New Zealand Marine Sciences Society and Australian Marine Sciences Association

Joint 2016 Conference

Sharing Ocean Resources – Now and in the future

4 - 7 July 2016 · Wellington · New Zealand

nzmss.org/events

Photos: Dave Allen, NIWA

New Zealand Marine Sciences Society

AMSA Australian Marine Sciences Association

Ministry for Primary Industries
Manatū Ahu Matua

'At-a-glance' conference schedule

Day 1 - Monday July 4th

Rooms	Room A (MCLT103)	Room B (MCLT101)	Room C (MNLT102)	Breakout (CO228)
0830	**Opening Ceremony**			
0900	**Plenary: Rawiri Smith**			
0930	**Plenary: Ray Wood**			
1000	MORNING BREAK			
Session 1 1030-1230	***Living resources*** 1A: Indigenous Science *Supported by Marine Biodiversity Hub, NESP*	***Non-Living resources*** 1B: Extractive and renewable energy resource challenges & dealing with scale	***Living Resources*** 1C: Iconic marine life	***No session scheduled***
1230-1300	LUNCH			
Session 2 1330-1500	***Emerging Issues*** 2A: Marine spatial planning DEDICATED TO BILL BALLANTINE	***Non-Living resources 2B:*** Physical mechanisms that link to biological processes	***Living Resources*** 2C: Iconic marine life (cont'd)	**Panel discussion:** Indigenous Science *Supported by Marine Biodiversity Hub, NESP*
1500	AFTERNOON BREAK			
Session 3 1530-1700	***Emerging Issues*** 3A: Marine spatial planning (cont'd)	***Non-Living resources*** 3B: Physical mechanisms that link to biological processes (cont'd)	***Living resources*** 3C: Iconic Marine Life (cont'd)	***No session scheduled***
1700	**SPEED TALKS**			
1730	**Welcome & Posters Reception** (MacLaurin Building Level 1 ends ~19:30)			

Day 2 - Tuesday July 5th

Rooms	Room A (MCLT103)	Room B (MCLT101)	Room C (MNLT102)
0830	Formalities		
0900	**Plenary: Prof Lionel Carter**		
0930	**Plenary: Chris Francis**		
1000	MORNING BREAK		
Session 4 1030-1230	***Fisheries Symposium*** 4A: Past/present/future challenges of fisheries science *Supported by MPI*	***Non-Living resources*** 4B: Physical mechanisms that link to biological processes (cont'd)	***Emerging Issues*** 4C: Biosecurity *Supported by MPI*
1230-1315	LUNCH & AGMS		
Session 5 1345-1500	***Fisheries Symposium*** 5A: Public face of fisheries Supported by MPI	***Non-Living resources*** 5B: Cumulative activities and multiple stressors	***Living resources*** 5C: Marine Ecology
1500	AFTERNOON BREAK		
Session 6 1530-1730	***Fisheries Symposium*** 6A: New developments in Fisheries Science *Supported by MPI*	***Living resources*** 6B: Resolving conflict and biosecurity	***Emerging Issues*** 6C: Estuaries and seagrass
1730		**Open Discussion:** ***Undaria pinnatifida***	
1800	**Early Career Professionals Networking Function (Hunter Lounge, VUW campus)**		

Day 3 - Wednesday July 6th

Rooms	Room A (MCLT103)	Room B (MCLT101)	Room C (MCLT102)	Breakout (CO228)
0830	Formalities			
0900	**Plenary: Dr Malcolm Haddon**			
0930	**Plenary: Barry Bruce** *AMSA 2016 Jubilee Award Winner*			
1000	MORNING BREAK			
Session 7 1030-1230	***FIsheries Symposium*** 7A: Future Proofing and stepping up to the challenges *Supported by MPI*	***Living Resources*** 7B: Methods and tools for assessing marine biodiversity	***Emerging Issues*** 7C: Climate change	***Fisheries Symposium*** 7D: Aquaculture *Supported by MPI*
1230-1315	LUNCH			
Session 8 1330-1500	***Fisheries Symposium*** 8A: Sustainable seas and the ecosystem approach *Supported by MPI*	***Living Resources*** 8B: Methods and tools for assessing marine biodiversity (cont'd)	***Emerging Issues*** 8C: Climate change (cont'd)	***Fisheries Symposium*** 8D: Multiple information sources *Supported by MPI*
1500	AFTERNOON BREAK			
Session 9 1530-1700	***Fisheries Symposium*** 9A: Sustainable seas (cont'd) *Supported by MPI*	***Living Resources*** 9B: Methods and tools for assessing marine biodiversity (cont'd)	***Emerging Issues*** 9C: Marine taxonomy	***Fisheries Symposium*** 9D: Multiple information sources (cont'd)
1830	**Gala Dinner at Museum of New Zealand Te Papa Tongarewa**			

Day 4 - Thursday July 7th

Rooms	Room A (MCLT103)	Room B (MCLT101)	Room C (MNLT102)
0900	**Late Breakfast - Post Dinner Healing!** Supported by DOC		
1000	**Plenary: 2016 NZMSS Awardee**		
1030	**Plenary: Prof Sean Connell** *Supported by NZ OARS*		
Session 10 1115-1230	***Fisheries Symposium*** 10A: Sustainable Seas and ecosystem approach (cont'd) *Supported by MPI*	***Emerging Issues*** 10B: Ocean Acidification *Supported by NZ Ocean Acidification Community*	***Living Resources*** 10C: Social Licence to Operate
1230-1300	LUNCH		
Session 11 1330-1500	***Fisheries Symposium*** 11A: Social Licence to operate- Fisheries case study and panel *Supported by MPI*	***Living resources*** 11B: Marine Ecology (cont'd)	***Living resources*** 11C: Social Licence to operate (cont'd)
1500	**CLOSING CEREMONY - concludes by 15:30**		
1545	**Workshop: Coastal citizen science opportunities** (concludes at 17:15)		

Friday July 8th

1030-1600	**Field trip: Te Awarua-o-Porirua Harbour field trip** *Supported by GWRC*
0830-1630	**Workshop: Introduction to mixed models using R** *Supported by VUCEL*
0900-1700	**Workshop: 9th Annual New Zealand Ocean Acidification** *Supported by NZ OARS*

www.mpi.govt.nz

Growing and Protecting New Zealand

New Zealand Government

June 2015

NZMSS-AMSA Joint 2016 Conference

|| Day 1 – Monday July 4th

Rooms	Room A (MCLT103)	Room B (MCLT101)	Room C (MCLT102)	Breakout Room (CO228)
8.30	**OPENING CEREMONY**			
9.00	**Plenary: Rawiri Smith,** Environmental Manager, Kahungunu Ki Wairarapa			
9.30	**Plenary: Ray Wood,** Chief Operating Officer, Chatham Rock Phosphate Ltd			
10.00	**MORNING BREAK**			
Session 1	***Living resources*** 1A: Indigenous Science *Supported by Marine Biodiversity Hub, NESP* Chair: Cass Hunter	***Non-Living resources*** 1B: Extractive and renewable energy resource challenges & dealing with scale Chair: Geoffroy Lamarche	***Living Resources*** 1C: Iconic Marine Life Chair: Olaf Meynecke	**No Session Scheduled** *May be available for onsite meetings by request to conference@nzmss.org.*
10.30	**Erica McCreedy** Innovative collaborations and knowledge transfers	**Craig Stevens** Marine Renewable Energy in New Zealand: Did we Look a Gift Horse in the Mouth?	**William Rayment** Demographic parameters of southern right whales estimated via analysis of photo-ID data	
10.45	**Christy-Louise Davies** Indigenous communities driving research and onground conservation efforts of endangered euryhaline Elasmobranchs in Northern Australia	**Ross Vennell** Tidal Energy: Scaling up Tidal Turbine Farms	**Malcolm Francis** The summer super-highway: migration of oceanic fishes between New Zealand and the tropical South Pacific islands	
11:00	**Lynnath Beckley** Mapping human use of the remote Dampier Peninsula (Kimberley, Australia) prior to coastal development	**Malcolm Clark** Balancing exploitation and environmental sustainability: how can science support the management of deep-sea mining in New Zealand?	**Joana Torres** Using research seismic surveys to increase knowledge of marine mammals presence in New Zealand waters	
11.15	**John Booth** Seven centuries of human-induced change in marine life of the Bay of Islands, New Zealand	**Ed Griffin** New Zealand Bathymetry Investigation	**Lindsay Wickman** Decreasing mark rate affects the precision of estimates of survival rate in Hector's dolphins	
11.30	**Chris Gillies** Loss and future recovery of Australia's shellfish reefs	**Ian Harrison** Land Information New Zealand Discovering and accessing LINZ's spatial hydrographic datasets using the LINZ Data Service	**Tom Brough** Nearshore habitat use by Hector's dolphins at Banks Peninsula: a comparison of visual and acoustic methods	
11.45	**Phil Ross** Can knowledge of early-Māori fisheries practices help restore the Toheroa?	**Graham Rickard** CMIP5 Biogeochemical Model Assessments for the NZ EEZ and the Ross Sea Region: Present Day Performance, and Scenario Predictions	**Kobe Martin** Does size still matter? How aquatic mammals have bucked the trend and adapted to vocalising underwater	
12.00	**Gemma McGrath** Bridging Science with traditional ecological Knowledge to protect Māui and Hector's Dolphins: Messaging that moves society	**Scott Nodder** The ups and downs of tectonics, sea-level and sediment supply in the recent geological history of Wellington Harbour (Te Whanganui a Tara)	**Gary Truong** Nuclear bombs and whales: using passive acoustic monitoring to identify blue whale migration patterns in the southern hemisphere.	
12.15	**Kelly Ratana & Cass Hunter** The journey of indigenous researchers: insights on navigating science with the needs of communities	**Roger Proctor** (**Kevin Mackay)** The Australian Ocean Data Network and New Zealand marine data	**Joshua Reinke** Environmental preferences of humpback whales, *Megaptera novaeangliae*, in Hervey Bay, Queensland, Australia: an important resting area	
12.30	**LUNCH**			

Session 2	***Emerging Issues*** 2A: Marine spatial planning **DEDICATED TO BILL BALLANTINE** Chair: Martin Cryer	***Non-Living resources*** 2B: Physical mechanisms that link to biological processes Chair: Graham Rickard	***Living resources*** 2C: Iconic Marine Life (cont'd) Chair: Nathan Walker	***Breakout Room*** Panel discussion: Indigenous Science
13.30	**Robyn Morcom** The challenge of detecting changes in South Australia's Network of Marine Parks	**Joe O'Callaghan** Shelf sea observations with an underwater glider	**Olaf Meynecke** Variation of sea conditions along the east coast of North Island, New Zealand linked to dolphin presence	**Exploring indigenous engagement throughout New Zealand and Australian coasts and seas** *Supported by the Marine Biodiversity Hub, National Environmental Science Programme*
13.45	**Debbie Chamberlain** Life on the fringe: choosing spatially explicit conservation actions for coastal ecosystems	**Aitana Forcen-Vazquez** How does oceanography of the New Zealand subantarctic region influence the ecosystem?	**Leena Riekkola** The Great Humpback Whale Trail	
14.00	**Beverly Oh** Predicting habitat suitability for juvenile sharks along a tropical coastline: implications for conservation	**Moninya Roughan** An observational study of the biophysical characteristics of two contrasting cyclonic eddies in the East Australian Current System	**Rochelle Constantine** Gray's beaked whale population genetics, dispersal and social structure	
14.15	**Mary-Anne Lea** Foraging habitat and fisheries overlap predictions for New Zealand sea lions from sub-Antarctic Campbell Island	**Rebecca McMullin** Ice fish as sentinels for understanding how environmental changes impact food web diversity and stability in Antarctica	**Marta Guerra** Trophic interactions in the Kaikōura submarine canyon: from primary productivity to sperm whales	
14.30	**Shane Geange** Evaluating progress towards a representative MPA network that balances use and protection: a case study from New Zealand	**Stefan Jendesie** Enhanced phytoplankton growth through sea ice and ice shelf processes in the Ross Sea; first results.	**Kimberly Goetz** Temporal variation in isotopic composition and diet of Weddell seals in the western Ross Sea	
14.45	**Sophie Mormede** Using spatial population models to investigate the effects of a proposed Marine Protected Area on Antarctic toothfish in the Ross Sea region	**Jan Jansen** Surface productivity influences Antarctic seafloor biodiversity	**Regina Eisert** Antarctic Top Predator Research and the Proposed Ross Sea Marine Protected Area	
15.00	**AFTERNOON BREAK**			
Session 3	***Emerging Issues*** 3A: Marine spatial planning (cont'd) Chair: Tim Lynch	***Non-Living resources*** 3B: Physical mechanisms that link to biological processes (cont'd) Chair: Megan Oliver	***Living resources*** 3C: Iconic Marine Life (cont'd) Chair: Olaf Meynecke	**No session scheduled**
15.30	**Hugh Kirkman** Australia has no Marine Spatial Planning	**Helen Neil** Mapping using multibeam echo-sounder to identify habitats within the Hikurangi Marine Reserve	**Michael Rasheed** Assessing seasonal and spatial changes in dugong (*Dugong dugon*) feeding activity using novel low-level aerial photography and next generation photogrammetry	
15.45	**Chris Longson** Behavioural responses of snapper (*Pagrus auratus*) to divers at two different marine reserves in northern New Zealand	**Alix Laferriere** Linking Physical and Biogenic Habitats to Reveal Kapiti Island's Submarine Landscape	**Samantha Tol** Quantifying the role of dugongs and green sea turtles in seagrass dispersal	
16.00	**Drew Lohrer** Empirical validation of an ecosystem service map in the Hauraki Gulf	**Josie Crawshaw** A comparison of denitrification capacity between two South Island eutrophic lagoons	**Haruhi Wabiko** Monitoring predation activity in burrowing seabird colonies at Southeast Tasmania by using motion triggered cameras.	
16.15	**Kelsey Roberts** Tracking the effectiveness of marine protected areas (MPAs) in achieving biodiversity conservation objectives	**Rebecca Gladstone-Gallagher** Export of estuarine production from a tidally-dominated temperate estuary	**Lincoln Wong** Sub-population densities and habitat preference of the critically endangered spotted handfish (*Brachionichthys hirsutus*)	
16.30	**Tim Lynch** CRAGS – CSIRO Ruggedized Autonomous Gigapixel Systems: a panoramic camera for studies of wildlife and fisheries	**Craig Steinberg** Responding to the 2016 Mass Coral Bleaching event on the Great Barrier Reef: from Observations to Modelling	**Helen Cadwallader** The ecology and movement of short tail stingrays in an urban harbour	
16.45	**Marnie Campbell** Burial duration influences resilience of a subtidal seagrass, *Posidonia australis*	**Tarn Drylie** Measuring ecosystem function in soft-sediments at low tide: method development & implementation	**Eva Leunissen** Underwater noise from pile driving and its impact on Hector's dolphins in Lyttelton harbour, New Zealand.	
17.00	**SPEED TALKS:** **Irawan Asaad, Ryan Koverman, Paul Caiger, Sophie Powell, Stacey McCormack, Steve Urlich**	**SPEED TALKS:** **Rachel Macdonald, Marnie Campbell, Claire Conwell, Helen Kettles, Sadie Mills, Helen Neil**		
17:30	**Welcome & Posters Reception** (ends ~19:30)			

Day 2 – Tuesday July 5th

Rooms	Room A (MCLT103)	Room B (MCLT101)	Room C (MCLT102)
8.30	Formalities		
9.00	**Plenary: Prof Lionel Carter,** Antarctic Research Centre, Victoria University of Wellington		
9.30	**Plenary: Chris Francis,** Fisheries Modeller		
10.00	**MORNING BREAK**		
Session 4	***Fisheries Symposium*** 4A: Past/present/future challenges of fisheries science *Supported by MPI* Chair: Matt Dunn	***Non-Living resources*** 4B: Physical mechanisms that link to biological processes (cont'd) Chair: Abigail Smith	***Emerging Issues*** 4C: Biosecurity *Supported by MPI* Chair: Kathy Walls
10.30	**Keynote: Pamela Mace** Past, present and future challenges for fisheries science	**Daniel McNaughtan** Using otolith microchemistry to infer movement patterns of larval reef fish in the nearshore coastal environment	**Anjali Pande** Response to *Sabella spallanzanii* (Mediterranean Fanworm) in the Coromandel
10.45		**Edward Butler** Barramundi, mercury and lifestyle	**Roffi Grandiosa** Innovative application for the characterization of haemocytes In the New Zealand black-footed abalone (*Haliotis iris*)
11.00	**Martin Cryer** Thirty years in New Zealand fisheries: can old dogs learn new tricks?	**Becky Focht** Evaluating the consequences of disturbance on the functional response of a marine reef fish	**Patrick Cahill** Individual or metaorganism: geographically conserved microbiomes of four invasive tunicates
11.15	**Freydis Hjorvarsdottir** Prioritising research and management of at-sea threats to New Zealand seabirds.	**Emily Douglas** Sedimentary environment influences estuarine ecosystem function response to nutrient enrichment	**Danilo Malara** Prawn pathogen inactivation using porphyrin-based PACT
11.30	**Jim Roberts** A Quantitative Risk Assessment of Threats to New Zealand Sea Lions	**Moira Decima** Zooplankton abundance and distribution patterns between New Zealand and the Ross Sea: what the Continuous Plankton Recorder can tell us and the value of long-term time series	**Robert Paul Wolf** Metamorphosis and settlement of the intertidal tubeworm Spirobranchus cariniferus (Gray 1843)
11.45	**Katie Clemens-Seeley** Threat management plans for protected species work	**Rolanda Lange** Stress tolerance, multiple stressors, and evolution	**Kerry Charles** Future directions for marine biosecurity in New Zealand
12.00	**Charles Edwards** Management Strategy Evaluation: what it is, what it is not, and what it is good for	**Iana Gritcan** Effect of anthropogenic activity on the nutrient status of temperate mangroves in northern New Zealand.	**Abraham Growcott** In-water cleaning of vessels: how do we know it works?
12.15	**David Middleton** Implementing the procedural approach for the management of lower information fish stocks		
12.30	**LUNCH & AGMS**	NZMSS AGM	AMSA AGM

Session 5	***Fisheries Symposium*** 5A: Public face of fisheries *Supported by MPI* Chair: Alistair Dunn	***Non-Living resources*** 5B: Cumulative activities and multiple stressors Chair: Hilke Giiles	***Living resources*** 5C: Marine Ecology Chair: David Bowden
13.45	**Pamela Mace** Perceptions and misconceptions about the status of marine fisheries	**Ben Knight** Unlocking ocean colour data for New Zealand	**Aldo Turco** Dietary differences of three temperate Kyphosus species: resources partitioning and the role of head and mouth morphology
14.00	**Malcolm Haddon** Does stock status really matter?	**Leigh Stevens** Characterisation of trophic changes in New River Estuary using the NZ Estuary Trophic Index (ETI)	**Phoebe Caie** Selective mortality on early life-history traits of a temperate reef fish
14.15	**Richard O'Driscoll** Co-operation with industry to acoustically survey southern blue whiting on the Bounty Platform	**Leigh Stevens** The NZ Estuary Trophic Index (ETI) – a toolbox for assessing 1. physical and nutrient susceptibility and 2. trophic condition.	**Moira Decima** 15N alanine trophic enrichment in protistan and metazoan consumers: widespread contribution of heterotrophic protists to pelagic food-webs
14.30	**Annah Gerlletti** The Bering Sea observer program and its perception by fishers and fishery observers	**Ben Robertson** Optimising a widely used coastal health index for use in New Zealand's shallow estuaries	**Roberta D'Archino** Beyond a name… the case of Callophyllis ornata from Auckland Island
14.45	**Paul Maxwell** Establishing a link between the extent of estuarine habitat, fish communities and the social and economic benefits the community receives	**Dana Clark** Assessing cumulative impact in Tauranga Harbour - validation and limitations of a cumulative impact model	**Bron Faulkner** Natural Character of the Coastal Environment
15.00	**AFTERNOON BREAK**		
Session 6	***Fisheries Symposium*** 6A: New developments in Fisheries Science *Supported by MPI* Chair: Pamela Mace	***Living resources*** 6B: Resolving conflict and biosecurity Chair: Claire Conwell	***Emerging Issues*** 6C: Estuaries and seagrass Chair: Megan Oliver
15.30	**Keynote: Dave Woods** What if we could transform the commercial harvestingof seafood?	**Amanda Putri** Small-scale fishers at the edge of Jakarta: Challenges and opportunities from a megacity	**Daniela Farias** In situ assessment of *Ulva australis* as a biomonitoring tool to support management of urbanised/industrialised metal pollution in estuaries
15.45		**Chantel Steele** Anchors aweigh: Exploring the frequency and intensity of anchored commercial vessels near Australian Ports	**Stine Sorensen** Seagrass (*Zostera muelleri*) vulnerability and resilience: The threat of sediment burial
16.00	**Craig Marsh** Understanding marine populations: a new generalised population modelling package	**Lincoln Critchley** Seawalls modify wrack dynamics in mangrove forests	**Alison Duncan** Interactions between New Zealand Seagrass (*Zostera muelleri*), Epiphytes and Gastropod Grazers.
16.15	**Darcie Hunt** Potential visual acuity and maximum swimming speed as predictors of trawl catch rates when using light as a bycatch reduction device	**Ashley Rowden** Developing Spatial Management Options for the Protection of Vulnerable Marine Ecosystems in the South Pacific Ocean Region.	**Fleur Matheson** Sex and the seagrass: why bigger is better
16.30	**Brittany Graham** Marine Isoscapes: Tracking animal movements in the South Pacific	**Paola Rodriguez-Salinas** How important are the coastal and marine environments in an Australian threatened area? Societal values of Gladstone Harbour in the Great Barrier Reef World Heritage Area	**Islay Marsden** Resilience of sea grass to natural and anthropogenic disturbances
16.45	**Glen Carbines** Evaluating the validity of pots to estimate the relative abundance and size structure of blue cod	**Raj Sekhar** Aich Encountering White sharks: Affective impact of cage diving	**Fleur Matheson** Restoration of seagrass in Te Awarua-o-Porirua Harbour: feasibility assessment and community-led transplant trials
17.00	**Oliver Wade** Efforts to reduce small fish cathes in the Hawke's Bay mixed trawl fishery	**Wendy Nelson** Are you an alien? Non–indigenous macroalgae in New Zealand	**Amanda Clarke** Do stable isotope ratios of seagrass reflect extreme weather events in an urbanised estuary?
17.15	**Claire Spillman** Seasonal forecasting for decision support in marine fisheries and aquaculture	**Paul South** The ecological impact of *Undaria pinnatifida*: insights from an invaded rocky shore	**Ian McLeod** Fostering the repair of Australia's saltmarshes
17:30		***Undaria pinnatifida* - Open Discussion (30 min)**	
18:00	**Early Career Professionals Networking Function** *(Hunter Lounge, VUW campus)*		

Day 3 – Wednesday July 6th

	Room A (MCLT103)	Room B (MCLT101)	Room C (MCLT102)	Breakout Room
8.30	Formalities			
9.00	**Plenary: Dr Malcolm Haddon,** Principal Fisheries Scientist, CSIRO *What protects spawning biomass the best, a TAC or Legal Minimum Size?*			
9.30	**Plenary: Barry Bruce,** Shark Scientist, CSIRO, ***AMSA 2016 Jubilee Award Winner***			
10.00	**MORNING BREAK**			
SESSION 7	***Fisheries Symposium*** 7A: Future Proofing and stepping up to the challenges *Supported by MPI* Chair: Malcolm Clark	***Living Resources*** 7B: Methods and tools for assessing marine biodiversity Chair: Shane Geange	***Emerging Issues*** 7C: Climate change Chair: Mike Williams	***Fisheries Symposium*** 7D: Aquaculture *Supported by MPI* Chair: Rich Ford
10.30	**Keynote: Tim Pankhurst** Future Proofing our Fisheries and stepping up to the challenges	**Leslie Watson** Methods for assessing biodiversity, abundance and distribution of Antarctic sea anemones	**Tom Davis** Predicting the impact of sea level rise on seagrass distributions	**Brit Finucci** Aggregative behaviour and social structure in deep-sea Chondrichthyans
10.45		**Tyler Northern** Radioactive Beaks: Using Trace Elements to Track Squid	**Claire Spillman** It's getting hot in here: Monitoring and predicting this summer's bleaching event on the Great Barrier Reef	**Mallisa Marquez** Habitat use throughout a Chondrichthyan's life
11.00	**David Middleton** Supporting a data culture for evidence-based decision making	**Eliza Oldach** Habitat Cascade: An overlooked process maintaining biodiversity in New Zealand estuaries	**Mohammad Wahiduzzaman** A Climatological Model of North Indian Ocean Tropical Cyclone Genesis, Tracks and Landfall	**Tim Young** Disturbance of larval host metabolism in response to OsHV-1 virus exposes novel immunological biomarkers
11.15	**Philipp Neubauer** When 15 years of data tell the wrong story: improving monitoring of New Zealand's largest pāua (black foot abalone; *Haliotis iris*) fishery using high resolution data-loggers	**Travis Foster** Interactions among co-existing foundation species and effects on invertebrate communities, in a New Zealand estuary	**Amanda Pettersen** Why do colder mothers make bigger larvae? Temperature alters the costs of development	**Rebecca Zitoun** Copper toxicity to blue mussels embryos (*Mytilus galloprovincialis*): The effect of natural dissolved organic matter on copper toxicity in estuarine waters
11.30	**Malcolm Clark** Orange roughy fisheries in international waters: challenges for low information stocks in the Tasman Sea and western Pacific Ocean	**Isis Metcalfe** Epiphyte density underpins a unique facilitation cascade across large and small scale ecological transition zones	**Annie Guillaume** Transgenerational plasticity and thermal stress: do paternal effects act as a conduit or a buffer?	**Hamish Allen** Spawning season lipid and fatty acid composition, quantity and provisioning strategy of the New Zealand snapper/ tamure (*Chrysophrys auratus*)
11.45	**David Flynn** Effort, targets and use of infrastructure by recreational trailer boating in South-Eastern Tasmania, assessed by two methods	**Alfonso Siciliano** Variability in habitat cascades across sites, environmental conditions, host and epiphyte species and underpinning mechanistic test-factors	**Anna Lara-lopez** Sustained biological and ecosystem ocean observing: how are we approaching it and why is it important?	**Nuwan Lawrance De Silva** Amphibola crenata as a bioindicator of contaminants in New Zealand estuaries
12.00	**Sophie Mormede** Monitoring fish with quantitative line surveys: Implementing vessel-based and sea ice-based surveys to characterise toothfish abundance and ecology in the southern Ross Sea	**Jared Kibele** Low cost subtidal habitat mapping of temperate reefs with multispectral satellite imagery	**Evatt Chirgwin** Revealing hidden evolutionary capacity to cope with global change	**Sarah Gardiner** Hyper-local forecast tool for coastal management
12.15	**Helena Armiger** Innovative collaborative approach to fisheries science data collection	**David Johnston** Dolphin cliques: a time-based method for defining associations using photo-identification	**Hsien-yung Lin** Climate change in marine and freshwater systems threaten the persistence of a threatened migratory fish	
12.30	**LUNCH**			

SESSION 8	***Fisheries Symposium*** 8A: Sustainable seas and the ecosystem approach *Supported by MPI* Chair: Jim Roberts	***Living Resources*** 8B: Methods and tools for assessing marine biodiversity (cont'd) Chair: Nicole Phillips	***Emerging Issues*** 8C: Climate change (cont'd) Chair: Lionel Carter	***Fisheries Symposium*** 8D: Multiple information sources *Supported by MPI* Chair: Hilke Giles
13.30	**Keynote: Julie Hall** Sustainable Seas National Science Challenge Update	**Nicole Phillips** Maybe the dead do tell tales: using dead settlers to examine variability in early post-settlement mortality in intertidal mussels	**Stephan Chiswell** Mean velocity decomposition and vertical eddy diffusivity of the Pacific Ocean from surface GDP drifters and 1000-m Argo floats	**Emma Newcombe** State of the Environment assessments using multiple data sources
13.45		**Andres Gutierrez-Rodriguez** Protistan plankton diversity and contribution to oceanic carbon export revealed by DNA metabarcoding	**Andrew Biggerstaff** Sediment induced transitions from coral to sponge dominated reef states: An example from within the Coral-Triangle	**Tim Hagitt** Collation of hawke's Bay marine information
14.00	**Vidette Mcgregor** Tasman and Golden Bays Ecosystem Model – Human Impacts	**Maria Milititsky** Present and Future of Marine Environmental Surveying – Snapshot from an Industry Perspective	**Simon Rowe** Australia's living shorelines- Utilising oyster shell to aid ecological recovery of fisheries	**Rebecca Smith** Assessing the Commercial Potential for Collection of Greenshell™ Mussel Seed in the Hauraki Gulf, New Zealand
14.15	**Marie-Julie Roux** Methods development for spatially-explicit assessment of fisheries impacts on non-target fish species and benthic habitats		**Tina Oldham** Occurrence of hypoxia in Tasmanian Atlantic salmon production cages – biological and environmental influences	**Paul South** Time to settle down: can co-seeding adult and juvenile *Perna canaliculus* promote their retention during the early aquaculture production cycle?
14.30	**Vidette Mcgregor** Chatham Rise Ecosystem Model – Structure and Mechanics	**Kate Naughton** What is *Dendrogramma*?	**Samantha Gale** Piloting biochemical tools to assess bivalve early life health in response to ecologically relevant coastal stressors	**Chris Gillies** Marine aquaculture and its ecosystem services: building an understanding of aquaculture value for spatial planning
14.45	**Kevin Mackay** Expanding OBIS beyond species occurrence data, with an extension for environmental data	**Erica McCreedy** Community based planning and monitoring for adaptive management strategies in north Australia: the I-Tracker initiative	**David Spencer** Could upwelling be enhancing short-term spanner crab (*Ranina ranina*) catchability?	**Helen Kettles** State of our estuaries report: reflections on the science, information and process
15.00	**AFTERNOON BREAK**			
SESSION 9	***Fisheries Symposium*** 9A: Sustainable seas (cont'd) *Supported by MPI* Chair: Mary Livingston	***Living Resources*** 9B: Methods and tools for assessing marine biodiversity (cont'd) Chair: Carolyn Stewardson	***Emerging Issues*** 9C: Marine taxonomy Chair: Wendy Nelson	***Fisheries Symposium*** 9D: Multiple information sources (cont'd) Chair: David Middleton
15.30	**Mike Hickford "**Causing whitebait": using artificial habitat installations to identify potential spawning site locations for inanga	**Shawn Gerrity** A test of compensatory dynamics: Canopy removal effects on community structure and primary productivity in fucoid-dominated rocky shore ecosystems	**Melanie Dohner** Crawling to connectivity: a whelk's direct-developing journey	**Ruth Thurstan** Archival records reveal a century of diminishing returns for recreational fishers
15.45	**Shane Orchard** Planning for whitebait: applying vulnerability assessment to inanga spawning sites	**Rick Stuart-Smith** Continental-scale assessment of biodiversity trends and indicators for Australia's rocky and coral reef ecosystems	**Keyne Monro** The biogeography of fertilisation mode in the sea	**Balam Jimenez** The rise of the mullets: contemporary and historical genetic population structure of the grey mullet (*Mugil cephalus*) in New Zealand inland and coastal waters
16.00	**Rich Ford** Assessing the effects of mobile bottom fishing methods on benthic fauna and habitats: report from a workshop	**Richard Stafford-Bell** Composition of microphytobenthic communities within seagrass systems reflects environmental condition	**Judy Sutherland** A northern enigma: *Corallinapetra novaezelandiae*, a new lineage of coralline red algae from the north of New Zealand	**Mark Morrison** Tails of an aquatic wanderer – the life and times of grey mullet/ kanae (*Mugil cephalus*), a remarkably versatile and mobile species
16.15	**David Bowden** Effects of chronic trawl disturbance on soft sediment benthic communities of Chatham Rise, New Zealand?	**Robert Dane** USVs for science and surveillance - consideration of laws and legislation	**Kate Naughton** The Odd Biogeographic Disposition of the Kermadecs: Old Lineages on Young Islands	**Elnear Egan** Morphology and microstructure of inanga otoliths; building blocks of the whitebait fishery
16.30	**Darren Parsons** Are all habitats the same: abundance response of nursery occupying snapper in an estuarine system	**Maren Preuss** Four new red algal parasites from New Zealand	**Clive Roberts** How many fishes can be identified in the NZ region? The most recent figure of 1262 may be over 700 species short	**Mark Yungnickel** Has the species composition of New Zealand's whitebait fishery changed over the last 50 years?
16.45	**Richard O'Driscoll** 25 years of monitoring: insights from a fisheries time-series on the Chatham Rise	**Phoebe Argyle** Ciguatera poisoning, not just humans? Larval sensitivity to toxin producing dinoflagellates from the New Zealand and Pacific.	**Ken Joseph Clemente** First comprehensive report on the marine macroalgal flora of the Romblon Island Group (RIG), Central Philippines including diversity and community analysis	**Johnny Pearce** Sperm viability in the giant kokopu (*Galaxias argenteus*)
18.30	**Gala Dinner at Museum of New Zealand Te Papa Tongarewa**			

Day 4 – Thursday July 7th

Rooms	Room A (MCLT103)	Room B (MCLT101)	Room C (MCLT102)
9.00	**Late Breakfast - Post Dinner Healing!** *Supported by DOC*		
10.00	**Plenary: NZMSS Award Winner 2016**		
10.30	**Plenary: Prof Sean Connell,** University of Adelaide *Supported by NZ Ocean Acidification Community*		
Session 10	***Fisheries Symposium*** 10A: Sustainable Seas and ecosystem approach (cont'd) *Supported by MPI* Chair: Matt Dunn	***Emerging Issues*** 10B: Ocean Acidification *Supported by NZ Ocean Acidification Community* Chair: Di Tracey	***Living Resources*** 10C: Social Licence to Operate Chair: Jonathan Gardner
11.15	**Warrick Lyon** The importance of estuaries to inshore fish species with a focus on Porirua Harbour, Wellington	**Abby Smith** Effects of Ocean Acidification on the Ca:Mg Foraminiferal Paleothermometer	**Keynote: Chris Battershill** New Zealand Marine Biotechnology: fragmented but poised to respond to new opportunities
11.30	**Matt Pinkerton** Middle trophic level organisms on the Chatham Rise: fish, zooplankton and everything in between	**Sara Mikaloff-Fletcher** A moving target: Changes in marine carbonates over the last fifty years	
11.45	**Valerio Visconti** Reproductive characteristics of the leatherjacket *Meuschenia scaber* in the Hauraki Gulf, New Zealand	**Cintya Del Rio** Effect of simulated ocean acidification on microbial assemblages in coastal sediment	**Rachel Kelly** Social license in the marine sector – How, why, where and when?
12.00	**Matthew Dunn** Validating and using trophic guilds	**Owen Anderson** Deepwater coral distributions in the seas around New Zealand - present and future	**Aleki Taumoepeau** Improved governance, management, and economic and biological sustainability of the demersal line fishery in Tonga
12.15	**Chris McDowall** Marooned dwarves: demographic consequences of landlocking in New Zealand smelt (*Retropinna retropinna*)	**Abby Smith** The White Island Blitz: Investigating a southern-hemisphere temperate vent system	**Shane Kelly** Technical and regulatory obstacles to mussel bed restoration in the Hauraki Gulf
12.30	**LUNCH**		
Session 11	***Fisheries Symposium*** 11A: Social Licence to operate-Fisheries case study and panel *Supported by MPI* Chair: Mary Livingston	***Living resources*** 11B: Marine Ecology (cont'd) Chair: David Bowden	***Living resources*** 11C: Social Licence to operate (cont'd) Chair: Lynnath Beckley
13.30	**Case Study: The Ross Sea Toothfish Fishery: Is it Sustainable or Should it be Closed** *Matt Pinkerton, Steve Parker, Stuart Hanchet, Alistair Dunn & Sophie Mormede*	**Karin Svanfeldt** Larval duration mediates selection on larval size	**Andrew Wright** Transparently revising New Zealand's code of conduct for seismic surveys
13.45		**Dustin Marshall** Trophic footprint of marine filter-feeders on artificial structures	**Joana Cid Torres** The Introduction of International Accredited Standards for PAM equipment and operators is overdue
14.00		**Hayley Cameron** Why do larger mothers produce larger offspring? A test of classic theory	**Richard Bowman** The Development of a Pathways Plan for Fiordland, New Zealand
14.15	**Panel discussion: Thirty years of New Zealand's QMS: Where to next?** *Matt Dunn, Bob Zuur, Darrel Sykes, Prue Williams, Malcolm Haddon, Shelton Harley & Julie Hall*	**Irina Ilyushkina** Investigation of Red Rock lobster (*Jasus edwardsii*) population structure using neutral and putatively under selection Single Nucleotide Polymorphism (SNP) markers	**Anna LaFratta** Long term perspective of lead pollution in Port Pirie (SA)
14.30		**Sam Mc Cormack** Biosystematic and chemical ecological insights to the identification of bioactive leads from New Zealand sponges (Porifera: Poecilosclerida)	
14.45			
15.00	**CLOSING CEREMONY - concludes by 15:30**		
15.45	**Workshop: Coastal citizen science opportunities** (concludes at 17:15) Join us in Rm CO228 for a chance to explore the fast growing world of Citizen Science in New Zealand.		

Friday July 8th

Time	Event	Details (see more on event website)
10.30-16.00	**Field trip: Te Awarua-o-Porirua Harbour field trip** *Supported by GWRC*	Join us on a field trip through the catchment's changing landscape to learn how collaboration, communication and communities are working towards 'healthy harbour and waterways'
8.30-16:30	**Workshop: Introduction to mixed models using R** *Supported by VUCEL*	This workshop will give background and concepts of mixed models, examples of designs, when and why you would use them. Held at Victoria University's Coastal Ecology Laboratory.
9.00-17.00	**Workshop: 9th Annual New Zealand Ocean Acidification** *Supported by NZ OAC*	The workshop this year includes a plenary speaker, short talks, updates from OA projects, and short discussion sessions on OA research coordination, directions and value to management, mitigation and adaptation.

Table of contents

Kia ora and a warm welcome to the NZMSS-AMSA Joint 2016 Conference

Thank you for joining us at our 2016 conference 'Sharing Ocean Resources - Now and in the Future', here at the Kelburn Campus of Victoria University in Wellington, particularly those of you who have travelled from afar. Worldwide, the commercial, recreational and traditional use of an increasingly broad range of ocean resources is escalating year by year. At this combined New Zealand Marine Science Society and Australian Marine Science Association conference we will deliberate on how to meet the needs of evidence-based decision making and policy development under future scenarios of resource sharing. To address this the NZMSS-AMSA 2016 conference has convened sessions with a focus on the multi-disciplinary challenges faced by the marine sector in the coming 20-30 years. By sharing each other's work and ideas, the conference aims to stimulate discussion and collaboration that will continue beyond the conference itself.

Our programme comprises four days of invited and submitted presentations from leading scientists around New Zealand and Australia, and comprises oral and poster sessions, speed talks, participatory workshops and panel discussion groups. We are particularly thrilled to welcome the Indigenous Science Session which is a new addition to the programme, and to present the Fisheries Symposium which celebrates 30 years of the Quota Management System in New Zealand, and explores science options for the the next 20 years. We have also received an overwhelming response to the call for papers on iconic species and biodiversity with a strong session that reflects interest in this sector. Haere Mai also to those who specialize in the more physical disciplines of science, who also well represented in our non-living resources sessions, as our respective society and association councils strongly support marine science that ranges across multiple disciplines.

The papers submitted to this Conference are diverse and stimulating with over 300 contributions. We hope that you enjoy yourselves and are able to join in with some, if not all, of the social activities we have put on for you! We wish you well in connecting with new colleagues as well as catching up with old friends.

We thank all the sponsors of, and contributors to, this conference; your enthusiasm and participation has resulted in a full and exciting programme. On behalf of members of the New Zealand and Australian Conference Organising Committee, and our respective Councils, we welcome you to Wellington and look forward to meeting you during the week ahead.

Here's looking forward to a united few days, with good weather and goodwill amongst us all.

Mary Livingston, Helen Neil, Megan Oliver, Alison MacDiarmid, Matt Dunn, Alistair Dunn, Tim Lynch, Olaf Meynecke & Kate Naughton

|| Fisheries Symposium -

brought to you with the support of Principal Sponsor Ministry for Primary Industries

Ministry for Primary Industries
Manatū Ahu Matua

This year, New Zealand celebrates 30 years of its fisheries Quota Management System that was considered to be ground-breaking when it was first implemented. Much has happened since, and MPI is currently re-evaluating our management approach and assessing the science needs for the coming 30 years. What can we learn from our Australian colleagues in terms of new and workable approaches that will future proof sustainability for this important food source? Can we better combine the skills of marine ecologists and biologists; oceanographers, modellers, physicists, geologists; marine chemists; social scientists and economists towards improved sustainability? The papers cover a wide range of topics relating to the fisheries science and management needs for the future in New Zealand and Australia including: the resolution of conflict and meeting public expectations; meeting conservation needs; advances in fishing technology; new assessment tools; ecosystem approach to fisheries; science based decision-making; advances in linking stock assessment and ecosystem approaches; interdisciplinary papers and emerging issues for fisheries. We welcome two internationally renowned fishery scientists as Plenary Speakers, Professor Malcolm Haddon from Australia and Chris Francis from New Zealand. Towards the end of the Symposium, we are trialling a focus seminar to discuss the scientific and political rational behind fisheries in the Ross Sea, followed by a Discussion Panel on the broader issue of what we need to achieve as marine scientists to prepare ourselves for the next 30 years of fisheries management.

Event supporters

|| Principal Sponsor

Ministry for Primary Industries
Manatū Ahu Matua

|| Major Sponsors

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA
UNIVERSITY OF WELLINGTON

CAWTHRON
INSTITUTE

NIWA
Taihoro Nukurangi

Department of Conservation
Te Papa Atawhai

|| Supporting Sponsors

Land Information New Zealand
Toitū te whenua

greater WELLINGTON
REGIONAL COUNCIL
Te Pane Matua Taiao

Marine Biodiversity Hub
National Environmental Science Programme

Boffa Miskell

|| Exhibitors and Supporters

ZEBRA-TECH LTD
www.zebra-tech.co.nz

SIRTRACK

Chatham Rock Phosphate

AM
TĀMAKI PAENGA HĪRA
AUCKLAND WAR MEMORIAL MUSEUM

New Zealand Antarctic Research Institute

as1

Benthic New Zealand Ltd

CLS

NZOAC
New Zealand Ocean Acidification Community

Antarctica New Zealand

daphic scientific
environmental research & monitoring equipment

vicel

REZO
WATER+ENERGY

Taylor & Francis Group
an informa business

the ROYAL SOCIETY of NEW ZEALAND
TE APĀRANGI

Important information

|| Conference venue

The conference will be held in the Maclaurin Building, Victoria University of Wellington (Kelburn Campus map). Access to the venue is either off off Kelburn Parade opposite 50 Kelburn Parade or you can also access the building through the Hub Building walking up the Mount Street walkway. Some activities will take place in alternative locations so please read the full details of the excursions and social activities you plan to attend. Notably, the conference Gala Dinner will take place at Te Papa and the Early Career Professionals Evening at the Hunter Lounge (Kelburn campus).

|| Parking

Parking is limited and public transport is encouraged. Pay and display parking is available on Waiteata Road below the Victoria University of Wellington Kelburn campus at $10.00 per day. Coupon parking is available in the Upland Road, Kelburn area for $7.50 per day. Coupons can be purchased from the Four Square on Upland Road. All parking in the Kelburn area is free on weekends. More infomration: http://www.victoria.ac.nz/about/explore-victoria/parking

|| Check-in & information desk

The information desk will be located in the foyer between the Hub and MacLaurin lecture theatres access on level 1. Access is possible from Kelburn Parade, the Hub or from the direction of the Cotton Building. Delegates are asked to check-in upon arrival for their name badges and conference programmes. Check-in will first open Monday at 7.15am. If assistance is not available at the desk please direct your inquiry to an organiser identified by a blue name tag and for off-site assistance phone the event manager. Messages and lost property can also be collected at the desk.

|| Notices

Daily updates or notices related to the day's most current programme will be available in the conference foyer near the registration desk and included in the day's housekeeping announcements.

|| Emergency & event contact information

Emergency: Dial 1-111

During work hours, dial Ext 8888 (0800 VIC 8888) or (04) 463 9999 to advise Campus Security who will dispatch Rescue Medics to provide emergency assistance until an ambulance arrives.

Urgent & after hours care: Located at 17 Adelaide Rd Mount Cook and open 8am-11pm daily. Phone (04) 384 4944.

Evacuation: In event of a fire please use the exit marked in the nearest lecture theatre emergency map or as directed during the health & safety briefing.

Event Manager: Kerry South, South Events, Ph. +64 21 024 77 554
Event email: conference@nzmss.org

|| Catering

Teas and lunches will be provided in the level 1 foyer of the MacLaurin Building amongst the exhibition and poster displays. Teas and lunches are provided throughout the event although Thursday will continue the "late-start breakfast" tradition following the Gala Dinner evening courtesy of Major Sponsor Department of Conservation.

All caterers have been provided dietary information from registration and every attempt has been made to meet all the dietary needs of delegates. Please let the event manager or caterer know if you have any questions or need assistance.

|| Transport

Transport is only planned for those attending the Friday July 8th field trip. All other events are either nearby the main conference venue or can be reached by walking or public transport.

The Airport Flyer is an express bus service that runs from Wellington International Airport through the centre of Wellington. The service runs at least once every 20 minutes, every day between the Airport and Lower Hutt. Airport Flyer departs from the southern end of the airport terminal, level 0 (exit from baggage claim doors on level 0 and turn right). http://www.metlink.org.nz/tickets-and-fares/

Wellington Combined Taxis P: (04) 384 4444

Green Cabs P: 0508 447336

Corporate Cabs P: (04) 387 4600

Kiwi Cabs P: (04) 389 9999

Super Shuttle P: 0800 SHUTTLE (0800 748885) or 04 472 9552

|| Internet access

Delegates can access wifi for free by logging into *Victoria Guest* and registering your email address.

|| Don't forget!

Valuables should not be left unattended at any time.

Please turn off your mobile phones during conference sessions.

No recording of presentations is permitted.

Name badges should be worn at all conference events and will be required for admittance to the conference dinner. Be sure to pick yours up at the check-in desk.

|| Sustainability

Delegates are asked to assist organisers in ensuring event waste is able to be managed most efficiently by using the appropriate bins provided for waste and recyclables.

Presenters' information

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

|| Social Media Policy #2016marine

Presenters should be aware that social media users may be posting about the event using text and images. Please state clearly if you do not want images to be shared of your presentation. While delegates are welcome to post about the event **no video of presentations is allowed**.

|| Talks

Each talk is allocated 15 minutes (12 + 3 minutes for questions) Please ensure your presentation is uploaded at least two breaks in advance of your presentation time. To upload your presentation, please go to the room you are presenting in during a break with your presentation on a USB memory stick or CD. **A volunteer or audio visual technician will be available to assist you from 8-8.30am (from 7:15am Monday) and during the second half of breaks.**

Each room features standard audio-visual equipment, including screens, data projector, lectern and computer. There is web access, sound and extended desktop ability. The MacLaurin lecture theatres use widescreen projection screens. Connection for external devices – vga and hdmi. No APPLE MAC connections provided.

It is strongly preferred that presenters load their talk using a data stick onto the lecture theatre computer as there is little transtion time.

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 presentation. WMV or AVI file types are recommended.

|| Speed talks

Each speed talk is allocated 5 minutes and 10 slides. Please ensure your talk is uploaded before lunch Monday, or alternatively email to helen.neil@niwa.co.nz. Your presentation must be set to advance each slide automatically after 30 seconds. Use the Transitions tab in Powerpoint. The speaker will have access to a pointer but will not be able to advance the slides. Pick a simple key message you wish to deliver to the audience and remember to have fun with this presentation style!

|| Posters

Please bring your posters to the MacLaurin foyer and place in the designated location (look for a name badge ordered alphabetically by presenter's last name) at the beginning of the conference as they will be on display throughout the event. Presenters are asked to make themselves available near their poster at the Welcome & Poster Reception occurring on Monday evening following the end of the first day's presentations. Posters should be A0 size in portrait orientation or smaller.

|| Chairpersons

Thank you for your assistance. Please be in your assigned room 15min before the session starts (see schedule) and view the instructions at the front of the room.

|| Student presenters

You can sign up to www.thinkable.org and upload your abstract, poster image or even a video if you'd like to gain online, public exposure for your presentation. An email will be issued with this information prior to the event. You will see all the awards listed. All award recipients will be posted online through Thinkable once the awards are issued. Search for either the AMSA or the NZMSS competition depending on your association.

|| Judges

If you are willing to assist with judging student presentations please contact Tim Lynch who will be leading the Australian judging or Megan Oliver who will be leading the New Zealand judging. This year we are using an online platform called Thinkable which means it is preferred that judges use a personal device to log into the online judging system. Judges will be added to the system and issued an online confirmation link. For more information go to: www.thinkable.org and view the AMSA or NZMSS competitions.

Plenary speakers

We are excited to bring you a terrific range of Plenary Speakers for this year's conference which will include...

Rawiri Smith, Environmental Manager, Kahungunu Ki Wairarapa

Dr Barry Bruce, CSIRO, ***AMSA 2016 Jubilee Award Winner***

Prof Lionel Carter, Antarctic Research Centre, Victoria University of Wellington

Ray Wood, Chief Operating Officer, Chatham Rock Phosphate

Dr Malcolm Haddon, Principal Research Scientist, CSIRO Oceans and Atmosphere

Chris Francis, Fisheries Modeller

Prof Sean Connell, Marine Biology and Ecology, University of Adelaide

Barry Bruce

Wednesday, July 6, 2016
9:30 AM - 10:00 AM

Barry's career has spanned multiple spatial scales in the ocean. Beginning with plankton in the 1980s, he worked for the Australian Antarctic Division publishing on krill physiology and reproduction, followed by a period working on the early life history of southern Australian finfish with CSIRO and the then South Australian Department of Fisheries. In the early 1990s, Barry and his colleagues increased the size of their animals of interest by researching the reproductive biology and captive husbandry of the endangered spotted handfish. Barry subsequently co-authored the recovery plan and several papers on this species. Following on from this grounding in conservation work, Barry has gone on to make an outstanding contribution to our knowledge and understanding of the iconic white shark. This contribution is on-going, with extensive advice provided to national and state governments and other stakeholders that helps guide management. Presently he leads a project using cutting-edge technologies to assess the status of white sharks, developing the first reliable estimate of population size for Australia.

Lionel Carter

Tuesday, July 5, 2016
9:00 AM - 9:30 AM

Lionel Carter is Professor of Marine Geology, Antarctic Research Centre, Victoria University, Wellington, New Zealand. Trained in geology and oceanography at the universities of Auckland, New Zealand and British Columbia, Canada, he has undertaken research in the North Pacific, North Atlantic and Southern oceans as well as off New Zealand. He helped set up major international projects in New Zealand including Ocean Drilling Program Leg 181 and the MARGINS "Source to Sink" initiative. Expertise gained in marine geology/ oceanography is applied to ocean engineering projects, in particular sub-sea telecommunications that underpin the Internet.

Website:
http://www.vuw.ac.nz/antarctic/people/lionel-carter/index.aspx

Sean Connell

Thursday, July 7, 2016
10:30 AM - 11:00 AM

Sean Connell is Professor of Ecology, University of Adelaide. He works on the past, present and future ecology of temperate reef systems. He has uncovered ecosystem change spanning decades to centuries, identified the pathways that drive ecological instability and stability, and interactions between local (e.g. fishing and pollution) and future global change (e.g. ocean warming and acidification). His latest work highlights a major gap in our understanding of natural systems that arises from our natural disposition to studying change and the mounting need to understand processes that stabilize against change.

Chris Francis

Tuesday, July 5, 2016
9:30 AM - 10:00 AM

Chris Francis, who trained as a mathematician, worked in fisheries research in New Zealand for 37 years. His research has covered a range of topics including survey design, fish growth, climate prediction, seabird population dynamics, statistical tests, and fishery stock assessment. In recent years he has broadened his understanding of stock assessment techniques by reviewing assessments in the USA, Chile, Europe, and Australia.

Malcolm Haddon

Wednesday, July 6, 2016
9:00 AM - 9:30 AM

Assoc. Prof. Haddon is now a Principal Research Scientist with CSIRO Oceans and Atmosphere where he focuses on fisheries stock assessment and management strategy evaluation of alternative management approaches. Malcolm joined the CSIRO in 1998 and previously, in New Zealand, had been with MAF Fisheries and a lecturer in Marine Ecology at Victoria University of Wellington, and in Australia he has been a Senior Research Fellow at the University of Sydney, The Head of Fisheries at the Australian Maritime College, and an Associate Professor at the University of Tasmania. As well as fisheries assessment and an array of research projects relating to fisheries management, and modelling, he also represents CSIRO on national stock assessment groups in the South-East fishery, the Great Australian Bight fishery, the sub-Antarctic fishery, and the Northern Prawn fishery. He has previously chaired the assessment groups for the Australian Northern Prawn and the sub-Antarctic fisheries, and was an Australian delegate to CCAMLR between 2004 – 2007. He has undertaken formal fishery, management, and policy reviews within New Zealand, Australia, the USA, and the Fisheries Commission in Europe.

Rawiri Smith

Monday, July 4, 2016
9:00 AM - 9:30 AM

An ancestor, Kupe is credited by Wairarapa sources with discovering Aotearoa. Other ancestors arrived on the waka Takitimu. This waka brought many tohunga (experts) to Aotearoa, including Rongokako. My preEuropean ancestors included tohunga trained in the whare wananga. My ancestors who lived during European settlement, including Te Tiriti o Waitangi era, recorded whare wananga dealings, of which genealogy was an important part. I descend from Whatahoro Jury, an ancestor 6 generations back who left us and Wairarapa a huge inheritance.

I am an Environment Manager for Kahungunu Ki Wairarapa and work with agencies including: 1) The Land And Water Forum small group 2) Greater Wellington Regional Council's Te Upoko Taiao 3)The Ruamahanga Whaitua Committee 4) National Science Challenge – Collaboration Lab

Ray Wood

Monday, July 4, 2016
9:30 AM - 10:00 AM

Ray Wood is the Director of CRP-OCS Consulting Limited, and Chief Operation Officer for Chatham Rock Phosphate. He retired from GNS Science in 2013 after a 34 year career as a marine geoscientist. He was a Principal Scientist at GNS and held several management positions in the resources division. He is currently working with GNS Science on Oman's continental shelf project.

Ray is an enthusiastic promoter of the exploration of New Zealand's marine territory and has led or contributed to studies of much of New Zealand's EEZ. He was the lead technical advisor to the New Zealand continental shelf project and to the MFAT team who negotiated New Zealand's maritime boundary with Australia. He has an extensive publication record on a wide variety of topics, but most of his research has focused on the tectonic evolution of the New Zealand region and its influence on the distribution of natural resources.

Discussions, workshops, social & Friday activities

|| Panel discussion: Exploring indigenous engagement throughout New Zealand and Australian coasts and seas

Monday July 4th - Session 2 (Breakout room: CO228)

He moana pukepuke, e ekengia e te waka – Mountainous seas can be navigated in a canoe

Nā Kingi Ihaka, Te Ao Hou, No. 22 (April 1958)

This Māori proverb highlights that working together to achieve a common and agreed objective is the most effective way forward. Meaningful engagement between indigenous peoples and the science sector provides many opportunities to resolve some of the complex issues we face today, but these must be founded upon an open and genuine desire to work together. Following on from the Plenary delivered by Rawiri Smith, and the presentation session on cross-cultural research, this panel discussion aims to open up a dialogue between indigenous peoples (practitioners, researchers and leaders) and the marine science community. It also aims to strengthen learnings and relationships across the Tasman.

Over many generations, indigenous communities have developed a deep an enduring connection to, and custodial relationship with the marine ecosystems that support their livelihoods and well-being. Recent shifts towards ecosystem-based management have emphasised the unique and vital contribution that indigenous peoples, values and knowledge bring to the conversation about socio-ecological systems. Engaging with indigenous communities is often a significant component of marine science, and cultural competency can often be the key to successful and meaningful research. Cultural competency and responsiveness requires learning, identifying challenges, and seeking solutions to improve both indigenous engagement with science and science engagement with indigenous communities.

Indigenous engagement within the New Zealand science system is promoted through national governmental policy (the Vision Mātauranga Policy) that seeks to support "unlocking the potential of Māori knowledge, resources and people," by "supporting research that concerns distinctive issues and needs arising within Māori communities." This means that in New Zealand a great deal of research moves past engagement and into a collaborative and co-production space. This is not always the case, or an easy journey, and our panellists will provide insight into the challenges and successes of their journey from an experienced iwi (tribal)/ Māori perspective. As a tribal people, one framework for engagement does not fit all, meaning it is often through shared learning, experiences and open communication that research succeeds.

In Australia, Indigenous engagement within the science system is currently promoted through a number of different mechanisms, including Traditional Owner driven processes, agencies, working groups, and ethical committees across the country. Australia differs to New Zealand as there is no national policy to help ensure Indigenous values, Indigenous knowledge systems and community priorities are recognised and responded to meaningfully through research that is inclusive, relevant, and beneficial. In Australia, we need to move on from having the same repetitive discussions about improving Indigenous engagement to actually establishing an Indigenous driven and led research agenda that establishes the guidelines for building collaborative partnerships across Australian Indigenous communities. For best practice to spread across Australia, important messages about cross-cultural research needs to be recognised and shared amongst all relevant bodies in order to grow those existing collaborative partnerships beyond a few Australian Indigenous communities. The Australian Indigenous panellists will share their experiences and insights into strengthening and advancing collaborative relationships. This panel discussion will lead into a further workshop to be held during the AMSA conference in Darwin, Australia, during July 2017.

We hope that by beginning the discussions in this panel session between indigenous peoples who have been engaged in the science system from both countries, and involving the audience at the conference, we can highlight the successes and consider some of the issues that have arisen in the past, to enable us to navigate the mountainous seas ahead.

Supported by

Marine Biodiversity Hub

National Environmental Science Programme

|| SPEED TALKS

Monday July 4th – Following session 3 (17.00 start)

Speed sessions are our own adaptation of the popular Pechakucha presentation style (5 minute duration, 10 slides at 30 sec per slide.

Room A (MCLT103):

Irawan Asaad Delineating priority areas for marine biodiversity conservation in the Coral Triangle region

Ryan Koverman The reproductive cycle of Yellowbelly Flounder, *Rhombosolea leporina*, from the Hauraki Gulf: Prospect for Domestication

Paul Caiger Evolutionary Ecology of NZ Tripterygiidae

Sophie Powell Evaluating the effects of recreational fishing on fish avoidance behaviour

Stacey Mccormack Using stable isotope data to advance marine food web modelling

Steve Urlich Reconstructing past ecosystem changes in the Marlborough Sounds

Room B (MCLT101)

Rachael Macdonald Light attenuation and vertical turbidity profiles of coastal Great Barrier Reef waters

Marnie Campbell Marine debris impacts on human health and public perceptions

Claire Conwell Forecasting microbial water quality in Te Awarua-o-Porirua Harbour

Helen Kettles Creating Our Estuaries: an online hub

Sadie Mills Inspirational Invertebrate e-guides and the NIWA Biodiversity Memoir Series: What are they and how do I find out more about them?

Helen Neil Direct hydrocarbon Indicators from combined seafloor, water column and ocean surface observations

|| SOCIAL ACTIVITIES

Unofficial Sunday Meet Up

Sunday, July 3, 2016 6:00 PM

Fork & Brewer Restaurant and Bar (20A Bond Road)

For those of you ready to say hello on Sunday an unofficial meeting point has been established.

Welcome & Poster Reception

Monday, July 4, 2016 5:30 PM - 7:30 PM

Maclaurin Building Level 1 Foyer

After a full day, some food and drink is your reward. Poster presenters will be on hand to discuss their work during this welcome networking function held in the foyer of the MacLaurin Building. A perfect time to catch up, meet some new people and make dinner plans.

Early Career Professionals Function

Tuesday, July 5, 2016 6:00 PM - 10:00 PM

A panel discussion aimed at early career professionals will be followed by networking event at the Hunter Lounge, VUW, Kelburn Campus.

Gala Dinner

Wednesday, July 6, 2016 6:30 PM - 11:45 PM

Museum of New Zealand Te Papa Tongarewa

Get creative - marine themed headware is the thinig for this year's Gala Dinner. Break out the hats, fascinators, bandannas, masks, top hats, berets, tam-o'-shanters, visors and turn them into something special... There will be prizes!

|| WORKSHOPS & DISCUSSIONS

***Undaria pinnatifida* - Open Discussion**

Tuesday July 5th - Session 11 Room B (MCLT101) at 17.30

In 2010 a single mature *U. pinnatifida* specimen was found growing on a mooring line in Sunday Cove, Breaksea Sound. Since 2010 DOC, MPI and ES, having been working together to remove the pest seaweed from the Sunday Cove area so that it does not spread throughout Fiordland. The programme is now in its sixth year and so far the team have removed over 1900 Undaria individuals with no confirmed mature specimens recorded since January 2012. However, the team have still been finding the odd immature *Undaria* over the last two years when some scientific advice suggested that the life span of gametophytes may only be 3-31/2 years in a natural environment such as Fiordland. This programme is currently working towards a successful outcome but there are some information gaps that exist which make planning for the future quite difficult. It is hoped that this short workshop may help to clarify some points and develop a clearer picture moving forward.

Case Study: The Ross Sea Toothfish Fishery: Is it sustainable or should it be closed?

Panel discussion: Thirty years of New Zealand's QMS: Where to next?

Thursday July 7th - Session 11 (Room A: MCLT103)
Six panel members have agreed to be part of a discussion on what we have learned from the last 30 years, what needs to happen over the next 30 years, and what keeps us awake at night in terms of fisheries-ie what are the priorities? The Panel speakers are Professor Matt Dunn (Fisheries Chair Victoria University of Wellington), Dr Bob Zuur (WWF-NZ and WWF-AUS), Darrel Sykes (Rock Lobster Fishing Industry), Prue Williams (General Manager Science Investments, MBIE), Dr Malcolm Haddon (Principal Fisheries Scientist CSIRO), Dr Shelton Harley (Fisheries Science Manager MPI) and Julie Hall (Director of National Science Challenge 'Sustainable Seas'). Dr Mary Livingston (MPI) will be facilitating the discussion and will open the session to questions from the floor for the last 20 minutes, so please prepare constructive and useful questions ahead of time.

There have been many articles in the media in recent years lamenting the lack of knowledge about the Antarctic toothfish population in the Ross Sea and questioning the sustainability of the fishery operating there. Indeed, a recent opinion piece in the journal Nature stated that virtually nothing is known about this fish: no eggs or larvae have ever been collected. So how true are these articles and what is known about Antarctic toothfish? NIWA scientists have been researching the biology, ecology, population dynamics of Antarctic toothfish and potential ecosystem effects of the fishery for the past 15 years. The talk will describe what is known about the Antarctic toothfish, the fishery, and potential ecosystem effects of fishing, including the development of a tagging program for monitoring its abundance, spatial population models for assessing bias, spatial management, and ecosystem models for understanding ecological interactions. They will also describe critical uncertainties, and how these may be addressed.

Workshop: Coastal citizen science opportunities

Thursday July 7th - Session 11 (Room A: MCLT103)

Join us at NZMSS 2016 for a chance to explore the fast growing world of Citizen Science in New Zealand. We will be presenting (and extending!) a list of NZ estuaries and wider coastal CitSci initiatives. The outcome will be featured in a national estuaries review. We will also explore future opportunities and provide an overview of some tools that can be used to develop or participate in projects.

Workshop organisers: Helen Kettles (Department of Conservation) & Shane Orchard (University of Canterbury)

‖ FRIDAY 8TH OF JULY

‖ Workshop: Introduction to mixed models using R

8:30 AM - 4:30 PM Friday, July 8th

Victoria University Coastal Ecology Laboratory:
396 The Esplanade, Island Bay, Wellington, New Zealand.

Cost: Free! NOW FULL
This workshop will give background and concepts of mixed models, examples of designs, when and why you would use them. We will also work through practical examples with data sets that we'll provide. We will primarily be working with R so a good understanding of R would be ideal. Transport and lunch are not included. City bus instructions: Take #1 bus towards Island Bay. At the last stop, Head south on The Parade toward Reef St, Continue onto Derwent St then onto The Esplanade along the coast. VUCEL will be on your right about 10 minutes form bus stop. This free workshop is brought to you with support from VUCEL.

Directions via bus: Take the #1 bus towards Island Bay. At the last stop, Head south on The Parade toward Reef St, Continue onto Derwent St then onto The Esplanade along the coast. VUCEL will be on your right about 10 minutes from bus stop.

‖ 9th Annual New Zealand Ocean Acidification Workshop

Friday 8th July 9AM-5PM

Venue: HMLT103, Hugh McKenzie Building, Victoria University, Kelburn, Wellington

The workshop will include a plenary by Professor Sean Connell (University of Adelaide), research presentations, updates on NZ OA projects, feedback from the recent Oceans in a High CO2 World Symposium, discussion on NZ OA research coordination, and finish with a discussion on OA research directions and value to management, mitigation and adaptation. Scientists, policy makers and stakeholders are all welcome. There is no registration fee and lunch and coffee will be provided; there will also be refreshments to assist the discussion.

‖ Te Awarua-o-Porirua Harbour field trip

10:30 AM - 4:00 PM Friday, July 8th

Cost: $40 GST inclusive

Located just 20 minutes north of Wellington city lies Porirua Harbour, the largest estuary in the lower North Island. The harbour has significant ecological, cultural and recreational values but these have been impacted by land use change within the surrounding catchment. And with more land use change in progress, including the current construction of the Transmission Gully Motorway, new residential housing and harvest of exotic forest in some parts of the catchment, further impacts are likely. In 2012, the three relevant local authorities and Te Runanga o Toa Rangatira combined efforts to launch the Porirua Harbour and Catchment Strategy and Action Plan. The Strategy, underpinned by a robust science programme, seeks to tackle the three big issues of sedimentation, pollution (nutrients and toxicants) and habitat loss.

Join us on a field trip through the catchment's changing landscape to learn how *collaboration, communication and communities* are working towards the Strategy's goal of a '*healthy harbour and waterways*'.

The bus will stop at a cafe for lunch where attendees can purchase their own lunches or delegates are welcome to bring a packed lunch. All trip details will be sent to attendees around the end of June. **The bus will depart from the top of Kelburn Parade outside the Centre for Lifelong Learning (east side).**

This trip is brought to you with the support of the Greater Wellington Regional Council.

AMSA Awards

The AMSA Jubilee Award honours a scientist who has made an outstanding contribution to marine research in Australia during his or her career. To commemorate its Silver Jubilee Year in 1988, AMSA established this award for excellence in marine research in Australia.

The AMSA Technical Award is intended to recognize outstanding achievements in the field of technical support to marine science in Australia. It was first awarded in 2009. This prize serves to emphasize the valuable contribution to marine science made by those who provide the technical and logistical support services which make much research possible.

|| Barry Bruce – AMSA Jubilee Award Winner 2016

Senior Research Scientist – Pelagic Spatial Dynamics, Marine Resources and Industries Program, CSIRO Oceans and Atmosphere

Barry's career has spanned multiple spatial scales in the ocean. Beginning with plankton in the 1980s, he worked for the Australian Antarctic Division publishing on krill physiology and reproduction, followed by a period working on the early life history of southern Australian finfish with CSIRO and the then South Australian Department of Fisheries. This resulted in 12 papers on larval taxonomy and ecology as well as two chapters of 'Larvae of Indo-Pacific shore fishes' (1989) and nine chapters of 'The larvae of temperate Australian Fishes: a laboratory guide for larval fish identification' (1997) both of which are texts that are still used today. Plankton related work has continued with research on the reproductive and larval ecology of seastars and research on the distribution of Southern rock lobster phyllosoma culminating with the development of a dispersal and settlement model to support decision-making by fisheries managers.

In the early 1990s, Barry and his colleagues increased the size of their animals of interest by researching the reproductive biology and captive husbandry of the endangered spotted handfish. Barry subsequently co-authored the recovery plan and several papers on this species. Following on from this grounding in conservation work, Barry has gone on to make an outstanding contribution to our knowledge and understanding of the iconic white shark. This contribution is on-going, with extensive advice provided to national and state governments and other stakeholders that helps guide management. Presently he leads a project using cutting-edge technologies to assess the status of white sharks, developing the first reliable estimate of population size for Australia.

Barry's team was the first to apply satellite tracking technology to white sharks in 2000/2001 and the first to make white shark tracks publically available via the internet. His team was also one of the first to use mobile phone and satellite technologies to receive real-time messages about the movements of acoustic-tagged white sharks around the coast of Australia, a technique that has since become widely used for telemetry of data. Recent results from his team's work has identified two populations of white sharks in Australian waters separated east and west by Bass Strait as well as a higher level of movement and potential for gene flow (or transient movement of non-breeding sharks) between Australia and New Zealand than previously thought. The profile of his team's work has led to a high media demand for comment on shark issues (with over 150 media interviews in the past five years) and has raised the national awareness of shark research and for white sharks in particular.

|| Lesley Clementson – AMSA Technical Award Winner 2016

Research Leader - Temperate Coastal Group Coastal, Development and Management Program, CSIRO Oceans and Atmosphere

Lesley both established and runs Australia's only dedicated marine bio-optics laboratory. Her lab has 'world class' status as one of only four phytoplankton pigment laboratories internationally accredited by NASA. The high quality data and analysis produced by Lesley's lab has been pivotal to the success of multi-institutional projects within satellite remote-sensing (SRS) of ocean colour, biological oceanography, coastal water quality management, biofuels from micro-algae and fisheries management.

Lesley plays a leading role in coordinating and managing Australian and international databases in pigments and bio-optical properties. Lesley developed and maintains an unique data archive of in situ bio-optical parameters for Australian waters, which currently contains over 15,000 data points from 1997 to the present day and is publicly available through the IMOS web portal. Lesley's collaborations with scientists at both the North American (NASA) and European (ESA) Space Agencies has allowed this data archive to be seamlessly included in their global databases, SeaBASS and MERMAID. This unprecedented inclusion of such a large amount of in situ data from the Australasian region in these global datasets both underpins the assessment of ocean colour products for this region and allows for regional tuning of global algorithms and the parameterization of regional algorithms.

The database is not only a valuable asset for satellite ocean colour validation and phytoplankton functional type (PFT) algorithm development, but also for the marine and climate science community in general; providing historic data and input variables for biological and ecological models at both local and global scales. Since late 2011 Lesley has been a member of the International Working Group for Phytoplankton Functional Type (PFT) Algorithm Development and has lead the development of global data sets to be used for the parameterisation and validation of PFT algorithms.

AMSA Student Awards

At each annual AMSA conference, outstanding student presentations and posters are recognised by awarding the following Prizes:

- Ron Kenny (Paper and Poster)
- Peter Holloway Physical Oceanography (Paper)
- Sea World Research and Rescue Foundation (Poster)
- Fisheries Research and Development Corporation (FRDC) (Paper and Poster)
- Ernest Hodgkin Estuary Research Award (Paper or Poster)
- Victorian Marine Science Consortium (Paper or Poster)

NZMSS Student Awards

The following student awards will be presented at the conclusion of the conference:

- Best NZMSS oral presentation supported by NIWA ($400)
- Runner Up NZMSS oral presentation supported by Cawthron Institute ($350)
- Best NZMSS poster presentation supported by Victoria University of Wellington ($400)
- Innovators Award courtesy of Plant & Food Research ($350)
- Best student talk making the best use of quantitative methodology supported by MPI ($400)
- Best student poster making the best use of quantitative methodology supported by MPI ($400)
- Best Applied Environmental Science presentation supported by the Coastal Special Interest Group ($350)
- Poster award placing emphasis on originality and presentation supported by The New Zealand Journal of Marine and Freshwater Research, published by the Royal Society of New Zealand and Taylor & Francis ($500)
- Technology Award supported by Zebra-Tech Ltd ($350)
- Marine Protected Areas Award supported by DOC ($350)
- Hickman Prize for the best student paper in marine aquaculture research supported by NZMSS ($350)

NZMSS AWARDS

2016 NZMSS Award

This highly prestigious award was inaugurated in 1985. The award is presented to a person who, in the opinion of the NZMSS Council, has participated in the activities of the Society, has represented the interests of the Society, and has been instrumental in the Society achieving its objective of the advancement of marine science in New Zealand. The award recognises “a person’s continued outstanding contribution to marine science in New Zealand”.

The award is a bronze sculpture in the form of the internal spire of a gastropod shell. It was designed and manufactured by Wellington artist Nick Dryden, and comes with an engraved plaque. The award carries with it lifetime membership of the Society. In accepting the Award the recipient agrees to continue promoting marine science in New Zealand by giving two or more public lectures on a topic of their own choosing. NZMSS awards are presented to individuals in recognition of their continued and outstanding contribution to marine science in New Zealand.

The 2016 NZMSS Award is supported by the Auckland Museum and will be announced and presented at the Gala Dinner on Wednesday July 6th.

John Morton Award - Inaugural Year 2016

The award is made to a person, or persons, who, in the opinion of the NZMSS Council, has made an outstanding contribution to the advancement of marine conservation and sustainability in New Zealand.

The 2016 John Morton award recipient will be announced at the Gala Dinner on Wednesday July 6th.

Abstracts: TALKS

Encountering White sharks: Affective impact of cage diving

Dr Raj Sekhar Aich[1]

[1]*University of Canterbury, Christchurch, New Zealand*

White sharks are invariable part of the marine ecosystem. However, their lives and oceanscapes are presently at peril due to various anthropogenic activities. New Zealand is a White shark hotspot, consequently two operates has been facilitating White shark cage diving in Foveaux strait since 2007. But, this practice has been a source of controversy in the region; residents want these operation stopped- fearing sharks getting more aggressive, and associating humans with food- even if research contradicts such claims. This attitude towards the operations and the sharks- beyond empirical evidence- may be related to the 'man eating monster' image of the shark perpetuated by media. An image, not only creating tension in the region, but is detrimental to shark conservation efforts globally. Alternatively, cage diving has potential of encouraging conservation through- economic impetus to the community, and demystifying the sharks through direct encounter in their natural environment. My research ethnographically investigates this practice facilitating an unique aquatic 'contact zone' where humans and sharks encounter each other, and the affective impact of such an encounter. At the intersection of the multispecies ethnography, and anthropology of conservation, this research situates itself in the process of 'life making' between two species whose lives and spaces are entangled within an assemblage of cultural, socio-political, economic, and ecological forces. This on-going research may make a novel contribution to the field of human- shark relation study, and create potential of resolving conflict between all the parties involved, including the operators, the residents, the sharks, and the local government.

Spawning season lipid and fatty acid composition, quantity and provisioning strategy of the New Zealand snapper/tamure (*Chrysophrys auratus*)

Mr Hamish Allen[1]

[1]*Auckland University Of Technology, Auckland, New Zealand*

Lipid and fatty acid composition, quantity and provisioning strategy of the New Zealand snapper/tamure (*Chrysophrys auratus*) were investigated throughout its spawning season between November 2015 and February 2016. Lipids and fatty acids are fundamentally important for growth, as sources of metabolic energy, in the structure and integrity of cell membranes and also as endogenous energy reserves for the purpose of reproduction. Throughout the reproductive process, the quantity and concentration of lipids and fatty acids can vary within a population. This may be maternally influenced, with factors such as an individual's size or age influencing lipid provisioning into reproduction, in turn affecting the fitness, size and growth rate of offspring, and consequently their chances of survival. Lipid composition may also vary, an important aspect as certain lipids play more integral roles than others throughout this process. Snapper are an important species ecologically, culturally, recreationally and commercially in New Zealand. Analyses of lipid and fatty acid levels in female gonads and livers throughout the spawning season will determine what composition and concentrations are present, if changes occur throughout the population demographic, and indicate the provisioning mechanisms used by snapper. These findings may have implications for determining accurate stock-recruitment estimates as well as enhancing our understanding of reproductive processes, an important aspect in our ability to implement effective conservation, to manage fisheries sustainably, and to understand wider marine ecosystem functions.

Deepwater coral distributions in the seas around New Zealand - present and future

Mr Owen Anderson[1], Dr Sara Mikaloff Fletcher[1], Dr Helen Bostock[1]

[1]*NIWA, Wellington, New Zealand*

The New Zealand region hosts a rich diversity of deepwater coral species, together forming a central component of vulnerable marine ecosystems. These ecosystems are under threat from human activities such as bottom trawling, offshore oil/gas development, deepsea mining, and climate change. We used boosted regression tree modelling to estimate current and future distributions of deepwater corals in the New Zealand region utilising locality information from decades of survey and fisheries data and predicted changes in marine environmental conditions between the present and 2100 AD derived from global earth system models. This work has provided a better understanding of the spatial distribution of protected corals, and how changes in the ocean chemistry may impact them. This research will help us to determine species tolerances to environmental conditions, in conjunction with recently completed in-aquaria experimental work. Predicted changes in suitable habitat species distributions due to changing marine environmental conditions over the rest of the century will be described for selected habitat forming coral groups and the role of some regions as possible 'sanctuaries' for these corals discussed.

Ciguatera poisoning, not just humans? Larval sensitivity to toxin producing dinoflagellates from the New Zealand and Pacific.

Ms Phoebe Argyle[1,2,3], Dr Tim Harwood[1], Dr Lesley Rhodes[1], Dr Olivier Champeau[1], Dr Mary Sewell[2], Dr Islay Marsden[3], Dr Louis Tremblay[1,2]

[1]Cawthron Institute, Nelson, New Zealand, [2]The University of Auckland, Auckland, New Zealand, [3]University of Canterbury, Christchurch, New Zealand

Toxin producing benthic dinoflagellates have been linked to human illness, including ciguatera fish poisoning caused by ciguatoxins produced by *Gambierdiscus*. In laboratory studies, algal extracts of *Ostreopsis* and *Gambierdiscus* from New Zealand and Australia containing known concentrations of palytoxin-like compounds, ciguatoxin, maitotoxin, and maitotoxin-3, were tested for their effects on larval development using the zebrafish (*Danio rerio*) fish embryo toxicity (FET) and sea urchin (*Evechinus chloroticus)* fertiilization and 96 hr larval development standard assays. Sea urchin fertilization rates were not affected by any algal extract. Sea urchin development was inhibited by one of seven *Ostreopsis* extract and three of five *Gambierdiscus* extracts. Zebrafish development was inhibited by all five *Gambierdiscus,* with strong responses to two, but was unaffected by *Ostreopsis* extracts. These results show the potential impact of marine microalgal toxins on larval development of exposed organisms and the possibility of these bioassays to characterise toxic microalgae. Ciguatera poisoning has been observed in many Pacific nations, including the Kingdom of Tonga. Preliminary sampling has found *Gambierdiscus* present at multiple sites around the largest island of Tongatapu. Comprehensive surveys of microalgae diversity and abundance around the Kingdom of Tonga are planned as part of future research. Toxin-producing isolates may be maintained in culture for research into toxigenesis, as this has been shown to vary between and within species. This work will provide information about which *Gambierdiscus* distribution and abundance in Tonga as part of research aiming to better understand the ciguatera phenomenon.

Innovative collaborative approach to fisheries science data collection

Ms Helena Armiger[1], Mr Oliver Wilson[2]

[1]NIWA, Auckland, New Zealand, [2]Trident Systems LP, Wellington, New Zealand

Fisheries science addresses important sustainability issues using independent and dependent data. Commercial fisheries provide large amounts of fishery dependent data on catch, effort and biological catch composition essential to the assessment and sustainable management of NZ fisheries. Formal catch sampling programmes for Northern New Zealand commercial fisheries have provided valuable data since 1988 for the management of these important fish stocks (e.g. snapper, trevally and tarakihi). Scientific data collection from commercial fisheries has numerous logistical and practical challenges. Achieving representative, unbiased sampling requires the ability to proactively manage multiple stakeholders within a dynamic industry whilst ensuring high quality data collection. Changing market demands and changes in the dynamic nature of the fisheries has increased the complexity and time critical nature associated with accessing samples and data collection. To continue providing high quality representative data innovative approaches were required to access samples and collect data. NIWA and Trident Systems LP developed and are now providing a new collaborative approach to collecting high quality fisheries dependent data in support of effective fisheries management. Trident provides real-time, accurate commercial catch information using trained industry staff to collect scientific data, including lengths, sex, stage and otoliths. NIWA's role has been to provide quality assurance of science standards, data analysis and age determination from collected otoliths. This collaborative partnership promotes innovative, transparent and auditable scientific data collection, promoting increased stakeholder engagement and responsibility. Enabling improved representative sampling of commercial fisheries, providing high quality inshore catch sampling data supporting the scientific assessment of New Zealand's fisheries.

Australia New Zealand Marine Biotechnology Society: facilitating research collaborations toward an enhanced and sustainable blue economy

Prof Chris Battershill[1]

[1]*University of Waikato, Tauranga, New Zealand*

Marine biotechnology in New Zealand is alive and well, however most practitioners in this country would not claim to be 'marine biotechnologists' *per se*. The sector is fragmented in terms of how scientists view their profession and research foci, most identifying themselves as natural products chemists, aquaculture physiologists, or marine microbiologists as examples; with relatively little referral to the wider implications of their research in arguably more applied sectors. Where marine biotechnology is cited, it is either as a failed biomedicinal discovery experiment (which couldn't be further from the truth), or as an emerging developmental sector with public and politicians alike frequently assuming the field is centred on development of value added products from fish waste. As it happens, this is now a research priority of considerable Governmental interest but, so far, with relatively poor coordinated uptake. A consequence of unrealised collective effort is a research sector that is steeped in misunderstanding. New Zealands EEZ supports a highly diverse marine fauna and flora with over 60% endemic for some taxa, hence a rich resource. With the Treaty of Waitangi and Wai262 legislation soon to be completed, New Zealand should also benefit from a clear understanding of the provenance of its' biodiversity in terms that satisfy the Access and Benefit Sharing components of the Nagoya Protocol (CBD). Wider recognition of sectors that marine biotechnologies can service is now creating opportunity that includes new pathways for funding. Now is the time to harness collective expertise to forge new national and international collaborations.

Mapping human use of the remote Dampier Peninsula (Kimberley, Australia) prior to coastal development

Prof Lynnath Beckley[1], Dr Claire Smallwood[2], Dr Emily Fisher[2]

[1]*Murdoch University, Perth, Australia,* [2]*WA Department of Fisheries, Perth, Australia*

Although Indigenous people have used the remote Kimberley coast for subsistence and cultural activities for thousands of years, it is only recently that coastal tourism and recreational use have expanded in the region. To ascertain the spatial and temporal distribution of current human use along the Dampier Peninsula coast and adjacent waters, aerial surveys were conducted over 12 months. People were generally located along the coast from Broome northwards to Coulomb Point and around Beagle Bay, Middle Lagoon, Cape Leveque and One Arm Point with few using the eastern shores of the Peninsula. Five times more people were recorded during the dry, winter season than during the wet, summer season but mean densities were generally low (<10 people per 0.1km^2) except around Broome. In terms of shore-based recreational activities, 40% of people observed were walking, 27% relaxing, 10% swimming and 6% fishing. Four-wheel drive vehicles were widespread along the coast and coastal camping was prevalent in the dry season along the western shores. Vessel activity was largely concentrated in waters off the south-western part of the Peninsula, particularly around Broome, though, during the dry season, boats were more frequently observed at Beagle Bay, Middle Lagoon, around the north of the Peninsula and near Derby. This study provides spatially-explicit, quantitative data as a bench mark of human use on the Dampier Peninsula prior to proposed major coastal development such as the construction of sealed roads and tourism infrastructure.

Future directions for marine biosecurity in New Zealand

Ms Kerry Charles[1], **Dr Andrew Bell**[1], Mr Geoff Daniels[1]

[1]*Ministry for Primary Industries, Wellington, New Zealand*

Biosecurity is fundamental to New Zealand retaining the values it currently enjoys from its natural resources. There has been a gradual enhancement of our biosecurity system but we now face significant challenges including changing societal expectations, climate change, and increasing volumes and diversity of trade and travel. The Ministry for Primary Industries will be consulting on the future direction of New Zealand's biosecurity system through the Biosecurity 2025 Project. The key output of the project will be a Direction Statement that will guide all participants in the system for the next 10 years. The Direction Statement will set out areas of focus to ensure that the system takes advantage of future opportunities, by harnessing the transformative potential of technology, science, information and public participation. Future directions for system leadership, governance and capability will also be considered. The future direction will have implications for everyone interested in New Zealand's marine environment. Of primary importance will be the need to understand how to coalesce New Zealand's marine constituency. A stronger sense of community is essential to realise the proposed direction and derive the benefits of strong biosecurity protection of our marine values. This presentation will focus on raising awareness and seek contributions to improve how marine issues may be reflected in the future Direction Statement and/or what specific actions could be taken.

Sediment induced transitions from coral to sponge dominated reef states: An example from within the Coral-Triangle

Mr Andrew Biggerstaff[1]

[1]*Victoria University Of Wellington, Wellington, New Zealand*

Coral abundance on tropical reefs is declining. Increases in sediment deposition have been shown to induce coral mortality, with this attributed to sediment impairing coral symbiont photosynthesis. However, at multiple locations where sediment induced coral declines have occurred there have been increases in sponge abundance, with many of these sponge species containing photosymbionts. Within the Wakatobi Marine Biosphere Reserve (UNESCO), Indonesia, a coral to sponge regime shift has occurred over the last decade, with increased levels of sedimentation. The abundance of the dominant photosynthetic sponge (*Lamellodysidea herbacea*) was monitored across 3 years on this sedimeted reef and at surrounding reef locations. In addition to this PAM fluorometry measurements were performed *in situ* and during shading and transplant experiments to assess photoacclimation of *L. herbacea's* photosymbionts. Furthermore experimental additions of differing sediment levels both *in situ* and in a laboratory were used to define sediment clearance mechanisms, as well as the short and long term effects of sedimentation on *L. herbacea's* respiration rate. *L. herbacea* appear to still be increasing in abundance on the sedimented reef system and have been shown to be able to rapidly photoacclimate during transplants from clear to turbid environments. Furthermore they have high sediment clearance rates by utilising mucus production and are able to alter their respiration rate to cope with the associated metabolic demands. These results indicate how this regime shift may have occurred through high sediment tolerance levels of *L. herbacea* and provide an example of how anthropogenic impacts can influence ecosystem regime shifts.

Seven centuries of human-induced change in marine life of the Bay of Islands, New Zealand

Dr John Booth[1]

[1]*Emeritus, Rawhiti, New Zealand*

Human settlement of the Bay of Islands, beginning perhaps as early as 1300, wrought huge change in the local marine ecology. Various of these transformations can be assigned to 1) increased levels of sedimentation from land-runoff (manifested in, for example, an expanded mangrove footprint and diminished area of seagrass); 2) harvesting of food (extirpations/extinctions; low catch rates and reduced individual mean-size; and emergence of sea-urchin barrens); 3) arrival of alien species (competition/extirpation/extinction); and 4) the physical and biological consequences of such activities as the construction of oyster farms. Despite numbers being modest, early pre-Contact human presence in the Bay of Islands resulted in increasing rates of sedimentation, and extirpations and extinctions (marine mammals, seabirds, one gastropod). It seems that, by late pre-Contact times, when the population of the Bay of Islands could have been as great as 10 000, the key irreversible ecological consequences of humans entering for the first time a pristine environment had been worked through; the main continuing and enduring impact of this later period was probably compounding siltation. With their new technologies, and pests, European arrivals greatly upped the ante. The combined population set in train escalating rates of sedimentation; there were further extirpations/extinctions among marine mammals and seabirds; massive increases in commercial fishing pressure resulting in loss of much of the shallow-water kelp forests of the main basin to sea-urchin grazing; and structures such as oyster groynes and farms changed the nature of large areas of the intertidal and shallow subtidal.

Effects of chronic trawl disturbance on soft sediment benthic communities of Chatham Rise, New Zealand

Dr David Bowden[1], Dr Daniel Leduc[1]

[1]*NIWA, Wellington, New Zealand*

Trawl fisheries have direct impacts on seabed habitats that are likely to alter ecosystem function over time. In the deep-sea, such effects may be longer lasting than in shallower environments but few data are available from existing deep-sea fisheries. We used towed cameras and corers to survey soft-sediment benthic epifaunal and infaunal communities across gradients of long-term cumulative trawl intensity at ca. 500 m depth on Chatham Rise, New Zealand. After allowing for the influence of spatial and depth gradients, trawling explained 12-16% of community variance in statistical models that explained up to 70% of total variation in epifaunal community structure, but there were no clear correlations between macro-infaunal community and trawling. Trawling was associated with declines in the evenness and diversity of epifaunal communities, and in the occurrence of functional traits associated with sensitivity to disturbance. Abundances of small mobile deposit feeders, small predator/scavengers, and two small sessile suspension-feeding species were highest at the most trawled sites. Our results indicate that chronic trawling modifies the structure of benthic soft sediment epifaunal communities in the deep-sea in ways previously observed from studies in coastal and shelf depth fisheries. As trawl fisheries continue to expand into deeper waters, this has implications for ecosystem function and long-term sustainability of living resources in one of the largest environments on Earth.

The Development of a Pathways Plan for Fiordland, New Zealand

Mr Richard Bowman[1], Mr Shaun Cunningham[1]

[1]*Environment Southland, Invercargill, New Zealand*

Fiordland has a highly unique marine environment characterised by black and red coral, seapens, brachiopods, numerous marine mammals and seabirds, as well as productive commercial fisheries. This area is of great ecological, commercial, social and cultural importance. These values are all threatened by the incursion of marine pests including those already present in New Zealand's major ports (*Undaria pinnatifida, Sabella spallanzanii,* and *Styela clava*). There is a high risk that marine pests will be introduced into Fiordland waters on vessels coming from infested areas. The Fiordland Marine Guardians has identified marine pests as one of the major risks to the Fiordland marine environment. This statutory body operates under the Fiordland (Te Moana o Atawhenua) Marine Management Act 2005. Since 2003 it has worked closely with the Ministry for Primary Industries, the Department of Conservation and Environment Southland to address the marine pest risks. In response to these concerns in 2014, Environment Southland approved the development of a formal proposal for a Regional Pathway Management Plan for Fiordland. Pathways management plans are a new and, as yet, untried statutory mechanism under the Biosecurity Act. The Plan proposes rules which would apply to hull fouling, contaminated gear and residual seawater on vessels entering the Fiordland Coastal Marine Area. In April 2016 a proposed Plan was formally notified for public submissions and hearings. It is intended that the Plan will become operative by 2017.

Nearshore habitat use by Hector's dolphins at Banks Peninsula: a comparison of visual and acoustic methods

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

[1]*Department of Marine Science, University of Otago, Dunedin, New Zealand,* [2]*Department of Zoology, University of Otago, Dunedin, New Zealand*

Knowledge of the dynamic use of habitat by marine top-predators increases our understanding of the role these species play in marine ecosystems and enhances our ability to establish effective habitat-based species management. Such information is particularly important for threatened species that inhabit coastal environments where anthropogenic effects on habitat quality can be significant. Hector's dolphin is an endangered, endemic cetacean that is found year-round at Banks Peninsula. This study aimed to assess how 'hotspots' in the dolphins' near shore distribution vary among seasons and over time. Visual sightings data from standardised surveys of the Banks Peninsula coast were analysed using fixed kernel density estimation (KDE). Twenty-five years of data were available and were pooled into four seasonal categories and three time periods. Separate KDE analyses were undertaken for each category. To further assess habitat use, passive acoustic monitoring devices (TPODs) were deployed at ten locations around the Peninsula. KDE of visual sightings demonstrated variation in the use of hotspots among seasons. Mean summer hotspot density ranged between 3.5 and 6.4 dolphins/km^2 (SE = 0.02<0.08), mean winter density was between 0.13 and 0.92 dolphins/km^2 (SE = 0.01<0.03). KDE analysis also suggested variation in the importance of some locations over time, with a recent decrease in dolphin density at several hotspots. Acoustic data showed little difference in habitat use among monitoring locations during winter and spring. In summer, variation in relative dolphin density among sites was evident, however these differences did not always correspond to the density values calculated using KDE analysis. This study illustrates the patchy nature of Hector's dolphin distribution at Banks Peninsula and suggests analyses of distribution may be sensitive to the monitoring method.

Barramundi, mercury and lifestyle

Dr Edward Butler[1], Mr Simon Harries[1], Ms Kirsty McAllister[1], Assoc Prof David Crook[2], Dr Julie Martin[3], Dr Thor Saunders[3]

[1]Australian Institute of Marine Science, Arafura Timor Research Facility, Darwin, Australia, [2]Research Institute for the Environment and Livelihoods, Charles Darwin University, Darwin , Australia, [3]NT Fisheries, Department of Primary Industries and Fisheries, Darwin, Australia

Barramundi (*Lates calcarifer*) is an apex predator in northern Australian waterways. As such, it is vulnerable to bioaccumulation of mercury. Its catadromous life cycle means that exposure to the heavy metal is likely to be highly variable, with habitats ranging from river channels and floodplains through estuaries to coastal seawaters. Our study has encompassed three, large river systems of the Northern Territory: Daly, Mary and McArthur. Hg concentrations in barramundi in these contrasting systems range from 0.036–0.77 ppm (wet wt); none exceeding the maximum level of 1 mg Hg/kg afforded barramundi, as an apex predator, by the Australia New Zealand Food Standards Code. Evaluating the full data set by conventional indices, such as Hg concentration *vs* total length (r^2 = 0.143) and trophic position (via $\delta^{15}N$ values), proved unproductive. Further analysis has revealed influence of habitat and potentially feeding preferences. Although differences are found among the river systems, of primary influence are the compartments within each of them. Fish inhabiting billabongs and feeding over floodplains are seemingly at greater risk of accumulating Hg, compared with those in estuaries and coastal seawaters. Even here, the distinction is not absolute. It is only using additional tools to resolve aspects of migration and diet (e.g. $^{87}Sr/^{86}Sr$ isotope ratios in otoliths and $\delta^{13}C$ values, respectively) that fish appearing anomalous in Hg concentration could be assigned more effectively.

The ecology and movement of short tail stingrays in an urban harbour

Ms Helen Cadwallader[1], Professor Chris Battershill[1], Dr Phil Ross[1]

[1]University Of Waikato Coastal Marine Field Station, Tauranga, New Zealand

The urbanisation and industrialisation of coastal areas has resulted in ecological changes and loss of biodiversity in the marine environment. Large predatory species, such as the elasmobranchs (sharks and rays), that inhabit our urbanised coastline may be particularly at risk from anthropogenic stressors such as pollutants, due to their slow growth, low fecundity, and long lifespans. Knowledge of the way in which these species utilise impacted areas, for example seasonal movement cycles and residency, is required in order to effectively assess the risks posed by different stressors or human activities. This study uses both direct (conventional identification tagging) and indirect (abundance proxies) methods to investigate seasonal movement patterns and site fidelity of the coastal stingray *Dasyatis brevicaudata* in the Tauranga Harbour. Contaminant body burdens will be assessed in populations hypothesised to have different levels of exposure to urban pollution. Movement behaviour and toxicology data will then be used to provide a framework to assess the impact of anthropogenic pressures on elasmobranch species in urban environments.

Individual or metaorganism: geographically conserved microbiomes of four invasive tunicates

Dr Patrick Cahill[1], Dr Andrew Fidler[2], Dr Grant Hopkins[1], Dr Suzie Wood[1]

[1]Cawthron Institute, Nelson, New Zealand, [2]Institute of Marine Science, University of Auckland, Private Bag 9201, Auckland 1142, New Zealand

No longer can we view individual organisms in isolation - all eukaryotes, from protists to humans, harbour symbiotic and commensal microbes that form integral parts of their biology. Collectively termed the 'microbiome', these microbes combine with their host to form interdependent and polygenomic 'metaorganisms'. The physiological role of the microbiome has received considerable research attention but the ecological implications of the metaorganism are largely unexplored. We have recently demonstrated that four invasive tunicates introduced to New Zealand within the last 50 years harbour unusually simple microbiomes in their tunics. Automated ribosomal RNA intergenic spacer analysis and High-Throughput Sequencing were used to characterise and compare the tunic microbiomes of *Ciona savignyi*, *Ciona robusta*, *Botrylloides leachi*, and *Botryllus schlosseri* sampled from discrete populations in in Nelson Marina, Wellington Harbour, and Lyttelton Port. Each species of tunicate had a distinct tunic microbiome that was conserved between geographic locations. Of particular note were the tunics of *C. robusta* and *C. savignyi*, each of which are dominated by fewer than five bacterial taxa related to known symbionts from other metazoans. These tunicates present a unique opportunity to begin unravelling the interplay between a host, its microbes, and the environment. In this way, viewing marine invaders as metaorganisms, rather than individuals, is vital to fully understanding the factors that cause a species to spread and proliferate.

Selective mortality on early life-history traits of a temperate reef fish

Phoebe Caie[1], Jeff Shima[1]

[1]Victoria University Of Wellington, Wellington, New Zealand

Phenotypic variation is particularly prevalent in the early life-history stages of reef fish, and provides the basis for selective mortality on growth related traits. Recruitment variability can alter the effective densities experienced by these early life stages, raising additional questions about the interplay between selection and density-dependent processes. While many examples of growth-selective mortality have been documented for young reef fish, few studies consider how the strength and/or direction of selective mortality changes with ontogeny, or how these patterns may be mediated by density. We evaluate patterns of growth-selective mortality on young stages of the common triplefin (*Forsterygion lapillum*). We conducted an experiment using a set of mesocosms to evaluate whether selective mortality on early life-history traits in common triplefin could be caused by a natural predator, the variable triplefin (*Forsterygion varium*). We used otoliths to reconstruct the traits of fish that survived versus fish that were consumed. Selection trials were conducted across realistic density gradients, and we found that both larvae and juveniles experienced significant selection against fast larval growth. However, juveniles also experienced selective predation for fast growth at the larval-juvenile transition. The strength of selection on both growth traits was inversely related to density (i.e., strongest at lower densities, weakest at higher densities). These results suggest that predators may preferentially target faster growing individuals regardless of developmental stage. However, this effect may be mediated by density, such that the strongest selection occurs during low recruitment.

Why do larger mothers produce larger offspring? A test of classic theory

Ms Hayley Cameron[1], Dr Keyne Monro[1], Dr Dustin Marshall[1]

[1]*Monash University, Clayton, Australia*

Offspring size is positively correlated with maternal body size within most taxa. In an influential paper, Parker and Begon (1986) explored this pattern in an optimality framework and proposed that larger, more fecund mothers create more competitive offspring environments that select for the production of larger offspring. Direct empirical tests of Parker and Begon's classic model are surprisingly rare. We parameterise this optimality model with field data that estimates the offspring size-fitness function across a range of sibling densities for a marine bryozoan. While sibling competition did modify the offspring size-performance relationship, this occurred in ways unanticipated by the classic theory.

Burial duration influences resilience of a subtidal seagrass, *Posidonia australis*

Prof Marnie Campbell[1]

[1]*The University of Waikato, Hamilton, New Zealand*

Sedimentation that leads to periodic and prolonged burial events are becoming more common on the world's coastlines as human populations expand and create marine urbanised environments. Different seagrass species react differently to sediment burial but many species in the southern hemisphere are yet to be examined. There is a need to critically assess how seagrass propagules responses to periodic (pulse) and prolonged (press) burial events before selecting the most appropriate species, transplant propagule, and transplant site for seagrass restoration attempts. Mesocosm experiments, coupled with field measurements were used to assess how sexual (seedlings) and vegetative (sprigs) propagules of *Posidonia australis* responded to pulse and press burial events. Seedlings were highly susceptible to burial (both pulse and press), with no survival at the end of the experimental period. In contrast, rhizome growth in vegetative propagules was stimulated by pulse burial, although press burial events resulted in mortality. The implication for *Posidonia australis* restoration efforts in areas where burial is periodic, was that vegetative propagules are optimal transplant units, in comparison to seedlings. Prolonged burial however, renders a transplant site sub-optimal for both seedling and sprig transplants.

Present and Future of Marine Environmental Surveying – Snapshot from an Industry Perspective

Andy Campbell[1], Dr Maria Milititsky[1], Michael Thompson[1], Katie Cross[1]

[1]*Gardline Environmental (New Zealand) Limited, Wellington, New Zealand*

Measuring biodiversity has always been an objective of environmental marine surveying. Traditional sediment sampling techniques have clear limitations regarding the adequacy of the method for different substrates, the area they can cover or the maintenance of the integrity of protected habitats such as biogenic reefs. New technologies are generally developed within the academic sphere and gradually transferred into industry. Besides traditional sediment sampling methods, more innovative technologies are being implemented. Quantitative seabed imagery analysis, tailored in house to suit our client's needs, has proved to be particularly useful when covering unexplored deep-sea areas or when assessing sensitive habitats such as coral reefs. Molecular tools, namely standard metabarcoding of meiofaunal communities is now available to our clients as a complementary biodiversity measuring technique, although it has yet to be implemented. Such technology would allow a rapid assessment of benthic meiofauna communities with a high degree of accuracy, providing complimentary ecosystem assessment alongside traditional taxonomy. In the future we aim at providing habitat prediction modelling services, however such techniques are now at their early stages, since there is a variety of modelling options available that need to be customized to different specifications. If current legislation does not envisage the use of new surveying techniques, there is no incentive for these to be implemented and the rollover of new technology into industry will dependent on forward thinking companies that are willing to go the extra mile. Such technologies might become particularly relevant for emerging industries such as deep-sea mining for instance.

Evaluating the validity of pots to estimate the relative abundance and size structure of blue cod

Dr Glen Carbines[1]

[1]*Saltwater Science Ltd, North Shore City, New Zealand*

The South Island of New Zealand has an iconic and nationally significant inshore weever fishery (blue cod - *Parapercis colias*). Potting surveys have been used for the last two decades to provide a means of evaluating the response of populations to changes in fishing pressure and to the implementation of management initiatives such as changes to daily bag limit, minimum legal size, and/or area closures. However, the basic premise of using potting (a passive capture method) to estimate the relative abundance and size structure of blue cod populations requires further validation, since different methods will have different selectivity biases. To investigate this, direct *in situ* observations of blue cod from remote Drift Underwater Video (DUV) transects were compared with catches from two pot designs used concurrently in the Foveaux Strait. Cameras were also placed inside the pots to observe blue cod behaviour during the experiment.

Life on the fringe: choosing spatially explicit conservation actions for coastal ecosystems

Ms Debbie Chamberlain[1], Professor Hugh Possingham[1], Professor Stuart Phinn[1]

[1]*University of Queensland, Brisbane, Australia*

We use a structured decision-making approach to determine suitable development and management options to safeguard a productive near shore fishery whilst accommodating climate change and the associated human responses. Within-realm (either for the land or the sea) spatial action planning to maximize biodiversity benefits has been widely studied, but little investigation has been made into three essential facets of integrated planning:

1. The land/sea interface, estuaries and near-shore marine systems;

a) Ecological processes e.g. self purification, delivery of ecosystem services to adjacent environs, and how they are affected by climate change;

b) Direct impact of climate change on interconnected realms.

Systematic conservation prioritization rarely explicitly accounts for connectivity. In the design of marine protected areas it is essential to incorporate both the influence of connectivity and climate change, and equally the effect of climate change on connectivity. We are developing a strategy for conservation action involving three integrated processes - reserve network expansion, zoning (i.e. land/seascape-use) and environmental impact avoidance. We use the Zonation framework and apply our plan to the Mackay Whitsunday NRM Region of North Queensland. We obtained data on fishing and included socio-economic costs. With the use of a distribution model in Maxent, remote sensing and prioritization tools we can incorporate threats in conservation planning thereby achieving a more efficient planning program.

Revealing hidden evolutionary capacity to cope with global change

Mr Evatt Chirgwin[1], Dr Keyne Monro[1], Dr Carla M. Sgro, Dr Dustin J. Marshall

[1]*Monash University, Melbourne, Australia*

The long-term persistence of populations under climate change will depend on their evolutionary capacity to adapt to future conditions. Such capacity is contingent on standing levels of genetic variance for traits under selection. Although a growing number of studies have estimated those levels under predicted climate change scenarios, few have considered multiple environments simultaneously and even fewer have considered evolutionary potential in a multivariate context. It is important to do so, however, because genetic correlations across environments can speed or retard rates of adaptation, and the multivariate structure of genetic variance across a population's environmental range will often be more informative than genetic variances and bivariate correlations in isolation. Here, we assessed the capacity of the larval stage of *Galeolaria caespitosa*, an important habitat-forming tubeworm of southeast Australia, to adapt to multiple levels of thermal stress. Specifically, we used a quantitative genetic breeding design to assess the larval survival of over 30 000 embryos from 204 families replicated across three temperatures that represent the mean to maximum temperature naturally experienced by our study population. We found that a multivariate analytic approach revealed adaptive genetic variance that was undetectable through simpler univariate and bivariate approaches and, as such, provided a more accurate assessment of the capacity of our study population to adapt to future climate change.

Mean velocity decomposition and vertical eddy diffusivity of the Pacific Ocean from surface GDP drifters and 1000-m Argo floats

Dr Stephen Chiswell[1]

National Institute of Water and Atmospheric Research, P.O. Box 14 901, Wellington, New Zealand

With the relatively recent development of Global Drifter Program (GDP) drifters that measure the near-surface ocean velocity, and Argo floats that can be used to derive both the intermediate (1000-m) ocean velocity and the mean dynamic height of the surface relative to 1000 dbar, there now exists the opportunity to directly observe the mean velocity decomposition of the ocean. Here we compute the mean Ekman velocity by subtracting the mean referenced velocity derived from Argo data, from the mean surface velocity derived from GDP data. This Ekman velocity is slightly stronger than previous observations, and shows a spatial structure consistent with a vertical eddy diffusivity that is linearly dependent on wind stress. In order to do this analysis, we have to deal with the fact that GDP drifters often lose their drogues, and a product of this research is validation of the wind slip correction applied to GDP drifters that have lost their drogues.

Using research seismic surveys to increase knowledge of marine mammals presence in New Zealand waters

Ms Joana Cid Torres[1]

[1]*Gardline Environmental (New Zealand) Limited, Wellington, New Zealand*

Between the 31st January and 21st March 2016, a geophysical and geological research survey was conducted in the Chatham Rise, New Zealand. During this survey a team of two Marine Mammal Observers conducted visual observations during daylight hours for marine mammals and two Passive Acoustic Monitoring System Operators conducted 24 hour acoustic monitoring. Literature shows that 25 species of cetacean use the waters around Chatham Rise as both a general feeding area and migratory corridor, with the New Zealand fur seal (*Arctocephalus forsteri*) being the only species of pinniped regularly recorded. The living sightings data for the area is pretty scarce with the Department of Conservation (DOC) sightings database showing the presence of six different species whilst the strandings database has recorded 19 species. The majority of these are recognised as a Species of Concern by DOC, therefore any additional information collected on their distribution will be beneficial for conservation efforts. During the survey there were a total of 46 sightings and seven acoustic detections, with eight different species recorded. These included bottlenose dolphin (*Tursiops truncates*), common dolphin (*Delphinus spp.*), false killer whale (*Pseudorca crassidens*), killer whale (*Orcinus orca*), long-finned pilot whale (*Globicephala melas*), New Zealand fur seal (*Arctocephalus forsteri*), sperm whale (*Physeter macrocephulus*) and dusky dolphin (*Lagenorhynchus obscurus*). The sighting of the false killer whale is only the second known live record within the waters around Chatham Rise. These sightings increase the number of cetaceans recorded in the Chatham Rise significantly and allow for a clearer knowledge of their distribution patterns.

The Introduction of International Accredited Standards for PAM Equipment and Operators is Overdue

Joana Cid Torres[2], Mr Randal Counihan[1], Ms Breanna Evans[2]

[1]Gardline Environmental New Zealand Ltd., Wellington, New Zealand, [2]Gardline Environmental Ltd., Great Yarmouth, United Kingdom

There are currently no accredited standards to which Passive Acoustic Monitoring (PAM) systems must conform. Various groups, including the IAGC and NOAA have made recommendations and memos, though none are binding and the level of technical detail is very low. Existing guidelines and regulations focus on how PAM should be applied and not what is required as suitable equipment. PAM manufacturers strive to produce quality equipment but there is no guide available that indicates a baseline level quality that must be achieved. In 2013 DOC New Zealand was the first and only body to implement an accredited standard of training for PAM operators. Most training courses are run by PAM equipment manufacturers or operator suppliers. However, many of these courses focus on the PAMGuard software and teach little of the technology background and its use in the field. Despite the courses available there is no necessity to take part in one before someone works as an Operator outside New Zealand. Anyone with experience of PAM in the field will attest to the huge differences in ability between relatively similar systems or between operators and their training levels. A combined international standard to cover both aspects of PAM needs to be created to achieve consistent and comparable implementation of guidelines and data collection. There has recently been a push to create a standard and in this presentation I will discuss some of the progress made as well as other proposed suggestions, and how these would benefit both the operators and industry.

Assessing cumulative impact in Tauranga Harbour - validation and limitations of a cumulative impact model

Ms Dana Clark[1], Mr Eric Goodwin[1], Mr Jim Sinner[1], Dr Joanne Ellis[1], Mr Gerald Singh[2]

[1]Cawthron Institute, Nelson, New Zealand, [2]University of British Colombia, Vancouver, Canada

The shift towards more comprehensive marine management (e.g. marine spatial planning and ecosystem based management) requires consideration of the spatial patterns of the cumulative impacts of human activities on ecosystems. Halpern et al. (2008) developed a model to quantify cumulative impact and several studies have used this approach. However, none of these studies ground-truthed the model outputs, so does it reflect reality? We used Halpern's approach to map and quantify the combined impact of multiple stressors on Tauranga Harbour. The impact of eight stressors on seven ecosystems was assessed at a 100 m resolution, using New Zealand-specific expert judgement on the vulnerability of different ecosystems to each stressor. Estimated cumulative impact tended to be highest in the southern basin and inner estuaries, corresponding with sensitive ecosystems and multiple stressors and reflecting what is known about the distribution of pressures in Tauranga Harbour. However, when we ground-truthed the model, only a weak relationship was found between the estimated cumulative impact and measured ecological condition. Substitution of a more realistic sediment layer improved model outputs, highlighting the importance of accurate input data, particularly for stressors or ecosystems with high impact weights. Different standardisation methods did not greatly affect the spatial distribution of cumulative impact patterns in the harbour. The study highlights some fundamental issues for consideration when using this cumulative impact mapping approach such as the importance of involving the expert panel throughout the course of the study and the availability and quality of the data used to construct the model.

Orange roughy fisheries in international waters: challenges for low information stocks in the Tasman Sea and western Pacific Ocean

Dr Malcolm Clark[1], Dr Marie-Julie Roux[1], Mr Peter McMillan[1], Mr Owen Anderson[1], Dr Ian Doonan[1], Dr Charles Edwards[1]

[1]NIWA, Wellington, New Zealand

Orange roughy has been fished by New Zealand and Australia since the late 1980s outside the New Zealand EEZ, on the Lord Howe Rise, Challenger Plateau, West Norfolk Ridge, and Louisville Seamount Chain. For many years, the fishery was unregulated, but it is now under the control of the South Pacific Regional Fisheries Management Organisation (SPRFMO). Stock assessment has always been problematic for these fisheries, with no fishery-independent surveys, and variable catch and effort levels over time and space limiting the effectiveness of CPUE analyses. In addition, the stock structure of orange roughy outside the EEZ is uncertain, and in a number of areas has been assumed solely on the distribution of fishing effort. However, recent work has been undertaken to revisit stock structure information, as well as to investigate the utility of spatial CPUE analyses and cohort-aggregated biomass dynamics models, in order to progress evaluation of the stock status of orange roughy in the SPRFMO Area. Stock structure analyses reviewed all available catch and biological information. No individual data set provided a complete result, but in combination supported the retention of existing assessment boundaries for fisheries in the Tasman Sea, and revised boundaries on Louisville. A spatial CPUE approach provided improved indices of abundance for several fishing areas, and coped with bias arising from non-random temporal changes in spatial effort distribution. A Bayesian state-space biomass dynamics model, fitted to catch series and spatial CPUE indices, provided new estimates of initial biomass, population growth rate and current stock status.

Balancing exploitation and environmental sustainability: how can science support the management of deep-sea mining in New Zealand?

Dr Malcolm Clark[1], Dr Geoffroy Lamarche[1], Dr Ashley Rowden[1], Dr Alison MacDiarmid[1], Dr Alison Swaddling[2]

[1]NIWA, Wellington, New Zealand, [2]SPC (Pacific Community), Suva, Fiji

There is growing interest in offshore minerals exploration around New Zealand, and more widely in the Southwest Pacific region. In recent years there has been exploration off New Zealand for ironsands, phosphorite nodules, and seafloor massive sulphides (SMS). In addition, SMS exploration is developing off Tonga and the Solomon Islands, and is well advanced in Papua New Guinea. Cobalt-rich crust and manganese nodule resources also occur in the region. However, a major challenge currently facing management agencies is how to facilitate development of potential mining operations while ensuring that environmental integrity is not compromised. In this presentation we review the scientific requirements to support environmental management, especially the need for baseline information, robust monitoring, and precautionary conservation measures. We describe a range of recent studies to advance these management aspects within a New Zealand and Southwest Pacific context, including the development of ecological risk assessment, guidelines for environmental impact assessment (EIA), a generic scientific research plan for studies that should be carried out during exploration surveys to underpin EIAs, and the application of predictive habitat modelling and spatial management planning tools in a mining context. Recent applications for mining licences in New Zealand for ironsands and phosphorite nodules have been unsuccessful, and we discuss some key lessons learnt from these case studies that can help scientific efforts to improve environmental management of mineral resources in the deep sea.

Do stable isotope ratios of seagrass reflect extreme weather events in an urbanised estuary?

Ms Amanda Clarke[1], Dr Troy Gaston[1], Associate Professor Natalie Moltschaniwskyj[2], Dr Tim Glasby[2], Dr Louise McKenzie[3]

[1]University Of Newcastle, Ourimbah, Australia, [2]NSW Dept. of Primary Industries, Taylors Beach, Australia, [3]Hunter Water Corporation, Newcastle, Australia

Seagrasses, together with their epiphytic algae counterparts, offer a range of services to the estuarine environment. However, the increasing pressure placed on estuaries due to urbanisation and population expansion has resulted in the decline of seagrass meadow coverage in many coastal estuaries. During extreme weather events, catchment derived nutrients can cause nutrient enrichment in estuaries, resulting in algal blooms, water quality reduction and loss of seagrass cover. Stable isotope analysis is an effective tool for identifying nutrient sources and energy flows in estuarine ecosystems, and can also be used to indicate trophic position in foodweb dynamics. This study used stable isotope analysis to determine the spatial and temporal variability of nutrient sources in an urbanised estuary on the NSW coastline. Samples of *Zostera capricornii* and epiphytic algae were collected from 22 sites in Lake Macquarie between January and April 2015 following consistent rainfall that culminated in an extreme weather event, resulting in large amounts of stormwater and wastewater effluent being discharged into Lake Macquarie. Evidence obtained from these samples indicated a wide range of $\delta^{15}N$ and $\delta^{13}C$ values within the lake, suggesting multiple nutrient sources. Spatial modelling revealed untreated sewage $\delta^{15}N$ values in epiphytic algae and seagrass and treated wastewater reuse entering the system. These results indicate that Lake Macquarie is a highly dynamic system and the effective management of wastewater and effluent inputs to the lake ecosystem is essential to maintain a productive and healthy ecosystem.

First comprehensive report on the marine macroalgal flora of the Romblon Island Group (RIG), Central Philippines including diversity and community analysis

Mr Ken Joseph Clemente[1], Dr. Susana Baldia[1], Dr. Paciente Jr. Cordero[1]

[1]University of Santo Tomas, Manila, Philippines

Marine macroalgae are considered as ecologically and biologically important component of marine ecosystems. Diversity studies on these organisms became mainstream in Philippine phycology for the past decades. However, a comprehensively accounted biodiversity data for most of the Philippine islands, including the Romblon Island Group (RIG), has remained to be largely unexplored. The present study, delving with the identification and classification of the marine macroalgal species collected from the islands of the RIG including their local distribution and seasonal occurrence, is designed to address the anemic biodiversity issue. Sample collections were conducte from 20 intertidal sites. A total of 129 macroalgal taxa are herein reported, encompassing 48 Chlorophyceae, 56 Rhodophyceae, 25 Phaeophyceae. Ecological community studies include assessment of biomass, community indices, importance value, and functional-form groups. Product of these analyses revealed Tablas Island as having the richest macroalgal community structure in terms of biomass (revealed significant difference with that of Romblon and Sibuyan at $P<0.05$ and $\alpha=0.05$), various diversity indices, and functional form groups. Albeit Romblon and Sibuyan islands also exhibit community structures as significant in the light of floristic and conservation viewpoint in the same nature with Tablas island. Moreover, DELTA software was also employed to provide an interactive taxonomic database for the common and economic seaweeds found in the RIG. This study is deemed to be a significant addition to the seaweed flora of Central Philippines and likewise broaden the previously known phytogeographic distribution of Philippine seaweeds.

Threat management plans for protected species work

Dr Laura Boren[1], Dr Erin Breen[2], **Mrs Katie Clemens-Seely**[1], Dr Rohan Currey[2], Dr Igor Debski[1], Ms Hannah Hendriks[1], Mr Greg Lydon[2], Dr Nathan Walker[2]

[1]Department Of Conservation, Wellington , New Zealand , [2]Ministry for Primary Industries, Wellington , New Zealand

The Department of Conservation is responsible for managing New Zealand's protected species. The conservation of threatened terrestrial species is typically implemented through Species Recovery Groups and associated Species Recovery Plans. Due to the unique nature of the marine environment, a different approach is needed to manage marine species. In 2006, the Department of Conservation and the then Ministry of Fisheries began working together on the first joint-agency Threat Management Plan (TMP), to guide the recovery of Hector's and Māui dolphins. Since the implementation of the plan in 2008, the Māui dolphin portion underwent a review in 2012-2013. In 2014, Ministers requested DOC and the Ministry for Primary Industries develop a TMP for the New Zealand sea lion. The TMP is a non-statutory management plan that identifies and assesses all potential threats to populations, and outlines and prioritises strategies utilising education, monitoring, mitigation and engagement to address those threats. The process of developing a TMP involves extensive information gathering and a risk assessment process, which informs the potential management measures. The process has evolved since its first application, with improved knowledge and risk assessment tools. The joint-agency approach encourages collaboration within government and with stakeholders to ensure the plans are robust. Here we describe the TMP process and how that process has evolved since 2006. We discuss how it contributes to science and conservation of New Zealand marine mammals using threat assessment and collaboration.

Gray's beaked whale population genetics, dispersal and social structure

Dr Rochelle Constantine[1], Selina Patel[1], Kirsten Thompson[1,2], Prof. C. Scott Baker[1,3], Anton van Helden[4], Dr Anna Santure[1], Assoc. Prof. Craig Millar[1]

[1]School of Biological Sciences, University of Auckland, Auckland, New Zealand, Auckland, New Zealand, [2]College of Life & Environmental Sciences, University of Exeter, Exeter, UK, Exeter, UK, [3]Marine Mammal Institute, Oregon State University, Oregon, USA, , USA, [4]20 Clunie Rd, Raumati South, New Zealand, Raumati South, New Zealand

Understanding the population biology and distribution of open-ocean, deep-water species provides challenges for conservation biologists and managers particularly when assessing anthropogenic threats. We took a novel approach by using data and samples from strandings to study the Gray's beaked whale; a species rarely seen alive yet is the second most commonly stranded whale in New Zealand. Using DNA we determined the population structure of Gray's beaked whales by analysing 530bp of mitochondrial control region and 12 microsatellite loci from 94 individuals stranded over a 22-year period around New Zealand and Australia. We found high genetic diversity (h=0.933–0.987, π=0.763–0.996% and Rs=4.22–4.37, He=0.624–0.675), and, surprisingly for cetaceans, a complete lack of genetic structure in maternally and biparentally inherited markers. The diversity of deep-water habitat with no apparent geographic boundaries to distribution has resulted in genetic homogeneity in the species. We found high estimates of female effective population size based on mitochondrial data indicating a large population size throughout New Zealand and Australia. Analysis of kinship among 56 individuals from 19 group-strandings using 16 microsatellite loci found that none of the adults stranded together were related, consistent with post-weaning dispersal by both sexes and dynamic group formation. The high levels of genetic diversity over a large area, combined with no known exploitation mean the Gray's beaked whale faces no immediate conservation threats. This study shows the value of a citizen science and multi-agency approach to collection of samples from stranding events over many years to understand rarely sighted species.

A comparison of denitrification capacity between two South Island eutrophic lagoons

Josie Crawshaw[1], Dr Marc Schallenberg[2], Dr Candida Savage[1], Dr Robert Van-Hale[3]

[1]Department of Marine Science, University of Otago, Dunedin, New Zealand, [2]Department of Zoology, University of Otago, Dunedin, New Zealand, [3]Department of Chemistry, University of Otago, Dunedin, New Zealand

Nitrate loads from dairying are fuelling phytoplankton growth in many coastal lagoon ecosystems. Denitrification may remove a substantial proportion of the nitrate load, reducing internal nitrate cycling and the eutrophication potential of this load. *In situ* denitrification measurements were made using flexible chambers and a labelled tracer ($K^{15}NO_3$) in two eutrophic coastal lagoons: Lake Ellesmere (Canterbury, Area = 189 km^2) and lower Tomahawk Lagoon (Otago, Area = 0.19 km^2). Denitrification was spatially variable, but showed similar ranges in both lagoons. Denitrification rates in Tomahawk Lagoon were highest in sediment with smaller grain sizes (high silt and clay %), higher organic matter and water content, lower redox potential and higher infaunal densities. Denitrification in Lake Ellesmere was positively correlated only with sediment organic matter content. Water column nitrate removal rates were high in Lake Ellesmere due to a large phytoplankton biomass which could assimilate up to 2mg/L nitrate within 24-30 hours. By comparison, biological nitrate uptake was slower in Tomahawk Lagoon with nitrate still remaining (34 μM) after 48 hours, and denitrification rates showing no sign of nitrate limitation. Benthic denitrification capacity is similar between the lagoons, however competition with phytoplankton for nitrate may be a limiting factor of this ecosystem service, especially at Lake Ellesmere. While denser phytoplankton communities in more eutrophic lagoons can compete for nitrate, decreasing the amount of nitrate available for denitrification, the longer-term capacity for removal of internally recycled nitrogen re-mineralized from the deposition of inorganic nitrogen to the sediment remains to be quantified.

Seawalls modify wrack dynamics in mangrove forests

Mr Lincoln Critchley[1], Dr. Melanie Bishop[1]

[1]Macquarie University, North Ryde, Australia

Seawalls are an increasingly common feature of developed coastlines. In addition to their intended impact on shoreline stabilisation, they can have large unintended ecological impacts. Subsidies of wrack (decomposing macrophytes) between land and sea can be important in shaping communities and ecosystems by providing food and habitat. This study addressed impacts of seawalls on wrack subsidies by comparing the supply, retention, and decomposition of wrack between pairs of adjacent armoured and unarmoured mangrove forests. Surveys revealed that mangrove forests were typically narrower at armoured than unarmoured locations, due to the loss of the high intertidal zone in the former. Consequently, in armoured mangrove forests, the area across which wrack could accumulate was less, resulting in greater cover of wrack at equivalent mid-tidal elevations of armoured than unarmoured shorelines. The greater cover of wrack on armoured shorelines was despite their lower rates of wrack retention than unarmoured shorelines in experiments tracking wrack movement. In many instances, armoured shorelines had a greater cover of terrestrially derived wrack than unarmoured shorelines, presumably because of greater proximity of terrestrial vegetation to the mid intertidal zone. In litter bag experiments, terrestrially derived *Casuarina* were more resistant to decomposition than mangrove leaves, but when present with mangrove leaves accelerated the rate at which the mangrove litter decomposed. Overall these results suggest that wrack accumulation, retention, and decomposition are all influenced by seawalls, with potentially large flow-on effects to dependent fauna. Hence, the modification of wrack subsidies by seawalls should be considered when developing environmentally friendly alternatives.

Thirty years in New Zealand fisheries: can old dogs learn new tricks?

Dr Martin Cryer[1]

[1]*MPI, Wellington, New Zealand*

In 1986, New Zealand introduced its radical new quota management system (QMS) for many key fisheries. 30 years later, an enlarged QMS remains the cornerstone of New Zealand fisheries management. Despite solid evidence of good performance on stock management, however, some condemn the system's single-species focus and claim this precludes it from being part of an ecosystem approach. Further, they claim the QMS does not even address important collateral impacts on protected species, seabed communities, marine biodiversity, and sensitive or important habitats. Coincidentally, this is also my 30th year in New Zealand fisheries and this long, sometimes perplexing, experience leads me to believe that the QMS can, and maybe must, remain a key component of our ecosystem approach. I will show how a ground-breaking risk assessment system can assess the extent to which the various effects of fishing are within agreed or widely-accepted norms or limits (and what to do when such limits are not available). I will also show how the "single species" focus of our risk assessments provides powerful tactical tools for fisheries managers to build wider, multi-species sustainability into their stock-focussed management. Finally, I will explore what we need to move further along the continuum of ecosystem approaches to incorporate ecological interactions, cumulative impacts, climate variability, and the full richness of human values and behaviour. Scary though it may be, I believe this means progressively adding to the fish-accounting and people-management we already do, and starting an intrepid adventure in complex social-ecological systems.

USVs for science and surveillance - consideration of laws and legislation

Dr Robert Dane[1], Prof Stuart Kaye[2], Dr Anthony Morrison[2]

[1]*Ocius Technology Ltd* , [2]*University of Wollongong*

There is increasing interest in the use of Unmanned Surface Vessels (USVs) in a variety of applications on the world's oceans. As USVs are developed and are operated at sea, a variety of legal issues are brought into sharp relief. The regulation of ships in international law is provided for in national legislation, underpinned by a complex collection of international treaties and other instruments, managed under the auspices of the International Maritime Organization (IMO). The international instruments and national legislation all proceed from the assumption that a vessel operating on the high seas would possess a crew in order to navigate safely. As such, international law, and the domestic regulation based upon it, is presently ill-equipped to provide for the safe navigation of USVs. This paper will look closely at the USVs being designed and built for Australian waters and applicable regulation of shipping that might be applied to USVs in the context of the Navigation Act 2012 (Cth) in Australia, and examine what the legal requirements might demand of such a vessel, and where legislation might need to change to permit the operation of such a vessel. The paper is intended to be part of engaging with regulators in Australia and at the IMO, as part of the increasing consideration of the operation of USVs at sea.

Beyond a name… the case of *Callophyllis ornata* from Auckland Island

Dr Roberta D'Archino[1], Dr. Wendy Nelson[1,2], Dr Joe Zuccarello[3]

[1]*National Institute of Water and Atmospheric Research, Wellington , New Zealand,* [2]*School of Biological Sciences, University of Auckland, Auckland, New Zealand,* [3]*School of Biological Sciences, Victoria University of Wellington, Wellington, New Zealand*

The seaweeds of New Zealand have always challenged taxonomists. Part of the problem is that we have used concepts and names of algae from other parts of the world. Also 'New Zealand' *sensu lato* is a diverse geographic region which includes the subantarctic islands and subtropical waters. Over the years we have realised that the algae, especially the 'bladed' red algae, of New Zealand are more diverse and more unique than we ever could have imagined. The story of the red alga called *Callophyllis ornata* is an example of this. Although it has been collected only rarely from its type locality, the Auckland Islands, numerous specimens have been referred to this species. The samples assigned to *Callophyllis ornata* have a wide range of morphologies, and while this is not unusual in some red algae, it does raise the possibility that they are not the same species. Morphological examination of the holotype from the Auckland Islands, plus specimens from other locations, held at the herbarium at Te Papa, revealed that '*Callophyllis ornata*' consists of probably several undescribed species. *C. ornata* is just one of several species from the subantarctic islands that require further studies that will not progress without new collections to provide more information about species' morphology and reproduction.

Indigenous communities driving research and onground conservation efforts of endangered euryhaline Elasmobranchs in Northern Australia

Ms Christy-Louise Davies[1], Dr Peter Kyne[2]

[1]*North Australian Indigenous Land And Sea Management Alliance Ltd, Darwin, Australia,* [2]*Research Institute for the Environment and Livelihoods Charles Darwin University, Darwin, Australia*

Northern Australia is of national importance to threatened sawfishes, and for some species including the Largetooth Sawfish (*Pristis pristis*) the region is one of the last remaining global strongholds. Indigenous land and sea managers are responsible for vast areas of country across the region and undertake a range of management activities to protect and maintain the natural and cultural values of their Indigenous estates. It is essential that research and conservation efforts focus on these traditional estates, recognising and integrating traditional knowledge and values with western scientific knowledge and management approaches. The Malak Malak Rangers from the Daly River region of the Northern Territory learnt about the global and national plight of the Critically Endangered (IUCN) Largetooth Sawfish whilst collaborating with researchers. The community held knowledge about young sawfish on their country, including that sometimes these became trapped in ephemeral off-channel billabongs. When a number of individuals were detected in a rapidly shrinking waterhole a rescue mission was undertaken with traditional owners, rangers and scientists working to return the juveniles to the main river channel, where they stood a far greater chance to mature and eventually reproduce. This act of teamwork triggered the development of a collaborative research project focussing on genuine partnerships with three Indigenous communities to build a more holistic understanding of the sawfish story, and ultimately improve management outcomes for this (and potentially other) species.

Predicting the impact of sea level rise on seagrass distributions

Mr Tom Davis[1], Dr David Harasti[2], Professor Stephen Smith[1], Dr Brendan Kelaher[1]

[1]Southern Cross University, Coffs Harbour, Australia, [2]NSW Department of Primary Industries, Nelson Bay, Australia

Climate change induced sea level rise will affect shallow estuarine habitats, such as seagrasses, which are already under threat from anthropogenic impacts. Here, we demonstrate that species distribution modelling can be used to investigate the impacts of climate change induced sea level rises, and changes in turbidity, on distributions of two seagrass species (*Posidonia australis*, and *Zostera muelleri* subsp. *capricorni*) using 5 estuaries from NSW, Australia. Models were developed based on species requirements for photosynthetically-available radiation, taking into consideration water depth and turbidity, and were constructed using seagrass data from Port Stephens. The resulting models were tested using independent datasets from 4 other NSW estuarine embayments, and then used to investigate the effects of future increases in water depth and turbidity on seagrass distributions. The study identified that sea level rise and increased turbidity would lead to substantial seagrass losses in deeper estuarine areas, resulting in a net shoreward movement of seagrass beds. Shallow turbid embayments were found to be especially vulnerable to increases in water depth and turbidity, while shallow estuaries with low turbidity were relatively unaffected. Current and forecasted future seagrass distribution models provide a valuable tool to managers and conservation planners because they allow identification of areas for protection, monitoring and rehabilitation of seagrass

Amphibola crenata as a bioindicator of contaminants in New Zealand estuaries

Mr Nuwan De Silva[1], Professor Islay Marsden[2], Dr. Sally Gaw[3]

[1]School of Biological Sciences, University of Canterbury, Christchurch, New Zealand, [2]School of Biological Sciences, University of Canterbury, Christchurch, New Zealand, [3]Department of Chemistry, University of Canterbury, Christchurch, New Zealand

Many urbanised estuaries are subjected to high concentrations of trace metals and nutrients. These elements can adversely affect estuarine organisms resulting in chemical and physiological changes at the organism level. The endemic pulmonate gastropod, *Amphibola crenata* is widespread throughout New Zealand and is proposed as a potential indicator of environmental conditions in estuaries. This research project is assessing *A. crenata* as a biomonitor of environmental health of estuarine ecosystems in New Zealand. The responses of the mud snail to trace metal contamination using multiple biomarkers (e.g. biochemical, physiological, and behavioural) is being investigated using field and laboratory based studies. The acute physiological and biochemical responses of mud snail to cadmium (Cd) were determined over 48 hours. The median lethal Cd concentration (LC_{50}) was 41. 8 mgL^{-1}. The Cd concentration varied with tissue type and exposure concentration, indicating that the mud snail is suitable as a metal bioindicator for aquatic trace metal contamination. Population parameters of *A. crenata* were measured as bioindicators of environmental conditions from nine different South Island sites with varying contaminant concentrations.

15N alanine trophic enrichment in protistan and metazoan consumers: widespread contribution of heterotrophic protists to pelagic food-webs

Dr Moira Decima[1], Dr Michael R. Landry[2], Dr Christina J. Bradley[3], Dr Marylin Fogel[3]

[1]National Institute of Water and Atmospheric Research ,Hataitait, New Zealand, [2]Scripps Institution of Oceanography, UCSD, La Jolla, U.S.A., [3]University of California, Merced, U.S.A.

Secondary production in the ocean is dominated by microzooplankton (protist-dominated consumers <200 µm), which can comprise a major food source for mesozooplankton (larger metazoan zooplankton) or a remineralization dead end. The extent to which primary production consumed by microzooplankton is transferred to mesozooplankton influences the efficiency of material flow up the food chain, and the biologically-mediated export of carbon to depth. This important energetic pathway has been historically hard to quantify and virtually invisible to most oceanographic measurements. In this study we conducted 6 chemostat experiments to investigate the isotopic enrichment of a different trophic amino acid, alanine (*ala*), as a tracer of protistan trophic steps, using compound-specific isotope analyses of amino acids. We aimed to develop an index that could track the contribution of microzooplankton to the broader pelagic food-web via the mesozooplankton, since glutamic acid (*glu*) only becomes isotopically enriched in metazoan consumers, blinding traditional food-web studies to protistan trophic pathways. Our laboratory results confirm enrichment in *ala* but negligible or absent in *glu* in protistan grazers, and the transmission of this signal up the food-chain to mesozooplankton feeding on protistan grazers. Finally, we conducted a re-analyses of published data and found that zooplankton from the North Pacific Subtropical Gyre, California Current and Antarctic all have diets that rely substantially on phagotrophic protists, and none were exclusively herbivorous. Our newly developed index holds promise for investigating lower food-web flows, particularly in different New Zealand water masses in which energy fluxes and material cycling are poorly constrained.

Zooplankton abundance and distribution patterns between New Zealand and the Ross Sea: what the Continuous Plankton Recorder can tell us and the value of long-term time series

Dr Moira Decima[1], Karen Robinson[1], Dr Matt Pinkerton[1], Rob Stewart[1]

[1]*National Institute of Water and Atmospheric Research, Hataitait, New Zealand*

Plankton plays a key role in marine ecosystem function and biogeochemical cycling, represent the first level of integration of hydrodynamic forcing on the open-ocean food-web, and can display specific associations with defined water masses. These characteristics make them excellent indicators of large-scale climate driven ecosystem change. However, detecting the effect of climate change on marine systems requires sampling over large spatial and temporal scales, which can only be done by maintaining long-term time series. The Continuous Plankton Recorder (CPR) method of sampling provides a cost-effective, scientifically-rigorous way of measuring zooplankton biodiversity, abundance and distribution over large ocean areas and extended time periods. The New Zealand CPR time-series was established in 2008 as part of the larger Southern Ocean CPR (SO-CPR) survey, and samples a transect from New Zealand to the Ross Sea every year during the austral summer. While the data to date is too sparse to disentangle patchiness and variability from longer-term trends, some patterns are emerging. Preliminary results indicate significant differences between the Ross Sea and the East Antarctic region, an area extensively surveyed by SO-CPR since 1991. These differences include higher zooplankton and chlorophyll *a* abundances in the Ross Sea. In addition, zooplankton abundance also appears to be associated with oceanic fronts. These results show the value of maintaining long-term time-series and the need for multiple years of data collection to be able to detect multi-decadal trends associated with climate change.

Effect of simulated ocean acidification on microbial assemblages in coastal sediment

Ms Cintya Del Rio[1], Dr Charles K. Lee[2], Dr Craig Cary[2], Dr Kay Vopel[1]

[1]*Auckland University Of Technology, Auckland, New Zealand,* [2]*The University of Waikato, Hamilton, New Zealand*

The ocean's pH has decreased by 0.1 units in the last two centuries and it is predicted that it will continue to decrease by 0.3 units during the next century. Acidification of the coastal seawater column, a result of increased concentration of atmospheric carbon dioxide and greater mineralisation of land-derived and in-situ produced organic matter, may alter environmental conditions in the surface layer of its sediment and thus the structure and function of the extant microbial assemblage. Knowledge of such cause-and-effect relationship is important because this assemblage drives the mineralisation of organic carbon, nitrogen, and phosphorus, the resulting sediment–seawater solute exchange, and to a large part the productivity of the seawater column. We conducted a controlled laboratory experiment with intact cores of soft, subtidal sediment to investigate if and how the sediment porewater environment and its microbial assemblage change in response to a gradual (days) acidification of the sediment-overlying seawater. We found that acidification enhanced photosynthesis and respiration of benthic diatoms but the structure of the assemblage of bacteria and archaea remained unchanged despite evidence for a decrease in the porewater pH at the depth of the oxic–anoxic boundary. Proliferation of benthic diatoms introduced extreme light/dark variations in the oxygenation and pH of the sediment porewater similar to those known for mat-forming microbial assemblages. We will discuss challenges associated with this type of research and how our solutions can inform and improve future experiments

Crawling to connectivity: a whelk's direct-developing journey

Ms Melanie Dohner[1], Dr Nicole Phillips[1], Dr Peter Ritchie[1]

[1]*School of Biological Sciences, Victoria University Of Wellington, Wellington, New Zealand*

While genetic connectivity does not ensure demographic connectivity, patterns of gene flow can reflect the dispersal power of a species. A recent genetic study of New Zealand's endemic direct-developing whelk *Cominella maculosa* identified a genetic break along the Wairarapa coast over a short geographic distance (<150 km). Primarily, this study investigated if the genetic differentiation was a sampling artefact or evidence of a barrier to dispersal. Secondarily, the viability of hatchling drift as a dispersal mechanism for gene flow was examined. Mitochondrial COI genes were analyzed from 324 whelks collected at seven sites along 125 km of Wairarapa shoreline. No significant level of genetic isolation-by-distance and no haplotypic break was observed. Instead, two sites in the middle of the region form a contact area where the dominant northern and southern haplotypes coexist. To investigate drift dispersal, three experimental trials were conducted with hatchlings obtained from field-collected egg capsules. When subjected to wave forces, or deposited directly in flow, hatchlings remained suspended and were carried a short distance. However, hatchlings circulated in currents and left for a longer period (12 hours) were rarely found drifting after this period. These trials indicate that wave dislodgement and local flow regime may result in small-scale displacement of hatchlings, but long-distance dispersal by drift is unlikely. This study supports the assumption that crawling is the dominant dispersal mechanism for *C. maculosa*. Crawling between sites probably best explains the genetic connectivity along the Wairarapa, but this dispersal mechanism likely limits demographic connectivity among sites.

Sedimentary environment influences estuarine ecosystem function response to nutrient enrichment.

Ms Emily Douglas[1], Professor Conrad Pilditch[1], Dr Candida Savage[2], Professor Louis Schipper[1], Professor Simon Thrush[3]

[1]*University of Waikato, Hamilton, New Zealand,* [2]*University of Otago, Dunedin, New Zealand,* [3]*University of Auckland, Auckland, New Zealand*

As coastal catchment land use intensifies, estuaries receive increased nutrient and sediment loads, resulting in estuarine habitats that are dominated by muddy organic-rich sediments. Increased mud content in sediments has been associated with negative effects on biodiversity and soft-sediment ecosystem functioning, but the corresponding impact on the ecosystem response to nutrient enrichment is unclear. Denitrification and nutrient processing in estuarine soft-sediments represent important ecosystem functions regulating the ability of an ecosystem to remove excess terrestrially derived nitrogen. To test the effect of sedimentary environment on ecosystem resilience to nutrient perturbation, we experimentally enriched the sediment with slow release fertiliser across an intertidal sedimentary gradient (0 - 24 % mud; < 63 μm). Our enrichment treatment successfully elevated pore water ammonium concentrations (0.3-255x ambient). Macrofaunal community structure did not differ significantly with enrichment or mud content, but the density of some key species and species richness was reduced. Most measured ecosystem functions (primary production, community metabolism and nutrient processing) were significantly correlated with sediment mud content, ($r = 0.25$-0.86) but only those functions associated with nutrient processing (Denitrification Enzyme Activity (DEA), gross and net NH_4^+ flux, and NH_4^+ uptake) were affected by enrichment. Significant mud × treatment interactions suggest that sediment type regulates the response of ecosystem function to nutrient perturbation. In particular, DEA was reduced by the enrichment in muddy cohesive sediments, but not in sandy sediments, indicating that the muddying of estuaries may reduce the ecological resilience of these systems to eutrophication.

Measuring ecosystem function in soft-sediments at low tide: method development & implementation

Ms Tarn P. Drylie[1], Professor Conrad A. Pilditch[1], Dr Andrew M. Lohrer[2], Dr Hazel R. Needham[1], Mr Dean R. Sandwell[1]

[1]University Of Waikato, Hamilton, New Zealand, [2]National Institute of Water and Atmospheric Research (NIWA), Hamilton, New Zealand

Studies of intertidal soft-sediment communities overlook the period of emergence when considering the functioning of such ecosystems. This knowledge gap means we know very little about the potential contributions to greenhouse gas emissions and benthic primary production (PP) during emergence. PP occurring in emerged conditions may provide resilience in turbid estuaries when light conditions are reduced during submergence. A repeatable method for measuring the PP of emerged intertidal sediments, as an indicator of ecosystem function, was developed. The net flux of CO_2 across soft sediments was measured using an infra-red gas analyser (IRGA) and paired light and dark chambers, indicating net PP and community metabolism, respectively. Low tide PP was measured in adjacent vegetated (*Zostera muelleri*) and unvegetated soft-sediment habitats at three locations encompassing a turbidity gradient within Kaipara Harbour and compared to values derived at high tide. Differences in productivity between habitats, tidal states and potential changes in turbidity will be discussed.

Interactions between New Zealand seagrass (*Zostera muelleri*), epiphytes and gastropod Grazers

Ms Alison Duncan[1], Dr. Nicole Phillips[1]

[1]Victoria University of Wellington, Wellington, New Zealand

Seagrass (*Zostera muelleri*) is an important and vulnerable coastal habitat that has dynamic interactions with epiphytic algae and grazing invertebrates. These interactions have the potential to alter ecosystem functioning, and may change in areas with high human impact. Epiphytic algae growing directly on seagrass blades can limit light availability to seagrass for photosynthesis. Therefore, small gastropod grazers, such as *Potamopyrgus sp.* and *Notoacmea sp*., which consume these epiphytic algae may play an important role in seagrass response to environmental perturbation. I surveyed seagrass, its epiphytes and associated microgastropods at three sites in Porirua Harbour that differ in tidal movement and anthropogenic inputs. Surveys over January 2015 found significant differences in shoot densities, plant biomass, and blade morphometry and appearance, with generally higher biomass consistently at one site (Elsdon), which is known to have high anthropogenic inputs (e.g. nutrient loading). Preliminary analyses of invertebrate and epiphyte assemblages from January 2016 indicate that, *Potamopyrgus sp.*, a fresh water tolerant mud snail, occurs in greatest densities at Elsdon, yet is virtually absent at Browns Bay where the limpet *Notoacmea sp.* occur in high abundance. Epiphyte cover also differs among sites, with significantly higher loads at Browns Bay than either of the other sites. An improved understanding of how interactions between seagrass and its associated flora and fauna are mediated by anthropogenic inputs may offer insight into how seagrass systems can be better managed in the future.

Validating and using trophic guilds

Dr Matthew Dunn[1], Peter Horn[2], Matt Pinkerton[2]

[1]VUW, Wellington, New Zealand, [2]NIWA, Wellington, New Zealand

Data on the diets of the most abundant 25 deep-water trawl caught fish species on Chatham Rise were collected from about 9,000 stomachs, over 3 years, and a trophic guild structure was estimated. Validation of the guild structure was attempted using trawl survey biomass and fish condition trends, under the hypothesis that if the guild structure was correct, then there would be stronger correlations in these indices within the guilds, than between guilds. We found no support for the estimated guild structure. Assumptions made during the estimation of the trophic guilds did not alter the result. We also found that very few of the species actually ate one another. We conclude from these samples that competition and inter-specific predation were of little importance to this fish assemblage. The deterministic food web links assumed by many ecosystem models, with the aggregation of species into functional groups (trophic guilds), could therefore be misleading, as in the short term at least, trophic relationships between these fishes may have little impact on population dynamics. Ecosystem models may therefore offer little benefit to the tactical management of these fish stocks; the prediction of future fish stock dynamics from stochastic sampling of past recruitments may be a simpler and also better approach.

Management Strategy Evaluation: what it is, what it is not, and what it is good for

Dr Charles T. Edwards[1]

[1]NIWA, Wellington, New Zealand

Management Strategy Evaluation (MSE) was first proposed as a framework within which alternative fisheries management approaches could be compared according their relative merits, in situations for which absolute values of risk and reward cannot be quantified. Evaluations and comparisons require that the annual decision making mechanism (e.g. the means of quota setting) be formally defined. This is an immediate step beyond the consensus-based decision making paradigm, which cannot be made explicit. The evaluation of any decision making strategy usually involves a computer simulation exercise, whereby the strategy is executed within the context of a given fishery model and observation process. This simulation exercise is often complex, opaque to non-scientific stakeholders, and mistakenly referred to as “MSE” – when in fact the simulation is just part of the MSE framework as it was first described. A failure to appreciate the broader context within which simulations should take place, with fisheries scientists themselves often the most at fault, has led to criticism of MSE and inappropriate branding of a range of loosely related simulation exercises. This presentation will attempt to describe the MSE approach fully, how it should be applied, and the benefits of doing so.

Morphology and microstructure of inanga otoliths; building blocks of the whitebait fishery

Eimear Egan[1], Dr Mike Hickford[1], Dr John Quinn[2], Prof. David Schiel[1]

[1]University Of Canterbury, Christchurch, New Zealand, [2]NIWA, Hamilton, New Zealand

In this study we used otolith morphology and microstructure to describe the marine larval population dynamics of one of New Zealand's whitebait species, *Galaxias maculatus.* Otolith morphology has typically been used to characterise aggregations of fish and discriminate between individuals that were spatially or temporally discrete at some stage of their life. The basis for this is that the shape of an otolith is the product of the growth history of an individual. Latitudinal differences in marine environmental conditions and spawning times may result in different growth trajectories. Given the correlative nature of growth, this may ultimately manifest in differences in otolith shape. Whitebait were sampled monthly from three rivers in four regions. Otolith morphology was quantified with Elliptical Fourier harmonics and shape indices. The morphometric variables were used as an exploratory tool to (i) discriminate between populations at regional scales and (ii) characterise within-region variability in individual dispersal patterns. Results were analysed in a multivariate statistical framework. Individual growth profiles were reconstructed using otolith microstructure and calculated larval duration and estimated spawning dates. Our results suggest regional separation of populations of *G. maculatus* and identify complex dispersal histories within regions. Latitudinal differences in growth and larval duration were identified. Furthermore, Golden Bay was identified as an area of high inter-mixing and this is supported by our understanding of the hydrodynamic regime in that area. We discuss our results in the context of meta-population theory, current management of the whitebait fishery and future conservation of this iconic species.

Antarctic Top Predator Research and the Proposed Ross Sea Marine Protected Area

Dr Regina Eisert[1], Dr Ben Sharp[2], Dr Rohan Currey[2]

[1]University Of Canterbury, Christchurch, New Zealand, [2]Ministry of Primary Industries, Wellington, New Zealand

The Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) is the international organisation responsible for conservation and management of fishing activities in the Southern Ocean, including the fishery for Antarctic toothfish (*Dissostichus mawsoni*) in the Ross Sea. New Zealand leads scientific and diplomatic efforts in CCAMLR to ensure wise stewardship and sustainable management of the Ross Sea, and is a leading participant in the Ross Sea fishery for Antarctic toothfish. The NZ Government is working with international partners to establish a large High Seas Marine Protected Area (MPA) in the Ross Sea. At this time, the Ross Sea presents a globally unique and time-sensitive opportunity to study the structure and function of an intact marine ecosystem that retains abundant populations of top predators. Top predators (seals, whales and penguins) serve as ecosystem sentinels by integrating the complex effects of external ecosystem drivers such as fishing and climate change, and may also exert strong internal stabilisation or control on ecosystem structure. Marine mammals such as Weddell seals (*Leptonychotes weddellii*), killer whales (*Orcinus orca*) and sperm whales (*Physeter macrocephalus*) may be affected by a reduction of toothfish availability, or interact with fisheries directly through depredation as is the case elsewhere in the Southern Ocean. Research on top predator ecology represents an effective mechanism for monitoring ecosystem status and impacts of fisheries, and provides objective criteria for the design, establishment, and maintenance of MPAs that gain traction across a wide range of audiences.

In situ assessment of *Ulva australis* as a biomonitoring tool to support management of urbanised/ industrialised metal pollution in estuaries

Daniela Farias[1], Catriona Hurd[1], Carmen Simioni[2], Eder Schmidt[2], Zenilda Bouzon[2], Catriona Macleod[1]

[1]Institute for Marine & Antarctic Studies, Fisheries and Aquaculture Centre,University Of Tasmania, Taroona, Hobart, Australia, [2]Plant Cell Biology Laboratory, Department of Cell Biology, Embryology and Genetics, Federal University of Santa Catarina, Florianopolis, Brasil

Seaweeds have been proven to be valuable as both bioindicators and biomonitoring tools for contaminated systems. They have also been used for bioremediation, particularly for nutrient mitigation in association with aquaculture operations. However, the potential to use seaweeds for mitigation of other contaminants is less clear. In this study we investigated the use of *Ulva australis* for bioremediation in a highly metal polluted estuary (Derwent estuary, Tasmania). *U. australis* is widely distributed throughout the Derwent estuary, including in areas with high levels of metal pollution. In this study we evaluated the *in situ* performance of transplanted *Ulva australis* plants in order to determine their effectiveness as a bioremediation tool. Relative growth rate, levels of photosynthetic pigments (Carotenoids, Chlorophyll *a* and *b*), cytology (Polysaccharides, proteins, starch granules), fluorescence capacity (Pulse amplitude modulate, PAM), ultrastructure (Transmission electron microscopy) and metal concentration (Inductively Coupled Plasma Atomic Emission Spectroscopy, ICP-AES) were evaluated in plants at three study sites, representing unpolluted (control), low level of metal pollution (Transplanted site 1) and high level metal pollution (Transplanted site 2). There were significant differences in metal accumulation in *Ulva* tissue and changes in the ultrastructure, which showed that this "adaptable" species was affected by the metal pollution. However, photosynthetic parameters did not change, suggesting that *Ulva* can acclimate to adverse conditions. Together these findings suggest that *U. australis* would be an effective bioindicator, and useful bioremediation tool, in heavy metal impacted environments such as the Derwent estuary, and should be incorporated in future biomonitoring programs.

Natural Character of the Coastal Environment

Bron Faulkner

[1]Boffa Miskell Ltd

Policy 13 of the New Zealand Coastal Policy Statement (NZCPS) 2010 deals with the Preservation of Natural Character and protecting it from inappropriate subdivision, use and development. The NZCPS lists a range of factors that natural character of the coastal environment may include; these can be grouped into abiotic, biotic and experiential factors. Assessing coastal natural character requires a range of expertise that can encompass terrestrial and marine components of the coastal environment – geomorphologists, marine and terrestrial ecologists, ornithologists, landscape architects and other specialists. Boffa Miskell has developed a robust assessment methodology, and has been involved with others working with the Department of Conservation to refine this methodology. To date, Boffa Miskell has completed natural character assessments of the coastal environment for 12 district/regional councils; these assessments have often involved working with other agencies to contribute marine science expertise including NIWA and the Cawthron Institute. This presentation discusses natural character and outlines the key aspects of Boffa Miskell's assessment methodology.

Aggregative behaviour and social structure in deep-sea Chondrichthyans

Ms Brit Finucci[1], Dr Matthew R. Dunn[1], Dr Emma Jones[2]

[1]Victoria University Of Wellington, Wellington, New Zealand, [2]National Institute of Water and Atmospheric Research, Auckland, Wellington

A wide range of Chondrichthyans are known to form aggregations, associations or groupings. The motivation for these interactions have been attributed to foraging, reproduction, energy conservation, and social preference. Due to the highly mobile nature of sharks, in addition to the difficulty of following individuals in the open sea, most research on social interactions or associations has been limited to temperate, inshore species, with some degree of site fidelity. However, some of the earliest insights into the structure of shark groupings were gained from analysing commercial trawl catches. We evaluate the occurrence of social grouping in a range of common and infrequently caught deep-sea chondrichthyans (6 holocephalans, 10 elasmobranchs), including the estimation of companion preferences across sex and size classes, using a large data set from fisheries-independent research trawl surveys. Only a few species were found to engage in aggregative behaviour, and those that did had companion preferences that varied with sex, and fish density. Group composition changed with depth and density, and for some species, aggregations were repeatedly found in discreet locations. Most often, aggregations consisted largely of juveniles, and mature females were the least likely to form aggregations. However, this pattern was not true of all species. The existence and nature of aggregations will influence species relative vulnerability to fishing.

Effort, targets and use of infrastructure by recreational trailer boating in South-Eastern Tasmania, assessed by two methods

Mr David Flynn[1], Dr Tim Lynch[1], Dr Neville Barrett[2], Ms Carlie Devine[1]

[1]CSIRO, Hobart, Australia, [2]University of Tasmania, Hobart, Australia

Evidence Based Management (EBM) of fisheries and infrastructure requires detailed information on spatial and temporal patterns of resource use. Some metrics, such as nominal fishing effort, are particularly difficult to obtain for open access, non-reporting fisheries, including the recreational sector. In this study, two methods were used in overlapping sample times to quantify trailer boat activity (thus angler effort) emerging from limited infrastructure at an established Tasmanian recreational boating hot-spot: (1) a traditional bus-route access point (boat ramp) survey and (2) a novel, high-definition, mosaic panorama camera system, known as CSIRO ruggerdised autonomous gigapixel systems (CRAGS). Both methods successfully attained reasonable estimates of fishing effort with matched temporal outputs. Access point surveys revealed that the primary activity of participants was indeed pelagic game fishing, however a myriad of other coastal uses were present. CRAGS estimations described finer scales of temporal variability, however were spatially limited to a local fishing grounds hotspot, the Hippolytes. Fine scale temporal variability demonstrated the suspected 'shock loading' of infrastructure on the Peninsula. Both methods of data collection demonstrated high user affinity for weekends and public holidays, which has consequential implications for the management of infrastructure locally and for future recreational fishing surveys at coastal activity hot spots. CRAGS methods employed here in tandem with traditional techniques has the potential to lower capital expenditure, labour and input from management agencies when attempting to procure coastal use metrics in an accurate and cost-effective manner.

Evaluating the consequences of disturbance on the functional response of a marine reef fish

Becky Focht[1], Jeff Shima[1]

[1]Victoria University Of Wellington, Wellington, New Zealand

Environmental stress models (ESMs) predict that food web interactions depend on the intensity and frequency of environmental stress. Consumer stress models (CSMs) predict that predators are more adversely affected by environmental perturbations than prey, causing a decline in predation rate. In the intertidal/shallow subtidal zone, wave induced disturbance events have a large impact on individuals in that zone (e.g., habitat removal, individual redistribution and/or limiting feeding time). We conducted a lab experiment to test the predictions of CSMs, and to investigate the mechanisms that underlie disturbance-induced variation in predation rates. Experimental mesocosms (40L buckets with rock and 2 stipes of *Carpophyllum*) were placed under a dump bucket system to create disturbance, recovery, or calm wave action treatments. Common triplefin (*Forsterygion lapillum*) served as focal predators, and were presented with five different densities of amphipod prey. Across all start densities, triplefin consumed the highest proportion of prey in the calm conditions and the lowest proportion of prey in the disturbance treatment. These results appear consistent with CSMs, suggesting that intertidal/shallow subtidal benthic marine fish predators could be more adversely affected by wave action than their prey.

How does oceanography of the New Zealand subantarctic region influence the ecosystem?

Dr Aitana Forcen-Vazquez[1], Dr Michael Williams[1], Dr Jim Roberts[1], Mr Alistair Dunn[1], Dr David Thompson[1]

[1]National Institute of Water and Atmospheric Research , Wellington, New Zealand

The New Zealand subantarctic region supports a variety of marine mammals and sea-birds. Their populations' are regulated by environmental and oceanographic factors as well as human activities. The region also supports fisheries of economic importance. The ecosystem is driven by local productivity from the mixing of nutrients associated with the Subtropical Front (STF). The micro-nutrient rich (especially iron) subtropical waters mix with the high-nutrient low-chlorophyll (HNLC) subantarctic waters generating an area of high primary production. Oceanography in this region exhibit marked variability, both interannually and over longer time scales and strongly influence the ecology of the area. Here we ask "what are these oceanographic changes that can affect marine communities?" and use the Campbell Plateau as a case study. In addition, we discuss how the scale of the relationships can be important in understanding the links between oceanographic change and local ecological patterns.

Assessing the effects of mobile bottom fishing methods on benthic fauna and habitats: report from a workshop

Dr Rich Ford[1]

[1]*Ministry For Primary Industries, Wellington, New Zealand*

A diverse group of experts (Appendix 2) convened in February 2015 for a workshop to address the issue:

"*What is the best scientific approach to assessing trawl and dredge impacts on benthic fauna and habitats in New Zealand in the short, medium and long-term?"*

The workshop viewed presentations on the Ministry for Primary Industries approach to quantifying risk (benthic and otherwise), benthic data, our current understanding of benthic impacts and a number of different approaches to combining or assessing the available data. In the short to medium-term the workshop participants reached a compromise that a fishing impact *(I)*/productivity *(P)* modelling approach to benthic risk assessment was a useful starting point. Values of *I/P* greater than one imply an impact above the management threshold; and values less than one imply an impact below the management threshold. This approach would be broadly similar to the south-eastern Australian marine region (SEMR) approach, where overlap is gauged between fishing footprint and distribution of species or habitats. The SEMR approach assumed a level of impact from fishing on a species could then be estimated for some taxa, groups or habitats based on the fishing gear used and the functional traits of the organism, e.g. fragility and position in/on the seafloor, etc. The strengths and weaknesses of this approach will be discussed.

Interactions among co-existing foundation species and effects on invertebrate communities, in a New Zealand estuary

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

[1]*University Of Canterbury, Christchurch, New Zealand*

Foundation species are habitat-forming taxa that have a widespread effect on biotic and abiotic functions in an ecosystem. Many foundation species can co-exist in a habitat, potentially competing or facilitating each other depending on stress levels. Most studies on co-existing foundation species have focused on two-species interactions, for example how seagrass affects bivalves. In this presentation we examine how multiple foundation species affect each other and how they affect molluscan foundation species (in particular the common cockle *Austrovenus stuctchburyi* and the trochid snails *Diloma* spp. and *Micrelenchus tenebrosus*) based on a manipulative experiment and seasonal surveys in the Avon-Heathcote estuary in Christchurch, New Zealand. In the survey we collected cores inside and outside of *Zostera muelleri* seagrass beds, with and without accumulations of the green seaweed *Ulva* spp. The experiment manipulated abundances of *Ulva*, *Zostera* and the blue mussel *Mytilus galloprovincialis*, using three densities (0 mL, 150 mL, 500 mL of Ulva; 0%, 50%, and 100% *Zostera* cover; and 0, 1, 4, *Mytilus*). Preliminary analysis suggests that trochid snails are strongly facilitated by *Ulva* and co-existing *Ulva* and *Zostera*. The effect of *Ulva* on *Austrovenus* was less clear as the survey and experiment shows zero and negative effects respectively. Our data highlight that different types of co-existing foundation species often interact and that some invertebrates (for example snails) can be strongly facilitated by co-occurring foundation species, while others may be negatively affected or not affected at all.

The summer super-highway: migration of oceanic fishes between New Zealand and the tropical South Pacific islands

Dr Malcolm Francis[1], Mr Clinton Duffy[2], Mr John Holdsworth[3], Dr Tim Sippel[4]

[1]*National Institute of Water and Atmospheric Research, Wellington, New Zealand,* [2]*Department of Conservation, Auckland, New Zealand,* [3]*Blue Water Marine Research, Northland, New Zealand,* [4]*Southwest Fisheries Science Center, NMFS, La Jolla, USA*

Many large oceanic fishes migrate seasonally between New Zealand and subtropical or tropical waters of the south-west Pacific. Commercial catch data and tagging data were used to determine the timing and routes of the migrations of some of these species, providing new insights into their behaviour and habitats. Albacore tuna (*Thunnus alalunga*) and skipjack tuna (*Katsuwonus pelamis*) are caught around New Zealand in summer and return to the tropics in autumn. Other large tropical oceanic species such as whale shark (*Rhincodon typus*), oceanic whitetip shark (*Carcharhinus longimanus*), tiger shark (*Galeocerdo cuvier*), giant manta ray (*Manta birostris*), wahoo (*Acanthocybium solandri*), and yellowfin tuna (*T. albacares*) appear in northern North Island waters in summer, and are presumed to migrate between the tropical Pacific and New Zealand. Electronically tagged juvenile shortfin mako sharks (*Isurus oxyrinchus*), spinetail devilrays (*Mobula japanica*), striped marlin (*Kajikia audax*) and broadbill swordfish (*Xiphias gladius*) migrated from northern New Zealand to the tropical South Pacific and the Kermadec Ridge. Great white sharks (*Carcharodon carcharias*) migrated from southern New Zealand to the tropical South Pacific and north-eastern Australia in winter–spring. The movement of large numbers of many species of large-bodied teleosts and chondrichthyans results in the seasonal transfer of large amounts of biomass between tropical and temperate waters.

Piloting biochemical tools to assess bivalve early life health in response to ecologically relevant coastal stressors

Dr Samantha Gale[1], Mr Tim Young[2,3], Associate Professor David Burritt[4], Dr Norman Ragg[1], Mr Le Viet Dung[2], Associate Professor Sylvia Sander[5], Mr Billy Benedict[5], Mrs Ellie Watts[1], Ms Hannah Mae[1], Miss Nicola Hawes[6], Miss Jolene Berry[1], Dr Kim Currie[7], Associate Professor Silas Villas-Boas[3], Associate Professor Andrea Alfaro[2], Mr Nick King[1], Dr Zoe Hilton[1]

[1]Cawthron Institute, Nelson, New Zealand, [2]Institute fo Applied Ecology, Auckland University of Technology, Auckland, New Zealand, [3]Centre for Genomics, University of Auckland, Auckland , New Zealand, [4]Department of Botany, University of Otago, Dunedin, New Zealand, [5]Centre for Chemical and Physical Oceanography, University of Otago, Dunedin, , [6]SPATnz, Nelson, New Zealand, [7]NIWA, Dunedin, New Zealand

There is an urgent need to develop sub-lethal stress detection tools to differentiate health status and forecast adult success, in the early-life of aquaculture shellfish species. In addition, the NZ coastal seascape is experiencing rapid change whereby numerous biotic and abiotic stressors are likely to influence biological processes, therefore both impact thresholds and diagnostic tools are increasingly sought. We show key trends of two large multi-disciplinary integrated stressor trials with NZ Green-Lipped mussel embryos. In both cases we explore the relationships between embryo-larval microscopy observations, oxidative stress damage markers (lipid hydroperoxides, protein carbonyls, DNA damage), and enzymatic defence antioxidants, and resultant shelled larvae and/or spat yields. In our first trial we show that incubating early embryos in elevated copper [bioavailable 50.3 ugL^{-1}] resulted in no shelled larvae formation at 48 hours post fertilization (hpf),compared to ~50 % in the control [bioavailable copper [0.47ngL^{-1}] . Whilst embryo-larval microscopy observations at ~3 and ~15 hpf time-points where not indicative of the eventual developmental failure in the elevated copper treatment, equivalent time-point oxidative stress damage and defence markers (superoxide dismutase [SOD] and catalase [CAT)] showed a ~x7 increase ~x2 reduction respectively, when compared to the control. In our second trial we show that when early embryos were incubated in a range of carbonate chemistry environments ΩAr values of <0.6 (future prediction) , 1.87 (current day control), and >6 (an aquaculture extreme), the resultant spat larvae yield at 21 days post fertilization was lowest in the ΩAr values of <0.6 and >6. This trend was identified earlier in the trial at 44 hpf, with ~x2 increase in oxidative stress damage marker concentrations and a ~x3 reduction in all enzymatic defence marker concentrations, when compared to current day control treatments. These findings represent an important step forward in the development of tools for the detection of stress in the early life of shellfish.

Hyper-local forecast tool for coastal management

Dr Sarah Gardiner[1]

[1]MetOcean Solutions Ltd, New Plymouth, New Zealand

Downscaling effectively bridges the gap between coarse-scale information from global climate models and the high resolution data needed for the robust management of the coastal environment, including aquaculture. Global metocean data sources can be downscaled with a range of dynamical or statistical techniques in order to produce targeted, high resolution weather forecasts, hindcasts and other modelling (e.g. dispersal) outputs. Using a combination of robust science that leverages open source code and modern technology, hyper-local resolution data can be generated and easily made available for coastal managers and industries working within the coastal environment.

Evaluating progress towards a representative MPA network that balances use and protection: a case study from New Zealand

Shane Geange[1], John Leathwick[2], Megan Linwood[1], Clinton Duffy[1], Greig Funnell[1], Don Neale[1], Sean Cooper[1], Helen Curtis[1]

[1]Department of Conservation, Wellington, New Zealand, [2]Leathwick Conservation Planning & Management, Hamilton, New Zealand

International agreements and conventions have called for the establishment of Marine Protected Area (MPA) networks as an approach to alleviating biodiversity declines; however, a common problem in planning MPA networks is how to minimize the cost of implementation to existing users while achieving conservation objectives. Here, using the distribution of 89 biodiversity features and 7 extractive uses, we trial the functionality of the systematic conservation planning software Zonation as a tool to evaluate progress towards New Zealand's commitment to establishing a representative network of MPAs. Our results indicate that: (i) New Zealand's existing MPA network provides on average 34% of biodiversity representation that would be achieved by an MPA network of equivalent area designed using Zonation; (ii) small increases in the geographic extent of the existing network can result in rapid increases in biodiversity representation when Zonation is used to inform expansion of the existing MPA network; and (iii) increased biodiversity representation within an expanded MPA network can be balanced against reduced impacts on existing users. These results demonstrate the utility of Zonation as a decision-support tool within a broader social process to MPA network design. The iterative application of Zonation during participatory processes that balance alternative uses could potentially lead to well informed, efficient and socially enduring outcomes that enhance New Zealand's ability to meet MPA network commitments.

The Bering Sea observer program and its perception by fishers and fishery observers

Annah Gerlletti[1]

[1]Victoria University of Wellington, Wellington, New Zealand

The National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA Fisheries) deploys fisheries observers to collect catch and bycatch data from commercial fishing fleets. The Bering sea observing program has a vital roll in the management of the North Pacific groundfish fishery and has been well established for more that 20 years. According to NOAA, the Dutch Harbor Alaska port handles the highest landing volumes of seafood catches in the United States, and the Bering Sea supports one of the most well-managed fisheries in the world. In the Bering Sea, approximately 90% of all groundfish caught are observed, and ¾ of hauls and sets are sampled. However, the fishers' discernment regarding the program doesn't support the conclusion of a well managed fishery. This talk will give a background of the North Pacific Groundfish Observer program, and a review of the Dutch Harbor observer program from the perspective of fisheries observers and fishers, based on three years of observations as a scientific observer. A story will be told from both the governmental side, and the side of the fishers, to produce an understanding of how the program is being perceived, and to highlight some of its difficulties and accomplishments.

A test of compensatory dynamics: Canopy removal effects on community structure and primary productivity in fucoid-dominated rocky shore ecosystems

Shawn Gerrity[1], Dr Leigh Tait[2], Paul South[3], Professor David Schiel[1]

[1]University of Canterbury, Christchurch, New Zealand, [2]NIWA, Christchurch, New Zealand, [3]Cawthron Institute, Nelson, New Zealand

The role of complex biogenic habitat, such as that provided by algal canopies, in structuring near-shore communities and supporting coastal biodiversity has been well-described. Disturbances to habitat-forming algal canopies have been shown to reduce local biodiversity and change community composition, but also to have notable effects on ecosystem function, such as primary production. But how do these functions fare in the potential loss of dominant canopies, a process that is occurring worldwide? Here, we test this with three habitat-forming fucoids (*Durvillaea antarctica*, *Cystophora torulosa* and *Hormosira banksii*) on the associated community, its recovery through time, and primary production at two sites in southern New Zealand. In the months immediately following removal of canopies in low- and mid-shore communities we observed species- and habitat-specific responses in understory taxa richness, abundance of ephemeral algae, and recovery processes. In all three habitats there was no compensation from competing fucoid macroalgal species, and recovery processes were dominated by recruitment of the removed species only. In situ measurements of dissolved oxygen production were made using photorespirometry chambers to quantify the contribution that disturbed versus undisturbed assemblages made to net primary production (NPP). Preliminary data showed that removal of these canopies reduced NPP, mainly through a reduction in photosynthetic biomass. Also, altered sub-canopy species composition influenced the production dynamics throughout the full range of natural irradiance. After one year where fucoid canopies were absent, there remained a reduction in NPP compared to controls, and little evidence of compensation by increased growth of understory species.

Loss and future recovery of Australia's shellfish reefs

Dr Chris Gillies[1], Mr Colin Creighton[2], Dr Ian McLeod[2]

[1]The Nature Conservancy, Carlton, Australia, [2]TropWATER, James Cook University, Townsville, Australia

Oyster reefs were once prominent features in Australia's estuarine and nearshore environments as evidenced by aboriginal and early explorer accounts, shell middens and sediment cores. A dramatic decline in the extent and condition of shellfish reefs occurred during the mid-1800s to the extent that shellfish reefs are now considered 'functionally extinct' habitats. We review the state of knowledge on shellfish reefs in Australia including their historical distribution, causes for decline and regulation and evaluate current policy mechanisms, research priorities and restoration methods which can enable the scaling-up of efforts to protect and repair Australia's shellfish reefs. Eight species of shellfish are identified as developing complex, three-dimensional reef structures over large scales in intertidal and subtidal areas in tropical, subtropical and temperate Australian waters. Despite early attempts to repair degraded reefs through primitive aquaculture and restoration efforts during the mid to late 1800s, living examples of shellfish reefs are now rare. Our knowledge of the extent, physical characteristics, biodiversity and ecosystem services of natural reefs is still extremely poor. Restoration efforts are impeded furthermore by 'shifting baselines' amongst the community and a general underappreciation of the ecosystem services and value provided by shellfish reefs. We advocate this research deficit should be urgently addressed to underpin best practice restoration, prioritise resource allocation and strengthen the case for long-term investment in restoration and protection. State-based natural resource management agencies supported by academia and state and federal government resources agencies, in partnership with recreational fishers, divers and the shellfish industry, are best placed to lead long-term, on-ground restoration work.

Marine aquaculture and its ecosystem services: building an understanding of aquaculture value for spatial planning

Dr Heidi Alleway[1], **Dr Chris Gillies**[2]

[1]Primary Industries and Regions South Australia, Adelaide, Australia, [2]The Nature Conservancy Australia Program, Melbourne, Australia

Over the last five decades aquaculture has become the fastest growing global food production industry. Aquaculture now contributes half of total production of seafood, an important source of protein. This growth has partly been in response to the limiting capacity of fisheries to meet increased demand and an increasing trend in the quantity and value of production from aquaculture is reflected in the seafood industries in Australia and New Zealand. This growth has presented challenges to sustainability, e.g. negative environmental impacts through the introduction of excess nutrients and chemical treatments, the escape of non-native species, and overexploitation of fish stocks used for feed. Although research, development and management can mitigate these negative environmental impacts there continues to be actual and perceived barriers to the ecologically sustainable development (ESD) of the industry. Growth in aquaculture provides the means to meet demand for seafood in the future. Hence, the challenges to ESD to meet demand are complex and will require not only ecological data but also the use of a range of socio-economic data, including broad consideration of economic return and positive environmental impacts. We examine the quantifiable ecosystem services marine aquaculture can provide and suggest a conceptual framework for incorporating these values into spatial planning and decision-making. These benefits and the framework include consideration of: increased efficiency in the use of public resources; increased efficiency in per hectare production from aquaculture; public visibility of the positive impacts of aquaculture; and potential attraction of investment to successfully meet future demand for seafood.

Export of estuarine production from a tidally-dominated temperate estuary

Ms Rebecca Gladstone-Gallagher[1], Dr Andrew Lohrer[2], Dr Carolyn Lundquist[2,3], Associate Professor Ian Hogg[1], Professor Conrad Pilditch[1]

[1]University Of Waikato, Hamilton, New Zealand, [2]National Institute of Water and Atmospheric Research Ltd., Hamilton, New Zealand, [3]University of Auckland, Auckland, New Zealand

Temperate shallow water estuaries are considered functionally important, supplying energy that fuels offshore food webs. Within these estuaries, diverse vegetated and unvegetated soft-sediment habitats contribute organic matter to wider coastal ecosystems. However, anthropogenic changes to catchment land use modify and degrade these habitats, altering the supply of organic matter that can be tidally transported to connected ecosystems. Stable isotopes have been useful to confirm that estuarine primary production is transported and utilised by adjacent coastal communities, but these studies tell us little of the magnitude of the subsidy. To quantify the subsidy, we comprehensively sampled different fractions of primary production entering and leaving the enclosed Pepe Inlet in Tairua Estuary, New Zealand. Seasonally, using a Van Dorn water sampler, and two large (1 m width) nets, we sampled water and suspended material from the mouth of the inlet (37 m width), over a 24- hour period (encompassing midday and midnight high tides). From the samples, we measured and calculated the tidal fluxes of floating macrodetritus (macrophyte leaf litter), dissolved oxygen, chlorophyll *a*, and particulate and dissolved forms of nitrogen (N) and phosphorus (P). Across seasons the inlet showed a net export of both particulate and dissolved N and P (up to ~ 12 kg N and ~2 kg P per tidal cycle), as well as macrodetritus (up to ~ 10 kg DW per tidal cycle). These results support the 'Outwelling Hypothesis' of Odum (1968) that estuaries export nutrients and production, highlighting the importance of estuaries in supplying energy and potentially subsidising wider coastal food webs.

Temporal variation in isotopic composition and diet of Weddell seals in the western Ross Sea

Dr Kimberly Goetz[1,3], Dr Jennifer Burns[2], Dr Luis Huckstadt[3], Dr Michelle Shero[2], Dr Daniel Costa[3]

[1]National Institute of Water and Atmospheric Research Ltd, Wellington, New Zealand, [2]Department of Biological Sciences, University of Alaska, Anchorage, Anchorage, USA, [3]Department of Ecology and Evolutionary Biology, University of California, Santa Cruz, Santa Cruz, USA

Weddell seals (*Leptonychotes weddellii)* are important predators in the Antarctic marine ecosystem, yet little is known about their diet. Previous studies have used scat and stomach content analyses to examine Weddell seal diet, however, these methods are biased towards prey with indigestible hard parts. To provide a more complete picture of their diet, we analysed the stable isotope composition ($\delta^{13}C$ and $\delta^{15}N$) of red blood cells (RBC, n=96, representing a time scale of weeks to months) and vibrissae (n=45, representing months to a year) collected over a three year period (2010-2012). Our objectives were to 1) examine isotopic variation in relation to Weddell seal mass, sex, season, location, percent lipid, and age, and 2) quantify the contribution of prey items to overall diet. Body mass was a significant predictor of $\delta^{13}C$ and $\delta^{15}N$ for both tissues, though the strength and direction of the relationship varied by year. The prey group consisting of *Pleurogramma antarcticum* and *Trematomus newnesi* was found to be an important dietary component, but its proportional contribution to Weddell seal diet varied with the timeframe represented by each tissue type [median RBC (range): 59.2 % (40.2 -8 1.1 %); median mean vibrissae (range): 69.3 % (43.9 - 89.6 %)]. Results from mixing models ran for each seal indicate individual variation in diet. Overall, this study provides new information on the isotopic variation and diet of Weddell seals and provides critical insight into the feeding ecology of an abundant Antarctic predator over two time scales.

Marine Isoscapes: Tracking animal movements in the south pacific

Brittany Graham[1, §]

[1]National Institute of Water and Atmospheric Research (NIWA), Wellington, NZ 6021. §MPI BRAG funded project

The inability to directly observe marine animals in the open ocean has hindered our understanding of their movements, distribution, and foraging behaviour. This challenge has spurred the development of new technologies and approaches to examine animal movements remotely, including the ever growing application of tagging individuals with sophisticated electronic tags. Here I discuss another emerging method: using the isotope values of the animals in the open ocean to examine their movements, analogous to a chemical tag. This approach requires coherent spatial variation of isotope values at the base of the food web in the open ocean. Nitrogen and carbon isotope values at the base of the marine food web vary due to biogeochemical processes and, are largely driven by the dominate nutrients and the primary producer communities utilizing them. This geographical variation then propagates up the food web and is incorporated into animals that reside in the area; individuals that have disparate values have then migrate from another region. I will discuss these spatial maps of isotope values, or isoscapes that have been developed by both models and baseline data in the South Pacific and Southern Ocean. I will then discuss specific applications that demonstrate how these isoscapes can then inform on the movements of fish and marine mammals around New Zealand and in the South Pacific, and, in turn, provide key information for management and conservation.

Innovative application for the characterization of haemocytes In the New Zealand black-footed abalone (*Haliotis iris*)

Mr Roffi Grandiosa[1], Dr. Fabrice Mèrien[2], Prof. Andrea Alfaro[1]

[1]Institute for Applied Ecology, School of Applied Sciences, Faculty of Health and Environmental Sciences, Auckland University of Technology, Auckland, New Zealand, [2]AUT-Roche Diagnostics Laboratory, School of Applied Sciences, Auckland University of Technology, Auckland, New Zealand

The cultivation of abalone is prone to diseases that often hamper production in many parts of the world, such as Australia and China. While the emerging New Zealand abalone production is relatively free of major diseases, infection from overseas pathogens is just a matter of time. Indeed, the strong bio-security programs in New Zealand may not be enough to stop a major disease outbreak in this developing industry. While considerable research has been conducted on fish pathophysiology, few studies have focused on molluscs, and less so on abalone. Thus, the aims of this research are to characterize the immune system of the New Zealand black-footed abalone (*Haliotis iris*), and develop health assessment methods to identify pathophysiological response to pathogenic challenges. As a first step to address health issues in *H. iris*,e conducted a detailed characterization of haemocytes using a combination of classical (cytochemical and phagocytosis assays with optical microscopy) and novel (flow cytometry with Sysmex XN-1000 and Muse® Cell analyser) technique

New Zealand Bathymetry Investigation

Ed Griffin[1]

[1]Land Information New Zealand

The NZ Bathymetry Investigation, completed in 2015, aimed to better understand New Zealand's bathymetric resources so that we can look at ways of developing and coordinating this fundamental data theme. This presentation will outline the results and the recommendations of the investigation, paying particular attention on how better to coordinate the collection and distribution of bathymetry data in New Zealand.

Effect of anthropogenic activity on the nutrient status of temperate mangroves in northern New Zealand

Ms Iana Gritcan[1], MSc Mark Duxbury[1], Dr Sebastian Leuzinger[1], Prof Andrea C. Alfaro[1]

[1]AUT, School of Applied Sciences, Institute for Applied Ecology New Zealand, Auckland, New Zealand

Nitrogen stable isotope ($\delta^{15}N$), total phosphorus (%P), and total nitrogen (%N) analyses were conducted on temperate mangrove (*Avicennia marina* sp. *australasica*) leaves collected from three harbours (Manukau, Mangawhai and Waitemata) in northern New Zealand. Such studies have been recently used for detecting sewage impacts on aquatic ecosystems. δN^{15} values around 10‰ have been found in environments where the major terrestrial water inputs are sewage. Moreover, nitrogen and phosphorus mangrove leaf concentrations can be used to assess levels of available nutrients in the surrounding environments. The highest total nitrogen and $\delta^{15}N$ values were found in Manukau Harbour at about 2% and 10‰, respectively. The lowest values were found in Mangawhai Harbour situated about 100 km north of Auckland city, at about 2% and 5 ‰, respectively. In the Waitemata Harbour both parameters were intermediate between those of Manukau and Mangawhai, at 2 % total N and 7‰ $\delta^{15}N$. Total phosphorus concentrations did not vary significantly. Additionally, analysis of historical mangrove leaf herbarium samples obtained from the Auckland War Memorial Museum indicated that a reduction in both leaf total nitrogen and $\delta^{15}N$ has occurred over the past 100 years in Auckland's harbours. Collectively, these results suggest that anthropogenically derived nitrogen has had a significant impact on mangrove nutrient status in Auckland harbours over the last 100 years. The observed decrease in nitrogenous nutrients probably occurred due to sewage system improvements. These results suggest that mangrove leaves can be used to determine the effects of human activity, such as eutrophication, on coastal areas.

In-water cleaning of vessels: how do we know it works?

Mr Abraham Growcott[1], Dr Daniel Kluza[1], Dr Eugene Georgiades[1]

[1]Ministry For Primary Industries, 25 The Terrace Wellington, New Zealand

Vessel biofouling is a major pathway for the introduction and spread of non-indigenous marine species. New Zealand is the first country in the world to regulate the international biofouling pathway through the development of the Craft Risk Management Standard for Vessel Biofouling (CRMS) (http://www.biosecurity.govt.nz/enter/ships). The CRMS has a voluntary four year lead-in period to allow industry time to adapt their biofouling management practices before compliance becomes mandatory in 2018. Currently, treatments to manage vessels that are non-compliant under the CRMS and domestic vessels carrying unwanted organisms are limited. In-water cleaning has the potential to manage biofouling risk, however, there is no validated testing procedure available to assess whether cleaning systems can operate in a biosecure manner. The Ministry for Primary Industries has commissioned the development of two testing frameworks to assess the effectiveness of in-water cleaning systems with respect to biosecurity risk. These frameworks, developed for the external hull and internal niche areas (sea chests and pipework), respectively, will be used to inform MPI policy.

Trophic interactions in the Kaikōura submarine canyon: from primary productivity to sperm whales

Ms Marta Guerra[1], Will Rayment[1], Lucy Wing[1], Liz Slooten[2], Steve Dawson[1]

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

Submarine canyons are high productivity habitats that are hotspots of faunal biomass and biodiversity. The submarine canyon of Kaikōura, New Zealand, is one of the most productive deep-sea habitats yet studied, and a feeding ground for male sperm whales (*Physeter macrocephalus*) which are present year-round. Using stable isotope analyses to investigate the sperm whales' feeding habits, the aims of this research were to: i) identify the base sources of primary productivity fuelling the canyon food web; ii) determine the trophic relationships within the Kaikōura Canyon ecosystem with reference to the diet of sperm whales; and, iii) investigate the variation in sperm whale diet in relation to season and residency at Kaikōura. Stable isotope ratios of N ($\delta^{15}N$) and C ($\delta^{15}C$) were measured in suspended particulate organic matter (N=20), coastal macroalgae (N=35), benthic and pelagic fish and squid (N=38), and sperm whale skin (N=43). Preliminary results suggested a food web fuelled by pelagic phytoplankton, highlighting the need to better understand the influence of oceanographic processes in this area. Isotope ratios also suggested seasonal shifts in sperm whale diet, possibly due to differences in habitat use driven by variations in distribution of their prey. Lastly, variation in isotopic signatures in relation to residency rates showed that transient whales reflect a food web distinct from that of the Kaikōura Canyon system. Furthering our knowledge on the foraging ecology of sperm whales at Kaikōura will help explain the decline of whales feeding in this area. These results aid the understanding of the trophic ecology of submarine canyons and the mechanisms by which these facilitate aggregations of top predators.

Transgenerational plasticity and thermal stress: do paternal effects act as a conduit or a buffer?

Ms Annie Guillaume[1], Dr Keyne Monro[1], Prof Dustin J Marshall[1]

[1]Monash University, Clayton, Australia

Phenotypic plasticity is an important mechanism by which organisms can buy time to adapt to novel selection pressures associated with climate change. For most organisms, early life-history stages are the most sensitive to environmental stress. Transgenerational phenotypic plasticity, whereby the parental environment alters the phenotype of offspring, is therefore viewed as key to promoting persistence in the face of environmental change. While there has been long-standing interest in the role of transgenerational plasticity via the maternal line (traditionally the field of maternal effects), it increasingly appears that paternal effects can also play a role. Despite the emerging role of paternal effects in studies of global change, key knowledge gaps remain: 1) whether paternal effects act to increase or decrease offspring performance remains largely unexplored; 2) the relative roles of maternal and paternal effects are rarely disentangled; and 3) the role of environmental variation, a key determinant of the benefits of transgenerational plasticity, has not been explored with regards to paternal effects. Through a series of experiments, we explore all three issues using the marine tubeworm *Galeolaria caespitosa*, an important habitat-forming species in southern Australia. Our results suggest that, while transgenerational plasticity may play an important role in modifying the impacts of global change, not all effects are uniformly positive. Importantly, paternal effects can be as strong, or stronger, than maternal effects and environmental variability strongly alters the impacts of paternal effects.

Protistan plankton diversity and contribution to oceanic carbon export revealed by DNA metabarcoding

Dr Andres Gutierrez-Rodriguez[1], Noemi Kinebayan[2], Dr. Tristan Biard[2], Dr. Mike R Stukel[3], Dr. Adriana Lopes[2], Prof. Michael R Landry[4], Prof. Daniel Vaulot[2], Dr Fabrice Not[2]

[1]NIWA, Greta Point, Wellington, New Zealand, [2]Station Biologique de Roscoff (UPMC/CNRS), Roscoff, France, [3]Florida State University, Tallahassee, USA, [4]Scripps Institution of Oceanography, La Jolla, USA

The biological pump refers to the vertical export of photosynthetically fixed organic matter to ocean's interior, whereby contributing to carbon sequestration and maintenance of benthic communities. The amount of the particulate organic matter exported depends largely on the diversity and structure of the microbial community – including primary producers and consumers - with higher export rates generally associated to larger cell (e.g., diatom) dominated communities compared to smaller cell (e.g., picocyanobacteria) dominated ones. However, beyond this coarse taxonomic perspective, little is known about the specific diversity and composition of the biological material vertically exported from the euphotic zone. Here, we applied DNA metabarcoding techniques to investigate the diversity and genotypic composition (18S rDNA) of the sinking particulate organic matter and the protistan community prevailing in the water column above. We analysed samples collected from the water column and from deployed sediment traps drifting at 100 and 150 m during 2-day cycles, repeated across contrasting water masses of the California Current Ecosystem. As expected, the specific composition of the water column community changed across the coastal to offshore gradient followed by the 2-day cycles with higher species diversity observed in offshore oligotrophic waters. Relative abundance of barcodes showed consistent similarities in the higher rank taxonomic composition between the water column and sinking material, although marked differences were found at finer taxonomic resolution. Dinophyta barcodes dominated the community in the water column, while increasing abundance of radiolarian barcodes in the sediment traps revealed a disproportionate contribution of Radiolaria to vertical fluxes undetected by image-based analysis.

What protects spawning biomass the best, a TAC or Legal Minimum Size?

Dr Malcolm Haddon[1], Dr Craig Mundy[2]

[1]CSIRO, Hobart, Australia, [2]IMAS, Utas, Hobart, Australia

Invertebrate fisheries management commonly includes implementing a minimum legal size. The reasons given for doing so include 1) to protect immature animals, 2) to ensure mature animals get one or two chances to reproduce before being fished, and, more mundanely, 3) ensuring an acceptable market size. In all rock lobster and abalone fisheries in New Zealand and Australia every discussion of legal minimum size leads to passionate debate. Typical topics for debate include: Should we increase or decrease the minimum size? How much of the fishery will never get fished again if the minimum size is increased? How much mature biomass will be protected? The objective of this present work is to attempt to inform intuitions about the effectiveness of legal minimum sizes for the protection of sub-legal reproductive animals. To do this a size-structured population dynamics model was used to explore the interactions between stock depletion levels, the maximum potential yield, the legal minimum size, the stock – recruitment relationship, and finally (for abalone) the size at emergence. The stock depletion level is a result of the fishing mortality imposed with the depletion level being inversely related to the harvest rate. Choice of the stock-recruitment relationship in modelling scenarios is critical because the assumption of steepness (= degree of density dependence) will influence the capacity of a size limit to provide protection for mature biomass. We conclude that using legal minimum sizes can certainly have some value for sustainability, but the effective management of fishing mortality is most important.

Does stock status really matter?

Dr Malcolm Haddon

[1]CSIRO, Hobart, Australia

A discussion of the difference between determining stock status (sustainable or not) and providing useful management advice.

Collation of Hawke's Bay Marine Information – a focus on marine habitats

Mr Oliver Wade[1], **Dr Tim Haggitt**[2]

[1]Hawke's Bay Regional Council, Napier, Auckland, [2]eCoast, Leigh, New Zealand

The Hawke's Bay coastal marine area (CMA) is approximately 770,000 ha in extent. It is comprised of myriad ecosystem types and falls into the eastern North Island coastal biogeographic region. This region is influenced by oceanic currents and experiences large fluvial inputs and associated high sediment flux. Historically the CMA has supported a diverse fishery, however there are fears within the local community that this fishery is under threat from many land-based impacts and fishing pressure. The CMA is administered by the Hawke's Bay Regional Council (HBRC); however, despite its size there is a paucity of knowledge and understanding of the diversity of marine habitats within Hawke's Bay; the importance of particular habitat types to various fisheries; and, how these habitats may, or may not,have changed through time. Recognising these information deficiencies, HBRC has undertaken an information gathering exercise that focused on amalgamating available scientific, customary, and anecdotal information across the CMA. The key objective of the exercise was to understand how pressures resulting from land-based activities may have changed various coastal habitat types and to identify gaps in the information base. In this paper we present the information gathering and dissemination process; our current understanding of the spatial distribution of physical and biological habitats across the Hawke's Bay CMA; GIS analyses used to identify gaps and prioritize areas where further research was required; and, outline key components of a strategy to tackle new areas of research and investigations.

Sustainable Seas National Science Challenge Update

Dr Julie Hall[1]

[1]*NIWA, Wellington, New Zealand*

The National Science Challenges are designed to take a strategic approach to the Government's science investment by targeting goals which will have major, enduring benefits for New Zealand. The Challenges provide an opportunity to align and focus New Zealand's research on large and complex issues and to answer questions of national significance. They do this by drawing scientists together from different institutions and across disciplines to achieve a common objective through collaboration.
The objective of the Sustainable Seas National Science Challenge is to "Enhance utilisation of our marine resources within environmental and biological constraints".
To achieve this objective the Challenge will develop an Ecosystem Based Management (EBM) approach which will:
• Identify the opportunities for, and limits to, marine resource use through in-depth engagement with Māori, industry, resource managers and communities.
• Support development of an EBM approach for the management of marine resources.
• Work directly with decision makers to incorporate new tools and decision-support systems into the resource management and stewardship of our marine environment.
• Form collaborations among environmental scientists, social scientists and practitioners, incorporating Vision Mātauranga, to ensure uptake of Challenge research.
• Foster international science collaboration to better leverage offshore science initiatives, resources and knowledge.
The Challenge is composed of five programmes: Our Seas; Valuable Seas; Tangaroa; Dynamic Seas; and Managed Seas. These are interlinked through cross-programme research projects, Vision Mātauranga, and Communication and Outreach.
Successful implementation of EBM in decision making in the marine environment will be truly transformative, and make New Zealand a world leader in marine resource management.

Discovering and accessing LINZ's spatial hydrographic datasets using the LINZ Data Service

Ian Harrison[1], Glen Rowe[1]

[1]*Land Information New Zealand*

Land Information New Zealand (LINZ) is responsible for managing land titles, geodetic and cadastral survey systems, topographic information, hydrographic information, managing Crown property and supporting government decision making around foreign ownership. The LINZ Data Service provides free online access to much of the land and seabed data produced by this work. This presentation will give a brief overview of the data service and ways to find and access the data; highlighting the spatial hydrographic and maritime datasets that are freely available from LINZ for reuse.

"Causing whitebait": using artificial habitat installations to identify potential spawning site locations for inanga

Dr Mike Hickford[1], Shane Orchard[1], Prof. David Schiel[1]

[1]*University of Canterbury, Christchurch, New Zealand*

New Zealand's whitebait fishery is comprised mainly of inanga (*Galaxias maculatus*). The unique life history of this diadromous species includes obligate spawning in tidally inundated riparian vegetation in upper estuarine areas. At the time of European settlement, the riparian vegetation in inanga spawning sites likely comprised tall overarching forest and scrub that shaded and sheltered the banks, and supported a loose undergrowth of sedges and herbs. It was within the root masses of these plants and associated detritus that inanga spawned. In recent times, more vigorous and tenacious exotic species have largely supplanted native riparian vegetation. But does native vegetation actually increase inanga spawning? There is growing impetus within New Zealand to restore riparian habitat, including inanga spawning sites. Restoration of inanga spawning sites has focussed on increasing the density and height of riparian vegetation by excluding grazers or removing anthropogenic interventions, as well as replanting native species because of additional benefits to water quality and instream community composition. In heavily degraded waterways where inanga spawning is very patchy, or absent altogether, there is a need to identify potential spawning site locations prior to long-term restoration. This presentation describes an example application using artificial spawning habitat installations in Christchurch waterways to identify potential inanga spawning sites after the Canterbury earthquakes.

Prioritising research and management of at-sea threats to New Zealand seabirds.

Ms. Freydis Hjorvarsdottir[1], Dr. Igor Debski[1], Ms. Katherine Clements[1,2], Dr. Edward Abraham[3], Dr. Yvan Richard[3]

[1]*Department Of Conservation, Wellington, New Zealand,* [2]*Harvard University, Cambridge, United States,* [3]*Dragonfly Data Science, Wellington, New Zealand*

A framework of tools is being developed by the Department of Conservation to prioritise research and management of at-sea threats to seabirds. The framework aims to ensure the available knowledge on seabird biology and ecology is adequate to understand and manage at-sea threats to New Zealand seabirds. The approach builds on quantitative fisheries risk assessment approaches, but broadens the scope to all potential threats. We demonstrate the utility of some of the tools being developed as part of the framework, in particular a spatial mapping platform and a population modelling tool. The framework also includes processes to facilitate expert guidance where data are poor. We show how the tools can be used to identify and prioritise gaps in current knowledge limiting our understanding of threats, so future research can be focussed on these areas. Population research gaps can be prioritised by assessing how the current uncertainty around each model input parameter influences our ability to project population trajectories. This will allow the identification of research required to improve our understanding of population dynamics, and thus the potential effects of different threats on those populations. Early results are presented for a number of New Zealand breeding seabird taxa.

Potential visual acuity and maximum swimming speed as predictors of trawl catch rates when using light as a bycatch reduction device

Ms Darcie Hunt[1], Ass/Prof John G. Purser[1], Mr Nicholas J. F. Rawlinson[1], Dr Giles A. Thomas[2], Dr. Jenny M. Cobcroft[3]

[1]Institute for Marine and Antarctic Studies, Launceston, Australia, [2]University College London, London, United Kingdom, [3]Institute for Marine and Antarctic Studies, Hobart, Australia

The relationship between the morphology or physiology of fish and their catch rates in commercial fishing practices is not often studied. This study used a predictive model that was developed from testing a light bycatch reduction device (BRD) using trawl fishing in Tasmania. This model determines the change in catch rates based on vision and maximum swimming speed. Firstly, the model was validated using catch data from Hannah *et al.* (2015) conducted in the shrimp trawl fishery in Oregon, US, which used lights to reduce bycatch. The model was applied by correlating the percent change in catch present in the study with the maximum swim speeds of the fish from available data. It was found that there was a strong linear correlation ($R^2 = 0.78$) between the maximum swimming speed and the percent change in catch for the three species with available data. Next, the model was used to predict the potential effectiveness of using a light bycatch reduction device in Australia's Northern Prawn Fishery (NPF). By evaluating the families that have been reported as bycatch in the NPF, the proportion of catch likely to decrease was estimated. It was predicted that out of a total of 84 families, the twelve fastest swimming families such as Carangidae, Leignathidae and Scombridae were most likely to escape, and 39 others may escape. This validation of the model supports the use of maximum swimming speed as a predictor of catch rate and demonstrates the effectiveness of light as a bycatch reduction device.

Empowering Australian coastal Indigenous communities towards sustainable management of their traditional use of marine resources

Dr Cass Hunter[1], Stan Lui[2], Tim Skewes[3], David Brewer[3], Wayne Rochester[3]

[1]CSIRO Oceans and Atmosphere, Cairns, Australia, [2]Reef and Rainforest Research Centre, Cairns, Australia, [3]CSIRO Oceans and Atmosphere, Brisbane, Australia

Aboriginal and Torres Strait Islander peoples' have an established right in Australia to traditional harvesting of marine resources. Effective management of traditional harvesting is built from consensus, commitment, and capacity of Indigenous groups for meeting their sustainability goals. Community-based monitoring and management of traditional use of resources has the potential to empower Indigenous communities to make more informed decisions about regulatory solutions. The data collection process for quantifying the pressure from traditional catch cannot be mandated through top-down regulatory rules but requires bottom-up endorsement and commitment. Here we discuss Australian cases where formulating agreements for traditional harvest have not always tracked towards agreeance as Indigenous communities challenge the controls imposed by a non-adaptive regulation framework. Across Australia, coastal Indigenous communities are at different developmental stages of monitoring and using recorded information to update management. Adequate consultation and engagement is variable between fisheries and locations in Australia due to the specific local context for negotiating, planning and managing. To date, management controls for traditional harvest in Australia include seasonal closures, traditional use of marine resource agreements, memorandum of understanding for hunting activities, and specialised Indigenous rangers with powers of compliance and monitoring human activities. We highlight the importance of building and maintaining the foundations for cooperative management that requires respect, flexibility and equal power balance. Continual building of on-ground capacity and local governance will help bridge the gap between common desires for sustainability and effective monitoring and management of traditional use.

Investigation of Red Rock lobster (*Jasus edwardsii*) population structure using neutral and putatively under selection Single Nucleotide Polymorphism (SNP) markers

Irina Ilyushkina[1], James Bell[1]

[1]*Victoria University of Wellington, Wellington, New Zealand*

Long pelagic larval duration (PLD) has been long thought to lead to low population structuring due to its potential to disperse larvae over vast geographical areas. However, recently an increasing number of studies have shown that long PLD does not necessarily infer a lack of population genetic structure using genome wide Single Nucleotide Polymorphism (SNP) panels. Recent advances in next generation sequencing and the development of reduced representation genome sequencing technologies has led to increased marker discovery and sample throughput. When applied to population genetic studies of non-model organisms, an increased number of markers leads not only to a better resolution in the estimation of population structure, effective population size and dispersal, but also provides an opportunity to explore genomic markers under selection. The analysis of markers putatively under selection (often described as "outlier" markers) can provide valuable insights into role of adaptation in population structure. The Red Rock Lobster (*Jasus edwardsii)* is a species with one of the longest PLD (up to 2 years) and is distributed throughout New Zealand including offshore islands. Recent studies using microsatellite markers have provided evidence of existence of three genetic groups within New Zealand. This talk will discuss recent insights from the application of SNP markers to the rock lobster. Further study using both neutral and outlier markers will increase our knowledge of population differentiation and source/sink population dynamics as well as provide an estimate of role of local selection in shaping population structure. This information also can be useful in ensuring the continued sustainability of fishery.

Surface productivity influences Antarctic seafloor biodiversity

Mr Jan Jansen[1,2], Nicole A Hill[1], Craig R Johnson[1], John McKinlay[2], Piers K Dunstan[3], Alexandra L Post[4], Marc P Eleaume[5], Michael D Sumner[2,6], Ben K Galton-Fenzi[1,6]

[1]*University Of Tasmania, Hobart, Australia,* [2]*Australian Antarctic Division, Kingston, Australia,* [3]*CSIRO, Hobart, Australia,* [4]*Geoscience Australia, Canberra, Australia,* [5]*MNHN Paris, , France,* [6]*Antarctic Climate & Ecosystem Cooperative Research Centre (ACE CRC), Hobart, Australia*

More than 90% of the world's oceans occur beneath 200m depth at which light attenuates to such an extent that no photosynthesis occurs. The diversity of life on the seafloor beneath this depth must derive energy from alternative sources such as food raining from the surface, a link often referred to as benthic-pelagic-coupling. However, the nature and strength of benthic-pelagic-coupling, and its influence on the structure and diversity of seafloor communities remains unclear, especially in Antarctica where ecological data are sparse. Here I present results from a novel approach combining physical models with a statistical framework that show benthic-pelagic-coupling in East Antarctica depends on physical processes and varies considerably depending on the types of benthic organisms considered. We used a particle tracking model, informed by remotely sensed surface productivity and combined with a regional oceanographic model to quantify the flux of food to the seafloor in the George V shelf area in East Antarctica. We optimised the particle tracking model-parameters by the statistical fit of the resulting particle distribution to data from sediment cores revealing spatial patterns food-abundance change little during the fast (200m/day) sinking to the seafloor. Fluctuating seabed currents however, are crucial in the redistribution of particles on the seafloor. Analysing data from towed still cameras we found the abundance and diversity of benthic filter feeders, but not other benthic groups to correlate strongly with the estimate of horizontal flux of food particles above the seafloor, enabling spatial predictions of seafloor biodiversity over vast regions of Antarctica.

Enhanced phytoplankton growth through sea ice and ice shelf processes in the Ross Sea; first results

Stefan Jendesie[1]

[1]*NIWA, Wellington, New Zealand*

The Ross Sea pelagic ecosystem has been modeled through coupling of a biological nutrient dynamics algorithm to an ocean circulation model. The biological state is described by two phytoplankton groups (diatoms and *Phaeocystis antarctica*), detritus and zooplankton. The growth of phytoplankton is modeled as a function of nutrient (nitrate and iron) and light limitation. The physical ocean simulation parametrizes sea ice formation and melting from SSM/I satellite data to determine the growth effects of enhanced nutrient supply in the polynyas of the Ross Sea. As a novelty the model also includes a thermodynamically active ice shelf component to investigate the impacts of glacial melt water plumes in contributing iron to the ecosystem. Other mechanisms such as wind forcing and tides are also studied with respect to their important role in defining the mixed layer and thus the local nutrient transport dynamics.

The rise of the mullets: contemporary and historical genetic population structure of the grey mullet (*Mugil cephalus*) in New Zealand inland and coastal waters

Balam Jimenez[1], Dr Peter Ritchie[1], Dr Mark Morrison[2]

[1]Victoria University of Wellington, School of Biological Sciences, Wellington, New Zealand, [2]National Institute of Water and Atmospheric Research , Auckland, New Zealand

The grey mullet (*Mugil cephalus*) has a circumpolar tropical distribution and has been described as a species complex with high levels of genetic diversity around the world. In this study, the genetic structure and migration patterns of *M. cephalus* in New Zealand were assessed using mitochondrial DNA (mtDNA) sequences from the Cytochrome Oxidase 1 gene (COX1), the D-loop region and genotyping of seven nuclear microsatellite DNA loci. New Zealand mtDNA sequences were used to identify historical subdivision and potential mtDNA lineages distributed around North Island's estuaries and inland waters. Then, they were compared with those from the Pacific Rim to test for significant differences in haplotype diversity, frequency and distribution from other haplotypes reported in the Pacific. Allele diversity and frequency of seven microsatellite DNA loci were used to assess contemporary genetic population structure of grey mullets. Levels of inbreeding and genetic differentiation in the populations identified were used to evaluate potential breaks to gene flow and levels of population isolation according to New Zealand's biogeographical regions, East-West marine currents, latitudinal gradients, and an isolation-by-distance scenario. Moreover, the levels of genetic differentiation in juvenile populations collected in estuarine environments and adult populations collected in coastal, estuarine and semi-enclosed inland water environments, were evaluated to test differences in life histories. The findings of this study are presented linked to a talk focused on grey mullet's life history and distribution, and the reconstruction of individual environmental histories using otoliths.

Dolphin cliques: a time-based method for defining associations using photo-identification

Mr David Johnston[1], Doctor Will Rayment[1], Professor Liz Slooten[1], Professor Steve Dawson[1]

[1]University Of Otago, Dunedin, New Zealand

Associations between individuals are the basis of sociality. For this reason, association analyses are important tools for understanding how individuals behave towards one another, and therefore how their societies are structured. For species in which individuals are uniquely identifiable, photo-identification is an invaluable method for documenting associations. Based on the assumption that individuals photographed close together in time are physically close in space, metadata associated with digital photography offers an opportunity to base association analyses on time between images. This approach was tested via analysis of association patterns within an isolated population of bottlenose dolphins (*Tursiops truncatus*) in Doubtful Sound, New Zealand over the summer of 2015. By comparing the widely used group membership method and an alternative time-based method, in which individuals are associated if photos of each fell within a specified time window, the practicality of defining associations at finer scales than group membership was assessed. Candidate time-frames of 1 to 5 minutes were evaluated. A time-frame of 1 minute provided the best compromise between lowest stress from non-metric multidimensional scaling, and highest cophenetic correlation coefficient values from cluster analyses, and thus used to further describe the social patternings of this population. This study aimed to validate the approach of using time as a basis for analyses of associations, potentially providing increased detail with similar field effort. Importantly, this method can be applied to any population of photographically identifiable individuals, and can be retrospectively applied to any photo-ID data set in which images are time-stamped by the camera.

Social license in the marine sector – How, why, where and when?

Ms Rachel Kelly[1]

[1]IMAS, Hobart, Australia, [2]University of Tasmania, Hobart, Australia

Social licence to operate' is a growing area of research pertinent to the development and exploitation of natural marine resources. Although 'social licence' is a term used broadly across the literature, a dearth of coherent definition remains particularly where it applies to the marine environment. Without consensus for social licence boundaries it prevails as an intangible construct within the marine sector. As an emergent phenomenon social licence reflects environmental and social change and positions the community as an important stakeholder of ocean environments and we argue that defining'social licence' may prove successful in addressing conflicts of 'ownership' and 'values' between industry (e.g. fisheries) and community in the marine environment. This talk discusses current understandings of social licence as it occurs in the marine sector. It poses and deliberates questions such as whether various industries of the Australian marine sector already hold 'social license' - if so, how was this established and if not, how one might be achieved. We discuss methods as to how social license may be measured, monitored and improved in marine industries, examining the 'pros and cons' of different popular approaches including citizen science and community participation. Public and community expectation for sustainability and sustainable practices have become 'the norm' with recognition and adoption of social license becoming more important than ever. o-operative industry-community involvement in the daunting task of sharing ocean resources in our changing world.

Technical and regulatory obstacles to mussel bed restoration in the Hauraki Gulf

Dr Shane Kelly[1], Dr Carina Sim-Smith[1], Dr Glen Carbines[1]

[1]*Coast And Catchment Ltd, Pine Harbour, New Zealand*

The Mussel Reef Restoration Trust is seeking to progressively restore historic mussel beds in the Hauraki Gulf. These beds once covered the inner Gulf, but were dredged out over a 50 year period. Despite a lack of fishing for the last 50 years, the mussel reefs in the Gulf have not regenerated naturally. In 2013, seven tonnes of mussels were obtained for a trial designed to provide "proof of concept". Mussel numbers within these original beds have declined, but most of the beds are still persisting. The Trust's efforts were increased in 2014, when 70 tonnes of mussels were spread over 10.5 ha. Monitoring of those beds indicates that around 82% of the mussels were lost, with most losses occurring soon after deployment. Sedimentation is thought to have been key cause. Habitat and site surveys indicate that a thick layer of soft mud now covers many, if not most, areas where mussel beds historically occurred. Areas free of mud typically contain diverse assemblages and are therefore unsuitable for mussel restoration. Ongoing, restoration efforts and research on transforming muddy areas back to shelly habitat have now been halted due to the presence of unwanted invasive species on the farms that supply mussels. These species are well established in the areas involved, but regulations still prohibit their transfer within those areas. Proposed methods of removal prior to transfer are considered to be impractical for the volumes of mussels involved. Meaningful restoration efforts are unlikely to proceed unless such challenges are overcome.

State of our estuaries report: reflections on the science, information and process

Ms Helen Kettles[1], Mr Matt Todd[1], Ms Claire Graeme[1], Mr John Sawyer[1], Ms Amber McEwan[1], Ms Lynn Adams[1]

[1]*Department Of Conservation, Wellington, New Zealand*

A report on the status of 48 estuarine systems in the lower North Island was published by the Department of Conservation (DOC) in 2016. The current state and future potential of the sites was assessed, which ranged from the large, celebrated Manawatu rivermouth on the west coast to the little known Waimata stream-mouth on the eastern Wairarapa coast.

Estuarine ecosystems – where saltwater meets freshwater – have high values but are under increasing pressure from a range of threats. The 48 sites were rated and ranked for conservation significance using a range of both absolute (number of Threatened/At Risk species present) and assigned values (ecosystem, social, restoration opportunity) and pressures. There is a growing awareness of the value of estuaries and the need to look after them. Many agencies, iwi and community groups are investing effort into their protection and restoration. DOC is providing national leadership for this community of interest. The estuaries report is designed to be used as a resource for everyone with an interest in estuarine ecosystems, including conservation and resource managers, landowners, tangata whenua, community groups and scientists. It can be used to guide decision making about priorities for ongoing estuarine management. The talk will provide an overview of the report and the process of its development. Challenges for science, protected areas policy implementation, prioritising restoration management and climate change adaptation will be discussed. Connections with the wider DOC Estuarine Work Programme, including the Our Estuaries hub and collaborative projects will also be mentioned.

Low cost subtidal habitat mapping of temperate reefs with multispectral satellite imagery

Mr Jared Kibele[1]

[1]*University Of Auckland*

Resource management efforts and many ecological studies depend on habitat maps. Previous shallow subtidal habitat mapping efforts in New Zealand have relied on a combination of labor intensive field methods and manual interpretation of aerial imagery. These methods are expensive, time consuming, and often lack objective accuracy assessment. Habitat maps have been successfully and efficiently generated from satellite imagery in tropical waters, but existing methods perform poorly in the temperate waters. In this talk a suite of methods and tools will be presented for mapping marine habitats based on multispectral imagery with an emphasis on low cost implementation. These include methods and free open source software for processing underwater images into ground truth data, estimating depth, and performing water column correction on satellite imagery. Resulting habitat maps from Leigh Marine reserve and the surrounding coast will be presented and discussed. The depth limits and habitat discrimination abilities of these methods will also be discussed. This work has the potential to drastically reduce the cost and complexity of subtidal habitat mapping in temperate, subtropical, and tropical environments and thereby contribute to ecological studies, marine spatial planning, environmental monitoring, and resource management efforts worldwide.

Australia has no Marine Spatial Planning

Dr Hugh Kirkman[1]

[1]*Private Marine Environmental Consultant, Seaholme, Australia*

Ocean resources are limited in space and abundance and the pressure on the marine environment, resulting from an expansion of existing use and the rise of new ones, have been devastating in many places. Management of the world's oceans through marine spatial planning (MSP) coupled with ecosystem based management (EBM) is needed. It requires integration and multi-level governance. Trade-offs on resources lost for remediation, recovery and the values of goods and services are discussed. Good MSP requires coordination, understanding and goodwill of all stakeholders. Management requires monitoring, evaluation and recording. Transboundary cooperation is well advanced in some places yet Australia and its states have no MSP. MSP elsewhere may be at a very low level and it can be seen that conflicts between stakeholders, even countries can occur. Marine protected areas are an important part of MSP and have come into consideration as more and more of the oceans' waters and substrates are exploited. Examples are given of global efforts to conserve marine biological diversity using conventions, international agreements and "soft law". Conflicts arise when uses are not compatible with one another and are competing for ocean space or have adverse effects on each other (user vs. user conflicts), or when uses are not compatible with the needs of a healthy and sustainable environment and cause conflicts between users and the environment (user vs. environment conflicts).

Unlocking ocean colour data for New Zealand

Mr Ben Knight[1], Dr Weimin Jiang[1], Dr Chris Cornelisen[1], Dr Raphael Kudela[2]

[1]Cawthron Institute, Nelson, New Zealand, [2]University of California - Santa Cruz, Santa Cruz, United States of America

Despite NZ's large coastal area, marine data is currently very limited either in space, or time for most regions of NZ. These data limitations make it very hard to improve our understanding of changes in our coastal and ocean environments. Ocean colour data has the potential to remove these limitations by unlocking up to 20 years of surface data for most of NZ's coastal and oceanic waters. However creating robust locally-trained models from ocean colour data for the things we want to measure can be time consuming, difficult and unsuccessful. Consequently, making a case for development of new models can be difficult. We present a recent application which uses an alternative approach to model training which appears to improve the chances of successful outcomes. Our initial tests have shown promise in enabling rapid and reliable estimates of chlorophyll-a in coastal waters around New Zealand. The key differences in our approach has been to use a simple empirical model and relatively high-frequency mooring data to match spatial-scales of mooring and satellite data. Our initial results suggest that this approach can facilitate the development of reliable models, even from imperfect 'off-the-shelf' ocean colour data products. The application of one algorithm developed for Hawke Bay, also provided good performance against a large independent dataset from the Californian coast. This independent validation suggests our initial algorithms may have wider application than their locally-trained environments and provides an approach that could help unlock a vast amount of new data on NZ's marine environments.

Linking Physical and Biogenic Habitats to Reveal Kapiti Island's Submarine Landscape

Ms Alix Laferriere[1], Dr. Shane Geange[2], Dr. Geoffroy Lamarche[3], Mr. Arne Pallentin[3], Dr. Jonathan Gardner[1], Dr. Vincent Zintzen[2], Ms. Helen Curtis[2], Mr. Stuart Caie[4]

[1]Victoria University Wellington, Wellington, New Zealand, [2]Department of Conservation, Wellington, New Zealand, [3]NIWA, Wellington, New Zealand, [4]LINZ, Wellington, New Zealand

Kapiti Island is one of New Zealand's most important small islands, hosting an ecologically important nature reserve that is juxtaposed by an equally important marine reserve. Although the geology surrounding Kapiti Island is dynamic with several active faults, information about seafloor morphology dates from the 1990s and has a low level of detail. Identifying the geomorphology and biogenic habitats of an area are essential to understanding the processes influencing species' distributions, ecological interactions and managing the marine environment. Through a collaborative mapping initiative, we mapped the seafloor using a Kongsberg EM2040 Multibeam Echosounder (MBES) to produce highly detailed maps of the reserve and surrounding area. Preliminary bathymetry data was visually analysed and segmented into 18 habitat types that were used to ground-truth the multibeam and define biogenic habitats. Ground-truthing included 214 camera drops, 12 sled tows and 46 dives distributed over the 18 habitat types. We present here the compilation of ground-truthing and multibeam data to reveal the diversity of physical and biogenic habitats that comprise the submarine landscape surrounding Kapiti Island, which include: soft sediments with associated infaunal communities, large areas of rock rubble and gravels with mobile invertebrates, extensive anemone and rhodolith beds, boulder fields with dense macroalgal stands, flat and complex rocky reefs encrusted with a diversity of invertebrates and algae. This multidisciplinary and scalar approach supports a greater ability to effectively manage the area and promote awareness of the richness, diversity and complexity of the seafloor of the Kapiti Island region and the biota it supports.

Long term perspective of lead pollution in Port Pirie (SA)

Ms Anna Lafratta[1], P.S. Lavery[1,2], P. Masqué[1,3,4,5], S Gaylard[6], O. Serrano[1,2,3]

[1]School of Sciences & Centre for Marine Ecosystems Research, Edith Cowan University, 270 Joondalup Drive, Joondalup, WA 6027, Australia, [2]Centro de Estudios Avanzados de Blanes, Consejo Superior de Investigaciones Cientificas, Blanes 17300, Spain, [3]The UWA Oceans Institute, University of Western Australia, 35 Stirling Highway, Crawley, WA 6009, Australia, [4]School of Physics, The University of Western Australia, 35 Stirling Highway, Crawley, WA 6009, Australia, [5]Departament de Física & Institut de Ciència i Tecnologia Ambientals, Universitat Autònoma de Barcelona, 08193 Bellaterra, Spain, [6]South Australian Environment Protection Authority, GPO Box 2607 Adelaide, South Australia 5001.

Located in the Gulf of Spencer (South Australia), Port Pirie is home to one of the world's largest lead/zinc smelter that has been in continuous operation since 1889, releasing lead, zinc and other metals (e.g. As, Cd, Hg, Ni, Se) to the environment. Recent studies have documented elevated lead contamination in the area due to atmospheric emissions. In this study we reconstructed the history of Pb contamination at Port Pirie as recorded in sediment archives from *Posidonia australis* meadows, which have been dated using ^{210}Pb and ^{14}C. The analyses of elemental composition of the sedimentary sequences have provided a long-term perspective of changes in lead concentration for the last ~3000 years. The data show relatively constant Pb concentrations (12 ± 5mg/kg) until the 1890s, followed by an 8-fold gradual increase since then until present, when concentrations reach about 100 mg/kg. The increase in Pb concentrations occurred at the time smelter operations commenced, reaching concentrations that fall between ANZECC/ARMCAZ's Interim Sediment Quality Guidelines (ISQG)-Low (50 mg/kg dry wt) and ISQG-High (220 mg/kg dry wt). The same pattern is followed by other metals such as Cd and Zn, for which the increase of concentrations during the last 120 years led to values above the ISQG-Low level. Lead isotopes have been analysed to investigate whether they can be used to trace sources of contamination in Port Pirie and to help assess if the smelter has been a significant source of lead since its opening.

Stress tolerance, multiple stressors, and evolution

Dr Rolanda Lange[1], Dr Keyne Monro[1], Prof Dustin Marshall[1]

[1]Monash University, Melbourne, Australia

Global environmental change has emerged as a major threat to almost all organisms on the planet. However, most organisms are also equipped with the ability to adapt to environmental change. Stress caused by global change will rarely be experienced as a single stress factor, but usually co-occur with other stressors. For instance, coastal environments are often polluted by heavy metals but are also disturbed by increasingly extreme temperatures and exotic species invasions. Stressors associated with global change will be experienced simultaneously and may act synergistically, so attempts to estimate the evolutionary capacity of marine systems requires a multi-stressor approach. We will here explore multiple approaches to explore how multiple stressors affect organisms, both ecologically and evolutionarily.

Sustained biological and ecosystem ocean observing: how are we approaching it and why is it important?

Dr Ana Lara-lopez[1], Mr Tim Moltmann[1], Dr Roger Proctor[1]

[1]*University of Tasmania*

Australia's Integrated Marine Observing System (IMOS) is a national scale, sustained observing system established in 2006. It supports the collection of physical, biogeochemical and biological observational time series across oceanic and coastal waters, contributing valuable data to assessments and models of ocean state and health, and providing information on ecosystem change. International cooperation is fundamental to the success of ocean observing and IMOS has been strongly influenced by developments in the Global Ocean Observing System (GOOS); the Framework for Ocean Observing influences IMOS science and implementation planning in terms of defining requirements, assessing 'readiness', and focusing on essential ocean variables (EOVs). However, with respect to ocean biological and ecosystem observing, developments have been slow - the GOOS Biology and Ecosystems panel was only established at the beginning of 2015 to guide the inclusion of essential biological and ecosystem variables into the global observation systems. Given that IMOS was conceived as a biophysical ocean observing system since its inception, IMOS chose to invest in proven methods delivering sustainable observations at specific trophic levels and biological communities that can be considered individually or synergistically in models of ecosystem change. IMOS has piloted sustained observing of benthic habitats, primary and secondary producers, mid-trophic, and higher trophic level organisms. Significant steps have been made towards the long term goal of sustained ecological observing; important lessons have been learned along the way which will be shared in this talk.

Foraging habitat and fisheries overlap predictions for New Zealand sea lions from sub-Antarctic Campbell Island

Dr Mary-Anne Lea[1,2], Dr Leigh Torres[3], Dr Rob Mattlin[4], Dr David Thompson[5], Dr Kimberly Vinette Herrin[6], Prof. Mark Hindell[1,2]

[1]*Institute For Marine And Antarctic Studies, University Of Tasmania, Hobart, Australia,* [2]*ACE CRC, Hobart, Australia,* [3]*Oregon State University, Newport, USA,* [4]*Marine Wildlife Research, Nelson, New Zealand,* [5]*Taronga Conservation Society, Sydney, Australia,* [6]*NIWA, Wellington, New Zealand*

Sea lions are highly threatened globally with three of the six species classified as endangered. The rarest, the New Zealand sea lion (NZSL, *Phocarctos hookeri),* sustains high levels of fisheries interactions with the Arrow squid, Hoki, scampi and southern blue whiting fisheries. At Campbell Island (CI), interactions occur exclusively with the southern blue whiting fishery. Since 2003, 46 sea lion bycatch mortalities have occurred. We aimed to describe the foraging behaviour, habitat requirements, and fisheries overlap for multiple age classes of NZSLs at CI for the first time. Juvenile to adult NZSL (n=25) were tracked using SPLASH satellite-dive tags in 2012-2014, resulting in usable movement and diving behaviour for 18 NZSL, tracked for up to 7 months. Location data were Kalman-filtered and diving data were recorded. Boosted regression tree (BRT) models were used to produce independent predictions of sea lion and fishery (Hoki, Ling and SBW) habitat use in relation to key environmental predictors. Distance travelled by NZSL was related to size, and most likely age, of sea lions with larger, sub-adult males travelling furthest. Low spatio-temporal overlap was predicted for all age-classes and fisheries except between sub-adult males and the SBW fishery. This overlap occurred in a discrete area to the northeast of Campbell Island over 400-500m water depth, where nine bycatch events occurred in the SBW fishery in 2013. These findings indicate that a spatially and temporally prescribed mitigation approach focused on this area and fishery could reduce NZSL mortality rates while also minimizing regulatory burdens to fishermen.

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

Eva Leunissen[1], Professor Steve Dawson[1]

[1]*University Of Otago, Dunedin, New Zealand*

Pile driving noise is among the loudest of underwater anthropogenic sounds and has been established as a serious threat to some marine mammal species. Numerous studies indicate that harbour porpoise (*Phocoena phocoena*), a broadly similar species to Hector's dolphins, shows strong avoidance responses and dramatically alter their distribution during pile driving operations. Our study is the first to investigate the impact of piling noise on endangered 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, quantify pile-driving noise during the summer of 2015, and to determine 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. A sound map of piling noise levels was created using propagation modelling in addition to the levels measured at each location. Although the onset of hearing damage in cetaceans is complicated to predict, studies of harbour porpoise hearing suggest that the levels measured in Lyttelton harbour have the potential to induce temporary hearing threshold shifts (TTS) in this species. A single strike could induce TTS within 30m of piling while the cumulative exposure of an hour of piling noise could induce TTS at up to 900m range. These levels are likely to have a similar effect on the hearing of the Hector's dolphins observed in these ranges.

Climate change in marine and freshwater systems threaten the persistence of a threatened migratory fish

Mr Hsien-yung Lin[1], Dr Christopher J. Brown[2], Dr Simon Linke[2], Dr Alex Bush[3], Prof Hugh Possingham[1]

[1]*Centre for Biodiversity and Conservation Science, The University of Queensland, St Lucia, Australia,* [2]*The Australian Rivers Institute, Griffith University, Nathan, Australia,* [3]*Commonwealth Scientific and Industrial Research Organisation, Canberra, Australia*

Climate change has modified global aquatic ecosystems and the impact varies among systems and species. Migratory species might be more vulnerable to climate change due to their requirement of intact habitats across connected ecosystems. For example, temperature change in freshwater and marine habitats could affect the migration and distribution of diadromous fish. Human disturbances may also interact with climate to shape the future of diadromous fish. We assess impacts of climate change in both river and marine habitats on a threatened species, Australian grayling *Prototroctes maraena* by modeling this species distribution in marine and freshwater habitats under climate change. We also consider the benefits of removing dams, which are barriers to freshwater migration. In New South Wales, climate change may cause local extinction of grayling in both marine and river habitats regardless of whether dams are present or removed. Climate change may also decrease suitable habitats in Victorian rivers but the cooler water in Bass Strait provides a better nursery habitat. Warming in the Tasman Sea decreases suitable marine habitats for larvae in eastern Tasmania but most freshwater habitats remain intact. As the result, dam removal could benefit grayling population in Tasmania under climate change. Further, the redistribution of suitable habitats in both marine and rivers also change the priorities for dam removal in the future. Our study highlights the importance of assessing climate range shifts in multiple ecosystems for migratory species and can help inform on priorities for stream restoration in a changing climate.

Empirical validation of an ecosystem service map in the Hauraki Gulf

Drew Lohrer[1], Mike Townsend[1]

[1]NIWA, Hamilton, New Zealand

The concept of Ecosystem Services (ES) has taken root in environmental science. It is a means of demonstrating the benefits that biodiversity and ecosystems deliver to humanity. The concept links ecosystem functions that organisms mediate to human perceptions of value relating to the natural environment. Recently, a method for mapping marine ES based on simple ecological principles and basic underpinning physical data (e.g., depth, sediment type, etc.) was developed, and ES maps were created at a 200 x 200 m grid scale across the entirety of the Hauraki Gulf. Nevertheless, to be relied on for management decision making, the ES maps/models must be cross-validated with empirical data. Here, we examined an ES map relating to the provisioning of biogenic benthic habitat structure (which promotes biodiversity and juvenile fish survivorship). We selected more than 70 grid cells from around Great Barrier Island across a range of predicted habitat structure values, and collected drop camera video footage from each grid cell to test the predictions. Analytical results indicated a high degree of concordance between predictions and data. Moreover, many of the mismatches between model and data were due to inaccuracies in the underpinning information driving the model (i.e., grid cell classed as 'soft-sediment' where in fact it was rocky). This provides confidence in the methodologies used to predict relative levels of habitat structural complexity in the Hauraki Gulf. Validation of other types of ES maps, and expansion to regions of New Zealand outside the Hauraki Gulf, are next steps.

Behavioural responses of snapper (*Pagrus auratus*) to divers at two different marine reserves in northern New Zealand.

Dr Chris Longson[1], Rebekah Gee[1]

[1]EcoQuest Education Foundation, 1204 East Coast Road, New Zealand

Fish in heavily visited marine reserves experience frequent interactions with humans. As a result of these interactions, their behaviour is often said to be modified. Given that the aim of marine reserves is to return the ecosystem to a natural state, fish behaving in un-natural ways is an undesirable outcome. There is very little quantitative data on the behaviour of fish in marine reserves, and it is not clear what represents natural versus modified behaviour for common species. We compared the response of snapper (*Pagrus auratus*) to a novel stimulus (a potential food item) presented both in association with a snorkeler and separately from the snorkeler, at two ecologically comparable marine reserves: the heavily-visited Goat Island reserves, and the less-frequented Tawharanui reserve. Fish at Tawharanui showed a similar initial response to all stimuli, whereas fish at Goat Island responded more strongly to stimulus associated with a snorkeler. The level of response to a snorkeler diving to the bottom stayed high across 10 repetitions at Goat Island, but declined significantly at Tawharanui over the same number of events. We suggest that curiosity about a new object is a natural part of the behaviour of snapper, but that snapper at Goat Island have been habituated to strongly associate divers with food.

CRAGS – CSIRO Ruggedized Autonomous Gigapixel Systems: a panoramic camera for studies of wildlife and fisheries

Dr Tim Lynch[1], Ms Georgina Wood[3], Mr David Flynn[1], Ms Carlie Devine[1], Mr Dave Hughes[1], Mr Gary Curtis[1], Dr Racheal Alderman[2], Dr Alistair Hobday[1], Associate Professor Will Figueira[3]

[1]CSIRO, Hobart, Australia, [2]DPIPWE, Hobart, Australia, [3]University of Sydney, Sydney, Australia

Remote sensing of wildlife and fisheries uses technology with scales of data collection ranging from global-regional coverage by satellite to camera traps. CSIRO have developed and tested with university and government partners a ruggedized autonomous gigapixel system – CRAGS – which is a remotely deployable panoramic camera that allows capture of data at the spatial scale of aerial surveys but with the persistence of standard camera traps to record time-series. CRAGS allows a telephoto lens equipped DSLR to take panoramic high resolution images. We enhanced 'off the shelf' technical purchases with development of a weather proof housing and thrall unit chip-set that makes the system programmable with low power consumption for long-term remote deployments. We have trialled across a wide variety of applications, which include shy albatross breeding biology, fishing effort around an offshore artificial reef, snap shot patterns of human use within urban aquatic reserves and longer term deployments of coastal bays that are candidates for reservation. Our system has proved to be generally useful for collecting data for both wildlife and fisheries questions at scales of 25 m – 6 km across timeframes of days to 12 months. The persistence of the system means that high levels of temporal replication are possible (3-4 samples per day ~ 100 samples per month), which has allowed for investigations of power curves for albatross breeding biology sampling and capture of heterogeneous rates of variation for different types of human activities along urban coastlines.

The importance of estuaries to inshore fish species with a focus on Porirua Harbour, Wellington

Mr Warrick Lyon[1]

[1]University of Auckland, Auckland, New Zealand, [2]NIWA, Wellington, New Zealand

Many coastal fish species that are commercial, recreational or customary managed species spend part of their life cycles within estuaries. There is a need for continued estuary-catchment management by local government as well as by fisheries managers. This presentation will show you the level of use, as well as the hazards faced, by the coastal fish species that use estuarine waters, using Porirua Harbour as an example.

Perceptions and misconceptions about the status of marine fisheries

Pamela Mace[1]

[1]*Ministry of Primary Industries*

Fourteen years ago Daniel Pauly stated that 'with few exceptions, we are going to lose most fisheries in the next decade if we don't quickly mend our ways'. Since then, few if any fisheries have actually been 'lost' and the percentage that are overfished has gradually declined. In fact, in developed countries such as New Zealand, Australia, the US and the EU, the status of most fish populations has been steadily improving over the past two decades or so. Yet public surveys indicate that many New Zealanders perceive marine fisheries to be in a generally poor state, much worse than our native terrestrial plants and animals. There are problem areas of course, particularly in terms of localised depletion in areas of high population density and for certain low productivity species that are caught incidentally. In the rest of the world, fisheries management has also proven difficult for many developing countries and on the high seas. I attempt to present a balanced view of the current status of marine fisheries, both in New Zealand and worldwide.

Past, present and future challenges for fisheries science

Pamela Mace[1]

[1]*Ministry of Primary Industries*

The early history of fisheries science was largely concerned with utilisation rather than sustainability. Existing fisheries were expanded and countries vied for the opportunity to develop new resources as they were discovered. The concept of maximum sustainable yield was developed in during the 1920s to 1950s, along with much of the basic theory of fisheries that still applies today. More recent developments have seen the addition of greater complexity and realism, and a tremendous expansion of data and knowledge.

The present has been about further development and refinement of methodologies, a closer marriage between fisheries science and fisheries management, particularly with the advent of our Quota Management System (QMS), and the first steps towards ecosystem approaches. The road to the current inception of the QMS has been bumpy and several issues have yet to be resolved.

Future challenges are diverse and broad in scope. We need to further refine our methodologies and communicate them to fisheries managers and the public in a way that increases confidence in the validity of the results and the QMS. We need much more interdisciplinary work that integrates knowledge from a broad range of fields including biology, ecology, oceanography, economics and sociology. To future proof the sustainability of fisheries and the marine environment we need a greatly enhanced research effort – something that will be difficult to do in the real world environment of fiscal constraint. There is much to be accomplished!

Expanding OBIS beyond species occurrence data, with an extension for environmental data

Kevin Mackay[1]

[1]*NIWA, New Zealand*

The data collected for biological studies often include more than just biological parameters. Also observations on the habitat and additional physical and chemical measurements are collected to study the organisms in their environment, as may be details regarding the nature of the sampling or observation methods, equipment, and effort. These combined data are needed for the analysis of ecosystem functioning, ecological niche modelling, climate change, etc. However, scientists currently lack internationally agreed standards for managing and sharing these mixed datasets with their peers. If, at best, the data are not lost, the biological observations get often split from the physicochemical data and sent to different data repositories. In March 2015, the International Oceanographic Data and Information Exchange (IODE) Committee of UNESCO's Intergovernmental Oceanographic Commission has established a 2-year pilot project, involving 11 institutions from 10 countries in North-America, South-America, Europe, Africa and Oceania. This project aims to develop procedures and guidelines for managing and sharing these mixed datasets, making sure that supporting measurements are curated and distributed alongside the species occurrence data. Moreover, it will investigate how these mixed datasets can flow to national, regional and global data repositories. Eventually, it will demonstrate the benefits of the approach for marine sciences, biological analysis and ecosystem modelling and will support the reproducibility of research. Here we will present a few case studies dealing with e.g. benthos and phytoplankton abundance and biomass data including sediment characteristics, water turbidity, temperature, salinity and dissolved oxygen, as well as biometric data and tracks of marine mammals holding CTD devices.

Prawn pathogen inactivation using porphyrin-based PACT

Danilo Malara[1], Miss Gabriella Citarrella[1], Associated Professor Kirsten Heimann[1], Associated Professor Michael Oelgemöller[1], Dr. Lone Hoj[2]

[1]*College of Science and Engineering, James Cook University, , Kirwan, Australia,* [2]*Australian Institute of Marine Science, Townsville, Australia*

Photodynamic Antimicrobial Chemotherapy (PACT) has shown promising results in pathogen eradication and control. The action of PACT relies on the irreversible damage of singlet oxygen ($^1O_2$) to microbial cells. In the current study, a naturally luminescent bacterium, *Vibrio campbellii* strain ISO 7, was used as a model aquaculture pathogen to test the suitability of PACT to treat aquaculture water. The bacterium was initially identified and its pathogenicity confirmed toward giant tiger prawn post-larvae. Koch's postulates were satisfied by identification of re-isolated strains by multiplex PCR and sequencing of housekeeping genes. The efficiency of one cationic and one anionic porphyrin was tested in separate time-course experiments. Porphyrins were diluted in aquaculture water seeded with the indicator bacterium and samples were irradiated for 24 h using 150 W LED. Bacterial viability was assessed by four methods; luminescence signal, absorbance at 570 nm, viable counts on agar plates and 7 days regrowth. No toxic effect was recorded in either controls samples, confirming that porphyrins and light alone were not toxic to the indicator bacterium, or anionic porphyrin. Cytotoxicity of the generated $^1O_2$ was both time- and dose-dependent, and it was demonstrated that continuous irradiation within 24 h of the cationic porphyrin achieved complete lethality of indicator bacterium. In conclusion, this work showed that the cationic porphyrin caused complete bacterial eradication while anionic counterpart only a slightly drop in luminescence signal. PACT using cationic porphyrins and visible or solar light is a promising, cost-effective and environmentally friendly method to generate pathogen-free aquaculture water.

Habitat use throughout a Chondrichthyans life

Melissa Marquez[1], Matthew Dunn[1]

[1]*Victoria University of Wellington, Wellington, New Zealand*

Over the last few decades, much effort has been devoted towards evaluating and reducing bycatch in marine fisheries. There has been a particular focus on quantifying the risk to chondrichthyans, primarily because of their relatively high vulnerability to overfishing. A key part of risk assessment is evaluating the distributional overlap of the fish with the fisheries, where fish distribution is influenced by habitat use. We synthesize published observations of habitat use for different life history stages of chondrichthyans, and hypothesize the associated catch composition in terms of fish sex, size, and maturity. We then search for these catch compositions, and thereby locations, using New Zealand research vessel catch data. Preliminary results show that some life history stages and habitats can be identified, whereas others cannot. In some species no discrete nursery grounds can be found; this may be because these are outside of the coverage of the data set (and also commercial fisheries), or because they do not actually exist for some chondrichthyans. A summary of final results will be presented at the conference.

Resilience of sea grass to natural and anthropogenic disturbances

Islay Marsden[1]

[1]*University of Canterbury, Christchurch , New Zealand*

Seagrass (*Zostera muelleri*) was historically abundant in many New Zealand harbours and estuaries but recently, in many areas, seagrass has declined. In the Canterbury Region seagrass occurs in shallow embayments and estuaries in Banks Peninsula and along the Canterbury coastline. It also occurs in sheltered sand habitats on the Kaikoura Peninsula. In the Avon-Heathcote Estuary/Ihutai seagrass populations have changed over the last 50 years, associated with anthropogenic disturbances, loss of intertidal habitats and inputs from sewage treatment works. Seismic activity in 2010 and 2011 resulted in shaking, the deposition of sand volcanoes and increased nutrient levels over the seagrass beds. We have followed the species diversity and abundance of seagrass communities over short and long time periods. Following extreme earthquake disturbances considerable areas of seagrass were lost, however, some patches remained, and the faunal diversity remained high. Following earthquake disturbances recovery of the seagrass was slow with an estimated recovery time of about 4 years, contrasting with exposed mud flats where the recovery time was less than a year. Since the earthquake, the main seagrass area in the Avon-Heathcote Estuary /Ihutai has expanded and seagrass has established in McCormacks Bay, where it had not previously been recorded for more than 40 years. This and other features suggest that the combined effects of removing treated sewage from the estuary and earthquake disturbances have improved estuarine ecosystems allowing the establishment of the seagrass beds, maintaining the species diversity and enhancing the ecological services provided by this habitat type.

Understanding marine populations: a new generalised population modelling package

Craig Marsh[1], Dr Ian Doonan, Alistair Dunn, Kath Large, Scott Rasmussen

[1]*NIWA, Wellington, New Zealand*

Understanding marine populations requires a quantitative understanding of their population dynamics. We present a new generalised population modelling package that implements a wide range of marine species population dynamics. CASAL2 is a flexible, generalised and open-source population dynamics software package. The package can be used to model a wide variety of marine populations, including fish, invertebrates, marine mammals and sea birds. Users can choose which population process and data observation types to apply depending on the hypothesised life history and data characteristics. The package allows inclusion of multispecies complexes, multiple populations across many areas, and predator-prey dynamics. CASAL2 is an open source package developed at NIWA and the code base is available for others to access and modify. The modular design of CASAL2 makes it easy to maintain and modify. The package also implements a modern unit-test framework, with most of the code base self-validated as it is compiled. CASAL2 evaluates uncertainty using Bayesian methods. It can also be used as a simulator and can be used to project future scenarios to evaluate potential population impacts and management decisions. The use of an open and well tested code base allows users to focus on the science around model inputs and results, rather than code development. In this presentation we will describe the design features and advancements in CASAL2 along with examples.

Trophic footprint of marine filter-feeders on artificial structures

Prof Dustin Marshall[1], Dr Martino Malerba[1], Prof. Craig White[1]

[1]*Monash University*

Over the past 200 years, coastlines have changed dramatically around the world as humans have built structures on shorelines for shipping, transportation and recreation. Collectively known as marine urbanisation, this change in coastlines from natural conditions to highly modified areas with ubiquitous human-made structures has accelerated in recent years. In most coastal environments, sessile marine invertebrates quickly dominate hard structures that are shaded from full sunlight. Sessile marine invertebrate communities can reach very high biomass densities on artificial structures. Artificial structures can accumulate around 20 kg. m^{-2} of biomass per annum, and can reach biomasses of 117 kg. m^{-2} after 5 years. Sessile marine invertebrates on artificial structures do not expend energy on movement but they do expend significant amounts of energy on pumping water to respire and feed. The proliferation of artificial structures worldwide, the significant biomass that forms on these artificial, and the energetic demands of this biomass make it likely that artificial structures constitute significant energy sinks and carbon sources in coastal ecosystems but the actual impacts have gone unquantified. Furthermore, these foodweb-level impacts of artificial structures have largely gone unconsidered in discussions of marine urbanisation. To this end, here we seek to estimate the physical footprint of artificial structures in two bays associated with major cities (Melbourne and Brisbane, Australia) using remote sensing data. We then estimated the biomass on these structures and the energetic demands of this biomass by direct sampling in the field and metabolic assays in the laboratory.

Does size still matter? How aquatic mammals have bucked the trend and adapted to vocalising underwater

Ms Kobe Martin[1], Dr Marlee Tucker[2], Dr Tracey Rogers[1]

[1]Evolution and Ecology Research Centre, School of Biological, Earth and Environmental Sciences, University Of New South Wales, Sydney, Australia, [2]Senckenberg Biodiversity and Climate Research Centre & Department of Biological Sciences, Goethe University, Frankfurt, Germany

Upon moving from the land into the aquatic environment, mammals were faced with issues of coping with changes in pressure, and the need to retain oxygen for extended periods of time. They were also faced with the need to communicate effectively in the water, given the limited opportunity for visual communication and the tendency of aquatic mammal species to disperse over great distances. How much did the aquatic environment drive the vocalisations that aquatic mammals produce? We used a phylogenetic model selection approach for 193 species, including a number of pinniped and cetacean species which occupy Australian waters, in order to determine the influence of a number of drivers (including body mass and environment) on the evolution of the vocalising characteristics of mammals. We found that body mass continues to be a dominant driver of minimum frequency of vocalisations among all three environments studied. However, this was not the case for the maximum frequencies produced by semi-aquatic and aquatic species. Interestingly, we found that in adapting to the unique conditions of the aquatic environment, mammals also developed interesting and unique vocalisation behaviours and apparatus to facilitate effective communication underwater. We explore the possible mechanisms which semi-aquatic and aquatic mammals employ in order to produce their maximum frequencies and how these differ among the separate groups.

Sex and the seagrass: why bigger is better

Dr Fleur Matheson[1], Dr Virginie Dos Santos[2]

[1]NIWA, Hamilton, New Zealand, [2]Observatoire des Galliformes de Montagne, Sevrier, France

Sexual reproduction by seagrasses (i.e. flowering and seed set) is relatively uncommon. After discovery of an intertidal flowering shoot of *Zostera muelleri* in Tauranga Harbour, we quantified their abundance monthly at four sites for a 2.5 year period. Concurrently we measured relevant plant attributes and environmental variables to better understand process drivers. We further examined these relationships in a subsequent single-site case study. Our results showed that flowering shoots were present annually from October/November through to January/February but generally at low densities (mean: 1.3/m^2, maximum: 136/m^2). Plant cover was significantly higher (by 1.5-fold) and leaf size was significantly larger (length by 1.5-fold, width by 1.8-fold) in plots containing flowering shoots than in plots with none. The onset of flowering was associated with monthly mean intertidal temperatures and light intensity levels ranging from 16.7 to 18.9˚C and 225 to 460 µmol m^{-2} s^{-1}, respectively, and day length of 13-14 h. In our case study we found that dense patches of seagrass with flowering shoots were restricted to the upper intertidal zone, had significantly higher above and below ground biomass (1.7- to 3.9-fold) than non-flowering areas, and were associated with a groundwater seepage zone, that kept plants wet. Our results suggest that allocation of energy into sexual reproduction in intertidal *Zostera muelleri* is plant density and size dependent and likely restricted to dense meadows or patches with larger plants. Thus anthropogenic or natural factors that limit plant size and density may inhibit sexual reproduction and, consequently, genetic diversity and fitness.

Establishing a link between the extent of estuarine habitat, fish communities and the social and economic benefits the community receives

Dr Paul Maxwell[1], Dr Ben Gilby, Dr Andrew Olds, Prof. Thomas Schlacher, Dr James Udy, Mr Nick Yabsley

[1]Healthy Waterways, Brisbane , Australia, [2]University of Sunshine Coast, Sippy Downs, Australia, [3]University of Sunshine Coast, Sippy Downs, Australia, [4]University of Sunshine Coast, Sippy Downs, Australia, [5]Healthy Waterways, Brisbane, Australia, [6]University of Sunshine Coast, Sippy Downs, Australia

Healthy estuaries are vital ecosystems. The maintenance of the values that we covet in estuaries, such as healthy fish communities for recreational and commercial purposes, is reliant on the preservation of large areas of healthy estuarine habitat (especially mangrove, saltmarsh and seagrass) and good water quality. However, many estuaries have become heavily degraded due to altered land use and habitat destruction either in the estuary itself or in the catchments surrounding the estuary. Maintaining healthy estuarine habitats is a vital part of most coastal environmental management programs. Estuarine vegetation provides important services to estuarine environments, including improving water quality by baffling sediments and preventing erosion, and by providing vital nursery habitats for fishes. Altered catchment land-use can have significant effects on downstream water quality due to increased erosion or runoff. Despite the recognized importance of habitat and water quality for important recreational and commercial fishes, many management programs do not quantify the link between estuarine habitat quality and the social and economic benefits received by the community. This research quantified the extent to which estuarine habitat quality affects fish communities in 19 estuaries in South East Queensland and concurrently quantified the social and economic benefits delivered to the community through recreational fish visits. We found a positive relationship between estuarine habitat and measures of the fish community which, in turn, led to an increase in the recreational fishing value as a result. The subsequent benefits of communicating the social and economic benefits concurrently with environmental benefits to stakeholders will be discussed.

Biosystematic and chemical ecological insights to the identification of bioactive leads from New Zealand sponges (Porifera: Poecilosclerida)

Sam McCormack[1], Dr Phil Ross, Dr Ian Hogg, Professor Chris Battershill

[1]*University of Waikato, Pyes Pa, New Zealand*

Sponge classification of the past existed based primarily on the morphology and arrangement of spicules, characters which have repeatedly been shown to be highly homoplasic in demosponges (i.e prone to convergent evolution and secondary loss). However, there have been a large number of molecular studies supporting evidence contradicting traditional taxonomy. Undeniably, there are too few demosponge taxa sequenced to create a full revision of Demospongiae to genus level. Consequently, sponge identification is in a state of instability where routine species classification has impeded our understanding of marine ecosystems. In order to feed into the drug discovery pathway for biomedicinal leads from sponges there is a need for a greater capacity for species identifications. Here, we report on preliminary investigations on the phylogeny and chemical ecology of a group of sponges known to produce interesting biomedicinal leads. Phylogenetic analysis of the diversity of a population of sponges collected from a New Zealand harbour environment utilising both molecular and classical techniques, suggests that a higher than expected proportion of cosmopolitan and potentially invasive species are associated with active compound biosynthesis. We plan a research programme that will make use of molecular biosystematics and inherent immune protein synthesis capacity combined with ecological investigation, to test the hypothesis that alien sponges produce higher rates of bioactive (immune-suppressive) secondary metabolites in order to gain an initial foothold (often as epizoic invaders) and hence be competitive in new microhabitats.

Innovative collaborations and knowledge transfers

Ms Erica McCreedy[1], Dr Bentley James[1], Ms Melissa George[1]

[1]*North Australian Indigenous Land And Sea Management Alliance Ltd, Darwin, Australia*

Indigenous peoples maintain intrinsic connections and responsibilities to their lands and seas through highly sophisticated knowledge and kinship systems. In recent decades, Indigenous communities in Australia have seen value in contributing customary lands, and more recently sea country, to a network of Indigenous Protected Areas, which currently constitute about 45% of Australia's National Reserve System. Indigenous custodians have actively sought collaborations with scientists to learn from and complement traditional knowledge systems. In this presentation we describe collaborative work between scientists and Indigenous communities in northern Australia. The Indigenous led North Australian Indigenous Land and Sea Management Alliance Ltd works with Indigenous communities, scientists, educators and linguists to develop scientifically robust and culturally appropriate education resources to support effective management of Indigenous estates. Drawing together Indigenous and western expertise, collaborations provide unique opportunities for Indigenous people to take up scientific knowledge and technical skills, while continuing intergenerational knowledge transfers that ensure the next generation of Indigenous custodians are empowered with the knowledge of their ancestors. For scientists and researchers, collaborative work provides an insight to Indigenous knowledges and the opportunity to contribute to developing locally appropriate conservation practices. Importantly, collaborative research and education enables Indigenous land and sea managers to own and control management efforts, where security of customary estates and traditional knowledge systems are often under threat. The Yolngu Shellfish Project will be used as an example to describe the collaborative process involved to capture and share incredibly diverse local knowledge about shellfish in North East Arnhem Land.

Community based planning and monitoring for adaptive management strategies in north Australia: the I-Tracker initiative

Ms Erica McCreedy[1], **Ms Christy-Louise Davies**[1]

[1]*North Australian Indigenous Land And Sea Management Alliance Ltd, Darwin, Australia*

Indigenous land and sea managers are responsible for vast areas of country across north Australia and undertake a range of management activities to protect and maintain the natural and cultural values of their Indigenous estates. In order to fulfil traditional and contemporary management priorities, Indigenous Knowledge is being combined with western science to improve management outcomes. The development of management plans over Indigenous estates must include an understanding of complex cultural meanings that define a range of management activities to protect and maintain natural and cultural values. Interactions with localised Traditional Owner structures require careful and considered engagement to ensure that management practices are carried out in accordance with local governance and customs. I-Tracker, an initiative of the North Australian Indigenous Land and Sea Management Alliance Ltd (NAILSMA), uses world renowned CyberTracker software to develop customised data collection applications that can be viewed in CyberTracker's easy to use mapping interface. These applications support Indigenous land and sea managers across north Australia to undertake natural and cultural resource monitoring, research and management activities using digital technology and equipment, giving Indigenous people the power to make informed decisions - empowering Traditional Owners and Indigenous ranger groups to use spatial information for planning and decision-making within a community-based planning framework. This is essential to implement adaptive management strategies that ensure planning is dynamic, responsive and remains firmly linked to community needs.

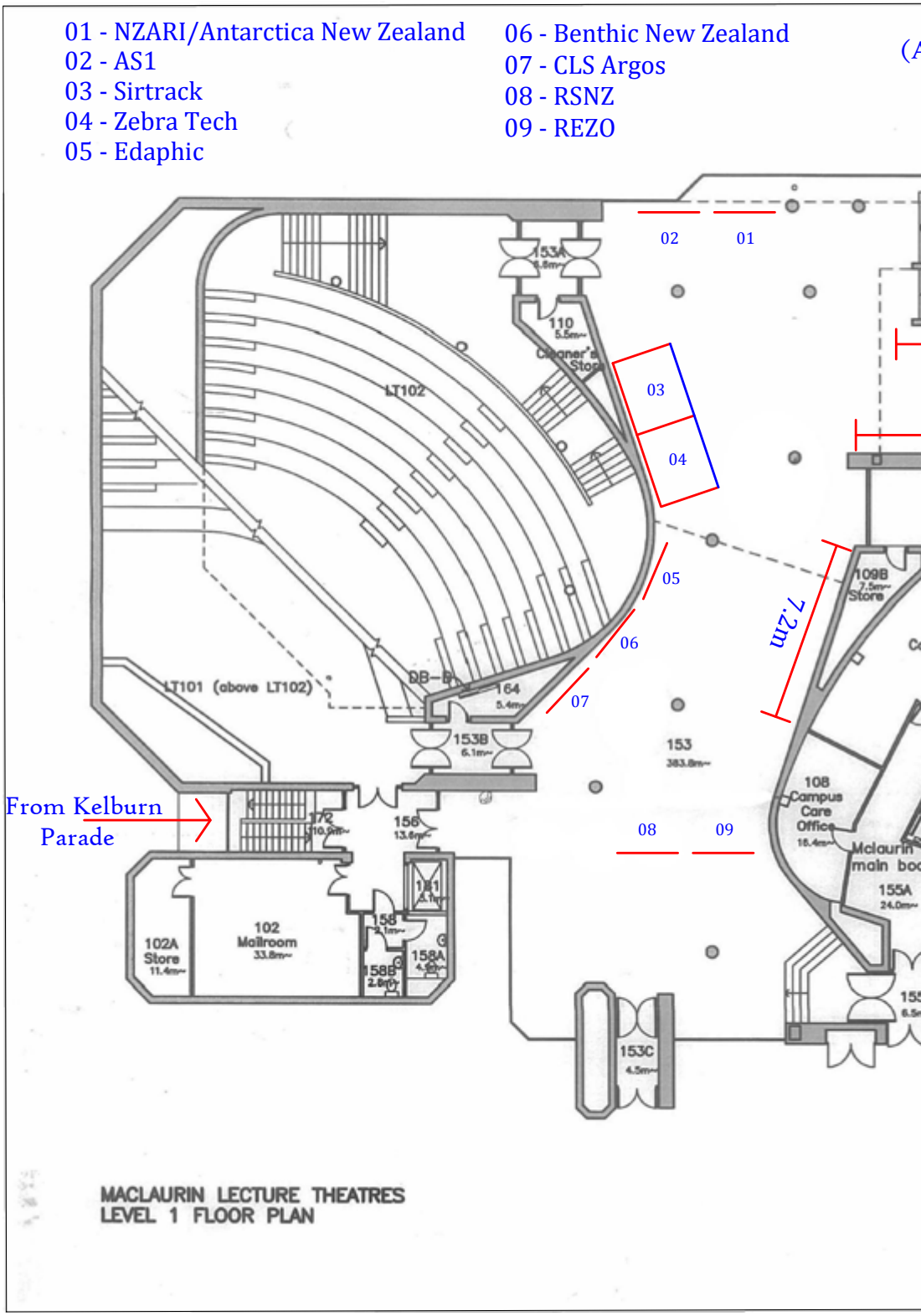
Marooned dwarves: demographic consequences of landlocking in New Zealand smelt (*Retropinna retropinna*)

Mr Chris McDowall[1], Prof Jeff Shima[1]

[1]*Victoria University Of Wellington, Wellington, New Zealand*

Amphidromous fish have evolved to use both freshwater and marine habitats. However they may become landlocked, and the demographic consequences of these natural experiments are poorly known. I sampled New Zealand smelt (*Retropinna retropinna)* from landlocked populations (Lake Taupo) and fully amphidromous populations (Wellington Harbour). I measured standard length, and used otoliths to infer growth rates and generation times, and to reconstruct individual growth histories. Amphidromous fish were greater in length than landlocked fish, and had higher growth rates – however both had a one-year generation time. Reconstructed growth histories showed that amphidromous fish began growing faster than landlocked fish after only 18-20 days of development. This suggests that fish from landlocked populations become dwarfed due to an induced physiological response that takes effect soon after hatching (likely due to poor food availability/quality). While dwarfism impairs the fecundity of landlocked fish, successful recruitment in a 'marooned' system is far easier – downplaying the demographic significance of large individuals with high fecundity.

Venue floorplan

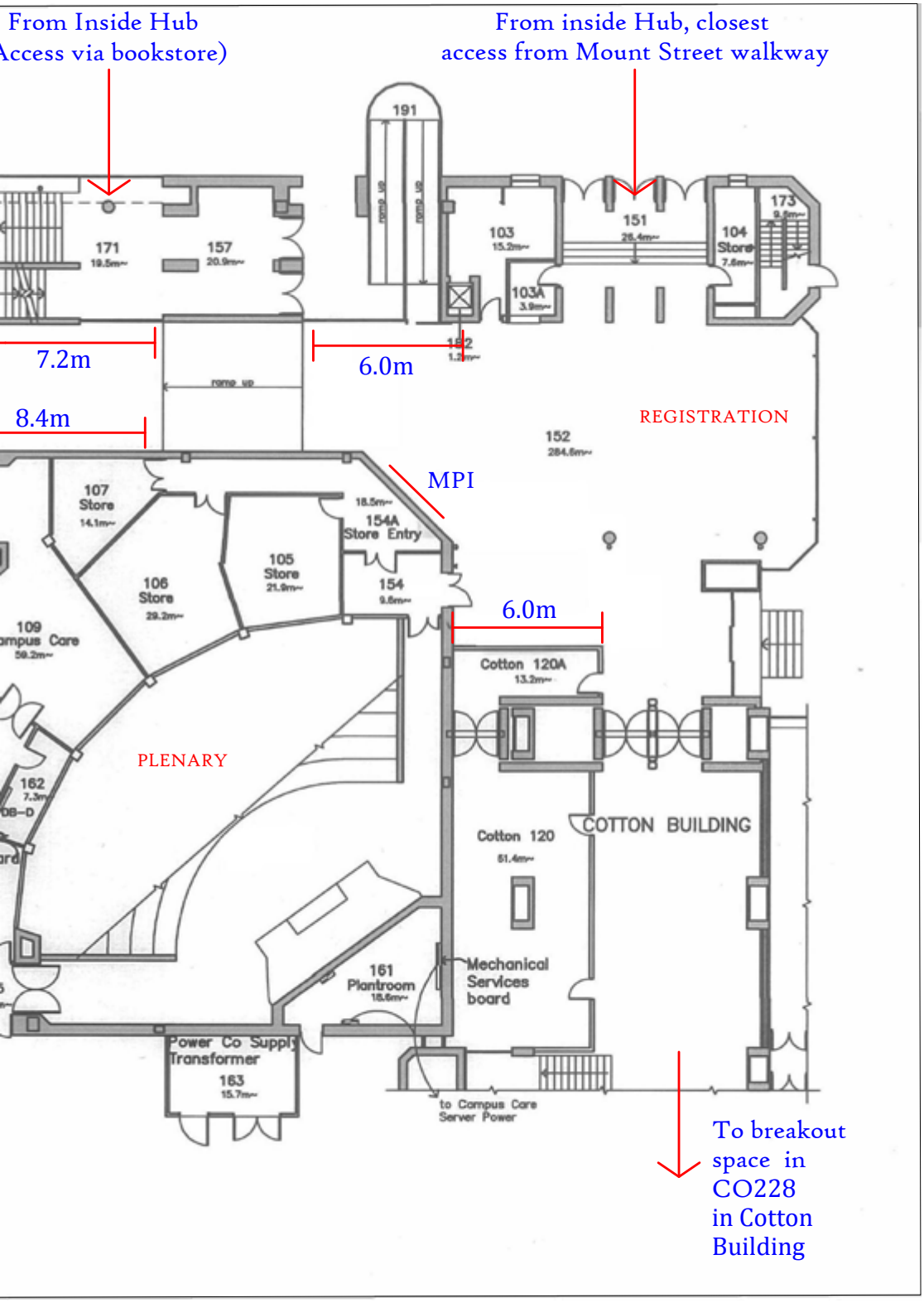


EXHIBITION HIRE SERVICES

Displayworks

MARINE SCIENCES CONFE

MACLAURIN BUILDING - VICTORIA U



ERENCE	Drawn By: Craig J Date: 09.06.2016 Version: 4 Panel System: Corinthian	Copyright of the drawing is reserved by Displayworks Limited and is issued on the condition that it is not copied, reproduced or disclosed to any third party either complete or in part without the prior approval of Displayworks Limited.
UNIVERSITY	Stands: 2.4m Freestanding Panels Stands: 3m x 2.4m	

Bridging science with traditional ecological knowledge to protect Maui's and Hector's dolphins: Messaging that moves society

Ms Gemma McGrath[1]

[1]*University Of Otago, Bannckburn, New Zealand*

Few New Zealanders had heard of Māui or Hector's dolphins a decade ago. Today, the majority are aware of their plight. An interdisciplinary study spanning eight years demonstrates the efficacy of combining Cephalorhynchus hectori science with Māori TEK for effective conservation actuation. Connections between often complex conservation biology and TEK were assimilated; designed to fuse clear science communication with principles embedded in New Zealand culture. Such syntheses involve: endemic dolphins as ecosystem indicators; intrinsic value; guardianship; and a finer-scale network of dolphin subpopulations that require adjacent gene flow. A plethora of methods were used to popularize this dolphin issue with the central syntheses including: a music compilation CD; music festivals; creative, dynamic stalls; advocacy by musicians; street art; press releases and interviews. Uniting and collaborating with NGOs for funding, resources and petitions was also instrumental and strengthened the movement. This strategic approach to conservation messaging has since progressed into opportunities to produce several wine vintages and citizen science projects. A significant outcome has been the recent willingness of political parties to put robust dolphin protection into policy. A much wider array of stakeholder groups are now supportive including recreational fishers, indigenous leaders, and other NGOs. Although conservation outcomes have been limited by the current political climate, national awareness continues to improve. Media interest persists and social media activity is high and increasing. As Māui and Hector's dolphins continue to decline, the conservation issues have become more urgent, while the TEK remains the same. These syntheses of knowledge have increased in poignancy, validity and remain pivotal. They connect deeper into New Zealand society, through the culture, and intersect with a wider range of issues and values. This approach can engage larger audiences over time and promote long-term, ecosystem-based solutions. Therefore, taking time and effort to authentically interconnect conservation biology with TEK and create key messages is worthwhile. As this study suggests, the benefits are synergistic, progressive and recommended.

Tasman and Golden Bays Ecosystem Model – Human Impacts

Ms Vidette McGregor[1,2], Mr Peter Horn[1], Mr Alistair Dunn[1], Dr Elizabeth Fulton[3]

[1]*NIWA, Wellington, New Zealand,* [2]*Victoria Univertisy, Wellington, New Zealand,* [3]*CSIRO, , Australia*

Tasman Bay/Golden Bay is a relatively shallow semi-enclosed embayment system at the north of South Island. It supports numerous commercial fisheries and marine farming activities, and active recreational and customary fisheries. The area is a destination for tourists and for large flocks of migratory shorebirds. Farming, forestry, residential development, fishing, marine farming, and other coastal changes have modified the marine environment. ATLANTIS is an ecosystem model which can be used as an environment in which different scenarios can be played out to test for different results and learn how a system may be reacting to changes within it, and includes the ability to compare social, conservation, and economic outcomes. This model can be extremely useful for management strategy evaluation, and has been applied to multiple marine systems in Australia and the United States. We present an Atlantis model of the Tasman and Golden Bays, focusing on the human impacts part of the model. We present "what if?" scenarios with respect to future fishing activities and how these can be explored using our Atlantis model.

Chatham Rise Ecosystem Model – Structure and Mechanics

Ms Vidette Mcgregor[1,2], Mr Peter Horn[2], Dr Matt Dunn[1], Dr Elizabeth Fulton[3], Dr Ian Tuck[2,4]

[1]*Victoria University, , New Zealand,* [2]*NIWA, , New Zealand,* [3]*CSIRO, Australia,* [4]*University of Auckland, , New Zealand*

ATLANTIS is an ecosystem model which can be used as an environment in which different scenarios can be played out to test for different results and learn how a system may be reacting to changes within it, and includes the ability to compare social, conservation, and economic outcomes. This model can be extremely useful for management strategy evaluation, and has been applied to multiple marine systems in Australia and the United States. We are developing Atlantis models in New Zealand for Tasman and Golden Bays and Chatham Rise. While many now understand the usefulness and applicability of end-2-end ecosystem models, not many have much understanding of the actual mechanics of these models. We present the structure of our Chatham Rise Atlantis model, including exploring some of the equations that are the building blocks of these models. We will explain how these building blocks come together to form an environment in which we can test scenarios and gain conceptual understanding of the whole ecosystem as well as its parts.

Fostering the repair of Australia's saltmarshes

Dr Ian McLeod[1], **Ms Carla Wegscheidl**[1], Professor Marcus Sheaves[1], Mr Paul Hedge[2], Dr Chris Gillies[3], Mr Colin Creighton[1]

[1]*TropWATER, James Cook University, Townsville, Australia,* [2]*Institute for Marine and Antarctic Studies, University of Tasmania, Hobart, Australia,* [3]*The Nature Conservancy , Carlton, Australia*

Saltmarsh habitats provide a range of ecosystem services including support for fisheries productivity and biodiversity, carbon storage, nutrient cycling and shoreline protection. However, their extent and value has been greatly reduced through land reclamation and indirect modification of estuaries in Australia. Saltmarsh repair has begun in some locations and with the promise of significant benefits. However, decision makers need to be able to weigh up the relative costs and benefits of repair and to do this they need detailed data on saltmarsh ecological function and economic value. To distil knowledge of saltmarshes in Australia we (1) established a network of experts to collate information and report on the current extent and condition of saltmarshes and opportunities of repair and (2) reviewed the published literature to determine information on their key ecological functions to inform evaluations of ecosystem services. None of the Australian publications quantified nutrient cycling and coastal protection functions and only eleven studies presented quantitative information on carbon sequestration and fish and invertebrate productivity. Critical knowledge gaps about the ecosystem services of saltmarsh habitats are impeding saltmarsh repair in Australia. Research should focus on addressing these knowledge gaps and communicating evidence in a relevant form and context for decision making. We discuss four principles for research funding organisations and researchers to consider when prioritising investment and undertaking research on key ecological functions of Australia's saltmarshes. We conclude with an approach to collect and communicate evidence to foster sustainable coastal development, protection and repair for long-term economic and community benefit.

Ice fish as sentinels for understanding how environmental changes impact food web diversity and stability in Antarctica

Ms Rebecca McMullin[1], Professor Steve Wing[1]

[1]*University of Otago, Dunedin, New Zealand*

Part one: Investigating how environmental variation in sea ice conditions influences population, food web, and community dynamics is important for predicting the outcomes of climate change on ice-covered ecosystems. The gradient in sea ice persistence and thickness, which runs from north to south in McMurdo Sound, presents a unique opportunity to study how locations with different physical and biological properties can harbour distinct communities. We have studied the ecological position of four ice fish species, which occupy contrasting habitats in the Antarctic marine environment. These ice fish act as important sentinel species to better understand how environmental changes may impact food web diversity and stability in the region.**Part two:** The trace element signatures of otoliths have been found to act as environmental recorders and biological tags within marine environments. Linking the environmental changes occurring in Antarctica to the otolith trace element signatures of ice fish will allow us to better understand the chemical, physical, and ecological properties of ice-covered environments. Here we provide evidence for the use of otolith trace elements as environmental recorders of sea ice conditions and habitat differences among species and sites in McMurdo Sound, Antarctica.

Using otolith microchemistry to infer movement patterns of larval reef fish in the nearshore coastal environment

Mr Daniel McNaughtan[1], Dr Jeff Shima[1], Dr Steve Swearer[2]

[1]*Victoria University Of Wellington, Wellington, New Zealand,* [2]*University of Melbourne, Melbourne, Australia*

The small size of larval stages of marine reef organisms severely limits our ability to determine their movement in the coastal environment. Chemical signatures recorded within the bony parts of some species may provide a solution to this problem, but this approach relies on persistent and interpretable variation in chemical signatures across an environment that is notoriously variable. We conducted a laboratory experiment to evaluate the ability of otolith microchemistry to resolve differences in water masses. Specifically, we reared juvenile stages of a temperate reef fish (the common triplefin) in water collected from offshore, inshore, and adjacent harbour environments, and at two different water temperatures for each water source. We detected significant 'spatial' variation in elemental signatures within the otoliths of fish reared in different water sources (multivariate signatures differed between offshore and inshore water). Signatures also depended upon water temperature, but this affect appears to be independent of water source. Collectively, our results suggest that otolith microchemistry can resolve short-term residence in different (adjacent) water masses and may be useful tool to infer movement of larval reef fish through the nearshore coastal environment.

Epiphyte density underpins a unique facilitation cascade across large and small scale ecological transition zones

Ms Isis Metcalfe[1], Dr Mads Thomsen[1], Prof. David Schiel[1]

[1]*University Of Canterbury, Christchurch, New Zealand*

Few studies have quantified facilitation cascades from rocky intertidal systems across spatio-temporal scales, or where the secondary facilitator is an obligate epiphyte. Here, we address these research gaps. We first quantified distributions of the seaweed host *Hormosira banksii* and its obligate epiphyte *Notheia anomala* at different tidal elevations in summer, autumn, winter, and spring at Kaikoura. This analysis showed that the host and the epiphyte were, in all seasons, most abundant at 'high' and 'low' tidal elevations respectively, probably driven by contrasting responses to desiccation. We subsequently quantified richness and abundances of mobile invertebrates associated with *Hormosira* and various levels of epiphytic *Notheia*. Hormosira fronds were collected from different elevations, seasons, and various regions across the South Island. All tests showed positive density-dependent effects of *Notheia* epiphytism on richness and abundances of invertebrates. An experiment comparing *Notheia* with artificial epiphyte mimics showed that both types of epiphytes had positive density-dependent effects on invertebrates. This suggests that invertebrates are facilitated by habitat space, rather than grazing on *Notheia*. Our results support a growing number of studies from different ecosystems which show that facilitation cascades can control biodiversity of small mobile invertebrates.

Variation of sea conditions along the east coast of North Island, New Zealand linked to dolphin presence

Dr Olaf Meynecke[1]

[1]*Humpbacks & High-rises, Gold Coast, Australia,* [2]*Griffith Centre for Coastal Management, Gold Coast, Australia*

The East Auckland Current (EAUC) is a continuation of the East Australian Current along the eastern coast of New Zealand's North Island. This warm water current is thus part of the western boundary current system of the South Pacific subtropical gyre. During summer (December–March) it continues southward as the East Cape Current to reach the Chatham Rise. The EAUC influences 3 important coastal regions along the east coast of North Island (Bay of Islands, Hauraki Gulf and Bay of Plenty). Little is known about the importance of fine scale mixing zones between coastal and offshore waters (fronts) and the response of marine megafauna such as dolphins. Rapid changes in ocean dynamics can occur on mesoscale (1 to 10 km's) and microscale (centimetres to 10's of meters). Surface salinity, light and temperature were continuously measured during a coastal survey expedition in January and February 2015 covering 800km. In addition 21 surface plankton casts were undertaken followed by 45 CTD casts and 29 fluoroprobe casts. The outcomes showed strong differences over mesoscales in zooplankton density and assemblages as well as phytoplankton concentration. The average phytoplankton concentration was less than 4 mg/l and surface water temperature ranged from 18°C to 23 °C. Dolphins were only sighted in areas with higher plankton density indicating their response to water property changes. Understanding alteration of physical and biological water properties on a temporal and spatial scale is essential for effective conservation management.

Supporting a data culture for evidence-based decision making

Dr David Middleton[1], Mr Oliver Wilson[1], Mr Maxwell Schofield[1]

[1]*Trident Systems LP, Wellington, New Zealand*

New Zealand's Quota Management System creates incentives for quota owners to invest in efficiently obtaining the information needed for the sustainable management of fisheries. However, the mechanisms for delivering fisheries research services have not always achieved the intended aspirations. In 2012, a group of quota owners established Trident Systems as a seafood industry research provider. Trident's mission is provide high quality fisheries research services in support of effective and efficient management of New Zealand fisheries, with the active involvement of the seafood industry and for the collective benefit of quota owners. Trident has focussed on developing and applying innovative systems and processes, aligned around three core areas:

- efficient data collection for fisheries management, especially from inshore finfish fisheries;
- realising greater value from fisheries data; and
- evaluating management procedures for lower information stocks.

Four years down the track we evaluate the progress made, concluding that the Trident model - together with the requirements of the Research and Science Information Standard for New Zealand Fisheries – is providing the seafood industry with a robust framework for undertaking and applying R&D, and is supporting effective management in a number of fisheries.

Implementing the procedural approach for the management of lower information fish stocks

Dr David Middleton[1], Mr Nokome Bentley[2], Mr Maxwell Schofield[1]

[1]*Trident Systems LP, Wellington, New Zealand,* [2]*Trophia Ltd, Kaikoura, New Zealand*

In the decades since the establishment of the Quota Management System, the stock assessments supporting the management of New Zealand's key stocks have been at the forefront of world's best practice. However development of integrated, Bayesian stock assessments has been more problematic for lower information stocks – primarily because the available data are limited. Bentley & Stokes (2009) describe an alternative paradigm for management of lower information stocks. The procedural paradigm proposes the development of Management Procedures that are tested through simulation to provide a robust approach for adjusting the management settings that apply to a stock. A decision rule that adjusts catch limits, or otherwise constrains catches, is central to most fisheries Management Procedures. We describe a number of innovations that support the evaluation and operation of fisheries Management Procedures, and discuss some of the practical challenges in the adoption of the procedural approach. We conclude that the implementation of the procedural approach as part of an effective fisheries management planning regime will be key to ensuring that lower information stocks are well managed in the next 30 years of the QMS.

The biogeography of fertilisation mode in the sea

Dr Keyne Monro[1], Dr Dustin Marshall[1]

[1]*Monash University, Melbourne, Australia*

The biogeography of life histories is central to understanding and predicting the impacts of global change on functional traits that shape species distributions and transcend taxonomic boundaries. Whether species are internal or external fertilisers is a key aspect of reproductive diversity in the sea, and has profound ecological and evolutionary consequences. Yet geographic variation in this trait, and the factors that potentially drive it, remain poorly characterised. Here, we analysed latitudinal gradients in fertilisation mode, plus their interactions with development (transitions from planktonic to aplanktonic development, or from feeding to non-feeding larvae), taxonomy and ecological variables for >1500 marine species spanning 17 invertebrate phyla. We found evidence of latitudinal gradients in fertilisation mode in the sea, but their strength and direction varies among phyla and developmental modes. The combined effects of recent adaptation and deeper phylogenetic history have likely shaped this systematic variation in the reproductive ecology of marine organisms.

The challenge of detecting changes in South Australia's Network of Marine Parks

Robyn Morcom[1], Dr Steven Delean[2]

[1]*Department of Environment, Water and Natural Resources, South Australia, Adelaide, Australia,* [2]*University of Adelaide, South Australia, Adelaide, Australia*

In October 2014, South Australia's network of 19 marine parks and associated 83 sanctuary zones were fully implemented. The main objective of the network is to protect and conserve marine biodiversity and habitats. To measure how well the marine parks achieve this objective requires a rigorous ecological monitoring program. Two core sampling techniques are baited remote underwater video systems (BRUVS) and underwater visual census (UVC) by scuba divers. These methods are commonly used for ecological monitoring in Marine Parks around the world. A key challenge is to design a sampling program that will be able to detect meaningful change in marine biota. We used generalised linear mixed models (GLMM) to estimate spatial and temporal components of variation in the abundances of a range of indicator species from baseline monitoring data collected at sites within and outside sanctuary zones using both sampling methods (mostly prior to the implementation of the marine parks). We used simulation-based power analyses to evaluate the ability to detect changes in abundance of varying magnitudes across multiple levels of sampling intensity. This enables us to identify optimal sampling strategies for future Marine Park monitoring across the Network.

Using spatial population models to investigate the effects of a proposed Marine Protected Area on Antarctic toothfish in the Ross Sea region

Dr Sophie Mormede[1], Alistair Dunn[1], Dr Steve Parker[2], Dr Stuart Hanchet[2]

[1]National Institute of Water and Atmospheric Research (NIWA), Wellington, New Zealand, [2]NIWA, Nelson, New Zealand

One aim of Marine Protected Areas (MPAs) is to protect a representative portion of specific ecosystem functions through spatial closures to extractive practices such as fisheries. Although they usually involve the displacement of fisheries, their design rarely takes into account the effect of that fishery's displacement on the target fish population. We used a spatially explicit population model of Antarctic toothfish in the Ross Sea region to investigate the effects of a proposed MPA on the status of the toothfish population. This study indicates that the MPA design proposed in 2013 is likely to result in a small increase in the catch limit under existing harvest management rules, as well as a large increase in the area with little depletion of the population and no increase in the area with higher depletion. Such spatial modelling tools can be used to inform MPA planning and compare alternative MPA scenarios. In particular they can assist in quantifying potential effects on the fish population and likely effectiveness of the proposed MPAs to meet some of their conservation goals.

Tails of an aquatic wanderer – the life and times of grey mullet/kanae (*Mugil cephalus*), a remarkably versatile and mobile species

Dr Mark Morrison[1], Professor Bronwyn May Gillanders[2], Mr Jeremy McKenzie[1], Dr Ian Tuck[1], Mr Cameron Walsh[3], Mr Balam Jimenez[4], Dr Peter Ritchie[4], Ms Nurhazwan Mohd Zain[5], Dr Richard Taylor[6], Dr Christopher Izzo[2]

[1]National Institute of Water & Atmospheric Research, Auckland, New Zealand, [2]Southern Seas Ecology Laboratories, School of Biological Sciences, University of Adelaide , Adelaide, Australia, [3]Stock Monitoring Ltd, Auckland, New Zealand, [4]School of Biological Sciences, Victoria University of Wellington, Wellington, New Zealand, [5]School of Biological Sciences, University of Auckland, Auckland, New Zealand, [6]Leigh Marine Laboratory, University of Auckland, Auckland, New Zealand, [7]Department of Statistics, University of Auckland, Auckland, New Zealand

The grey mullet *Mugil cephalus* has a global tropics-to-temperate zone distribution (circa 16 cryptic species may be involved). We present a range of new information on its juvenile and adult distribution, habitat use, growth, age and connectivity in New Zealand waters. Genetics are presented in a linked talk. Its strongholds are in the north, where it supports regionally important commercial and customary fisheries; but its distribution extends around the North Island, with seasonal migrations down to the upper South Island. Polymorphic behaviour is also indicated. Small juveniles are estuarine-dependent. Sampling of 0+ juveniles from 85 estuaries is used to define the dominant juvenile nursery areas/habitats. Otolith chemistry is assessed for its potential to distinguish the natal origins of fish, ranging from regions for stock boundary discrimination, down to individual estuaries for source-sink dynamics. The relative influences of habitat, environmental conditions, and latitude/coast on juvenile growth are evaluated; with a particular emphasis on proportional mangrove forest cover of intertidal flats, and catchment sediment and nutrient (N, P) inputs. Adults are much more wide-ranging, occurring across lakes/rivers, coastal lagoons, estuaries, coastal embayments, and exposed surf beaches. Adult fish otolith chemistry across these environments is used to reconstruct environmental histories, time-stamped by age, including residency and connectivity between these environments. Of note, 'land-locked' fish in an unfished coastal dune lake reached a maximum age of 19 years, weights to 4.1 kg, and sizes to 61 cm. We conclude with how this species and its fisheries may expand southwards in NZ with climate change.

The Odd Biogeographic Disposition of the Kermadecs: Old Lineages on Young Islands

Dr Kate Naughton[1], Dr Timothy O'Hara[1]

[1]Museum Victoria, Melbourne, Australia

The Kermadec Islands are located approximately 750 kms north-east of the northernmost point of New Zealand, approximately half the distance between New Zealand and Australia at the closest point (approx. 1,500 kms). Some previous work has shown that the islands exhibit a relatively low rate of endemism, showing close faunal affinities with New Zealand, south-eastern Australia and other islands in the subtropical South Western Pacific (SWP). Despite this previous evidence, recent collections of ophiuroid specimens from the shallows down to shelf depth (20-200m) have revealed a number of endemic new species, many bearing an extremely close morphological resemblance to Australian and New Zealand taxa. Specimens initially identified as *Ophionereis schayeri* and *Clarkcoma canaliculata* have proven not only to be undescribed species, but to have diverged from neighbouring lineages during the Late Miocene to Early Pliocene according to a COI-based molecular clock, an age at odds with the relatively youthful Kermadec Islands (<1.4Myr). By contrast, other specimens proved to represent range extensions for existing species from neighbouring regions. These results will be discussed in context with the wider biogeographic status of the Kermadec Islands.

What is Dendrogramma?

Dr Timothy O'Hara[1], Dr Andrew Hugalla[1], Dr Hugh MacIntosh[1], **Dr Kate Naughton[1]**, Dr Alan Williams[2], Dr Adnan Moussalli[1]

[1]Museum Victoria, Melbourne, Australia, [2]CSIRO, Hobart, Australia

In 2014, two species of the mysterious deep sea animal *Dendrogramma* were described. Both species are diploblastic, mushroom-shaped animals, presenting an apparent gastrovascular system extending from the base of the stalk to bifurcating canals radiating throughout the disc. The authors could not assign the new genus to any known animal group with certainty, and the possibility of a new phylum was raised, generating a great deal of public curiosity. In November 2015, 85 fresh specimens of *Dendrogramma* were collected on an expedition by the Australian research vessl R/V *Investigator*. Specimens were preserved in ethanol and RNAlater, allowing a wide range of molecular analyses to be undertaken. These range from the successful generation of a partial transcriptome from RNA sequences, in order to place the *Dendrogramma* on the Tree of Life, to lower-resolution analyses of basic 16S and 28S ribosomal RNA sequences with the goal of ascertaining how many species of *Dendrogramma* were present. In March 2016, an Antarctic survey recovered additional specimens; these were preserved in ethanol, allowing a direct comparison of 16S and 28S sequences to be made. *Dendrogramma* has been successfully identified and placed on the Tree of Life; the results, process and biogeographic implications shall be discussed directly.

Mapping using multibeam echo-sounder to identify habitats within the Hikurangi Marine Reserve

Dr Helen Neil[1], Mike Aviss[2], Kevin Mackay[1], John Mitchell[1], Arne Pallentin[1]

[1] National Institute of Water and Atmospheric Research, Wellington, New Zealand, [2]Department of Conservation, New Zealand

No abstract The Department of Conservation recently identified the need for a baseline survey of the new Hikurangi Marine Reserve, immediately south of Kaikoura. This baseline survey required multibeam bathymetry of the nearshore (~5–200 m depth), which was unmapped by previous shallow side-scan sonar and deeper multibeam surveys. During June 2015 a mapping initiative using NIWA's Kongsberg EM2040 high-resolution multibeam echo-sounder (MBES) was undertaken to map the seafloor bathymetry and identify the diversity of physical habitats. The multibeam survey mapped the bathymetry of ~ 7.5 km2 of seafloor, consisting of over 385 million soundings. This density of soundings has been used to create a bathymetric grid at 0.5 m resolution. Data reveal four first-order geomorphic domains that describe the broad context of the survey area: rocky reefs-platform, flat seafloor with high backscatter reflectivity, flat seafloor with low backscatter reflectivity, and flat seafloor with medium backscatter reflectivity. Superimposed on these domains are three second-order geomorphic features: boulder-rock apron, megarippled sediment, and canyon head (ridges and gullies). Bathymetric data from the survey were also processed in a benthic terrain model (BTM) to classify the seafloor into zones based on bathymetric variability. The new survey data has been combined with existing multibeam data from two previous R.V. Tangaroa surveys to produce a single regional high quality MBES baseline coverage, gridded at 10 m resolution, over the full extent of the ~104 km2 area of the Marine Reserve. These data and analyses form the basis of an ecosystem or habitat classification map that outlines the biophysical features within the reserve compared to the surrounding coast to the north and south, thus identifying distinct environments for subsequent targeted photographic and sampling programmes. This baseline information can be used in any subsequent reviews of the marine protection provisions at Kaikoura.

Are you an alien? Non–indigenous macroalgae in New Zealand

Prof Wendy Nelson[1,2], Ms Kate Neill[1], Dr Roberta D'Archino[1], Dr Judy Sutherland[1]

[1]NIWA, Wellington, New Zealand, [2]University of Auckland, Auckland, New Zealand

Recognition of non-indigenous species is predicated on our ability to distinguish native from non-native. For various reasons this is not as simple as it sounds. Amongst other things this requires good taxonomic knowledge of the local flora and fauna (i.e. regional inventories based on a sound taxonomic framework), as well as experts with a thorough knowledge of global biota. In 1983 Adams published the first list of macroalgae that were "possibly naturalised" in New Zealand, discussing 14 species. In the intervening 33 years many additional species of macroalgae have been identified as introductions to the region, while the status of other species remains less than clear. There are now over 40 species of macroalgae that are regarded as non-indigenous. Examples of early and recent arrivals will be presented as well as some of the major issues that arise when clarifying the status and distribution of these taxa, and the approaches we are currently applying to this work.

When 15 years of data tell the wrong story: improving monitoring of New Zealand's largest pāua (black foot abalone; *Haliotis iris*) fishery using high resolution data-loggers

Dr Philipp Neubauer[1]

[1]Dragonfly Data Science, Wellington, New Zealand

New Zealand's pāua fisheries are important recreational, commercial and customary species. Pāua stocks are currently assessed and managed as quota management areas (QMAs) which span 10s to 100s of kilometers, despite considerable evidence that population dynamics of pāua populations vary over scales of 10-100s of meters. Stock assessments are strongly driven by catch-per-unit-effort (CPUE) estimated from paper based reporting forms, which is assumed to represent trends in relative biomass within QMAs. In New Zealand's largest pāua fishery, pāua management area PAU 4 (Chatham Islands), standard CPUE analyses suggest a steep increase in CPUE. However, anecdotal evidence and formal fisher interviews suggest a steady decline of the stock, with some fishers voicing concerns that serial depletion and increasing effort are impacting the long-term sustainability of the stock. I suggest that CPUE from standard paper-based reporting is probably strongly biased by intentional mis-reporting and increasing but undocumented effort, and does not reflect actual trends in biomass in PAU 4. By contrast, recently introduced data-loggers, devices worn by pāua divers that record dive parameters and GPS positions, are now allowing unprecedented resolution in effort reporting, and experimental fishing suggests that the data-loggers provide accurate CPUE on small spatial scales. CPUE estimated from the logged data in PAU 4 is aligned with diver perception, and shows no increase in CPUE once dive effort is accurately accounted for. This result suggests that the data loggers provide a new, cost effective reporting paradigm that will enable accurate monitoring of real fishing effort in pāua fisheries. In addition to the data-logger programme, fine-scale sampling of growth and age-at maturity are now being implemented. Together, these datasets will ultimately allow spatially explicit assessments and management strategies that reflect the resource dynamics on small spatial scales.

State of the Environment assessments using multiple data sources

Emma Newcombe[1], Chris Cornelisen[1]

[1]*Cawthron Institute, New Zealand*

Information for assessing State of the Environment is often scarce or absent for the coastal marine area (CMA). Councils are increasingly addressing the need for improved marine environmental knowledge to inform decision-making and environmental reporting. The majority of available information collected in the CMA is in most cases linked to consent-associated monitoring, which often includes resampling of sites over time for the purpose of managing effects from consented activities. Historical information, data from research and community-led projects may also inform state of the environment assessments, although these are rarely maintained over time. When combined with emerging Council-led monitoring, these multiple sources of data can prove useful for assessing temporal or spatial trends in environmental health; such knowledge is required to contextualise consent monitoring results and document cumulative environmental change. The current limitations and potential use of existing data for assessing State of the Environment has been identified in recent projects in the Top of the South. This work has identified the need for frameworks to guide integration of data collected for different purposes in order to maximise knowledge gains for broader-scale assessments.

The ups and downs of tectonics, sea-level and sediment supply in the recent geological history of Wellington Harbour (Te Whanganui a Tara)

Dr Scott Nodder[1], Dr Philip Barnes[1], Dr Geoffroy Lamarche[1], Dr Joshu Mountjoy[1], Dr Helen Neil[1], Dr Alan Orpin[1], Mr Arne Pallentin[1], Dr Susi Woelz[1]

[1]*NIWA, Wellington, New Zealand*

Wellington Harbour is located at the southern end of the North Island, New Zealand, and is an 80 km-diameter, near-circular depression with one prominent arm (Evans Bay) and a narrow harbour entrance. The harbour lies within a series of tectonically uplifted and tilted structural blocks that comprise greywacke basement rocks, with major bounding strike-slip faults. The present-day harbour sediment-fill are marine silty muds that overlie coarse fluvial and colluvial clastic materials deposited during the last glacial period when sea-level was ~120 m lower than today. At the harbour entrance, marine sands and gravels, pushed into the harbour by southerly storms, interfinger with the muds. Since human habitation, extensive areas of the harbour have been reclaimed and harbour sedimentation rates have increased substantially due to widespread land vegetation clearances in the hinterland caused by natural earthquake events and human activities. Recently collected marine geophysical and sediment core data have elucidated the effects of tectonics, climate/sea-level and sediment supply on the recent geological formation and evolution of Wellington Harbour. These data have improved our appreciation of known tectonic structures, led to the discovery of new faults in the harbour, better definition of sea-floor depressions and pockmarks, caused by freshwater and/or biogenic gas expulsion, and an enhanced understanding of the distribution of near-surface groundwater aquifers and aquicludes that are important for water supply to Wellington City and its environs. These new data offer the potential to build further resilience into geological hazard and resource exploitation plans for the benefit of the Wellington region.

Radioactive Beaks: Using Trace Elements to Track Squid

Mr Tyler Northern[1], Prof. Abby Smith[2], Dr. Jean McKinnon[3]

[1]*University of Otago, Dunedin, New Zealand,* [2]*University of Otago, Dunedin, New Zealand,* [3]*University of Otago, Dunedin, New Zealand*

Squid are important as both marine predators and prey of commercially important species. It is therefore important to develop and improve tools for population identification and management of these animals. Trace element analyses of hard parts can give information about the squid post mortem as these hard parts resist dissolution. Beaks of *Onykia ingens* (warty squid) caught in two locations (Chatham and Pukaki Rise) were analysed using LA-ICP-MS to characterise their trace element composition. The beaks contained detectable levels of Mg, Mn, Cu, Zn, Sr, Ba and U. This is the first time metals have been analysed in squid beaks. If there is a significant difference between beaks from squid caught in different locations, trace element analysis could prove to be a useful method for tracing the geographic origin of squid via their beaks. This information could be useful in diet analyses of predators that consume squid due to the long residence time of squid beaks in stomachs.

Shelf sea observations with an underwater glider

Dr Joe O'Callaghan[1]

[1]*Niwa, Wellington, New Zealand*

Underwater gliders have revolutionised the way ocean observations are made. Briefly, gliders are autonomous vehicles that collect observations of biophysical properties below the surface of the ocean. Gliders use a buoyancy engine to see-saw through the interior of the ocean. This relatively low power engine allow a glider to be deployed for many weeks per mission. The slow, continuous motion of a glider results in data being obtained at higher spatial and temporal resolution than traditionally collected by research vessels, and data are delivered to a land-based computer in near real-time via satellite communications. NZ's first ocean glider was delivered in 2014 with glider missions planned to address the dearth of biophysical observations in the shelf seas of NZ. A transect has been established in the Taranaki/Cook Strait shelf sea region. The fourth mission in May 2016 will complete the first annual cycle for the region. This talk will cover aspects of glider operations as well as preliminary analysis of shelf sea biophysics in 2015/16.

25 years of monitoring: insights from a fisheries time-series on the Chatham Rise

Dr Richard O'Driscoll[1], Mr Darren Stevens[1], Ms Sira Ballara[1], Mr Dan MacGibbon[1], Mr Dan Fu[1], Dr Ian Tuck[2]

[1]NIWA Wellington, Wellington, New Zealand, [2]NIWA Auckland, Auckland, New Zealand

NIWA carried out trawl surveys of the Chatham Rise using R.V. *Tangaroa* every year from 1992–2014. This is the most comprehensive time series of fish abundance estimates in New Zealand's 200-mile Exclusive Economic Zone. The main aim of these surveys is to estimate the abundance of hoki and other commercially important species (e.g., hake and ling). As well as being an essential input into single species' stock assessments, the surveys fulfil an important ecosystem monitoring role by providing information on distribution, ecology, and biodiversity. Since the start of the time-series we have recorded a total of 558 species or species groups and individually measured more than one million fish, squid, and crustaceans. Abundance trends and spatial and depth distributions were estimated for 142 species or groups. For the 49 groups where abundance was relatively well-estimated by surveys from 1992 to 2010, biomass decreased significantly for only two species: hake and rudderfish. Hoki and arrow squid decreased in the middle part of the time series, but then increased. Eighteen groups increased significantly, 9 increased and then decreased, and 18 showed no clear trend. Species diversity increased as the proportion of hoki in survey catches declined from nearly 60% in 1993 to 21% in 2004 (leading to a more even spread of abundance between species and a higher diversity measure). More recently, hoki stocks have improved, and diversity has reduced. An interactive web interface is being developed to provide public access to survey data.

Co-operation with industry to acoustically survey southern blue whiting on the Bounty Platform

Dr Richard O'Driscoll[1], Dr Alistair Dunn[1], Dr Adam Dunford[1]

[1]NIWA, New Zealand

Annual acoustic surveys of spawning southern blue whiting (SBW) on the Bounty Platform, southeast of New Zealand, have been carried out using industry vessels since 2004. In most years, surveys were carried out from a single vessel, while in 2009, acoustic data were collected from three vessels. The survey approach in all years was the same – fishing vessels with calibrated Simrad ES60/ES70 echosounders and hull-mounted 38 kHz transducers conduct aggregation-based surveys using an adaptive design. Surveys attempted to cover all areas of high SBW density. In most years there were multiple snapshots of the same aggregation. The resulting biomass estimates are used as relative indices of spawning SBW abundance. Survey coverage depends on both the amount of survey time available (which is often limited by commercial constraints) and the behaviour of the fish (e.g., the extent and density of the aggregation, and the timing of spawning). It is therefore difficult to incorporate the resulting series of abundance estimates into a formal stock assessment model as a time series. Despite this, industry acoustic surveys of the Bounty Platform have led directly to management decisions and changes in catch limit

Predicting habitat suitability for juvenile sharks along a tropical coastline: implications for conservation

Ms Beverly Oh[1,2], Dr Ana Sequeira[1,2], Dr Mark Meekan[3], Dr Jonathan Ruppert[4], Professor Jessica Meeuwig[1]

[1]Centre for Marine Futures, School of Animal Biology and The Oceans Institute, The University of Western Australia, Perth, Australia, [2]Indian Ocean Marine Research Centre, The University of Western Australia, Perth, Australia, [3]Australian Institute of Marine Science, Perth, Australia, [4]Department of Renewable Resources, University of Alberta, Edmonton, Canada

Marine protected areas (MPAs) are expanding globally to counter the rapid loss of marine biodiversity, however, the paucity of monitoring data at large-scales means it is still unclear if MPAs are effectively protecting mobile species. Using data from baited remote underwater video systems (BRUVS), we predict distribution patterns of juveniles of three shark species and *all juveniles* (21 species as a group) in North-west Australia and assessed the spatial overlap with existing MPAs. Adult co-occurrence, distance to reef, oxygen, salinity, temperature and turbidity were important drivers of the distribution of *all juveniles*, while salinity, temperature and turbidity were the most influential drivers of distributions of grey reef and whitetip reef sharks. Sandbar shark distributions were most influenced by aspect, depth, distance to shore and slope. Predicted habitat suitability was highest north of 20°S for *all* juveniles, north of 15°S for grey reef and whitetip reef sharks, and in offshore waters between 13–18°S and 19–24°S for sandbar sharks. Species-specific models had higher model accuracy (κ) and deviance explained (DE) (κ > 0.68 and DE > 47 % respectively) relative to the *all juveniles* model (κ = 0.36; DE = 10 %), indicating that species-specific predictions are needed to accurately delineate priority habitats for conservation. Highest habitat suitability for multiple species of juvenile sharks encompassed a wider section of northwest Australian waters than is covered by existing MPAs. We provide fundamental information within a data-deficient region to guide the management of these species and their essential habitats.

Habitat Cascade: An overlooked process maintaining biodiversity in New Zealand estuaries

Ms Eliza Oldach[1], Dr Mads Thomsen[1], Prof. David Schiel[1]

[1]University Of Canterbury, Christchurch, New Zealand

Past research into the drivers and maintenance of biodiversity has usually overlooked the possible importance of 'habitat cascades' (HC). In HC, primary habitat-forming species facilitate secondary habitat-forming species, thereby indirectly facilitating those species (hereafter inhabitants) that depend on the secondary habitat-former. Examining an ecosystem through the lens of HC may reveal facilitative processes that allow species persistence and high biodiversity. In this study, we used surveys and experiments in the Avon-Heathcote Estuary, Christchurch, to document how HC can affect distribution and abundance of species often overlooked in inventories and biodiversity assessments. First, we demonstrated the existence of a long cascade incorporating up to six habitat formers. Cockles provided hard substrate for seaweeds, which provided habitat for trochoid snails, which in turn facilitated encrusting and sessile animals, more seaweeds, and more snails. Second, we identified underlying patterns of this process. The strength of the HC was strongly density-dependent: increasing the amount of secondary habitat formers positively influenced the abundance of inhabitants. Increasing the amount of sampled habitat formers also allowed us to document the presence of 'ubiquitous' species that nevertheless rarely are considered parts of estuarine biota. In addition, we found that inhabitants had varying affinities for different habitat formers, as both generalist and specialist species were documented. The diversity of habitat structure, in combination with varying habitat-affinities, allows the persistence of many species in the estuary. We conclude that HC can be a valuable tool for examining biodiversity in many ecosystems and should be considered as a key process.

Occurrence of hypoxia in Tasmanian Atlantic salmon production cages – biological and environmental influences

Ms Tina Oldham[1], Dr Tim Dempster[2]

[1]University Of Tasmania, Launceston, Australia, [2]University of Melbourne, Melbourne, Australia

Despite being the most valuable fisheries product in Australia, the Tasmanian salmonid industry is constrained by environmental challenges. Hypoxia, which can occur naturally, is exacerbated in marine pens due to restricted water movement and locally increased biomass. With warmer than average summer waters increasingly common in Tasmania, a global hotspot of sea temperature increase, farmers are reporting greater problems with hypoxic events. In extreme cases acute hypoxia can cause mass mortality - such as the event on 6 May 2015 in Tasmania which resulted in the largest single fish kill in the history of Australian aquaculture. In less extreme cases sub-optimal dissolved oxygen concentrations result in decreased growth, appetite, immune function and fish welfare. In this study we measured dissolved oxygen concentrations at five depths across five commercial salmon cages in southern Tasmania concurrently with vertical profiles of temperature, salinity and fish density. Data was collected continuously during the summer 2016 season to describe the nature and extent of hypoxia in marine pens, test for climatic and environmental factors that may be driving hypoxia and assess exposure of penned fish to hypoxic conditions. This improved understanding of the dynamics of dissolved oxygen fluctuation in pens will allow managers to focus mitigation efforts and minimize risk as sea temperatures continue to rise

Restoration of seagrass in Te Awarua-o-Porirua Harbour: feasibility assessment and community-led transplant trials

Dr Megan Oliver[1], **Dr Fleur Matheson**[2], Mary Diniss[3]

[1]Greater Wellington Regional Council, Pipitea, Wellington, New Zealand, [2]NIWA, Hamilton, New Zealand, [3]Guardians of Pauatahanui Inlet, Porirua, Wellington, New Zealand

Te Awarua-o-Porirua Harbour is the only estuary in the lower North Island with a substantial cover of seagrass (*Zostera muelleri*) but more than 40% of the harbour's seagrass cover has been lost since the 1980s. Siltation and elevated water column nitrate (NO_3^-) concentrations were likely responsible for the decline in seagrass and failure to regenerate/recover. However, light climate data suggests that present-day conditions should be sufficient to support plant growth. In early 2015 with the support of a keen group of community volunteers and the local iwi, NIWA and Greater Wellington Regional Council commenced a small-scale citizen science project to trial the potential for seagrass reestablishment and growth. Following mixed success of the first trial, a second trial was established in November 2015 with modifications to the transplanting technique, to test the success of transplanting during the active growth (i.e. spring) compared with dormant (i.e. autumn) phase. These trials have been monitored at monthly intervals by our volunteers with complimentary water quality monitoring and light logger deployment. This presentation will outline the latest results of these transplant trials and discuss key learnings from this citizen science project.

Planning for whitebait: applying vulnerability assessment to inanga spawning sites

Mr Shane Orchard[1], Dr Mike Hickford[1], Prof. David Schiel[1]

[1]University Of Canterbury, Christchurch, New Zealand

Inanga (*Galaxias maculatus*) are known to use specific locations for spawning. These sites are on riparian margins in upper estuarine areas near the spring high tide waterline. Many anthropogenic activities that occur in the same area may present threats to the availability and condition of spawning sites. These factors suggest that spawning may be a vulnerable stage in the life cycle and that spawning sites are an important focus for management. Such sites may be susceptible to land use change and will undoubtedly be affected by sea level rise. To ascertain if these potential vulnerabilities are real, it is necessary to identify and characterise the actual sites used for spawning. This underpins the understanding of potential threats and is necessary for the assessment of specific risks under various management scenarios. However, the biogeography of these sites varies spatially and temporally, so unravelling the spatial ecology of spawning sites remains a key requirement for quantifying the impacts of various activities and for assessing the effectiveness of protection measures. Here we describe an approach to address these questions. We include an example application to assess changed patterns of vulnerability in the waterways of Ōtautahi Christchurch after the Canterbury earthquakes. Analysis shows that spawning sites were resilient to earthquake changes, but that vulnerabilities to human activities remain. Addressing these effectively presents opportunities to improve outcomes within the wider context for waterways management.

Response to *Sabella spallanzanii* (Mediterranean Fanworm) in the Coromandel

Dr Anjali Pande[1], Dr Hernando Acosta[1], Kathy Walls[1], Dave Hodges[2,3], Dr Naya Brangenberg[1]

[1]Ministry For Primary Industries, Wellington, New Zealand, [2]Waikato Regional Council, Hamilton, New Zealand, [3]Dairy NZ, Hamilton, New Zealand

The Mediterranean fanworm (*Sabella spallanzanii),* an unwanted and notifiable organism under the New Zealand Biosecurity Act 1997, was first detected in the Auckland region in 2008. This fouling species is now well established in this region where commercial and recreational vessels are likely to act as vectors spreading this species to other regions across New Zealand. In 2013, Sabella was first reported in the Coromandel region, on two infested vessels. The Waikato Regional Council and MPI (Ministry for Primary Industries) then instigated a joint-agency response. Although not the only instance of a joint agency response, this is a nice example of how agencies can work together and use expertise from both agencies to jointly address a biosecurity risk to New Zealands' marine space. This presentation covers some of the challenges and solutions met during this response, including an initial delimitation survey, an in-water hull cleaning process and a 6-month follow up detection/ delimitation survey in case of accidental propagule release during vessel cleaning. This response is constantly changing to meet the changing requirements of the situation. The methodologies employed to monitor this marine pest, which incorporate elements such as habitat type, hydrodynamics, risk habitats and characteristics such as search efficiency and assumed density, could be employed in many other circumstances.

Future Proofing our Fisheries and stepping up to the challenges

Tim Pankhurst[1]

[1]*Seafood New Zealand*

Our world-leading Quota Management System is 30 years old. Much has changed since the boom and bust days prior to the QMS. Our fish stocks are sustainably managed and are in good heart and export earnings are growing, reaching a record $1.7 billion for the year ended this March. All of this bodes well for a bright future for the seafood industry, but only if we step up to the challenge of a changing global marketplace. Our commitment to a sustainable fishery is non-negotiable, which means the future is not about increasing volumes, but adding value to the resource, providing premium products for high end markets around the globe. Increasingly, customers in these markets want to know where their food comes from, whether it's safe to eat and natural, how it was harvested and whether it comes from a sustainable source. The challenge for us is rising to these opportunities – it's not just about selling our seafood, it's about promoting it and telling our story – our commitment to quality, sustainability, the environment and the exclusivity of our products.

Monitoring fish with quantitative line surveys: Implementing vessel-based and sea ice-based surveys to characterise toothfish abundance and ecology in the southern Ross Sea

Dr Steve Parker[1], Dr Sophie Mormede[1], Dr Stuart Hanchet[1], Dr Alistair Dunn[1]

[1]*NIWA, Nelson, NZ*

We have developed and implemented two standardised, random stratified, longline surveys in the southern Ross Sea to index the age composition, diet, reproductive status, and local abundance of Antarctic toothfish (*Dissostichus mawsoni*). An annual vessel-based survey has been conducted for five years targeting juvenile toothfish recruiting to the southern Ross Sea shelf area. The vessel-based survey series shows that modal age progression is tracked by the surveys and these data have already been incorporated into the Ross Sea stock assessment. It also provides an 'early warning system' to managers in the event of a sustained period of weak or strong year classes. A vertical longline survey has recently begun from the sea ice in McMurdo Sound, extending a long time series of sampling using similar gear. The sea ice-based survey suggest that the toothfish in McMurdo Sound are still abundant relative to historical catch rates, have a similar size composition to the historical data, are relatively old (median age of 24 years), and their diet was varied consisting of euphausiids and fish (mainly *Pleuragramma antarcticum*), though many had empty stomachs. The sea ice-based data will be synthesised with parallel studies on the diets of Weddell seals and killer whales in McMurdo Sound and in Terra Nova Bay. The results will contribute to the development of ecosystem models that could be used to inform management strategies to respond to the potential ecosystem effects of fishing and the likely interacting effects of climate change.

Are all habitats the same: abundance response of nursery occupying snapper in an estuarine system?

Darren Parsons[1], Dane Buckthought[1], Crispin Middleton[1], Graeme Mackay[1]

[1]*NIWA*

Many fish species rely on estuarine nursery habitats as they transition to adult life stages. Quantifying nursery value, however, requires identification of the life stages (often small and short lived) that utilise nursery habitats, and survey methods that provide comparable estimates across habitats. We conducted surveys of post–settlement snapper (*Chrysophrys auratus*) using video camera deployments across habitats within a northeastern New Zealand harbour. Post–settlement snapper abundance was higher amongst structured habitat types relative to bare sediments, with the type of structured habitat not influential. The exception appeared to be for reef habitat (although sampling was limited). Reef sites were structurally complex, but largely inhabited by older life stages (snapper and other fish species). Overall, nursery value for snapper appears connected to structure, rather than structure type. This result emphasises the importance of a broadened scope to coastal fishery management, one which incorporates not just fish extraction, but also habitat maintenance or restoration.

Sperm viability in the giant kokopu (*Galaxias argenteus*)

Mr Johnny Pearce[1]

[1]*Auckland University of Technology, Auckland, New Zealand*

The endemic giant kokopu (*Galaxias argenteus*) is the largest member of the group of native fishes of the family Galaxiidae. Along with four other diadromous species of native Galaxiid's, juvenile giant kokopu form mixed species schools of fish that migrate from the ocean into rivers and streams where they are commercially and recreationally harvested as the iconic New Zealand delicacy known as "whitebait". Giant kokopu are being commercially farmed in Walkworth, North of Auckland by New Zealand Premium Whitebait Limited (NZPWL) to supply sustainable whitebait to restaurants and retail markets. Flow cytometry is a novel technique in assessing sperm cell viability. It involves cells in suspension flowing through a tubular system where they are exposed to laser illumination allowing the flow cytometer to record the physical and fluorescence properties of cellular organelles. Using a combination of dyes such as propidium iodide (PI) and Sybr-14 a flow cytometer can be used to assess the number, concentration and membrane viability of sperm cells. In this study we examined the viability of giant kokopu sperm cell samples taken from fish raised in different water temperatures and over a range of age and size groups. Our results show that this experimental technique can be used to investigate integrity of sperm cell membrane and other factors such as oxidative stress.

Why do colder mothers make bigger larvae? Temperature alters the costs of development

Ms Amanda Pettersen[1], Professor Craig White[1], Professor Dustin Marshall[1]

[1]*Monash University, Melbourne, Australia*

Larval size is a key life-history trait that can influence both maternal and larval fitness – for a given amount of reproductive resources, a mother can produce a few, large or many, small larvae. Larger larvae generally perform better than smaller larvae – a benefit which may offset the costs of reduced fecundity for the mother. However, the larval size-performance relationship is highly context-dependent and environments that alter the size-dependent fitness of larvae can pose important consequences for the evolution of larval size. Temperature gradients produce clear patterns in larval size – among and within species, and even within a single individual, mothers produce larger larvae in cooler environments. Broadly applicable explanations for the temperature-size relationship are lacking. Here, we address one potentially widespread, however previously untested explanation for why larval size co-varies with temperature. We measured development time and metabolic rate in the bryozoan *Bugula neritina* across a range of temperatures in order to determine the temperature-dependent costs of development for larvae.

Maybe the dead do tell tales: using dead settlers to examine variability in early post-settlement mortality in intertidal mussels

Dr Nicole Phillips[1]

[1]*Victoria University Of Wellington, Wellington, New Zealand*

Early post-settlement mortality is a key modifier of larval settlement patterns, and a crucial factor influencing recruitment in benthic marine invertebrates, but is difficult to measure in mobile taxa such as mussels. Here, empty shells of pediveligers, i.e., recent settlers that died before beginning to grow as juveniles, were used to assess temporal and spatial patterns of early mortality in mussels, whether size at settlement determined mortality, and whether mortality was density-dependent. This study took place at two intertidal sites in Wellington where monthly cohorts of mussels were collected over a 2 year period. Mortality varied substantially across the monthly cohorts, ranging from 0 - 43%, but not across the two sites that were 27 km apart. Although there was no density-dependent mortality evident within cohorts, the proportion of pediveligers which were dead on collection was positively correlated across sites, suggesting a role for large-scale environmental drivers of variability in mortality. Live settlers were on average larger than dead settlers, and the size distribution of dead settlers was shifted toward smaller sizes compared to live settlers. These results suggest that size at settlement may be an important determinant of very early mortality in mussels, with smaller settlers at higher risk. These results also demonstrate the potential value in evaluating dead pediveligers from naturally settling cohorts to complement other approaches for assessing early post-settlement mortality in mussels.

Middle trophic level organisms on the Chatham Rise: fish, zooplankton and everything in between

Dr Matt Pinkerton[1]

[1]*NIWA, Wellington, New Zealand*

Middle trophic level (MTL) organisms are increasingly recognised as key parts of marine ecosystems – they are the "ecosystem glue" that connect high trophic level predators with primary producers and are important for ecosystem resilience. MTL organisms include small (less than about 20 cm in length) demersal fishes as well as hyperbenthic invertebrates (e.g. prawns, shrimps, mysids, amphipods), mesopelagic fishes (including myctophids), cephalopods, and meso- and macro-zooplankton. The MTL assemblage is diverse and, despite its importance in ecosystem function, remains poorly understood. Partly, this is because MTL organisms are hard to sample. For example, many small demersal fishes are rarely caught by commercial trawl gear or normal scientific bottom trawls because they are small or slender enough to escape through the mesh, or because they live close to the seabed and pass beneath the trawl. Studies of the diet of commercially-important fishes (from stomach-contents analysis) and food-web modelling suggest that these poorly-sampled small, slender and cryptic demersal fishes play a crucial role in the Chatham Rise food-web. MTL organisms may also be key to understanding the potential for climate change to affect New Zealand's deepwater ecosystems. In this presentation we report on two research voyages in August and December 2015 which sampled MTL organisms on the Chatham Rise, including carrying out the first large-area survey of small demersal fishes in the New Zealand offshore ocean. The voyages sampled nearly 300 different species or species groups and measured over 30,000 individuals.

The Ross Sea Toothfish Fishery: Is it Sustainable or Should it be Closed

Matt Pinkerton[1], **Dr Steve Parker**[1], **Stuart Hanchet**[1], **Alistair Dunn**[1], **Sophie Mormede**[1]

[1]*NIWA*

There have been many articles in the media in recent years lamenting the lack of knowledge about the Antarctic toothfish population in the Ross Sea and questioning the sustainability of the fishery operating there. Indeed, a recent opinion piece in the journal Nature stated that virtually nothing is known about this fish: no eggs or larvae have ever been collected. So how true are these articles and what is known about Antarctic toothfish? NIWA scientists have been researching the biology, ecology, population dynamics of Antarctic toothfish and potential ecosystem effects of the fishery for the past 15 years. The talk will describe what is known about the Antarctic toothfish, the fishery, and potential ecosystem effects of fishing, including the development of a tagging program for monitoring its abundance, spatial population models for assessing bias, spatial management, and ecosystem models for understanding ecological interactions. They will also describe critical uncertainties, and how these may be addressed.

Four new red algal parasites from New Zealand

Maren Preuss[1], Wendy Nelson[2], Joe Zuccarello[1]

[1]Victoria University of Wellington, Wellington, New Zealand, [2]National Institute of Water and Atmospheric Research, Wellington, New Zealand

Parasitism is a common lifestyle in organisms and approximately 40% of all known species are parasitic. Parasites can be found in all groups, but red algal parasites are unique due to their close relationship to their hosts. Red algal parasite have a reduced morphology and unique development. There are common on other red algae and can switch hosts. There are nine parasites known in New Zealand but preliminary studies indicate a much higher number. This study details four undescribed parasites growing on *Polysiphonia aterrima, Cladhymenia oblongifolia, Phycodrys novae-zelandiae, Callophyllis hombroniana* and *Callophyllis calliblepharoides.* Microscopy and molecular markers (mitochondrial, nuclear, plastid) were used to study the morphology and genetic variation of these parasites. The parasites on *Cladhymenia*, *Polysiphonia* and *Phycodrys* show a close relationship to their hosts. The close relationship between parasite and host combinations suggests that the parasite evolved from its host and relatively recently. The parasite on the two *Callophyllis* species is more closely related to *Judithia* than to its host species. The close relationship between parasite and *Judithia* indicates that the parasite evolved from *Judithia*, or a common ancestor, and later switched hosts.

The Australian Ocean Data Network and New Zealand marine data

Dr Roger Proctor[1], Mr Sebastien Mancini[1], Dr Peter Blain[1], Dr Jochen Schmidt[2], Mr Kevin Mackay[2]

[1]Integrated Marine Observing System, University Of Tasmania, Hobart, Australia, [2]NIWA, Wellington, New Zealand

Following a symposium in Hobart in 2012, NIWA and Australia's Integrated Marine Observing System (IMOS) agreed on establishing a New Zealand ocean data node compatible with the Australian Ocean Data Network (AODN) which would enable New Zealand to serve large amounts of multi-disciplinary ocean data into the international community using open standards. The groundwork has been done – components of information infrastructure are common between IMOS and NIWA, for example, both utilise the GeoNetwork software for their metadata catalogs, both use the Marine Community Profile (MCP) as their metadata standard – and some preliminary datasets have been made public. Recent developments in the AODN infrastructure, promoting the discovery of data through controlled vocabulary services and delivery of data through Open Geospatial Consortium web map services and web feature services, offer greater flexibility in the discovery and download of data collections. We will outline the significance in these new developments for users of ocean and coastal seas marine observations and indicate the New Zealand data collections intended for publication.

Small-scale fishers at the edge of Jakarta: Challenges and opportunities from a megacity

Mrs Amanda Putri[1], Associate Professor Stuart Pearson[1]

[1]University Of New South Wales in Canberra, Canberra, Australia

People living in the coastal areas of the Jakarta megacity have preserved the livelihoods of small-scale fishing communities for decades. Nowadays, these natural resource-dependent communities are squeezed between the pressures and competitiveness of other industries such as tourism, shipping, high-end residential, and even more sophisticated and modernised fishery industries. Living on the edge of this megacity, their daily livelihood and experiences reflect the challenges and opportunities of being between the progress of development and environmental damage. This paper, a part of much bigger project, provides synthesis and insights into the changing livelihood of poor small-scale fishers (capture fisheries and green mussel mariculture) in Jakarta megacity within the context of pressures from the environmental degradation and multiple user conflicts. The research engaged communities' participation in several activities such as questionnaire survey, interviews, and community workshops. Information that relates to their livelihood conditions, fishery activities, perceptions of environmental issues, their attitudes and adaptation strategies in dealing with uncertainty and degraded environment quality and resources were collected. The insights and local knowledge gained from this research represent the coastal poor community's voices that are too often ignored in the decision-making and development processes. The results illuminate the communities' strengths and resilience in facing the emerging challenges and show them using various strategies to sustain their livelihood. The research demonstrates the importance and potential of integrating such knowledge into decision-making to achieve more actionable solutions that could support the sustainability of communities' livelihood.

Assessing seasonal and spatial changes in dugong (*Dugong dugon*) feeding activity using novel low-level aerial photography and next generation photogrammetry

Dr Michael Rasheed[1], Dr Damien O'Grady[1], Ms Emma Scott[1]

[1]James Cook University, Cairns, Australia

Dugong (Dugong dugon) are large herbivorous animals that are almost entirely reliant on seagrasses as their food source. Listed as 'vulnerable to extinction' by the International Union for the Conservation of Nature (IUCN), the largest dugong population on the planet occurs in tropical northern Australia and the Torres Strait. For the majority of areas within this range little is known on how dugong vary their utilisation of different seagrass resources temporally and spatially. The feeding trails left behind when dugong excavate for seagrass offer some of the best physical evidence of feeding and habitat use and are common in preferred foraging habitats in the intertidal regions of the Great Barrier Reef. We developed a novel method for quantifying dugong feeding trails over large spatial scales using low-level aerial photography from helicopter and drone platforms, combined with next generation photogrammetry (structure from motion) techniques and software. This enabled the production of orthomosaics of meadows with less than 5cm pixel resolution suitable for identifying dugong feeding scars or trails and developing algorithms to reliably extract feeding activity metrics over large spatial scales. The successful low-cost technique was applied in quarterly assessments and generated new insights into how dugongs utilise seagrass habitats over time and space as well as the relationships between herbivory and seagrass recovery. We discuss the implications of these results and how they can be combined with tagging and other studies to aid in management and understanding of dugong and their key habitats

The journey of Indigenous researchers: insights on navigating science with the needs of communities

Kelly Ratana[1], **Cass Hunter**[2]

[1]*NIWA,* [2] *CSIRO Oceans and Atmosphere, Cairns, Australia*

The Māori proverb '*Nā tō rourou, nā taku rourou ka ora ai te iwi*' is literally translated, 'with your food basket and mine, we will flourish'. It alludes to the benefits that arise from genuine and lasting collaborations, mutual respect of knowledge, and a common purpose, a concept well understood by indigenous peoples. In Australia, Aboriginal and Torres Strait Islander people manage and benefit from their land, sea and cultural resources in accordance with Aboriginal Lore and Ailan Kastom. Indigenous people have a deep and enduring relationship with their land and seascapes, established through generations of survival, adaptation and sustainable management practice. This relationship is both spiritual and physical, and encompasses all environments from inland through to the sea. Indigenous people, their knowledge, and their ways of knowing have a great deal to contribute towards the mutually beneficial goal of supporting a flourishing socio-ecological system.

When indigenous peoples become embedded in research organisations, the outcomes of research can be transformed by their deeper aspirations to align outcomes towards benefits for communities. Each indigenous researcher has their own unique experiences, values and skill sets. This shapes their role and expectations within research organisations. Often as indigenous researchers we are asked to walk the line between knowledge systems, becoming navigators of language to develop shared understanding between both our non-indigenous colleagues and communities. We will draw on our personal experiences as indigenous researchers within research organisations and explore the assumed expectations we often carry, highlighting that the responsibility for effective engagement between indigenous peoples and science falls on the shoulders of many

Demographic parameters of southern right whales estimated via analysis of photo-ID data

Dr Will Rayment[1], Dr Trudi Webster[1,2], Mr Anthony Davidson[1,3], Professor Steve Dawson[1]

[1]*University Of Otago, Dunedin, New Zealand,* [2]*Otago Museum, Dunedin, New Zealand,* [3]*University of Canberra, Canberra, Australia*

Estimates of demographic parameters such as survival rate are essential for understanding the status of impacted populations. Southern right whales were hunted to the brink of extinction in New Zealand by commercial whaling, but populations have increased since protection in 1935. We aimed to quantify this recovery and investigate demographic parameters in the sub-Antarctic Auckland Islands, the primary known calving area in New Zealand. Photo-ID surveys were conducted in Port Ross during annual 3-week long expeditions from 2006-2013. All whales except calves were recognisable from unique patterns of callosities on the head, resulting in an ID catalogue of 786 individuals. Mark-recapture models allowing temporary emigration from the study area were implemented using the robust design in program MARK, with competing models ranked by AIC. The best model included capture probabilities varying by primary sampling period, with Markovian temporary emigration by mature females and random temporary emigration by other whales, justifying the use of models which allow whales to be absent from the study area. Estimates of the abundance of whales using the calving ground during each study period varied from 171 (95% CI: 127-236) in 2007 to 550 (481-631) in 2012. The best estimate of non-calf survival rate was 0.985 (95% CI: 0.926-1.000). This study provides the most up-to-date population parameters for southern right whales in New Zealand which will be useful for modelling the species' recovery

Environmental preferences of humpback whales, *Megaptera novaeangliae*, in Hervey Bay, Queensland, Australia: an important resting area

Mr Joshua Reinke[1,2], Dr Trish Franklin[3], Dr Wally Franklin[3], Dr Jan-Olaf Meynecke[2,4], Prof Charles Lemckert[1]

[1]*Griffith University, Gold Coast, Australia,* [2]*Humpbacks and Highrises Inc., Gold Coast, Australia,* [3]*The Oceania Project, Byron Bay, Australia,* [4]*Griffith Centre for Coastal Management, Gold Coast, Australia*

Humpback whales, *Megaptera novaeangliae*, migrate annually from polar feeding grounds in summer to tropical breeding grounds in winter. East Australian humpback whales travel from the Southern Ocean, along the East Coast of Australia, to the Great Barrier Reef (or further) to breed. Particular areas are used as resting spots along the way, where whales will remain for longer periods of time (ranging from a few hours to days), rather than simply passing through.Hervey Bay, located to the south of the Great Barrier Reef, provides a shallow, protected area which is utilised as a resting area on the return (southern) migration. Environmental preferences of humpback whales in resting areas have received much less attention in previous research than other stages of migration. Understanding small scale distribution patterns and environmental preferences is important to provide protection from a range of threats, as well as predicting the effects of climate change. This study investigates relationships between humpback whale distribution and environmental conditions in Hervey Bay, Australia. Whale locations were recorded during boat-based surveys from August to October, 1992 to 2008. Analysis included a range of environmental parameters, remotely sensed and measured in situ, such as bathymetry, temperature, chlorophyll, salinity, turbidity and weather conditions.

CMIP5 Biogeochemical Model Assessments for the NZ EEZ and the Ross Sea Region: Present Day Performance, and Scenario Predictions

Dr Graham Rickard[1], **Dr Erik Behrens**[1], **Dr Stephen Chiswell**[1]

[1]*NIWA, Wellington, New Zealand*

An assessment is made of the ability of Coupled Model Intercomparison Project 5 (CMIP5) models to represent the seasonal cycles of biogeochemistry for the New Zealand (NZ) Exclusive Economic Zone (EEZ), and for the Ross Sea region over the late twentieth century. In particular, sea surface temperature (SST), sea ice concentration, surface chlorophyll *a*, nitrate, phosphate, silicate, and the depth of the seasonal thermocline (measuring vertical mixing), are examined to quantify the physical-biogeochemical capabilities of each model, and to provide for ``ranked'' model ``best/poorest'' (``inner/outer'') ensembles. This permits critical assessment of modelled biogeochemical cycling, including less well observed variables such as iron and vertically integrated primary production. Model output confidence limits enable bounds on future model projections RCP4.5 and RCP8.5 of ecosystem changes over the coming century. For the Ross Sea region, there will be average increases in SST, surface chlorophyll *a*, integrated primary production and iron, average decreases in surface nitrate, phosphate, and silicate, and relatively large decreases in the depth of the seasonal thermocline and percentage coverage by sea ice.For the NZ EEZ, there will be average domain wide increases in SST and surface iron, but average decreases in surface chlorophyll *a*, nitrate, and phosphate, with relatively large decreases in the depth of the seasonal thermocline. For surface silicate the inner ensemble suggests general declines, and vice versa for the outer ensemble. For integrated primary production the ensembles predict declines in Sub-Tropical water, but elsewhere generally neutral to slight increases.

The Great Humpback Whale Trail

Leena Riekkola[1], Olivia Andrews[2], Virginia Andrews-Goff[3], Scott Baker[4], Simon Childerhouse[5], Remi Dodemont[6], Mike Double[3], Claire Garrigue[6,7], Rebecca Lindsay[8], Debbie Steel[4], James Tremlett[1], Silje Vindenes[1], Alex Zerbini[9,10], Rochelle Constantine[1]

[1]School of Biological Sciences, University of Auckland, Auckland, New Zealand, [2]Conservation International, Auckland, New Zealand, [3]Australian Marine Mammal Centre, Australian Antarctic Division, , Australia, [4]Marine Mammal Institute, Oregon State University, , USA, [5]Blue Planet Marine, Nelson, New Zealand, [6]Operation Cétacés, Noumea, New Caledonia, [7]Institut de Recherche pour le Développement, Perpignon, France, [8]REL Marine Ltd, Auckland, New Zealand , [9]National Marine Mammal Lab, NOAA, Seattle, USA, [10]Cascadia Research Collective, Olympia, USA

Humpback whales were hunted to near extinction during commercial whaling. Most populations are recovering well, but others are slower to increase in number. The Oceania humpbacks are considered endangered while, the neighbouring east Australian whales are recovering at a rate of 10.6%/annum. Humpbacks migrate from winter tropical breeding grounds to summer Antarctic feeding grounds, distances of >19,000km round-trip. To investigate whether migration path or feeding grounds may contribute to the slow recovery of Oceania's whales, we undertook a multi-disciplinary study to track the whales' southern migration and determine the breeding ground origins of whales passing Raoul Island. During 13 days field-work (September-October 2015) we deployed 24 satellite tags, collected 85 tissue samples from 78 individuals, and photo-identified 128 whales from 127 pods. Nineteen tags transmitted for >21 days with the longest transmission >6 months. The whales travelled through the Kermadec Island chain, then diverging into migration paths up to ~7,000km distance, before stopping at feeding grounds ranging from the eastern Ross Sea to the Bellingshausen Sea. Genotype and photo-identification matches identified whales from several breeding grounds ranging from New Caledonia to the Cook Islands. Stable isotope analysis suggests the whales are primarily feeding on krill with latitudinal differences reflecting their feeding grounds. We have shown that whales migrating from several breeding grounds pass by Raoul Island on their way to Antarctic feeding grounds spanning 3,500km of the Southern Ocean. The migratory paths of Oceania and east Australian whales differ substantially and may help us understand differences in population recovery rates.

Tracking the effectiveness of marine protected areas (MPAs) in achieving biodiversity conservation objectives

Ms Kelsey Roberts[1], Dr Carly Cook[1]

[1]Monash University , Clayton, Australia

The Australian marine protected area (MPA) network has grown to over 3 million km^2, making it the largest of any country and covering about a third of Australia's marine jurisdiction. However, to understand the value of these MPAs to biodiversity conservation, it is important to know more than just the total area of the marine environment they protect. We also need to know where this growth has occurred and the level of protection these areas offer to important habitat and species. To do this, we have conducted a comprehensive, longitudinal assessment of change in the Australian MPA network, systematically evaluating gains and losses in area across a 12 year period. We also analyse this growth in relation to the level of protection from human impacts the MPA network offers biodiversity based on the composition of areas with different IUCN Categories. We overlay these changes to the network with a wide range of habitat and species distribution data to determine what the growth means for representation and protection of Australia's marine biodiversity. Our results suggest that using simple, area-based metrics of growth in MPAs is insufficient to determine progress in marine conservation. Using our analysis, we present recommendations for how to strengthen the existing MPA network.

A Quantitative Risk Assessment of Threats to New Zealand Sea Lions

Dr Jim Roberts[1], Dr Ian Doonan[1]

[1]NIWA, Wellington, New Zealand

A quantitative risk assessment of threats to the New Zealand sea lion (*Phocarctos hookeri*) was undertaken to inform the development of a Threat Management Plan (TMP) for the species. Demographic assessment models were developed for females at the Auckland Islands and Otago Peninsula, integrating information from mark-recapture, pup census and age distribution observations. The Auckland Islands assessment indicated that low pup survival and adult survival are the primary processes affecting population decline. Much higher estimates of pup survival were obtained for the growing Otago Peninsula population. The consequences of removing the effects of an array of threats (best or upper-bound estimates) were assessed in terms of projected population growth rate of mature females at the Auckland Islands. Using best-estimates of threat levels, a stable population size was obtained only with the elimination of *Klebsiella* mortality of pups. Eliminating commercial trawl-related mortality resulted in increased population growth rate relative to the base run, but did not reverse the declining trend and food limitation had the next greatest effect. For the Otago Peninsula population, a number of threats were estimated to have a similar positive effect on mature numbers. This assessment indicates that the site-specific TMP goals would be difficult to achieve at the Auckland Islands with the complete elimination of a single threat. Spreading the management effort across the key threats may be the best approach to meeting TMP goals.

How many fishes can be identified in the NZ region? The most recent figure of 1262 may be over 700 species short.

Dr Clive Roberts, Andrew Stewart, Carl Struthers, Jeremy Barker, Salme Kortet

[1]Museum of New Zealand Te Papa Tongarewa, Wellington, New Zealand

For the first time all known fishes contained within the outer boundary of the New Zealand EEZ can be accurately identified. The encyclopaedic guidebook *The Fishes of NZ*, published in four volumes by Te Papa Press in Nov 2015, treats a total of 1262 fish species – an increase of about 1140 species over a period of 143 years since the last comprehensive ichthyological catalogue by Hutton (1872). With another 105 species keyed and known to occur just outside the boundary of the EEZ, and probably within it, the number will likely rise to at least 1367 species in the near future. So, how many fishes are there in the NZ region? Best estimates indicate that about 40% of the New Zealand fish fauna has yet to be discovered and described. Currently, there is little sign of a decrease in the high rate of discovery, and if this rate continues throughout the twenty-first century, documentation of another 700 fish species is likely. With continued resourcing and active biodiversity research by new generations of scientists, the diversity of New Zealand fishes may exceed 2000 species by 2100. The implications of our incomplete knowledge of New Zealand fish faunal diversity is discussed.

Optimising a widely used coastal health index for use in New Zealand's shallow estuaries

Mr Ben Robertson[1]

[1]*University Of Otago, Dunedin, New Zealand*

Many globally applied biotic indices, including the AMBI benthic index, are based on species' sensitivity/tolerance to anthropogenic disturbances. The AMBI scoring primarily relies on the correct assignment of both taxon stressor-sensitivities and the disturbance thresholds or bands. In this talk, using an extensive, long-term monitoring dataset from New Zealand (NZ) estuaries, I will describe how the AMBI has been strengthened through quantitative derivation of taxon-specific sensitivities and condition thresholds for two key estuarine stressors [mud and total organic carbon (TOC)], and the integration of taxon richness. The results support the use of the existing AMBI condition bands but improve the ability to identify cause; 2-30 % mud reflected a 'normal' to 'impoverished' macrofaunal community; 30-95 % mud and 1.2-3 % TOC 'unbalanced' to 'transitional'; and >3-4 % TOC 'transitional' to 'polluted'. The (refined) AMBI was also successfully validated (R^2 values >0.5 for mud, and >0.4 for TOC) for use in shallow, intertidal dominated estuaries NZ-wide. Most biotic indices lack the ability to differentiate between anthropogenic disturbances, which in turn undermine their effectiveness for applied purposes. By integrating key quantitative information to an existing benthic index, these results enable more robust identification of coastal stressors and facilitate defensible management decisions.

How important are the coastal and marine environments in an Australian threatened area? Societal values of Gladstone Harbour in the Great Barrier Reef World Heritage Area

Paola Rodriguez-Salinas[1], Marnie L Campbell[2], Chad L Hewitt[1], Emma Jackson[3], Owen Nevin[3]

[1]*The School of Science, University of Waikato, Hamilton, New Zealand,* [2]*The Environmental Research Institute, University of Waikato, Hamilton, New Zealand,* [3]*School of Medical and Applied Science, Central Queensland University, Gladstone, Australia*

Coastal marine environments provide a wide range of goods and services that contribute to human wellbeing resulting in a natural connection with the environment where economic and spiritual values may be equally important. As a result of these perceived values, people tend to gravitate towards coastal marine areas, with a resultant potential to degrade these areas. Often, research that examines the value of an area considers natural capital or ecosystem services (both in economic terms), but fails to capture concepts of perceived intrinsic, social, or cultural values in a meaningful manner and rarely all values are considered together. Identifying and attempting to understand the importance assigned to environmental, economic, social and cultural values from an individual's perspective and the socio-demographic characteristics that influence these indicators can help to improve how we manage our coastal marine environments. Our understanding of societal behaviour towards coastal marine environments is relatively limited, which impacts upon how we can effectively manage environmental developments in these ecosystems. To build further knowledge and test different mechanisms for capturing, analysing and representing societal information, this research developed a Geographic Information System based approach that identifies and maps perceived values of a coastal marine area. We anticipate that environmental managers can use this approach to pro-actively acknowledge and include community concerns, views, and values within local, regional, national, and international projects. Gladstone Harbour, which sits within the Great Barrier Reef World Heritage Area, was used as a case study to develop and test the approach. This harbour is industrialised and undergoing port expansion.

Can knowledge of early-Māori fisheries practices help restore the Toheroa?

Dr Phil Ross[1], Dr Huhana Smith[2], Dr Bruce McFadgen[3]

[1]*University Of Waikato, Tauranga, New Zealand,* [2] *Te Rangitāwhia Whakatupu Mātauranga Ltd. , Kuku, New Zealand,* [3]*Victoria University of Wellington, Wellington, New Zealand*

Toheroa (*Paphies ventricosa*), an endemic shellfish of cultural importance to Māori, was formally abundant on a number of New Zealand's west coast beaches. Unsustainable commercial and recreational harvesting during the early to mid-1900s led to the collapse of the fishery. Despite 40+ years of protection, toheroa populations have, for unknown reasons, failed to recover. A genetic analysis of toheroa mitochondrial DNA supplemented with Māori environmental knowledge, has led us to hypothesise that human-mediated translocations have strongly influenced the present-day distribution of this taonga (treasured) species. If the hypothesis is proven, translocation would explain the disjointed modern distribution and the limited success achieved in managing what may in fact be ecologically isolated populations located outside their natural distribution and preferred niche. Working in partnership with tangata whenua, this hypothesis is being tested through a multidisciplinary research programme examining Mātauranga Māori (Māori knowledge) and Māori oral histories in conjunction with archaeological records and further genetic analyses. By gaining a better understanding of the extent to which early Māori manipulated and managed their marine environment, fisheries managers and kaitiaki (guardians) will be better equipped to support the recovery of this iconic species.

An observational study of the biophysical characteristics of two contrasting cyclonic eddies in the East Australian Current System

Prof Moninya Roughan[1], Dr Shane Keating[1], Dr Amandine Schaeffer[1], Dr Paulina Cetina Heredia[1]

[1]*Coastal and Regional Oceanography Lab, UNSW, Australia, , Australia*

Mesoscale cold core eddies are known to be highly productive regions of the ocean due to their cyclonic rotation which drives upwelling at the core. Lesser known however are the dynamics and productivity of smaller frontal eddies that form on the inside edge of western boundary currents. In this study we investigate the physical and biogeochemical properties of two contrasting cyclonic eddies in the Tasman Sea. The first being a frontal eddy that formed from a shelf water billow at ~ 32S on the continental shelf of SE Australia and was advected offshore along the EAC front. The second is a larger meso scale cyclonic eddy that formed at ~ 28S and was trapped off Brisbane, blocking the southward flow of the EAC. We present results from a dedicated research voyage on the RV Investigator to study the biophysical interactions and productivity in cyclonic eddies of the Tasman Sea. Our results show that not all cyclonic eddies are created equal, ie the smaller frontal eddy is significantly more a-geostrophic, more energetic and more productive than the mesoscale cyclone, despite its small size and short life. We show that frontal eddies contribute significantly to the net productivity of the Tasman Sea region

Methods development for spatially-explicit assessment of fisheries impacts on non-target fish species and benthic habitats

Marie Julie Roux[1], Alistair Dunn[1], Dan Fu[1], Malcolm Clark[1], Sophie Mormede[1], Charles Edwards[1], Nokuthaba Sibanda[2], Suze Baird[1], Brent Wood[1]

[1]NIWA, Wellington, New Zealand, [2]Victoria University, New Zealand

The assessment of fishing impacts on non-target fish populations and benthic communities are key components of the ecosystem approach to fisheries, yet remain complicated by data paucity. Spatially-explicit and quantitative tools are being developed to evaluate population or habitat status relative to current impacts from fisheries and a maximum impact sustainable threshold (MIST) reference point. The spatially-explicit approach allows a shift of the assessment focus from population processes that are often poorly informed, to spatial processes inferred from species distribution and the occurrence and intensity of fishing activities. Such assessment frameworks promote data synthesis, the development and integration of operating models to suit different data types and data availability scenarios, and uncertainty evaluation. Fishing impacts are assumed to be cumulative in both time and space as well as across fishery sectors. The outcomes serve to identify and prioritize candidate indicator species and fishery sectors for surveillance and potential management action. Successful implementation of spatially-explicit assessments requires methods development in the areas of species distribution modelling, fishery catchability estimation, spatial population dynamics, functional traits-based vulnerability estimation, outputs mapping and uncertainty estimation and propagation. This paper will present an overview of the current status of methods development, with examples of its application in sustainability assessments of selected bycatch species in New Zealand and elsewhere.

Developing Spatial Management Options for the Protection of Vulnerable Marine Ecosystems in the South Pacific Ocean Region

Dr Ashley Rowden[1], Dr Carolyn Lundquist[1], Dr Malcolm Clark[1], Mr Owen Anderson[1], Dr John Guinotte[2], Ms Suze Baird[1], Dr Marie-Julie Roux[1], Mr Sanjay Wadhwa[1]

[1]National Institute of Water & Atmospheric Research, Wellington, New Zealand, [2]Marine Conservation Institute, Seattle, USA

The South Pacific Regional Fisheries Management Organisation (SPRFMO) Convention includes specific provisions to protect vulnerable marine ecosystems (VMEs). The SPRFMO Commission has determined that the interim measures put in place to protect VMEs would be replaced by an improved system of fishable and closed areas. These closures would effectively represent a preliminary spatial management plan, whereby conservation and management measures are implemented that will result in sustainable fisheries and benthic protection. We used the conservation planning tool *Zonation* to develop spatial management options that balance the protection of VMEs with utilisation of high value areas for fishing. Input data included habitat suitability maps, and uncertainties associated with these model predictions, for eleven VME indicator taxa at bathyal depths across the entire SPRFMO area; New Zealand fishing catch data; naturalness; and a bioregionalisation scheme. Running various scenario models for spatial planning allowed for the cost to fishing to be determined, in terms of the amount of the trawl catch footprint lost if high priority areas for VME indicator taxa are protected. Generally, the cost to fishing was low given the relatively high proportion of suitable habitat for VME indicator taxa protected. The main outcome of the present study is a demonstration of the practical utility of using available data, including modelled data, and the *Zonation* conservation planning software tool to develop options for the spatial management of the SPRFMO area.

Australia's living shorelines- Utilising oyster shell to aid ecological recovery of fisheries

Mr Simon Rowe, Mr Andy Myers

[1]OceanWatch Australia, Pyrmont, Australia

Eco-engineering remains under-utilised in the management of coastal environments, especially where coastal fish habitat is the nursery ground for seafood resources. OceanWatch is currently embarking on an innovative, interdisciplinary project using organic materials and waste product to restore intertidal oyster reef. The process which has the potential to greatly improve habitat outcomes is challenging the paradigm of those that action coastal protection. NSW was once rich in natural oyster reefs. These structures would have provided natural protection of estuarine foreshores, stabilising sediments and buffering the effects of wave action and floodwaters. Re-establishing living shorelines in the form of oyster reefs will not only mitigate coastal erosion, but will also provide a suite of additional ecosystem services. These may include water filtration, habitat and food provision for fish, invertebrates and birds, stabilisation of adjacent habitats and shorelines, diversification of landscapes and ecosystems, carbon sequestration and riparian vegetation enhancement. This project is the first of its kind in Australia, utilising waste shell from commercial oyster farms and the hospitality sector as the aggregate on which new reefs can establish. The presentation will share the trials and tribulations of this journey.

Variability in habitat cascades across sites, environmental conditions, host and epiphyte species and underpinning mechanistic test-factors

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

[1]University Of Canterbury, Christchurch, New Zealand

It is well-established that habitat-forming host-species characterized by widely different form-functional traits affect epiphytes and faunal community differently. However, the opposite hypothesis, that similar habitat-forming hosts have similar effects on epiphytes and fauna, has been studied much less. We used a survey and two experiments to test if density or type of epiphytes modify the abundance and taxonomic richness of small gastropods associated with three co-occurring seaweed hosts (*Cystophora scalaris*, *C. torulosa*, *C. retroflexa*) that similar canopy-forming species. In the survey, host-epiphyte-gastropod associations were collected from different locations, sites and tide pools on rocky shores. We found that the three *Cystophora* species supported similar epiphyte and gastropod communities and that the epiphytes facilitated gastropods across sites, locations and tide pools. The first experiment confirmed the positive effects of epiphytes on the abundance but not richness of gastropods. The second experiment showed that both density and type of epiphytes increased the abundance but not richness of gastropods. These results will be compared to gastropod communities associated with a co-occurring but morphologically different host, *Hormosira banksii*, and its obligate epiphyte *Notheia anomala* (work in progress). Finally, we will discuss results in the context of rocky shore 'habitat cascades', in the context of general ecological processes whereby primary biogenic habitat-formers (here fucoid species) indirectly facilitate inhabitants (here gastropods) by providing structural support to secondary habitat-formers (here different densities and types of epiphytes).

Effects of Ocean Acidification on the Ca:Mg Foraminiferal Paleothermometer

Prof Abby Smith[1], Prof Maria Byrne[2]

[1]University Of Otago, Dunedin, New Zealand, [2]University of Sydney, Sydney, Australia

The Mg:Ca ratio in both benthic and planktonic foraminiferal skeletal carbonate is used as a proxy for ocean temperature, by examining internal seasonal Mg-banding or by integrating the life of the organism in whole-test analyses. Post-mortem taphonomic processes, including dissolution and precipitation of high-Mg cement, can confound the paleothermometer. Reduction in sea-water pH caused by global increase in atmospheric carbon (ocean acidification) increases the likelihood of dissolution, and thus might reduce the utility of this widely-used proxy. We examined the effects of post-mortem exposure in four species of common Foraminifera living on the algal flat and recently dead on the nearby sandsheet at One Tree Island, Queensland, Australia (23° 30.5' S, 152°05.5' E), especially looking for the effects of ocean acidification on Mg content in calcite. Three of the species (*Amphistegina lobifera, Baculogypsina sphaerulata, Calcarina spengleri*) exhibited decreased Mg in calcite after death, whereas *Marginopora vertebralis* showed a slight increase in Mg after death. Marine foraminiferal skeletal carbonate mineralogy exhibits a strong phylogenetic signal: two families are generally aragonitic; 12 families are generally entirely calcitic, with Mg^{2+} substituting for Ca^{2+} in the crystal lattice at rather low levels (1-4 wt% $MgCO_3$), and 10 families are formed of high-Mg calcite (8-10 wt% $MgCO_3$). To avoid these phylogenetic effects, we considered two species from the same family (Order Rotaliida: Family Calcarinidae), with Mg content in a narrow range (11-12 wt% $MgCO_3$), in more detail. Mg contents in specimens collected living, recently dead and in cores (subfossil, about 1000 y old) were compared.

The White Island Blitz: Investigating a southern-hemisphere temperate vent system

Prof Abby Smith[1], Miles D. Lamare[1], Sylvia G. Sander[2], Sally Carson[3], the White Island Blitz Team

[1]Department of Marine Science, University of Otago, Dunedin 9010, New Zealand, [2]Department of Chemistry, University of Otago, Dunedin 9010, New Zealand, [3]New Zealand Marine Studies Centre, University of Otago, Portobello, New Zealand

Natural CO2 vents allow study of the effects of climate change on marine organisms on a different scale from laboratory-based studies. The advantages of acclimated organisms, integrated ecosystems and natural variability outweigh the disadvantages that may be posed by emissions such as sulphur or copper. This study outlines a preliminary investigation into the suitability of natural CO2 vents near White Island, Bay of Plenty, New Zealand (37°31.19°S, 117°10.85°E) for climate change research by characterising water chemistry, planktonic communities, and benthic algae and invertebrates from vent and control locations during a single week in the (southern) spring. A "blitz" consisting of 17 scientists from 8 institutions in New Zealand, Australia, New Caledonia, Belgium, Germany and the UK was undertaken in early December 2015. Divers and snorkelers on two vessels sampled vent gases, water, plants and animals. Moored instruments collected data on water movement, temperature, salinity, and pH all week long. At the same time, a shore-based team conveyed information about the importance of vent communities to local tourist operators, media, the public, teachers, and school children. Preliminary data suggest that White Island can provide a suitable natural laboratory for studying temperate marine systems of the future. More than that, we demonstrate the usefulness of multi-scientist expeditions to ascertain connections and relationships in a volcanic vent setting. We also reflect on the importance of community involvement and engagement when engaging in major scientific expeditions.

Assessing the Commercial Potential for Collection of Greenshell™ Mussel Seed in the Hauraki Gulf, New Zealand

Ms Rebecca Smith[1], Dr Andrew Jeffs[1]

[1]University Of Auckland, Auckland, New Zealand

Greenshell™ mussel production in New Zealand is constrained by three main factors. The first being the highly seasonal nature of Greenshell™ mussel production. In northern New Zealand mussels spawn mostly from July to November and during much of this period mussels cannot be harvested due to their poor condition. The second is the industry's heavy reliance on a single source of beachcast wild seed which supplies around 80% of the spat used in the country's mussel aquaculture industry. Finally, the loss of mussel seed from nursery ropes can be as high as 100%, but is usually between 50 and 70%. This wasteful use of mussel seed is thought to cost the industry between NZD$6-10 million annually. Anecdotal evidence suggests that mussels from the Hauraki Gulf region may develop and spawn at a different time of the year to seed from the main commercial seed source. If this were the case and mussel seed could be collected commercially in the Hauraki Gulf this could potentially extend the harvesting season as well as provide an alternative source of mussel seed. This study focused on the following aims; 1) determining whether seed mussels obtained from two different sources have different annual condition cycles, and growth rates, 2) determining the yearly pattern of seed arrival in the Hauraki Gulf, and 3) comparing the retention rates between the two seed sources.

Seagrass (*Zostera muelleri*) vulnerability and resilience: The threat of sediment burial

Ms Stine Sorensen[1], Professor Marnie Campbell[1], Associate Professor Merilyn Manley-Harris[1], Professor Chris Battershill[1], Dr Phil Ross[1]

[1]School Of Science, University of Waikato, Hamilton 3240, New Zealand, Hamilton, New Zealand

Seagrasses are important, highly productive primary producers that provide a range of ecosystem services. Globally, increasing anthropogenic pressure in coastal regions has resulted in the reduced distribution and abundance of seagrasses. *Zostera muelleri* is recognised as a declining species in New Zealand. Many of New Zealand's estuaries and coastal waterways suffer from sedimentation events, which have the potential to impact seagrass via smothering and light attenuation. This study examined the response of *Z. muelleri* to both one-off and repeated sediment burial events using mesocosm and field experiments. Mesocosm experiments examined how *Z. muelleri* responded to burial events of 5, 10 and 15 days in duration. Recovery periods were used to determine the resilience of *Z. muelleri* to the differing burial periods and frequency of burial event. Morphometric and physiological seagrass parameters, such as sucrose content, were measured to quantify impact. In parallel, *in situ* field experiments were performed at three sites in Tauranga Harbour over a 66 day period to assess the spatial variation in responses to burial events and recovery processes. It is anticipated that the outcomes of these experiments will increase our knowledge of the vulnerability of *Z. muelleri* to burial events and their resilience to differing burial regimes. This information will also aid in identifying areas that are at risk of losing seagrass due to sedimentation events.

Time to settle down: can co-seeding adult and juvenile *Perna canaliculus* promote their retention during the early aquaculture production cycle?

Paul South[1,2], Oliver Floerl[2], Andrew Jeffs[1]

[1]University of Auckland , Auckland, NZ, [2]Cawthron Institute, Nelson, NZ

New Zealand's mussel aquaculture industry is worth around NZ$250 million and accounts for over 70% of the total export earnings from the country's aquaculture sector. This important industry is heavily reliant on natural seed supply and, as a result, can be heavily impacted by fluctuations in rates of settlement. In addition, the early production cycle is inefficient and massive amounts of seed are lost due to many factors such as predation, food provision and hydrodynamic processes. Some studies have indicated that a likely cause of poor retention of juvenile mussels is secondary settlement, the process by which juvenile mussels move to attempt to optimise their position and chances of recruiting to an adult population. The factors that trigger secondary settlement and promote successful recruitment to a wild population of mussels are not well understood and likely not replicated in an aquaculture setting. Single cohorts of juvenile mussels are deployed at very high densities for aquaculture purposes whereas in the wild, mussels appear to recruit or at least survive better among adults. Here we deployed adult mussels with juveniles of hatchery-reared *Perna canaliculus* to test whether this increases their retention during the early aquaculture production cycle. The underlying process that would support this proposition is that co-seeding adults and juveniles might better replicate conditions in the wild and "convince" juveniles to settle down. However, the results of the study show that other important processes are at play during early stage of mussel aquaculture production.

The ecological impact of *Undaria pinnatifida*: insights from an invaded rocky shore

Paul South[1,2], Mads Thomsen[2], Stacie Lilley[2], David Schiel[2]

[1]Cawthron Institute, Nelson, NZ, [2]University of Canterbury, Christchurch, New Zealand

The laminarian kelp *Undaria pinnatifida* is one of the world's most successful invasive macroalgae. Despite this, its impact on invaded communities is poorly understood largely due to a deficit of experimental studies that have tested *Undaria*'s effects. Here, we draw on mensurative and manipulative experiments to gauge the community level impact of this notorious invader. We show that *Undaria* is highly successful at recruiting in great density and can add significant biomass where native canopy-formers are absent. However, it generally has weak impacts on the community composition of the invaded assemblage. We document that *Undaria* reduces the abundance of disturbance oriented and seasonal ephemeral algae, but it does not appear to be displacing native canopy-forming species in long-term (circa 4 years) experimental removal plots. We show that these impacts are consistent at multiple invaded sites and when *Undaria* occurs in persistent stands or following disturbance to native canopy-forming algae. We consider these findings in the context of *Undaria*'s continued spread on temperate coastlines.

Could upwelling be enhancing short-term spanner crab (*Ranina ranina*) catchability?

Mr David M Spencer[1,3], Dr Ian W Brown[2], Prof Charles J Lemckert[1], Prof Shing Y Lee[3,4]

[1]School of Engineering, Griffith University, Gold Coast, Australia, [2]Dept Agriculture Fisheries and Forestry, retd., Brisbane, Australia, [3]School of Environment, Griffith University, Gold Coast, Australia, [4]Australian Rivers Institute, Gold Coast, Australia

Physical oceanographic processes and water properties may affect fisheries by modifying the species' availability and/or catchability – a particularly important but poorly understood factor frustrating ecologically-based stock assessments. For example, ambient bottom temperatures may affect the behaviour of spanner crabs by influencing their energy and activity levels, and their vulnerability to predators. The work presented here was aimed at studying whether spanner crab catches are related to ambient temperature in the waters off the South East Queensland coast, Australia. Temperature data was collected using small temperature loggers attached to spanner crab nets and additional temperature data was obtained from the Water Quality Monitor (WQM) attached to the Integrated Marine Observing System (IMOS) National Reference Station offshore North Stradbroke Island (NRSNSI). Temperature changes in the benthic boundary layer are driven by complex larger scale processes; including upwelling, eddies, and the East Australian Current (EAC) and it is important to understand how they impinge upon the crabs' habitat. EAC encroachment onto the shelf has been observed to drive upwelling by means of Ekman pumping due to increased seabed sheer stress, decreasing bottom temperature by up to 5^{o}C. Results collected to date show crab catches appear to be suppressed by warmer temperatures in the bottom boundary layer and therefore upwelling events enhance catchability. Further research into small-scale and large-scale hydrodynamic processes affecting the spanner crab fishery could considerably benefit the fishing industry, as well as provide important information for evidence-based management of the valuable resource.

It's getting hot in here: Monitoring and predicting this summer's bleaching event on the Great Barrier Reef

Dr Claire Spillman[1], Dr David Wachenfeld[2], Rachel Pears[2]

[1]Bureau Of Meteorology, Melbourne, Australia, [2]Great Barrier Reef Marine Park Authority, Townsville, Australia

Mass coral bleaching occurred on the Great Barrier Reef (GBR) this past summer. Severe bleaching was observed along the northernmost part of the reef and as far south as the Whitsundays, with substantial coral mortality also recorded on inshore northern reefs. Sea surface temperature (SST) is recognised as the primary cause of mass coral bleaching events, with SST up to 3oC warmer than average this summer on the GBR. The monitoring and prediction of elevated ocean temperatures over a range of time and spatial scales is crucial to the management of reef health. Realtime seasonal forecasts for coral bleaching risk on the GBR, produced operationally using the Bureau of Meteorology's coupled ocean-atmosphere model POAMA, predicted these warm conditions several months in advance. Early warnings of potential bleaching risk assisted reef managers to prepare for the likelihood of an event, focusing resources, briefing stakeholders and increasing awareness of bleaching onset. During the event reef managers utilised ReefTemp Next Generation (RTNG), a sophisticated high resolution remote sensing application which operationally monitors temperatures across the GBR. Evidence of high thermal stress on certain reefs improved the planning of reef surveys and focused attention on the worst affected reefs. Seasonal POAMA thermal stress forecasts and RTNG are key components of the Great Barrier Reef Marine Park Authority's Early Warning System under the Reef Health Incident Response System, which informs situational awareness, management action and response strategies. Continuous SST monitoring, combined with seasonal forecasts, provide tools to understand and better manage the complex interactions leading to coral bleaching events, particularly in a changing climate.

Seasonal forecasting for decision support in marine fisheries and aquaculture

Dr Claire Spillman[1], Dr Alistair Hobday[2], Paige Eveson[2], Jason Hartog[2]

[1]Bureau Of Meteorology, Melbourne, Australia, [2]CSIRO Marine and Atmospheric Research, Hobart, Australia

Fishery and aquaculture production is strongly influenced by environmental conditions, with wide ranging impacts including changes in growth rates of cultured animals and wild stock habitat distributions. Short-term environmental fluctuations, combined with long-term climate-related trends, often require adjustments in fishing, farming and management practices. Seasonal forecasts from dynamical ocean-atmosphere models of high risk conditions in marine ecosystems in the coming months can be very useful tools for fishery managers. Seasonal forecasting is being used in marine farming and fishing operations in Australia to reduce uncertainty and manage business risks. Forecast variables include water temperature, rainfall and air temperature, and are considered skillful up to 3-4 months into the future, depending on time of year and the region of interest. Further, habitat distribution forecasts can be generated by combining these environmental forecasts with biological habitat preference data, providing industry for species-specific information. Dynamical forecasts also potentially offer improved performance relative to statistical forecasts, particularly given baseline shifts in the environment due to climate change. Seasonal forecasts are most useful when management options are available for implementation in response to the forecasts. Advance warning of suboptimal conditions allows for proactivemanagement responses and helps maintain industry profitability in an uncertain environment. Improved management of marine resources, with the assistance of such forecast tools, is also likely to enhance industry resilience and adaptive capacity under climate change.

Composition of microphytobenthic communities within seagrass systems reflects environmental condition

Mr Richard Stafford-Bell[1,2], Dr Randall Robinson[1], Dr Anthony Chariton[2]

[1]Victoria University, Melbourne, Australia, [2]CSIRO, Lucas Heights, Australia

Microphytobenthic (MPB) communities within seagrass systems provide a range of ecosystem services including the provision of considerable primary production. MPB hold a significant place in the trophic structure of seagrass systems and their ability to transfer energy to higher tropic levels, often through complex food chains, can sustain a number of economically important fish species. The highly sensitive nature and rapid response of MPB to anthropogenic nutrient inputs, has led them to being considered as useful bio-indicators. However, because of their size, diversity and morphological characteristics, obtaining MPB community data can be challenging and time consuming. Here we used metabarcoding, a DNA profile technique, to identify communities of molecular operational taxonomic units (MOTU) within populations of the seagrass *Zostera muelleri* from five Victorian estuaries of varying condition. We found each estuary contained a unique MBP community with MOTU richness, evenness and diversity also varying among the estuaries. MOTU richness and diversity were generally greater within the higher indicative nutrient estuaries while the low nutrient estuary had the lowest evenness across the estuaries studied. Interestingly, we found that positioning within the seagrass meadow had no influence on MPB community structure, even in areas where there was no seagrass cover. The presence of both nutrient-sensitive and nutrient-tolerant species, within the estuaries provided an indication of water quality at the time of sampling. The ability to identify and use multiple taxa in determining the condition of estuarine water quality is a novel approach that can facilitate improved management outcomes within seagrass systems.

Anchors aweigh: Exploring the frequency and intensity of anchored commercial vessels near Australian Ports

Ms Chantel Steele[1], Dr Tim Ingleton[2], Professor Andrew Davis[1]

[1]University of Wollongong, Wollongong, Australia, [2]NSW Office of Environment and Heritage, Sydney, Australia

Almost 30,000 vessels visited Australian Ports in the 2012/13FY, an increase of more than 17 percent over the past decade. Due to safety, timing or operations, it is common for these large commercial ships to arrive outside Ports and anchor. Studies examining anthropogenic threats to marine biodiversity and ecological systems are numerous, and anchoring is often highlighted as a key risk in near-shore coastal systems. However, impacts resulting from the anchoring of large ocean-going vessels are principally unknown. The spatial and temporal extent of anchoring from September 2012 to June 2015 was determined from Vessel Traffic Data (CTS) provided by the Australian Maritime Safety Authority for eleven of Australia's Ports. Metrics such as the average number of anchor events per month, average length of time spent at anchor and average vessel length of anchored vessels in waters near to each of the assessed Ports was determined. Examination of the data near Port Kembla, NSW, a port without a designated safe anchorage area, shows approximately 40 km of coastline is potentially impacted by the anchoring of commercial vessels. CTS data combined with benthic habitat maps in the region indicates that areas of reef and intermediate-type habitats (as well as unconsolidated sediments) exist in areas where anchoring is occurring. This information is useful for stakeholders and policy makers to assist in working towards safe and sustainable anchorage practices, as the focus on managing multiple uses and ecological impacts around Ports increases.

Responding to the 2016 Mass Coral Bleaching event on the Great Barrier Reef: from Observations to Modelling

Mr Craig Steinberg[1], Dr Jessica Benthuysen[1], Dr Mike Herzfeld[2], Dr Hemerson Tonin[1], Mr Scott Bainbridge[1], Dr Richard Brinkman[1], Prof. Chari Pattiaratchi[3], Dr William Skirving[4], Ms Felicity McAllister[1], Dr Mark Baird[2]

[1]AIMS, Townsville, Australia, [2]CSIRO CMAR, Hobart, Australia, [3]School of Environmental Systems Engineering and the UWA Oceans Institute, Perth, Australia, [4]Coral Reef Watch, NOAA/NESDIS, , USA

In October 2015 NOAA declared the possibility of a global mass coral bleaching event given that the Northern Hemisphere had already experienced widespread bleaching. Seasonal outlook models by NOAA and BoM predicted the warming to extend to the Southern Hemisphere through the austral summer into 2016. At the time the GBR was anomalously cool, nevertheless a National Coral Bleaching Taskforce was formed. Significant warming subsequently did occur and peaked in March 2016 where aerial surveys found that bleaching had severely affected the majority of the GBR with the bleaching and mortality most severe in the north and less so towards the south. This talk seeks to understand the warming mechanisms responsible for the thermal stratification that led to belaching and to determine how deep corals may have been affected. Q-IMOS contributed a wide range of observations from satellite observations feeding into ReefTemp to reef based sensor networks that provided real time observations as events unfolded. Fixed point moorings had temperature loggers spread throughout the water column to help understand how deep the thermal stress extended to. Fortuitously CSIRO, AIMS, IMOS and the GBR Foundation funded 13 glider missions for the first time in the central and northern GBR to assist with the validation of the eReefs modelling suite. The combination of intense summer time observations throughout the water column by multiple observing platforms and the application of the operational eReefs model is allowing the 2016 bleaching event to be analysed in ways unprecedented since the last major event in 2002.

The NZ Estuary Trophic Index (ETI) – a toolbox for assessing 1. physical and nutrient susceptibility and 2. trophic condition

Leigh Stevens[1], Dr Barry M Robertson[1], Ben Robertson[2], Dr John Zeldis[3], Anna Madaraz-Smith[4], Mal Green[5], Dave Plew[3], Richard Storey[3], Terry Hume[7], Megan Oliver[7]

[1]Wriggle Coastal Management, Nelson, New Zealand, [2]University of Otago, Dunedin, New Zealand, [3]NIWA, Christchurch, New Zealand, [4]Hawkes Bay Regional Council, Napier, New Zealand, [5]Streamlined Environmental, Hamilton, New Zealand, [6]Hume Consulting Limited, Hamilton, New Zealand, [7]Greater Wellington Regional Council, Wellington, New Zealand

More than half of lowland NZ rivers now fail to meet national guidelines for TN nutrient levels and clarity, with eutrophication symptoms (e.g. excessive algal growth, sediment anoxia, and compromised biodiversity) now common in many freshwater and estuary environments. Despite being an obvious national priority, there has to date been very limited guidance in NZ on how to assess eutrophication in estuaries (including indexes and indicators that are useful for management).

In response, the Envirolink funded ETI, with supporting technical appendices, was developed for regional councils as follows:

Screening Tool 1. Physical and Nutrient Susceptibility

A desktop susceptibility approach based on estuary physical characteristics, and nutrient input load/estuary response relationships for key NZ estuary types, to enable the prioritisation of estuaries for more rigorous monitoring and management by defining where an estuary sits along the ecological gradient from minimal to high eutrophication, and providing stressor-response tools (e.g. empirical relationships, nutrient models) that link the ecological expressions of eutrophication (measured using appropriate indicators) with nutrient loads (e.g. macroalgal biomass/nutrient load relationships).

Screening Tool 2. Trophic Condition Assessment

A monitoring approach that characterises the ecological gradient of estuary trophic condition for relevant ecological response indicators (e.g. macroalgal biomass, dissolved oxygen), and provides a means of translating these ratings into an overall estuary trophic condition rating/score (the ETI). The latter involves measurement of the expression of both primary (direct) eutrophication symptoms (e.g. macroalgae, phytoplankton) and supporting indicators for secondary (indirect) symptoms of trophic state.

This talk describes the recently released ETI.

Characterisation of trophic changes in New River Estuary using the NZ Estuary Trophic Index (ETI)

Leigh Stevens[1], Barry M Robertson[1], Nick Ward[2]

[1]Wriggle Coastal Management, Nelson, New Zealand, [2]Environment Southland, Invercargill, New Zealand

New River Estuary in Southland is a large, well flushed tidal lagoon estuary that has experienced a very significant and rapid increase in eutrophic conditions since 2002. This has coincided with a significant intensification of agricultural land use, particularly dairy farming. Because the expression of eutrophic symptoms and deteriorating estuary condition have been well documented (e.g. large losses of seagrass, large increases in nuisance macroalgae, extensive sediment degradation through decreased oxygenation and the presence of sulphides, high rates of sedimentation in settlement zones, the estuary provides an excellent practical example to apply and validate the tools developed in the ETI - firstly to assess the physical and nutrient susceptibility of the estuary, and secondly to assess its trophic state under various nutrient input loads over time. This talk provides a brief overview of New River Estuary, describes how the ETI has been used to assess it, and indicates likely magnitude of nutrient load reductions that would be required if the estuary was be returned to a less eutrophic state.

Marine Renewable Energy in New Zealand: Did we Look a Gift Horse in the Mouth?

Dr Craig Stevens[1,2]

[1]NIWA, Wellington, New Zealand, [2]University of Auckland, , New Zealand

New Zealand is a maritime nation with one of the planet's larger EEZ. It's geographic situation also means it is subject to substantial wave and tidal energy fluxes. Internationally there are substantial moves to develop viable extractive technology. The nation has a highly responsive marine technology sector as well as an energetic aquaculture industry proving that the marine sector is about more that extractive fishing. Despite this, static electricity demand has meant that renewable energy has not been able to secure research support both in terms of capability and infrastructure, resulting in us a nation falling well behind the international bench-mark. In this talk I'll review the state of the art internationally, make comparisons with other national approaches, the reasons for and against local development, the local challenges and examine the timescales for realisation of new advances.

Continental-scale assessment of biodiversity trends and indicators for Australia's rocky and coral reef ecosystems

Dr Rick Stuart-Smith[1], Professor Graham Edgar[1], Dr Neville Barrett[1], Dr Hugh Sweatman[2]

[1]University of Tasmania, Hobart, Australia, [2]Australian Institute of Marine Science, Townsville, Australia

Establishment of biodiversity agreements and targets has outpaced the capacity to collect the data needed to assess progress towards these. Indicators used to assess biodiversity status at national scales have typically been indirect or vague, and provided limited understanding of real change in response to key pressures. We change this situation for shallow reefs, describing results from a continental-scale biodiversity assessment using data on multiple phyla collected by Reef Life Survey and the two longest-running scientific monitoring programs for Australian reefs (the IMAS long-term temperate MPA and AIMS long-term monitoring programs). Indicators were selected to cover responses to fishing, ocean warming, invasive species, and local conservation value in IUCN-listed threatened species. We evaluated the sensitivity of a large range of fishing indicators to identify the most suitable indicator for assessing fishing impacts, with results suggesting many previously applied fishing indicators do not provide sufficient insight into the types of fishing pressure and impacts experienced on shallow Australian reef systems. We then mapped indicator values nationally and assessed trends in fishing and warming indicators over the last decade. Fishing impacts appear most pervasive, but warm-water events have caused substantial change at particular locations. Invasive species were concentrated on reefs near ports in south-eastern Australia, and the threatened species index highest in the Great Australian Bight and Tasman Sea. Our study provides a blueprint for collecting and using broad-scale data for reporting against biodiversity targets and greatly improving understanding of the status and trends in marine biodiversity by the public and policy-makers.

Observations and investigations of a potential occurrence of Sea Star Wasting Disease (SSWD) in the Southern Seas

Ms Brooke Sullivan[1], Ms. Lucy Chapman[2]

[1]University Of Melbourne, Parkville, Australia, [2]Deakin University, Warn Ponds, Australia

Sea Star Wasting Disease (SSWD) is an infectious disease known to cause rapid and extensive losses to pacific sea stars in the United States and China since 2013. The symptoms of this disease including changes in sea star behaviour, presence of lesions, loss of turgor, limb loss and rapid decomposition of tissues following death. Over the spring and summer 2015-2016 a mass die-off event of native and invasive sea stars was observed in Port Phillip Bay, Victoria, Australia. We investigated the possible causes of this event, including, 1) environmental conditions and 2) the presence of infectious disease agents, such as viruses and microbes. Our experiences investigating this potentially catastrophic disease event provided insights into the strengths and weaknesses of the ability of academic institutions, state and federal governments and the public to adequately assess a marine infectious disease event. Given our experiences and results, we provide some key recommendations for improving the chances of future success in monitoring and responding to potential disease outbreaks and pathogenic invasions in Australia and New Zealand.

A northern enigma*: Corallinapetra novaezelandiae*, a new lineage of coralline red algae from the north of New Zealand

Judy Sutherland[1], Wendy Nelson[1,2], Tracy Farr[1], Darren Hart[3], Hee Jeong Kim[4], Hwan Su Yoon[4]

[1]National Institute of Water and Atmospheric Research, Wellington, New Zealand , [2]School of Biological Sciences, the University of Auckland, Auckland, New Zealand , [3]Department of Biochemistry, University of Otago, Dunedin, New Zealand, [4]Department of Biological Sciences, Sungkyunkwan University, Suwon 440-746, Korea

Collections of coralline algae were made from near Stevenson's Island in the north of the North Island, as part of our studies of coralline algae in New Zealand. In these collections we found a non-geniculate coralline alga with unusual reproductive features, not matching any structures previously recorded. Reproductive structures are important characters for the recognition of orders in the Corallinophycideae. Phylogenetic analyses of these collections based on 4 gene markers show that this taxon is sister to a clade containing the extant orders Hapalidiales and Corallinales, and is in fact excluded from all existing orders in the Corallinophycideae. Here I present what we currently know about this species, which is still known only from a single collection, in terms of morphology, reproduction and relationships with other taxa.

Larval duration mediates selection on larval size

Ms Karin Svanfeldt[1], Dr Keyne Monro[1], Prof Dustin J Marshall[1]

[1]Monash University, Melbourne, Australia

Larval size varies at all levels of organisation, among species, mothers and clutches. The reason for this variation is thought to be the result of a trade-off between offspring quality and quantity, where larger offspring perform better but are more costly to produce. Local environmental conditions alter the benefits of increased offspring size and so shift the offspring size selection. For sessile organisms, dispersal is a crucial part of the offspring phase, and in animals, bigger larvae tend to better endure longer dispersal distances than smaller larvae because they have more energy. Theory predicts that increasing distances between suitable habitats strengthens selection for larger larvae. We manipulated the larval duration of offspring of different sizes in the bryozoan *Watersipora subtorquata* and then examined the relationship between offspring size and post-metamorphic performance in the field. We found that the selection on offspring size is altered by larval experience but not in the way we expected.

Improved governance, management, and economic and biological sustainability of the demersal line fishery in Tonga

Aleki Taumoepeau[1], Stuart Hanchet[1], Alistair Dunn[1], Rosemary Hurst[1], Tu'ikolongahau Halafihi[2]

[1]National Institute Of Water And Atmospheric Research, Wellington, New Zealand, [2]Ministry of Agriculture, Food, Forestry & Fisheries Department, Nuku'alofa, Tonga

NIWA scientists have just started the second year of a phased five year program funded by NZAid. It aims to deliver an ongoing, well-managed, sustainable line fishery for deepwater demersal fish species (including deepwater snappers and potentially bluenose) in the Tonga EEZ. Economic sustainability will be achieved through economic analysis of the fisheries, identification of a value chain that maximises return to Tonga, and implementing changes to enhance value. Biological sustainability and improved governance will be achieved through developing monitoring methods to assess changes in the size of the resource, and an adaptive management framework for making effective and transparent management decisions. The project is drawing together expertise from NIWA, the Secretariat of the Pacific Community, the Tonga Government's Department of Fisheries and the Tonga fishing industry.

Archival records reveal a century of diminishing returns for recreational fishers

Dr Ruth Thurstan[1], Dr Edward Game[2], Professor John Pandolfi[3]

[1]Deakin University, Warrnambool, Australia, [2]The Nature Conservancy, Brisbane, Australia, [3]University of Queensland, Brisbane, Australia

We lack long-term monitoring data for many coastal marine ecosystems, consequently there is a need to identify alternative sources of data to help us better understand the scale of ecological change. Recreational fishing has occurred in many of Australia's coastal ecosystems for over a century, but our understanding of historical recreational resource use remains incomplete. We examined government and popular media records for a southeast Queensland estuary across a 140-year period, sourcing both qualitative and quantitative information on species targeted, numbers caught and locations fished by recreational fishers. From the quantitative information contained in these articles we constructed three time series of multi-species catch and effort (n fish fisher^{-1} trip^{-1}): recreational fishing trips, mean and best fishing club competition results. Catch rates reported from recreational fishing trips (1900-1998) displayed a significant decline over time. Mean catch rates from fishing competitions (1913-1983) also significantly declined, but best competition catch rates (1925-1980) displayed no significant change over the time series. Our findings demonstrate that exceptionally long time series of recreational catch and effort exist in public archives, and that examination of these sources can contribute towards a comprehensive understanding of coastal ecosystem change. Perhaps most importantly, these data enable us to anchor ecological changes using species that many people know and care about, and using scales and metrics that resonate with peoples' personal experiences. In doing so we demonstrate that ecological change impacts upon a broad array of users, including those who access aquatic environments purely for recreational purposes.

Quantifying the role of dugongs and green sea turtles in seagrass dispersal

Ms Samantha Tol[1,2], Dr Rob Coles[1], Dr Paul York[1], Dr Jessie Jarvis[1,3], Dr Ian Bell[4], Dr Brad Congdon[2]

[1]Centre for Tropical Water & Aquatic Ecosystem Research (TropWATER), James Cook University, Cairns, Australia, [2]College of Marine and Environmental Sciences, James Cook University, Cairns, Australia, [3]Centre for Marine Science, University of North Carolina, Wilmington, United States of America, [4]Marine Turtle Conservation Threatened Species Unit, Queensland Department of Environment and Heritage Protection, Townsville, Australia

Plants use an array of animals as vectors providing dispersal over a variety of distances, sometimes greater than abiotic factors (e.g. wind, water currents). This relationship is well studied for terrestrial environments, however there is a gap in knowledge of similar relationships in marine environments. Seagrasses are the only marine plants that produce fruits, flowers and seeds underwater. Many herbivores consume seagrasses and have the potential to play a role in dispersal. Marine mega-herbivores (dugongs and green sea turtles) have been suggested as potential dispersers over large distances in the tropics. Our research on the Great Barrier Reef confirms that dugongs and green sea turtles consume and pass at least four different species of seagrass seeds (endozoochory), with an average of 2.6 ± 0.56 seeds/gdw of faecal matter during peak fruiting season, and viability on excretion of 9.13% ± 4.61%. To calculate potential dispersal from endozoochory, we used digesta time, average daily movement distance and the number of viable seagrass seeds excreted. Using population estimates, our results show that during the summer flowering months these marine mega-herbivores have the capability to disperse over 500,000 viable seagrass seeds in a time scale of up to two weeks, with a maximum dispersal distance of circa 650 kilometres. Dugongs may also create viable seagrass fragments when feeding (epizoochory) and we report on our initial results from investigations of this pathway.

Nuclear bombs and whales: using passive acoustic monitoring to identify blue whale migration patterns in the southern hemisphere.

Mr Gary Truong[1], Dr Joy Tripovic[1], Dr Tracey Rogers[1]

[1]Evolution and Ecology Research Centre, University of New South Wales, Sydney, NSW 2052, Sydney, Australia

Passive acoustic monitoring (PAM) is a powerful tool useful for studying long term patterns of animals that are cryptic and otherwise difficult to study. It is a non-invasive technique which reduces the impact caused to the study organisms, by more conventional methods. PAM is cost effective and is not constrained by weather conditions, able to provide continuous long term data. The blue whale (*Balaenoptera musculus*) is the world's largest animal yet they are difficult to locate and study; due to the immense size of the ocean and their low population numbers. PAM allows us to identify blue whales by detecting their calls and songs acoustically. Using the CTBTO's (Comprehensive Nuclear-test Ban Treaty Organisation) hydro-acoustic network, we are able to access continuous recordings of sea noise that span over a decade across five sites in the Southern Hemisphere. The hydrophones located in the SOFAR channel (Sound Fixing and Ranging channel), at approximately 1000m depth, are able to pick up the low frequency whale calls. Using these calls we are able to examine long term patterns of blue whale presence at each site and identify when whales are most likely to be present. This data will provide vital information for ocean exploration and naval activities that utilise SONAR, which has been shown to negatively impact whale behaviour. Blue whales are listed as endangered by the IUCN and any effort to reduce the impacts to the whales will help in the recovery of the species.

Dietary differences of three temperate Kyphosus species: resources partitioning and the role of head and mouth morphology

Mr Aldo Turco[1], Ass./Prof. Glenn Hyndes[1], Dr Alan Kendrick[2], Dr Shaun Wilson[2]

[1]Edith Cowan University, Joondalup, Australia, [2]Department of Parks and Wildlife, Kensington, Australia

Diet partitioning among and within sympatric, closely-related herbivorous fishes, has been widely investigated in tropical areas but remains poorly understood in temperate waters. In this study, I analysed the stomach contents of juvenile and adult fish belonging to three herbivorous fish species from the genus *Kyphosus* (*K. sydneyanus*, *K. gladius* and *K. cornelii*) that are commonly found in temperate reef areas of Western Australia. The aim of the study was to investigate interspecific and ontogenetic differences in the diet of these species. *K. cornelii* consumed mainly Chlorophytes (approximately 30% of total biomass ingested by adults and 17% for juveniles) and Rhodophytes (approximately 62% for adults and 72% for juveniles). Conversley, *K. sydneyanus* and *K. gladius* fed mainly on Phaeophytes (approximately 79% of total biomass ingested by *K. sydneyanus* and 90% for *K. gladius*), with the latter equally feeding on both *E. radiata* and *Sargassum* spp. while the former ingested higher amounts of *Sargassum* spp. Consumption of brown algae increased in adults of both *K. sydneyanus* and *K. gladius*, though there was no evidence of ontogenetic shifts in diet for *K. cornelii*. Morphological measurements of the head and mouth underlined differences in feeding structures between *K. cornelii* and the other species, though no clear relationship was found between variation of morphology and diet composition.

Tidal Energy: Scaling up Tidal Turbine Farms

Ross Vennell[1], Alice Harang[1], Malcolm Smeaton[1]

[1]Univeristy of Otago

The oceans have a huge potential to generate electricity from tidal currents using underwater turbines. Cook Strait alone has one of the highest potentials in the world and could produce up to two NZs worth of renewable electricity. To realise the potential of tidal channels like the Strait, large tidal turbine farms generating 100s of MW must be developed. A critical question that needs to be addressed is, "How much power can be produced by a large scale turbine farm?". This is a complex question because power production does not scale in proportion to the number of turbines in a farm, with one hundred 1 MW rated turbines generating much more, or much less than, 100MW depending on the channel's dynamics. A Marsden funded research program is using computer models to unravel the complex relationship between power production and the number of turbines in a farm. Some of the results from this work show that turbine farms installed in tidal channels behave in surprising ways. The benefits of grouping turbines into large farms within large channels like Cook Strait includes allowing turbines to exceed the fundamental "Betz limit", which governs power production from an isolated wind or tidal turbine. Being smart about the timing of power production within a tidal cycle can also have several benefits. For example, producing power at specific times can increase the upper limit of power production by a factor of 2.5, or provide short term energy storage to meet peaks in electricity demand

Reproductive characteristics of the leatherjacket *Meuschenia scaber* in the Hauraki Gulf, New Zealand

Mr Valerio Visconti[1], Dr Elizabeth D.L. Laman-Trip Jensen[2], Professor Kendall Clements[1]

[1]School of Biological Sciences, The University Of Auckland, Auckland, New Zealand, [2]Nelson Marlborough Institute of Technology, Nelson, New Zealand

The leatherjacket Meuschenia scaber is widely distributed in New Zealand waters and was added to the Quota Management System in 2003. The Ministry for Primary Industry recognises leatherjacket as a priority for research because of the lack of data on its biology (e.g. growth rate, longevity, mortality and reproduction) and to ensure its sustainability for commercial fisheries. Some information is available early life history stages and diet from shallow rocky reefs in north-eastern New Zealand, but reproductive data are still scarce. The main aim of this research is thus to provide MPI with the necessary biological information (demography, life history etc.) to inform the management of this species. Here, we present preliminary results on reproductive characteristics of leatherjacket in the Hauraki Gulf. No evidence of hermaphroditism was found, indicating that leatherjacket is a gonochoristic species. We found clear reproductive seasonality based on relative gonad weight and macroscopic and microscopic gonad analyses. Spawning starts in late winter and finishes at the end of spring. Females and males began to mature around 230mm and 235 mmTL, respectively. The size distribution of males differed from females (X^2=20.3, d.f.=8, p=0.009), with the mean size of mature males (276.5 ± 13.6mm TL) being slightly greater than that of females (271.9 ± 16.3 mm TL) (F=12.99, d.f.=1, p<0.001). The maximum size recorded for males was 315 mm TL and 320mm TL for females.

Monitoring predation activity in burrowing seabird colonies at Southeast Tasmania by using motion triggered cameras

Miss Haruhi Wabiko[1], Dr Mary-Anne Lea[1,2], Professor Mark Hindell[1,2]

[1]Institute for Marine and Antarctic Studies, Hobart, Australia, [2]Antarctic Climate Ecosystems Cooperative Research Centre, Hobart, Australia

Human activities such as habitat destruction and the introduction of non-native predators are one of the main causes of extinction and population decreases in wildlife. These effects are severe especially for burrowing seabirds on islands where predators are normally absent. However, information about how these phenomena can alter predation pressure on native animals is limited. This study was conducted at two little penguin/ shearwater colonies: a remote site - the Neck, Bruny Island, Tasmania and at an urbanised site - the Derwent Estuary. To investigate the presence of native and non-native predator species, and their temporal and spatial fluctuations within the colonies, we deployed motion-triggered cameras (n=5 at Boronia Beach and n=18 on Bruny Island) during the austral breeding season. Carcass numbers and state were also monitored throughout the study to assess predation related mortality. Seven potential predator species were observed: tiger snakes, white-bellied sea eagles, forest ravens, brush-tailed possums, eastern quoll, black rats (introduced), and feral cats (introduced). Native predators were observed rarely and few rats were seen. Two cats were detected frequently, and were mainly active at night with five direct predation events on rats and seabirds captured by cameras. 34 seabird carcasses were found at the Bruny Island colony during study period and were most likely killed by cats. While it is obvious that predation on seabirds by introduced animals is occurring, more studies, such as cat tracking, and seabird breeding success, will be required to fully understand the implications of predator behaviour and impact on the colonies.

Efforts to reduce small fish cathes in the Hawke's Bay mixed trawl fishery

Mr Oliver Wade, Mr Rick Burch, Laws Lawson[2]

[1]Independent fisheries consultant, Napier, New Zealand, [2]Te Ohu Kaimoana, Wellington, New Zealand

Technical modifications to trawl nets can be an effective way to reduce the environmental impacts of trawling on marine habitats. Whilst these modifications can take a multitude of forms they generally have similar aims. Trawl modifications can reduce discards and bycatch, mitigate benthic impacts, reduce fuel consumption, increase the value of the catch and improve efficiency. This paper describes experiments to test the efficacy of different trawl designs in the inshore trawl fishery of Hawke's Bay on the east coast of the north island of New Zealand. This research has been led by members of the fishing industry and represents a multiple stakeholder approach to improving the impacts of inshore trawling in Hawke's Bay. Low tech gear modifications have been successful in reducing discards and bycatch of unwanted fish whilst having little impact in that proportion of the catch which is normally retained.

A Climatological Model of North Indian Ocean Tropical Cyclone Genesis, Tracks and Landfall

Mr Mohammad Wahiduzzaman[1], Dr Eric Oliver[2], Dr Simon Wotherspoon[3], Dr Neil Holbrook[4]

[1]IMAS, University of Tasmania, Hobart, Australia, [2]IMAS, University of Tasmania, Hobart, Australia, [3]IMAS, University of Tasmania, Hobart, Australia, [4]IMAS, University of Tasmania, Hobart, Australia

Extensive damage and loss of life can be caused by landfalling tropical cyclones (TC). Seasonal forecasting (of TC landfall probability) is potentially beneficial to insurance/re-insurance companies, decision makers, government policy and planning as well as possibly residents in coastal areas. In this study, we develop a seasonal forecasting model of tropical cyclone tracks and landfall for North Indian Ocean (NIO) rim countries based on a Generalized Additive Model (GAM) approach. Using a 35-year record of tropical cyclone track observations (1979-2013), from the Joint Typhoon Warning Centre (accessed in the International Best Track Archive Climate Stewardship Version 6), the GAM model is fitted to the observed cyclone track velocities as a smooth function of location in each season. The distribution of genesis points is approximated by kernel density estimation. Trajectories are then simulated from randomly selected genesis points in the kernel, and an array of stochastic innovations applied at each time step. Three hindcast validation methods are applied to evaluate the integrity of the model. First, leave-one-out cross validation is applied whereby the country of landfall is determined by the majority vote (considering the location by only highest percentage of landfall) from the simulated tracks. Second, the probability distribution of simulated tracks is evaluated against the observed tracks. Third, the distances between the point of landfall by observed tracks and simulated tracks are compared and quantified. Overall, our model shows very good cross-validated hindcast skill of modeled landfalling cyclones against observations for most NIO rim countries, with only a relatively small difference (for Myanmar the percentage of observation is 6.3 where as prediction by model is 6.2%) in the percentage of predicted landfall locations compared with observations.

Methods for assessing biodiversity, abundance and distribution of Antarctic sea anemones

Ms Leslie Watson[1], Dr Karen Miller[3], Dr. Jonny Stark[2], Dr. Erik Wapstra[1], Dr. Glenn Johnstone[2], Dr. Simon Jarman[2]

[1]University of Tasmania, Sandy Bay, Australia, [2]Australian Antarctica Division, Kingston, Australia, [3]Australian Institute of Marine Science, Australia

Our current knowledge on Antarctic sea anemone biodiversity is poor, with less than 50% of species identified. Most species descriptions date back to early last century and recent work has suggested that taxonomic uncertainty is high. One of the challenges in identification of sea anemones biodiversity is the paucity of rigid taxonomic features. A modern approach using genetic techniques could help resolve some of these problems. We used DNA sequencing of the mitochondrial CO1 and 16S gene regions, and nuclear ITS sequence combined with genotyping using Single Nucleotide Polymorphisms (SNPs) on 387 individual sea anemones from the Southern Ocean and Macquarie Island to identify and resolve taxonomic discrepancies. We found that all three genetic markers were able to distinguish between species, although hypervariable markers such as SNPs are needed to distinguish between some closely related species. Understanding sea anemone biodiversity is, however, just one part of understanding their role in the ecology of the Southern Ocean. Many Antarctic sea anemones have distributions that extend beyond depths that are accessible by SCUBA diving, hence to study the ecology of key sea anemone species requires alternate approaches. We used ROVs and photoquadrat surveys to understand sea anemone distribution and relationships with their environment. These studies found that sea anemone distribution was correlated to ecological engineer and habitats that comprised of hard substrates. This combination of phylogenetic studies with distribution studies has given us an insight into the complex relationships of the Antarctic benthic ecosystem and the role sea anemones play.

Decreasing mark rate affects the precision of estimates of survival rate in Hector's dolphins

Lindsay Wickman[1], Professor Steve Dawson[1], Professor Elisabeth Slooten[1], Dr William Rayment[1]

[1]University Of Otago, Dunedin, New Zealand

Survival rate is an important demographic parameter that can be used to assess population trends if it is suitably precise. Survival rate of Hector's dolphins (*Cephalorhynchus hectori*) at Banks Peninsula, NZ has been estimated from data collected using photo-ID methods. This involves photographing unique marks on individuals (e.g. nicks on the dorsal fin). Some marks appear to be caused by non-fatal encounters with fishing gear. Therefore, conservation measures which reduce fishing effort (e.g. the Banks Peninsula Marine Mammal Sanctuary), have resulted in a decline in the proportion of individuals that are marked (the mark rate). Because of impacts on sample size of individuals in the mark-recapture dataset, we hypothesised that a lower mark rate would decrease the precision of estimates of survival rate. To test this hypothesis, mark rates of 5-15% were simulated by resampling a dataset of 516 marked dolphins collected between 1990 and 2009. A Cormack-Jolly-Seber model was applied to each simulated dataset to estimate survival. This process was repeated to produce 10,000 bootstrap replicates of survival rate and its precision for each mark rate. The median CV of survival rate increased by 42% as mark rate reduced from 15% to 5%, with the most rapid declines in precision occurring below a mark rate of 11%. This study demonstrates that a decline in mark rate can reduce precision of survival rate estimates, and therefore has implications for research directed at detecting population change. Additionally, the methods of the simulation may be applied to other long-term photo-ID studies.

A moving target: Changes in marine carbonates over the last fifty years

Dr Sara Mikaloff-Fletcher[1], **Dr Mike Williams**[1], Dr Helen Bostock[1], Dr Di Tracey[1]

[1]NIWA, Kilbirnie, New Zealand

Until recently, carbonate parameters were poorly characterised in the Southwest Pacific due to a limited number of measurements in this region. In order to address this, we developed algorithms to estimate the dissolved inorganic carbon (DIC) and alkalinity from three parameters that are measured much more widely: temperature, salinity and oxygen. This approach has provided a much more detailed picture of the present state of carbonate chemistry in waters around New Zealand, but it yields no information about how it has changed in response to industrial activities or how it might change in the future. The algorithms were developed using relatively recent observations (post 1990's) and neglected changes due to increasing storage of anthropogenic carbon in the oceans over time. A clearer picture of how carbonates have changed over time in response to industrial activities would provide valuable information about how much environmental stress marine organisms in the waters around New Zealand are already under and aid in our understanding of the current distribution of corals and other calcifers. Here, we present newly developed algorithms that account for changes in anthropogenic carbon uptake over the industrial era using a combination of ship-board data and a suite of ocean models optimised against ocean interior carbon data. We use these refined algorithms to estimate the pre-industrial ASH and CSH for oceanographic regions around New Zealand, and compare these data based estimates to simulations from the CMIP5 models. The implications for future climate change will be explored.

Metamorphosis and settlement of the intertidal tubeworm *Spirobranchus cariniferus* (Gray 1843)

Dipl. Robert Paul Wolf[1], Dr. Nicole E. Phillips[1]

[1]Victoria University Of Wellington, Wellington, New Zealand

Tube-dwelling polychaetes often form aggregations that can have significant impacts on their environment, and arise from larval settlement behaviour. However, the process of settlement in these taxa has been described inconsistently in the literature. The purpose of this study was to describe metamorphosis and settlement for the New Zealand native serpulid tubeworm, *Spirobranchus cariniferus*, and to examine factors that may mediate settlement success. When larvae of *S. cariniferus* become ready to settle, they swim near the bottom and/or crawl on it for up to several days. Once those larvae reach a suitable location, then they will attach themselves to the surface, beginning with building a tube and continuing with their metamorphosis. To examine responses to potential settlement stimuli we raised larvae in laboratory cultures to settlement size and then exposed them to different cues (biofilm, conspecific tube material, and sandstone). In a pilot experiment, we observed low settlement success (0-4%) within 48 hours whereas, after a much longer period (408 hours) 14-30% of individuals were attached to the surface. In a different experiment, we observed gregarious settlement near the water surface in response to a developing biofilm. Further, settlement was very low (2-12% after 26 days) under starvation conditions regardless of the settlement cue (conspecific tube material or sandstone). These results suggest that the process of settlement may not be rapid, but instead may take a longer period of time than has been previously assumed and that larval settlement behavior is mediated in part by food availability over this period.

Sub-population densities and habitat preference of the critically endangered spotted handfish (*Brachionichthys hirsutus*)

Mr Lincoln Wong[1,2], Dr Tim Lynch[2], Dr Neville Barrett[1], Dr Jeff Wright[1], Mr Mark Green[2]

[1]Institute for Marine and Antarctic Studies, University of Tasmania, Hobart, Australia, [2]CSIRO Ocean and Atmosphere, Castray Esplanade, Hobart, Australia

Spotted handfish (*Brachionichthys hirsutus*) are a critically endangered angler fish endemic to the south-east Tasmania, Australia. Historically, the species have been subjected to various anthropogenic impacts, with a drastic reduction in population size. Ongoing efforts to conserve the species, have been constrained by the species patchy distribution and rarity, resulting in decreased statistical power of surveys. Using a new GPS associated, variable length underwater visual census method which provides a more efficient approach to our sparse sampling problem, our study established a wide-scale baseline estimate of fish densities across all known local populations (n=9) within the Derwent Estuary. In addition, GoPro video cameras were attached to diver for a simultaneous benthic habitat survey to model microhabitat preferences of *B. hirsutus*. A total of 72 transects were completed with 79 fish observed. While individual were present at each surveyed location, densities demonstrated significant variation, with one high density, five medium density and three low density sites. Additional comparison with historical dataset showed no consistent pattern of densities across all sites, each with intendent trends and inter-annual variations. Result from microhabitat preference quantification showed a strong association by handfish with those microhabitats that had increased physical complexity, including filled depressions or low-profile relief. This baseline dataset provided the first ever broad-scale snapshot of *B. hirsutus* population densities and a key insight into the species-environment relationship, providing speculations on its patchy population structure. This result also provides a consistent methodological comparisons to this year's (2016) follow up surveys to develop a time-series dataset.

The Chatham Rise Phosphorite Project: Science, Uncertainty and the Way Forward

Mr Ray Wood[1]

[1]Chatham Rock Phosphate Ltd

Phosphorite was discovered on the Chatham Rise in 1952 and exploration continued for the next three decades, culminating in joint New Zealand–Germany surveys in the late 1970's and 80's that included plans to develop the resource. However the price of phosphate declined and interest in the resource waned until Chatham Rock Phosphate (CRP) took out a prospecting licence in 2010. CRP was granted a mining licence over part of this area in 2013 and failed to get its environmental consent in 2014. The purposes of the relevant legislation are "to promote prospecting for, exploration for, and mining of Crown owned minerals for the benefit of New Zealand" (Crown Minerals Act) and "to promote the sustainable management of the natural resources of the exclusive economic zone and the continental shelf" (EEZ Act). However, in spite of this apparent bias in favour of development CRP's experience has highlighted the difficulties in achieving the consents needed to start mining. These difficulties appear to rise primarily from the uncertainties inherent in any marine development project. Science has been essential to get CRP's project this far: discovering a commercially viable resource, designing a practical mining system, and identifying the nature and extent of marine environments and communities. These components of the project are based on the belief that the world is governed by natural laws, and that if these laws are understood then it is possible to minimise the inherent uncertainties by appropriate sampling techniques and thereby reliably predict outcomes of the activity (e.g., environmental effects, profitability, social impact). The decision processes that determine whether a project will be granted the necessary consents are based on the belief that the benefits and costs of the project can be assessed against agreed societal values. These processes appear to have difficulty dealing with the inherent uncertainties about those costs and benefits, and concepts such as the precautionary principle and adaptive management that are designed to help cope with uncertainty are not sufficiently well defined or understood to achieve that guidance. CRP intends to reapply for its marine consent. Science will have a role to play in addressing some of the concerns raised in the previous hearings. But equally important will be working to achieve a decision framework that has both a sufficient scientific grounding and an understanding of decision tools such as the precautionary principle and adaptive management that will allow it to make judgements that reflect the intent of the legislation and society's values.

What if we could transform the commercial harvesting of seafood?

Dave Woods[1]

[1]Precision Seafood Harvesting

The design of the modern trawl net has remained largely unchanged for many decades and is used by fishing fleets around the world. The mesh based designs have proven durable, easy to maintain and very capable of harvesting large volumes of wild catch fish species. These designs are so common and have been used for so long that many of the regulations and expectations for sustainability performance are based solely on the use of conventional trawls. The design of commercial fishing vessels has evolved to improve the efficiency of harvesting using the mesh based trawl designs and now represents a massive capital investment by the industry worldwide. Now the Precision Seafood Harvesting innovations are set to challenge this *status quo*. PSH is a NZ based partnership of fishing companies (Sanford, Sealord & Aotearoa Fisheries Ltd) along with the Ministry for Primary Industries. This collaboration is using a science based approach (supplied from Plant & Food Research) to commercialise a set of exciting new concepts in seafood harvesting and on-board handling. The scope of work is ambitious and includes; Developing new seafood harvesting technologies that can be retro fitted to existing fishing vessels. Validation of the sustainability and seafood quality performance to allow changes in the fishing industry regulatory framework. Creation of a new brand and provenance story that will communicate the performance of the Precision Seafood Harvesting methods. This presentation will provide a summary of the core technologies being developed, results to date, challenges encountered and opportunities realised.

Transparently Revising New Zealand's Code of Conduct for Seismic Surveys

Dr Andrew Wright[1], Dr Dave Lundquist[1]

[1]*Department Of Conservation, Wellington, New Zealand*

In 2012, after a 2-year stakeholder process, New Zealand's Department of Conservation (DOC) implemented a new "Code of Conduct for Minimising Acoustic Disturbance to Marine Mammals from Seismic Survey Operations" (the Code). These guidelines were intended to be reviewed after 3 years. Accordingly, a review process has been underway since mid-2015 to incorporate new scientific information, technical expertise and stakeholder input. Feedback during implementation and a systematic stakeholder review identified primary areas of concern, including: (1) the biological basis for mitigation; (2) requirements for visual observers and passive acoustic monitoring operators; (3) data collection and analysis; (4) application of the Code to non-seismic noise sources and non-standard seismic surveys; and (5) propagation modelling and in-field ground-truthing. Nine technical expert groups were convened to provide advice in specific areas. In addition to specific feedback, there was strong interest across stakeholders in facilitating the introduction of new technologies. Two workshops were held at scientific conferences to discuss options for achieving this. Advice from all these sources has been incorporated where possible, given New Zealand's regulatory landscape. Following internal review and cross-agency discussions, stakeholders reviewed the provisional changes prior to finalisation. Although extensive, the Code revision process has been an open, transparent, and collaborative and involved representatives from government, industry, iwi, the environmental community, and academia. Notably, operators now have more flexible, less-prescriptive management and mitigation options that retain protection of marine mammals. We believe the revised Code is more effective and will maintain New Zealand's global leadership in this area moving forward.

Disturbance of larval host metabolism in response to OsHV-1 virus exposes novel immunological biomarkers

Tim Young[1], Aditya Kesarcodi-Watson[2], Andrea Alfaro[1], Fabrice Merien[3], Hannah Mae[2], Norman Ragg[2], Zoë Hilton[2], Samantha Gale[2], Henry Kaspar[2], Mark Camara[2], Thao Nguyen[1], Silas Villas-Bôas[4]

[1]*Institute for Applied Ecology New Zealand, Auckland University of Technology, Auckland, New Zealand,* [2]*Cawthron Institute, Nelson, New Zealand,* [3]*AUT-Roche Diagnostics Laboratory, Auckland University of Technology, Auckland, New Zealand,* [4]*Centre for Genomics, Proteomics and Metabolomics, University of Auckland, Auckland, New Zealand*

OsHV-1 is a proliferating virus that causes mortality in the larvae and juveniles of several bivalve species including the Pacific oyster *Crassostrea gigas*, *Ostrea edulis*, *Ruditapes decussatus*, *R. philippinarum* and *Pecten maximus*. The virus can be found in adult bivalves but without any mortality. Infected larvae show a reduction in feeding and swimming activities, and mortality can reach 100% in a few days. Affected spat show sudden and high mortalities mainly during summer time. Since 2008, a variant (OsHV-1 µvar) has been identified and associated with high levels (up to 100%) of mortality in oyster spats reared in France, Ireland and England. In late 2010, OsHV-1 µvar was found associated with high mortalities of spat in New Zealand, and now poses considerable environmental and economic threats to our wild and farmed oyster populations. Significant research has been conducted globally by various groups with aims to selectively breed for viral resistance. This includes identifying useful phenotypes for monitoring outcomes of selective breeding trials, characterising the viral replication process and virulence mechanisms, and gaining an in-depth understanding of the virus-host interaction. We report on the application of a newly-emerging biochemical approach, metabolomics, to investigate the host response of oyster larvae to the virus for the first time. Our results provide complimentary information to that gained at other levels of biological organisation, such as gene and protein expressions, and demonstrates the power of untargeted metabolite profiling for assessing early life-stage heath of marine molluscs in response to pathogens.

Has the species composition of New Zealand's whitebait fishery changed in the last 50 years?

Mr Mark Yungnickel[1], Dr Mike Hickford[1], Prof David Schiel[1]

[1]*University of Canterbury*

Of the five species that comprise New Zealand's whitebait catch, it is believed that the vast majority are inanga (*Galaxias maculatus*), with the remaining four species (koaro, *G. brevipinnis*, banded kokopu, *G. fasciatus*, giant kokopu, *G. argenteus,* and shortjaw kokopu, *G. postvectis*) making up a variable, but much smaller component. This belief is based on the last widespread study of the composition of New Zealand's whitebait catch completed by McDowall in the 1960s. Four of the five whitebait species are now ranked as 'declining or nationally vulnerable' due to bottlenecks in their life history. However, we have little current knowledge of the species composition of migratory shoals, or any temporal and spatial shifts in the make-up of the whitebait catch. We completed a nationwide study of the composition of the whitebait fishery within and outside the 2015 whitebaiting season. Over 500 samples of whitebait were collected by whitebaiters on 96 rivers in 14 regions throughout New Zealand. Results of this study, including spatial and temporal differences in species composition and morphology, will be discussed together with whether the whitebait fishery has changed in the last 50 years.

Copper toxicity to blue mussels embryos (*Mytilus galloprovincialis*): The effect of natural dissolved organic matter on copper toxicity in estuarine waters

Rebecca Zitoun[1,2], Associate Professor Sylvia Sander[1], Doctor Rob Middag[1], Professor Abigail Smith[2], Doctor Susane Clearwater[3], SNF Professor Fellow Christel Hassler[4]

[1] *University of Otago, Department of Chemistry, Dunedin, New Zealand,* [2] *University of Otago, Department of Marine Science, Dunedin, New Zealand,* [3]*National Institute of Water & Atmospheric Research (NIWA), Hamilton, New Zealand,* [4]*Institute F. A. Forel, University of Geneva, Geneva, Switzerland*

Copper, in natural low concentrations, is an essential trace element to various organisms as it is indispensable for the proper functioning of metabolic processes. However, at elevated concentrations copper has sublethal effects and can become toxic. In order for copper to be toxic, the element needs to be present in a bioavailable form, able to bind to a specific receptor (i.e. biotic ligand) on, or within an exposed organism. Bioavailability is, however, strongly mediated by geochemical conditions and hence differs drastically in the dynamic environment of an estuary. Key factors influencing metal speciation are organic and inorganic constituents, both omnipresent in natural water bodies. Organic and inorganic ligands can complex metals (i.e., competing complexation) and thus reduce metal bioavailability to organisms. Accordingly it is essential to understand the biogeochemical parameters influencing the speciation of copper in aquatic environments to assess its toxicity risk to ecologically and commercially important organisms. The University of Otago and NIWA collaborated to conduct modified blue mussel (*Mytilus galloprovincialis*) embryo tests designed to examine the effect of natural dissolved organic carbon (DOC: including strong Cu-binding ligands as well as humic and fulvic acids) on copper toxicity and speciation. The study was implemented to mimic realistic copper concentrations as well as highly variable chemical conditions (i.e., DOC and salinity) in the Whau Estuary, Waitemata Harbour, Auckland, New Zealand. Our results will provide useful information on toxicity thresholds in estuarine environments, as well as help to improve Biotic Ligand Model (BLM) parameters for organic matter complexation in estuaries.

Abstracts: SPEED TALKS

Delineating priority areas for marine biodiversity conservation in the Coral Triangle region

Irawan Asaad[1], Dr Mark Costello[2], Dr Carolyn Lundquist[3], Dr Mark Erdmann[4]

1Institute of Marine Science - University of Auckland, Auckland, New Zealand, 2Institute of Marine Science - University of Auckland, Auckland, New Zealand, 3National Institute of Water & Atmospheric Research, Hamilton, New Zealand, 4Conservation International-Asia Pacific Marine Programs, Auckland, New Zealand

A challenge in implementing marine biodiversity conservation is in identifying representative network for biodiversity protection with standardized and consistent criteria. Here we developed a concise set of ecological and biological criteria of identifying areas significant for biodiversity conservation. Four criteria were based on habitat characteristics and another four based on species' feature. To assess these criteria, We propose five key biodiversity variables: habitat cover, species attributes, species richness, geographic range and population abundance. We used data derived from open-access biodiversity informatics databases, and applied our framework to the Coral Triangle region. We used a modelled geographic distribution of 12,783 species to map species richness, and 39,452 points of occurrence of 1,742 species to generate distribution maps of threatened species. The coverage of three biogenic habitats (i.e. coral reefs, seagrass, and mangrove forests) was used to assess the habitat distribution. Spatial analysis and multi-criteria evaluation were developed to objectively and systematically prioritise areas with high biodiversity conservation values. We found that ecoregions of Papua, Eastern Philippines, Halmahera, Banda Sea and Salomon Sea were the high priority areas for biodiversity conservation. The criteria and key biodiversity variables proposed here are a potential tool to facilitate the identification of additional important areas for marine biodiversity and contribute to minimizing gaps in ecological representativeness within the protected areas networks.

Evolutionary Ecology of NZ Tripterygiidae

Mr Paul Caiger[1], Prof. Kendall Clements[1]

1University of Auckland

With the fourth largest EEZ in the World, New Zealand's waters are filled with a high diversity of endemic marine life. This includes fishes, and it is no far reach to say that triplefins, with the highest diversity and endemism of New Zealand's fishes, are iconic. With unique natural history characteristics, and an adaptive radiation reminiscent of other famous freshwater fish groups, triplefins are a fantastic opportunity to explore patterns of evolution, biodiversity and marine fish ecology. The research covered by this project examined the evolutionary ecology of four triplefins. Specifically, we quantified measures of fitness performance between populations, showing variation in growth, longevity, abundance, fecundity and morphology. The environment-phenotype correlations seen here may represent an initial intraspecific stage of the interspecific habitat diversification that generated the New Zealand triplefin assemblage as a whole. Additionally, we explored the cause of phenotypic variation seen in Forsterygion lapillum across habitats, using lab rearing experiments, and found plasticity to be responsible. Few field studies have examined these processes at an ecological level in marine fishes, and the environmentally-induced results provide insight into the relationship of the environment, and in particular habitat, to the origins and diversity of reef fishes. Studies of this nature are important in working toward an understanding of the drivers that promote and maintain diversity in these systems, especially given the pressure on the environment, and rapidly changing habitats.

Marine debris impacts on human health and public perceptions

Prof Marnie Campbell[1], Chris Slavin[2], Anna Grage[4], Amber Kinslow[3]

1The University of Waikato, Hamilton, New Zealand, 2University of Tasmania, Launceston, Australia, 3Central Queensland University, Gladstone, Australia, 4University of Wollongong, Wollongong, Australia

People take for granted that injuries occur at beaches. Within this mindset, people focus on water related or sport-related injuries and tend to ignore injuries caused by beach litter from marine debris. Beach litter injuries may represent a hidden cost of beach usage and potentially affect beach management and award systems such as Blue Flag. We set out to determine if injuries from beach litter was a problem by examining the prevalence of litter related beach injuries at Tasmanian (Australia) beaches. A risk equation was developed to determine injury risk posed by litter based on a user's frequency of beach visitation. Using the Clean Beach Index for guidance, we selected apparently 'clean' beaches (approximately 1.69kg of debris per beach), with the thought that if injuries are present at clean beaches then the threat may be greater than expected. We determined that moderate proportions (21.6%) of beach users received injuries from beach litter, illustrating that even clean beaches pose a threat. Realised risk was high; with wounds (65%) being the most common injury but diseases also prevalent. Daily beach visitation decreased injury risks (from high to moderate/high). Respondents seldom (12.9%) recognise beach litter injuries as a major concern, instead focussing on impacts that litter in the marine and coastal environment has on biota. Respondent's perceptions of cause and responsibility of beach litter are presented, with implications provided

Forecasting microbial water quality in Te Awarua-o-Porirua Harbour

Dr Claire Conwell[1], Mr Ben Tuckey[2]

1Greater Wellington Regional Council, Wellington, New Zealand, 2DHI, Auckland, New Zealand

A 3-day forecast is being developed to predict microbial water quality at key recreational sites in Te Awarua-o-Porirua Harbour - a regionally significant estuarine system, used widely for recreation and, historically, food gathering. Results of existing microbial water quality monitoring indicate that the waters overlying shellfish gathering and recreational contact areas are frequently exposed to faecal contamination, posing a risk to human health. This presentation outlines the approach and methods used to develop the model, and will give an overview of the performance since it was established in November 2015. An existing calibrated 2-D hydrodynamic model was modified to simulate the dispersion of faecal contaminants in both arms of the harbour and the immediate outer harbour. An initial assessment was undertaken for the movement and dispersion of faecal contaminants for both event based scenarios (wet and dry weather across a range of wind and rain conditions) and year-long simulations. This model was then set up as a 3-day forecast (updated every 12 hours) to provide predictions of Enterococci levels at the key sites within the harbour. Following the end of the current 2015/16 summer recreational bathing season, field monitoring data collected during this period will be compared against the forecast predictions and the efficacy of the model will be discussed.

Creating Our Estuaries: an online hub

Ms Helen Kettles[1], Ms Melissa Reid[1], Mr Dion Fabbro[1], Ms Sarah Wilcox[2], Mr Peter Badalamenti[1], Mr Kurt Sharpe[1]

[1]Department Of Conservation, Wellington, New Zealand, [2]Descipher, Wellington, New Zealand

A desire to promote the wonder of estuaries and connect up a community of interest was the vision behind the new Our Estuaries hub on the Department of Conservation website (www.doc.govt.nz/estuaries). Using social media to promote the hub launched 'Captain Kettles' into the Twittersphere with #OurEstuaries, which extended the visibility of the project into the international conservation community. A multidisciplinary team worked on the project, building interactive maps that allow users to discover monitoring, management and recreation activities in New Zealand's estuaries. Links to a wealth of resources such as citizen science projects, teacher resources, field guides, kayak trails and videos are also included in the hub. Helen will present a tour of the maps, outline the origins of the project, present some visitor statistics and proposed future directions. These include plans for new citizen science projects, an online GIS portal and new space for teachers.

The reproductive cycle of Yellowbelly Flounder, *Rhombosolea leporina*, from the Hauraki Gulf: Prospect for Domestication

Mr Ryan Koverman[1], Dr. Steve Bird[2], Dr. Simon Muncaster[3]

[1]University Of Waikato, Tauranga, New Zealand, [2]University of Waikato, Hamilton, New Zealand, [3]Bay of Plenty Polytechnic, Tauranga, New Zealand

Recreational and Commercial fishing are important aspects of New Zealand's infrastructure and culture. While endeavours are made to further fishing's sustainability, efforts towards preserving wild stocks, of intrinsic value, through artificial re-seeding is limited. Sustainable aquaculture reseeding ventures have aided in the recovery of wildlife and biodiversity within the supplemented ecosystem. Fishing efforts in the Hauraki Gulf have been scrutinized in recent years and all stake holders, including the largest commercial flounder industry in the southern hemisphere, are affected by the proposed changes. An understanding of the reproductive cycle of Yellowbelly Flounder (YBF), Rhombosolea leporina, is important for domestication. This study investigates the seasonal timing of gametogenesis in sexually mature wild male and female YBF. The ability to culture Yellowbelly Founder will expand conservation management solutions and could offer coastal stakeholders a new economic opportunity through sustainable land based aquaculture.

Light attenuation and vertical turbidity profiles of coastal great barrier reef waters

Dr. Rachael Macdonald[1], Dr. James Whinney[2], Prof. Peter Ridd[1]

[1]James Cook University, Townsville, Australia, [2]Marine Geophysics Laboratory, Townsville, Australia

Water turbidity has been thoroughly studied throughout Great Barrier Reef waters, mostly due to its influence on light availability for marine biota. However the relationship between turbidity and light has been almost ignored. Here vertical light and turbidity (*T*) profiles are obtained and linked for the first time, for inshore GBR locations. Attenuation coefficients (k_d) are calculated over water-column intervals, producing linear relationships between k_d and turbidity (R^2=0.91). Site-specific, average diffuse attenuation (k_d^{AVG}=0.43m^{-1}), clear-water (k_d^{cl}=0.3 m^{-1}) and turbidity-based attenuation (α=0.076 m^{-1}/NTU) components are calculated. Depth-averaged turbidity and seabed turbidity show linear relationships (R2=0.96) and depth-averaged turbidity is 0.3-0.4 times seabed turbidity. A site-specific model predicting depth-averaged turbidity (T_{pred}) using light data correlates well to measured turbidity (T_{avg}); T_{pred} = 1.0(T_{avg}) and R^2=0.78 (Cleveland Bay), and Tpred = 0.77(T_{avg}) and R2=0.68 at (Tully coast). The euphotic depth of Cleveland Bay is 10 m for a depth-averaged turbidity of 2.5 NTU.

Using stable isotope data to advance marine food web modelling

Miss Stacey McCormack[1,2], Dr Jessica Melbourne-Thomas[2,3], Dr Rowan Trebilco[1,2], Dr Andrew Constable[2,3], Dr Julia Blanchard[1]

[1]Institute for Marine and Antarctic Studies, Hobart, Australia, [2]Antarctic Climate and Ecosystems Cooperative Research Centre, Hobart, Australia, [3]Australian Antarctic Division, Kingston, Australia

Marine foodweb models are important tools for guiding sustainable management decisions and for evaluating the potential combined effects of harvesting and climate change. A key challenge is handling uncertainty in these models to ensure they provide robust predictions and management advice. Uncertainty is arguably highest for parameters relating to mid-trophic levels – in particular mesopelagic fish – for foodweb models in many regions, despite that these groups are thought to play a central role in trophic energy transfer. Stable isotope signatures are an important data source for both parameterising these mid trophic levels, and for evaluating model skill. However the full potential of this data source has not been realised, and the implications of recent theoretical advances in the analysis and interpretation of stable isotope data have not yet been considered. We review the verification and evaluation process for ecosystem models and assess the potential for incorporating stable isotope results into the parameterisation and evaluation of these models. This review provides the first integrated framework for understanding how stable isotope data are used in both size- and species-based models, and clearly identifies priorities for future work. We then summarise results from a preliminary implementation of the findings from our review for a foodweb model that is under development for Prydz Bay and the southern Kerguelen Plateau region in the Indian Sector of the Southern Ocean. We conclude by summarising the implications of our modelling work for evaluating the effects of climate change and fishing in the region.

Direct hydrocarbon Indicators from combined seafloor, water column and ocean surface observations

Helen Neil[1], Joshu Mountjoy[1], Gareth Crutchley[2], Geoffroy Lamarche[1], Ben Higgs[1]

[1]NIWA, Wellington, New Zealand, [2]GNS Science, New Zealand

Seafloor fluid seeps offer a window into hydrocarbon processes occurring at depth and can be indicators of fluids enriched with methane and other hydrocarbons. Fluid seeps are often identified from water-column acoustic flares detected as phase differences in multi- or single-beam echosounder data, associated carbonates can be identified as localised patches of high acoustic backscatter on the seabed, and fluid expulsion features or pockmarks on the seafloor can be identified in high resolution bathymetry. Globally, fluid vents are being identified at a rapid rate in many locations across the world's continental margins, aided by multibeam echosounder systems capable of mapping water column scatterers in 3D. NIWA's Kongsberg EM302 multibeam echosounder is a state-of-the-art instrument for imaging the water column. RV Tangaroa has now mapped well over 200,000 km2 of New Zealand's Extended Continental Shelf with this equipment. A case study shown here covers the northern East Coast Basin which was proposed for release by the New Zealand Government as part of the 2016 Petroleum Exploration Block Offer. In the last 3 years a number of RV Tangaroa voyages have collected high resolution acoustic data that reveal the distribution and character of fluid seeps on the continental slope and shelf. The combination of multi-frequency seismic reflection data, seafloor bathymetry and acoustic backscatter from the seafloor and water column reveal a spatially variable network of gas seepage. This case study draws on work completed for the northern East Coast Basin Screening Report.

Inspirational Invertebrate e-guides and the NIWA Biodiversity Memoir Series: What are they and how do I find out more about them?

Ms Sadie Mills[1], Dr Michelle Kelly[1]

[1]NIWA, Wellington, New Zealand

NIWA's Coasts and Oceans Programme produces two key serialised publications that document the marine biota of New Zealand: The NIWA Biodiversity Memoir series and Inspirational Invertebrate e-guides series.

Our Biodiversity Memoirs are comprehensive, illustrated works that capture rigorous, peer-reviewed scientific study of New Zealand's marine fauna and flora. The series began in 1955 (the New Zealand Oceanographic Institute Memoirs) covering topics spanning oceanography to geomorphology in New Zealand and the Ross Sea. Today's series describe New Zealand's invertebrate marine life e.g., sponges, corals, and crustaceans, to list but a few, including new species and revisionary systematics work that is relevant globally. The Memoir series is an indispensable reference for academics and researchers interested in marine systematics and the conservation of New Zealand's unique aquatic biodiversity. The Inspirational Invertebrate e-guides bring the Memoirs series to life! They are designed for those who dive, snorkel, fish, and explore our coasts, and to aid those who educate, conserve and manage our marine realm. There are currently five e-guides including Awesome Ascidians, Extraordinary Echinoderms, Coastal Crabs, and Splendid Sponges. The e-guides provide a simple introduction to the group and detailed individual species pages with high quality images of animals. Each of these pages has a non-technical description enabling users to differentiate species from each other by eye. We will show you how both series can unlock the diversity of our fauna for a wide range of users, where you can access them, and how you can help us to grow them.

Evaluating the effects of recreational fishing on fish avoidance behaviour

Ms Sophie Powell[1]

[1]University Of Sydney, Camperdown, Australia

Observer bias is a common source of error in ecological surveys and needs further investigation if meaningful conclusions are to be drawn. In marine systems diver-based underwater visual census (UVC) is the most commonly used method to survey fish populations. Evidence suggests that fish avoid divers where fishing effort is high, causing potential observer bias. This study examined A; whether recreational fishing can cause changes in flight initiation distance (FID; a metric of avoidance) and mean body length of fish and B; whether these changes have the capacity to alter UVC results. Levels of recreational fishing effort (angling and spearfishing) were recorded at six sites in Sydney over six weeks. Fish avoidance behaviour was recorded by roving divers using stereo diver-operated video systems (stereo-DOVs). Multiple regression analyses revealed that higher fishing effort increased FID and decreased mean body length of target species. Analyses of individual species showed that species react to different fishing techniques depending on the dominant method of harvest for each species. Spearfishing effort had the greatest absolute impact on flight distance compared to angling effort, although the greater overall number of anglers may compensate to some degree. This study found that FID increased significantly with fishing pressure, a trend that could bias controlled studies of fishery and spatial management practices. However, according to our model, the level of fishing effort required to raise flight distance beyond UVC detectability was unrealistic for most species.

Reconstructing past ecosystem changes in the Marlborough Sounds

Dr Steve Urlich[1]

[1]Marlborough District Council, Blenheim, New Zealand

Bob Marley once sang "If you know your history, then you will know where you coming from". Marlborough District Council (MDC) is applying Marley's tenet in its coastal science and monitoring programme to inform future management of its 725,000 hectares of coastal waters. MDC has embarked on a multi-stranded ecosystem reconstruction project to identify how coastal ecosystems have changed since human habitation of the Marlborough Sounds. These strands include:

- Sediment coring to characterise past seabed composition and impacts of different land uses
- Literature reviews including grey literature and historic newspaper accounts.
- Capturing and geo-referencing early aerial photo surveys to identify land use change
- An on-line Tell Your Story form for people to share reminisces
- Video interviews of elderly residents to create a Marlborough Sounds storybook.
- Public talks and YouTube presentations.

The information gathered to date shows that shifting baselines have occurred. There have been significant changes to ecosystem processes such that the Sounds are now a place of relative scarcity. This is manifest to Malburians in reduced fish numbers and loss and degradation of shellfish beds, and sedimentation. The value of the Marley approach is starting to become evident in community conversations about restoration and marine protection. This is because ecological problems are becoming better defined, thus helping the search for solutions. The project is also likely to influence the regional coastal plan framework through public submissions. The outcomes are planned to be used in the 250 year celebrations in 2020 of Captain Cook's first visit to the Sounds.

Abstracts: POSTERS

Australia New Zealand Marine Biotechnology Society: facilitating research collaborations toward an enhanced and sustainable blue economy.

Prof Chris Battershill[1], Prof Wei Zhang[2]

[1]University Of Waikato, Tauranga, New Zealand, [2]Flinders University, Adelaide, Australia

Enhancing and diversifying the 'Blue Economy' in Australia and New Zealand is becoming a highly prominent element of both nation's marine science plans and is tipped to contribute significantly to a growing marine economy worth more than $100 billion in this region within the next ten years. Multidisciplinary research underpinning applications of Marine Biotechnology is increasingly being looked to as the source of innovation to realise sustainable wealth from our nation's seas, collectively accounting for the 3rd and 4th largest EEZ's globally.

Marine biotechnology is: "The application of (marine) science and technology to living organisms, as well as parts, products and models thereof, to alter living or non-living materials for the production of knowledge, goods and services". The current market for global biomarine economies is over $US176b/yr. Aquaculture is currently 12% of the global protein market but is projected to grow by 35% by 2020. Marine nutriceuticals and ingredients are 32% and 38% respectively of nutraceutical and natural products markets respectively and are projected to grow by 50% and 55% by 2020. Aquaculture grows more rapidly than all other animal food-producing sectors (8.8%/yr since 1970, cf 1.2% capture fisheries , 2.8% terrestrial farmed meat production) (FAO 2010). Both Australia and New Zealand have signalled a priority need to enhance sustainability of marine resource development while increasing the generation of wealth from our respective nations' seas. The Australia New Zealand Marine Biotechnology Society has been launched to facilitate collaborative research and development to achieve this goal.

The carbon budget of an endemic New Zealand marine sponge

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

[1]The University of Waikato, Tauranga, New Zealand, [2]Bay of Plenty Polytechnic, Tauranga, New Zealand

Initial estimates show marine sponges can process four tonnes of carbon per square kilometer of seabed per day. How excreted carbon from sponges translates back into the food web is not understood despite their prevalence across benthic habitats globally, and their apparent enormous capacity for carbon processing and sequestration. This important component of ocean carbon budgets is missing. Unfortunately, sponges are poorly represented in ecological research in New Zealand. To address what may be utilizing sponge respiration products and what the consequences are in terms of benthic-pelagic carbon flux, understanding the carbon budget of a representative species is first required. To address this, the current project will focus on the *in situ* feeding, pumping efficiency and respiration rate of an endemic marine sponge. Samples of inhalant and exhalant water will be collected over time and under varying micro-environmental conditions for individual sponges to assess feeding ecology. Oxygen consumption rates of individual sponges will be measured using respirometers. This will allow estimates of carbon dioxide production to be calculated under varying conditions. Pumping efficiencies will be calculated through the analysis of fluorescein dye front speed and micro thermistor measurements. Collectively, this data will enable an estimation of the total carbon consumed and excreted per unit of time and in response to relevant environmental variables. Understanding the carbon budget for this sponge will set a foundation to identify the missing link of what may be utilizing sponge respiration products, and what the consequences are in terms of benthic-pelagic carbon flux.

On where things are coming from and where things are going to – A lagrangian perspective

Dr Erik Behrens[1], Dr Helen Macdonald[1], Dr Graham Rickard[1], Dr Steve Chiswell[1]

[1]NIWA, New Zealand

Lagrangian particles and their trajectories were used in this modelling study to investigate pathways, the inter-connectivity between different regions and related time scales in the South-West Pacific Ocean. These particles (virtual floats) were seeded in the coastal waters around New Zealand over a period of several years in a global eddy permitting model (hind cast simulation) and were tracked forward and backward in time. Advection is facilitated by ocean currents to simulate the drift of small neutral buoyant organic matter or fish-larvae. In sensitivity simulations we varied the seeding location (i.e. north and south of the subtropical front and around the shores of North and South Island) to obtain a more detailed understanding of pathways and effects of ocean currents, eddies and fronts. The results confirm that the subtropical front acts as a barrier although cross-frontal transports is facilitated by mesoscale eddies in certain locations. The backward trajectories exhibit complex pathways across the Tasman Sea and a distinct separation into East Austral and Antarctic Circumpolar Current. Forward trajectories show a convergence of particles along the Chatham Rise and its continuation.

The Apex Predator Project: A new shark and ray research initiative

Ms Helen Cadwallader[1], **Ms Melissa Kellett**[1], Professor Chris Battershill[1], Dr Phil Ross[1], Dr Malcolm Francis[2], Mr Clinton Duffy[3]

[1]University Of Waikato Coastal Marine Field Station, Tauranga, New Zealand, [2]National Institute of Water and Atmospheric Research, Wellington, New Zealand, [3]Department of Conservation, Auckland, New Zealand

Elasmobranchs (sharks and rays) are amongst the most iconic inhabitants of our oceans. They are also one of the most threatened. Unfortunately, a lack of information about the biology and ecology of this group is hindering the development of robust strategies for the management of elasmobranchs and the habitats in which they occur. The **Apex Predator Project** is a new collaborative initiative based at the University of Waikato's Coastal Marine Field Station (Tauranga). The project endeavours to increase our knowledge of shark and ray species both in the Bay of Plenty and New Zealand wide. The objective is to provide knowledge to inform sustainable management and conservation of this ecologically important group. Current research utilises a variety of methods including visual tagging, toxicological analysis, Baited Remote Underwater Video surveys and vertebrae chemistry to study the spatial ecology of the short tail stingray (*Dasyatis brevicaudata*) and bronze whaler sharks (*Carcharhinus brachyurus*).

Carbon stock and burial rates in coastal vegetated ecosystems (seagrass, saltmarsh and mangroves): moving towards spatially explicit estimates at a continental scale

Dr Robert Franklin Canto[1], Dr. Stuart Phinn[1], Dr. Oscar Serrano[2,3,4], Dr. Trisha Atwood[5], Dr. Catherine Lovelock[6], Dr. Peter Macreadie[7], Dr. Chris Roelfsema[1], Dr. Paul Lavery[2], Dr. Carlos Duarte[8], Dr. Gary Kendrick[4], Dr. Pere Masque[9,10,11], Dr. Mohammad Rozaimi[12,2], Mr. Jeffrey Kelleway[13], Ms. Stacey Trevathan-Tackett[14], Dr. Bradley Eyre[15], Dr. Christian Sanders[16], Dr. Andy Stevens[17]

[1]Remote Sensing Research Centre / School of Geography, Planning and Environmental Management - Global Change Institute, University Of Queensland, Brisbane, Australia, [2]School of Sciences & Centre for Marine Ecosystems Research, Edith Cowan University, Joondalup, Australia, [3]Centro de Estudios Avanzados de Blanes, Consejo Superior de Investigaciones Cientificas, Blanes, Spain, [4]The UWA Oceans Institute, University of Western Australia, Crawley, Australia, [5]Aquatic Ecology and Global Change Lab, Ecology Center and Watershed Sciences, Utah State University, Logan, USA, [6]School of Biological Sciences, University of Queensland, Brisbane, Australia, [7]Blue Carbon Lab, Centre for Integrative Ecology, School of Life and Environmental Sciences, Faculty of Science Engineering & Built Environment, Burwood, Deakin University, Burwood, Australia, [8]King Abdullah University of Science and Technology (KAUST), Red Sea Research Center (RSRC), Thuwal, Saudi Arabia, [9]School of Science, Edith Cowan University, Joondalup, Australia, [10]Departament de Física & Institut de Ciència i Tecnologia Ambientals, Universitat Autònoma de Barcelona, Bellaterra, Spain, [11]Oceans Institute & School of Physics, University of Western Australia, Crawley, Australia, [12]School of Environmental and Natural Resource Sciences, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, Bangi, Malaysia, [13]Department of Environmental Sciences, Macquarie University, Sydney, Australia, [14]University of Technology Sydney, Sydney, Australia, [15]Centre for Coastal Biogeochemistry Research School of Environment, Science and Engineering, Southern Cross University, Coffs Harbour, Australia, [16]National Marine Science Centre, Southern Cross University, Coffs Harbour, Australia, [17]Oceans & Atmosphere Flagship, CSIRO (Commonwealth Scientific and Industrial Research Organisation), Dutton Park, Australia

Coastal vegetated ecosystems (seagrass, saltmarsh and mangroves) play a major role in the ability of marine systems to mitigate climate change through carbon accumulation and storage. These marine vegetated systems have a smaller areal coverage than terrestrial forest ecosystems (which are 35 times larger) but their contribution to carbon sequestration is comparable and may be stored for greater time (millennia). Thus, seagrass, saltmarsh and mangroves ecosystems should be incorporated in the global carbon cycle and programs. However, the lack of robust estimates of carbon storage at regional and continental scales precludes the implementation of carbon trading schemes. Scaling carbon storage from local measurements to national scales is complex and so we developed and assessed methods for scaling up and resolving spatial variability within Australia. This involved; 1) data and methods review for carbon stock and burial estimates, 2) identification of a suitable estimation method accounting for spatial variability and 3) generating spatially explicit (SE) carbon stock and annual burial estimates and assessing the difference of these with non spatially explicit (NSE) estimates. Spatially explicit scaling of carbon stock and burial, accounting for the spatial variability between Australian bioregions, provided better estimates than non spatially explicit estimates. Specifically, our findings showed; 1) habitat area estimates from different sources can differ by a factor of four and 2) use of national mean based NSE estimates can result to either a overestimate (up to 600% more stock and 216% more burial) or underestimate (up to 31% less stock and 25% less burial).

Validation of first annulus in blue cod (*Parapercis colias*) otoliths

Dr Glen Carbines[1]

[1]*Saltwater Science Ltd, North Shore City, New Zealand*

Blue cod (*Parapercis colias*) is an important inshore commercial and recreational fish species around the southern islands of New Zealand, and estimates of their growth rate, age at maturity, and longevity are required for stock assessment and fisheries management.

Previous studies have validated the annual formation of opaque and translucent zones on the margins of blue cod (≥30 cm TL) otoliths, but the first annulus is yet to be validated. This study used zero plus and one plus blue cod otoliths to identify the first annulus. Otoliths from the zero plus fish (4–7cm TL and assumed to be 6 months old) contained a zone previously assumed to be the first annulus, which was therefore identified as a juvenile check. Consequently, blue cod have previously been aged at least one year older than their true age.

With supporting information from small zero plus blue cod it has been possible to determine the radial distance to the first annulus and identify associated notches on the distal surface of the otolith that will assist future readers of blue cod otoliths in identify the juvenile ring.

Upskilling Scientists to Share Their Own Stories

Dr Megan Carbines[1], Ms Elizabeth Connor[2]

[1]*Auckland Council, Auckland, New Zealand,* [2]*The KinShip, Wellington, New Zealand*

Summary: Rather than relying on the communications team to share your organisation's science stories, why not train the scientists to do it themselves. Not only does this make the process of report-writing easier, it connects scientists with the communities that benefit from their research. In this poster we will share the process and outcomes of this innovative new approach to science communication training and production using our collaboration on Auckland Council's 2015 State of the Environment (SOE) Report as an example. **The Challenge:** In November 2014 Megan's team faced the challenge of producing a report to capture many years of monitoring results for a diverse audience including decision-makers, iwi and community groups. In the past SOE report writing had been painfully long, thwarted by misinterpretation and resulting in reports that were overwhelming for audiences and unsatisfying for scientists. This time we were keen to do things differently. Our Solution: Our idea was to train the scientists to communicate to a wide audience and get them to write the report themselves. Having developed their own key messages, they could use these as a compass to guide their collaborations with communication and design teams and maintain control. The result has been a clearer, more audience-focused report that was much smoother to produce.

Behavioural and morphological adaptation to an invasive predator

Lucy Chapman[1,2], Peter Biro[1], Simeon Livoski[1], Craig Sherman[1]

[1]*Deakin University, Queenscliff, Australia,* [2]*Victorian Marine Science Consortium, Waurn Ponds, Australia*

Increasing globalisation has led to a significant increase in invasive species introductions in both marine and terrestrial ecosystems. Introduced species can have devastating impacts on native ecosystems and cause evolutionary shifts in a range of life history and behavioural traits. In particular, introduced predators are often able to exploit novel prey sources that lack anti-predatory escape responses. If native species fail to evolve and adapt to the invasive species, local extinction can occur. Here we examined changes in the anti-predatory response of the southern commercial scallop *Pecten fumatus* in response to the invasive predatory Northern Pacific sea star *Asterias amurensis*. Scallops from populations exposed to the invasive sea star for more than 20 years show greater anti-predatory response behaviour compared with scallops from populations with no history of exposure to the predatory sea star. We also demonstrate a shift in scallop morphological traits favouring active swimming in exposed populations. These results strongly suggest that southern commercial scallop behaviour and morphology have adapted in response to the presence of the Northern Pacific sea star, and have done so rapidly since the sea star introduction in 1995.

Is habitat change impeding the recovery of toheroa?

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

[1]*University Of Waikato, Hamilton,* [2]*Triplefin Environmental Consulting, Napier,* [3]*NIWA, Auckland*

The collapse of toheroa (*Paphies ventricosa*), an endemic surf clam of cultural, recreational and economic importance, is attributed to the intensification of human harvesting in the early to mid-1900's leading to population decline and ultimately closure of the fishery in the 1970s. Despite 40+ years of protection, toheroa have failed to recover, with some populations continuing to decline. Whilst toheroa abundance has been quantified on numerous occasions over the last 80 years, there has been little effort expended examining the human or environmental parameters that may affect toheroa distribution and abundance or explaining the failure to recover. Poaching, vehicle impacts, climate change, algal blooms, predation and changing land use have been suggested as explanatory factors. This research begins the process of investigating these factors by identifying the environmental parameters affecting toheroa distribution and dynamics along Northland's west coast. Combining ecological knowledge and Matauranga while working alongside tangata whenua, we aim to determine what constitutes 'good' toheroa habitat. Initial investigations will focus on the role of freshwater seeps in determining toheroa distribution, and examine whether changes in land use or dune vegetation may have altered beach hydrology and led to a reduction in suitable toheroa habitat.

Guiding Coastal and Marine Resource Management in New Zealand: the coastal special interest group science research strategy

Coastal Special Interest Group[1]

[1]*New Zealand Regional Council Coastal Scientists and Planners*

This poster describes the national science research strategy developed by the regional council and unitary authority Coastal Special Interest Group (C-SIG). Regional councils and unitary authorities are responsible for managing and monitoring the near-shore coastal environment; the area extending from mean high water springs to 12 nautical miles offshore. The purpose of the C-SIG Strategy is to promote a nationally consistent approach toward the coastal marine area (CMA) and support its sustainable management. Regional councils and unitary authorities have statutory responsibilities for the sustainable management of the CMA under the New Zealand Coastal Policy Statement 2010 and the Resource Management Act 1991. However, the lack of a nationally consistent framework for monitoring and reporting on the state of the CMA and gaps in our understanding of coastal ecosystems and processes make sustainable management challenging. The Strategy provides a framework of research information needed to enable council scientists and planners to better fulfil their statutory obligations. The Strategy is also intended to be used by funding providers to guide funding into avenues that address the needs of the coastal/ marine sector. The Strategy will help providers align their research proposals with the resource management needs of regional councils and unitary providers.

Impacts of coastal armouring on sedimentary communities vary with wave exposure

Mr Lincoln Critchley[1], Dr. Melanie Bishop[1]

[1]*Macquarie University, North Ryde, Australia*

Seawalls are a regular feature of urban coastal landscapes, and while commonly built along sedimentary shorelines, their impacts on sediment-dwelling organisms are poorly understood. Seawalls built along sedimentary shorelines modify movement of materials and energy and, depending on placement, may result in the loss of intertidal area by modifying coastal processes. This study tested the hypotheses that (1) the ecological communities of estuarine sediments would differ between stretches of shoreline with and without seawalls, and (2) the nature of impacts would differ according to wave exposure. Sediment-dwelling invertebrates and sediment characteristics were sampled at paired sedimentary sites, with and without seawalls. Five locations in Brisbane Water, New South Wales were selected, three along a sandy and higher-energy shoreline and two along a muddy and lower-energy shoreline. At high and low intertidal elevations, differences in abundances and richness of invertebrates between shorelines with and without seawalls were idiosyncratic and varied in magnitude and direction. However, at a mid-intertidal elevation, abundances of invertebrates were consistently smaller at sites with than without seawalls at low-energy sites, but, to the contrary greater at sites with than without seawalls at the higher-energy sites. Sediment grain size analysis revealed no difference between sites with and without seawalls at any location, suggesting the differences in ecological communities or the way seawalls modify hydrodynamics account for the differing direction of effects between exposed and sheltered sites. An understanding of how seawalls modify sedimentary communities, and where impacts are greatest, is needed to minimise ecological impacts of seawalls.

Flowering patterns for seagrass in Raglan Harbour

Ms Willemien de Kock[1], Dr Fleur Matheson[2], Dr Chrissen Gemmill[1]

[1]University Of Waikato, Hamilton, New Zealand, [2]National Institute of Water and Atmospheric Research (NIWA), Hamilton, New Zealand

Seagrasses are highly important ecologically, not least because they serve as a nursery for juvenile fish. *Zostera muelleri* is native to New Zealand and our only species of seagrass. There is currently a lack of knowledge about the reproductive strategies of this species, particularly surrounding flowering and the release of seeds. We studied the summer-time flowering habits of intertidal *Zostera muelleri* in Raglan Harbour, sampling 7 sites at different locations in the harbour monthly from November 2015 to January 2016. At each site we quantified flower (inflorescence) density, seed bank density, plant biomass and leaf size. We also collected water samples to gauge salinity, turbidity and nutrient levels at each site. Light loggers were deployed at three sites to give an indication of the summer light climate experienced by seagrass beds in this harbour. We found that flowering took place during all months sampled, but at relatively low densities, and there were differences in the timing of flowering between sites. Flowers were most abundant in dense patches with larger plants which were often located in wet seeps or tide pools. The maximum inflorescence density found was 84/m^2. We were unable to locate any seeds in sediment amongst flowering patches. Our results showed that plant biomass decreased after flowering was complete. The results of this study are an initial indication of the flowering patterns of *Zostera muelleri* in Raglan Harbour. They can be used to further research which will aid the management and conservation of New Zealand seagrass meadows.

Evaluating the efficacy of voluntary conservation measures: a case study from the Hauraki Gulf, New Zealand

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

[1]University Of Auckland, Auckland, New Zealand

As commercial use of the marine environment increases, anthropogenic activities result in conflict with marine wildlife. Ship-strike is one such conflict; as both the number of vessels at sea and whale populations increase, fatal whale-vessel collisions are becoming more common. The Hauraki Gulf is home to New Zealand's busiest port, but also to a population of Bryde's whales, of which an average of 2.2 are killed annually by ship strike. The shipping industry introduced a voluntary Transit Protocol in 2013 to reduce the risk of whale mortality from ship-strike. To determine whether mitigation measures are effective we used spatial analysis tools to map the overlap between ship transits and whale presence in 2015-2016. With ships having decreased their average speed from 14.2 kt in 2012 to 10.9 kt in late 2015 the risk of a lethal strike has declined significantly, but there is still overlap between whales and ships. Watch-keepers are required to take action when whales are reported along their transit through the Gulf and avoid areas with recent whale sightings. To measure whether watch-keepers respond to whale sightings, we plotted the ships track via Automatic Identification System and measured the closest point of approach between the ship and the whale. They were rarely in proximity with each other and this, combined with the reduced speed means the chance of collision is low. Conservation strategies need to be evidence-based, and this research evaluates whether current mitigation strategies are sufficient to protect Bryde's whales in the Hauraki Gulf.

Examining the links between habitat use and prey field distribution for little penguins in South Eastern Tasmania

Ms Rhian Evans[1], **Mr Lachlan Phillips**[1], Prof. Mark Hindell[1], Dr. Alistair Hobday[2], Dr. Kerrie Swaddling[1], Dr. Mary-Anne Lea[1], Dr. Eric Woehler[3]

[1]Institute of Marine and Antarctic Studies, Hobart/Battery Point/Hobart, Australia, [2]CSIRO Marine and Atmospheric Research, Hobart/Battery Point/Hobart, Australia, [3]BirdLife Tasmania, Hobart, Australia

Little Penguins (*Eudyptula minor*) are endemic to Australia and New Zealand with the largest population breeding in Tasmania. Most colonies have declined over recent decades, with several disappearing altogether due to a combination of different anthropogenic activities. Breeding success of pairs has been linked with quality of prey and during the breeding season they are reliant on prey being available close to the colony. The study aims to investigate how physical environmental factors and zooplankton distribution influence little penguin foraging behaviour. Currently, relationships between at sea habitat use and the local marine ecosystem remain unstudied, although in Tasmania little penguins are considered to prey primarily on small pelagic fishes, squid and *Nyctiphanes australis*. Eight penguins from a key colony in South-eastern Tasmania were fitted with high-resolution GPS tags for 1-3 foraging trips (n=14) during the chick-rearing season in January 2016. Penguins travelled in a southwards direction up to 35km from the colony to a region characterized by a water depth of approximately 70-90m. To identify key drivers in their movement and foraging activities, concurrent sampling of zooplankton distribution, abundance and diversity were also conducted at 19 stations in the foraging areas of the tracked penguins. Community analysis will be used to characterize the species composition of the zooplankton prey field. Exploration of how movement and behaviour is influenced by the environment and other factors is key to understanding species' reactions to environmental variability. Studies such as this are integral to protect biodiversity and ensure that iconic species are not lost.

A preliminary assessment of the effects of multimotored UAVs on bottlenose dolphin (*Tursiops truncatus*) behaviour off Great Barrier Island – New Zealand

Ticiana Fettermann De Oliveira[1], Lorenzo Fiori[1], Barbara Breen[1]

[1]AUT Unmanned Science, Institute for Applied Sciences New Zealand, Auckland University of Technology , Auckland, New Zealand

The use of Unmanned Aerial Vehicle (UAV) represents a novel and cost effective research tool to investigate dolphin behaviour and complement standard boat and land-based surveys. The high resolution aerial videos recorded from the UAV sensor provide the opportunity to gather data about the pod size, age classes and underwater behaviour from an advantageous perspective. Concern has risen about the potential risk of disturbance to wildlife caused by the UAV visual and acoustic stimuli. Recently, we tested the behavioural responses of bottlenose dolphins (*Tursiops truncatus*) to small Vertical Take-Off and Landing (VTOL) UAVs. The surveys took place at Great Barrier Island – New Zealand. Flights at different altitudes were performed. Changes in swim direction, pod cohesion and frequencies of aerial behaviours were recorded before and during the aerial survey. In addition, the pod behavioural state was recorded every one minute using focal group follow method. The preliminary results show no evident signs of disturbance for bottlenose dolphins when flying at 25 and 40 meters of altitude. These initial findings strengthen the argument that UAVs may represent a non-invasive tool to study dolphin behaviour. This research project will help to establish best practises and guidelines for the use of UAVs in marine mammal research.

Specialized Diet of the Deep-sea Elasmobranch, the prickly dogfish (*Oxynotus bruniensis*)

Ms Brit Finucci[1], Dr Carlos Bustamante[2], Dr Emma Jones[3], Dr Matthew R. Dunn[1]

[1]*Victoria University Of Wellington, Wellington, New Zealand,* [2]*University of Queensland, Brisbane, Australia,* [3]*National Institute of Water and Atmospheric Research, Auckland, Wellington*

Specialist diets have been identified amongst elasmobranch, although the degree of specialization can be subjected to individual specialists, competition, and fluctuations in spatial and temporal prey abundance and availability. Several examples of chondrichthyans playing a large role in diet of other chondrichthyans have been previously documented, although few are known from the deep-sea, and have included large bodied species. The prickly dogfish*, Oxynotus bruniensis*, is a small (<75 cm), little known deep-sea elasmobranch distributed on the outer continental and upper slope of southern Australia and New Zealand. Specimens (n=53) were collected from research trawls surveys and fisheries observers from around New Zealand at depths from 200 to 1000 m. Stomach contents were dissected and prey items were identified to the lowest possible taxon. Findings included *Harriotta raleighana* embryos and vitellus from unknown origin. 24 samples of vitellus were analysed with DNA methods, revealing that *O. bruniensis* preys exclusively on the egg capsules of oviparous chondrichthyans, including *Rhinochimaera pacifica* and *Chimaera carophila*. These are the first results of a wild elasmobranch sample relying solely on other chondrichthyans as a food source. In addition to its low reproductive output and high distribution overlap with fishing efforts, the reliance on a specialized diet makes *O. bruniensis* a particular vulnerable species to overfishing.

Surfzone View: A tactical decision aid for amphibious operations

Ms Sally Garrett[1]

[1]*New Zealand Defence Force , Auckland, New Zealand*

Rafael M. C. Guedes[2], Andre A. F. Lobato[2], David Johnson[2], Matthew Ruglys[1]

Amphibious warfare is one of the most complex operation in modern warfare. The safety and success of amphibious landings are largely dependent on surf conditions. SurfZoneView (SZV) is modelling and tactical decision aid developed by MetOcean Solutions to support beach landing operations conducted by the New Zealand Defence Force (NZDF). SZV provides a fast, reliable and simple tool that can be used by command teams to plan and execute safe and efficient operations. The SurfZoneView (SZV) software uses the XBeach model to provide a robust prediction of nearshore waves and currents. The easy to use GUI allows setup of model simulations without specialist oceanographic or modelling training. Wave boundary conditions can be sourced from local wave buoys; forecasted SWAN spectra files or visual observations. Model depths are defined from gridded or XYZ formats, with grids of different resolutions seamlessly interpolated within the tool. Model results are processed within the GUI to produce derived surf zone information tailored to support command decision making. Outputs are in units and formats familiar to the sailors conducting the operations, and can be displayed as one-dimensional transect profiles or two-dimensional surface data. The Royal New Zealand Navy employed this tool at the 2014 RIMPAC exercise in Hawaii. A comparison of modelled and observed conditions was made, with the tool providing “GO - NO GO” decision correctly throughout the exercise. Surfzone View has now been commercialised by Metocean Solutions Limited and is being used throughout the Pacific.

Gastropod communities associated with different morphs of the intertidal seaweed *Hormosira banksii* in Tasmania

Federica Gemelli[1], Jeffrey Wright, Craig Johnson

[1]*IMAS, Hobart, Australia*

The seaweed *Hormosira banksii* is an abundant intertidal habitat-forming species on open coasts and in estuaries in south-eastern Australia. In Tasmania, the morphology of *Hormosira* varies markedly between regions (a small morph on the north coast compared to a standard morph the east coast) and habitats (a large morph in estuaries compared to smaller morphs on open coasts). These different morphs are likely to result in different ecosystem engineering of abiotic factors and thus, different conditions beneath the canopies for associated species. In this study, we investigated (1) whether distinct gastropod communities were associated with each of the three *Hormosira* morphs (small, standard and large) at replicate sites from the north coast, east coast and estuaries, and (2) whether the same gastropod species associated with the different *Hormosira* morphs differed in shell morphology. The gastropod communities associated with the three *Hormosira* morphs were very different. Compared to the estuarine morph, coastal morphs tended to have a higher abundance of gastropods and support more species. However, the small north coast morph and the standard east coast morph also had distinct gastropod communities with different species dominating on each coast. In addition, the morphology of several gastropod species that occurred beneath both *Hormosira* morphs on north and east coasts also varied. Overall our results indicate very different gastropod communities, and for individual gastropod species very different shell morphologies, associated with different *Hormosira* morphs. Currently, we do not know the relative importance of *Hormosira* morphology vs. site-level variation in environmental factors (e. g. wave exposure, temperature, predation) in driving these patterns. Experiments to tease apart the effects of these site-level factors in contributing to gastropod community structure and morphology are the next steps in this research.

Coastal science at Waikato Regional Council: working with the marine sciences community

Dr Hilke Giles[1], Dr Hannah Jones[1], Mr Pete Wilson[1], Mr Stephen Hunt[1], Dr Cathy Liu[1]

[1]*Waikato Regional Council, Hamilton, New Zealand*

Waikato Regional Council' coastal science team is responsible for providing robust scientific information so that: 1) The public has access to relevant information on the environment and early warning of environmental problems 2) Policies for the management of the coastal marine area can be developed more effectively 3) We can identify critical catchment-sea linkages and thus achieve integrated catchment management 4)We can assess the effectiveness of environmental interventions 5) We can better support central government with national initiatives, for example national environmental reporting 6) Conflict created through poor understanding of critical environmental issues and/or the state of the coastal environment can be minimised. The areas of coastal science we cover can broadly be described as coastal water quality, ecology and coastal processes but in reality include all aspects of coastal science, including cumulative effects. The challenges we are facing can only be met by working with others and our relationships with scientists from universities, research institutes and small consultancies are crucial for our success. In return for your scientific support, we can provide financial assistance to research and student projects. We also provide our data and can act as technical advisors to help scientists understand and meet resource management related science needs. This poster outlines our priority research and information needs and the mechanisms available to develop and enhance mutually beneficial collaborations. Our aim is to inform the marine sciences community of the ways we can support research and through collaborating improve the knowledge and management of the Waikato coastal marine area.

Density decrease of brown sea cucumber in a biosphere reserve from Gulf of California, Mexico

Ms Andrea Glockner-Fagetti[1], PhD Luis E Calderon-Aguilera[2], PhD María D Herrero-Pérezrul[3]

[1]*PhD Student, Wellington, New Zealand,* [2]*CICESE, Ensenada, Mexico,* [3]*CICIMAR-IPN, La Paz, Mexico*

The brown sea cucumber *Isostichopus fuscus* (Ludwig, 1875) has been exploited in the Gulf of California since 1988, both legally and illegally, but little is known about it's population in its northernmost geographical distribution. We surveyed abundance, size and weight of *I. fuscus* in the boreal summer of the 2005-2007 period and in 2013, using 50x2 m transects, at the biosphere reserve Bahía de los Ángeles, Gulf of California. In 2013, densities were lower (0.15±0.01 ind·m^{-2}), compared to the 2005-2007 period (0.27±0.04 ind·m^{-2}), but mean length was higher (17.8±3.8 cm, and 13.9±3.5 cm, respectively). In 2005-2007 the population was mainly constituted by individuals <20 cm in length, and only 10% of the population was of reproductive age (4-5 y; 21 cm). While in 2013, 32% of the population were individuals of ≥20 cm in length, and few juveniles were observed (1%). There were no significant differences in the weight-length relationship ($W=7.17 \cdot L^{1.29}$), and parameters of the von Bertalanffy growth equation (L_{∞}=35.74 cm, K=0.26 y^{-1}) between the study periods. This study corroborates that the growth rate of the *I. fuscus* population in its northernmost geographical distribution was similar to those from southern locations. But the observed values of density and mean length in 2013 were well below those previously registered in the region, and in southern locations. Basic management actions such as minimum size of capture and a ban on fishing during reproductive season, have not been sufficient to assure the sustainable exploitation. Some actions are proposed for the sustainable management of this resource.

The effects of diet on the developmental thermal window of the sand dollar *Arachnoides placenta*

Ms Shannon Goodwin[1], Dr Miles Lamare[1], Dr Sven Uthicke[2]

[1]*University Of Otago, Dunedin, New Zealand,* [2]*Australian Institute of Marine Science, Twonsville, Australia*

Arachnoides placenta Linnaeus (Echinoidea; Clypeasteridae) is a tropical sand dollar commonly found in the Indo-Pacific region sandy intertidal. This species produces a planktonic facultative pluteus larva that can reach the advanced pluteus stage in four days and can further complete development without food in as little as 7 days. As with many amrine species, developmental thermal windows of the sand dollar correlate with the present-day latitudinal distribution of populations. Thus, there is interest in how changing ocean conditions (i.e.warming temperatures/increaded ocean productivity) may alter thermal windows of larvae. With this in mind, we examined the thermal window of *Arachnoides* (at 12 temperatures across a 13°C to 34.6°C range in temperature) and metabolic rate in larvae that were feed (10,000 cell mL^{-1}) and those that were not feed. Responses were measured in terms of larval size and development.We found larval size increased significantly with increasing experimental temperature up to 30.7°C, after which final size reduced. This pattern was consistent in fed and non-fed larvae, despite non-fed lavae being consistently and significantly larger across temperatures. We also noted an increase in respiration in fed (0.72 ± 0.24 pmol ind h^{-1}) versus non-fed larvae (0.51 ± 0.14 pmol ind h^{-1}). The lack of an interaction between temperature and food concentration does not support our hypotheses that thermal windows will be altered by food concentration. The findings of the study are, however, consistent with known morphological plasticity and metabolic responses in echinoderm larvae of increased size and reduce metabolism under limited food supply. These physiological adjustments to food supply and the faciltative development in *A.placenta* may mask a changes in thermal windows in this species.

Diverse sponge assemblages of upper canyon habitats along the New Zealand west coast continental shelf

Dr Emma Jones[1], Dr Michelle Kelly[1], Dr Mark Morrison[1]

[1]*Niwa, Auckland, New Zealand*

Managing the increasing pressures on New Zealand's marine estate requires fundamental information on identity and spatial location of biodiversity resources. Such knowledge is currently lacking from many parts of the outer continental shelf. We present the results of a faunal study of canyon heads and nearby shelf edge along the west coast of the North Island (140–350 m), identified from local fisher knowledge. Acoustic maps, biological samples and imagery were used to characterize the habitats and communities. These dramatic topographic features were found to harbour an unusual and diverse sponge fauna on rocky outcrops and rubble fields, along with a variety of other suspension feeders. Of the thirty sponges identified, nine were new to science, and others, previously considered rare, were observed at unusually high densities. Of particular note was the re-discovery of the hexactinellid sponge *Rosella ijimai*, previously only known from the North Cape. Towed video also indicated a fish assemblage dominated by sea perch and butterfly perch that were closely associated with these habitats. This study contributes valuable information towards mapping of these habitats over wider areas and understanding their vulnerability to current and future anthropogenic impacts.

Coastal monitoring programmes and indicators: where does marine science and research fit in?

Dr Hannah Jones[1], Dr Hilke Giles[1], Dr Judi Hewitt[2]

[1]Waikato Regional Council, [2]NIWA

Waikato Regional Council (WRC) has embarked on a large project that aims to improve the effectiveness of coastal information gathering and monitoring. Part of this project involves: 1)A strategic assessment and prioritisation of all information gathering and monitoring activities that WRC is required to conduct in the coastal marine area 2) Developing and implementing monitoring programmes for high priority activities 3) Developing tools for communicating monitoring results to others. The project commenced in 2015 and will run for at least 5 years. We have conducted a stocktake of available information for the Waikato coastal marine area, and identified major information gaps and high priority needs. We anticipate that research will be required into effective monitoring methodologies for several areas/programmes (including water quality, ecology and biodiversity and physical processes) and for developing indicators that can report on the state of the environment in a meaningful way. There is considerable scope for collaboration between council scientists and marine science researchers and students to develop effective monitoring techniques and indicators This poster outlines progress on this project to date, highlights some of the big questions and knowledge gaps, and is a call for discussion and collaboration.

How do cross-shelf shifts in population distribution influence reproduction of blue cod?

Miss Stina Kolodzey[1], Prof. Stephen R. Wing[1]

[1]University Of Otago, Dunedin, New Zealand

A thorough understanding of the reproductive biology of fish is fundamental for an accurate assessment of a population's spawning potential. It is now recognised that relative fecundity is dependent on size, age or other maternal characteristics. Size selective harvesting effectively truncates the age and size structure of fish populations favouring genotypes with slower growth, earlier age at maturity and resulting in lower productivity of a population. The reproductive biology of blue cod (*Parapercis colias*) is relatively poorly understood. Here, we examine evidence for a shift of the reproductive centre from an onshore to an offshore population at the coast of the Otago Peninsula. A comparison of the size-frequency distributions between the two sites shows a larger proportion of larger fish further off the coast. Using stable isotope ($\delta^{15}N$ and $\delta^{13}C$) compositions we found a significant difference in the trophic position of fish between sites, with a higher amount of suspended particulate organic matter supporting the food web onshore than offshore. Modelled batch fecundity for both populations shows a significantly higher relative fecundity (hydrated oocytes per gram of body weight) for the offshore population. Our results indicate a shift in the population structure of blue cod at the Otago Peninsula as a potential effect of high fishing pressure on the onshore population. A possible consequence could be a shift of the reproductive centre further offshore, resulting in a change in the basal organic matter sources supporting the population or a shift in the starting point for dispersal of larvae.

Making the New Zealand Kapiti Marine Reserve an integrative part of its natural and societal environment through habitat mapping

Dr Geoffroy Lamarche[1], Mr Arne Pallentin[1], Dr Alix Laferriere[2], Prof Jonathan Gardner[2], Dr Shane Geange[3], Dr Vincent Zintzen[3], Ms Helen Curtis[3]

[1]Niwa, Wellington, New Zealand, [2]Victoria University of Wellington, Wellington, New Zealand, [3]Department of Conservation, Wellington , New Zealand

Kapiti Island, along the west coast of southern North Island of New Zealand is one of the country's iconic natural places. The ca. 6 km-wide passage between the mainland and Kapiti Island is characterised by a c. 70 m-deep channel that experiences strong currents, and that has been a passage for whales. The seafloor surrounding Kapiti Island is of significant cultural and environmental value. A marine reserve was established in 1992 covering ~2200ha encompasses a dynamic and rugose seafloor that creates suitable habitat for a diverse and abundant group of fish and iconic invertebrates such as paua (*Haliotis iris*) and rock lobsters (*Jasus edwardsii*). The geology surrounding Kapiti Island is dynamic with several active faults. We used a Kongsberg EM2040 Multibeam Echosounder to produce maps around the island. The strip between land and the mapped area was covered by satellite derived bathymetry. The bathymetry reveal the morphology of the seafloor, and backscatter provides information on the bottom types. The data enable to image objects less than 50 cm wide in 20 m of water. 216 camera drops, 4 sled tows, 46 dives and 30 sediment samples acquired in November 2015 on targeted habitats provide comprehensive ground-truthing for the predictive habitat maps. The assessments covered 13 different habitat types and enabled the mapping of important areas including critical habitats such as the nationally protected Rhodolith beds (coralline red algae "balls"). Overall, the data collected enable a greater ability to effectively manage the area and promote awareness of the richness, diversity and complexity of the seafloor around Kapiti.

The activity of Risso's dolphins off Pico Island (Azores) is significantly affected by whale-watching vessels

Ms Jennifer Libotte[1], Ms A. Mel Cosentino[2], Ms Arianna Cecchetti[3], Dr Karin Hartman[4]

[1]No Affiliation at the moment, Gougnies, Belgium, [2]Wild Earth Foundation, Av de las Ballenas 9500, Puerto Pirámides, Península Valdés, Argentina, [3]cE3c - Centre for Ecology, Evolution and Environmental Changes/Azorean Biodiversity Group, University of the Azores, Biology Department, 9501-801 Ponta Delgada, Portugal, [4]Nova Atlantis Foundation, Rua Dr. Freitas Pimeltel 11, 9930- 309 Santa Cruz das Ribeiras, Portugal

The Risso's dolphin is a resident species off Pico Island in the Azores (Portugal). The coastal waters form an important nursery area for this population, which overlaps during summertime with intensive whale-watching activities where resident pods are frequently targeted. The impact of these interactions on Risso's dolphins was studied by applying the Markov chain model. Boat-based data was collected during 132 days (201.25h) from May to October 2004 to 2007. The activity state (i.e., travelling, foraging, resting and socializing), speed and direction of movement were studied to evaluate the probability to switch from one activity to another, before, during, and after the presence of tour vessels. Significant differences regarding the transition probabilities and activity budget were found, as well as changes in recurrence time. During the presence of vessels there was a significant increase in travelling behavior, speed and direction of movement towards the East (i.e., displacement from the area where the whale-watching vessels operate). Significant changes also occurred even after vessels left the groups with increased resting and foraging behaviors, and direction of movement to the North (i.e., the dolphins return to the coast). These results suggest dolphins are disturbed by whale-watching vessels, beyond their presence, and respond similarly as predicted by the predation risk hypothesis. Changes in activity budget can potentially affect the fitness of individuals. This study shows that a responsible management of the whale-watching activity at a local level is needed, as well as monitoring of this population in order to understand potential long-term impacts.

Are climate variations the cause of shifting phytoplankton communities in Port Phillip Bay?

Ms Emilie Luna-laurent[1], Randall Lee[1], Alison Kemp[1], Michael Sams[1]

[1]Environmental Protection Authority Victoria, , Australia

Port Phillip Bay is a large, temperate and shallow embayment in southern Australia with limited exchange with Bass Strait waters through its narrow entrance. The Bay shows a strong response to inter-annual climate variation with salinity levels representing a balance between evaporative fluxes, ocean flushing and catchment inflows, making it an ideal metric for bay condition. Climatic variations are reflected in the abundance and diversity of phytoplankton communities, with a decrease of spring bloom activity and reductions in overall productivity during prolonged droughts. Key inflow events play an important role in bay turnover between drought conditions to wetter years, often triggering prolonged plankton blooms in the bay. This paper explores the influence of these strong physical drivers on phytoplankton assemblages and succession patterns, analysing eight years of data in Port Phillip Bay and exploring changes following the millennium drought through a markedly wetter period and the recent return to drought conditions in 2016.

Biogeochemical modelling in New Zealand Waters

Dr Helen Macdonald[1], Dr Graham Rickard[1], Dr Mark Hadfield[1], Dr Joanne O'Callaghan[1]

[1]NIWA, Wellington, New Zealand

Global climate change is predicted to alter the physical and biogeochemical structure of the world's oceans. As such, there is an increasing need for an understanding of physical and biogeochemical processes and the link between the two. Studying these physical and biogeochemical processes can be problematic as data on physical and biogeochemical processes is sparse for the New Zealand region. Biogeochemical models are a good way to interpolate between these data points. Here results will be presented from two different coupled physical/biogeochemical models: PISCES run under the CROCO (Coastal and Regional Ocean Community model) framework and Fennel run under the ROMS (Regional Ocean Modelling System) framework. Firstly results from a New Zealand Exclusive Economic Zone – scale model will be shown (using CROCO). The model output captures spatial and seasonal patterns of chlorophyll well and improves on previous modelling estimates for the region. These results are then downscaled for a case study of the Haruki gulf region (using ROMS). The vertical distribution of phytoplankton and nutrients are explored and the effects of physical processes such as upwelling and mixing driven by winds and tides are investigated.

Any new species....? Our recent discoveries from the deep.

Ms Diana Macpherson[1], Ms Sadie Mills[1], Ms Di Tracey[1]

[1]NIWA, Wellington, New Zealand

To help assess the impacts of fishing on benthic communities and the wider ecosystem for the Ministry for Primary Industries (MPI) and Conservation of Antarctic Marine Living Resources (CCAMLR), NIWA are funded to provide taxonomic identifications of invertebrate bycatch from observers on commercial vessels and research trawl surveys. The samples are often the source of exciting discoveries. Between July 2012 and June 2015, 2,499 sample lots (a count of 11,034 specimens) were authoritatively identified, a result of 1,318 species ranging 13 key Phyla. Approximately 3% of these species were undescribed or new to science. Many more specimens provided additional material to poorly known species, or extend the known distribution of others. Examples of important discoveries include an undescribed species of deepsea clam from the family Vesicomyidae, representing the first indicator of deepsea hydrothermal venting in the Ross Sea. The discovery of a specimen of demosponge *Geodia chathamensis* was only the second of this new species and is now the holotype specimen. A remarkably intact specimen of the poorly known chiroteuthid squid *Asperoteuthis lui* was discovered, along with two specimens of goblin shrimp *Glyphocrangon armata* which extended the known distribution south into New Zealand waters. Observer samples of bottlebrush deep-sea octocorals have helped scientists recognise four distinct populations for this group. A new species of Bryozoa belonging to genus *Euthyroides* and a new genus of Smittinidae were discovered. The results contribute significantly to our understanding of various marine invertebrate groups, their ecological significance, and expands our knowledge of New Zealand's biodiversity.

Behavioural, endocrine and external pattern changes during sexual transition in the temperate Spotty wrasse (*Notolabrus celidotus*)

Mr Carlos Moraes[1], Dr Chris Battershill[1], Dr Simon Muncaster[2]

[1]University Of Waikato - Coastal Marine Field Station, Tauranga, New Zealand, [2]Bay of Plenty Polytechnic, Tauranga, New Zealand

Sex change in protogynous wrasses is often regulated by social structure. The presence of a dominant male will influence behaviour of subordinate individuals within the breeding harem. This ultimately affects the gonadal endocrine environment and sexual phase via the hypothalamic-pituitary-gonad axis. Many studies of sex changing fish use tropical species, while few focus on temperate fish. This study aims to characterize aspects of socially induced sex change in the protogynous temperate New Zealand wrasse Notolabrus celidotus. Artificial breeding groups will be arranged using 1 male and 5 females in 10 replicate 500L recirculating seawater tanks. The females within each tank will be selected to provide a size hierarchy. Following an acclimation period of at least two weeks, males will be removed from half of the tanks to create a 'permissive' social environment. This study focuses on the relationship between behavioural sex change, circulating sex steroid concentrations and the transition between sexually dimorphic markings. Based on pilot work, we expect to see the largest females in the treatment tanks, without males, to initiate more aggressive interactions toward smaller subordinate females. Large dominant fish are likely to undergo gonadal sex change in accordance with Ghiselin's size advantage model. The transition of these fish from female to male should be reflected in the relative plasma estrogen-androgen concentrations as well as external colour and pattern changes. This study attempts to describe milestones of behavioural, endocrine and external marking transitions throughout the process of protogynous sex change in this temperate wrasse.

Increasing the chances of a successful return to home for recovered Magellanic penguins

Dr Júlia Morais[1], Dr Julieta Volpato[1], Dr Adson Costa[1], Dr Cristiane Kolesnikovas[2], Prof Mere Saito[1]

[1]Laboratório de Patologia Animal - Centro de Ciências Agroveterinárias, CAV UDESC, Conta Dinheiro, Lages, Brazil, [2]Centro de Triagem de Animais Silvestres, Parque Estadual do Rio Vermelho, Brazil

Climate change has increased the number of Magellanic penguins that arrive each year in Brazil. Currently there are rehabilitation centers up to Espírito Santo state (20ºS), though the largest collections are in Rio Grande do Sul (32ºS). The reports of recovered penguins usually refer to little waterproofing plumage, much due to sea pollution with oil products which also weakens the liver of the animals. During rehabilitation many penguins acquire diseases atypical of its wildlife, like malaria avian and aspergillosis. The program of banding penguins, started in 1984, was already applied to more than 1100 exemplars; however, resights were less than 100. Currently the criteria for release in nature are: perfect waterproofing plumage, good or optimal body condition, blood hematocrit, white blood cells and total protein tests, no clinical signs of disease, absence of lesions and normal behavior. Nevertheless, clinical signs of disease are classically hidden by the wild animals in order not succumb to predators, so, other plasma parameters, in addition to total protein, may give useful information. As the rescue penguin is usually juvenile, a small animal with less than 4.5 kg, the collection of large amounts of blood may delay its recovery. A serum sample always yields lower volumes than the plasma one. In this work were compared 12 biochemical analytes measured in serum and plasma with heparin and EDTA from recovery penguins. The results showed that most of the parameters may be assayed in any of the conditions while some presented significantly differences, depending on the pre-treatment.

In vitro studies on the hemolytic effect of *Catostylus tagi* jellyfish in humans and dolphins

Prof Zilda Morais[1], Prof Rita Soeiro[1], Dr Mário Godinho[1], Dr Sónia Matias[2], Dr Arlete Sogorb[2]

[1]CiiEM - Egas Moniz Cooperativa de Ensino Superior, Caparica Almada, Portugal, [2]Lisbon Zoo, Sete Rios - Lisboa, Portugal

Toxins from cnidarians usually have hemolytic, cardiotoxic and/or neurotoxic effects in mammals, although their intensity may differ widely according to the predator and the prey. Cnidarians with the most potent toxins are usually located in the Australia / Oceania region, while in the Mediterranean and the coastal zone of continental Portugal their toxicity is typically low. The jellyfish *Catostylus tagi* occurs in estuaries of the Tagus and Sado rivers during the summer, so, because there are also swimmers and dolphins (*Tursiops truncatus)* in these areas, some casual interactions between them and *C. tagi* may happen; however, there are no reports with systematic data about the effect of its toxins. In the present work, *in vitro* assays were performed on captive dolphins (*T. truncatus*) and on human volunteers. The assay consisted of incubating a suspension of erythrocytes with the toxin extract – obtained by rupturing the nematocysts. The hemolytic activity was evaluated by spectrophotometry, associated to the hemoglobin released from the cells to the solution. The results showed that the hemolytic activity of *C. tagi* over dolphins and humans are similar. The individual IC_{50} results varied from 2.0 to 4.5 μg/mL; the estimated IC_{50} by average results was 4.0 μg/mL.The action of *C. tagi* had the same magnitude of the *Cassiopea xamachana* (7.0 $\mu g/mL$) both being significantly less hemolytic than *Pelagia noctiluca* (0.1 $\mu g/mL$). Comparative studies on the intensity of hemolytic effect regarding the human blood type are now in progress.

Effects of coastal development and urbanisation on subtidal macrophytes

Dr Simon Muncaster[1], Keith Gregor[1]

[1]Marine and Environmental Group, Bay of Plenty Polytechnic, Tauranga, New Zealand

The majority of urban centres have been developed along coastal areas often within the proximity of suitable ports. Few studies have examined evolving gradients due to processes such as urbanisation and land modification and their possible effects on coastal subtidal reefs. Tauranga has the largest port in the country and is one of the fastest growing cities in New Zealand. Significant horticultural and farming industry exists around the city limits. Urban and agricultural runoff as well as dredging can influence sediment loads and water quality and may ultimately influence primary production in subtidal macrophytes. This study investigates the photosynthesis-irradiance response of *Ecklonia radiata*, the dominant habitat forming macrophyte on rocky reefs in the Bay of Plenty, across a nearshore-offshore gradient. This involves collecting live tissue samples from *E. radiata* within the Tauranga Harbour, the open coastline and offshore reefs out to the edge of the continental shelf. Light attenuation is recorded at each site and the photosynthetic rate measured and modelled in relation to irradiance. This provides insight to the light adaption and productivity of *E. radiata* on nearshore Tauranga reefs. The results of these investigations as well as other innovative approaches to examining the effects of urbanisation on subtidal macrophytes will be presented.

Gonadal sex change in the protogynous temperate spotty wrasse, *Notolabrus celidotus*

Dr Simon Muncaster[1], Erica Todd[2], Mark Lokman[2], Neil Gemmell[2]

[1]1Marine and Environmental Group, Bay of Plenty Polytechnic, Tauranga, New Zealand, [2]Department of Anatomy, University of Otago, Dunedin, New Zealand, [3]Department of Zoology, University of Otago, Dunedin, New Zealand

While sex change has been extensively researched in fish, few of these studies focus on temperate species. The New Zealand spotty, *Notolabrus celidotus,* is an endemic, protogynous wrasse inhabiting temperate coastal reefs. They are conspicuous among reef and shallow coastal communities due to their abundance and broad geographical range. Despite their prevalence, surprisingly little is known about the process of gonadal sex change in *N. celidotus*. This study describes gonadal transition based on separate manipulative studies of captive populations that were either artificially (AI) or socially (SI) induced to undergo sex change. AI fish were implanted with 200 µg of fadrozole, an aromatase inhibitor, while a 'permissive' social environment was created for female SI fish through male removal. Both treatments successfully induced female to male sex change. Early stages of sex change were characterised by the atresia of oocytes and apparent proliferation of gonia that differentiated into male germ cells. As spermatogenesis progressed cysts of spermatogonia and primary spermatocytes predominated over the diminishing atretic oocytes. Melanomacrophage-like aggregations of cellular debris were also evident. Further development lead to a fully functional testis with mature sperm present in testicular lobules. Some previtellogenic oocytes persisted in the testis providing evidence of recent sex change. This transition is also reflected externally through sexually dimorphic changes to fin colour and markings. Complete sex change seems to be possible within 10 weeks. Progress in developing this species as a temperate model to better understand the physiological and molecular regulation of sex change will be discussed.

Day-night changes in a temperate reef fish assemblage

Ms Elisabeth Myers[1], Professor Euan Harvey[2], Benjamin Saunders[2], Michael Travers[3]

[1]Massey University, Auckland Campus, Auckland, New Zealand, [2]Curtin University, Western Australia, Perth, Australia, [3]Deparment of Fisheries, Western Australia Fisheries and Marine Research Laboratories, Hillarys, Australia

The distribution, abundance and composition of marine fish assemblages are influenced by changes in behaviour and movement associated with the diel cycle. The majority of studies exploring day–night differences have demonstrated that there is a greater abundance and diversity of fishes during diurnal compared with nocturnal hours, and that fish assemblage composition varies with time of day or night. We investigated fine-scale (hourly) diel cycles in the composition and relative abundance of temperate reef fishes using unbaited remote underwater video systems. We observed short crepuscular changeover periods with the hours around dawn and dusk sharing many species, some of which are nocturnal and others diurnal. Diurnal surveys recorded a greater number of individuals (16,990) and species (70) than nocturnal surveys (1053 individuals and 19 species). There was a clear difference between the diurnal assemblage, which was characterized by benthic invertivores, and the nocturnal assemblage composition, which contained zooplanktivores and generalist feeders. Within the diurnal period the hourly temporal variation was relatively homogenous, indicating that standardization of diurnal sampling to a particular time of day may not be necessary.

Mapping large brown algal distributions – with the help of citizen science

Ms Kate Neill[1], Professor Wendy Nelson[1,2], Dr Roberta D'Archino[1]

[1]Niwa, Wellington, New Zealand, [2]University of Auckland, Auckland, New Zealand

Members of the Fucales and Laminariales (true kelps) are common and significant members of New Zealand's coastal flora. These large brown algae are often seen, but not always collected leaving significant gaps in their distributions as recorded by vouchered herbarium specimens. As part of a project funded by the Ministry for Primary Industries we are enlisting keen citizen scientists to fill some of these gaps. We are asking people from around the country to upload any images they may have of a list of species we provide.

Benthic–pelagic coupling in the future coastal ocean

Ms Cintya Del Rio[1], **Dr Chris Pook**[1], Dr Kay Vopel[1]

[1]AUT Science, Wellesley, New Zealand

Microbial degradation of organic matter in the soft-sediment sea floor drives primary production in coastal seawater. Natural and anthropogenic acidification of this seawater may indirectly affect coastal productivity by at least three possible mechanisms: (1) acidification of the sediment porewater modifies the metabolism of benthic bacteria and archaea, (2) elevated concentrations of inorganic carbon in acidified seawater increase primary production of benthic microphytes, and (3) the structure of the benthic macrofaunal assemblage responds to the seawater acidification. If, in fact, each or any combination of these mechanisms affect the productivity of the coastal seawater column then this should be reflected in the rates of the sediment–seawater solute exchange—the process that couples the biogeochemistry of the sea floor with that of the seawater column. Here, we report the results of a simple laboratory experiment in which we tested this hypothesis. We measured the sediment–seawater exchange of dissolved ammoniacal nitrogen, nitrate/nitrite nitrogen, reactive phosphorus and oxygen before and after gradually decreasing the pH of the sediment-overlying seawater from 8.1 to 7.8.

Trends in marine-based Species Distribution Models (SDM) with emphasis on modelling approaches and model validation

Nestor M. Robinson[1,2], Wendy A. Nelson[1,2], Judy E. Sutherland[1,2], Carolyn Lundquist[3,4], Mark J. Costello[3]

[1]School of Biological Sience, University Of Auckland, Auckland, New Zealand, [2]National Institute of Water and Atmospheric Research, NIWA, Wellington, New Zealand, [3]Institute of Marine Science, University of Auckland, Auckland, New Zealand, [4]National Institute of Water and Atmospheric Research, NIWA, Hamilton, New Zealand

A decade of research on marine-based species distribution models (SDM) has shown the utility of correlative approaches to understand species distributions. In this review, publications using marine-based SDM applications have been analyzed quantitatively. There has been an increase in the number publications by year. A considerable number of papers (19) were published in 2013 followed by a significant increase (34 publications) in 2015. Among these publications, a great deal of research focused on fishes (30 publications), followed by marine macroalgae (25 publications). In terms of modelling approaches, correlative models have been the most popular tools (122 publications) to predict species distributions, whereas, hybrid and mechanistic approaches are at the infancy of their application in marine-based SDM research (12 and 10 publications respectively). Among correlative approaches, the Maximum Entropy principle (Maxent) is a general statistical model which has frequently been applied (56 publications= 38.8 %). In relation to model validation, correlative approaches such as Maxent base their inferences on the interpretation of the so-called Receiving Operating Characteristic (ROC) also known as the Area Under the Curve (AUC), comments on the application of such model validation scores are presented herein.

A decline in abundance of sperm whales at Kaikoura, revealed by analysis of photo-ID data

Ms Tamlyn Somerford[1], Dr William Rayment[1], Professor Steve Dawson[1], Professor Elizabeth Slooten[1]

[1]University of Otago, Otago - Dunedin, New Zealand

Understanding the abundance and population dynamics of sperm whales at Kaikoura is important for several reasons. These data are directly relevant to the management of the whale-watch industry, both in terms of its impact and profitability. Additionally, whales are known to reflect larger changes in ecosystems, potentially driven by climate change or other human impacts. The Otago Marine Mammal Group has conducted research on sperm whales at Kaikoura since 1990. Here, we analyse photo-ID data for trends in abundance over the period 1990-2015. Cormack-Jolly-Seber capture-recapture methods were used to estimate the yearly abundance. A suite of models were trialled and compared using AIC. The best model consisted of constant survival, time-dependent recapture probability and a behavioural response to first capture. Weighted linear regression of those abundance estimates showed a significant decline from 89 (95% CI = 13 60) to 37 (95% CI = 4630) individuals from 1991-2015. This change could represent actual population decline or a shift in distribution outside of the study area. Changes in oceanographic conditions, prey distribution, impacts of tourism, and/or continued effects from past commercial whaling pressure may be influencing this decline. The next step is to prioritise research on the possible causes of the decline so that effective population management can be established.

Marine Water Quality Dashboard: New generation tools for monitoring water quality

Mr Jamie Treleaven[1], Mr Greg Stuart[2], **Dr Claire Spillman**[1]

[1]Bureau of Meteorology, Melbourne, Australia, [2]Bureau of Meteorology, Brisbane, Australia

A number of threats, including water quality, climate change, shipping, fishing and coastal development, have the potential to detract from the Great Barrier Reef's natural, cultural and economic value. In fact, although the GBR is recognised as one of the best managed reefs in the world, coral cover has continued to decline over the last decades at rates similar to less well managed reefs. eReefs is a response by Australian and Queensland Government agencies plus private investors to mitigate the risks associated with the multiple use of the GBR. eReefs will for the first time, provide a comprehensive picture of the reef in the past, present and future. It integrates existing efforts, and forms the first step in building a comprehensive coastal information system for the whole of Australia. By 2015, the project partners of eReefs (BoM, CSIRO, AIMS, the Queensland Government and the Great Barrier Reef Foundation) will deliver a framework to explore and predict the impact of factors such as temperature, chlorophyll, nutrients, turbidity and pH, and provide an interactive visual picture of the reef and its component parts. This paper describes the marine water quality dashboard that delivers unprecedented access to information across the GBR. This dashboard enables access to near real-time data on sea surface temperatures, chlorophyll levels, sediments and coloured dissolved organic matter for the entire Great Barrier Reef. Data can be displayed in different formats – such as animations of changing temperatures over time – or downloaded from the web for further analysis and interpretation. The dashboard provides access to over ten years of water quality information to identify changes.

Opportunistic seabirds sightings in the Chatham Rise

Ms Joana Cid Torres[1]

[1]Gardline Environmental (New Zealand) Ltd, Wellington, New Zealand

Between the 31st January and 21st March 2016, a geophysical and geological research survey was conducted in the Chatham Rise, New Zealand. During this survey incidental data on seabirds was collected by the team Marine Mammal Observers with experience in seabird surveying and ID. The Chatham Islands are an important breeding ground for many species of seabird and number of endemic and rare species breed on these islands. Common species found around the Chatham Island include albatrosses, mollymawks, prions, skuas, sooty shearwaters, storm petrels and blue penguins. A total of 27 species were expected to be present in the survey area. During the survey there were a total of 46 sightings of 16 different species. These included Arctic skua, black browed albatross, black winged petrel, black-bellied storm petrel, broad-billed prion, Buller's albatross, Cape Petrel, Flesh fotted shearwater, Northern giant petrel, Northern Royal albatross, shy albatross, snowy albatross, sooty shearwater, Southern royal albatross, white chinned petrel and white fronted tern. The most frequent sighted species was the buller's albatross (New Zealand Threat Classification at risk and IUCN Near threatened), followed by the Northern royal albatross (New Zealand Threat Classification at risk and IUCN Endangered). This survey increases the knowledge of which species use the Chatham Rise area, with species that were thought to be present due to breeding in the Chatham Islands were sighted (Black-winged petrel and white fronted tern), as well as species that were thought to visit the area (Black-browed albatross and snowy albatross).

The role of on-board education in the whale watch industry. A case study from the Gold Coast, Queensland, Australia

Ms Laura Torre-Williams[1,2], Dr Jan Olaf Meynecke[2,3], Dr Emmanuelle Martinez[1], Dr Karen Stockin[1]

[1]Coastal-Marine Research Group, Institute of Natural and Mathematical Sciences, Massey University, North Shore MSC, New Zealand, [2]Griffith Centre for Coastal Management, Griffith University, Gold Coast, Australia, [3]Humpbacks & Hi-Rises, Gold Coast, Australia

Whale-watching tourism is a growing global industry, with responsible tourism operators expected to provide an education programme as an integral tour component. The programme should aim to educate tourists and encourage bio-centric ideas, attitudes, and actions. Herein, we investigated: a) what value whale-watching tourists assign to the education programme, b) how tourists perceive their on-board learning, c) whether they hold bio-centric views, and d) whether they would take bio-centric actions. A self-complete questionnaire, employing closed-response and open-ended questions, was used. A total of 309 surveys were completed during 26 tours between 24 September and 2 November 2014. The majority of respondents were well-educated, female, aged 26 to 35, from foreign countries, and were on their first whale-watch. Survey respondents ranked factors such as seeing whales and getting close to them as more important than having an on-board education programme when deciding to participate in the tour. Most respondents reported an increase in their knowledge level after their tour. Respondents had a higher satisfaction level for the education provided to them than for having their tour expectations met. In this case study, the majority of respondents exhibited bio-centric ideas and attitudes. However, although whale-watch tourists valued the education programme, believed they were learning, and held bio-centric views, they were unwilling to act on those views. Overall on-board education is an important component of the whale watch industry. Incorporating stronger conservation messages and suggestions about simple actions that help protect the marine environment into the education programme may assist in encouraging tourists to act on their bio-centric views. Providing take-home education materials may aid in further learning and conservation activities.

An environmental education program focused on small cetaceans: an example from Chiloé Island, Chile

Mrs. Marjorie Fuentes[1], Mrs. Irma Morales-Reyes[2,3], **Ms. Maria Jesus Valdes**[4], Mr. Cayetano Espinosa-Miranda[1,5]

[1]NGO Yaqu Pacha, Valencia 2125, Ñuñoa, Santiago., Chile, [2]Pontificia Universidad Católica, Macul, Santiago, Chile, [3]Universidad Alberto Hurtado, Santiago, Chile, [4]Otago University, Dunedin, Otago, New Zealand, [5]Universidad Andrés Bello, Santiago, Chile

The goal of environmental education (EE) is to engage the global citizenry in new ways of thinking and acting, in, with, and for the environment, contributing to a more environmentally literate population. However, most EE programs have failed to incorporate high quality, systematic evaluation into their programming. The aim of the "Small Cetaceans of Chiloé Project" (CSCP), based in Chile, is to study the ecology of small cetacean species that inhabit the coast of Chiloé Island, and the possible threats those marine ecosystems face as a consequence of anthropogenic activities. Driven by a general lack of public knowledge on cetacean species, the CSCP started an EE program in 2002, consisting initially of talks on rural schools and since 2007 of an EE workshop. This program was evaluated in 2013 and 2015 using a "scale of attitudes towards environmental education and nature conservation" and a "test of knowledge" before and after the workshop. The results showed that after the workshop the children's attitude towards EE and nature conservation became significantly more positive in both years ($z = -3.929$, $p < 0.005$; $z = -5.679$, $p < 0.005$, for 2013 and 2015 respectively). Additionally, the percentage of children who passed the test of knowledge was significantly higher after they had participated in the workshop, increasing from 50% to 63,6% in 2013 and from 50% to 68% in 2015. These results that the EE program is effective in teaching children about their environment, and improving their attitudes towards conservation.

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

Susan Wells[1], Dr Lucy Wing[1], Professor Abigail Smith[1], Associate Professor Ian Smith[1]

[1]University Of Otago, Dunedin, New Zealand

The New Zealand Littleneck Clam (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. Due to the late settlement of New Zealand there is a strong record of climatic conditions since early Maori arrival, therefore we are able to distinguish anthropogenic effects on growth rates over this time period from natural variation. We analysed growth rates of *A. stutchburyi* shells excavated from a shell midden (ca. 1350AD) located in Purakaunui inlet, Otago, New Zealand. Modern specimens were collected from three sites in Purakaunui inlet and growth parameters were compared between modern and archaeological shells. Thin sections of shell were prepared and annual growth bands were counted to determine age. The growth rate of the modern *A. stutchburyi* was found to be significantly lower than that of the archaeological shells ($F_{3,23}=9.9806$, $p<0.001$). It is likely that environmental conditions in the estuary are less favourable to cockle growth; this may be attributed to changes in land use in surrounding areas, polluted runoff from farm land, and pressure from harvesting. *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.

The sequences of blacklip abalone hemocyanin (*Haliotis rubra*)

Ms Jiadai Wu[1,2], Professor Anthony Cunningham[1], Professor Fariba Dehghani[2], Doctor Russell Diefenbach[1]

[1]Centre for Virus Research, The Westmead Institute for Medical Research, The University of Sydney, Sydney, Australia, [2]The University of Sydney, Faculty of Engineering and Information Technologies, School of Chemical and Biomolecular Engineering, Sydney, Australia

The respiration protein of the Australian blacklip abalone (*Haliotis rubra),* hemocyanin (HrH), has been recently found to possess antiviral activity against one of the most common human pathogens, Herpes Simplex Virus type 1 (HSV-1). HrH selectively binds to HSV-1 glycoproteins to block viral entry in vitro. To investigate the potential of applying this native protein as a novel antiviral drug, a comprehensive understanding of HrH is essential. In this study, the primary sequences of two HrH isoforms, HrH1 and HrH2, have been revealed for the first time. The amino acid sequences of HrH isoforms were predicted from the complete cDNA sequences obtained by polymerase chains reaction (PCR) and gene cloning. By aligning against the only fully sequenced abalone hemocyanin, which is derived from *Haliotis tuberculata* (HtH), the common features of abalone hemocyanins were pinpointed. The two HrH isoforms have an almost identical predicted molecular weight of ~390 kDa and share an amino acid sequence similarity of 65.9%. Each isoform comprises eight functional units (FUs-a-h) separated by highly variable linker regions. In each FU, the 6-Histidine di-copper centre along with the conserved amino acid sequences "PYWDW" which contributes to hemocyanin's role as an oxygen transporter, were confirmed. Similar to HtH, HrH contains several predicted N-glycosylation sites. The predicted N-linked glycosylation pattern of HrH is highly similar but not identical to HtH. Such differences may translate to differences in structural organisation of these oligomeric proteins or in other known functions of hemocyanin such as innate immunity or antiviral activity.

Metabolic regulation of immunotoxicity during marine invertebrate embryogenesis

Tim Young[1], Samantha Gale[2], David Burritt[3], Norman Ragg[3], Dung Le[1], Sylvia Sander[4], Billy Benedict[4], Andrea Alfaro[1], Ellie Watts[2], Jolene Taylor[2], Silas Villas-Bôas[5]

[1]Institute for Applied Ecology New Zealand, Auckland University of Technology, Auckland, New Zealand, [2]Cawthron Institute, Nelson, New Zealand, [3]Department of Botany, University of Otago, Otago, New Zealand, [4]Centre for Chemical and Physical Oceanography, University of Otago, Otago, New Zealand, [5]Center for Genomics, Proteomics and Metabolomics, University of Auckland, Auckland, New Zealand

Immunological defence systems in marine invertebrates are poorly understood compared to other taxa. For example, recent studies are demonstrating that the line between innate and adaptive immunity in marine molluscs is unprecedentedly blurred and challenges our entire theses on the evolution of molecular defence pathways. One relatively well-characterised mechanism is the immunological regulation of heavy metal toxicity via generation of reactive oxygen species (ROS) and mitigation of oxidative damage through ROS regulatory enzymes and antioxidants. To date, few studies have investigated the immunological effects of metal toxicity on early developing marine mollusc embryos; the most delicate and vulnerable life-stage. We have assessed copper toxicity in mussel (*Perna canaliculus*) embryos by probing various components of the innate immune system, and have additionally conducted the first metabolomics-based analysis during marine invertebrate embryogenesis to gain potentially novel mechanistic insights into immunotoxic regulation and tolerance. Our results reveal that mussel embryos are susceptible to very low levels of bioavailable copper, with indications that a critical phase exists between early trochophore and early D-stage development. Embryos do however seem have an adaptive metabolic capacity to alleviate toxicity through ROS homeostasis, and a variety of other biochemical mechanisms. Lethal copper doses led to complete disruption of ROS homeostasis, oxidative damage to lipids, protein and DNA, as well as causing dysregulation of various pathways, including glutathione metabolism, histidine metabolism, lipid metabolism, nucleic acid catabolism, and protein synthesis, among others. These novel findings strongly support the use of metabolomic approaches for assessing early life-stage health of marine invertebrates.

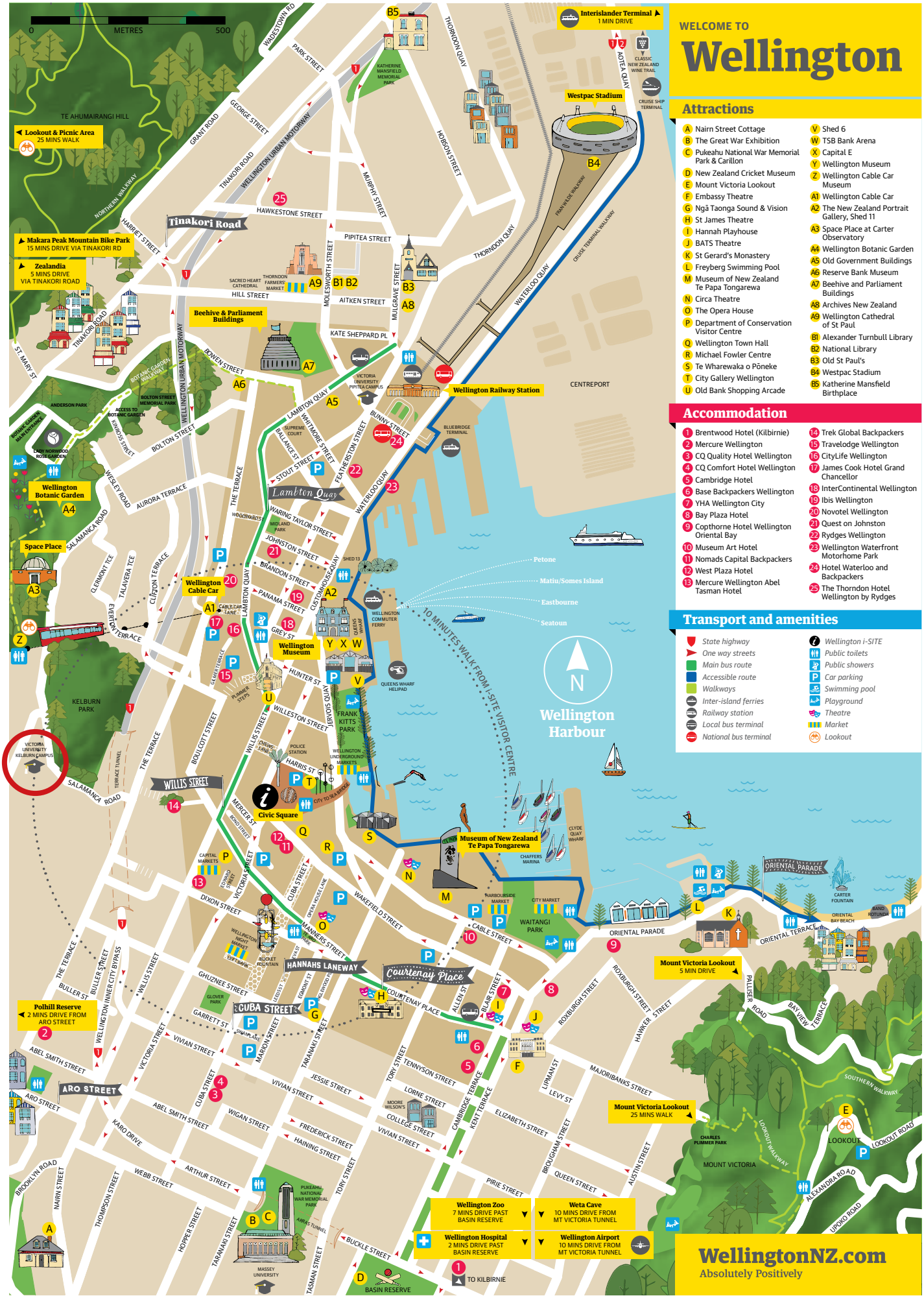

Photo: DOC
HEALTHY COAST – HEALTHY COMMUNITIES
Together let's make a difference
www.doc.govt.nz
New Zealand Government
Department of Conservation
Te Papa Atawhai

|| Kelburn campus Map

Maclaurin Lounge (Student union)

MacLaurin Building - Conference venue

Mount Street pathway


WELCOME TO
Wellington
Attractions
A Nairn Street Cottage
B The Great War Exhibition
C Pukeahu National War Memorial Park & Carillon
D New Zealand Cricket Museum
E Mount Victoria Lookout
F Embassy Theatre
G Ngā Taonga Sound & Vision
H St James Theatre
I Hannah Playhouse
J BATS Theatre
K St Gerard's Monastery
L Freyberg Swimming Pool
M Museum of New Zealand Te Papa Tongarewa
N Circa Theatre
O The Opera House
P Department of Conservation Visitor Centre
Q Wellington Town Hall
R Michael Fowler Centre
S Te Wharewaka o Pōneke
T City Gallery Wellington
U Old Bank Shopping Arcade
V Shed 6
W TSB Bank Arena
X Capital E
Y Wellington Museum
Z Wellington Cable Car Museum
A1 Wellington Cable Car
A2 The New Zealand Portrait Gallery, Shed 11
A3 Space Place at Carter Observatory
A4 Wellington Botanic Garden
A5 Old Government Buildings
A6 Reserve Bank Museum
A7 Beehive and Parliament Buildings
A8 Archives New Zealand
A9 Wellington Cathedral of St Paul
B1 Alexander Turnbull Library
B2 National Library
B3 Old St Paul's
B4 Westpac Stadium
B5 Katherine Mansfield Birthplace
Accommodation
1 Brentwood Hotel (Kilbirnie)
2 Mercure Wellington
3 CQ Quality Hotel Wellington
4 CQ Comfort Hotel Wellington
5 Cambridge Hotel
6 Base Backpackers Wellington
7 YHA Wellington City
8 Bay Plaza Hotel
9 Copthorne Hotel Wellington Oriental Bay
10 Museum Art Hotel
11 Nomads Capital Backpackers
12 West Plaza Hotel
13 Mercure Wellington Abel Tasman Hotel
14 Trek Global Backpackers
15 Travelodge Wellington
16 CityLife Wellington
17 James Cook Hotel Grand Chancellor
18 InterContinental Wellington
19 Ibis Wellington
20 Novotel Wellington
21 Quest on Johnston
22 Rydges Wellington
23 Wellington Waterfront Motorhome Park
24 Hotel Waterloo and Backpackers
25 The Thorndon Hotel Wellington by Rydges
Transport and amenities
State highway
One way streets
Main bus route
Accessible route
Walkways
Inter-island ferries
Railway station
Local bus terminal
National bus terminal
Wellington i-SITE
Public toilets
Public showers
Car parking
Swimming pool
Playground
Theatre
Market
Lookout
Interislander Terminal 1 MIN DRIVE
Westpac Stadium
Lookout & Picnic Area 25 MINS WALK
Makara Peak Mountain Bike Park 15 MINS DRIVE VIA TINAKORI RD
Zealandia 5 MINS DRIVE VIA TINAKORI ROAD
Tinakori Road
Beehive & Parliament Buildings
Wellington Railway Station
CENTREPORT
Wellington Botanic Garden
Space Place
Wellington Cable Car
Lambton Quay
Wellington Museum
Civic Square
Museum of New Zealand Te Papa Tongarewa
Wellington Harbour
10 MINUTES WALK FROM i-SITE VISITOR CENTRE
Petone
Matiu/Somes Island
Eastbourne
Seatoun
KELBURN PARK
WILLIS STREET
HANNAHS LANEWAY
Courtenay Place
CUBA STREET
ARO STREET
Polhill Reserve 2 MINS DRIVE FROM ARO STREET
Mount Victoria Lookout 5 MIN DRIVE
Mount Victoria Lookout 25 MINS WALK
ORIENTAL PARADE
MOUNT VICTORIA
Wellington Zoo 7 MINS DRIVE PAST BASIN RESERVE
Weta Cave 10 MINS DRIVE FROM MT VICTORIA TUNNEL
Wellington Hospital 2 MINS DRIVE PAST BASIN RESERVE
Wellington Airport 10 MINS DRIVE FROM MT VICTORIA TUNNEL
TO KILBIRNIE
BASIN RESERVE
WellingtonNZ.com
Absolutely Positively

|| Principal Sponsor

Ministry for Primary Industries
Manatū Ahu Matua

|| Major Sponsors

Te Whare Wānanga o te Ūpoko o te Ika a Māui
Victoria University of Wellington

CAWTHRON INSTITUTE

NIWA
Taihoro Nukurangi

Department of Conservation
Te Papa Atawhai

|| Supporting Sponsors

Land Information New Zealand
Toitū te whenua

greater WELLINGTON
REGIONAL COUNCIL
Te Pane Matua Taiao

Marine Biodiversity Hub
National Environmental Science Programme

Boffa Miskell

|| Exhibitors and Supporters

ZEBRA-TECH LTD
www.zebra-tech.co.nz

SIRTRACK

Chatham Rock Phosphate

AM
Tamaki Paenga Hira
Auckland War Memorial Museum

New Zealand Antarctic Research Institute

as1

Benthic New Zealand Ltd

CLS

NZOAC
New Zealand Ocean Acidification Community

Antarctica New Zealand

daphic scientific
environmental research & monitoring equipment

vicel

REZO
WATER • ENERGY

Taylor & Francis Group
an informa business

the Royal Society of New Zealand
Te Apārangi