

[1]Marine Science Dept., Otago University, [2]Geology Dept., Otago University, [3]School of Surveying, Otago University

We describe a simple system enabling accurate size estimation of swimming marine mammals and other large vertebrates from low-altitude single frame photogrammetry via inexpensive modifications to a "prosumer" quadcopter unmanned aerial vehicle (UAV) equipped with gimballed micro4/3 camera and 25 mm lens. Image scale is established via a lightweight independently powered LIDAR/GPS data-logging system, programmed to log altitude and GPS location at 1 Hz. Photogrammetric calibration of the camera and lens allowed lens projection and distortion parameters to be rigorously accounted for during image analysis, via a custom-programmed Graphical User Interface running in MATLAB.

LIDAR accuracy, measured from 10 bridges ranging from 9-39 m above water was 99.9%. The system was deployed on 136 flights in New Zealand's subantarctic Auckland Islands for measuring southern right whales. Repeated measurements of a floating reference target showed a mean error of c.1 %. Mean lengths of 10 individual whales, each photographed between 7 to 15 times had CVs (SD/mean) ranging from 0.5-1.8 % (mean = 1.2 %). Our system is relatively inexpensive (<NZ$8000), easily put together, produces accurate, repeatable measurements from single vertical images, and hence is applicable to a wide range of ecological questions in both terrestrial and marine habitats.

Assessment of trace metal pollution in New Zealand estuaries: Integrated use of biochemical, physiological and reproductive biomarkers in New Zealand mud snail *Amphibola crenata*

Mr. Nuwan De Silva[1], Prof. Islay Marsden[1], Assoc. Prof. Sally Gaw[2]

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Organisms that live in estuaries are often exposed to higher levels of contaminants than those in open coastal habitats because they are exposed not only water borne toxins but they may also be closely associated with highly contaminated sediments. The endemic deposit feeding mud snail *Amphibola crenata* is widespread throughout New Zealand estuaries and is being assessed as a bioindicator of environmental conditions in estuaries using multiple biomarkers approach. Mud snails and sediment samples were collected from eleven estuarine sites varying in terms of anthropogenic impacts, of the South Island of NZ. Trace elements, including Cu, As, Cd, Zn, Ni and Pb, were measured in body tissues, and in the sediments from where mud snails were collected. Sediment trace metals remained relatively low for most of the sites. Tissue metal accumulation level correlated with the sediment trace metals for most of the study sites. Haemolymph glucose and protein levels increased in the most of the contaminated sites compared to the respective reference sites. Physiological biomarkers including oxygen consumption and ammonia excretion also correlated with metal bioaccumulation. Reproductive behavior of *A. crenata* showed significant site specific variations.

Thus, the sampling sites were easily distinguishable based on the metal contamination and biomarker responses of mud snails.

Unlocking NZ's EEZ data

Mr. Matthew Dean[1]

[1]*Environmental Protection Authority*

The EPA holds a relatively new role within NZ's legislative framework as a guardian of information on activities and environments in NZ's Exclusive Economic Zone and Continental Shelf. As part of that role the EPA receives unique information on activities and habitats in our deep oceans. This includes information on sensitive environments, direct toxicity analysis, benthic monitoring attained both statutorily and through unique arrangements with people operating in this area.

As part of the EPA's strategic focus on forming enduring partnerships, a project is being developed to extract valuable information to expand our understanding of this little known part of NZ's sovereignty. The EPA expects outcomes to guide future activities, monitoring efforts and consenting decisions and is excited to discuss this with members.

Plankton food web structure and trophic flows in the Chatham Rise

Dr. Moira Décima[1], Dr. Matt Pinkerton[1], Dr. Andres Gutiérrez-Rodríguez[1], Dr. Michael R. Stukel[2], Karl Safi[1], Mark Gall[1]

[1]*NIWA,* [2]*Florida State University*

The Subtropical Convergence zone east of New Zealand is characterized by high phytoplankton production, economically important fisheries (relying heavily on meso- macro-zooplankton and mesopelagic fish for growth and survival), and low export. We investigated these waters in the region located over the Chatham Rise, during two voyages in late winter (August) and early summer (December) 2015. A mosaic of physical and biological conditions were encountered in the different stations sampled and seasons, which had marked effects on trophic flows. In particular, some areas during the summer season (but not all) were dominated by gelatinous zooplankton (salps), contrasting to winter crustacean-dominated conditions, and these shifts significantly affected grazing rates and trophic structure. Experimental results from microzooplankton dilution experiments, gut-pigment-based grazing, biological standing stocks, and stable isotopes, were assimilated using an inverse ecosystem model to constrain the main trophic pathways within the pelagic food web. We used a novel inverse ecosystem modeling approach combining linear and non-linear programming techniques to assimilate in situ measurements into a consistent food web model for the region. Results indicate important differences among flows during the two seasons, and sensitivity analyses identify the processes that disproportionately affect trophic flows.

Managing Manukau Mangroves: investigating the social-ecological trade-offs between removing and preserving mangrove

Ms. Amrit 'Imi' Dencer-Brown[1], Prof. Andrea Alfaro[1], Prof. Simon Milne[1]

[1]*Auckland University of Technology*

Seaward expansion of mangroves in New Zealand has created a myriad of social-ecological issues regarding their value. An investigation into the social-ecological trade-offs of preserving and removing mangroves is of pressing importance for sustainable management of coastal ecosystems where mangroves exist. This research employs a mixed-methods approach to review current management practices, ecological assessments, perceptions and attitudes towards mangroves at three sites in the Manukau Harbour, Auckland. Polarity of opinion exists depending on which ecosystem services are valued. Early results indicate that decisions for mangrove removal are driven by observations of landscape change over time with replacement of open water spaces. This is viewed by some as detrimental to both society (e.g. recreation) and ecology (e.g. wading bird species requiring open water and mudflats). Advocates for mangrove preservation focus on ecological values such as providing cover for threatened species like the Banded Rail. The majority of ecological assessments of mangroves have been short-term with a focus on benthic and bird species. Long-term ecological monitoring of mangroves must be put in place to assess the effects of removal. This research integrates social and ecological data through a convergent parallel design to address this complex human-environment interaction.

Delivery of probiotics to aquaculture: challenges and strategies

Ms. Seyedehsara Masoomi Dezfooli[1,2], Dr. Noemi Gutierrez-Maddox[2], Prof. Andrea Alfaro[2], Dr. Ali Seyfoddin[1,2]

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Probiotics can have various applications in aquaculture industry such as prevention of infectious diseases and conferring health benefits. However, conventional methods of delivering probiotics in aquaculture have many shortcomings including the potential to contaminate aquatic environment, high preparation cost, inefficiency in delivering probiotics in enough dosages and to their specific target sites. This study aims to introduce an environmentally friendly strategy for delivering probiotics to farmed abalone (*Haliotis iris*). Natural and biocompatible polymers were used to encapsulate a combination of three bacterial species isolated from abalone's gut tract. Pre-formulation studies were performed to evaluate probiotics' ability in facilitating feed digestion in abalone. The three bacterial species (*Exiguobacterium*, *Vibrio* and *Enterococcus*) were screened for their proteolytic, amylolytic and alginolytic activities. Probiotics were then encapsulated using a water-in-oil emulsion technique. Probiotics were successfully encapsulated with the encapsulation efficiency of between 75-95%. The produced microparticles were within the size range of 30 to 200 micrometres. The stability of particles was studied in seawater and simulated gastric juice of abalone. In conclusion, confined probiotics in multi-layer microcapsules were protected against adverse environmental conditions and were capable of delivering probiotics efficiently into the target site in abalones' gastrointestinal tract.

Denitrification activity in New Zealand estuaries: A synthesis of environmental factors that control variability

Ms. Emily Douglas[1], Prof. Conrad Pildtich[1], Dr. Drew Lohrer[2], Prof. Louis Schipper[1], Dr. Candida Savage[3], Prof. Simon Thrush[4]

[1]University Of Waikato, [2]NIWA, [3]University of Otago, [4]University of Auckland

Denitrification in coastal soft sediments removes bioavailable nitrogen and may provide resilience to nutrient enrichment, and mitigate shifts towards eutrophication. Much of the existing knowledge about denitrification is based on small-scale field measurements or laboratory studies because it is a difficult and expensive process to measure. Denitrification is likely to be highly variable, both spatially and temporally and managers need to know what factors regulate denitrification at scales broader than most studies can encompass (i.e. whole habitat/estuary scale). We conducted a synthesis of denitrification enzyme activity (DEA, a proxy for denitrification) and environmental data (grain size, organic content, macrofaunal community, microphytobenthic biomass) from three estuary surveys and ambient data from two experimental studies (n=118) to bridge this information gap. We found that overall, sedimentary environment accounted for the majority of variability in DEA (DistLM R^2=45%), and the remainder by the macrofaunal community (R^2=10%). With increasing sediment mud and organic content DEA increased up to a threshold of 30% mud content. Delivery of this ecosystem service is therefore likely to be hindered by increasing sedimentation in coastal ecosystems. Our findings are in agreement with other denitrification studies in oligotrophic estuaries and give confidence in scaling up results.

Does primary production in emerged estuarine sediments provide resilience against increasing turbidity?

Ms. Tarn Drylie[1], Prof. Conrad Pilditch[1], Dr. Andrew Lohrer[2], Dr. Hazel Needham[1]

[1]*University of Waikato,* [2]*NIWA*

Increasing inputs of terrestrial sediments elevates water column turbidity, reducing light availability to benthic primary producers that sustain estuarine foodwebs. For intertidal habitats, photosynthesis during low tide periods of emergence may provide resilience against this temporally displaced stressor, yet the significance of low tide production (PP) has largely been overlooked. Emerged and submerged benthic PP was measured in adjacent vegetated (*Zostera muelleri*) and unvegetated soft-sediment habitats at three locations encompassing a turbidity gradient within Kaipara Harbour. The net flux of CO_2 across emerged sediments was measured using an infrared gas analyser, and converted to O_2 flux. Benthic incubation chambers were used to measure dissolved oxygen flux across submerged sediments. Paired light and dark chambers were used in both cases, from which net (NPP) and gross PP (GPP) were derived. Emerged NPP and GPP (μmol O_2 m^{-2} h^{-1}) were both significantly higher than submerged in all habitats and locations ($p < 0.01$). Total PP (emerged NPP + submerged NPP) decreased with increasing turbidity for both habitats, whilst the relative contribution of emerged NPP increased as sites became more turbid. Our study shows the importance of emerged intertidal sediments for providing resilience against productivity losses in highly turbid environments.

Testing the efficacy of ship strike mitigation for whales in the Hauraki Gulf, New Zealand

Ms. Philippa Ebdon[1], Ms. Leena Riekkola[1], Dr. Rochelle Constantine[1,2]

[1]*School of Biological Sciences, University of Auckland,* [2]*Institute of Marine Science, University of Auckland*

Evidence-based policy is critical to marine governance, especially when many stakeholders are involved. In 2013, a range of ship strike mitigation measures were introduced to protect a critically threatened population of Bryde's whales in the Hauraki Gulf, including a voluntary 10kt speed limit and whale-avoidance protocol. To test the efficacy of the protocol, from October 2014 – September 2016, 189 groups of whales and shipping routes of 703 vessels >70m in length were mapped using ArcGIS. Hotspots of preferred whale habitat differed from previous years, but shipping traffic density did not. Probability of lethal ship strike to Bryde's whales in the Hauraki Gulf has nearly halved (26%) since 2013 (51%), due to a drop in average vessel speeds from 13.2kt to 10kt. Using the Large Whale Warning System, a real-time ship-strike mitigation measure, potential ship-strike events were analysed using Automatic Identification System shipping data to map the ship movements when a whale was reported. Only 15% of whale sightings were reported to harbour control, and no ships clearly diverted their course to avoid reported whale locations. This study highlights the importance of testing the efficacy of conservation mitigation measures, as highly effective actions may eclipse the need for less effective techniques.

"..water your own yard if you crave green grass" – industry's investment in innovative research

Mr. Mark Edwards[1]

[1]*NZ Rock Lobster Industry Council*

It is a commonly held view that government is responsible for natural resource research. But since 1997 the NZ Rock Lobster Industry Council (NZRLIC) has been the principal rock lobster research provider to government. It contracts an international team of scientists to undertake stock assessments, oversights observer catch sampling and tagging, and runs an extensive commercial vessel logbook programme. The research focus of NZRLIC now extends into biosecurity, food safety, climate change, animal husbandry and protected species interactions.

NZRLIC has recently collaborated with Victoria University in two tranches of genetic research. The latest, using state-of-the-art DNA profiling, has produced different, more reliable results. The project sought information on larval exchange, population structure and source-sink dynamics. Evidence has emerged of different genetic groups and environmental factors affecting genetic structure.

These results tend to support current management arrangements for rock lobster stocks, have implications for stock assessment, and have particular application to support food safety traceability, increasingly important for marketing provenance and branding.

NZRLIC's investment in innovative research reflects the strong stewardship incentive in the stock and ongoing pursuit of the best science to inform advice, in partnership with the recreational sector and customary, that supports a productive, sustainable rock lobster resource.

The price of piscivory: Body size vs. dietary specialisation in Antarctic killer whales (*Orcinus orca*)

Dr. Regina Eisert[1], Dr. Olav Oftedal[2], Dr. Ingrid Visser[3]

[1]*University of Canterbury,* [2]*Smithsonian Institution,* [3]*Orca Research Trust*

Killer whales (*Orcinus orca*) in the Southern Ocean and elsewhere have been classified into types on the basis of differences in morphology and dietary specialisation. Dietary specialisation has been proposed as a possible driver of radiation within the genus *Orcinus*, but a functional link between observed morphological differences and diet among types has been missing. This study presents the first quantitative analysis of body size, body mass, energy expenditure, and prey energy density in relation to dietary specialisation of Antarctic killer whale types.

Based on refined models for estimating body mass (BM) and field metabolic rate (FMR) from body length of killer whales [$BM=21.2BL^{2.82}$; $FMR= 12.262BL^{2.117}$], the range of adult BM and FMR. among Antarctic killer whale types varies by a factor of three for FMR. to five for BM. Estimated differences in the size and energy expenditure of Antarctic killer whale types correlate closely with the energy value of their postulated diet (fish>penguins>seals>minke whales).

Large differences in body size and a strong correlation of body size and dietary specialisation support the interpretation of Antarctic killer whale types as representing an adaptive radiation within the genus *Orcinus*, as first proposed by Russian scientists.

Penguins – marine sentinels on the way out? The importance of managing regional threats in the face of climate change

Pablo Garcia-Borboroglu[3], **Ursula Ellenberg**[1], Thomas Mattern[2,3], Philip J. Seddon[2]

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Using two threatened penguin species as an example, we illustrate current challenges and opportunities for effective protection of coastal marine habitat in the face of environmental change. Like all central place foragers, penguins have to balance the need for breeding habitat with the requirement to find food to sustain themselves and their offspring. Species confined to narrow ranges may be more vulnerable to environmental perturbations. Fiordland penguins/tawaki (*Eudyptes pachyrhynchus*) breed discontinuously along a stretch of only ~500 km of coastline in New Zealand's rugged and inaccessible southwest. Yet, despite their limited distribution, the species utilises remarkably diverse oceanic habitats, ranging from shelf, to pelagic and even fjord ecosystems. Consequently, global environmental change might differentially affect parts of the population depending on which habitats are used. Yellow-eyed penguins (*Megadyptes antipodes*), in comparison, appear less flexible in their foraging strategies. Although their distributional range is larger than that of Fiordland penguins, as almost exclusive bottom foragers Yellow-eyed penguins are sedentary and limited to the shallow continental shelf as marine habitat. We will discuss how the differences in their marine ecology will affect their ability to cope with environmental change, and provide data to inform and refine current conservation efforts.

Building the molecular phylogeny of New Zealand marine bony fishes: a first step toward understanding phylogenetic diversity across latitude and depth

Dr. David Eme[1], Libby Liggins[2], Elisabeth Myers[1], Clive D. Roberts[3], Carl D. Struthers[3], Salme Kortet[3], Jeremy Barker[3], Andrew L. Stewart[3], Marti J. Anderson[1].

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Knowledge regarding spatial patterns in oceanic biodiversity is mostly limited to descriptions of species diversity in shallow waters. However, understanding the origin and evolution of oceanic biodiversity requires information regarding biodiversity variation along the depth gradient, as well as variation in functional (role of the organisms) and phylogenetic (their evolutionary history) diversity. Our research aims are to quantify functional and phylogenetic diversity of New Zealand's ray-finned fishes across latitude (21 degrees, Kermadec Islands– Auckland Islands) and depth (50–1200m) using a robust, replicated fish community survey. This contribution will focus on one of the essential building-blocks of our research - constructing the first multi-gene molecular phylogenetic tree for the marine bony fishes of New Zealand. We have developed a pipeline to extract DNA sequences and metadata from various databases, select representative sequences for the most informative genes, identify the gaps in a species*gene matrix to inform targeted DNA sequencing, and build a time calibrated phylogeny including the topological knowledge based on previous large scale fish phylogenies. We will represent a preliminary phylogeny and chronogram of New Zealand's bony fishes and discuss the macroecological and macroevolutionary research that will ensue.

Response of marine invertebrates to reduced seawater pH and warming at larval settlement, metamorphosis and early post-settlement

Ms. Nadjejda Espinel[1], Mr. Sam Dupont[2], Mr. Antonio Agüera[3], Ms. Linn Hoffmann[4], Mr. Federico Baltar[1], Mr. Miles Lamare[1]

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Many studies concur in the fact that early-life stages of marine invertebrates are the most vulnerable stages to the effects of Ocean Acidification (OA) and warming. Understanding the vulnerabilities of marine early life history stages seems crucial for predicting how marine populations and ecosystems will fare in the face of climate change.

My research aims at quantifying the potential effects of ocean acidification (OA) and warming on larval settlement, metamorphosis and early post-settlement in a range of key New Zealand coastal species. The subject species have important ecological, cultural and commercial value in New Zealand, and include the New Zealand Abalone (*Haliotis iris*), the Green-lipped mussel (*Perna canaliculus*), the sea urchin *Evechinus chloroticus*, the barnacle *Austrominius modestus* and the Polychaete *Galeolaria hystrix*. Besides, little is currently known on how exactly OA and warming affects settlement on marine invertebrates, whether it is through direct or indirect effects. Specifically, I will examine how reduced seawater pH and warming may induce changes in the larval settlement, which may be due to either direct effects on the larval behaviour or physiology, due to indirect effects (i.e. changes in settlement substrate), or both.

Bilge water as a vector for the spread of marine pests: a morphological, metabarcoding and experimental assessment

Dr. Lauren Fletcher[1], Dr. Anastasija Zaiko[1,2], Dr. Javier Atalah[1], Dr. Xavier Pochon[1,3], Dr. Susana Wood[1,4], Dr. Grant Hopkins[1]

[1]Cawthron Institute, [2]Marine Science and Technology Center, Klaipeda University, [3]Institute of Marine Science, University of Auckland, [4]Environmental Research Institute, University of Waikato

Vessel movements are considered the primary anthropogenic pathway for secondary spread of marine nonindigenous species. In comparison to the well-studied mechanisms of hull fouling and ballast water, the importance of bilge water for domestic spread of non-indigenous species is largely unknown and has the potential to compromise the overall effectiveness of biosecurity management actions. In this study, the diversity and abundance of biological material contained in bilge water from 30 small vessels (< 20 m) was assessed using traditional and molecular identification tools. Laboratory-based studies were also used to investigate the relationship between voyage duration and propagule success. A large taxonomic diversity in organisms was detected, with 118 and 45 distinct taxa identified through molecular and morphological analyses, respectively. Molecular techniques identified five species recognised as nonindigenous to the study region. Larvae and fragments passed through an experimental bilge pump system relatively unharmed. Time spent in the bilge sump was found to affect discharge success, particularly of short-lived and sensitive larvae, but survival for 3 days was observed. Our findings show that bilge water discharges are likely to pose a non-negligible biosecurity threat and that further research to identify high-risk vessel operating profiles and potential mitigation measures are warranted.

Marine urban sprawl in New Zealand – risks and opportunities

Dr. Oliver Floerl[1], Mr. Mitchell Chandler[1]

[1]*Cawthron Institute*

Marine urban sprawl —the proliferation of artificial structures associated with coastal towns, cities and industries—is a recognised threat to coastal marine habitats and ecosystems. The replacement of beaches, mudflats, rocky shores and other coastal habitats by anthropogenic infrastructure affects the abundance and distribution of local species, and provides opportunities for the proliferation and spread of marine pests. To enable the effective management of these risks and impacts for New Zealand it is necessary to understand the present-day extent of marine urban sprawl, and develop predictions for its rate of growth over the coming decades. We quantified the surface area associated with urban artificial infrastructure for New Zealand's main coastal centres using recent and historic geo-spatial imagery, and identified potential drivers of coastal urbanisation relating to economic, social, environmental or geomorphological variables. On average, 49% of the coastline around New Zealand's largest urbanised harbours is artificial. More than half of the total area of artificial habitats is associated with shipping and boating facilities. We present current progress on the development of a statistical model to predict coastal urbanisation around New Zealand, and opportunities for making coastal urban infrastructure more sustainable.

The Secret Language of the New Zealand Paddle Crab – Sound production and associated behaviours in the New Zealand paddle crab, *Ovalipes catharus*

Ms. Ashley Flood[1]

[1]*University of Auckland*

Crustacean acoustics is a relatively unexplored area of research and is heavily based on theories and presumptions. For example, all paddle crabs (*Ovalipes* sp.) are presumed capable of producing sounds based on anatomical observations - a series of ridges located on the chela. To investigate this hypothesis, we used controlled tank-based experiments to record acoustic and video footage of *Ovalipes catharus* sound production and associated behaviours.

Our results show that *O. catharus* produce three distinct sounds: rasps, zips and bass. Rasps were produced by males, females and juveniles, and significantly increased during feeding events. The rasp sound occurred with no apparent external movements indicating a possible internal mechanism. The zip and bass sounds were produced only by males during mating events with male-male competition. The zip was produced using the previously described chela ridges and the low-frequency bass coincided with a swaying motion of the whole body and is suggested to be generated internally.

In conclusion, *O. catharus* produce two sounds which don't use the previously described ridged chelipeds. Indicating that sound production in crustaceans is not limited to hard external structures and that sound production may be more wide-spread among decapod crustaceans than previously assumed.

Kaikoura earthquake marine science recovery package

Dr. Rich Ford[1]

[1]*Ministry for Primary Industries*

The Kaikōura Earthquake marine recovery package comprises 2 million dollars of expenditure, implemented by the Ministry of Primary industries, to be spent on science to support fisheries and marine impact quantification and recovery. Discussions were held across government, and with research providers, iwi and local communities to prioritise spending on this package. All work on this package will focus on the nearshore, with the main aims of characterising impacts and establishing or continuing time-series. Three strands of work were identified to be supported: fisheries, habitat mapping and iconic species. Work under the fisheries strand will be focused on rock lobster, paua and blue cod fisheries as well as monitoring the rocky reef communities that support these fisheries. Work on iconic species will extend existing time series for Sperm Whale and Hector's dolphin monitoring and assess Hutton's shearwater population size and threats to colonies. Habitat mapping work will assess change in, and the extent of, nearshore rocky reef communities. Coordination across government and engagement of, or communication with, iwi and local communities will be a feature of this research where possible. This work will be evaluated, communicated and recommendations made for potential future actions in mid-2018.

Gone But Not Forgotten: Legacy Effects of a Bivalve Foundation Species in New Zealand Estuaries

Travis Foster[1], Dr. Mads Thomsen[1], Prof. David Schiel[1]

[1]*Marine Ecology Research Group, University of Canterbury*

Foundation species are habitat-forming species that have a widespread effect on biotic and abiotic functions in an ecosystem. Bivalves are particularly important to aquatic ecosystems, creating complex habitat with their shells that persist in the environment long after the organism has perished. The persistence of dead shells is known as an environmental legacy effect, and is understudied in marine community ecology. A field experiment testing for the legacy effects of the cockle *Austrovenus stutchburyi* was done in 6 estuaries of the South Island of New Zealand. A 2-month factorial experiment was set up with two levels of legacy effects: with and without addition of 15 dead, sterilised, *Austrovenus* shells, crossed with three habitat types: mudflat, intact seagrass bed, and disturbed seagrass bed (leaves removed). The objective was to test how the addition of a hard-substrate to the unstable estuarine substrate would affect the community. Colonisation, biodiversity, seagrass growth, and shell-retention were analysed. Results show that seagrass growth was not impeded by the presence of shells, that the presence of the shell habitat had positive effects on biodiversity in some, but not all, estuaries, and that the intact seagrass beds retained shells better than disturbed seagrass or mud alone.

Distribution of personal care products and steroid hormones in Lyttelton Harbour, New Zealand.

Dr. Sally Gaw[1], Dr. Phil Emnet[1], Dr. Grant Northcott[2]

[1]University of Canterbury, [2]Northcott Research Associates

There is a lack of data for emerging contaminants (ECs) in New Zealand coastal waters. Three wastewater treatment plants (WWTPs) discharge into Lyttelton Harbour. Concentrations of personal care products and steroid hormones were measured in WWTP effluents, seawater, sediment and the green lipped mussel *Perna canaliculus* over 12 months to identify which ECS were being discharged into the harbour and their distribution. Octylphenol (OP), uv-filters, triclosan, methyl triclosan, bis-phenol A (BPA), and the steroid hormone E1 were detected in effluents. Emerging contaminants were present in seawater across the harbour at low concentrations with mParaben, uv-filters, BPA, and E1 being the most commonly detected ECs. The harbour sediments were a sink for ECs accumulating mParaben, OP, four uv-filters, BPA and E1. Three ECs (mParaben, OP, and a uv-filter BP-3) were detected in the green lipped mussels. An assessment of the potential risk these ECs pose to Lyttelton Harbour's ecosystem will be presented.

Mapping Global Marine Aquaculture Potential

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In the context of a growing global population and limited capacity to increase wild fisheries catches, marine aquaculture presents an intriguing opportunity for increased production of seafood. However, the global capacity for increased aquaculture production from the ocean or the relative productivity potential across countries in unknown. To address this question, we use an innovative approach drawing from physiology, allometry, and growth theory to calculate and map potential marine aquaculture production. Even after applying substantial constraints based on environmental conditions and existing ocean uses, we find vast areas in nearly every coastal country that are suitable for aquaculture. We conclude that development potential far exceeds foreseeable seafood demand and that suitable space is unlikely to limit marine aquaculture expansion. Further, we show that considerable flexibility exists to site farms in a way that aligns with economic, environmental, and social objectives.

Charting the loss and recovery of intertidal community structure and function following a cataclysmic coastal uplift event

Mr. Shawn Gerrity[1], Prof. David Schiel[1]

[1]*Marine Ecology Research Group, University of Canterbury*

The 2016 7.8M Kaikoura earthquake and associated coastal uplift, while tragic, offered a rare opportunity to observe the recovery dynamics of the New Zealand rocky shore ecosystem following a catastrophic disturbance. The uplift of the reef, which ranged from approximately 0.3-6.0 m and affected over 130 km of coastline, caused extensive die-offs of intertidal and subtidal communities and restructured intertidal zonation dramatically. By thoroughly surveying the affected coastline, our research group was able to compare post-earthquake community composition and primary productivity of these communities to long-term data sets. In the immediate months following the earthquake, these communities, once highly productive and dominated by canopy-forming fucoids and a diverse understory assemblage, followed a similar trajectory of recovery seen in previous small-scale canopy removal experiments. This recovery is typically characterised by the immediate loss of turfing coralline algae, release of entrapped sediments, invasion of opportunistic ephemeral species, and a drastic decline in primary productivity across affected platforms. Here we present some of the initial changes to the reefs along the uplifted coastline, discuss the broader implications of these changes, and speculate on the future recovery of the ecosystem.

Site-dependent seagrass ecosystem resilience to nutrient enrichment

Dr. Rebecca Gladstone-Gallagher[1], Ryan Hughes[1], Emily Douglas[1], Prof. Conrad Pilditch[1]

[1]*University Of Waikato*

Seagrass beds provide a wealth of ecosystem services that benefit society, but these productive habitats are declining globally. Temperate estuaries are becoming eutrophic, but the role of anthropogenic nutrient enrichment in seagrass decline is not understood. Through a manipulative field experiment, we test how nutrients from agricultural fertiliser effect seagrass ecosystem health, and how this varies between sites characterised by different sediment and seagrass morphological properties. At six intertidal seagrass sites, we added slow release fertiliser at a dose rate of 200 g N m^{-2} to treatment plots (1 m^2). 60 d after the fertiliser addition, we monitored several seagrass morphology variables (collectively referred to as seagrass 'health'), as well as the macrofaunal community, in both treatment and control plots. Our results show that the resilience of seagrass ecosystems to cope with increased nutrients is highly context-dependent; two of the six sites showed significant declines in seagrass 'health' with nutrient enrichment, but other sites appeared resilient. We suggest that sites with initially low ambient seagrass biomass, and macrofaunal community diversity and abundance are less resilient to increased nutrient loading. These findings contribute to the knowledge that is required for predicting and mitigating future impacts of estuarine eutrophication on seagrass ecosystems.

Life at the edge: a population study of green turtles (*Chelonia mydas*) in temperate New Zealand

Dan Godoy[1]

[1]*Massey University*

With New Zealand lying at the southern boundary of the distributional range of green turtles (*Chelonia mydas*) in the southwestern Pacific, little consideration has been given to the ecology of this species in the region. This study investigated for the first time, the population structure, genetic origin, diet and anthropogenic impacts of green turtles in New Zealand. Data presented here illustrates that the population is comprised of post-pelagic immature juveniles to large subadults (μ= 51.9 cm curved carapace length (CCL), SD = 11.6, range 17.6–94.6 cm, *n* = 86). Upon recruitment into neritic habitats at approximately 40.8 cm CCL, individuals transition to a benthic foraging strategy consuming a variable diet of macroalgae, seagrass (*Zostera muelleri* subsp. *Novozelandica*), and mangrove (*Avicennia marina*). Interestingly, diet component data suggests that neritic stage green turtles do not ontogenetically transition to a strictly herbivorous diet as they age, yet they continue to consume a large proportion of macroinvertebrate prey, including the grey side-gilled sea slug (*Pleurobranchaea maculata*), and woolly sea hare (*Bursatella leachii*). Mitochondrial DNA analyses revealed the New Zealand green turtle aggregation represents a distributional overlap of 14 recognised Management Units (MU) originating from widely dispersed rookeries throughout the Pacific Ocean, including the endemic eastern Pacific clade. This unique aggregation differs from all other regional foraging aggregations, thus highlights novel regional connectivity and trans-oceanic dispersal routes from the eastern Pacific not previously identified. Despite being protected nationally, an investigation into the adverse effects of anthropogenic activities found that green turtles in New Zealand are impacted by propeller strike injuries, incidental capture in fisheries activities and ingestion of plastic debris. Ultimately, this study shows that New Zealand's northern region constitutes a transitional developmental ground for post-settlement green turtles originating from widely dispersed genetic stocks, and represents the most southern foraging aggregation identified in the Pacific Ocean. Consequently, we provide a baseline understanding of the ecology of green turtles at the edge of their range, providing opportunities to investigate regional niche modelling and connectivity of this highly mobile species, while also monitoring broad-scale effects of climate-induced environmental change.

Multi-strain probiotics enhances immune capacity and alters metabolic profiles in the New Zealand black-footed abalone (*Haliotis iris*)

Mr. Roffi Grandiosa[1], Assoc. Prof. Fabrice Merien[2], Tim Young[1], Thao Nguyen[1], Dr. Noemi Guiterrez[1], Prof. Andrea C. Alfaro[1]

[1]*Auckland University of Technology,* [2]*AUT-Roche Diagnostics Laboratory, School of Applied Sciences, Auckland University of Technology*

The present study assessed the immune enhancement of juvenile New Zealand Black-footed abalone (*Haliotis iris*) by adding multi-strain probiotic namely *Exiguobacterium* JHEb1, *Vibrio* JH1 and *Enterococcus* JHLDc. The bacterium was administered orally with the dose of $2.2x10^7$ (JHEB1), $7x10^5$ (JH1) and $4.10x10^8$ (JHDLc) CFU/g feed upon abalone juvenile. Feeding was conducted for four months with the feeding 1%/day. Analysis of immune parameters of haemocyte viability, viable counts, apoptosis and oxidative stress was done after haemolymph sampling obtained at the initial feeding time, after 2 months and at the end of the 4 month experiment. Foot tissue was also obtained for metabolomics GC-MS analysis. Results showed that in comparison to untreated control abalone, the probiotic fed abalone had a significantly higher viable cell counts, cell viability, ROS positive cells but significantly lower percentage of apoptotic cells. In addition, a general increase in free amino acid content of foot muscle was observed. These results indicate that the probiotic diet enhances immune capacity by stimulating haematopoietic processes, with a simultaneous low-level upregulation of ROS production, as a priming mechanism of the antibacterial defence system.

Preliminary insights into the effects of the Kaikōura Earthquake on sperm whales

Marta Guerra[1], Dr. Will Rayment[1], Roger Williams[2], Tamlyn Somerford[1], Prof. Liz Slooten[1], Dr. Lucy Wing[1], Prof. Steve Dawson[1]

[1]University of Otago, [2]Whale Watch Kaikoura

The Kaikōura submarine canyon is an important foraging ground for male sperm whales. The abundance of whales feeding in the area has declined over the last two decades for causes that remain unknown, making the population particularly vulnerable to additional impacts. Earthquakes and underwater slips have the potential to affect sperm whales through noise, changes in topography, and smothering of benthic fauna. Combining information on abundance, distribution, behaviour and stable isotope analyses, we will investigate the effect of the 2016 earthquakes on the population of sperm whales at Kaikōura. We will compare three years of pre-earthquake observations to data collected throughout the year after the earthquake. Initial results showed that whales were foraging in the area within one week of the earthquake and had a continued presence at Kaikōura for the five following months. Preliminary analyses of behaviour and diving locations during summer suggested that whales had longer surface intervals (difference in means = 3.4min ± 0.6 SE, n=90) and were using the canyon slopes to a lesser extent than in previous summers. Although these observations suggest some changes in foraging behaviour and/or habitat use, further research is necessary to better understand the significance of this event for the population.

Phytoplankton growth, microzooplankton grazing and the fate of primary production in contrasting oceanographic conditions of New Zealand open-ocean waters

Dr. Andres Gutierrez Rodriguez[1], Dr. Karl Safi[1], Ms. Ro Allen[2], Dr. Moira Decima[1], Karen Thompson[1], Mark Gall[1], Dr. Joanne O'Callaghan[1], Dr. Matt Pinkerton[1], Dr. Scott Nodder[1]

[1]NIWA, [2]Department of Botany, University of Otago

The majority of marine primary production is consumed by microzooplankton grazing, which represents its main loss pathway, but also a key trophic step linking primary and secondary production. Despite its pivotal role, current understanding of the processes that regulate microzooplankton grazing remains rudimentary. The depth of the mixed layer, phytoplankton growth rate and plankton food-web structure have been hypothesized to influence microzooplankton composition and grazing dynamics. In this study we will investigate these relationships using oceanographic data and experimentally estimated phytoplankton growth and microzooplankton grazing rates obtained during two NIWA-led voyages to the Chatham Rise (December 2015) and the Hauraki gulf cross-shelf region (May 2016). Despite the mosaic of physico-chemical and trophic conditions surveyed, phytoplankton growth and microzooplankton grazing were strongly correlated indicating a tight trophic coupling. These preliminary results suggest a high turnover of phytoplankton biomass and confirms microzooplankton grazing as the main trophic pathway for primary production. However, occasionally, phytoplankton growth exceeded grazing losses leading to phytoplankton accumulation, allowing mesozooplankton herbivory. Understanding how these episodes of trophic decoupling relate to environmental and biological drivers is crucial to assess and predict the fate of primary production in a changing ocean.

Rapid habitat surveys and finer scale sampling of estuaries on Great Barrier Island.

Miss Sarah Hailes[1], Miss Kelly Carter[1], Dr. Andrew Lohrer[1], Dr. Michael Townsend[1]

[1]*NIWA*

Few ecological surveys of estuaries on Great Barrier Island (GBI) have been performed to date. In October 2015, three estuaries on GBI were intensively sampled: Whangapoua Estuary, Whangaparapara Estuary and Shoal Bay. Study objectives were to (i) gather data on the diversity of habitat types present in each estuary using broad scale survey techniques, (ii) sample several of the habitat types present in each estuary using finer scale methodologies, and (iii) quantify sediment heavy metal contaminants and assess ecological health status at one or more of the fine scale study sites per estuary. Ecological health status was assessed using sediment invertebrate based indices that have been collaboratively developed by NIWA, Auckland Council and University of Auckland colleagues. The hope is that the information gathered will be used in conjunction with other observations and knowledge streams to more fully understand the health status of the estuaries on GBI.

Updating the ANZECC water quality guidelines for copper and zinc

Dr. Chris Hickey[1], Jennifer Gadd[1]

[1]*NIWA*

The ANZECC (2000) water quality guidelines are currently being updated. In contrast to other contaminants, there is no shortage of toxicity data for these metals. For example, an initial search of toxicity databases for copper in marine waters yielded over 3000 lines of data. This required considerable data filtering to include only data from chronic tests and reported important water quality characteristics. The metals are also highly influenced by water quality factors, such as hardness, pH and dissolved organic carbon (DOC). In fresh and marine waters, the presence of DOC reduces the aquatic toxicity of copper, as copper binds to DOC, decreasing bioavailable free copper. As part of the guideline derivation we developed new algorithms for adjusting the conservative default guidelines based on water quality factors, with copper guidelines for freshwater and marine waters have an adjustment for DOC. These adjustments result in substantial changes to the guideline value, implying that site-specific measurements of water quality factors will be required in the future to avoid applying excessively stringent default guidelines. The marine zinc guidelines have no adjustments for water quality characteristics. Guideline values were derived based on at least 19 different species from at least 5 taxonomic groups.

Legacy effects of marine larval development for whitebait: bigger fish to fry?

Dr. Mike Hickford[1], Eimear Egan[1], Mark Yungnickel[1], Prof. David Schiel[1]

[1]*Marine Ecology Research Group, University of Canterbury*

Every spring, thousands of New Zealanders congregate near river mouths to try to catch their share of whitebait. Although some whitebaiters go home with many kilograms of fish, many catch only a cupful. Our research has shown that the number of whitebait that make up that cupful differs hugely around the country. Intensive spatial and temporal sampling of inward-migrating post-larvae (whitebait) of inanga *(Galaxias maculatus)* has shown significant differences in body size, age and growth rates between geographical regions. Whitebait caught in northern New Zealand are smaller, younger and faster-growing than those caught in southern regions. These patterns are consistent across the four month long whitebaiting season despite the marine environment that these larvae have developed in changing markedly during that time.

Marine larval development facilitates dispersal in this diadromous species, but has legacy effects for adult growth, maturation and fecundity. Fecundity is closely associated with body length in fish species with allometric growth. Smaller post-larvae in northern regions will need compensatory adult growth to achieve the same level of fecundity as their southern counterparts. We will discuss these findings in the context of conservation biology and the potential for zonal fishery management.

Complexity in nutrient cycling highlights the significance of habitat variation in coastal soft-sediment ecosystems

Ms. Jenny Hillman[1], Dr. Carolyn Lundquist[1,2], Dr. Theresa O'Meara[1], Prof. Simon Thrush[1]

[1]*University of Auckland,* [2]*NIWA*

Large animals in coastal soft-sediment ecosystems are important influences on ecosystem function as ecosystem engineers. Few field experiments consider spatial variation's role in affecting ecosystem function, yet this is critical in mapping ecosystem functions or related services and defining the consequences of habitat change. Transformation of organic matter and remineralisation of nitrogen are critical in coastal and estuarine sediments. First we tested the effect of spatial variance along an environmental gradient on differences in solute fluxes (ammonium and oxygen) across the sediment-water interface. We simulated an extinction/ disturbance event by removing the large animals from the sediment, altering the site's dominant community. We demonstrate that spatial variation in multiple habitat features, as well as disturbance-related shifts in the attributes of the benthic community, have important effects on ecosystem function. Our results reveal important levels of variability in ecosystem function associated with habitat variation at a rarely defined level of resolution in estuarine/coastal classification and management. Disturbance-induced changes in local community dynamics interact with habitat features leading to spatial changes in ecosystem performance Improved research is needed to account for variation in ecosystem function and more integrative management of human-altered ecosystems, including more ecologically informed mapping, spatial planning and assessment of ecosystems.

Changes in natural phytoplankton community composition from STFZ and SASW waters under future ocean conditions.

Dr. Linn Hoffmann[1], Ms. Kelsey Donahue[2]

[1]*Department of Botany, University of Otago,* [2]*University of Bremen*

The efficiency of the biological carbon pump and energy transfer to higher trophic levels not only depends on phytoplankton productivity but also largely on the composition of phytoplankton communities. Phytoplankton community composition can be significantly affected by changes in environmental conditions. However, we still know very little about how ocean acidification alone or in combination with other environmental factors might affect the composition of marine phytoplankton communities and what the implications for the productivity of the future marine ecosystem might be. We present data from a recent incubation experiment where we investigated the effect of increased pCO_2 and light intensity on natural communities from two Southern Ocean water masses surrounding New Zealand, the Subtropical Frontal Zone (STFZ) and Subantarctic Surface Waters (SASW). Using both microscopy and Flow Cytometry, our results indicate that there are taxon-specific and locality specific differences in the response of the phytoplankton community to increased light and pCO_2 within these water masses. The combination of increased light and pCO_2 had a stronger effect than pCO_2 alone in both experiments.

Technological Tools for Saving Whales

Assoc. Prof. Travis W. Horton[1]

[1]*University of Canterbury*

Conservation and protection of marine megafauna requires robust knowledge of when and where animals are located. For elusive marine species, such as whales and sharks, gaining this spatiotemporal knowledge is a significant challenge. Technological advances, including biotelemetry and multispectral imaging tools, present unprecedented opportunities to rigorously document animal movement and habitat utilization. The data gained from widespread deployment of these tools can be used to develop predictive models and autonomous animal detection systems through integration with novel analytical technologies. In this talk I will present two examples of how technology can be used to inform marine magafauna conservation and protection initiatives.

The first example involves the deployment of satellite-monitored platform transmitting terminal (PTT) tags on humpback whales and great white sharks. Widespread deployment of PTT tags on humpbacks and white sharks reveals that both species are capable of migratory route fidelity (e.g. Fig. 1). When integrated with astronomical and geophysical analytical technologies, these same movements further demonstrate both a temporal pacing with respect to the moon illumination/tidal gravity cycle and a spatial fidelity to gravitationally distinct locations (e.g. Fig. 2). The highly symmetrical and reproducible patterns present in both humpback and white shark long-distance movements suggest these movements are similar and predictable. Such ecological insights can only be gained from the integration of biotelemetry tools with astronomical and geophysical tools.

The second example involves the use of infrared and multispectral imaging devices as viable cetacean detection technologies. Thermographic imaging of humpback whales in both tropical and sub-polar environments conclusively demonstrates that whale surface behaviour can be detected by infrared cameras (e.g. Fig. 3). Surprisingly, the thermographic anomalies associated with humpback whale blows, dorsal fins and flukes are of similar magnitude despite >10°C differences in water temperature between tropical and sub-polar habitats (Fig. 4). These results highlight a fundamental challenge associated with thermographic imaging: emissivity. However, the challenge of emissivity can also be considered an asset if cetacean detection, rather than cetacean thermoregulation, is the desired outcome. Satellite and drone based multispectral imaging tools represent similarly attractive emerging technologies for cetacean detection in both remote and highly developed/explored marine environments.

A key question that emerges is: **What is needed to realize the full potential of technological advances in marine science? I encourage you to engage in a panel-led discussion of this central question following my talk.**

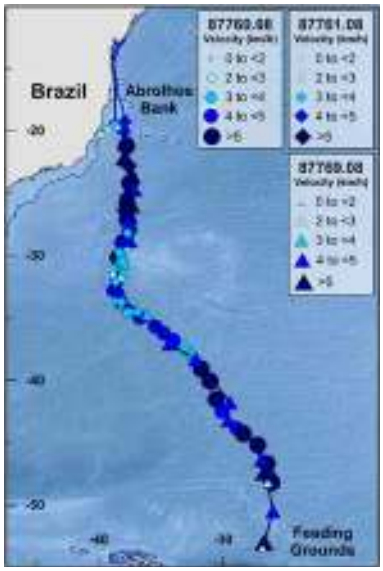

Fig. 1 PTT tracks of three humpback whales tagged of Brazil. These three whales are migrating at distinctly different times along an identical migration route.

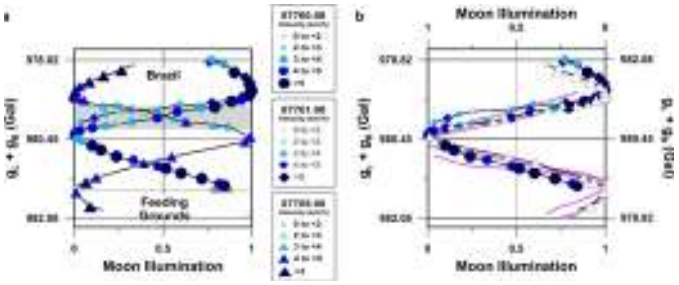

Fig. 2 Latitude (g_L) and bedrock (g_B) dependent gravitational coordinate trajectories followed by the same three whales shown in Fig. 1 when plotted against the lunisolar/tidal gravity cycle.

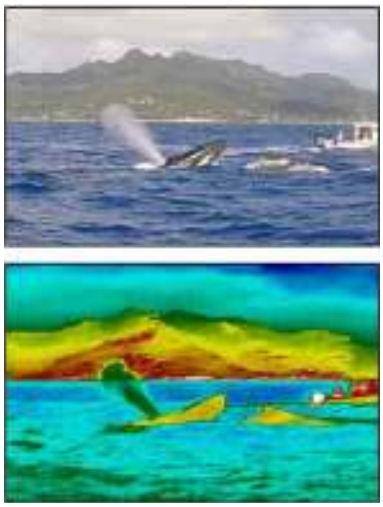

Fig. 3 Visible (top) and thermographic (bottom) images of two humpback whales fighting at the ocean surface off Rarotonga.

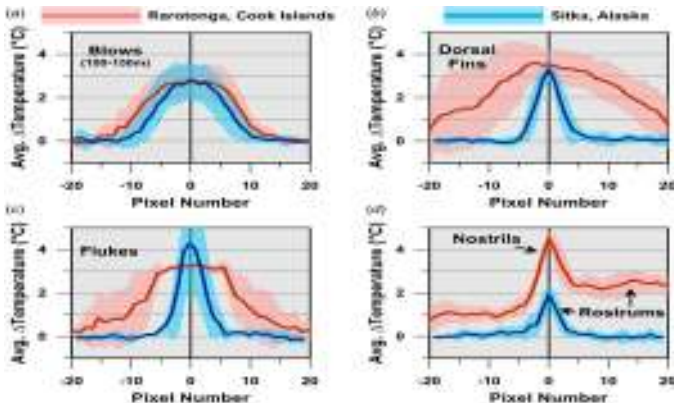

Fig. 4 Quantitative thermography of various recognizable features associated with humpback whale surface behaviour in both tropical and sub-polar contexts.

Advancing photo-identification of cetaceans: Exploring the application of computer vision for individual recognition

Dr. Krista Hupman[1], Dr. Matthew Pawley[2], Dr. Arno Leist[2], Dr. Karen Stockin[2], Miss Ting Dong[2], Dr. Andrew Gilman[2]

[1]*NIWA*, [2]*Massey University*

While several computer software programs have been developed for automatic matching of marine species, the user is still required to manually localise and extract the identifying features from digital images. We used common dolphins (*Delphinus* sp.) as a model species to assess how computer vision methods may assist in individual identification for a large catalogue of poorly marked individuals. We will give a live demonstration showing how deep learning methods (convolutional neural networks) can be used to automatically localise and extract dorsal fins from digital images with very high precision. Moreover, we demonstrate that non-traditional identifying features, such as pigmentation, could be successfully quantified using computer software in a manner that is robust to changes in fin orientation. The resultant pigmentation features gave a 'signature-like' pattern which proved temporally stable for up to 11 years. Using only these pigmentation features, our model was able to correctly classify individuals 75% of the time, with our top-5 estimates containing the correct dolphin 86% of the time. Our work suggests that computer vision methods can substantially improve the standard workflow typically involved with photo-identification studies and that, for many poorly marked cetacean species, non-traditional features can be used to robustly identify individuals.

The importance of data bias and choice of metric in estimating the rates of spread of invasive marine species

Dr. Graeme Inglis[1], Ms. Kimberley Seaward[1], Ms. Lily Pryor Rodgers[1]

[1]*NIWA*

Forecasts of the rate and geographic pattern of spread of invasive species are important for anticipating potential impacts and identifying suitable intervention strategies. Observed patterns of range expansion are, however, complex as they are influenced by both diffusive spread away from the leading edge of nascent populations (typically by natural dispersal of larvae, spores or fragments) and long-distance jump dispersal, often associated with a human transport pathway. Artefacts in the data used to construct estimates of spread can also obscure the true pattern. These data are typically obtained in two ways: (1) through review and compilation of historical records (often museum or herbarium specimens) or, less frequently, (2) through analysis of long-term survey data. The spatial patterns of distribution of a species and temporal changes in it will be affected by the distribution of observations, the spatial scales at which observations are made and the metrics that are used to summarise diffusive and long-distance dispersal. In this study, we used data obtained from long-term (15 yr) national surveys in 11 New Zealand harbours and historical distribution records to explore the effects of these biases and the choice of metric to describe patterns of range expansion for 11 non-indigenous marine species.

Incorporating mātauranga māori into decision making

Mr. Doug Jones[1]

[1]*EPA*

Initiating the conversation with iwi early to establish a fit for purpose engagement process is essential to partner and achieve mutual outcomes. Appreciating the differences in environmental approaches between 'western' science and mātauranga Māori – traditional and contemporary Māori knowledge systems and practices can be difficult. Reconciling these two paradigms and being able to resolve issues requires the EPA to understand Māori environmental values and worldviews, and how these are exercised through key Māori concepts.

Industry-led efforts to reduce catches of small fish in a mixed fishery in Hawkes Bay, New Zealand

Emma Jones[1], Oliver Wade[2], Rick Burch[3], Karl Warr[4], Derrick Parkinson[1], Laws Lawson[5], Jeremy Helson[6], Alicia McKinnon[7]

[1]NIWA, [2]Hawkes Bay Regional Council, [3]skipper: Nancy Glen II, [4]skipper: Chips, [5]Te Ohu Kaimoana, [6]Fisheries Inshore New Zealand, [7]Ministry for Primary Industries

Concerns about the status of fish stocks in the Hawkes Bay, have led a number of individual fishers in this region to make a variety of modifications to their gear to reduce catches of small fish. In partnership with scientists and fisheries stakeholder organizations, we report on how these fisherman are demonstrating the impacts of their modifications and innovations. These changes have included voluntary closed areas, trialling different combinations of increased mesh sizes, T90 and square mesh sections, and development of novel ideas, such as a rigid cage-style codend. Recent trials of the cage codend have demonstrated how it is feasible to target particular species, and achieve minimal bycatch. In this case, selection for sand flounder over 28cm (Rhombosolea plebeian), with reductions in undersized catches of other flatfishes, gurnard (Chelidonichthys kumu) and red cod (Pseudophycis bachus) of between 70 – 100%. However, there were also significant reductions in catches of marketable-sized fish for these species, and this level of selectivity is only practicable under certain circumstances. This presentation outlines the results of the trials and considers the role of these partnerships in the effective governance of Hawke's Bay's marine environment.

Seasonal habitat use and trophic ecology of bronze whaler sharks (*Carcharhinus brachyurus*) in New Zealand

Ms. Melissa Kellett[1], Dr. Malcolm Francis[2], Dr. Brittany Graham[2], Mr. Clinton Duffy[3], Dr. Phil Ross[1], Dr. Chris Battershill[1]

[1]University of Waikato, [2]NIWA, [3]Department of Conservation

Bronze whaler sharks (*Carcharhinus brachyurus*) are present throughout the North Island and upper South Island of New Zealand. They occupy a variety of coastal habitats which support a diversity of marine organisms. Bronze whaler sharks are known to utilise coastal environments during summer months, but little is known about their movements or distribution during the remainder of the year. This research uses stable isotope analysis of blood and tissue samples to investigate seasonal movements between pelagic and coastal habitats, along with their position and importance in food webs. This research will be the first to use these techniques to investigate bronze whaler shark movements and will provide much needed information about the ecology of this species.

Early gonad development in juvenile Yellow-Belly Flounder, *Rhombosolea leporina*

Mr. Ryan Koverman[1]

[1]*University of Waikato*

Yellow-Belly Flounder (YBF), *Rhombosolea leporina*, is a prized taonga species of significant cultural and ecological value. They are also targeted by commercial and recreational fisheries. Despite declining numbers in many coastal areas there are few detailed studies on reproduction in YBF. Understanding the reproductive development of a species throughout its life-cycle is important for ecological management. In particular, clarification of the timing and process of sex differentiation in early life-stages of YBF will enable greater insight into whether environmental effects influence sex ratios in wild stocks. This study, therefore, investigates the timing and morphology of gonadal development in wild caught juvenile YBF using histological analyses. This may be further supported through the subsequent development of molecular markers. This knowledge of early reproductive development will improve the understanding of reproduction in the adult population and its management.

Underwater noise from pile driving and its impact on Hector's dolphins in Lyttelton harbour, New Zealand

Ms. Eva Leunissen[1], Dr. William Rayment[1], Prof. Steve Dawson[1]

[1]*University of Otago*

Pile driving noise is among the loudest of underwater anthropogenic sounds. It has been established as a serious threat to some marine mammal species, including harbour porpoise (*Phocoena phocoena*), a species sharing many characteristics with Hector's dolphins (*Cephalorhynchus hectori)*. Hector's dolphins in Lyttelton harbour were exposed to pile driving noise during the Port Lyttelton rebuild and development in 2014-2015. We aimed to characterise the harbour soundscape, measure pile-driving noise and its propagation, and to quantify the impact of this noise on the distribution of dolphins around the harbour. Wideband underwater sound recordings were made at various locations around the harbour using a combination of moored and boat-based recorders. T-PODs were used to monitor dolphin distribution at the outer, mid and inner harbour. Statistical analysis indicated a decrease in echolocation detections in the inner harbour during pile driving, which could last 40 hours or more. Potential zones of hearing damage for Hector's dolphin in Lyttelton are also proposed.

Ammonium toxicity in seagrass *Zostera muelleri*: seasonal difference?

Ms. Moyang Li[1], Dr. Alwyn Rees[1], Dr. Carolyn Lundquist[1,2], Prof. Conrad Pilditch[3], Prof. Simon Thrush[1], Dr. Joanne Ellis[4]

[1]University of Auckland, [2]National Institute of Water and Atmospheric Research, [3]University of Waikato, [4]King Abdullah University of Science and Technology

Seagrasses are important habitat-forming species, and their worldwide loss has caused serious damage to the numerous ecological services they support. Excessive nutrient and sediment inputs are believed to be the major causes of seagrass decline. However, are increased nutrients always deleterious to seagrass? An outdoor mesocosm experiment was conducted at the Leigh Marine Laboratory between December 2016 and March 2017. Seagrass from sand and mud substrates were grown with and without nutrient-enrichment in their native sediment. Pore water in sediments that were nutrient-enriched had significantly higher concentrations of ammonium, which in a field experiment with the same populations in 2015/6 were sufficient to be toxic to the seagrass. The results from this experiment will be presented and the contrasting effects on the populations from sand and mud substrates described.

Multispecies analysis reveals emergent patterns of genetic diversity across the Indo-Pacific Ocean

Dr. Libby Liggins[1], Dr. Eric Crandall[2], Assoc. Prof. Cynthia Riginos[3], Dr. Michelle Gaither[4], Dr. Eric Treml[5], Prof. Rob Toonen[4], Diversity of the Indo-Pacific Network (DIPnet)

[1]Massey University, [2]California State University, [3]University of Queensland, [4]University of Hawai'i, [5]University of Melbourne

Patterns of genetic diversity provide us a window into the past and present demography of a focal species, and can inform their conservation management. Despite the potential for genetic diversity information from a whole community of species to provide insight regarding the origin, maintenance, and future of that community, there have been few synthetic analyses of genetic diversity patterns in the marine environment. Many researchers independently collect genetic data for marine organisms, but combining these data has been previously impeded by data accessibility and interoperability of database infrastructures. The Diversity of the Indo-Pacific Network (DIPnet) has formed the Genomic Observatory Metadatabase (GeOMe) to provide a centralised repository for genetic data of marine species. GeOMe is now the most extensive database of georeferenced mitochondrial DNA sequences comprising over 36,000 individuals and over 230 species. Although initiated in the tropical Indo-Pacific, GeOMe is extensible to all marine regions. I will present the first multispecies, synthetic analyses regarding genetic diversity patterns for Indo-Pacific marine organisms, conducted by DIPnet and based on GeOMe data. I will then discuss extension of the collaborative network into New Zealand where the application of genetic data may help us predict and manage future challenges.

Metals in New Zealand pelagic squids

Ms. Alexandra Lischka[1], Dr. Chris Pook, Dr. Kat Bolstad

[1]*Auckland University of Technology*

This project will focus on the contamination of metals in commercially important squids of New Zealand. Squids are important within marine food webs, both as predators of fish and diverse invertebrates as well as prey for marine mammals, fishes, birds and humans. They are, therefore, an important vector for both nutrients and contaminants in marine food webs. Cadmium, arsenic, mercury, lead and other toxic metals are usually present within the marine environment at low or trace concentrations. Human and geological activity can elevate those levels, causing increased concentrations of these metals to be transferred through food chains. Our first results show that toxic metals in New Zealand squid can reach levels hazardous to human health, suggesting that they may be hazardous to other predators too. The proposed research aims to survey metal contamination in different life stages of three of the most abundant, commercially and ecologically important squid species (*Onykia ingens*, *Nototodarus sloani* and *N. gouldi*) in NZ waters as a proxy to understand metal contamination throughout the marine ecosystem. We will be able to determine whether squid from different populations and species around New Zealand are a hazard to the health of their predators, including humans.

Denitrification along a gradient in Mahurangi Harbour: do macrofauna matter most?

Dr. Drew Lohrer[1], Dr. Teri O'Meara[2], Emily Douglas[3], Katie Cartner[1], Kelly Carter[1]

[1]*NIWA,* [2]*University of Auckland,* [3]*University of Waikato*

Denitrification, the conversion of nitrate into nitrogen gas, is an important process in estuaries. It is a pathway by which inorganic nitrogen is removed, rather than continually cycled, thus contributing to the resilience of estuarine systems affected by elevated nutrient loads. However, measuring denitrification can be difficult and expensive, and factors affecting denitrification rates are poorly understood. Here, we measured denitrification rates at four subtidal soft-sediment sites along a head-to-mouth estuarine gradient in Mahurangi Harbour. We hypothesised that denitrification rate would be highest at the head end of the estuary, where 95% of the riverine nitrate enters the system and where the estuarine sediments are muddiest. Results indicated the lowest rate of denitrification at the head end of the estuary, contrary to predictions, perhaps due to fewer macrofauna, particularlwy tube dwelling polychaetes. Other data collected at the same time (sediment characteristics, macrofauna, water column nutrients, benthic oxygen consumption, nutrient regeneration rates) were also analysed to better understand the factors affecting denitrification in Mahurangi Harbour.

Characterising the pathology of spinal curvature in farmed New Zealand king salmon (*Oncorhynchus tshawytscha*)

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In finfish aquaculture, spinal curvature can cause downgrades. Spinal curvature can affect individual vertebrae, such as in fusions, compressions and dislocations, or compromise the entire spinal column, such as in vertebral column compression syndrome (VCCS), fusion centres and spinal curvatures. Whilst a range of environmental, genetic and husbandry-related factors have been identified as contributing to their development, the cause of spinal curvature is often multifactorial. In New Zealand king salmon, *Oncorhynchus tshawytscha*, spinal curvatures such as lordosis, kyphosis and scoliosis have been known to occur in farmed stocks, however their cause is currently unknown. The aim of the current research is thus to characterise the pathology of spinal curvature in farmed New Zealand king salmon, in order to identify potential risk factors contributing to its onset and subsequently develop appropriate measures to reduce its prevalence.

Pacific Oyster coculture growout assessment and fucoidan yield of New Zealand native intertidal brown seaweed *Hormosira banksii* (Turner) Decaisne

Ms. Candace Loy[1,2], Mr. Jim Dollimore[3], Dr. Craig Radford[1], Dr. Andrew Jeffs[1]

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This study assesses the coculture of native brown seaweed, *Hormosira banksii*, with Pacific oysters on an intertidal oyster farm. This candidate seaweed was selected because it is a hardy, edible native littoral species, which has recently been shown to contain beneficial fatty acids and carbohydrate compounds.

Growout potential of *H. banksii* on farm infrastructure was assessed. The seaweed was sourced from six locations within two main areas, Mahurangi and Whangateau Harbours, and placed in oyster baskets for 200 days. Initial results indicate starting deployment mass and source location played a part in seaweed growth and survival, and improved cultivation methods are required.

Fucoidan is a variable polysaccharide found in brown seaweeds shown to possess high pharmaceutical potential, and is used in cosmetics and human and stock feed supplements.

Fucoidan was isolated from wild *H. banksii* from the same locations using the water extraction method adapted from Mak (2012). Fucoidan yield was found to have no significant difference based on whether they were from the Mahurangi or Whangateau ($p = 0.881$), but significant differences were found based on the more specific locations each sample of seaweed was sourced from ($p < 0.001$). Further statistical analyses, and improved cultivation methods are required.

Incorporating uncertainty in habitat suitability models to inform biodiversity prioritisations for vulnerable marine ecosystems

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Conservation prioritisation tools allow for consideration of trade-offs between biodiversity features and costs to resource users such as fishing or mining. Typically biodiversity features are represented by species distribution or habitat suitability predictive models based on species-environment relationships extrapolated across broad areas with limited validation. Here, we demonstrate how the inclusion of model uncertainty influences biodiversity prioritisation outputs, utilising habitat suitability and associated uncertainty layers for nine Vulnerable Marine Ecosystem (VME) indicator taxa (4 Scleractinian stony coral species; 3 other cnidarian groups (Family Stylasteridae, Order Antipatharia, Order Pennatulacea; and 2 classes of sponges (Demospongiae, Hexactinellidae)) and two VME-associated taxa (Crinoidea and Brisingida). We unpack uncertainty to illustrate the influence on biodiversity prioritisations of different aspects of uncertainty such as spatial variability in sampling effort, differences in the number of records between taxa, and criteria representing model fit. We demonstrate how these exercises can be used to inform best practice for including uncertainty in these decision support tools.

The rise and fall of the Ahuriri Estuary, Napier

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An ecologically unique east coast estuary with a rich cultural history, the Ahuriri Estuary, Napier represents one of the few tidal lagoon estuaries on the lower North Islands East Coast. Despite extensive natural and anthropogenic modifications, the estuary has, until recently, continued to support a diverse array of flora and fauna.

Excess sediments, nutrients and contaminants to the estuary over the last century has resulted in the estuary 'tipping' into a highly nutrient rich and disturbed state.

This presentation documents the stressors and responses observed in the Ahuriri Estuary over the last 5 years, and outlines the approach required to work towards restoration of the Ahuriri Estuary in the face of increasing resource utilisation.

The influence of sediment characteristics on estuarine benthic microalgae (BMA) community structure

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Benthic microalgae are an important component of estuarine ecosystems, where they can account for more than 50% of total primary production. BMA also perform other ecological functions, often being considered as ecosystem engineers. In New Zealand, however, we have a generally poor grasp of the species diversity and functional aspects of BMA taxa. Here we assess the abundance of different taxa and their relationships with key benthic parameters. Diatoms are the most diverse and abundant taxa, often co-occurring with cyanoprokaryotes, euglenoids and dinoflagellates. However, the taxonomic composition of BMA can be highly variable between and within different estuaries, depending on local environmental parameters, in particular sediment characteristics.

Here we present and discuss results from a survey in the Avon-Heathcote estuary, aimed to identify key microalgal taxa and their relationships with the environment. Percent mud in the sediments was the most important factor affecting BMA diversity and biomass. Samples from muddy sand (<30% mud) had highest chlorophyll *a* content and the most diverse BMA communities. By contrast, samples dominated by sand had lower algal biomass and contained more species-poor BMA communities. These data will be compared to BMA data from other South Island estuaries to test spatial variability of BMA communities.

Minimum light thresholds for seagrass indicated by continuous data from multi-year rehabilitation trials

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[1]NIWA, [2]Greater Wellington Regional Council, [3]NIWA, [4]Northland Regional Council

Sufficient light is critical for seagrass persistence and growth. We quantified the light available to seagrass (*Zostera muelleri*) at existing and former sites in two New Zealand estuaries for periods ranging from one and a half to four years. Measurements were made alongside transplant trials to directly test the feasibility of reestablishment at former sites. In Whangarei Harbour, seagrass was successfully transplanted from One Tree Point to Takahiwai in 2008 to 2010 and then from Takahiwai to McDonald Bank in 2012 to 2016. At both sites transplants increased in cover and expanded in size. In contrast, transplants from Ivey Bay to Ration Point in Porirua Harbour in 2015 to 2017 did not persist. In Whangarei Harbour, where transplants were successful, light levels at former sites, as average daily irradiances (PAR, mol m^{-2} d^{-1}), were significantly less than existing sites but much higher than thresholds indicated by prior studies. A similar result was found in Porirua Harbour, although light levels at former sites were substantially less than in Whangarei Harbour. Our results, based on multi-year field measurements, indicate higher minimum light thresholds for *Zostera muelleri* than previous studies based on short-term field or laboratory studies.

Why are river mouth visits important to adult kahawai?

Mrs Kimberley Maxwell[1], Assoc. Prof. Richard Arnold[1], Dr. Erica Williams[2], Dr. Matthew Dunn[2]

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NZ has adopted the holistic ecosystems approach to fisheries management (EAFM) which addresses both human and ecological well-being. This research is part of a larger study using EAFM for a local kahawai fishery (*Arripis trutta*, Bloch & Schneider, 1801) in the eastern Bay of Plenty, North Island from the perspective of the Te Whanau-a-Hikarukutai/ Ngāti Horomoana hapū. The aim was to understand why adult kahawai undertake mass migrations to the river mouth each year. Five hypotheses were investigated, no role, food source, parasite removal, predator avoidance and reproduction. Samples were collected over the 2015/2016 summer from the local fishery and at sea and assessed for stomach contents, parasite loads, predator observations, liver and fat content, gonad stage and weight. Kahawai caught at the river mouth had empty stomachs and high parasite loads relative to the kahawai caught at sea ruling out H_{A2} and H_{A3}. Multiple kahawai with scarring were observed supporting the river's role as a refuge from predators and river fish also had high liver weights, fat content and large running ripe gonads suggesting the visits are related to reproduction.

The effects of thin mud deposits on the behaviour of a deposit-feeding Tellinid bivalve: Implications for ecosystem functioning

Ms. Lisa Mccartain[1,2], Dr. Michael Townsend[1], Prof. Simon Thrush[3], Prof. Conrad Pilditch[2]

[1]NIWA, [2]University of Waikato, [3]University of Auckland

Sediment runoff and deposition has significant impacts on many of New Zealand's estuaries. The effects of thick deposits (2-10 cm) of terrigenous sediment have been shown to cause mass mortality and reduce ecosystem functioning. In contrast, the impacts of thinner deposits have received less attention but are expected to occur more frequently and cumulatively have important consequences. A laboratory experiment was conducted, to examine how behaviour of a tellinid bivalve, *Macomona liliana* (Iredale, 1915), was affected by thin surface layers of mud (1-4 mm) and its incorporation into surface sediment. Time-lapse photography and porewater pressure sensors were used to characterise changes in behaviour before and after mud addition. Mud addition modified the sediment matrix which had an immediate response on *M. liliana* behaviour; significantly affecting the rates of feeding and the degree of porewater pressurisation during feeding events. Ultimately, subtle modifications in behaviour and sediment hydraulic conductivity may have consequences for nutrient exchange and benthic-pelagic coupling. Our results highlight the potential for widespread, cumulative harm and the disruption of ecosystem functioning from stressors that subtly change the physical environment and the behaviour of benthic species.

The Moana Project – An Ocean-Atmosphere Knowledge Infrastructure for New Zealand

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The Moana Project is a proposal to create an ocean - atmosphere knowledge infrastructure for NZ, based on a suite of high-resolution models recreating the winds, waves, currents and ocean temperatures for the EEZ over the past 25+ years. It will build NZs first capability in the novel techniques of ocean data-assimilation modelling and include a truly cross-institutional team that aims to bring NZ to the forefront of modern physical oceanography. Deployed within our unique Mātauranga Māori setting, the Moana Project seeks to actively lower the barriers for marine scientists and other users to freely access and engage with reference physical oceanic datasets in new and meaningful ways.

The unrestricted access to the highest quality physical oceanic datasets will improve the national standard of marine research excellence by facilitating a starting point for future research that is significantly more advanced than present day. The results will be measurable and meaningful in science and have economic multipliers that will provide a prudent return on the investment. It is expected that the resultant operational efficiencies and informed decision-making arising from the Moana Project will be expressed in every aspect of NZs future engagement with the marine environment.

Systematics and biogeography of marine sponges from North Eastern New Zealand

Mr. Sam McCormack[1], Chris Battershill[1], Michelle Kelly[2], Phil Ross[1], Ian Hogg[1]

[1]*University Of Waikato,* [2] *NIWA*

Protecting earth's marine life requires increased taxonomic knowledge, and an understanding of how biodiversity is distributed. However, the potential morphological plasticity of marine sponges can make classifying them difficult. Because sponges can be hard to identify information regarding their patterns of distribution is often scarce. Therefore, there is a need to improve both morphological and molecular based taxonomic tools in order to make it easier to classify sponge diversity. Here we present the first biogeographic analysis of sponges from the North Eastern Coast of New Zealand; with a taxonomic focus on the systematics of the Callyspongiidae family. This region represents coastal systems where there is a paucity of information on benthic encrusting biodiversity. The Callyspongiidae were chosen due to their limited taxonomic characters available to define species. Specifically, research will provide: (1) a broad taxonomic review of all sponge taxa from the North Eastern coast of New Zealand, over a 730 km coastal range. This will cover a range of environments from pristine to heavily influenced by human activity, and (2) a focused systematic revision of the Callyspongiidae (*O. Haplosclerida*); an ecologically important group that reflects environmental condition, using molecular and morphological techniques.

Paua and the Kaikoura earthquake: Industry research and management responses

Dr. Tom McCowan[1]

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The coastal uplift caused the November 2016 Kaikoura earthquake resulted in massive paua mortality and the loss of critical paua habitats. This has caused great concern about the future of this locally important fishery and iconic species in the Kaikoura region. The immediate response has been a closure of the paua fishery in the affected area, leaving management decisions to be made as to when and how this fishery will be re-opened. A key research need to inform these decisions is estimating and monitoring the spawning biomass of paua in the affected area. We have undertaken to estimate and monitor the surviving spawning biomass using novel methodologies derived from data and technology from our paua 'data logger' programme. Ongoing research will be supported by MPI and industry-based initiatives to ensure that the Kaikoura paua fishery recovers successfully.

Transport and retention of benthic marine invertebrate larvae in a large semi-enclosed meso-tidal estuary

Mr. Bradley Monahan[1], Dr. Conrad Pilditch[1], Dr. Karin Bryan[1], Dr. Niall Broekhuizen[2], Dr. Joanne Ellis[3]

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Field observations and numerical simulations were used to investigate the effect of complex channel morphology on the transport and retention of benthic invertebrate larvae. Tauranga Harbour, a large (218 km^2) meso-tidal estuary has a tidal prism which indicates a flushing time of 0.8 to 1.5 days. However, residence times vary throughout the harbour, due to residual circulation patterns caused by complex channel morphology. Field observations indicate increased abundance and differing community composition of invertebrate larvae in the upper harbour compared to the lower. Tidal circulation is asymmetrical, with transport through a seaward channel during flood tides, and a landward channel during ebb; suggesting that larval retention in the upper harbour may provide a source of larvae for the lower harbour. Larval transport pathways were evaluated by a coupled hydrodynamic-transport model and confirm the pathways indicated by field observations. Larvae released in the upper harbour landward channel were retained for up to 16 days at all times. Retention for larvae released in other harbour locations were much more variable and dependant on timing of release and direction of initial transport. Our results highlight the impact of small scale morphological changes on the transport and retention of benthic invertebrate larvae.

Disappearing forests: loss, survival and potential ecological implications of Kaikoura's earthquake on bull kelp populations

Mr. Luca Mondardini[1], Dr. Mads Thomsen[1], Mr. Shawn Gerrity[1], Prof. David Schiel[1]

[1]*Marine Ecology Research Group, University of Canterbury*

Bull kelp (Durvillaea spp.) are important habitat-forming species that increase biodiversity and productivity and provide significant economic and cultural value. Recently, the Kaikoura region experienced major uplift along 120 km of coastline following a 7.8 earthquake, causing mass mortality with unknown ecological consequences. To better understand the ecological impact it is imperative to have data on bull kelp losses. The aim of this study is to (a) provide data on bull kelp loss along the Kaikoura coastline, (b) to monitor regrowth and recolonisation and (c) to compare data to un-impacted areas south of Kaikoura. We have, so far, surveyed 20 impacted reefs (south of the Highway-1 closure) characterised by different degrees of uplift, using small-scale quadrats and large-scale drone-images. We have also tagged kelp remnants at 10 reefs to follow individual survival. We aim to re-survey these reefs after 6 months using the same sampling procedure, and to survey both impacted reefs north of the road closure and healthy reef south of Kaikoura. Here, data will be presented to show the first estimation of losses and remaining cover of bull kelps. Preliminary analysis suggests that at least some Durvillaea willana has survived, whereas other Durvillaea species have mostly disappeared.

Functional biodiversity of fish along a depth gradient: a study from the Kermadec Islands and Great Barrier Island

Ms. Elisabeth Myers[1], Prof. Marti Anderson[1], Dr. David Eme[1], Dr. Libby Liggins[2], Dr. Clive Roberts[3], Prof. Euan Harvey[4]

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Changes in species assemblages have long been studied using taxonomic diversity alone. To better understand and predict ecological processes, ecosystem services and resilience, it is important to study functional biodiversity. The deep sea occupies the largest area on earth and sustains many important fisheries around the globe. Little is known however, how biodiversity and especially functional biodiversity, changes with depth. This project looks to fill this gap by assessing how fish traits associated with structure, locomotion and feeding reflect functional adaptations to the extreme environment of the deep sea. Functional trait measurements such as body length and depth, jaw size, and eye size were obtained from unique stereo-baited remote underwater video (stereo-BRUV) footage of fishes from the Kermadec Islands and Great Barrier Island in a structured replicated ecological sampling design from 7 depth strata (50 m, 100 m, 300 m, 500 m, 700 m, 900 m, and 1200 m). Morphological measurements were carried out on 78 species, from 76 genera across 48 families from the two sites. For this study we used univariate statistical models to describe for the first time, the relationship between functional biodiversity and depth for these two assemblages.

First molecular identification of Apicomplexan – "X" (APX), an apicomplexan parasite associated with flat oysters (*Ostrea chilensis*) in New Zealand

Ms. Suong Nguyen[1], Dr. Stephen Webb[2], Dr. Jonathan Banks[2], Dr. Kevin C. Wakeman[4,5], Mr. Henry Lane[3], Prof. Andrew Jeffs[1], Ms. Cara Brosnahan[3], Dr. Brian Jones[3], Dr. Andrew Fidler[1]

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The Apicomplexa is recognised as a diverse group of parasitic unicellular eukaryotes with significant impacts on humans and livestock health around the world. Relatively little attention has been given to apicomplexans in invertebrates, especially apicomplexans infecting marine hosts. Typical example is the unnamed apicomplexan-X parasite (so called APX) of the commercially important flat oysters (*Ostrea chilensis*) in New Zealand. Although previous work has reported APX may be associated with increased host vulnerability to the infectious disease bonamiosis, the parasite so far has only been identified morphologically. In this study, we report an 18S rRNA sequence amplified from APX infected *O. chilensis* tissues. Phylogenetic analyses clearly established that the 18S sequence was of apicomplexan origin. Two specific probes, designed from the 18S rRNA sequence, co-localised with APX cells in *in situ* hybridisations. This is the first study to use genetic sequence to identify and describe parasitic APX associated with flat oysters. This sequence will facilitate the development of inexpensive and sensitive molecular diagnostic tests for APX thereby facilitating research focused on the biology and ecology of this organism and its role in morbidity and mortality of *O. chilensis*.

Interannual and seasonal variability of export fluxes across the Hauraki continental margin, 1996-97 and 2015-16

Dr. Scott Nodder[1], Dr. Moira Décima[1], Dr. John Zeldis[1], Dr. Mike Stukel[2], Lisa Northcote[1]

[1]NIWA, [2]Florida State University

Globally, continental margins are significant sinks of atmospheric CO_2, although the rate at which carbon is sequestered into the deep ocean in such locations is poorly quantified. Carbon export fluxes can be measured using several techniques that encompass multiple time-scales. In 1996-97 and 2015-16, moored time-series sediment traps were deployed for 6 months and 1 year, respectively, on the Hauraki continental margin along which the East Auckland Current (EAUC) transports warm, subtropical waters into the wider NZ region. These time-series flux data show that export fluxes have pronounced seasonality, with peaks in autumn and spring, decreasing in winter, with the lowest fluxes recorded in summer. In 1996-97, free-floating trap deployments indicated shifts in the carbon export pathways across the Hauraki Gulf, with sediment resuspension important in the inner gulf, and phyto- and zooplankton-mediated fluxes dominant in the middle to outer gulf, respectively. Finally, new geochemical data collected in May 2016 using the ^{234}Th proxy for particulate organic carbon export highlights the spatial variability of particle flux across the EAUC and the shelf-break onto the Hauraki/Northeast continental shelf. These observations indicate the variability of carbon export on this NZ continental margin, as supported by other observations of ecosystem and biogeochemical dynamics.

Ontogenetic changes in *Perna canaliculus* shell material – a precursor to geochemical tagging of larvae

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Elemental fingerprinting takes advantage of differences in physio-chemical properties of water being reflected in the microchemistry of shell material to track the dispersal of marine larvae. Shell formed whilst in the larval phase provides a tag of the natal water mass. Several knowledge gaps, however remain, particularly with regards to changes in shell chemistry due to ontogeny. This study uses a combination of FTIR and Raman spectroscopy to determine if changes in the carbonate polymorph produced in shell material occur as individuals age. Current results indicate that aragonite is produced throughout the shell. This information is combined with trace element data obtained from individuals of different ages, raised under constant conditions to determine if shell material deposited in settled shell can be used as a proxy for larval shell produced under the same conditions. This would allow the complicated larval outplanting techniques which are currently used to be avoided.

Impacts of the Kaikoura earthquakes on fisheries, and how fisheries management is responding

Jenny Oliver[1], **Mark Geytenbeek**[1]

[1]Ministry for Primary Industries

Earthquakes on 14 November 2016 caused considerable damage to the coastline in north Canterbury, Kaikoura, and east Marlborough, and resulted in an emergency fisheries closure for shellfish and seaweed species. The repercussions of the earthquake and ongoing recovery of the ecosystem have wide-ranging implications for fisheries management in the earthquake-affected areas and adjacent areas. High mortality of some fisheries species means that these populations have suffered a decrease in numbers, and alterations to or destruction of habitat is likely to impede the recovery of some fisheries species. Taken together, this suggests a long recovery period for some of the affected fisheries in the area. The Ministry for Primary Industries (MPI) is responsible for setting fisheries catch limits and regulations. With the emergency closure due to expire on 20 November 2017, MPI is developing new management protocols for affected fisheries in and around the earthquake-affected areas that account for the range of negative impacts from the earthquakes, potential fishing effort displacement, and the expected long-term recovery of some of the fisheries.

Rising tides, cumulative impacts and cascading changes to estuarine ecosystem functions

Dr. Teri O'Meara[1], Ms. Jenny Hillman[1], Prof. Simon Thrush[1]

[1]*University of Auckland*

In coastal ecosystems, climate change affects multiple environmental factors, yet most predictive models are based on simple cause-and-effect relationships. Multiple stressor scenarios are difficult to predict because they can create a ripple effect through networked ecosystem functions. Estuarine ecosystem function relies on an interconnected network of physical and biological processes. Estuarine habitats play critical roles in service provision and represent global hotspots for organic matter processing, nutrient cycling and primary production. Within these systems, we predicted functional changes in the impacts of land-based stressors, mediated by changing light climate and sediment permeability. Our *in-situ* field experiment manipulated sea level, nutrient supply, and mud content. We used these stressors to determine how interacting environmental stressors influence ecosystem function and compared results with data collected along elevation gradients to substitute space for time. We show non-linear, multi-stressor effects deconstruct networks governing ecosystem function. Sea level rise altered nutrient processing and impacted broader estuarine services ameliorating nutrient and sediment pollution. Our experiment demonstrates how the relationships between nutrient processing and biological/physical controls degrade with environmental stress. Our results emphasise the importance of moving beyond simple physically-forced relationships to assess consequences of climate change in the context of ecosystem interactions and multiple stressors.

Abrasion Resistance of New Zealand Chitons

Mr. Bryce Peebles[1], Prof. Abigail Smith[1]

[1]*University of Otago*

Chitons are common marine invertebrates found worldwide that use aragonite to form their shell and are rare in the sediment and fossil records. Their rarity in the fossil record may appear unremarkable since aragonite is known to disappear from the fossil record over time. However, laboratory observations have been made that suggest that chitons resist dissolution, which appears inconsistent with their rarity in the sediment and fossil records and aragonite composition. If dissolution is not removing chiton valves from the fossil record, then other taphonomic processes may be. The effects of abrasion on chiton skeletal material are understudied, and are needed to provide insight to the taphonomy of chitons. Valves from eight New Zealand chiton species were cleaned, weighed, and tumbled for 96 hours. The valves lost an average of 9-44% of their weight and the damage varied among species. The dorsal layer of the valves (the tegmentum) was the most damaged in all species while the ventral layer (the articulamentum) showed the least damage. *Leptochiton inquinatus* (the sole Lepidopleuran) lost the most material while the acanthochitonids (*Acanthochitona zelandica*, and *Notoplax violacea*) and the chitonids (*Chiton glaucus*, *Onithochiton neglectus*, *Sypharochiton pelliserpentis*, and *S. sinclairi*) were the most resistant to abrasion.

Satellite observation of water quality in New Zealand's territorial waters, 2002–2017

Dr. Matt Pinkerton[1]

[1]*NIWA*

Monitoring water quality in New Zealand's territorial coastal zone is crucial for understanding processes, detecting change and managing human impacts. However, coastal waters are spatially heterogeneous and temporally dynamic so that water sampling from vessels has limited ability to assess or monitor large-scale patterns over long periods. Satellite ocean colour data can complement water sampling by observing coloured material in coastal regions on large time and space scales, with high frequency (up to daily). We present an overview of satellite observations of New Zealand territorial waters by NASA's MODIS-Aqua sensor, at 500 m spatial resolution between 2002 and 2017, asking:

- How accurate are satellite observations of sea-surface temperature, suspended sediment, turbidity, chlorophyll-a, and water clarity?
- Are there trends in these water quality variables around the New Zealand coast over the last 15 years as measured by satellite?
- What patterns in productivity are revealed by the remote-sensing data?

The presentation will also suggest priorities for bio-optical sampling to validate and locally-tune satellite observations of water quality around New Zealand in the future.

Effects of noise on the communication space of individual marine fauna

Ms. Rosalyn Putland[1], Dr. Nathan Merchant[2], Dr. Adrian Farcas[2], Dr. Craig Radford[1]

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Sound pollution in coastal embayments is a concern facing scientists and policy makers alike because vessel sound directly overlaps the frequency range of many marine animals, potentially putting communication between individuals in jeopardy. However, quantitative research into the impact of vessel sound on communication space, is surprisingly limited. We used long term acoustic recordings and AIS ship tracking data to determine the effect of large commercial vessels on the communication space of New Zealand bigeye, *Pempheris adspersa* and Bryde's whales *Balaenoptera edeni*. At four listening stations throughout the Hauraki Gulf, north-eastern New Zealand, both natural seasonal variation in the soundscape as well as individual vessel passages increased the ambient sound level. However, the noise generated by a vessel at its closest point of approach had the potential to mask any concurrent biological vocalisation, reducing the communication space for both bigeyes, up to 45m, and Bryde's whales, up to 13.6km. The quantitative methods used in this study provide an important tool for understanding the magnitude and potential effects of chronic noise from vessels on specific species. Applying the tool to other species or ecologically significant embayments would continue to improve shipping noise mitigation strategies.

Diversity and distribution of cetaceans in the Otago submarine canyons

Dr. William Rayment[1]

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Submarine canyons are hotspots of productivity in the deep sea, providing important habitat for top predators including marine mammals. The continental shelf off Otago is incised by a network of canyons which to date have been poorly studied. With the aim of investigating diversity and distribution of cetaceans, a series of visual line-transect and passive acoustic surveys were conducted off the Otago coast between April 2016 and March 2017. During a total of 630 km of survey effort over eight survey days, 32 cetacean encounters were recorded representing seven species. The most frequently sighted species were dusky dolphin (n=13 encounters), long-finned pilot whale (n=7) and sperm whale (n=6). Shepherd's beaked whale, a very poorly known species with only three previous live records from New Zealand, was seen on three separate occasions. Acoustic detections of sperm whales were made in every season, suggesting year-round presence of the species in the deep water habitats off the Otago coast. These surveys have demonstrated the importance of the Otago canyons as habitat for deep-diving odontocetes, and lay the foundations for analyses to investigate the mechanisms behind this relationship.

Migration of Oceania humpback whales across a large ocean basin

Ms. Leena Riekkola[1], Olive Andrews[2], Virginia Andrews-Goff[3], Scott Baker[4], Simon Childerhouse[5], Phillip Clapham[6], Remi Dodemont[7], Mike Double[3], Ari Friedlaender[4], Ramon Gallego Simon[1], Claire Garrigue[7,8], Yulia Ivashchenko[6], Rebecca Lindsay[9], Logan Pallin[4], Debbie Steel[4], James Tremlett[1], Silje Vindenes[1], Alex Zerbini[6], Rochelle Constantine[1,10]

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Attaining observational data on large oceanic animals, such as whales, that migrate long distances is challenging. We deployed 25 satellite tags and collected 84 tissue samples from Oceania humpback whales at the Kermadec Islands in 2015, to determine population demographics and connectivity between breeding and feeding grounds. Nineteen whales, with varying tag performance, were tracked for an average of 105 days across the Pacific Ocean to their Antarctic feeding-grounds (distances of up to 7,000 kilometres). The feeding-ground destination may be linked to the whales' life history stage, with all tracked mother-calf pairs (n=4) migrating to the Ross Sea and 66% of adults without calves (n=8) migrating to the Bellingshausen and Amundsen Seas. Progesterone analysis revealed a high pregnancy rate (55%), including five females accompanied by a young-of-year calf, indicative of yearly pregnancies. Whales travelled faster at mid-latitudes (average=3.3km/h) and slower at low (average=1.1km/h) and high latitudes (average=1.8km/h), with no significant difference between sex/reproductive groups. Satellite tagging and biopsy sampling were found to be informative methods for studying these 'hard to reach' animals. Understanding the migratory routes, pregnancy rates, and the Antarctic feeding-ground destinations of the Oceania humpback whales are vital elements in the future management and conservation of this population.

A prey survey to understand nutritional stress in New Zealand sea lions

Dr. James Roberts[1], Dr. Richard O'Driscoll[1], Mr. Alan Hart[1], Dr. Brittany Graham[1]

[1]*NIWA*

The Auckland Islands breeding population of New Zealand sea lions (*Phocarctos hookeri*) has declined by ~50% since the late 1990s and displays numerous indicators of nutritional stress. We undertook a trawl and camera survey of prey species distributions over seafloor foraged by females at the Auckland Islands and compared with another area used by a small recolonising population at Stewart Island. At the Auckland Islands we found a low diversity and abundance of known prey shallower than 200 m and this is a plausible explanation for the extreme deep diving of Auckland Islands females. Mesopelagic prey were abundant from 200-500m, but major shifts in their availability to female NZ sea lions may have occurred over the past 25 years. By comparison, the Stewart Island population appears to have abundant prey both shallow and deeper than 200m and the prospects for continued growth of this population are good based on food resources. This prey survey provides a vital resource for understanding the mechanisms of nutritional stress for NZ sea lions, including the spatial/bathymetric distributions of key prey and factors that might affect their availability to female NZ sea lions.

Fish rest where they see best – the effect of light intensity on snapper behaviour and physiology

Dr. Esme Robinson[1,2], Prof. William Davison[2], Dr. Suzy Black[1], Alistair Jerrett[1]

[1]*Plant and Food Research,* [2]*University of Canterbury*

The sensory physiology and behaviour of many fish species are strongly affected by light. This study demonstrated that in the Australasian snapper (*Chrysophrys auratus*) absolute light intensity governs visual acuity and also guides preference behaviour, with fish choosing to 'rest where they see best'. Use of the optomotor response to test visual acuity at four light intensities (0.01, 0.05, 1 and 3 μmol s^{-1} m^2), showed that visual acuity (measured as directional bias) was best at a light intensity of 0.05 μmol s^{-1} m^2 (84.9% directional bias), but weakened at the highest and lowest light intensity (41.1 and 35.3%). When provided with a choice of the same four light environments fish also spent most time in the 0.05 μmol s^{-1} m^2 light environment, while the highest and lowest intensity light environments were usually avoided. Such findings provide an important background for the successful design of improved trawl fishing methodologies.

The story of toheroa: a tale of love, loss and life between Tāne and Tangaroa

Dr. Phil Ross[1]

[1]*University of Waikato*

Mātauranga tells of the special relationship that exists between the surf clam toheroa, and the dune grass pīngao. Blown by Tāwhirimātea, toheroa spat ride the foaming waves of the wild west coast up and into the sand dunes of Te Oneroa-a-Tōhē, Mitimiti and Ripiro Beaches. Captured by the pīngao, spat settle and grow in the dune grass, eventually catching a ride back to the water's edge on the spinifex seed heads. Although sometimes derided by 'western scientists' as being wrong and of little use to the study of ecology, traditional ecological knowledge (TEK) is an accumulation of years of observation and utilisation of natural resources. The Mātauranga interpretation of surf beach dynamics may not be in agreement with the bioscience understanding of toheroa life history. However, that does not mean that this narrative cannot enhance our knowledge of toheroa ecology. In this talk I explore the story of toheroa and attempt to answer the long standing question: what is the biological basis to the relationship between pīngao and toheroa.

First detection of gas-bubble disease and Rickettsia-like organisms in toheroa (*Paphies ventricosa*)

Dr. Phil Ross[1], Dr. Anjali Pande[2], Dr. Brian Jones[2], Ms. Jane Cope[1], Ms. Georgina Flowers[1]

[1] *Coastal Marine Field Station, University of Waikato,* [2]*Ministry for Primary Industry, Animal Health Laboratory*

At the start of the 20th century, New Zealand endemic toheroa were abundant on a handful of west and south-facing surf beaches. Increased popularity and harvesting pressure from the early-1900s depleted the resource. By the mid-1900s populations had collapsed and commercial and recreational harvest ceased from 1971 – 1980. Despite 40+ years of protection, toheroa have, for unknown reasons, failed to recover. In November 2016, blisters were observed on the shells of Northland toheroa. Closer examination revealed the blisters to be a consequence of gas-bubble disease (GBD), a condition analogous to 'the bends' in scuba divers. *Rickettsia*-like organisms (RLOs), a group of pathogens associated with mass mortalities in clams worldwide, were also detected as was extensive damage to toheroa gill tissues. Research is ongoing to better resolve the taxonomy of RLOs and to determine whether RLOs and GBD could explain mass mortality events in toheroa, and other shellfish, and the failure of toheroa to recover from historical overharvesting.

Parasitism of diatoms in the Chatham Rise subtropical convergence zone East of New Zealand during summer

Mr. Karl Safi[1], Dr. Andres Gutierrez-Rodriguez[1]

[1]*NIWA*

Living organisms are almost constantly confronted by pathogens. However, very little is known about rate of infection of marine diatoms, an important primary producer in oceans. Few examples of marine diatoms infected by zoosporic parasites have been published but these suggest significant impacts affecting community composition and functioning. During a summer voyage of the RV Tangaroa to the Chatham Rise (3-23rd, December 2016) we frequently observed diatoms suffering from putative parasitism. These observations were made using a FlowCam imaging system, which allowed us to obtain live images of both the diatoms and their zoosporic parasites. Using this novel method we observed the infection of a range of live diatom cells including Thalassiosira and *Chaetoceros* spp. We will present an estimated rate of infection on diatom species based on image analysis, and investigate how these rates varied spatially in relation to water column physico-chemical properties and physiological condition of the phytoplankton community. Advantages and limitations of this approach will be discussed. The Chatham Rise is one of the most productive open-ocean ecosystems in the NZ EEZ and sustains important fisheries. Given diatoms' crucial role as a primary producer, parasitism lowering their productivity has the potential to influence this important ecosystem.

Particle capture capabilities in juvenile green-lipped mussel (*Perna canaliculus*)

Ms. Dyahruri Sanjayasari[1], Dr. Andrew Jeffs[1]

[1]*University of Auckland*

The feeding biology of juvenile green-lipped mussels is poorly understood. However, it is a critical importance in terms of the growth and retention of seed mussels for the Greenshell aquaculture industry which is worth $300 million a year for New Zealand. Improvements in feeding efficiency of juvenile mussels has the potential to overcome the intermittent shortage of seed supply in this industry. Using advanced flow cytometry (FCM) methods, we investigated the ability of juvenile green-lipped mussels of a range of sizes (i.e., 500 µm to 8 mm in shell length) for capturing different types of particles to better understand their filtering capabilities. Distinct differences were found between sizes of mussel and their capability on capturing the particles which will be discussed further in this presentation.

Dynamic range models to forecast impacts from invasive marine species

Ms. Kimberley Seaward[1], Dr. Graeme Inglis[1], Dr. Dong Wang

[1]*NIWA*

Over 360 non-indigenous species have been recorded from New Zealand coastal waters. Forecasts of the potential future distributions of these species and the rates at which they are likely to be realised are important for determining areas within New Zealand at risk and for designing intervention strategies. Ecological niche models (ENMs) provide a static representation of the potential suitability of different environments for a species, but assume niche conservatism in the projected range and provide no information on the rate at which suitable areas will be occupied. In this presentation, we discuss results from the initial development of dynamic range models for invasive species in New Zealand, that combine ENMS with the spatio-temporal population dynamics of selected species. The models use global distribution data to calibrate the ENMS and measures of local proliferation and regional spread obtained from the national Marine High Risk Site Surveillance to parameterise the dynamic rates of niche occupation. We use results from a few select species to illustrate the utility of dynamic range models for invasive species and some of the challenges in their development and interpretation for marine species.

From Humans to Molluscs: Target Specific Bioactive Delivery Using Microcapsules

Dr. Ali Seyfoddin[1,2], Miss Seyedehsara Masoomi Dezfooli[1,2], Dr. Noemi Gutierrez-Maddox[2], Prof. Andrea Alfaro[2]

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Microencapsulation is a process in which drugs, food ingredients, bioactive materials or dyes are engulfed within a capsule for a variety of applications. The size of these capsules can vary from 100 nm to 1000 µm and they can be made of biocompatible synthetic or natural materials such as polymers and lipids. Encapsulation techniques have been widely used in medical and food industries for enhancing therapeutic efficiency of drugs and preserving food ingredients during manufacturing and after consumption. Target specific drug delivery, sustained drug release profiles, programmed release, increased stability and viability of bioactive material are some of the advantages of microencapsulation that can be well utilised to address current aquaculture problems. Encapsulation can be used to deliver probiotics, vaccines, immune-stimulants or bioactive materials in aquaculture settings. This presentation will introduce the potential use of encapsulation techniques for various aquaculture applications. To illustrate this approach, alginate and chitosan based microcapsules for delivering probiotics to abalone (*Haliotis iris*) were developed and characterised. An emulsion based inotropic gelation technique was used to encapsulate probiotics and the resultant particles were 30-200 µm in size. The capsules were programmed to retain their content in sea water and only release it in abalone's intestine.

The new Ross Sea region Marine Protected Area: New Zealand's contribution to an international research and monitoring plan

Dr. Ben Sharp[1], Alistair Dunn[1], Marine Pomerade[1]

[1] *Ministry for Primary Industries*

In November 2016, the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) adopted the Ross Sea region Marine Protected Area (RSRMPA). New Zealand, in partnership with the United States, played a lead role in a more than ten-year process to design, propose, and secure consensus endorsement of the RSRMPA. The conservation measure establishing this protected area requires introduction of a research and monitoring plan to the forthcoming meetings of CCAMLR and its Scientific Committee in October 2017. The purpose of this plan is to identify research and monitoring activities required to evaluate the effectiveness of the MPA in achieving a specific set of scientific and ecosystem protection objectives. Results of this research will inform the periodic review and potential modification of the MPA.

As a key architect and proponent of the RSRMPA, New Zealand expects to play a very active role in the design and delivery of new research under the MPA research and monitoring plan. In April 2017 New Zealand scientists attended an international workshop in Rome to begin the process of developing this plan in collaboration with other CCAMLR Member countries. In March 2017, we also assembled an expert workshop of New Zealand Antarctic marine scientists to design New Zealand's research contribution under the plan.

In this presentation we summarise the scientific basis for the design of the Ross Sea MPA and implications the research that will be required to evaluate its effectiveness. We present results from the New Zealand and CCAMLR workshops to develop the Ross Sea MPA research and monitoring plan, and outline New Zealand's planned research contribution to ensure its effective implementation, to safeguard the future of the Ross Sea MPA.

Host variety enhances diversity: the role of multiple secondary habitat-forming seaweeds in facilitating estuarine invertebrate communities

Mr. Alfonso Siciliano[1], Dr. Mads Thomsen[1], Prof. David Schiel[1]

[1]*Marine Ecology Research Group, University of Canterbury*

Shell-forming molluscs are primary habitat-forming species that affect the structure of invertebrate assemblages in sedimentary estuaries. Importantly, their shells provide hard substratum that seaweeds attach to, and these seaweeds can subsequently provide secondary habitat to epibiontic invertebrates, giving rise to habitat cascades. Here we hypothesized that (1) invertebrate communities depend on the identity and density of morphologically different seaweeds (*Gracilaria chilensis* vs. *Ulva* sp.), (2) these invertebrates have different host-specificities related to the ecological differences between seaweeds, (3) results are consistent across latitudes and (4) invertebrate community structure depends on whatever primary and secondary habitat-formers are alive or dead (mimics). The first two hypotheses were tested in surveys and experiments run seasonally. There were consistent significant effects of both seaweed species-identity and density, but the results from the experiment was less conclusive. A regional survey in 13 estuaries tested the third hypothesis, confirming the results from the local survey. Finally, a field experiment confirmed hypothesis four demonstrating that live habitat-formers have higher diversity than mimics, suggesting that secondary habitat-formers may provide trophic subsidies for invertebrates. In concert, these results show that habitat cascades are common in increasing biodiversity in estuaries of the South Island of New Zealand.

Power to detect Maui dolphin population trends

Prof. Elisabeth Slooten[1], Lindsay Wickman[1], Prof. Steve Dawson[1]

[1]*Otago University*

We quantify the potential to detect population trends for the Critically Endangered Maui dolphin *(Cephalorhynchus hectori maui)*. The population has declined 2% per year from 134 individuals in 1985 (95% CI 46-280) to 63 in 2016 (95% CI 57-75). A Bayesian linear regression of the last three estimates: 69 (95% CI 52-100), 55 (95% CI 48-69) and 63 (95% CI 57-75) resulted in a 68% probability of continued decline. It would take 20 years to detect, with 80% statistical power, population trends of 60% per survey (currently conducted every five years). A 60% decline would likely result in extinction. Recovery of 60% in five years is not biologically realistic, given maximum population growth of 2-4% per year. Statistical power to detect population trends within 5-10 years is very low. Only very large, catastrophic population declines are detectable. This indicates that attempting to judge the effectiveness of current conservation management from repeated surveys is doomed to failure. Experience with Yangtze River dolphin and Gulf of California harbour porpoise shows that when a dolphin population drops below 100 individuals a precautionary approach to conservation management is critical.

Collaborative Coastal Management when the earth shakes – the Kaikoura model tested

Peter Lawless[1], **Gina Solomon**[1], Larnce Wichman[2]

[1]*The Lawless Edge Ltd,* [2]*Te Korowai o Te Tai o Marokura*

Collaborative models for environmental management are emerging in New Zealand. At the forefront are processes for coastal and freshwater environments. Full development of a community led programme is demonstrated in the Kaikoura integrated coastal management programme. Collaborative processes are found to be useful for complex issues involving multiple parties with overlapping interests, making these approaches suitable for integrated coastal management. Kaikoura coastal and marine management had evolved inclusion of statutory Guardians as well as the community based Te Korowai o te Tai o Marokura incorporated society when everything was turned on its head by the earthquake. This paper explores how the governance structures responded and how things have further developed to deal with the changed environment.

Spatial and Temporal Changes in Inshore Fishing Effort and Habitat Use

Dr. Fabrice Stephenson[1], Prof. Nick Polunin[2], Dr. Aileen Mill[2], Ms. Paula Lightfoot[2], Dr. Catherine Scott[3], Dr. Clare Fitzsimmons[2]

[1]NIWA, [2]Newcastle University, [3]Natural England

Habitat and fisheries usage data are key components for ecosystem based management (EBM). Significant gaps in knowledge remain for fisheries–habitat interactions, particularly in inshore fisheries where vessels are <12m. Here we show changes in inshore fishing effort distribution (<12m) and habitat use over the decade 2004-2013.

Sightings data of fishing vessel activity recorded at sea during routine fisheries patrols in Northumberland, UK, were combined with landings data to estimate and map pot-fishing activity between 2004 and 2013. Spatial temporal changes were investigated using Monte Carlo simulation of randomly sampled fishing effort maps. High resolution (1m) broadscale (EUNIS level 3) predictive habitat maps of a Marine Conservation Zone (MCZ) were used to investigate spatial temporal changes in fishers' habitat selection using compositional analysis.

Fishing effort in the study area increased between 2004 and 2013 (233,642-354,193 pots.year $^{-1}$). Fishing effort distribution differed between individual years, becoming highly concentrated inshore; particularly in 2010-2011 and 2012-2013. Fishers in the MCZ showed a preference for rocky habitats over sediment habitats. This study demonstrates the potential of existing datasets, collected through routine fisheries patrols, to investigate temporal and spatial changes in fishing effort, offering a viable alternative to VMS for monitoring smaller vessel inshore fisheries.

Conservation welfare during whale mass stranding events – is it time for a paradigm shift?

Dr. Karen A Stockin[1], Ms. Emma L Betty[1], Assoc. Prof. Wendi D Roe[1], Dr. Ngaio J Beausoleil[1]

[1]Massey University

Historically, animal welfare and conservation have been regarded as separate disciplines, with dissimilar objectives that often conflict. However, the newly emerging field of conservation welfare has started to align these disciplines more closely, with the aim of improving both animal welfare and conservation outcomes. In putting conservation science into practice, scientists, conservationists and managers alike may inadvertently induce significant detrimental impacts upon the welfare of the animals that they seek to conserve. In the context of mass stranding events, impacts may arise at different levels, in numerous ways. However, such issues and the ethical and scientific foundations of decision-making regarding stranded whales, have yet to be explicitly explored in any detail. At what cost is our anthropogenic desire to 'save the whales' really achieved? Within the context of a recent record breaking pilot whale mass stranding event in New Zealand, we discuss social, ethical and animal welfare issues surrounding rescue attempts and offer considerations for future discourse, research and practice in the broader context of compassionate conservation.

Consequences of earthquake uplift on rocky reef primary productivity on the Kaikōura peninsula

Dr. Leigh Tait[1], Mr. Shawn Gerrity[2], Prof. David Schiel[2]

[1]*NIWA,* [2]*University of Canterbury*

The unprecedented loss of habitat-forming algae and their associated understory flora and fauna following the Kaikōura earthquakes has significant implications for nutrient cycling, primary productivity and overall functioning of nearshore ecosystems on one of the most productive coastal zones in New Zealand. Uplifted reefs have been affected by substantial loss of canopy-forming fucoid algae which has caused further collapse of the communities facilitated by these autogenic engineers. While the composition of rocky reef communities will be subjected to long (years to decades) recovery trajectories, the almost instantaneous loss of biomass and productivity has implications that go well beyond the ecosystems immediately impacted. To understand these changes we have measured the primary productivity of intertidal rocky reefs several times post-earthquake and compare this output to a time-series of pre-earthquake output. Furthermore, we use past studies of recovery trajectories in these communities to estimate the potential lag in carbon production from rocky reefs. Finally we will discuss the impediments to fucoid recovery and the potential negative feedbacks caused by altered physical and biological interactions.

Ecosystem indicators for fishery management: 24 years of Chatham Rise data

Rikki Taylor[1]

[1]*University of Auckland*

Ecosystem based fisheries management needs new techniques to help understand and monitor marine ecosystems for effective application. Indicators provide this opportunity, whereby a small suite of metrics can be used to track and communicate changes and patterns in the communities within an ecosystem. To explore potential indicators for New Zealand's marine ecosystems, 24 years of trawl survey data on the Chatham Rise will be analysed. The region is highly important economically for fisheries due to mixing of subtropical and Antarctic waters creating high productivity and diversity throughout the Rise. Survey (catch and size composition) data combined with life history traits can be used to explore how species, communities and size structure vary both spatially and temporally. With further inclusion of environmental factors into the analysis, dynamics of the Chatham rise ecosystem can be teased out to explore overarching patterns. By forming a useful suite of indictors, managers can more accurately track, understand and communicate changes on the Chatham rise, providing an effective tool for ecosystem based fisheries management in New Zealand.

SETAC Keynote: Contaminants of emerging concern in the marine environment

Prof. Kevin Thomas[1]

[1]*Queensland Alliance for Environmental Health Sciences (QAEHS), University of Queensland,*

The world's oceans and seas are of major economic and strategic importance. They provide transport routes for shipping, extractable sand and gravel, space and resources for aquaculture, access to sub-sea oil and gas, food for human consumption and a backdrop for recreation and tourism. Furthermore, the overwhelming bulk of humanity lives concentrated along or near coasts on just 10% of the earth's land surface. All of this activity results in the point and non-point release of chemicals, a number of which are not monitored and can be considered contaminants of emerging concern (CECs). This presentation will consider the occurrence of CECs from human activities in the marine environment and how this potentially affects the environment, our exposure and the links that have been made to certain diseases.

Habitat cascades destroyed in the Kaikoura earthquake

Dr. Mads Solgaard Thomsen[1], Isis Metcalfe[1], Alfonso Siciliano[1], Dr. Tommaso Alestra[1], Stacie Lilley[1], Shawn Geritty[1], Prof. David Schiel[1]

[1]*Marine Ecology Research Group, School of Biological Sciences, University of Canterbury*

It is well-described how anthropogenic activities and natural disasters can destroy primary habitat-forming species, like seagrasses, corals and kelps. However, less research and conservation effort has focused on how these types of disturbances affect associated secondary habitat-formers, like epiphytes, and animals depending on biogenic habitat. In this talk we will first introduce the concept of habitat cascades with examples from New Zealand rocky shores and compare them to habitat cascades from other ecosystems. We will then show that intertidal primary (fucoid hosts) and secondary (seaweed epiphytes) habitat-formers and their inhabitants (small mobile invertebrates) have been decimated on reefs along a 100km swathe of coastline that were uplifted by 1 – 6 m by the recent 7.8 mW Kaikoura earthquake. Finally, we will discuss potential cascading ecological effects, future scenarios for natural recovery and whether restoration is a viable option to speed up the recovery of habitat cascades on these degraded reefs.

80 years in Waitemata Harbour: The arrival of new species and continued changes in benthic ecology

Dr. Michael Townsend[1], Dr. Drew Lohrer[1], Dr. Leigh Tait[1], Miss Samantha Parkes[1]

[1]*NIWA*

Subtidal soft-sediment habitats in the Waitemata Harbour have changed substantially since they were surveyed by AWB Powell in the 1930s. By the 1990s, areas once dominated by native species were observed to be dominated by non-indigenous bivalves from Asia (Hayward et al. 1997), such *Arcuatula (Musculista) senhousia*, *Limaria orientalis,* and *Theora lubrica*. Here we present information on habitat types and community dominance from surveys of the Waitemata Harbour conducted in 2008 and 2017. The most recent survey revealed declines in *A. senhousia* at sites where it was once extremely abundant, and the occupation of those sites by the recently arrived (2009) Mediterranean fan worm, *Sabella spallanzanii*. We will discuss the implications of the shifts in non-indigenous species abundance for native marine benthic communities, and will highlight our recent investigations of the Japanese paddle crab, *Charybdis japonica* and Australian dog whelk, *Nassarius burchardi,* in the Auckland Region.

Drivers of Community Structure and Food Web Architecture in Temperate Reef Fish

Ms. Jacquetta Udy[1]

[1]*University of Otago*

The structure of a community is controlled through a combination of the amount of available resources and by consumer regulation. This study aims to resolve the relative importance of natural patterns in composition and productivity of habitats versus fishing pressure in driving reef fish community and food web structure. We examined fish community composition and structure between fished and unfished communities in Fiordland, Malborough Sounds and Abel Tasman with an orthogonal design covering habitats with varied algal densities. Stable isotope analysis was used to determine the trophic position of different species and hence elucidate the energetic consequences of fishing. Here we show that within each region the fished and unfished communities are distinct, with the effect size of reserves varying between regions. Sites with macroalgae present supported more diverse fish communities with higher biomass. Fishing was found to have less of an impact on communities in areas with macroalgae. Macroalgae was the most important organic matter source supporting fish communities in all habitats, and was particularly important in supporting exploited species. These results have important implications for the spatial planning and management of fishing regions and show macroalgal abundance must be considered to maximize yield and sustainability of NZ fisheries.

Beneath the waves of Tōtaranui: world-class hydrography, bathymetry and habitat information from Queen Charlotte Sound

Mr. Adam Greenland[1], **Dr. Steve Urlich[2]**, **Rebecca Batton[1]**

[1]Land Information New Zealand, [2]Marlborough District Council

In 2016, Land Information New Zealand (LINZ) and Marlborough District Council (MDC) joined together to undertake an ambitious survey in the Marlborough Sounds.

Over 43,000 hectares is currently being surveyed to the highest standards of bathymetric survey using multibeam echosounder technology. In addition to providing hydrographic information in support of safety of navigation, backscatter data is being used to identify and characterise the type and extent of different benthic habitats in accordance with international best practice.

LINZ is responsible for nautical charting information for safe navigation in New Zealand waters and certain areas of Antarctica and the South-West Pacific (www.linz.govt.nz/sea). MDC is the local authority with the statutory responsibility for the sustainable management of natural and physical resources in the Marlborough region, which includes the territorial sea within 12 nautical miles of mean high water springs (www.marlborough.govt.nz). MDC's harbourmaster is also responsible for maritime safety within its harbour limits.

We describe a number of challenges that have been successfully met during the project, including potential concerns around marine mammals and a busy, engaged boating community in one of New Zealand's iconic waterways. The test of any partnership is whether it would be done again, and both LINZ and MDC are exploring other potential opportunities with additional partners.

Effects of mussel farms on Hector's dolphins at Banks Peninsula: an ecosystem perspective

Ms. Maria Jesus Valdes[1], Dr. Will Rayment[1], Dr. Steve Dawson[1], Dr. Chris Hepburn[1]

[1]University of Otago

With the growth of human population, and decline in wild-caught fisheries, aquaculture production of fish and shellfish has increased rapidly over the last 20 years. Research on effects of aquaculture is important to understand the impacts of human activities on coastal ecosystems and endangered species. In New Zealand, one of the main species cultured is the green-lipped mussel (*Perna canaliculus*). Due to growing demand, production has expanded around the country, including at Banks Peninsula, home to a population of endangered Hector's dolphins (*Cephalorhynchus hectori hectori*). This study will assess the effects of mussel farms on Hector's dolphins from an ecosystem perspective by comparing three bays with farms (Pigeon Bay, Port Levy, Menzies Bay) and three without (Little Akaloa, Decanter Bay, Little Port Cooper). Oceanographic variables, sediment, benthic macrofauna and relative density of demersal fish will be analysed, along with data on dolphin habitat use gathered via land-based observations using a theodolite and passive acoustic monitoring. Results show significant differences in dissolved nutrients in the water and in organic matter content in sediment from bays with and without mussel farms. Mussels could be performing "bottom-up" control that would ultimately have an effect on species occupying high trophic levels, such as dolphins.

‘Diet and Diversity: Exploring the Biology of the New Zealand Scampi

Ms. Aimee van der Reis[1], Dr. Shane Lavery[1], Dr. Andrew Jeffs[1]

[1]*University of Auckland*

Commercial catches of New Zealand scampi are worth around $20M a year, but very little is known about some aspects of the biology of this deep sea lobster species, including their diet. Other overseas species in the genus have a highly varied diet including fish, crustaceans, worms and bivalves, but nothing is known for the New Zealand scampi, *Metanephrops challengeri*. Visual microscopic examination of scampi gut contents provides only low taxonomic resolution of the diet because of the difficulty in reliably identifying digested material. This study is expanding the limited knowledge of the New Zealand scampi’s feeding biology by utilizing DNA metabarcoding methods to analyse gut contents. Multiple individuals from different regions, locations, size classes, and sexes will be examined. This presentation will outline the aims, methodology and progress of this research. The knowledge gained from determining the composition of the natural diet of the New Zealand scampi will be valuable for further research into scampi aquaculture.

Using high throughput sequencing to characterise bacterial and eukaryotic marine biofouling assemblages and screen for invasive species

Ms. Ulla von Ammon[1,2], Dr. Anastasija Zaiko[1], Dr. Susie Wood[1,3], Mr. Olivier Laroche[1,2], Dr. Leigh Tait[5], Dr. Shane Lavery[2,4], Dr. Graeme Inglis[5], Dr. Xavier Pochon[1,4]

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Artificial conditions on ship hulls and harbour structures often promote the establishment and spread of invasive marine biofouling species. Settlement plates are routinely used in surveys to monitor the presence and abundance of invasive biofouling species. However, identification using conventional morphological taxonomy can be time consuming and challenging for cryptic organisms or those in early life stages. The aim of this study was to assess the utility of high throughput sequencing and metabarcoding to characterise bacterial assemblages and early benthic eukaryotic stages on settlement plates, and to test their efficiency in detecting high risk organisms. Settlement plate arrays were deployed over winter and summer seasons with different configurations to return the greatest diversity of invasive biofouling species; anti-fouling copper paint, plate orientation and surface texture were used to simulate potential selective conditions on hull or harbour structures. Copper significantly reduced bacterial but increased protist diversity. Untreated plates were dominated by urochordata and mollusca, and yielded the highest bacterial richness. A network analysis indicated that copper exposure disrupted the community stability, and favoured the growth of a few tolerant taxa e.g. Annelida and Nematoda. The comparison of morphological and molecular identification of invasive species on the settlement arrays is currently conducted.

Assessment of the risk of commercial surface longline fisheries in the southern hemisphere to ACAP seabird species

Edward Abraham[1], Yvan Richard[1], **Nathan Walker[2]**, Marie-Julie Roux[3]

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New Zealand has been utilising and refining a spatially explicit assessment of risk to seabirds from commercial fishing since 2009. New Zealand has been intending to extend the risk assessment framework applied to main fishing methods within the New Zealand Exclusive Economic Zone (EEZ) to a broader set of fisheries. This paper presents the progress on this to date, where the methodology has been applied to public tuna RFMO fishing data throughout the southern hemisphere for the 26 ACAP listed seabird species that breed in the southern hemisphere.

Across all the seabird species and surface longline fishing effort included in this study, the total estimated annual potential fatalities were 5534 (95% c.i.: 4346–7007). The risk ratio is defined as the ratio of the annual potential fatalities to the population sustainability threshold (PST), a measure of the productivity of seabird species. Black petrel had the highest risk ratio, followed by three wandering-type albatross species (Tristan albatross, Amsterdam albatross, and Antipodean albatross). All other seabird species had risk ratios that were entirely less than one.

This presentation is a report on progress, and the data used in this initial iteration contain some deficiencies. In particular, of seabirds to capture was estimated using New Zealand data only; the seabird distributions were simplistic; and effort data that was not reported to RFMOs was not included. The analysis can readily be updated however, if improved data become available.

Mediterranean fan worm – a case study of collaboration to manage a marine pest

Ms. Kathy Walls[1]

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Mediterranean fan worm (*Sabella spallanzanii*) is classified as both an Unwanted Organism and a Notifiable Organism under the Biosecurity Act, 1993. Outside of its native habitat in Europe, this species of fan worm forms dense, filter-feeding colonies on a range of marine substrates, both manmade and natural. It poses risks to New Zealand's native biodiversity and our aquaculture industry. *Sabella* was first detected in 2008 in Lyttelton and, in 2009, it was found in Auckland's Waitemata Harbour. In 2012, *Sabella* was found in Whangarei Harbour, followed by detections in seven other locations, the most recent one being in mid-2016. The Ministry for Primary Industries has been working collaboratively with the affected councils to eliminate local populations of fan worm, where possible, in an effort to slow its spread around New Zealand. This marine pest has become the call to action for building marine capability across the country. This presentation will outline the current state of fan worm elimination programs, give an overview of the capability development that has been gained and propose a range of actions that could be taken to manage this marine pest nationally.

Double trouble? The effects of microplastics and triclosan on the green-lipped mussel *Perna canaliculus*

Samantha Webb, Dr. Sally Gaw[1], Prof. Islay Marsden

[1]*University of Canterbury*

There is growing concern regarding the impacts of microplastics on marine species due to their physiological effects and the potential for plastics to adsorb chemical contaminants. This study examined the impacts of microplastics and the anti-microbial compound triclosan on the green-lipped mussel *Perna canaliculus*. Physiological biomarkers (clearance rate, byssus production and oxygen respiration), and biomarkers of oxidative stress (lipid peroxidation, superoxide dismutase (SOD) and glutathione-S-transferase) were assessed. Microplastics decreased oxygen respiration rate and byssus production when present alone. Triclosan, both singly and sorbed to microplastics, adversely affected mussel oxidative stress markers including SOD and lipid peroxidation. A potential synergistic effect was observed for SOD activity for mussels exposed to triclosan sorbed to microplastics. Microplastics enhanced the uptake of triclosan in the mussel tissue compared with triclosan uptake in the absence of microplastics indicating that microplastics may provide an additional pathway of exposure of marine organisms to contaminants.

Changes to *Austrovenus stutchburyi* growth rate since early human settlement in New Zealand: an indication of the extent of human impact on estuarine health

Ms. Susan Wells[1], Dr. Lucy Wing[1], Prof. Abigail Smith[1], Assoc. Prof. Ian Smith[1]

[1]*University of Otago*

The New Zealand cockle (tuaki, *Austrovenus stutchburyi*), a filter-feeding bivalve, is commonly found in estuaries throughout New Zealand. The growth rate of *A. stutchburyi* is affected by many factors, including nutrient concentrations and sediment load within the water column. *Austrovenus* is consequently an ideal indicator species for studying temporal changes in environmental conditions. *A. stutchburyi* was an important food source for early Maori and shells are abundant in middens nationwide. This study uses modern and archaeological cockle shells to investigate how estuarine productivity has changed since human arrival in New Zealand by analysing growth rates as an indicator for productivity.

We analysed growth parameters of *A. stutchburyi* shells from middens sites across New Zealand and compared them to modern shells collected from the same localities. Thin sections of shell were prepared and annual growth bands were counted to determine age. Width of growth bands were measured to determine growth rate.

A. stutchburyi is a culturally important species and is recreationally and commercially harvested within New Zealand. The information gained from this study can be used to inform future management of *A. stutchburyi* stocks and to aid in the conservation of estuarine areas.

Demonstrating the New Zealand Estuary Trophic Index (ETI) Tools

Amy Whitehead[1], John Zeldis[1], David Plew[1], Richard Storey[1], Olivia Burge[2], Anna Madarasz-Smith[3], Megan Oliver[4], Leigh Stevens[5]

[1]NIWA, [2]Landcare Research, [3]Hawkes Bay Regional Council, [4]Greater Wellington Regional Council, [5]Wriggle Coastal Management

Although nutrient enrichment threatens many New Zealand estuaries, guidance on how to assess current and future states of estuarine trophic health is limited. Consequently, it has been difficult to determine the current state of estuaries regarding eutrophication, assess effects of land-use intensification on estuaries, and gauge consequences for estuaries of freshwater nutrient limit-settings, relative to estuary health objectives. The NZ Estuary Trophic Index (ETI) project sought to develop tools that would help Regional Councils use a nationally consistent approach to the assessment and prediction of estuary eutrophication. Among the project outputs are three online web applications, developed using the 'R-Shiny" platform, that allow users to input and interrogate estuary data. This talk will demonstrate these three web applications using a case-study estuary to illustrate how users can assess the susceptibility of an estuary to eutrophication (Tool 1), score the current trophic state of an estuary (Tool 2), and assess how the trophic state of an estuary might change under different scenarios of nutrient loading or limit-setting. We hope that the ability to quickly assess and predict estuarine eutrophication using a nationally-consistent approach will provide robust and transparent results to assist with regional freshwater and coastal planning.

An observed decline in the mark rate of Hector's dolphins (*Cephalorhynchus hectori*) after area-based protection

Ms. Lindsay Wickman[1], Prof. Steve Dawson[1], Prof. Elisabeth Slooten[1], Dr. William Rayment[1]

[1]University of Otago

Capture-recapture analyses on marine mammals typically assume mark rate (the proportion of individuals with unique, recognisable natural marks) is constant over time. However, this assumption may not be true if management has decreased the frequency of interactions with fishing gear (a known source of marks). We hypothesised that mark rate of a population of Hector's dolphins has declined since the establishment of area-based protection from set netting. A hierarchical Bayesian model was used to estimate mark rate from 2,363 images of 160 groups of dolphins for the period 1992 – 1996, and 1,133 images of 163 groups in 2016. Mean mark rate of the population was estimated as 0.105 (95% HDI: 0.083 – 0.128) for the period of 1992 – 1996, and 0.068 (95% HDI: 0.051 – 0.087) in 2016. Results indicated a 99% probability that the mark rate in 2016 is lower than the 1992-1996 period. The lower mark rate in 2016, along with previous evidence of improvement of survival rate after area-based protection, strongly suggests encounters between dolphins and fishing gear have declined. A lower mark rate may, however, decrease the precision of estimates of demographic parameters (e.g. survival rate), which may compromise future monitoring of the population.

Towards ecosystem-based fisheries management in New Zealand

Dr. Anne Wietheger[1]

[1]*Ministry for Primary Industries*

In 2016, New Zealand celebrated 30 years of the Quota Management System. Since then, there have been significant developments in how fisheries and aquatic ecosystems are managed around the world. In response, the Ministry for Primary Industries has developed the Future of our Fisheries programme with the purpose of strengthening the New Zealand fisheries management system to ensure it is fit for purpose now and in the future.

As part of this programme, there is an opportunity to progress towards a more fulsome ecosystem-based fisheries management (EBFM) approach in New Zealand. An EBFM framework could not only look to integrate the management of fish stocks and the ecosystems that support them but also provide for more inclusive involvement of stakeholders, acknowledging their different values. Questions that could be considered include: what constitutes EBFM; what steps will bring us closer to achieving EBFM; how far should we go; and how are costs distributed?

Tracking the source of estuarine contamination

Dr. Pete Wilson[1], Mrs Marguerite Nakielski[2], Dr. Eloise Ryan[1]

[1]*Waikato Regional Council,* [2]*4Sight Consulting*

The more we look at the state of water quality in our estuaries, the more potential there is to identify water quality issues, particularly excess nutrients, sediment, and bacteria. The sources of these contaminants are rarely derived within the estuaries themselves; in most cases, we need to identify diffuse sources in the catchment that are flushed into estuaries via streams and rivers following rainfall or during flooding of low-lying land caused by spring tides.

Routine monitoring of our estuaries is often the first step to identifying potential issues but there is some crucial information missing if we are attempting to identify the cause; such as, where in the catchment this contamination may have come from or, in the case of faecal contamination, whether humans or animals were responsible. To fill in these information gaps, we need to apply more comprehensive sampling designs and use more sophisticated analysis tools such as faecal source tracking.

We have been applying these approaches using a combination of weather-based sampling, stream transects, and faecal source tracking to identify estuarine contamination sources in various Coromandel catchments. We have also been looking at how contaminant sources differ between dry and wet weather and, at stream mouths, between neap and spring tides. These investigations help us to build a better understanding of catchment-specific sources of estuarine contamination which can ultimately inform robust, science-driven management responses.

Surveillance for the Mediterranean fanworm (*Sabella spallanzanii*) and club tunicate (*Styela clava*) in environmental samples using real-time PCR assays

Dr. Susie Wood[1], Dr. Anastasija Zaiko[1], Witold Ming[1], Ulla van Ammon[1], Dr. Graeme Inglis[2], Megan Carter[2], Chris Woods[2], Matt Smith[2], Dr. Xavier Pochon[1]

[1]*Cawthron,* [2]*NIWA*

The non-indigenous Mediterranean fanworm, *Sabella spallanzanii*, and club tunicate, Styela clava, are now abundant at several locations around New Zealand. Once established, these species can proliferate rapidly, reaching high densities with potential ecological and economic impacts. Early detection of new incursions is important to prevent their spread, guide eradication or control efforts, and to increase knowledge on the species' dispersal pathways. In this study, we developed a TaqMan probe real-time Polymerase Chain Reaction assay for *S. spallanzanii*, targeting a region of the mitochondrial *Cytochrome Oxidase I* gene. We analyzed 145 environmental (water, sediment and biofouling) samples and obtained positive detections only from spiked samples and those collected at a port with established *S. spallanzanii* populations. We then tested the applicability of this assay, and an already developed real-time assay for S. clava for routine surveillance. Water samples (ca. 180, 60 sites) were collected from Nelson and Auckland in parallel with dive surveys undertaken as part of the nationwide Summer 2016–17 round of Marine High Risk Site Surveillance (MHRSS) surveys (funded by the Ministry for Primary Industries). DNA and RNA samples were analysed to determine whether positive detections were due to extracellular DNA or the presence of larvae.

Marine sweeps: update on the national Marine High Risk Site Surveillance (MHRSS) for 2016–17

Dr. Chris Woods[1], Ms. Kimberley Seaward[1], Dr. Graeme Inglis[1], **Mr. Abraham Growcott**[2], Dr. Mike Taylor[2]

[1]*NIWA,* [2]*Ministry for Primary Industries*

The Marine High Risk Site Surveillance (MHRSS) is a national programme of surveys targeted at the early detection of High Risk marine non-indigenous species (NIS). The MHRSS programme, first begun in 2002, involves targeted surveillance undertaken bi-annually at 11 major ports and marinas around the country deemed to be at highest risk for the introduction and establishment of marine NIS.

The primary objective of the MHRSS programme is to detect incursions of New to New Zealand marine NIS listed on the Unwanted Organisms Register (*Asterias amurensis*, *Carcinus maenas*, *Caulerpa taxifolia*, *Eriocheir sinensis* and *Potamocorbula amurensis*). The MHRSS programme also has two secondary objectives, which are: (i) to detect incursions of marine NIS or cryptogenic organisms not previously recorded in New Zealand, and; (ii) to detect range extensions by marine NIS or cryptogenic organisms that are already established in New Zealand waters (e.g., *Arcuatula senhousia*, *Eudistoma elongatum*, *Sabella spallanzanii* and *Styela clava*).

Here, we present and discuss findings of the targeted surveillance at the 11 High Risk Sites covered by the MHRSS programme in the survey rounds of Winter 2016 and Summer 2016–17, detailing new detections, range extensions and existing invasions.

Marine conservation in a sea of alternative facts

Dr. Andrew Wright[1], Jovana Balanovic[2]

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Ensuring the continued viability of marine animal populations has always been a difficult proposition: their meat makes them edible, their furs make them wearable, and their oils once provided power to the world. Although mass hunting for furs and commercial whaling have largely come to an end, fishing has become more industrialised, and many other threats remain. However, it is likely that no single threat is as malevolent as the rise of anti-elitism and the prevalence of alternative facts in a post-truth era. With growing division between the rich and the poor, rising sentiment of abandonment in the disillusioned masses has produced a falling trust in all authority figures. Anti-elitism has been leveraged by more 'relatable' and unorthodox, or 'nouveau,' politicians to exploit this disenfranchised block at the cost of further undermining the credibility of scientists and other experts. Subsequent rebuttal attempts then fall foul of quirks of our own biology. Cognitive simplicity means that we are neurologically dispositioned to respond more favourably to simple, definite statements that we easily understand, than complex statements that involve uncertainty or ambiguity. Cognitive dissidence is the denial that occurs when someone is presented with new information that contradicts with their worldview. Such a challenge can actually cause people to reinforce their misconceptions and ultimately produce effects contrary to those desired – especially if presented by a source that is perceived to be bias. Finally, anyone that might find arguments persuasive is held in place by social norms. Breaking through will not be easy, and will require efforts within communities and in partnership with community leaders. We will also need help from Hollywood and other entertainers to make scientists less maniacal and more relatable in the eyes of the disenfranchised population. Without such endeavours, efforts to conserve marine environments will continue to find increasing resistance before any substantive discussions can even begin.

The New Zealand Estuary Trophic Index (ETI) Tools

Dr. John Zeldis[1], Dr. David Plew[1], Dr. Amy Whitehead[1], Dr. Richard Storey[1], Dr. Olivia Burge[2], Ms. Anna Madarasz-Smith[3], Dr. Megan Oliver[4], Mr. Leigh Stevens[5], Dr. Barry Robertson[5], Dr. Bruce Dudley[1]

[1]NIWA, [2]Landcare, [3]Hawkes Bay Regional Council, [4]Greater Wellington Regional Council, [5]Wriggle Coastal Management

Although nutrient enrichment threatens many New Zealand estuaries, guidance on how to assess current and future states of estuarine trophic health is limited. Consequently, it has been difficult to:

- Determine the current state of estuaries regarding eutrophication;
- Assess effects of land-use intensification on estuaries;
- Gauge consequences for estuaries of freshwater nutrient limit-settings, relative to estuary health objectives.

In response, Regional Councils sought advice *via* the MBIE Envirolink Tools scheme, on the development of a nationally consistent approach to the assessment and prediction of estuary eutrophication. This talk describes the results: the NZ Estuary Trophic Index (ETI) project. The project developed knowledge on relevant estuary attributes, methods and indicators to measure estuary health and empirical relationships and nutrient models to assess estuary health under nutrient management scenarios. We describe how this knowledge has been implemented within the web-based ETI Tools Application, and illustrate results with case studies. Its 3 tools are:

- Tool 1 – Assesses the susceptibility of estuaries to eutrophication,
- Tool 2 – Scores the current trophic state of estuaries using measured values of trophic state indicators,
- Tool 3 – Uses a Bayesian Belief Network to score trophic state under scenarios of nutrient loading/limit-setting, or when values of trophic indicators are lacking.

Damage to disaster: Cause and effect of tail fan necrosis in lobsters

Mr. Hua Zha[1,2], Dr. Gillian Lewis[2], Ms. Yimin Dong[2], Dr. Andrew Jeffs[1,2]

[1]Institute of Marine Science, University of Auckland, [2]School of Biological Sciences, University of Auckland

Tail fan necrosis (TFN) is a disorder commonly found in some populations of commercially fished and aquacultured lobsters. The unsightly appearance of affected lobster tails not only dramatically lowers the commercial value of the lobsters, but may also impact their health. In this study, six common crustacean immune parameters were assessed in common crayfish (*Jasus edwardsii*) to determine if TFN was impacting their immune status. Reduced total haemocyte count and low phenoloxidase activity in the haemocyte lysate supernatant (HLS) were both found to be associated with TFN, while haemocyte viability, haemolymph bacterial count, the protein content of haemolymph plasma and HLS showed no differences. In addition, a range of bacterial isolates exhibiting proteolytic, lipolytic and especially chitinolytic activity were found to be associated with TFN in lobsters, and might be associated with bacteraemia. Other bacterial characteristics including biofilm forming capability, melanin and siderophore production, were more often associated with bacteria isolated from lobsters with TFN. These results indicate that TFN is likely to be the result of bacteria with characteristics well-suited to exploiting sites of damaged tail fan, potentially causing longer term negative outcomes via bacteraemia and immune suppression.

Key Words: Tail fan necrosis; bacteria; immunity; lobster.

The development of multispecies models for evaluating predator-prey effects on the assessment of hoki, hake and ling on the Chatham Rise, New Zealand

Dr. Jingjing Zhang[1], Dr. Ian Doonan[1], Mr. Craig Marsh[1], Dr. Matt Dunn[1], Dr. Andy McKenzie[1], Dr. Jim Roberts[1]

[1]NIWA

Hoki (*Macruronus novaezelandiae*) is the most abundant commercial finfish species and one of the most important fishery in New Zealand, with a total allowable catch of 150,000t per fishing year. Current stock assessment of hoki uses single-species, two-stock models that do not account for predator-prey interactions and assume natural mortality (mortality other than fishing) is constant over time. In this study, we developed a multi-species interaction model that incorporate the processes of predation by hake (*Merluccius australis*) and ling (*Genypterus blacodes*), and the indirect effects of commercial fisheries for these species on hoki abundance. The amount of hoki consumed by its predators was estimated using information collected from a long-term dietary study of hoki, hake and ling on the Chatham Rise. We found that predation by hake and ling is likely to comprise a major component of hoki natural mortality. Current single species assessments indicate that stock abundance of hoki, hake and ling are all quite variable through time. Models accounting for year-varying predation mortality explained survey and commercial fishery observations better than single-species assessments. This study emphasis the importance of incorporating key ecosystem processes that influence the dynamics of managed species in the model design for future stock assessments.

POSTERS

Climate change effects on sponge functionality and ecosystem services.

Ms. Fenna Beets[1], Prof. Chris Battershill[1], Dr. Simon Muncaster[2]

[1]*University of Waikato,* [2]*Toi Ohomai Institute of Technology*

Marine sponges are a diverse, ubiquitous and functionally important group of marine invertebrates. Despite their ecological importance, sponges remain poorly represented in research programs. Studies of their physiology are rare but have indicated that sponges may play an important role in benthic carbon flux. However, the possible consequences of climate change for this important ecosystem service are largely unknown. Our research investigates how projected sea temperature rise and increased sedimentation may affect the respiration, survivorship and benthic carbon flux in sponges. The respiration response of the common golf ball sponge, *Tethya burtoni*, was examined under a range of temperatures and sediment treatments. Preliminary analyses suggest that sponge mortality is higher at projected temperature ranges compared to current conditions and that respiration rates are largely suppressed under high sediment loads of fine sediment. These results indicate that in the absence of adaptation, climate change may compromise the ecosystem services provided by sponges.

International Union for the Conservation of Nature (IUCN) and the Governance of New Zealand's Oceans

Dr. Ann Brower[1]

[1]*IUCN, Lincoln University*

This poster shares the International Union for Conservation of Nature's (IUCN) contributions to the governance of the open ocean, the least governed reaches of our planet.. Our oceans are notoriously difficult to govern and even harder to manage for several reasons. First is their sheer scale – they cover more than two-thirds of the planet. Second is ownership – they are both everyone's and no one's. Social science scholarship has many bright ideas about governing common pool resources. But when the grandmother of this research, Nobel laureate Elinor Ostrom, visited New Zealand in 2011 for an IUCN conference, she said straight out that her models do not work in rivers or oceans.

When formal governance structures fail to fill the cracks, informal 'soft law' can step into the breach. This is where the International Union for Conservation of Nature (IUCN) fits in. IUCN has little formal power over the oceans, but great moral influence over the nations that govern the ships traversing and extracting from those oceans. Improving the governance of the ungovernable treasures that belong to everyone and no one at once is IUCN's raison d'etre. New Zealand is one of 83 State members of the IUCN. The New Zealand Committee of IUCN consists of New Zealand members and representatives of expert commissions.

Implementation of the Fiordland Marine Regional Pathway Management Plan

Shaun Cunningham[1], Richard Bowman[1], Fleur Mathews[1], Jen Brunton[2], Richard Kinsey[3], McLeod Rebecca[4], Laurel Tierney, Derek Richards[5]

[1]Environment Southland,, [2]Ministry for Primary Industries, [3]Department of Conservation, [4]Fiordland Marine Guardians, [5]Ngāi Tahu

Due to Fiordland's unique and pristine underwater environment, marine invasive species are a major threat to the Fiordland Marine Area. Once established, invasive species can have major impacts on commercial, ecological and social values. It is important as the management agencies for the Fiordland Marine Area that we can manage marine biosecurity threats. In 2012 there was an amendment to the Biosecurity Act 1993 to allow for Pathway Management Plans. Together, the agencies, the Fiordland Marine Guardians and other key stakeholders adopted this approach, and managed to develop and implement a pathway plan for the Fiordland Marine Area. These plans allow rules to be placed on the vectors marine invasive species use to get to new areas. The Fiordland Marine Pathway Management Plan focuses on setting standards for hull and gear fouling, and residual seawater. The standards are communicated to vessel operators through a Clean Vessel Pass in which all vessels are required to hold. Until now, the marine biosecurity approach has been reactive, however, the new Fiordland Pathway Plan is an important preventative tool that will reduce the risk of marine pest establishment in an iconic marine environment.

The ecological role of the invasive dinoflagellate *Ostreopsis siamensis* in northern New Zealand reef ecosystems

Jade Dudley[1]

[1]University of Auckland

Increased prevalence of harmful algal blooms in temperate marine environments has been anecdotally suggested as the result of rising temperatures. Declining urchin barrens in parts of northern New Zealand is hypothesised to have been a result of blooms of the epi-benthic dinoflagellate, *Ostreopsis siamensis*. This study sought to investigate how blooms of *O. siamensis* affects the abundance, behaviour and grazing rates of benthic invertebrates through observational and experimental techniques. It was hypothesised that blooms of *O. siamensis* would reduce the abundance and grazing pressure of *Evechinus chloroticus*, and have negative impacts on seaweed epifauna. Four sites were sampled near Leigh, New Zealand for bloom dynamics, involving collections of *Carpophyllum plumosum* macroalgae and associated epifaunal communities. Experimental methods were utilised to determine how grazing rates of sea urchins, as well as the survival and condition of epifauna are affected by *O. siamensis*. Although the study is still currently in progress, the preliminary results suggest that *O. siamensis* has little impact on the grazing rates of *Evechinus chloroticus* and the community composition of epifauna taxa.

Effects of Ocean Acidification on the larval settlement of *Evechinus chloroticus*

Ms. Nadjejda Espinel[1], Assoc. Prof. Miles Lamare[1]

[1]*Department of Marine Science, University of Otago*

Ocean acidification (OA) is especially harmful to calcifying marine invertebrates (i.e. shellfish, corals, …), particularly their early-life stages. In most marine species, reproduction is by an indirect lifecycle involving the key processes of larval settlement and metamorphosis. Although the direct effects of OA on single early life-stages of several marine invertebrates have previously been described, very few studies have investigated the effect of OA on at least two succeeding life-history stages. Moreover, very little is known on the effects of ocean acidification on the settlement phase and early post-settlement development of marine invertebrates.

In this study we aim to test the effects of OA on the larval settlement and early-post settlement processes of a key New Zealand species: the sea urchin *Evechinus chloroticus*. We tested the direct influence of reduced seawater pH in the larval settlement. Sea urchin larvae reared at ambient conditions were left to settle in a range of reduced seawater pH conditions. Settlement rates were measured and early post-settlement processes were quantified.

Preliminary results show no direct effect on the settlement due to reduced seawater pH, suggesting that the effects of OA on the larval settlement of marine invertebrates will be through indirect mechanisms.

Population genetics and phylogeography of the New Zealand flat oyster *Ostrea chilensis*: strong subdivision inferred from mtDNA and microsatellite markers

Mr. Xiang-Zhao Guo[1], Ms. Ruo-Jin Yan[1], Prof. Jonathan Gardner[1]

[1]*Victoria University of Wellington*

Population genetic structure of marine species is shaped by historical and contemporary factors. Phylogeography and population genetics of species with low fecundity, short distance larvae dispersal and old evolutionary histories (7 – 11 Ma) such as the New Zealand flat oyster *Ostrea chilensis* permit testing of the effects of historical and contemporary processes affecting genetic differentiation and diversity. Analyses of genetic variation in *O. chilensis* from 14 locations at two mitochondrial DNA regions and at 13 microsatellite loci revealed three genetic clusters (Hauraki Gulf (HG), north and south) across the range of the species. Divergence time estimates of HG from north+south (1.92 Ma) and of north from south (0.34 Ma) indicate that these regions represent evolutionarily significant units that evolved separately and rapidly in the early to middle Pleistocene. Analyses revealed no obvious periods of historical oyster population expansion for either the northern or southern regions. Genetic subpopulation structure identified by the microsatellites was weak compared to structure identified from the mitochondrial DNA, suggesting that contemporary gene flow has eroded regional genetic differences. These results contribute to a better understanding of historical and contemporary factors influencing genetic variation of species and provide vital information on population genetics of *O. chilensis*.

Shadowy Futures - investigating turbidity effects on yellow-eyed mullet

Mr. Douglas Hill[1], Prof. Bill Davison[1], Dr. Esme Robinson[1]

[1]*University of Canterbury*

Increased sedimentation is recognised as a significant pollutant in estuarine habitats, producing a myriad of behavioural and physiological outcomes for resident fish populations. This project investigated the effects of increased sedimentation on yellow-eye mullet (*Aldrichetta forsteri*), which is an important species in the estuarine food chain. Mullet have a highly visual lifestyle within the estuary, relying on visual information for performing a number of important daily tasks including searching for prey, catching prey and forming schools. Increased sedimentation may disrupt visual function, resulting in impaired function and potential stress in this species. However, as a species that routinely encounters raised turbidity it is possible that coping strategies are employed by these fish to offset potential negative outcomes. The effect of acutely raised turbidity on visual acuity (measured using the optomotor response), activity patterns, schooling behaviour and metabolic rate were investigated. Results demonstrated a range of potential coping strategies for this species during times of raised turbidity.

Plastic ingestion by South Pacific fish – Field study

Ms. Ana Markic[1], Ms. Clarisse Niemand[2]

[1]*University of Auckland,* [2]*University of Waikato*

Plastic pollution of the marine environment has raised much concern in the current decade. Plastics do not biodegrade and they pose a threat marine organism prone to plastic ingestion. Upon ingestion, plastic debris does not harm the organisms only physically (rupture, blockage), but it also releases toxic chemicals bound to the surface or internal structure of plastic materials, which then accumulate in tissue of marine animals. In this study, 34 species of commercial marine fish from Auckland, Samoa, Tahiti and Easter Island were examined for the presence of plastic debris in their gastrointestinal tracts. Plastic debris was found in 33 species, with an average plastic ingestion rate of 23.6 % and plastic load of 1.9 plastic particles per individual fish. The greatest ingestion rates were found in fish from Easter Island, 50.2 ± 5.8 % on average, while New Zealand fish exhibited the lowest ingestion rates (av. 17.8 ± 7.5 %).

Towards national consistency: National Environmental Monitoring Standard (NEMS) for Discrete Water Quality Sampling and Measurement – Coastal waters

Ms. Juliet Milne[1], Dr. Robert Davies-Colley[1], Dr. Jarrod Walker[2], Dr. Peter Robinson[3]

[1]NIWA, [2]Auckland Council, [3]Hill Laboratories

The Ministry for the Environment (MfE) and Statistics NZ are required to publish a report on the state of the marine environment every three years, under the recent Environmental Reporting Act (2015). Therefore, a set of National Environmental Monitoring Standards (NEMS) is currently being prepared, by an interagency team – including regional authority scientists – to ensure that long term monitoring is consistent and supports robust, defensible national reporting. This poster overviews the recently drafted NEMS for Discrete Water Quality Sampling and Measurement for long-term State of the Environment monitoring, focussing on the coastal domain. Rivers, lakes and groundwater are also covered in this Standard.

The content of the Standard was developed through a review of existing national and international guidance, and expert panel workshops to refine and develop new material. The Standard presents protocols for: sample point selection and timing, visit metadata, sampling equipment, on-site measurements, water sample collection and handling, laboratory testing, and data quality assurance (QA) and archiving. A matrix-style scoring system has also been developed to assign a quality code to individual water quality measurements, taking into account key aspects of sample collection, measurement and laboratory testing that have the potential to influence data quality.

Seasonal Ocean SST Forecasts for New Zealand Marine Industries – OC-ForNZ

Dr. Claire Spillman[1], Dr. Graham Rickard[2], Dr. Catherine de Burgh-Day[1], **Assoc. Prof. Craig Stevens**[2,3]

[1]Australian Bureau of Meteorology, [2]NIWA, [3]University of Auckland

We describe development of a project to develop OC-ForNZ (Ocean Climate Forecasts for New Zealand) – a state of the art seasonal ocean climate forecast product suite. It seeks to provide enhanced knowledge to stakeholders around up-coming ocean conditions with particular initial focus on (i) aquaculture industry and (ii) identification of ocean temperature extremes. Here we focus on sea surface temperature but a range of ocean conditions can be forecast. Seasonal forecasting has great scope for use in marine applications, particularly those with a management focus. Seasonal forecasts from dynamical ocean-atmosphere models of high risk conditions in marine ecosystema can be very useful tools for managers, allowing for proactive management responses. The Australian Bureau of Meteorology's previous seasonal forecast model POAMA-2 currently produces real-time SST forecasts for Australia. This has been succeeded by ACCESS-S1, a UKMO-Bureau of Meteorology collaboration. In this project we look at forecast skill as a function of outlook period and season and relate this to ocean processes. We then investigate how to connect this science with stakeholder needs.

Development and characterisation of microsatellite loci in *Munida isos* and cross-amplification in *Munida endeavourae* and *Munida gracilis*

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Squat lobsters *Munida isos*, *Munida endeavourae* and *Munida gracilis* are widely distributed across the New Zealand and south Australian region. *M. isos* is primarily associated with seamounts while the other two are found on both seamount and non-seamount habitats. Here, a genomic library was obtained based on Illumina paired-end shotgun sequencing platform to develop microsatellite loci for *M. isos*. Cross-amplification was attempted in two other species. Eighteen novel polymorphic microsatellite markers were developed and characterised in 4 populations of *M. isos* from the Tasman Sea, with 3 to 15 alleles and a mean expected heterozygosity of 0.569. Only one locus was identified as being a candidate locus experiencing positive selection. Evidence for null alleles was observed at 10 of 72 locus/population pair. Eleven of 72 tests were significantly different from Hardy-Weinberg Equilibrium and no locus pairs were in Linkage Disequilibrium across any population after FDR. testing. Cross-species amplification tests revealed that the transferability of 13 loci was positive for two other *Munida* species. The accessibility to new polymorphic microsatellite markers will facilitate comparative genetic studies between related species, contribute towards future research on phylogeographic patterns and aid in developing conservation and management strategies for *Munida* species.

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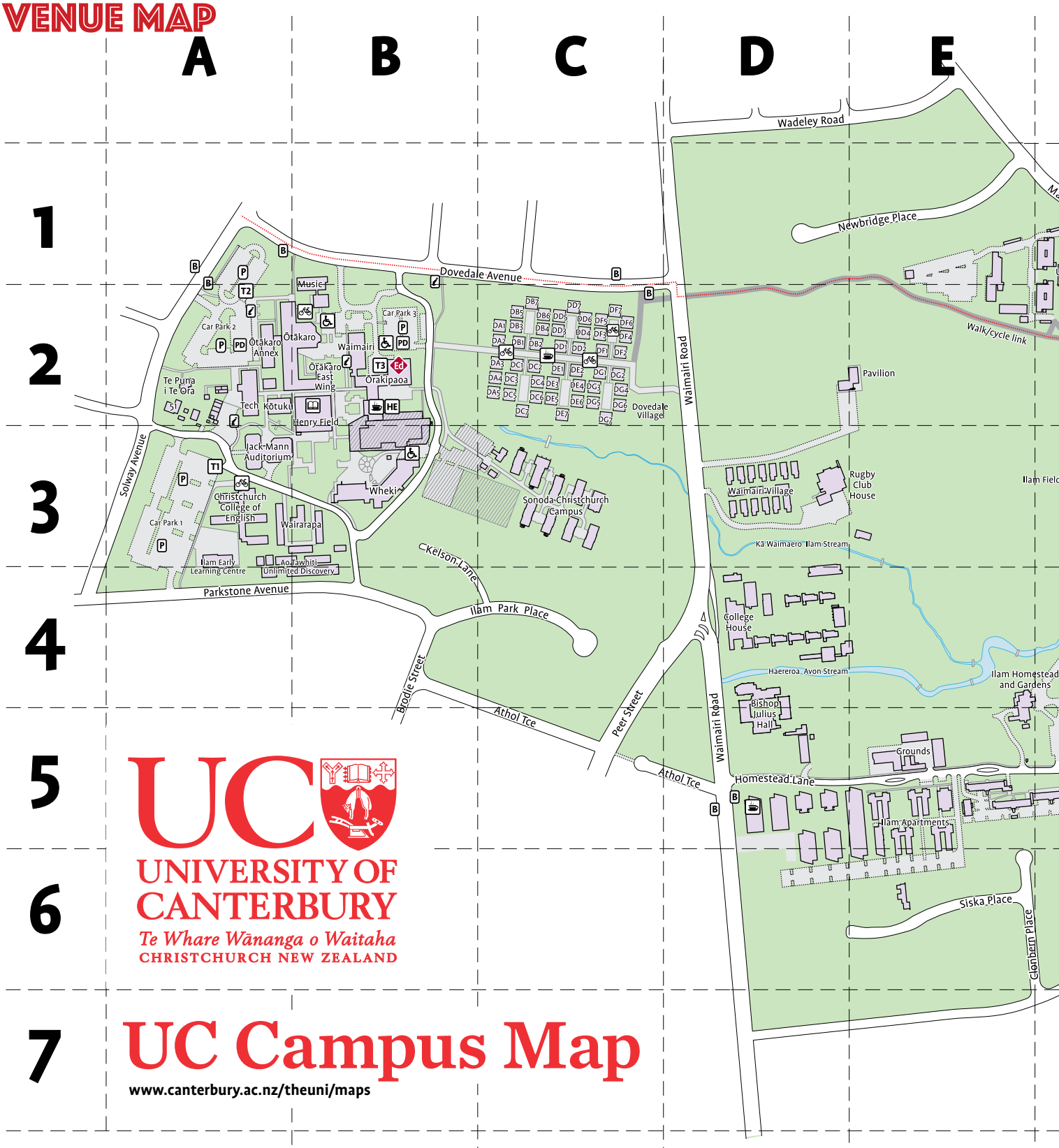
VENUE MAP



UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
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UC Campus Map

www.canterbury.ac.nz/theuni/maps

- Directory
- B Bus stop
- T Taxi pick up point
- CP Contractor permit parking
- P Permit parking
- PD Pay and Display parking
- L Link parking
- Accessible parking
- Library
- Café or Bar
- HE Heat and Eat
- Cycle stand

- SSC Student Services Centre
- Security
- Closed temporarily
- Uni-Cycle Route
- Ed College of Education, Health & Human Development office
- S College of Science office
- BL College of Business and Law office
- A College of Arts office
- En College of Engineering office

Cafés, bars and galleries

I4	Café 101 – *Psychology/Sociology*
H4	Café 1894 – *Puaka-James Hight*
B2	Collective – *Dovedale Village*
G3	Hard Hat Café
I5	Ilam Campus Gallery – *Fine Arts 2*
D5	Shirley's – *Ilam Apartments*
G3	Reboot Café – *Erskine*
G5	The Foundry and Bentleys – *UCSA Events Centre*
H7	The Shed – *Kirkwood Village*
H4	The Shilling Club – *Puaka-James Hight*
H4	Undercroft Food Hall – *Puaka-James Hight*
H2	Nuts & Bolts – *Engineering Core*

Computer workrooms (24/7)

A2	Kōtuku
G3	Erskine

Halls of residence

D4	Bishop Julius
D4	College House
E5	Ilam Apartments
I8	Kirkwood Avenue Hall
F6	Rochester and Rutherford
C3	Sonoda Christchurch Campus
F1	University Hall
D3	Waimairi Village

Lecture theatres

A3 Jack Mann Auditorium
H4 A1 – A3 North Arts lecture theatres
H5 A4 – A9 South Arts lecture theatres
H4 C1 – C3 Central lecture theatres
H2 E5 – E16 Engineering lecture theatres
I4 F1 and F3 Forestry lecture theatre
B2 L1 – L2 Ōtākaro lecture theatres

Libraries

H4 Central Library – *Puaka-James Hight*
B2 Education Library – *Henry Field*
I2 Engineering and Physical Sciences Library
I4 Macmillan Brown Library – *Te Ao Mārama*

Services

H4 Bank, ANZ – *Puaka-James Hight*
G5 Health Centre
B2 IT Service Desk – *Henry Field*
H4 IT Service Desk – *Puaka-James Hight*
H4 Pharmacy – *Puaka-James Hight*
H4 Postal Agency – *Puaka-James Hight*
I7 Recreation Centre
H4 Students' Association (UCSA) – *Puaka-James Hight*
H4 Uni Bookshop
G4 Vice-Chancellor's Office – *Matariki*

Whares

A2 Te Puna i Te Ora – *Dovedale*
F2 Te Whare Akonga o Te Akatoki – *Ilam*

Feb 2017


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