

POSTER ABSTRACTS

Posters in the Boardwalk Gallery are arranged firstly in numerical order, and then by Symposia number followed by Thematic Session number

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1	Gilby, Ben	Gilby, Ben L. *, Tim Stevens and Ian R. Tibbetts	Effects of Marine Park implementation on the macroalgal communities of Moreton Bay, Queensland	SS03 - MPA Research & Management
2	Neale, Don	Neale, Don	Implementing the New Zealand Marine Protected Areas Policy – a Case Study from the South Island West Coast	SS03 - MPA Research & Management
3	Donnelly, David	Donnelly, David M, Paul Ensor, Natalie T Schmitt	The First Confirmed At-Sea Sightings and New Diagnostic Descriptions of Shepherd's Beaked Whale (<i>Tasmacetus shepherdi</i>)	SS05 - Marine Mammals
4	Dwyer, Sarah	Dwyer, Sarah* <i>et al.</i>	The importance of Great Barrier Island waters for Nationally Endangered New Zealand bottlenose dolphins (<i>Tursiops truncatus</i>).	SS05 - Marine Mammals
5	Heritage, Jemma	Heritage, Jemma K.* & John P. Y. Arnould	Factors influencing territorial tenure in male Australian fur seals: Big boys get the joy	SS05 - Marine Mammals
6	Kelly, Natalie	Kelly, Natalie* <i>et al.</i>	Estimating circumpolar abundance of Antarctic blue whales	SS05 - Marine Mammals
7	Knox, Travis	Knox Travis*, Arnould John	Tooth growth in Australian fur seals (<i>Arctocephalus pusillus doriferus</i>) as an indicator of Bass Strait ecosystem variability	SS05 - Marine Mammals
8	Miller, Elanor	Miller, Elanor* <i>et al.</i>	Hector's dolphin diet: prey species, sizes and relative importance, quantified using stomach content and stable isotope analysis.	SS05 - Marine Mammals
9	Thompson, Kirsten	Thompson, Kirsten <i>et al.</i>	New Zealand's Beaked Whales: Novel Insights from 20 Years of Stranding Samples.	SS05 - Marine Mammals
10	Samanta, Moneesha	Samanta, Moneesha*, Michael Ellwood, Graham Mortimer	Determining the zinc isotope composition of marine samples collected from the Tasman Sea and Southwest Pacific Ocean.	SS06 - Trace element cycles
11	Sinoir, Marie	Sinoir, Marie* <i>et al.</i>	Zinc speciation in the Tasman Sea	SS06 - Trace element cycles
12	Flynn, Adrian	Flynn, Adrian and Marshall, Justin	A Zoogeography of Lanternfishes (family Myctophidae) in the Eastern-southeastern Australian Region and Comparisons with Physicochemical Biogeography	SS07 - Deep Sea Pelagic Biol.
13	Lewis, Mark	Lewis, Mark*, Rudy Kloser and Lisa Gershwin	Acoustic properties of deep-sea fish and micronekton.	SS07 - Deep Sea Pelagic Biol.
14	Paxton, John	Paxton, John* and Alan Williams	Lanternfishes (Family Myctophidae) in Australian Waters, 130 Species and Counting	SS07 - Deep Sea Pelagic Biol.
15	Hill, Katy	Hill, Katy, Tim Moltmann and Marian Wiltshire	The Integrated Marine Observing System (IMOS): Taking an integrated approach to monitoring marine ecosystem responses.	SS08 - MarineEcoMonitor
16	Moltman, Tim	Moltmann, Tim, Katy Hill and Marian Wiltshire	The Integrated Marine Observing System (IMOS): taking an integrated approach to monitoring boundary currents.	SS09 - Pacific currents

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17	Picone, Kate	Picone, Kate* <i>et al.</i>	Seasonal and latitudinal changes in zooplankton community composition along the East Australia Current: The AusCPR survey	SS09 - Pacific currents
18	Rigby, Paul	Rigby, Paul* <i>et al.</i>	Q-IMOS observations of extreme marine conditions under Tropical Cyclone Yasi.	SS10 - Technology
19	Consalvey (Malcolm Clark)	Consalvey, Mireille, Maria Baker, and Malcolm Clark*	INDEEP: Across the ditch	SS11 - Deep sea benthos
20	Hardy, Natasha	Hardy, Natasha* <i>et al.</i>	From the frying pan into the fridge: thermal boundaries for early embryonic development to the pluteus stage in a tropical sand dollar, <i>Arachnoides placenta</i>	SS12- Larvae and extremes
21	Bekker (Shirley Sorokin)	Bekker, Jan ... Shirley Sorokin <i>et al.</i>	Predicting anti-cancer bioactivity of marine sponges using untargeted metabolic profiles.	SS13 - Biotech/bioproducts
22	Mehbub, Mohammad	Mehbub, M. Ferdous* <i>et al.</i>	Metabolic response of the sponge <i>Aplysilla rosea</i> challenged by <i>Vibrio natriegens</i> in controlled closed aquarium system	SS13 - Biotech/bioproducts
23	Wang (Wei Zhang)	Wang, Jing Jing <i>et al.</i>	Anti-proliferative and Anti-metastatic Activities of Marine Sponges collected from the South Australian Coastline	SS13 - Biotech/bioproducts
24	Yang (Wei Zhang)	Yang, Qi, Chris Franco, Caihuan Ke, Wei Zhang*	Phylogenetic Diversity of Cultivable Actinobacteria Associated with Ascidiaceae <i>Styela plicata</i> and <i>Molgula manhattensis</i> from the South China Sea	SS13 - Biotech/bioproducts
25	Bostock (Scott Nodder)	Bostock, Helen.. <i>et al.</i> & Scott Nodder*	Estimating carbonate parameters from hydrographic data in the Southern Ocean	SS15 - S.Ocean Biogeochem
26	Lannuzel, Delphine	Lannuzel, Delphine <i>et al.</i>	Effect of Melting Sea Ice on microbial Communities in the Western Weddell Sea	SS15 - S.Ocean Biogeochem
27	Laurenceau, Emmanuel	Laurenceau, Emmanuel* <i>et al.</i>	What drives the sinking rate of marine snow? Roller tank experiments give new insights into carbon export in a naturally iron-fertilised area of the Southern Ocean.	SS15 - S.Ocean Biogeochem
28	Gothland (Nicolas Spilmont)	Gothland Moana, Dauvin Jean-Claude and Spilmont Nicolas*	Four year record of the presence of the <i>Hemigrapsus</i> genera on the French coast of the English Channel : on the road to extreme US densities ?	SS17 - Marine invasives
29	Suarez Jimenez, Rocio	Suarez, Rocio* <i>et al.</i>	The ecological role of the invasive kelp <i>Undaria pinnatifida</i> in southern New Zealand	SS17 - Marine invasives
30	Wilkins, Serena	Wilkins, Serena	MITS: The NIWA MAFBNZ Marine Invasives Taxonomic Service	SS17 - Marine invasives
31	Quayle, Lucy	Quayle, Lucy* <i>et al.</i>	Hydrodynamic control of plankton in Recherche Bay, southern Tasmania.	SS18 - SE Tas. waters

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33	Hadley, Scott	Hadley, Scott et al.	Modelling macroalgae for Integrated Multitrophic Aquaculture in southeast Tasmania	TS01 - Aquaculture/ Mariculture
34	Armbrecht, Linda	Armbrecht, Linda* et al.	Phytoplankton time-series Survey and biogeochemical Assessment of the Coffs Harbour Region, Eastern Australia.	TS02 - Climate Change
35	Botha (Arnold Dekker)	Botha, Elizabeth J., Arnold G. Dekker* et al.	A remote sensing tool-set for monitoring the ecological impacts of sea level rise on barrier estuaries	TS02 - Climate Change
36	Hohaia (Peter Wilson)	Hohaia, Aysha, Kay Vopel, Peter Wilson*	Thin terrestrial sediment deposits on intertidal sandflats: effects on bivalve burial behaviour and porewater chemistry	TS02 - Climate Change
37	Oellermann, Michael	Oellermann, Michael*, Hans Otto Pörtner, Felix Christopher Mark	Mitochondrial Dynamics underlying thermal Plasticity of Cuttlefish (<i>Sepia officinalis</i>) Hearts	TS02 - Climate Change
38	Pope, Adam	Pope, Adam, Jan Barton, Paul Close, and Rebecca Lester	Space-for-time substitution to assess likely response of aquatic ecosystems to future climate-related change	TS02 - Climate Change
39	Rozaimi, Mohammad	Rozaimi, Mohammad* et al.	Carbon accumulation in an estuarine seagrass meadow: A case study of <i>Posidonia australis</i> in Oyster Harbour (south-western Australia)	TS03 - Ecosystem Services
40	Slawuta, Marta	Slawuta, Marta* ¹ , Paul Boon ¹ and Birgita Hansen ²	How well is habitat quality for birds reflected in existing protocols for assessing the condition of coastal wetlands?	TS03 - Ecosystem Services
41	Verhoeven, Mirella	Verhoeven, Mirella*, Melanie Bishop	Detrital pulses alter decomposition rates of donor species	TS03 - Ecosystem Services
42	Blom, Wilma	Blom, Wilma* and John Early	Auckland Museum Natural History Collections Online	TS04 - Education and Community
43	Starkey (Rob McCammon)	Starkey, Peter, Rob McCammon & Brett Smith	Development of an iPad Application for Coastal Studies	TS04 - Education and Community
44	Anderson, Douglas	Anderson, Douglas, J. Et al.	Re-sightings, residency and sightings distribution of whale sharks <i>Rhincodon typus</i> at Ningaloo Reef, Western Australia	TS05 - Everything In-Between
45	Berlincourt, Maud	Berlincourt*, Maud, Andrew J. Hoskins and John P.Y. Arnould	Colony-specific foraging behaviour in the short-tailed shearwater <i>Puffinus tenuirostris</i>	TS05 - Everything In-Between
46	Bouvais, Pierre	Bouvais, Pierre, Paul Lavery and Mat Vanderklift	How dredging impacts on benthic filter-feeders: a structural and functional approach.	TS05 - Everything In-Between
47	Butler, Edward	Butler, Edward C.V.* , David K. Williams, Claire Stretten-Joyce, Britta Schaffelke	The Challenges and Needs for Research in Australia's northern Seas and Estuaries	TS05 - Everything In-Between

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48	Cumming, Rebecca	Cumming, Rebecca* et al.	Slugs on the move: transoceanic dispersal history of an intertidal gastropod genus with contrasting reproductive modes.	TS05 - Everything In-Between
49	Edwards, Luke	Edwards, Luke* and Jenni Harrison	Collaborative and Automated Tools for Analysis of Marine Imagery and Video (CATAMI)	TS05 - Everything In-Between
50	Lister, Kathryn	Lister, Kathryn*, Miles Lamare and David Burritt	The Consequences of pollutants on the antioxidant defenses and life history strategies of marine invertebrates	TS05 - Everything In-Between
51	Mason, Suzanne	Mason, Suzanne*, Jennifer Parsons, Jeffrey Weir	Presence of epidermal lesions in resident southern Australian bottlenose dolphins <i>Tursiops australis</i> in Port Phillip, Victoria	TS05 - Everything In-Between
52	Meyerink, Scott	Meyerink, Scott* et al.	Investigations into the fractionation of Silicon Isotopes in Diatoms	TS05 - Everything In-Between
53	Saeedi, Hanieh	Saeedi, Hanieh* and Mark J. Costello	Aspects of global distribution of six marine bivalve mollusc families	TS05 - Everything In-Between
54	Suwandy, Jason	Suwandy, Jason* and Goldstien, Sharyn	Temporal Currency: Life-history strategies of a native marine invertebrate increasingly exposed to urbanisation and invasion	TS05 - Everything In-Between
55	Trickey, Jennifer	Trickey, Jenny*, Chris Garden, Martin Thiel and Jon Waters	Global genetic structure of a cosmopolitan rafting nudibranch: molecular systematics and phylogeography of <i>Fiona pinnata</i>	TS05 - Everything In-Between
56	Verlis, Krista	Verlis, Krista*, Scott Wilson and Marnie Campbell	What are we doing to our seabirds? How Australasian seabirds on the Great Barrier Reef are being impacted by marine debris	TS05 - Everything In-Between
57	Vitelli, Federico	Vitelli, Federico*, Glenn Hyndes, Alan Kendrick	Feeding ecology of <i>Parma mccullochi</i> (Pomacentridae) and its ecological role in fish herbivory in temperate algal-dominated reefs	TS05 - Everything In-Between
58	Woods, Josephine	Woods, Josephine L.D*, Allyson L. O'Brien and Mick J. Keough	Benthic Macroinvertebrate Community Response to ongoing Low-level Metal Contaminated Sediments	TS05 - Everything In-Between
59	York, Paul	York, Paul* <i>et al.</i>	Effects of moderate nutrient enrichment on seagrass trophic pathways	TS05 - Everything In-Between
60	Henriquez, Luis	Henríquez, Luis et al.	Simulation of macroalgal ecosystem changes associated with nutrient enrichment in SE Tasmanian rocky reefs.	TS06 - Extreme Events
61	Bax, Narissa	Bax, Narissa	Deep-water emergent Patagonian coral fields	TS07 - Extreme Habitats
62	Hayward (Hugh Grenfell)	Hayward, Bruce, Hugh Grenfell*, Ashwaq Sabaa, Helen Neil, Martin Buzas	Monograph of New Zealand deep-water benthic foraminifera	TS07 - Extreme Habitats
63	Paul, Sourav	Paul, Sourav* et al.	Physiological tolerance of estuarine mysid shrimps (<i>Tenagomysis</i> spp) to temperature and salinity variation	TS07 - Extreme Habitats

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65	Somerville, Gayle	Somerville, Gayle*, Martin Krkosek and Chris Hepburn	Exploring harvest regulations of New Zealand abalone (<i>Haliotis iris</i>) via population modelling.	TS08 - Fisheries
66	Strzelecki (Ming Feng)	Strzelecki, Joanna, Feng, Ming* et al.	Tracking the early life stages of Western Australian Dhufish (<i>Glaucosoma hebraicum</i>)	TS08 - Fisheries
67	Fernandez, Pamela	Fernández, Pamela* et al.	Carbon physiology and photosynthetic responses of <i>Macrocystis pyrifera</i> (Phaeophyceae) under ocean acidification	TS10 - Ocean Acidification
68	Ho (Cassandra Price)	Ho Melanie, Cassandra Price* et al.	Impacts of ocean acidification and increasing seawater temperature on juveniles of two Antarctic heart urchins, <i>Abatus ingens</i> and <i>Abatus shackletoni</i> .	TS10 - Ocean Acidification
69	Lenton, Andrew	Lenton, Andrew*, Bronte Tilbrook and Nicolas Metzl	Observed changes in ocean acidification in the Southern Ocean over the last two decades.	TS10 - Ocean Acidification
70	Ross (Elliot Scanes)	Ross, Pauline, Laura Parker, Elliot Scanes*, Wayne O'Connor	Are oceanic scallop and abalone mollusc species less resilient to ocean acidification?	TS10 - Ocean Acidification
71	Stuck, Esther	Stuck Esther*, Lamare Miles	Effects of Ocean Acidification on Intracellular pH and Development: Comparisons between Tropical, Temperate and Polar Echinoderm Species	TS10 - Ocean Acidification
72	Macdonald, Helen	Macdonald, Helen*, Moninya Roughan, Mark Baird and John Wilkin	The evolution of a Cold-Core Eddy in a Western Boundary Current.	TS11 - Oceanography
73	Oke, Peter	Oke, Peter* et al.	Validation of a near-global eddy-resolving ocean model	TS11 - Oceanography
74	Zhong, Liejun	Zhong, Liejun*, Ming Feng	Upper Ocean Heat Balance off the West Coast of Australia	TS11 - Oceanography
75	Cougnon, Eva	Cougnon, Eva*, Clothilde Langlais, Peter Oke	Interannual variability in the Southern Ocean and implications for the upwelling/downwelling systems	TS12 - Southern Ocean & Antarctica
76	Kolb, Jürgen	Kolb, Jürgen B.* et al.	Short Circuit Co-Evolution by the perfect Parasite? Antifreeze Glycoproteins of Fish Leeches in Antarctica	TS12 - Southern Ocean & Antarctica
77	Somerville, Gayle	Shatova, Olga*, Stephen Wing and Lucy Jack	Phytoplankton productivity in sub-Antarctic waters: role of nutrients accumulated and recycled by seabirds.	TS12 - Southern Ocean & Antarctica
78	Durrant, Halley	Durrant, Halley M.S.* ¹ , Christopher P. Burridge ¹ , Brendan P. Kelaher ² and Melinda A. Coleman ²	Isolation by distance in marine algae: a global meta-analysis	SS03 - MPA Research & Management

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Re-sightings, residency and sightings distribution of whale sharks *Rhincodon typus* at Ningaloo Reef, Western Australia

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Whale sharks *Rhincodon typus* migrate to Ningaloo Reef every year and are observed there between March and July. Encounter data in the form of digital images, many taken from DVD's provided by tourism operators and lodged in the ECOCEAN Whale Shark Photo-identification Library (<http://www.whaleshark.org/>), and sightings data collected by the Department of Environment and Conservation (DEC) from logbooks and "black boxes" used by tourism operators, were obtained for the years from 2006 until 2010. Over these five years, 430 individuals were identified in the Library and of these, 267 were resighted at least once. Most of the resightings (76%) occurred in the same year as the previous sighting, with 20% occurring one year apart and 4% at least two years apart. Individual sharks were sighted on up to a maximum of 33 days over the five years, with a median of two sighting days per individual. The average annual residency of individual whale sharks, estimated using the encounter data and the program Socprog (Whitehead 2009), was 34.04 days over the five year period and the longest estimated residency time was 190 days. Data collected by the DEC from tourism operators showed that the highest density of sightings were in the northern part of Ningaloo, between 21°50'S and 22°05'S (offshore from Tantabiddi), with a peak density of 118.55 sightings per km². The highest density of sightings in the southern part of Ningaloo occurred between 22°45'S and 23°10'S (offshore from Coral Bay), with a peak density of 11.44 sightings per km². Significant inter-annual variation was found in the number and distribution of sightings, particularly in the strong La Nina year of 2010. This study highlights the value of the data provided by the tourism operators and the spatial information collected by the DEC for the conservation of whale sharks.

Phytoplankton time-series Survey and biogeochemical Assessment of the Coffs Harbour Region, Eastern Australia

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In the context of ongoing climate change, studying phytoplankton is of particular importance as it plays a key role by linking atmospheric and oceanic carbon cycles through the species-specific biological carbon pump. Furthermore, at the lowest level of the marine food web, phytoplankton are of indispensable nutritional value to higher trophic organisms and its health, distribution and abundance patterns ultimately affect the sustainability of all marine life. This project will be the first detailed 1-year survey of phytoplankton composition and biogeochemistry, assessing seasonal and regional variations, in the Coffs Harbour region (Eastern Australia). This temperate area, at the southernmost end of the Solitary Islands Marine Park (SIMP), is characterized by high biodiversity due to the strong influence of the southward flowing tropical East Australian Current (EAC) which, when it is strongest in summer, encroaches onto the continental shelf. The close proximity of the EAC to the Coffs coast (24km) allows comparisons of coastal and EAC phytoplankton communities and the results will be a valuable reference for future phytoplankton research in NSW. As a consequence of global warming, physical parameters of the EAC (e.g. salinity, temperature) have changed during the past 60 years. It is expected that alterations in the food web structure, southward species shifts and an increased frequency of harmful algal blooms will occur, which might result in severe consequences for the functioning of the East Australian ecosystem.

Deep-water emergent Patagonian coral fields

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The shallow coral fields of the Patagonian fiords provide the unique opportunity to gain in-sight into the dispersal capacity of corals in more inaccessible ecosystems such as sea-mounts and submarine ridges in Antarctica where *Errina* sp. is found in field-like aggregations at ~450m. Information on the dispersal potential of the habitat-forming species *E. antarctica* may provide essential information to conservation managers in the Chilean fjords and Antarctica. Enabling us to evaluate connectivity between *Errina* spp. populations on a local scale (~100's km) within fiords (100m), between fiords (<10 km) and hence infer levels of connectivity present on a single sea mount/shelf location. In February 2012 ROV and SCUBA were utilised to document, and collect *E. antarctica* colonies across varying depths (~10–40m) in combination with environmental variables. The sampling latitude extended southward from 48 – 55°. Within this sampling range three fiords were chosen, and three sites within each fiord were sampled, based on ease of sampling and coral abundance. This presentation will outline the extent of these coral habitats, factors which may contribute to their distribution and preliminary genetic results regarding connectivity between *E. antarctica* populations.

Predicting anti-cancer bioactivity of marine sponges using untargeted metabolic profiles

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Predictive statistical methods provide powerful but rarely used tools in the search, classification and identification of bioactive compound producing organisms. This in combination with untargeted metabolic profiling can be used to create predictive models that can speed up the process of pre-classification of organisms as bioactive compound producers or non-producers. Sponges are known producers of a wide range of bio-active compounds. One of the many time consuming prerequisites for the identification of sponges that produce bioactives is the activity testing itself. A model that predicts bioactivity can be used to speed up the identification process. To construct a predictive model for bioactivity in marine sponges, samples taken from the South Australian coastline were extracted and analysed by low resolution GC- and LC-MS/MS to produce comprehensive polar and non-polar fingerprints. In parallel to the fingerprinting, polar and non-polar extracts were tested for anti-cancer activity against eight cancer cell lines (Breast T47D, Cervix HeLa, Colon DLD-1, Prostate DU-145 and PC3, Lung A549, Skin A431, SK-MEL-28). Data matrices containing mass-spectrometry derived chemical information and bioactivity data were used as input for cross-covariance analysis. Various methods were applied to construct predictive models for sponge anti-cancer bioactivity. We illustrate the application of such models to classify untargeted metabolic profiles of South Australian sponges in the search of anticancer marine natural products.

Colony-specific foraging behaviour in the short-tailed shearwater *Puffinus tenuirostris*

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Establishing patterns of movements of free-ranging animals in marine ecosystems is crucial for a better understanding of their feeding ecology and life history traits, but also for their conservation. The at-sea movement and habitat use of short-tailed shearwaters *puffinus tenuirostris* was investigated at 2 sites marked by contrasting ecological conditions. One colony was studied at Gabo Island (Victoria, Australia) at the eastern end of Bass Strait and within the East Australian Current. The EAC is the major western boundary current of the South Pacific Gyre, flowing from southern Coral Sea and along the coast of northern New South Wales. It plays an important role by removing heat from the tropics and releasing it to the mid-latitude atmosphere. The other colony was studied at Griffith Island (Victoria, Australia) in western Bass Strait near the seasonally productive, and inter-annually variable, cold-water Bonney upwelling. The foraging ecology of short-tailed shearwaters was examined using GPS loggers fixed dorsally to parents provisioning chicks. Only foraging trips of short-duration were targeted by this study, and a range of parameters including trip duration, foraging location, total distance travelled and maximum speed were recorded and analysed in order to determine the behaviour of individuals undertaking short-duration foraging trips. Adults foraging behaviour differed significantly between locations. Birds breeding at Griffith Island travelled farther distances than birds from Gabo Island. Birds from Griffith Island also appeared to have two different "strategies": some birds foraged over the shelf-edge on the west coast of Victoria while other ones foraged along the shoreline. They might adopt different strategies to avoid interspecific competition. Our results illustrate the importance of behavioural plasticity in seabirds living in highly variable environments.

Auckland Museum Natural History Collections Online

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Since the late 1990s changes in the capabilities of electronic databases and the potential to store huge quantities of information in one place have been the catalyst for museums to transfer from paper records to an electronic format. Auckland Museum has been steadily digitising the databases of its biological collections and now has almost 430,000 specimen records across the collecting areas of Entomology (81,500), Botany (240,500), Marine (89,000) and Land Vertebrates (18,800). Of these ca. 2,300 are primary types. By definition types have high scientific value and consequently Auckland Museum receives frequent requests for the loan of its type specimens. Particularly for New Zealand institutions this often involves sending specimens over long distances by mail or courier. Many modern natural history institutions no longer allow the loan of these unique items, because of the inherent risks involved. Very recent advances in digital imaging have made it possible to create high resolution images. In the past 3 years Auckland Museum has created images of more than 1000 of its primary types using a focus stacking system which eliminates depth-of-field problems. Software programmes such as Zerene Stacker or Helicon Focus are used to combine as many as 250 high definition partly-focussed digital images into a single high resolution image that is in focus throughout the entire depth of the subject. By making these images available online it will remove much of the need for loans and will therefore lessen risks to these unique specimens. It will also hugely increase the visibility and accessibility of the museum's research collections. Considering that many of the specimens are organic and fragile, digital media and documentation provide longevity to an object and records which are otherwise limited by the life time of the specimen and traditional paper based documentation.

Estimating carbonate parameters from hydrographic data in the Southern Ocean

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Our understanding of the carbonate concentrations and saturation in the oceans has been considerably advanced by the collection of large global datasets over the last 50 years (GEOSECS 1960-1970s, GLODAP 1990s, CARINA and PACIFICA 2000s). However, there are still many areas of the globe that have had little sampling for carbonate parameters. We have used the global datasets of dissolved inorganic carbon (DIC) and alkalinity from the Southern Hemisphere extratropics (south of 25°S) to develop multiple linear regressions (MLR) to estimate these two species from the common hydrographic parameters; temperature, salinity, depth/pressure and oxygen. We find 3 distinct regimes based on water masses, where the alkalinity and DIC have different relationships with the hydrographic parameters. In order to objectively determine the best dividing points for these three regimes, we undertook a Monte Carlo simulation in which 5,000 different pairs of dividing points were used in the MLR. The aim of this work is to use all the hydrographic data for the region to produce detailed maps of the carbonate parameters pCO₂, pH, [CO₃²⁻], aragonite saturation, calcite saturation, that take into account local currents, especially around complex topography e.g. around New Zealand. These maps will be ground-truthed with opportunistic sampling for alkalinity and DIC on future voyages, especially in coastal regions where the relationship between the hydrographic and the carbonate parameters may not hold. It will also be important to continue to measure DIC and alkalinity as their relationship with hydrographic parameters will change over time due to increasing uptake of anthropogenic CO₂, therefore the MLR algorithms will vary in the future.

A remote sensing tool-set for monitoring the ecological impacts of sea level rise on barrier estuaries

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Sea level rise may result in extensive changes to estuarine ecosystems. Increases in sea level are predicted to impact bathymetry, sediment transport, water quality and estuarine macrophyte distribution and abundance. The expected marinization of estuaries will accelerate the migration/loss/gain of seagrasses, saltmarshes and mangroves. Monitoring the position and extent of key estuarine macrophytes, estuarine bathymetry and water quality can serve as an indicator for estimating changes in estuarine ecology and morphology expected with sea level rise. Modified barrier estuaries provide a model system for studying sea level rise impacts as changes to the estuary entrance impact the same estuarine processes as expected with the sea level increase. By implementing trend analysis from historic (1984 onwards) and current satellite image data, a tool-set for estimating the ecological impacts of SLR on barrier estuaries can be developed by monitoring changes induced by existing enhancements to estuarine entrances. Variables that can potentially be assessed from satellite data include:

Subtidal:

- Water Column Properties:
 - Chlorophyll-a, Phaeophytin (of all photosynthesizing organisms)
 - Cyanophocyanin & Cyanophycocerythrin=>Cyanobacteria
 - Total suspended matter
 - Coloured dissolved organic matter
 - Transparency/turbidity/vertical attenuation of light
- Bathymetry (depth of substrate, if visible)
- Benthic substratum (if visible)
 - Seagrasses, macro-algae and associated substrates (extent, density of cover)
 - Main species differentiation (if spectrally & spatially discriminable)

Intertidal and supratidal features:

- Mangrove extent and main species differentiation (if spectrally & spatially discriminable)
- Saltmarsh extent and main species differentiation (if spectrally & spatially discriminable)

How dredging impacts benthic filter-feeders: a structural and functional approach

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Australia's tropics are among the World's least impacted marine ecosystems. Though under-studied, the abundance and diversity of filter-feeders in habitats throughout NW Australia suggests they are an ecologically important component of the community. North-western Australia is also the epicentre of oil and gas development, including the construction of ports and pipelines involving massive dredging programmes. Dredging has the potential to significantly impact marine environments, directly through the loss of benthic habitats and indirectly through the suspension of sediment into the water column, with associated increases in turbidity, light attenuation and smothering of the benthos.

Being immobile, filter-feeders are likely to be negatively impacted by sediment deposition associated with dredging, and good candidates to indicate changes in ecosystem functioning. This Ph.D. project aims to understand the relationship between filter feeders assemblages (composition and function) and habitat alteration induced by dredging.

The poster will outline the mechanisms through which dredging processes can impact filter-feeder assemblages and their ecological functions. There are two major pathways of impact: pelagic and benthic. Pelagic pressures result from increased TSS, change in sediment particle size and light attenuation, which impact feeding activity, photosynthetic activity and endo-microbial induced nutrient and energy fluxes. Benthic mechanisms arise from the smothering of benthic filter-feeders and changes to the sediment bio-geochemistry (reduced oxygen concentration and organic matter availability).

This study is examining these pathways of impact, to clarify the pressure/response relationships between dredging and filter feeder assemblages, identify the cause-effect pathways, quantify those effects and identify indicators of lethal and sub-lethal impacts. The poster summarises the mechanisms of impact and outlines the approaches being used to understand how dredging affects these potentially important ecosystems.

The Challenges and Needs for Research in Australia's northern Seas and Estuaries

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Australia's northern seas—the Arafura and Timor Seas—for all of their rich biodiversity are little studied and their ecosystems remain mostly unknown. The region is heading for rapid expansion in resource industries and the infrastructure to support these. Environmental quality and ecosystem health are affected by both maritime developments and the terrestrial run-off from land-based activities. It is crucial now to build a better picture of coastal ecology, and the associated environmental pressures. To meet this challenge, AIMS has established an interdisciplinary team at the Arafura Timor Research Facility in Darwin, Northern Territory. With other partners in the Northern Australian Marine Research Alliance (NAMRA), AIMS is tackling coastal research from the oceanography through biogeochemistry to marine and estuarine biology, supported by advanced analytical science, molecular and genetic techniques, and hydrodynamic and water quality models. We highlight the diversity of the developing science in this region by presenting results of a few case studies. (i) Darwin Harbour is growing as a transport and service hub with dredging activity ensuing to develop new facilities. Environmental studies have previously been haphazard, but now a comprehensive hydrodynamic and sediment model has been developed to better predict environmental quality and consequences for benthic biota, basin-wide. The model is being refined and improved with extensive field data (ii) Further afield in the Kakadu floodplains, the insidious effects of climate change causing saltwater intrusion is being monitored by bioindicators identified by molecular techniques. Hydrodynamic and sediment transport processes are also being studied. (iii) Across Northern Australia, interlinked laboratory and field projects are using an array of tools (environmental chemistry, ecotoxicology, molecular microbiology, sentinel biota monitoring, modeling and scenario testing, etc.) to assess the effects of mining and mineral processing in coastal areas. (iv) Autonomous sensors installed in Darwin Harbour and other locations in Northern Australia are proving powerful, near real-time, early warning systems (in integrated monitoring networks) to safeguard inshore waters more effectively from the harmful effects of contaminated run-off or extreme events in coastal catchments.

INDEEP: Across the ditch

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Historically, deep-sea national level research programmes have been very successful but our understanding of deep ecosystems cannot be limited by international borders. Furthermore, traditional research considered each habitat in isolation. Whilst this worked well to address some key questions, the research community quickly recognised that we cannot consider deep-sea habitats in isolation but rather must consider this largest biome on Earth in its entirety. Building on the foundation of knowledge and international collaborations developed throughout the Census of Marine Life the International Network for Scientific Investigations of Deep-Sea Ecosystems (INDEEP) was born. INDEEP will develop our understanding of deep-sea global biodiversity and functioning, and provide a framework to bridge the gap between scientific results and society. This poster will highlight how current research is informing the 5 major INDEEP themes:

- Taxonomy and evolution
- Global biodiversity and biogeography
- Population connectivity
- Ecosystem functioning and
- Anthropogenic impact and social policy

This will have a particular focus on projects being led in Australia and New Zealand.

Interannual variability in the Southern Ocean and implications for the upwelling/downwelling systems

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Understanding the dynamics of the Southern Ocean and its variability is critical for the prediction of ocean warming, carbon uptake, ventilation and acidification. Present understanding of the sensitivity of the Southern Ocean circulation to climate change is incomplete because of the challenges in observing and simulating key processes including the overturning circulation, subduction of water masses, and the role of small-scale motions (eddies). This work explores the four dimensional structure of the Southern Ocean overturning circulation using ocean modelling simulations. Guided by recent observational and theoretical work that identified the importance of regional "hot spots" related to topography and eddy-mean flow interactions, we focus on quantifying regional vertical pathways using depth-density space analysis of the vertical velocities. We use modelling outputs from 1/10° resolution BlueLink model called OFAM3 (Ocean Forecasting Australia Model) that covers the 1993 to 2010 period and 1° resolution AusCOM model simulations (Australian Climate Ocean model) that has been run on longer period. We also explore the impact of interannual variability of surface forcing on the regional pathways and sequestration, in particular we focus on the impact of the two dominant modes of variability in the Southern hemisphere: the extra-tropical signature of El-Niño Southern Oscillation and Southern Annular Mode.

Slugs on the move: transoceanic dispersal history of an intertidal gastropod genus with contrasting reproductive modes

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Within the gastropod genus *Onchidella*, different southern hemisphere species display contrasting life-histories (planktonic-versus direct-developing) and ecologies (epifaunal versus rock-dwelling) that have potential to strongly affect dispersal ability. We used MtDNA sequences (n = 260) and AFLP whole genome fingerprinting (n = 376, 81-139 polymorphic loci) to assess colonization history and gene flow between populations over a range of spatial scales. Based on strong genetic similarity, three widely dispersed species of direct-developing *Onchidella* recognised from New Zealand, NZ subantarctic Islands, Tierra del Fuego (southern Chile) and the Falklands are now proposed as synonymies of *O. marginata* (Couthouy in Gould 1882). *O. marginata* has a strong ecological association with buoyant macroalgae (*Durvillaea antarctica*) and thus rafting is proposed as the most likely means of transoceanic colonization in this otherwise non-dispersive taxon. MtDNA diversity and site-to-site variation were substantially higher in the northern parts of the study region (New Zealand mainland, Chatham Islands) than in the south, consistent with the temporal stability of populations in higher latitudes. These observations imply recent, possibly post-glacial, colonization of high-latitude areas. Interestingly, both planktonic and direct-developing taxa show evidence of ongoing connectivity mediated by ocean currents, with no significant trans-Tasman differentiation detected for the planktotrophic developer *O. nigricans*, suggesting ongoing oceanic gene flow. This study highlights 1) the significance of dispersal in facilitating connectivity on a trans-oceanic scale 2) the impact of historical climate events on Southern Ocean intertidal fauna and, 3) the potential for regional taxonomic treatments to obscure close relationships of intertidal marine taxa found on different landmasses.

The First Confirmed at Sea Sightings and New Diagnostic Descriptions of Shepherd's Beaked Whale (*Tasmacetus shepherdi*)

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Shepherd's beaked whale (*Tasmacetus shepherdi*), is amongst the most poorly understood of all mammals and is one of the least known cetaceans in the world (Mead 1989, 2002). Up until 2008, there had been no confirmed at-sea sightings of this species (Robert L. Pitman pers.comm. 2008). Apart from good observations of an individual stranded alive in New Zealand in 1994, there has been a paucity of detailed descriptive data on the external morphology of live *T. shepherdi*. To date, additional morphological information has been acquired from a combination of a small number of aerial observations and data collected from beach cast specimens. Offshore vessel based surveys between May 2008 and January 2012, in northern New Zealand and southern Australian waters, have presented us with rare opportunistic sightings of free-swimming *T. shepherdi*. These sightings have enabled the collection of greatly enhanced diagnostic, behavioural data and insights into their habitat preference. Here we present relevant data pertaining to the first detailed morphological description of live *T. shepherdi* using first hand accounts gathered from four confirmed at-sea sightings of the species.

The importance of Great Barrier Island waters for *Nationally Endangered* New Zealand bottlenose dolphins (*Tursiops truncatus*)

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Within New Zealand waters, three known genetically differentiated populations of bottlenose dolphins (*Tursiops truncatus*) exist, with one found along the northeast coast of the North Island. The species has been recently uplisted to *Nationally Endangered* owing to a reported decline in local abundance. Great Barrier Island (GBI), 90 km northeast of Auckland city, is a previously unstudied area situated within the home range of the northeast coast population. Between January 2011 and January 2012, photo-identification data were collected during 40 dedicated boat-based surveys conducted at GBI to gather baseline data on occurrence and distribution of bottlenose dolphins. Group size ranged from one to 66 individuals (mean = 29.2, SD = 20.4). A total of 120 individuals were identified, of which 19.2% (n = 23) were sighted 10-15 times, 33.3% (n = 40) were sighted 4-9 times and 47.5% (n = 57) were sighted 1-3 times. Overall, 80% (n = 96) of individuals were resighted within GBI waters. In addition, 58.3% (n = 70) of individuals sighted at GBI were cross-matched to the Inner Hauraki Gulf (IHG) where opportunistic photo-id surveys were conducted between April 2010 and January 2012. Of the individuals sighted only once at GBI (n = 24), 14 were resighted in IHG, with distances of up to 75 km between all GBI and IHG matches. Bottlenose dolphins were encountered across all seasons, suggesting year round usage of GBI waters. This combined with relatively large group sizes and high site fidelity, suggests the region is important for the northeast coast *T. truncatus* population. Based on results presented herein, we recommend other poorly studied areas within the home range of this population be examined.

Isolation by distance in marine algae: a global meta-analysis

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The decline of macroalgal forests has become a global concern because such habitats are disproportionately important to marine biodiversity via the myriad of associated organisms they support. Macroalgal forests are at threat from human mediated impacts including pollution, climate change, direct harvesting and indirect effects of trophic cascades. Marine Protected Areas (MPA's) may safeguard macroalgal forests and their associated marine communities in a future of increasing threats. In particular, MPAs may maintain connectivity among macroalgal populations despite increasing habitat fragmentation and loss. To achieve effective MPA design, knowledge of dispersal distances of a range of macroalgae is critical. We conducted a global meta-analysis on current literature to determine the relationship between genetic differentiation and geographic distance in macroalgae. We also examined whether relationships were general across a suite of different life history and habitat traits. Incorporation of knowledge on spatial scales of dispersal and gene flow is an important consideration in MPA design to prevent population isolation and inbreeding depression and ensure continued resilience of macroalgal forests.

Collaborative and Automated Tools for Analysis of Marine Imagery and Video (CATAMI)

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Transforming raw visual data into quantitative information useful for science and policy decisions requires substantial effort by human experts. However, there is currently no standardised approach to the cataloguing, annotation, classification and analysis of this imagery from the various 'silos' of data existing across Australia. This makes comparison across disparate sites as well as further abstraction very difficult. In addition, the volume of data to be analysed requires significant, labour intensive resources. To assist in addressing this issue we propose to develop eResearch tools that will provide access to and consistent methods for analysing imagery and video streams that support marine research across Australia. These tools are:

- An online data access and browse tool;
- An analysis and annotation data tool;
- An automated image classification tool; and
- A national video and imagery repository.

The CATAMI project is funded under the National eResearch Collaboration Tools and Resources (NeCTAR) program which is a Australian Government project, conducted as part of the Super Science initiative and financed by the Education Investment Fund. We are also working with Dr Stefan Williams from the University of Sydney who has similar project funded through the Australian National Data Service (ANDS). We will make these eResearch tools available online through the NeCTAR Research Cloud and the Australian Ocean Data Network (AODN). Once complete, the CATAMI project will help transform the way marine ecology is undertaken in Australia by enabling marine scientists to focus on specific marine research questions.

Carbon physiology and photosynthetic responses of *Macrocystis pyrifera* (Phaeophyceae) under ocean acidification

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The concentration of CO₂ dissolved in coastal seawater is projected to rise to 1,000 ppm by the year 2100, which means a 2.5-fold increase over the present level of 375 ppm. Consequently, seawater pH will drop from the today's level (8.1) to 7.6. CO₂ concentrations (currently 14 μM) are predicted to increase by 200% while, HCO₃⁻ which is principal species of dissolved inorganic carbon (91%) present in the ocean today will rise by 14%. These changes in seawater chemistry are expected to affect the ability of macroalgae to acquire inorganic carbon (C_i) and, consequently, their photosynthetic performance. The mechanism of C_i acquisition and the photosynthetic response to elevated CO₂ levels were studied in the giant kelp *Macrocystis pyrifera*. *Macrocystis* fulfils important ecological role as foundation species of coastal ecosystems. Blade discs of individuals of *M. pyrifera* were cultured in the laboratory under two CO₂ conditions (400 vs. 1,000 ppm) and their physiological responses determined after either seven hours or seven days. *M. pyrifera*'s ability to acclimate to a high CO₂ environment was revealed by determining the rates of photosynthetic activity and dark respiration (R_d). Photosynthesis vs. irradiance (P-E) and photosynthesis vs. carbon (P-C) curves provide information on the likely effects of changing seawater carbonate chemistry. The effects of pH and inhibitors on both photosynthesis and external and internal carbonic anhydrases (CAs) were analyzed to get an insight into the mechanism of acquisition of HCO₃⁻. This study allows better predictions of how an important ecosystem engineer might respond physiologically to ocean acidification.

A Zoogeography of Lanternfishes (family Myctophidae) in the Eastern-southeastern Australian Region and Comparisons with Physicochemical Biogeography

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In this first attempt to model the distributions of a mesopelagic fish family at this scale in the eastern-southeastern Australian region (10°S to 57°S), lanternfish species occurrence records spanning a period from 1928 to 2010 were collated. Generalised Additive Models (GAMs) were used to investigate species-habitat relationships and depth interactions of environmental covariates for selected species. The results of GAMs were used to inform the selection of environmental covariates used in presence-only models (MAXENT) that were required in order to model all species over the full study area. A four-region zoogeographic scheme is hypothesised: Coral Sea region, Subtropical Lower Water region, Subtropical Convergence/South Tasman region and Subantarctic region. The major frontal systems of the Tasman Front, Subtropical Convergence and Subantarctic Front represented zoogeographic boundaries. An additional boundary at ~25°S (coined the 'Capricorn' boundary) was adopted from one of the existing biogeographic schema to delineate the Coral Sea from Subtropical Lower Water regions. Lanternfish zoogeographic regions are congruent with some aspects of two existing biogeographic schema in the region that were derived from physicochemical properties. However, neither existing physicochemical biogeographic scheme alone reflects lanternfish distributions. Zoogeographic regions are discussed in context with the paleoceanographic setting and hypotheses of speciation that may be useful for future phylogeographic studies.

Effects of Marine Park implementation on the macroalgal communities of Moreton Bay, Queensland

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Increasing fishing pressure and eutrophic runoff significantly impacts upon macroalgal community density and composition in the Moreton Bay Marine Park (MBMP), Queensland. In addition, the 2009 rezoning of the MBMP, which increased marine park areas (MPAs) or 'no fishing' zone coverage from 0.5% to over 15%, aims to protect and alter fish communities which in turn alters the rates and intensity of grazing present in the marine park. The interaction between nutrients, macroalgae, herbivores and benthic communities, especially corals, is particularly important in the subtropics, where corals grow near the southern limits of their distributions and macroalgae begin to enter their southerly dominance patterns. Here we present the results of initial investigations into the cross-shelf distribution of macroalgal communities on hard substrates in MBMP using towed underwater video. Macroalgae have been found to react strongly and quickly to variations in abiotic and biotic factors, utilising their capacity to integrate biological influences over relatively short term periods, thus this study used macroalgae as a bioindicator to evaluate the rezoning of the MBMP. Our results also entail a description of the make-up and coverage of the relatively unknown oceanic deep-water macroalgal communities off Moreton Island. These investigations provide insight and baseline figures for the effect of the rezoning program on macroalgal communities on hard substrates, seasonal macroalgal variations and coral-algal interactions in the bay. Future studies will investigate the motile herbivore community of Moreton Bay using a newly designed baited video technique and the connectivity of deep-water macroalgal communities with inshore macroalgal communities and fisheries.

Four year record of the presence of the *Hemigrapsus* genera on the French coast of the English Channel : on the road to extreme US densities ?

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Invasions in coastal areas have become an ineluctable and irreversible phenomenon. The presence of two Asian decapod crustaceans, *Hemigrapsus sanguineus* (Asakura & Watanabe, 2005) and *Hemigrapsus takanoi* (de Haan, 1835), along the French coasts illustrate the impacts that invasive species can have on the biodiversity and the functioning of coastal and littoral ecosystems. *Hemigrapsus takanoi* and *Hemigrapsus sanguineus* were observed in France for the first time in 1994 at La Rochelle, and in 1999 at Le Havre, respectively. These species, native from the northwestern Pacific, were most probably introduced on the European coast via ballast waters and/or by Asian oyster importation. Larvae of these grapsidae crabs tolerate important variations in salinity (15-30 ‰) and temperature (15-30°C), which contribute to the success of their dispersion despite extreme conditions. A survey of the spread of the two species along the French coast of the English Channel was initiated in April 2008. More than 60 sites were monitored and the presence of introduced species was detected from Mount Saint-Michel Bay to Dunkerque on the Opale Coast. The regular harvesting of juveniles and ovigerous females (March-November), the extent of the breeding season, the small size of the first spawning (<10 mm) are proofs of the strong reproductive capacity of these naturalized species along the French coast. The survey of the most colonized sites indicates that the density doubled from 2009 to 2011, exceeding 100 ind.m⁻² at some sites. Nevertheless, these densities are low compared to those observed on the east coast of USA for *H. sanguineus* (up to 350 ind.m⁻² in Long Island) but are, to date, the highest reported in Europe for both species. Densities are increasing and surveys are really important in particular to understand the potential interspecific competition that may exist) and to evaluate the consequences on communities.

Monograph of New Zealand deep-water benthic foraminifera

Grenfell presenting: Hayward, Bruce, Hugh Grenfell*, Ashwaq Sabaa, Helen Neil, Martin Buzas

Refer 'Hayward' for abstract.

Modelling Macroalgae for Integrated Multitrophic Aquaculture in Southeast Tasmania

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A biogeochemical model simulating macroalgal productivity is applied to investigate the potential for Integrated Multitrophic Aquaculture (IMTA) in SE Tasmania. Work already completed into the impact of salmon farming on the marine environment in the D'Entrecasteaux Channel and Huon Estuary indicates nutrient increases in the region due to the output from the farms. Consequently there is a need to investigate options for mitigation of nutrient loading from salmon aquaculture, particularly in light of a proposed expansion of the industry. This study will look at the potential of IMTA, specifically by growing macroalgae in association with salmon farms, as a means to manage nutrient loading in this region. The talk will focus on constructing a biogeochemical model to describe the growth and remediation potential of selected species of seaweed. Once it is developed, the model will be modularised in a fully coupled high resolution 3D hydrodynamic, sediment & biogeochemical model (already developed by CSIRO) to estimate the system-wide effectiveness of growing marine macroalgae in multitrophic aquaculture.

From the frying pan into the fridge: thermal boundaries for early embryonic development to the pluteus stage in a tropical sand dollar, *Arachnoides placenta*

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Climate change is altering ocean conditions, affecting numerous oceanographic parameters, and none more so than temperature. Oceanic sea surface temperatures (SSTs) are predicted to increase by +2-4°C by 2100, with marked warming occurring in Eastern Australia, a climate change hotspot. Temperature is the single most important environmental factor controlling developmental rate in marine invertebrates. The development rate of echinoids from fertilization through to the 6-arm pluteus stage is markedly temperature-dependent. The inherent thermal tolerance of embryos and larvae will play an important role in shaping the future distributions of many echinoid species in the face of changing and warming SSTs. However, most studies to date have involved temperate species. The thermal tolerance and the impacts of warming on the embryonic life stages through to the 6-armed pluteus stage of the tropical sand dollar, *Arachnoides placenta*, were investigated here. This study aimed to determine a thermal window for normal development for the tropical echinoid *A. placenta*. Embryos were reared from fertilization in a suite of twelve temperatures in a specifically designed temperature block ranging from 14°C representing a decrease of -12°C from the control temperature range, to 36.5°C representing an increase of +8.5°C, based around current conditions documented for their habitat at the time of peak breeding season of 26-28°C. Temperature treatments were determined in a pilot study and reflect possible temperatures in the adult habitat and in the plankton. Additionally, extreme hot and cold treatments were used to establish thermotolerance. Development was scored for five timepoints: 6h (blastulation); 10h (gastrulation); 24h (pluteus); 48h (6-armed pluteus); 60h (8-armed pluteus). Random samples of embryos were scored according to developmental stage achieved, and the percent of embryos to reach relevant developmental milestones was documented. Temperature had a significant effect on the growth rate and survival of *A. placenta* embryos and larvae.

Monograph of New Zealand deep-water benthic foraminifera

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A new monograph on New Zealand's deep-water benthic foraminifera was published in 2010 as a companion volume to an earlier monograph on New Zealand's shallow-water benthic foraminifera (Hayward et al. 1999). The new publication records 563 benthic foraminiferal species from deep water (>50 m) within the New Zealand Exclusive Economic Zone (EEZ). Three hundred and forty-seven of the most common or distinctive species are fully illustrated and their diagnostic features outlined. In combination with the shallow-water monograph, 504 New Zealand species are fully illustrated and described. Cluster and canonical correspondence analyses of census count data (59,000 specimens) are used to map the distribution of deep-water (50-5000 m depth) benthic foraminifera around New Zealand and relate this distribution to a number of environmental "drivers", such as quality, quantity and seasonality of organic carbon flux, sea-floor oxygen concentration, temperature, salinity, bottom current strength, and carbonate corrosiveness. A slightly greater proportion of deep-water (>100 m) species (69%) have a cosmopolitan distribution than do shallow water. An improved guide to the use of foraminifera in assessing the paleoenvironments of Neogene fossil faunas is provided. Together these two monographs provide the modern analogue data that underpins the use of fossil foraminiferal faunas in New Zealand as proxies for studies on sea-level rise, earthquake displacements, human impacts on coastal environments, palaeogeography, palaeobathymetry, basin analysis, sequence stratigraphy, palaeoproductivity, palaeoceanography, ocean acidification.

Simulation of macroalgal ecosystem changes associated with nutrient enrichment in SE Tasmanian rocky reefs

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Anthropogenic nitrogen inputs to coastal waters may shift the community structure of coastal ecosystems (Halpern et al., 2008). Replacement of species (Worm, 2006) and loss of species diversity are well recognised effects of nutrient enrichment on coastal reefs. Shallow rocky reefs are one of the most diverse habitats in temperate waters (Dayton, 1985) and one of the most susceptible to human-induced change (see Halpern, 2008). Consequently, activities that release nitrogen to the water column, such as caged finfish aquaculture, can have effects on reef algal communities. The extent of impact will depend on both the distance from the source and the level of nitrogen released. The relative stability of reef communities allows us to detect and measure the impacts of "transient events", such as proliferation of nuisance algae. However, changes in the overall community structure may be a more sensitive mechanism to assess resilience, than presence/absence of indicator species. Assessment of the broader community impacts and cumulative effects of ephemeral macroalgal proliferation associated with enrichment may provide more reliable tools to detect the integrated impacts of enrichment over periods longer than a seasonal bloom, and over spatial scales greater than individual reef systems (Edgar et al., 2005; Piazzini et al., 2011). The main aim of the current study is to determine macroalgal indicators (proliferating and sensitive) that will allow us to more rapidly define species shifts under sustained nitrogen enrichment, and to characterize the implications of this for ecosystem resilience. Consequently, we have established a field experiment to evaluate the impact of increased nutrient exposure on macroalgal communities in 3 reef systems in SE Tasmania. The experiment will identify community changes associated with cleared/uncleared plots in areas with controlled nutrient release. In this presentation I will outline my experiment and detail the baseline conditions.

Factors influencing territorial tenure in male Australian fur seals: Big boys get the joy

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In resource defence polygynous mating systems, territorial tenure duration is an important determinant in overall mating success. The Australian fur seal (*Arctocephalus pusillus doriferus*) is a temperate otariid species which can experience extreme ambient temperatures during the breeding season. Their need to thermoregulate in water or shade may influence territory quality and tenure duration. Little is known, however, of tenure durations and the factors influencing it in this species. Such knowledge may be important for predicting how changing environmental conditions may influence the species' breeding patterns. Using laser-metrics and behavioural observations, the current study investigated the relationships between body size, activity levels, mass loss and territory quality in territorial male Australian fur seals on Kanowna Island, northern Bass Strait. Similar to what has been shown in other species, the largest bulls maintained territories in the highest quality zones. However, surprisingly, while these individuals exhibited the greatest activity levels and experienced the greatest relative mass loss, they were able to maintain tenure for the longest durations. Hence, in this species, large body size not only confers advantages in male-male conflicts but also in fasting duration thereby increasing potential mating success. Interestingly, a substantial number of aquatic matings were also observed. As climate change leads to increases in ambient temperatures, this alternative mating strategy may become more important in this species.

The Integrated Marine Observing System (IMOS): Taking an integrated approach to monitoring marine ecosystem responses

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Measuring spatial and temporal changes in productivity, distribution and abundance of species is vital for determining their response to climate change and how anthropogenic activities will impact on natural resources, biodiversity and ecosystem services. For marine ecosystems, observing natural and anthropogenic change is more difficult for biology than it is for the physics or chemistry, and it is more difficult for some trophic levels than others. Measuring all trophic levels at the same time over large areas is not feasible. This conundrum has led to the development of methods that provide sustainable observations at specific trophic levels that may then be considered individually or synergistically in models of ecosystem change. IMOS is taking observations of:

- marine chemistry and nutrients; including pCO₂ and carbonate chemistry.
- lower trophic levels i.e. phytoplankton and zooplankton;
- mid-trophic levels i.e. fish and squid; and
- higher trophic levels i.e. apex predators.

An integrated approach is sought whereby measurements ranging from biogeochemistry through lower to higher trophic levels are undertaken across particular systems ; encompassing variability on spatial scales from broad (national /ocean basin) to regional (i.e. boundary current) and local (i.e. bio-region) and timescales from multi-decadal to intra-seasonal.

All IMOS data is freely available for anyone to use. For more information, visit www.imos.org.au.

Impacts of ocean acidification and increasing seawater temperature on juveniles of two Antarctic heart urchins, *Abatus ingens* and *Abatus shackletoni*

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Simultaneous effects of ocean acidification and temperature change in Antarctic environments warrant investigation as little is known about the synergistic consequences of these factors on Antarctic benthic species. Juvenile *Abatus ingens* and *A. shackletoni* were incubated under elevated $p\text{CO}_2$ and temperature scenarios as predicted by the IPCC (2007). Direct lecithotrophic development to juveniles occurs in *Abatus* without a pelagic larval phase. Adult urchins were collected near Davis Station during the Austral summer season (January-February 2011). Juveniles were extracted from the parental brood pouch and reared in flow-through experimental treatments for 4 weeks. CO_2 -enriched air was supplied to seawater in which $p\text{CO}_2$ was regulated at the target levels of 448 ± 6.51 (pH 8.01 ± 0.005), 846 ± 6.58 (pH 7.83 ± 0.005) and 1371 ± 7.34 (pH 7.63 ± 0.007) ppm and seawater temperature was set at $-1 \pm 0.03^\circ\text{C}$ (Control) and $1 \pm 0.32^\circ\text{C}$. The growth, skeletal development and lipid content of juveniles were investigated. Preliminary results from this investigation showed significant increases in spine growth in juveniles of both *A. ingens* and *A. shackletoni* over the experimental period. However, juveniles reared in 1°C exhibited significantly more incidences of epithelial separation in the spines compared to those reared in -1°C . This suggests that, although there is an inherent capacity for tolerance of varying levels of pH in seawater in the absence of the protection afforded by the maternal brood pouch, these juveniles are still at risk from increasing temperatures.

Thin terrestrial sediment deposits on intertidal sandflats: effects on bivalve burial behaviour and porewater chemistry

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Sea level rise and coastal urbanisation increase the supply of terrestrial sediment to coastal and estuarine waters. This increase affects the function of soft sediment ecosystems; the underlying mechanisms, however, are not well known. We conducted a laboratory flume experiment to investigate how millimetre scale deposits of terrestrial clay affect the burial behaviour of benthic juvenile recruits. This experiment built on evidence for a link between the biogeochemistry of the deposit-underlying sediment and the behaviour of recruits on the surface of the deposit. First, we describe how pore water profiles of pH, redox potential, and oxygen concentration change after deposition of terrestrial clay onto natural intact intertidal sediment and intertidal sediment depleted of organic matter. Second, we compare the burial behaviour of post-settlement juvenile *Macomona liliana* placed onto the surfaces of these sediments and the surfaces of terrestrial clay deposits over these sediments. We predicted that juveniles would not bury into clay-covered intertidal sediment. They would, however, bury into clay-covered intertidal sediment if this sediment was depleted of organic matter.

Estimating circumpolar abundance of Antarctic blue whales

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Antarctic blue whales (*Balaenoptera musculus intermedia*), the largest animal that has ever lived, was subject to intensive commercial whaling during the twentieth century; some 330,000 were removed from Southern Ocean. As a result, the species was close to extinction when its exploitation was banned in 1964. Subsequent circumpolar abundance estimates derived from IWC line transect surveys between 1981 and 1998 suggest that while population size is probably increasing, it still remains less than 5% of pre-exploitation abundance. Following the cessation of IWC surveys in 2010 there is currently no strategy or means to obtain further circumpolar abundance estimates for Antarctic blue whales, but renewed effort could be conducted as a part of the multi-national, circumpolar Southern Ocean Research Partnership (SORP). With a combination of low abundance, and a survey design less focussed on blue whale habitat, encounter rates have been historically low, so, standard line transect (sighting) methods are not likely to yield an estimate of abundance with reasonable precision, particularly given the expected availability of polar research platforms. Because of this, we are proposing a mark-recapture approach, using both photo-ID and genetics, for estimating current and future circumpolar abundance of Antarctic blue whales. These data may also prove valuable in studying population structure and individual movements within the Southern Ocean and beyond. Mark-recapture methods are more robust to actively seeking out animals in space and time, in a way that standard line transect approaches are not. We anticipate being able to improve on historical encounter rates by targeting known hot-spots and by using passive acoustics to detect and physically locate blue whales, at a scale of 50 nmi or so. With sufficient but reasonable international collaboration and effort these methods can form the foundation of a long-term monitoring programme for Antarctic blue whales in the Southern Ocean.

Tooth growth in Australian fur seals (*Arctocephalus pusillus doriferus*) as an indicator of Bass Strait ecosystem variability

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Tooth growth patterns were examined within the dentine growth layer groups of 67 male Australian fur seal teeth (*Arctocephalus pusillus doriferus*) collected at Seal Rocks, in Bass Strait, south eastern Australia between 1967-1973. Clear fluctuations in relative growth were apparent between 1956-1971 suggesting large inter-annual variations in food availability within Bass Strait. These fluctuations were found to be significantly correlated to winter Bass Strait sea surface temperature, wind speed and the Southern Oscillation Index (SOI) on a 2 year lag. The long delay between the measured environmental variables and relative growth in these animals may reflect the time required for the nutrient cascade to filter through to the predominantly benthic prey of Australian fur seals. Stable isotope analysis of C and N were used to investigate whether these fluctuations in growth were associated with different prey resources. Inter-individual variation in $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ was substantial and masked inter-annual variation which did not correlate with relative growth. However, inter-annual variations in $\delta^{13}\text{C}$ were found suggesting changes in the influence of oceanographic currents on Bass Strait and the prey they transport into the region. These variations were correlated to the SOI on a 2 year lag which is consistent with previous studies that have shown correlations between the SOI and prey assemblages in the diet of Australian fur seal in the region.

Short Circuit Co-Evolution by the perfect Parasite? Antifreeze Glycoproteins of Fish Leeches in Antarctica

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Antifreeze glycoproteins (AFGPs) play an important role in biochemical adaptation to supercooled waters and subsequently, the survival of notothenioid fish in Antarctica. These fishes have a well-developed parasitic epifauna, which in turn is also exposed to freezing conditions. In order to retain their association with Antarctic fishes as the environment progressively cooled during the Miocene, leeches and other fish-associated ectoparasites had to either (i) adapt their own genome to confer protection from freezing or (ii) adapt a short circuit strategy by acquiring the necessary life-saving chemical compounds from their host. We have found that Antarctic leeches (Annelida, Hirudinea, Piscicolidae), feeding on a variety of notothenioid fish species, contain antifreeze compounds. The analysis of protein chemical structures in leech material revealed characteristics typical for fish AFGPs. Furthermore, there are high capacities for freezing point suppression or bio activity of proteins in parasite samples of *Cryobdella levigata*, confirming the presence not only of similar macromolecules but true AFGPs. To trace the origin of these proteins to leech or host genomic information, mRNA molecules were successfully targeted as the intermediate level necessary for a de novo AFGP biosynthesis by the parasite. We aim now to identify possible antifreeze gene candidates in the genome of *C. levigata* by whole genome sequencing. This will determine whether these leeches have in fact developed a novel means of short-cutting evolution by co-opting mechanisms for survival in supercooled waters from their hosts, either by biochemical exploitation only or additionally by horizontal gene transfer (HGT). This represents the first example of an instantly effective adaptive advantage provided by another species in a quasi short circuit co-evolution.

Effect of melting sea ice on microbial communities in the Western Weddell Sea

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We investigated the effect of melting Antarctic sea ice on microbial communities (algae, bacteria, protozoa) at the onset of spring/summer in the Weddell Sea. In addition to field observations, we performed 20 L microcosm ship-based experiments for 10 days, under temperature controlled and trace-metal clean conditions to study the effect of the fertilisation by sea ice microorganisms, organic matter and iron on the planktonic community. Sea ice was a major source of algal biomass (resulting in a 9- to 27-fold increase over the control). However, heterotrophs (bacteria and protozoa) were supplied in lower numbers (only a 2- to 6-fold increase). Our results show that sea ice clearly seeded the water column with microorganisms, mainly in the form of diatoms. Sea ice was also an important source of dissolved organic matter to the planktonic community as indicated by the enhanced microbial growth in sea ice-fertilized seawater, compared to the control. Iron measurements in the field suggest that the direct supply of ice-derived iron to the microcosms was low at this time of the melting season. We finally ran a "sequential melting" experiment to estimate the timing of the release of the sea ice elements in seawater. Brine drainage occurred first and was associated with the release of salts, dissolved organic carbon and dissolved iron. Particulate organic carbon and particulate iron were released afterwards. The timing of the release of these essential nutrients is most likely fundamental to initiate blooms in this area.

What drives the sinking rate of marine snow? Roller tank experiments give new insights into carbon export in a naturally iron-fertilised area of the Southern Ocean

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The second Kerguelen Ocean and Plateau compared Study (KEOPS2) examined in October - November 2011 the naturally iron-fertilised phytoplankton bloom over the Kerguelen plateau and its consequences for biogeochemical cycles. We sampled seawater at 30 and 80 m in high phytoplankton biomass layers at 6 stations and then incubated it in rolling tanks to form organic aggregates by physical aggregation *via* differential settling. Sinking velocity recordings combined with physico-chemical measurements and microscopic observations were conducted individually on aggregates in order to identify parameters driving their settling rate and thus assess the contribution of physical aggregation to carbon export. The equivalent spherical diameters (ESD) of aggregates ranged between ~2 and 14 mm. Measurements of their solid content in Particulate Organic Carbon (POC), Biogenic Silica (BSi) and Transparent Exopolymer Particles (TEP) revealed high TEP proportions (~80 ± 5%). Calculations based on aggregate volumes and solid contents lead to an average porosity of 0.989 ± 0.008, consistent with documented values for marine snow. We recorded sinking velocities between 6 and 187 m.day⁻¹, roughly in the same range as *in-situ* values derived from Underwater Video Profiler (UVP) and polyacrylamide gel-filled sediment traps during KEOPS1. The sinking velocity showed little variation with particle size, suggesting that physical aggregation may not accelerate carbon export. Preliminary microscopic observations tend to indicate a positive correlation between the sinking speed and the size of dominant diatom species composing the aggregates, emphasizing the importance of community composition to carbon export efficiency. Thus it may be that the change in the size of the diatoms as a response to iron fertilisation, is more than the change in their abundance, as an influence on the sinking rate of aggregates. This result is in contrast with typical aggregation models which predict that an increase in particle abundance alone will lead to enhanced export.

Observed changes in ocean acidification in the Southern Ocean over the last two decades

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As the oceans take up anthropogenic CO₂, slowing the rate of global warming, carbonate ion concentrations are simultaneously being reduced, leading to ocean acidification. While decreases in pH have been measured in the Subtropical Gyres e.g. ESTOC, BATS, HOT, the Southern Ocean changes in pH are yet to be well quantified. The Southern Ocean plays a key role in the global carbon cycle, and is projected in coming decades to become under-saturated with respect to aragonite at high latitudes. Clearly understanding where and how fast the Southern Ocean is acidifying is critical for: detecting and monitoring biological impacts; understanding the impact of variability on rates of ocean acidification; and validating coupled and ocean model used to make projections and understand processes.

To quantify the ocean acidification changes in the Southern Ocean we use the recently released Surface Ocean Carbon Atlas (SOCAT). This dataset, comprising more than 7.5 million oceanic pCO₂ measurements collected globally since 1968, offers unprecedented Southern Ocean coverage in summer and winter. We use these Southern Ocean measurements of pCO₂ and published relationships of Alkalinity with Salinity and Sea Surface Temperature to calculate pH and the saturation states of aragonite and calcite. From these values we calculate trends over the last decades. To understand the integrated response of the Southern Ocean we calculate trends in each of the major zones between the fronts, as derived from satellite altimetry. Finally we contrast the response in each of these zones between the three major ocean basins of the Southern Ocean.

Acoustic properties of deep-sea fish and micronekton

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Acoustic surveys are used to estimate deep-sea fish biomass of species such as orange roughy and to monitor micronekton at basin scales. Multi-frequency acoustic methods are used to distinguish dominant acoustic scattering groups based on acoustic properties of the fish. This is governed largely by their size and if they have a gas-filled swim bladder. The shape and size of the gas bladder is required to model the acoustic backscatter at multiple frequencies. For fishes without swim bladders (such as orange roughy and deep water sharks) specimens are computed tomography CT scanned to measure their density and sound speed for Finite Element Method (FEM) modelling. Estimating the size and shape of the swim bladder is complicated by the swim bladder distorting when the fish is brought to the surface. To investigate the actual size and volume of the gas-bladder at depth the fish is dissected and the size and location within the body cavity measured. The swim bladder is then deflated and the fish immersed in a pressure chamber to estimate the volume of gas required to achieve neutral buoyancy at depth. For many species the volume of gas required for neutral buoyancy at depth was well in excess of the available cavity volume within the fish and in particular the deep sea fish blue grenadier. For other micronekton species the size of the gas bladder measured was very much greater than that estimated from resonant scattering models. Either the gas bladder at depth is very much less than expected or other organisms with gas-bladders may be present. Based on net and optical measurements very small fish and syphonophores with gas-bladders are observed in low numbers.

The Consequences of Pollutants on the Antioxidant Defenses and Life History Strategies of Marine Invertebrates

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Environmental change, caused by both natural and human activities, is one of the major crises facing the health of the world's marine ecosystems. In addition to climate change variables, such as increased sea temperatures, anthropogenic pollution is a major threat to marine organisms. Polycyclic aromatic hydrocarbons (PAHs) are a group of widespread organic compounds that can occur in unnaturally high concentrations as a result of human activities, such as wastewater discharge. They are ubiquitous in their distribution, impacting on all media, and are considered a serious pollution problem. Oxidative stress, or the accumulation of intracellular reactive oxygen species (ROS) to a level high enough to overcome antioxidant defenses, is one important component of the stress response in marine organisms. The impacts of PAHs, in terms of basic toxicology, on animals have been reasonably well studied, but information regarding the carry-over effects on reproductive capacity remains scarce. Moreover, few studies have examined this physiological response in marine species in response to multiple stressors. Using the New Zealand sea urchin *Evechinus chloroticus* as a model organism, laboratory experiments were conducted to assess the effects of PAHs on morphology and oxidative stress parameters in gametes and embryos. The presence of four major PAHs (fluoranthene, pyrene, benzo[a]pyrene and phenanthrene) in the urchins food source (*Ulva pertusa*) resulted in reduced fecundity of reproductive females, but successful embryos from those eggs that were released. Results also indicate that embryos from PAH-exposed females may have a greater ability to continue normal development in the face of additional temperature stress. The present research provides important insights, firstly into the concept of viewing oxidative stress as a mediator of life-history changes in marine research with wide-reaching consequences for maternal investment patterns and secondly into the complexity of responses to multiple stressors, an important consideration across all areas of marine biological research.

The evolution of a Cold-Core Eddy in a Western Boundary Current

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Cold-Core Eddies (CCEs) are a common feature in Western Boundary Currents such as the East Australian Current (EAC). We use The Regional Ocean Modelling System to investigate the ocean state during the formation of one such CCE in the EAC during October of 2009. This eddy initially appears as a small billow which cuts into the edge of the EAC. We make use of particle release experiments to investigate the eddy's source waters. Nearly all of the surface particles within the eddy (and hence source waters) originated on the continental shelf. Particles above 500 m within the eddy came from both north (as expected) and south of the eddy. Particles come from the south due to a northward flow on the continental shelf just prior to eddy's formation. Close to 100% of particles in the top 50 m of water in the eddy came from water which was located in the top 100 m on the continental shelf prior to the eddy formation. We also investigate the impact of 3 wind forcing scenarios: upwelling, downwelling and realistic winds. The hydrography of the continental shelf changes in response to the wind forcing, producing cooler or warmer surface temperatures. Despite the difference in wind forcing, an eddy still forms in each of the scenarios but, the path on which the eddy travels differs. The different scenarios also have different isothermal displacement. Interestingly, the maximum uplift of the 17°C isotherm is produced in the downwelling winds scenario. This study is the first of its kind to investigate CCE's in the EAC and entrainment of shelf waters which can serve as biologically significant source of nutrients or seed populations.

Presence of epidermal lesions in resident southern Australian bottlenose dolphins *Tursiops australis* in Port Phillip, Victoria

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Cetacean poxvirus and epidermal lesions are prevalent in many dolphin populations across the world. Severe lesion outbreaks have been recorded in Australia in the Swan River, Western Australia and Gippsland Lakes, Victoria. Prior to 2011, epidermal lesions were present but inconspicuous on the resident southern Australian bottlenose dolphins (SABD), *Tursiops australis*, in Port Phillip. A significant change was noted in February 2011 when a juvenile, 'clean-finned' animal was photographed with extensive epidermal lesions. Dedicated photo monitoring surveys conducted by the Dolphin Research Institute (DRI) in April 2011 recorded five different epidermal lesion types on 73 re-identifiable resident Port Phillip dolphins (72 SABD's and 1 short-beaked common dolphin *Delphinus delphis*). Of these, 40 SABD dolphins showed evidence of lesions; 15 animals exhibited two types of lesions and 25 dolphins a single form of lesion. All affected dolphins displayed normal behaviours and appeared to be in good condition. The most prevalent type of lesion on re-identifiable dolphins was white; this type was observed on 26 of the re-identifiable dolphins. Twelve re-identifiable animals were photographed with white-fringed spots, the second most common type. Photographs taken ten days apart of one individual with a large cloudy lesion showed significant healing with limited signs of the lesion after ten days. The situation in Port Phillip is consistent with descriptions in the literature, with lesions occurring after a change in salinity and mostly in younger animals prior to them developing adult immunity. There is a need to develop a systematic classification protocol for lesions. DRI will continue to monitor the presence and extent of epidermal lesions in the resident SABD and short-beaked common dolphins as part of our on-going core research program.

Development of an iPad Application for Coastal Studies

McCammon presenting: Starkey, Peter, Rob McCammon and Brett Smith

Refer 'Starkey' for abstract.

Metabolic response of the sponge *Aplysilla rosea* challenged by *Vibrio natriegens* in controlled closed aquarium system

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Marine sponges are a major source of new bioactive compounds, with the potential for treating cancer, HIV, Malaria and other life-threatening diseases. However, development of these compounds into drugs has been hindered by the difficulties in obtaining a sustainable supply of these often-complex molecules for pre-clinical and clinical trials. Increasing evidence suggests that the high diversity of secondary metabolites in sponges are produced in response to symbiotic and foreign bacteria. The exact interactions between sponge and bacteria, and how these interactions impact on the biosynthesis of bioactive metabolites, however, remain unresolved questions, which if answered may help to develop sustainable production of sponge-derived metabolites. We investigated the metabolic response of a South Australian marine sponge *Aplysilla rosea* to the presence of the non-pathogenic bacteria *Vibrio natriegens* at 5×10^6 cells/ml in a closed aquarium system for 48 hours. Microbes were efficiently filtered and ingested by sponges within the first 3 hours and started multiplying again after 12 hours. The *Vibrio natriegens* multiplied quickly and could not be completely removed from the water by the sponges. From 24 hours onward, the *V. natriegens* cell density in the aquarium water remained constant. Analysis by GC and LC- MS revealed that these interactions caused significant changes in the sponge's metabolic profiles and protein levels.

Investigations into the fractionation of Silicon Isotopes in Diatoms

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Silicon isotopes found in fossil diatoms have been used to determine the level of silicon utilisation by diatoms over glacial-interglacial timescales. These studies assume a constant fractionation factor between the biogenic silica found in the diatoms and the dissolved silicon utilized for their growth. Although the fractionation factor appears to be independent of temperature and pH, it is still poorly constrained. This study aims to better determine the fractionation kinetics of silicon isotopes in diatoms through a series culture experiments and proteomic approaches. Here, we present our initial investigations on the effects of trace metal limitation on silicon uptake and isotope fractionation in the coastal diatom *Thalassiosira pseudonana*. In addition, we have made attempts to isolate silicon transporters (SITs) from diatoms to determine how silicon isotopes are fractionated as they are actively transported across the diatom cell membrane. Preliminary results from these experiments are promising, however further work is required to achieve greater consistency. It is hoped that results from this work will provide a better understanding of silicon uptake in diatoms and allow researchers to better determine the level of silicon utilization by diatoms in the Southern Ocean over interglacial-glacial time scales.

Hector's dolphin diet: prey species, sizes and relative importance, quantified using stomach content and stable isotope analysis

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Dietary studies provide important insight into interactions among species and help to define a species' ecological role. Such work not only increases ecological understanding but can aid predictions of how a species will respond to anthropogenic disturbance and climate change. Stomach contents from 63 Hector's dolphins (*Cephalorhynchus hectori*) found beachcast or bycaught between 1984 and 2006 were analysed to provide the first quantitative assessment of prey composition. Twenty-nine taxa were identified and primarily small and juvenile prey were consumed. Overall, species from throughout the water column were eaten but stomach contents were dominated by a few demersal and mid-water species. Red cod (*Pseudophycis bachus*) contributed the most in terms of mass (37%) while ahuru (*Auchenoceros punctatus*) and Hector's lanternfish (*Lampanyctodes hectoris*) were consumed in large numbers. Diets from the South Island east and west coasts were significantly different, due largely to javelinfish (*Lepidorhynchus denticulatus*) being of greater importance in west coast stomachs. In order to further assess the relative contribution of prey to the diet of dolphins on the east coast, tissue signatures of both the dolphins and identified prey species are being analysed using stable isotope mixing models. Bone collagen samples from 42 dolphins beachcast and bycaught between 1973 and 2011 have been collected for comparison with signatures from 11 potential prey species. This work begins to examine these endangered top-predators in a wider ecosystem context. Using this as a baseline, future work can aim to determine how Hector's dolphin movements are influenced by prey availability, and could identify which areas have the greatest potential for future population recovery.

The Integrated Marine Observing System (IMOS): taking an integrated approach to monitoring boundary currents

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The waters around Australia form a complex intersection of the Pacific and Indian Oceans. There are two major boundary current systems; the East Australian Current (EAC) on the east coast and the Leeuwin Current on the west coast. There are also two major inter-basin flows connecting these ocean regions; the Indonesian Throughflow, between the western Pacific and the northeast Indian Ocean, and the Tasman Outflow by which the EAC penetrates into the Indian Ocean. These current systems have a central role in transferring heat, salt and nutrients into the coastal region. They vary on inter-annual and longer timescales, influenced by the major modes of climate variability (e.g. ENSO). The boundary current systems are therefore crucial in understanding how global ocean processes influence regional marine ecosystems.

Boundary currents are narrow, highly dynamic systems, and are difficult to observe with a single platform. Successful monitoring of boundary currents demands multiple observational techniques, and this is the strategy the Australian marine and climate science community has taken when designing IMOS. The Expendable Bathythermograph (XBT) lines form the backbone of the boundary current observing system. These are complemented by full depth mooring arrays across the Indonesian Throughflow and East Australian Current, glider deployments and satellite remote sensing products.

All IMOS data is freely available for anyone to use. For more information, visit www.imos.org.au.

Implementing the New Zealand Marine Protected Areas Policy – a Case Study from the South Island West Coast

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The West Coast Marine Protection Forum was established in 2005 to recommend marine areas for protection in the South Island West Coast inshore marine biogeographic region. The independent Forum comprised fourteen people who were representative of a range of stakeholders and users, including tangata whenua, commercial fishing, recreational fishing, environment and conservation, education, local community and local government. The Forum was advised and funded by New Zealand government agencies, the Department of Conservation and Ministry of Fisheries. The Forum was primarily guided by the New Zealand government's Marine Protected Area Policy and Implementation Plan, and its associated ecosystem classification and protection standards. Multiple users and diverse interests are a feature of mainland coasts such as the West Coast. Accordingly, the Forum had a strong focus on ensuring public and stakeholder input, and the use of the best available information. In accordance with the MPA Policy, the forum sought to recommend representative coverage of marine habitats within MPAs, while minimising adverse impacts on existing users.

The Forum succeeded in recommending marine protected areas at four "primary sites" (each with two or three options) and five smaller "educational showcase sites". In September 2011, the Minister of Conservation directed the Department to proceed with applying for highly protected marine reserves at the five sites, including the four primary sites. The Ministry of Fisheries is to proceed with proposals to prohibit bottom-impacting fishing methods adjoining two of the primary sites. In total, these MPA proposals cover 27085 hectares or 2.1% of the marine environment of the biogeographic region. If approved, they will include three of the four largest marine reserves on the mainland New Zealand coast. It is expected that the necessary legal processes for these proposals under the Marine Reserves Act 1971 and Fisheries Act 1996 will proceed during 2012.

Mitochondrial Dynamics underlying thermal Plasticity of Cuttlefish (*Sepia officinalis*) Hearts

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In the eurythermal cuttlefish *Sepia officinalis*, performance depends on hearts that ensure systemic oxygen supply over a broad range of temperatures. We therefore aimed to identify adjustments in energetic cardiac capacity and underlying mitochondrial function supporting thermal acclimation that could be critical for the cuttlefish's competitive success in variable environments. Two genetically distinct cuttlefish populations were acclimated to 11°C, 16°C and 21°C, respectively. Subsequently, skinned and permeabilised heart fibres were used to assess mitochondrial functioning by means of high-resolution respirometry and a substrate-inhibitor protocol, followed by measurements of cardiac citrate synthase and cytosolic enzyme activities. In cuttlefish hearts, thermal sensitivity of mitochondrial substrate oxidation was high for proline and pyruvate but low for succinate. Oxygen efficiency of catabolism rose from 11°C to 21°C via shifts to oxygen-conserving oxidation of proline and pyruvate as well as via reduced relative proton leak. Acclimation to 21°C decreased mitochondrial complex I activity in Adriatic cuttlefish and increased complex IV activity in English Channel cuttlefish. However, compensation of mitochondrial capacities did not occur during cold acclimation to 11°C. Moreover, temperate English Channel cuttlefish had larger hearts with lower mitochondrial capacities than subtropical Adriatic cuttlefish. The changes observed for substrate oxidation, mitochondrial complexes, relative proton leak or heart weights improve energetic efficiency and essentially seem to extend tolerance to high temperatures and reduce associated tissue hypoxia. We conclude that cuttlefish sustain cardiac performance and thus, systemic oxygen delivery over short and long-term changes of temperature and environmental conditions by multiple adjustments in cellular and mitochondrial energetics.

Validation of a near-global eddy-resolving ocean model

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Abstract: Analysis of the variability simulated in an 18-year run of the new Bluelink model, a near-global, eddy-resolving ocean general circulation model, is presented. Comparisons between the root-mean-squared (RMS) of sea-level anomaly (SLA) from the model and from gridded observations indicate that the model variability is realistic, with local extrema in the same locations as observations and with similar magnitude. Similarly, comparisons between the RMS of sea surface temperature (SST) anomalies from the model and from gridded observations show local extrema in the same locations as observations, except the model tends to over-estimate the magnitude of SST anomalies in regions of high variability, such as western boundary current (WBC) regions. Comparisons of volume transports in key regions, and zonal-averaged properties of the model lead us to conclude that the model realistically reproduces most aspects of the global ocean circulation.

Physiological tolerance of estuarine mysid shrimps (*Tenagomysis* spp) to temperature and salinity variation

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In estuaries mysid shrimps are a critical link between benthic and pelagic food webs, and often form a large biomass. Species of *Tenagomysis* are abundant in New Zealand estuaries, but hardly studied. Our research investigated the impact of variation in salinity (0-33) and temperature (5-20°C) on the survival, osmoregulation and respiratory physiology of *Tenagomysis* spp. to examine inter-specific variation within southern New Zealand estuaries. Results from laboratory studies showed that survival across a range of salinities (0-33) at 5°C and 20°C for *Tenagomysis chiltoni* and *T. novae-zealandiae* varied in relation to life stage, temperature and salinity. However, inter-specific variation was minor. Each species maintained stable body fluid concentrations over a wide range (5-30) of salinities, but few survived in fresh or sea water. Whilst survival across a broad salinity and temperature range was high, respirometry indicated that survival at the environmental extremes could be energetically costly. Metabolic rates of *Tenagomysis chiltoni* and *T. novae-zealandiae* varied significantly across a range of salinities (0-33) at 5°C (metabolic rates at higher temperatures to be reported), with higher metabolic rates at high and low salinities. These changes in metabolic rates suggest that changing temperatures and salinities have the potential to alter the energy balance of these dominant estuarine organisms.

Lanternfishes (Family Myctophidae) in Australian Waters, 130 Species and Counting

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The lanternfish family Myctophidae, with some 250 recognised species, is one of the two largest families in the mesopelagic and bathypelagic zones. Myctophids occur in all oceans and most seas, and are distributed from the surface nocturnally to at least 1500 m diurnally. Some deep-dwelling species are non-migrators. Maximum sizes range from 25 to 280 mm standard length. Some species form dense aggregations, off South Africa, Uruguay-Argentina, and in the Arabian and Coral Seas. Lanternfishes are important as trophic links in energy transfer from shallow waters where they feed, to deeper waters. They are food for a wide variety of piscivores, including many commercial fishes, mammals, birds, and squids. Despite their diversity and prominence in marine ecosystems globally, there was little knowledge of Australian lanternfishes until relatively recently. The first lanternfish described from Australia was in 1898, while a checklist of Australian fishes in 1964 listed 13 species, mostly from beach strandings. Collections of Australian midwater animals increased in the 1970s, and 96 species of myctophids were recorded from continental exclusive waters in the 1989 volume of the Zoological Catalogue of Australia. The current count has risen to 130 species (28 genera) due to inclusion of all territorial waters and some newly collected species. A rapidly increasing focus on myctophids in studies of marine food webs and biogeography requires a key for non-specialists to unravel this bewildering diversity. This paper reports that a key to the Australian myctophids, with a figure for each species, is nearing completion. It includes detailed guidelines for non-taxonomists. Photophore distributions and gill-raker counts are two of the most important diagnostic characters. Sexual dimorphism in the distribution and/or form of luminous organs is evident in most species. Two subfamilies are easily distinguished, but conflicting hypotheses on which is the more generalised have yet to be resolved.

Seasonal and latitudinal changes in zooplankton community composition along the East Australia Current: The AusCPR survey

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The East Australian Current (EAC) is the pole-ward flowing, western boundary current of the South Pacific Gyre. Running along the east coast of Australia, it shows a strong seasonal cycle and is so highly variable that it is often hard to distinguish a single continuous current. The effects of the inter-annual and seasonal variability of the EAC on the ecology of the area are largely unknown, making it difficult to assess how predicted strengthening of this current will impact on productivity in the region. This study focuses on zooplankton dynamics in the EAC, and will examine how zooplankton communities change as a result of large-scale seasonal effects as well as smaller-scale oceanic features. The study particularly focuses on zooplankton communities associated with warm core and cold core eddies, sites of upwelling and primary productivity as well as the region affected by the increasing and decreasing strength of the EAC. This study also examines zooplankton biomass, as an integrated measure of the food available for higher trophic levels. The Continuous Plankton Recorder (CPR) is a device developed to continuously sample plankton to examine the patchiness and horizontal structure of plankton communities. Since June 2009, the Australian Continuous Plankton Recorder (AusCPR) survey has conducted twenty transects from Brisbane to Melbourne along the EAC. AusCPR, which forms part of the Integrated Marine Observing System's (IMOS) long-term ocean monitoring program, measures plankton communities as a guide to the health of Australia's oceans. Here we show latitudinal changes in the zooplankton communities along the EAC, as well as seasonal and inter-annual variation in all communities and the biomass of the community. This study provides baseline data for the EAC zooplankton communities, which will provide highly valuable information in the face of climate change.

Space-for-time substitution to assess likely response of aquatic ecosystems to future climate-related change

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Predicting and managing ecological response to a changing climate is often limited by an incomplete understanding of response thresholds and biogeographic differences. For example, step changes in rainfall and runoff, and threshold dynamics and hysteresis in ecological response make projection of future conditions difficult. To combat these constraints we propose that biophysical data across existing climatic gradients can be used in a space-for-time substitution to predict climate-related ecological response elsewhere. This method builds on previous attempts at space-for-time substitution by using patterns in physical and physicochemical data to explain biological differences across the spatial gradient, then using those patterns to formulate hypotheses of temporal ecological response and finally testing those hypotheses on temporal data available in a second, similar region of interest. As an example application of the method, we used existing biophysical data from across a known longitudinal gradient in rainfall and runoff in south-western Australian estuaries to quantify trajectories of ecological response to differences in freshwater flow and estuarine conditions. Based on these trajectories, hypotheses were established for likely climate-related responses in other southern Australian estuaries of similar latitude. Available temporal physicochemical and ecological data for a subset of those estuaries were then explored for evidence in support of those hypotheses, using Victorian estuaries in the first instance. In this way, we are able to identify the susceptibility of a range of southern Australian estuaries to climate-related changes in freshwater flows. By assessing the evidence of similar response across regions, we gain an understanding of the transferability of ecological risk and thus management strategies across estuary types and biogeographic boundaries. This could then form the basis of a regional framework, enabling identification of strategic management options that aim to increase estuarine resilience at multiple spatial scales.

Hydrodynamic control of plankton in Recherche Bay, southern Tasmania

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Zooplankton play a critical role in the food chain as they link primary producers to higher order predators. However, little is known about the zooplankton in Tasmania. This study focuses on how environmental factors influence the composition and abundance of zooplankton over an annual cycle in Recherche Bay, Tasmania. Recherche Bay is situated in an area that is influenced by three main currents: the East Australian Current (EAC), subantarctic water and the Leeuwin (Zeehan) Current. The EAC has strengthened over the last 60 years and will continue to expand its influence along the Tasmanian coast, carrying warmer, saltier, low nutrient water further south. While it is expected that the increased presence of this warmer water will induce changes in the planktonic communities, it is currently not known what these effects might be. We are investigating the distribution and abundance of mesozooplankton in Recherche Bay in relation to environmental drivers, including temperature, salinity, nutrients, chlorophyll a, phytoplankton species, rainfall and wind conditions. Water temperature was relatively stable around 12.5 °C during winter and spring, and then increased to approximately 15.5°C in summer. Zooplankton diversity, abundance and biomass were much lower in winter than in summer. Small calanoid copepods, including *Paracalanus* spp. and *Acartia* spp., were present in Recherche Bay throughout the year. The biomass during the summer was dominated by chaetognaths, from the genus *Sagitta*, and large copepods, including *Calanus australis* and *Neocalanus tonsus*. Other seasonally dominant taxa included euphausiids, cladocerans and appendicularians. Although oceanography was an important driver of zooplankton community structure, it is likely that complex inter-species interactions were also significant.

Q-IMOS observations of extreme marine conditions under Tropical Cyclone Yasi

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Severe Tropical Cyclone Yasi made landfall in northern Queensland, Australia on 3rd February 2011. As the system moved south-westwards towards the Australian coast, it passed over the Great Barrier Reef (GBR) component of the Queensland Integrated Marine Observing System (Q-IMOS). The observing system established in 2007 seeks to understand the impact of the Coral Sea, in particular boundary currents and cool and warm water intrusions, on the GBR. Shortly before making landfall, the Yasi system passed just to the north of a pair of moorings located on the continental shelf and slope and a coastal National Reference Station located at the wreck of the SS Yongala, itself a victim of another cyclone 100 years earlier. In this poster we present some of the data captured by the observing system, and discuss the performance of the array under these extreme conditions. While there was damage to surface instrumentation, the subsurface moorings were resilient to this extreme event. Pressure sensors on some of the moorings showed that they exhibited significant lean and the dynamics of the mooring will provide a reference for future mooring design improvement. The availability of output from a near-real time 4 km resolution three-dimensional hydrodynamic model covering the entire GBR and western Coral Sea improves our ability understand and interpret the oceanographic observations and vice versa. Q-IMOS GBR Moorings are operated and maintained by the Australian Institute of Marine Science and funded by the Queensland State Government, the Australian Government's National Collaborative Research Infrastructure Strategy and the Super Science Initiative. All data is made freely and openly available through the IMOS ocean data portal that is accessible from www.imos.org.au.

Linking the extremes in intertidal trophic networks: macrobenthos and shorebirds long-term changes (1980-2010) on a muddy sand beach

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Sandy beaches are not considered as important areas for shorebirds because of low food resources. However, when muddy patches are present, food supplies may become as attractive as estuarine ones. These intertidal areas are therefore holding a substantial number of birds refueling on their migration route or in winter. The intertidal zone located east of Calais (France, Southern North Sea) featured such a muddy-sand macrozoobenthic community (A2.24 - EUNIS typology) in the early 80's. The offshore extension of the Calais harbor in the mid 80's caused important bio-sedimentary changes on these beaches in favour of a sandy community (A2.22 - EUNIS typology). This spatial reorganization of communities was studied using data on macrofauna and sediment (17 stations) collected in 1982 and 2010. Functional implications of these long lasting human perturbations on the ecotone between marine and terrestrial realm were analyzed and the consequences on the food availability for wintering and staging shorebirds are discussed.

Are oceanic scallop and abalone mollusc species less resilient to ocean acidification?

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It is expected that the anthropogenic increase of CO₂ and the subsequent ocean acidification will greatly affect most marine organisms, but those most vulnerable will be calcifying organisms, such as molluscs (Dupont et al., 2008, Kurihara, 2008, Ross et al., 2011), which secrete calcium carbonate shells (Doney et al., 2009, Kurihara et al., 2007, Parker et al., 2010, Parker et al., 2011). In one of the only studies worldwide to investigate resilience and acclimatisation through chronic transgenerational experiments, Parker et al. (2012) found that exposure of adults of the Sydney Rock oysters, *Saccostrea glomerata*, to elevated CO₂ influenced positively the resilience of the larvae, facilitating acclamatory processes. This may be anticipated for Sydney rock oysters and other estuarine species of molluscs which live in intertidal habitats characterised by natural fluctuations in environmental parameters such as pH and salinity. It is less likely that oceanic subtidal molluscs, which live in environments where pH and salinity are stable, will share the same resilience and capacity for acclimation to ocean acidification. The aim of this study was to determine whether adult commercial species of oceanic molluscs namely the Doughboy scallop (*Chlamys asperrima*) and the abalone (*Haliotis rubra*) and their larvae were able to acclimatise and adapt to chronic exposure of CO₂ acidified water during reproductive conditioning. We report here on the mortality, growth, settlement and the nutritional condition of these late stage larvae including the rate of protein synthesis using DNA: RNA ratio and analysis of lipid content used to measure energetic reserves.

Carbon accumulation in an estuarine seagrass meadow: A case study of *Posidonia australis* in Oyster Harbour (south-western Australia)

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Seagrass meadows are generally reported to accumulate carbon in their sediments. From the aspect of its depositional environment, seagrasses occur in both estuaries and non-estuarine offshore sites. Carbon accumulation capacities within the seagrass meadow may vary between these two depositional environments. There are, however, not many accounts of carbon accumulation in seagrass meadows based on this distinction. It is hypothesized that the sediments of estuarine seagrass meadows may accumulate more carbon than in offshore meadows. Using a case study of an estuarine *Posidonia australis* meadow in Oyster Harbour (south-western Australia), this paper presents preliminary findings of carbon accumulation in the sediments of the estuary. This is through analyses of organic and inorganic carbon content in representative sediment cores taken from the meadow. Accumulation rates are calculated based on the carbon content relative to the radiocarbon age of organic matter found in one sediment core. The results obtained are then compared to our data of carbon content in offshore seagrass meadows, which ranges between a mean of 0.28-0.79 % sediment bulk carbon content. These results will show whether estuarine seagrass meadows accumulate more carbon than seagrasses growing further offshore.

Aspects of global distribution of six marine bivalve mollusc families

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Abstract: Molluscs are shelled marine and freshwater invertebrates which are one of the largest phyla are known so far. Gastropods and Bivalves are two important classes of this phylum. In this chapter, 6 different scientifically and economically important families of bivalves belonged to four different Orders will be studied. The selection of the families is based on the economic importance in terms of the fisheries and aquaculture production. These selected families are Veneridae Rafinesque, 1815 (venus shells), Mactridae Lamarck, 1809 (surf clams), Donacidae Fleming, 1828 (wedge shells), Myidae Lamarck, 1809 (softshell clams), Pharidae H. Adams & A. Adams, 1856, and Solenidae Lamarck, 1809 (razor clams). Nowadays, study the distribution of Molluscs in their ecosystem during geological time (Mollusca biogeography) counts as an important science issue. Knowing about species' distribution and environmental factors affecting their distribution helps scientist to study the biogeography of those species accurately. Biogeography studies are vital to preserve and protect different population of animals regarding climate change and human disturbing activities. All information on distribution maps of all 6 mentioned families in this part are gathered from open-access-databases including GBIF (Global Biodiversity Information Facility) (<http://data.gbif.org>), and OBIS (Ocean Biogeographic Information System) (<http://www.iobis.org>). First, a data-cleaning has been done on first-hand data regarding the basis of records and viability of coordinates in different data from the different mentioned open-access-databases. Then, all species have been checked for verification status in WORMS (World Register of Marine Species) (<http://www.marinespecies.org>), and those were accepted species only showed in these maps. Therefore, there can be some gaps in these maps as all studied areas are not included in these websites so far. To fill partially the gaps, a literature review has been provided on some important and well-known species of the studied families. These extracted information on distribution of important members, will be mentioned in the text for each family. The results of the different distribution maps showed a high diversity and abundance of different families mainly in two continents, Europe and Asia. However, there was no evidence and records of distribution of none of the families in Antarctic. All other remained continents including North and South America, Africa, and Australia presented different distribution patterns for each family.

Determining the zinc isotope composition of marine samples collected from the Tasman Sea and Southwest Pacific Ocean

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Marine phytoplankton account for 40% of marine primary production and hence play an important role in moderating global climate. The trace metal micronutrient zinc (Zn) is an essential component of many enzymatic systems. It plays a particularly important role as it is directly connected to the carbon acquisition system within marine phytoplankton via the enzyme carbonic anhydrase. In the marine realm the interaction between phytoplankton and zinc is complex and is dependent on its concentration and its chemical speciation, which affect Zn bioavailability. In the surface ocean Zn is strongly bound to organic ligands which reduce free Zn ion concentrations to low levels. The aim of our research is to investigate changes in Zn speciation and bioavailability by determining the Zn isotopic composition of water and phytoplankton samples collected from the field and phytoplankton cultured under controlled condition. The first step in realising this aim is to develop a procedure to determine the zinc isotope composition of marine samples. Zinc has five naturally occurring stable isotopes, ^{64}Zn , ^{66}Zn , ^{67}Zn , ^{68}Zn and ^{70}Zn , thus it is well suited to isotopic determination using the double spike methodology, which corrects for the instrumental mass bias during measurement and mass dependent fractionation during sample preparation. To make the double spike, enriched isotopes of ^{67}Zn and ^{68}Zn were mixed in the clean laboratory and calibrated against the certified Zn standard IRMM-3702. We are currently evaluating the double spike technique by determining the zinc isotope composition for sea water samples collected from both coastal and open ocean settings across a range of depths.

Phytoplankton productivity in sub-Antarctic waters: role of nutrients accumulated and recycled by seabirds

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Iron has been demonstrated to be a limiting nutrient in the waters of the Southern Ocean. Great congregations of seabirds around the sub-Antarctic islands result in delivery of iron rich guano to coastal zones that potentially enhances productivity and supports biodiversity in the iron-limited waters in the region. We performed element analysis and dissolution experiments on guano from six seabird species collected during the cruise to the Auckland Islands in February 2011. Results demonstrate that guano contains large amounts of bio-available micro-nutrients such as iron, zinc and cadmium, with significant differences observed among species and foraging type. Guano solubility was also highly variable between ecological groups of seabirds (seabirds foraging in the open ocean, inshore and predators). In particular, species feeding inshore provide higher amounts of dissolved guano-derived micro-nutrients than predators and oceanic feeders. We performed a phytoplankton incubation experiment with water samples collected in the wake of the Snares Islands and offshore in sub-Antarctic waters in February 2012. Samples were treated with nutrients derived from guano. Growth rates were significantly higher in offshore treatment samples compared to offshore control samples: concentration of Chl a in the treatment increased to $60 \mu\text{g Chl a/L}$, while remained low in controls (average value of $6 \mu\text{g Chl a/L}$). This response indicates that seabird guano provides nutrients that limit primary production in sub-Antarctic waters and that these nutrients are readily taken up by phytoplankton. Simultaneously, samples from the island wake showed a less dramatic response to additions of guano indicating no similar nutrient limitation in the region. Analysis of changes in nutrient concentration and phytoplankton community composition is under development. Our study elucidates the potential role of seabirds in enhancing productivity in the vicinity of the sub-Antarctic Islands in the Southern Ocean.

Zinc speciation in the Tasman Sea

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Chemical speciation of trace elements determines the different physico-chemical forms in solution, and whether they are bioavailable or not for the phytoplankton community. For example, iron solubility and bioavailability in seawater is strongly influenced by complexation to natural organic ligands such as siderophores. These organic ligands help phytoplankton and bacteria to access trace elements required for their growth.

Zinc (Zn) is essential for phytoplankton growth as it plays an essential role in the enzyme carbonic anhydrase, which is part of the carbon uptake machinery within phytoplankton. In open ocean waters, dissolved concentrations of Zn are in the nanomolar ($0.1\text{-}10 \times 10^{-9} \text{ mol L}^{-1}$) range with depletion in surface waters and higher concentrations at depth. Moreover, 98 % of this dissolved Zn is complexed by natural strong organic ligands which decreases free Zn^{2+} ion concentrations into the low picomolar range ($10^{-12} \text{ mol L}^{-1}$). As a consequence, there is a potential for phytoplankton growth to be Zn limited.

Here, we present dissolved Zn and Zn speciation results for the Tasman Sea region. Dissolved Zn concentrations range between 0.02 to 0.19 nmol L^{-1} (15 m) and 0.02 to 0.11 nmol L^{-1} (150 m) along a north-south transect. Zn speciation was determined using Anodic Stripping Voltammetry (ASV) on three selected profiles from the Tasman Sea. Our results indicated that dissolved Zn is strongly complexed to natural organic ligands, the conditional stability constant for the Zn-ligand complex ($\log K'_{\text{ZnL}}$) ranged between 9.8 and 11.0. Dissolved ligand concentrations showed variations with concentrations ranging between 0.8 and 4 nmol L^{-1} . In surface waters, ligand concentrations always exceeded dissolved Zn concentrations, lowering the free Zn^{2+} ion concentrations in the picomolar range. Based on these results, we suggest that there is the potential for zinc limitation of certain phytoplankton groups within the Tasman Sea.

How well is habitat quality for birds reflected in existing protocols for assessing the condition of coastal wetlands?

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The quality of habitat for foraging, roosting and breeding is critical for birds that visit or live in coastal wetlands. Different types of coastal wetland may provide different types of resources, but the ecological condition of a given wetland is also likely to affect that wetland's utilisation by birds. There are a wide range of wetland types in Western Port, Victoria, including large areas of seagrass beds as well as extensive areas of intertidal mudflats and smaller areas of mangrove, saltmarsh and brackish-water wetlands. Western Port supports more than 253 species of birds, including waterbirds, bush birds, raptors and parrots. It also supports thousands of trans-equatorial migratory shorebirds during their non-breeding season. Most of the bird species rely on vegetative characteristics as a determinant of habitat quality. This study aims to determine whether current protocols for assessing wetland condition are the right tools to measure habitat quality for birds. Twenty different wetland sites in Western Port, across a wide range of wetland types, vegetation cover and likely ecological condition will be assessed using contrasting sets of protocols that have been developed, and in some cases, partly trialled, for assessing wetland condition. The assessment methods include those of Kessler (2006), widely used in NSW, Boon et al. (2011), an approach developed to be consistent with the Habitat-Hectares methods used for vegetation assessment across Victoria, and Dittman (2011), which was developed for mangroves in South Australia. Each method will be implemented by a suite of different operators: 1) wetland ecologists and professional botanists; 2) members of bird-watching organisations and other community groups; and 3) park rangers, in order to compare assessment methods, determine the easiest and the most informative technique to use, and see how well their assessment scores correlate with bird abundance and diversity.

Exploring harvest regulations of New Zealand abalone (*Haliotis iris*) via population modelling

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New Zealand abalone of the species black-footed paua (*Haliotis iris*) are harvested both commercially and recreationally, however many harvest areas are being seeded with young commercially raised paua in an effort to increase yield. *Haliotis iris* are found throughout New Zealand at depths from intertidal to 20 metres, but are more common in the cooler latitudes and at depths of less than 6 m. They have a cryptic juvenile stage of 3-5 years, then emerge from shelter at approximately 70 mm in length and begin living in patches (groups of 1-300 in size), with fecundity increasing rapidly. As age is impossible to tell paua are classified by size, and presently a minimum length requirement of 125 mm is generally in place for harvesting black-footed paua, which aims to ensure at least two years of reproductive capacity before harvesting. My aim is to discover if changing the harvest rules to a slot type size limit (for example minimum 100 mm, maximum 135 mm) would increase the numbers of paua, measured both as individuals; and as harvestable biomass. One way to explore this possibility is by population modelling. As paua have location dependant growth, mortality, maximum size and fecundity rates, I am using a single local population to trial this idea. Matrix modelling allows elasticity analysis of life history parameters, giving an understanding of which size paua are having the largest effect on population growth, and allowing predictions of the effects of changing harvest regimes. If sufficient data can be gathered to build an effective population matrix, which shows there are gains to be made in yield, then a slot size harvest system may be recommended.

Predicting anti-cancer bioactivity of marine sponges using untargeted metabolic profiles

Sorokin presenting: Bekker, Jan^{1,2}, Jing Jing Wang^{1,2}, Shuang Peng^{1,2}, Jie Lei^{1,2}, Shirley Sorokin*^{1,2}, Wei Zhang^{1,2}

Refer 'Bekker' for abstract.

Development of an iPad Application for Coastal Studies

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This presentation explains what Year 9 Hutchins boys are doing in Coastal Studies as part of the new Power of 9 schooling. This includes students spending a quarter of the year off campus doing activities outside of the classroom in challenging and exciting field work. The presentation details their data collection including the use of technology and apps developed by the school.

Tracking the early life stages of Western Australian Dhufish (*Glaucosoma hebraicum*)

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Western Australian dhufish (*Glaucosoma hebraicum*) is one of the most commercially and recreationally important finfish on the west coast of Australia. Together with pink snapper they account for more than half of the commercial catch of the demersal scalefish in the West Coast Bioregion. *Glaucosoma hebraicum* is a slow growing and long-lived species with a maximum age of 40+ years, making it particularly vulnerable to the effects of fishing. Often populations of such long lived individuals are sustained by infrequent episodes of good recruitment termed the storage effect, such as dhufish stocks were dominated by cohorts produced during four consecutive years of relatively strong recruitment (from 1993 to 1996), followed by two weak years of recruitment (1997, 1998) and another strong recruitment in 1999. Tracking the early life stage development of dhufish is important to understand the interannual variations of the dhufish recruitment, however, dhufish larvae have never been captured in the wild and our knowledge of early life stages and recruitment in this species is very limited. In this study, we present results from a recent field survey off the Capes region off southwest Australia which has successfully captured dhufish larvae with the aid of a hydrodynamic particle-tracking model and rapid genetic screening of zooplankton samples. During the survey, passive particle tracking simulations nested in high resolution (2-3 km grid) hydrodynamic model of shelf currents were used to inform likely transport routes and congregation sites of dhufish larvae from plausible spawning regions. In addition to traditional taxonomy, a rapid DNA-based system was used to identify larvae from net samples containing mixed zooplankton. This "DNA-barcoding" system processed samples more efficiently and accurately than conventional microscopic sorting in providing day to day feedback about presence/absence of eggs and larvae of dhufish.

Effects of Ocean Acidification on Intracellular pH and Development: Comparisons between Tropical, Temperate and Polar Echinoderm Species.

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Ocean acidification is a major threat to calcifying marine organisms such as echinoderms because it decreases availability of the carbonate ions required for the production of a skeleton (Byrne 2011). Echinoderm larval stages may be especially sensitive to reduced seawater pH, with research showing that their growth rates, survival, metabolism, calcification rates and gene expression are all altered under lower seawater pH. Little is known about the effects that elevated seawater $p\text{CO}_2$ has on intracellular pH, despite this being a key factor that will mediate their response. Intracellular pH is important for the activity of enzymes which are pH sensitive. Additionally, all cells have a Na^+/H^+ antiporter, important for the regulation of intracellular pH after acid loads. Previous studies have focused on development, fertilization and calcification (Clark et al. 2009; Kurihara & Shirayama 2004; Ericson et al. 2010), however what is now required is knowledge of how larvae is effected at the physiological level, most importantly acid/base regulation and the regulation of intracellular pH under different environmental conditions.

In this study the pH sensitive fluorescent probe HPTS is used to determine intracellular pH. Images are taken of larvae under fluorescent light of wavelengths 405 nm (λ_1^{exc}) and 460nm (λ_2^{exc}) and a pH profile is produced by dividing λ_2^{exc} by λ_1^{exc} . Intracellular pH regulation is energetically expensive and therefore the metabolic rate of larvae is an important consideration. For example, larvae from cold environments such as Antarctica have much slower metabolic rates than warmer water species, so their pH regulation may be more or less affected by seawater pH, in addition to their existence in an environment which already has elevated levels of CO_2 (Clark et al. 2009). Once acid/base regulation and calcification among polar species are compared with non-Antarctic species, an understanding on the relative sensitivity of polar species to processes associated with ocean acidification will be more evident.

The ecological role of the invasive kelp *Undaria pinnatifida* in southern New Zealand

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Seaweeds, as ecosystem engineers, can introduce significant changes on both ecosystem structure and function when they establish in new regions. The kelp *Undaria pinnatifida* (Harvey) Suringar is considered to be one of the world's most invasive species. *U. pinnatifida* has been present in New Zealand for at least 24 years, and is now well established around the coastline. Considerable concern has been raised about the possible effects of this species on marine communities; however, there is a scarce knowledge of the ecological implications of *U. pinnatifida* specific to coastal assemblages in New Zealand. This study aims to identify the ecological role *U. pinnatifida* now plays in the Otago region, and specifically how this invasive seaweed affects community structure and local food webs. First, the abundance of *U. pinnatifida* relative to native species was quantified at multiple sites in subtidal (as attached algae) and intertidal (as wrack) habitats. This baseline information was used to form hypotheses about the potential importance of *U. pinnatifida* as a food and habitat source for intertidal and subtidal organisms, and as a competitor with native seaweeds. Second, potential shifts of epifaunal assemblages due to the presence of *U. pinnatifida* at subtidal sites were studied. Finally, feeding preferences of native intertidal invertebrate grazers (sandhoppers) were tested in a series of controlled laboratory experiments. Findings to date support the notion that *U. pinnatifida* is, in some cases, a preferred food source for coastal communities and that it provides key habitat for certain groups of invertebrates, thus changing the composition of invertebrate assemblages in Otago. The presentation will also outline plans for future work.

Temporal currency: Life-history strategies of a native marine invertebrate increasingly exposed to urbanisation and invasion

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A diverse assemblage of ascidians is a major component of the natural coastal reef communities of New Zealand, with many of these occurring in very specific biogeographic regions. *Pyura pachydermatina* is an ascidian species that is found only on the South Island and is particularly abundant around Banks Peninsula and towards the south of the Kaikoura coastline. The competition that our native ascidians face from the more recent arrivals has not yet been tested, in fact, very little is known about our native ascidian assemblages, despite *P. pachydermatina* having Taonga status. This study has three components: (1) to describe the life history of *P. pachydermatina*, (2) to test the viability and frequency of self-fertilisation in natural environments, and (3) to assess the role of reproductive strategy in resilience to non-indigenous species. Australian research shows that this species reproduces during the winter months. However, a preliminary study and the data from the past one year suggest that *P. pachydermatina* can also spawn during the summer months, indicating a year-round reproductive cycle. Like most ascidians, *P. pachydermatina* is a hermaphrodite with the potential for self-fertilisation. Laboratory experiments suggest that self-fertilisation is a strategy readily adopted by this species with potentially viable offspring. The year-round reproduction period and the ability to self-fertilize may give this species an advantage when competing for resources against increasing numbers of invasive species. In addition, these early life history strategies show the potential of the native species in adapting to changes in the environments such as climate change or extreme weather conditions.

Does global warming promote smaller size? A case study of the krill *Nyctiphanes australis* in Storm Bay, Tasmania

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It has been hypothesised that, along with species' range expansions and shifts in key life cycle events, the third universal ecological response to global warming is reduced body size. The 'temperature-size rule' (TSR) contends that juveniles raised at higher temperatures will grow into smaller adults than those reared at cooler temperatures. For some marine crustaceans it has further been shown experimentally that early life stages are not temperature sensitive, and that the TSR response develops with ontogeny and is often most pronounced in adults. It is likely that reduced size of individuals due to warming will have repercussions across food webs, especially if predators and prey are not affected in the same fashion. In temperate Australian waters the krill *Nyctiphanes australis* occupies a key position in coastal food webs and is the major prey item of predators such as jack mackerel, barracouta, mutton birds and pygmy blue whales. For krill collected from Storm Bay, Tasmania, in 2009-10 we observed a decrease in length compared to krill collected from the same region between 1979 and 1981. Concomitantly, SST were at least 1°C warmer during 2009-10 than during 1979-80. There was an average decrease in length of ~5% for the population, but this decrease was not uniform across the developmental stages. While adults showed the largest reduction (~8%) in length, juvenile and larval stages were up to 6% smaller. Clearly this decreasing size could have important implications for productivity in the region, and the phenomenon requires closer analysis. We will present a detailed examination of krill lengths, size class distribution and abundance in relation to water temperatures during the periods 1979-81 and 2009-12. We will question whether this decreasing size is unidirectional, or whether size is reset at the beginning of each generation and then regulated by environmental temperatures experienced by that cohort?

New Zealand's Beaked Whales: Novel Insights from 20 Years of Stranding Samples

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New Zealand has the highest diversity of beaked whale species in the world. Thirteen species of ziphiid are known to have stranded around the coast of New Zealand since 1991, yet there are no known areas at sea where they can be reliably found and very few reported live sightings. Samples collected from strandings of three species: Gray's (*Mesoplodon grayi*); straptoothed (*M. layardii*) and Cuvier's beaked whale (*Ziphius cavirostris*), represent 83% (n = 225) of all ziphiids in the New Zealand Cetacean Tissue Archive (n=272). Species identity of these archived samples has been confirmed using DNA barcoding. We used the spatial and temporal distribution of these records to investigate patterns of these strandings around New Zealand. We suggest that the waters to the north-east of New Zealand and around the Chatham Islands may hold key habitat for these cryptic species. Likely calving season for Gray's, straptoothed and Cuvier's beaked whale is described in addition to seasonal and sex-biased patterns of stranding mortality. Mature female Gray's beaked whale strand more consistently during summer and autumn, coinciding with the likely calving season for this species. In contrast mature males strand throughout the year. We also comment on stranding distributions of the additional 10 ziphiid species and preliminary results of analysis of population structuring in Gray's beaked whale. As beaked whales are known to be threatened by anthropogenic activity in other parts of the world, these records provide a critical baseline for understanding future impacts due to planned development in New Zealand waters.

Global genetic structure of a cosmopolitan rafting nudibranch: molecular systematics and phylogeography of *Fiona pinnata*

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Long-distance oceanic rafting has been documented in several marine invertebrate species and represents an important dispersal mechanism with implications for biogeography. The pelagic nudibranch *Fiona pinnata* (Mollusca: Gastropoda) occurs exclusively on macroalgal rafts and other floating substrata, and displays circum-tropical and circum-temperate distribution. Although it was one of the very first aeolid nudibranchs to be recognized and identified, this study represents the first molecular data for this animal. *Fiona pinnata* is presently considered the sole species of the monotypic family Fionidae, but given its "cosmopolitan" distribution it is possible that cryptic regional lineages exist within this taxon. This study therefore entails a global genetic analysis of specimens collected from different rafts worldwide in order to elucidate the genetic structure across widespread populations of this ubiquitous nudibranch. Phylogenetic analysis of DNA sequence data generated from modern and museum samples will be used to assess the hypothesis that rafting maintains gene flow on trans-oceanic scales. By examining these global patterns we can explore the extent to which oceanic rafting facilitates genetic connectivity over broad geographic ranges and thereby further our understanding of the evolutionary significance of this biological process.

Temporal dynamics of detrital pulses: first in, best dressed?

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Detritus is the main carbon pathway in estuarine ecosystems, supporting dense and diverse ecological communities. On intertidal mudflats, detritus arrives as a spatial subsidy from adjacent habitats and its supply is often highly variable in space and time. Previous studies have largely assessed the decomposition of single or mixed species of detritus entering sediments simultaneously. However the supply of detritus to the ecosystem is not continuous. Subsidies frequently arrive as a series of discrete pulses of single or mixed species, which vary in frequency and volume. The temporal dynamics of detrital subsidies has seldom been considered in decomposition studies. Here we investigated how pulses of subsequently arriving material influence the decomposition of two species of common seagrass wrack in NSW, *Zostera muelleri* and *Posidonia australis*. We established single and mixed species litterbags, and examined how subsequent detrital pulses of the same or different detrital resources influenced decomposition rates of (1) the first arriving species and (2) the subsequently arriving species. The decomposition of both species was influenced by species identity, the order in which species arrived, the presence of existing detritus and seasonality. These effects on the decomposition rates of donor species may have cascading effects on the ecosystem. The results highlight the need to include the temporal as well as the spatial dynamics of heterogeneous detrital resources in models of carbon cycling.

What are we doing to our seabirds? How Australasian seabirds on the Great Barrier Reef are being impacted by marine debris.

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Marine debris is a major pollutant of oceans worldwide, and has far reaching effects on the users and inhabitants of the marine environment. Globally, it has been shown that over 43% of seabird species are affected by marine debris; however, not much is known about these impacts locally, especially on the much acclaimed Great Barrier Reef. This project seeks to remedy this by examining the prevalence of marine debris on beaches, and by examining its impacts on seabirds. As the southern reef supports a high percentage of breeding and nesting seabirds; this project aims to increase our knowledge of the risks and impacts associated with marine debris to these populations and what influence it may be having on recent population declines in the area. This study will focus on two-species of seabird that are known breeders in the Capricorn-Bunker group of islands, the wedge-tailed shearwater (*Ardenna pacifica*) and the brown booby (*Sula leucogaster*). The wedge-tailed shearwater is a Procelliform which is an order of seabird known for its higher incidence of plastic ingestion and transference to chicks. This is a result of the birds' inability or tendency not to regurgitate unless feeding its young. Ingestion of debris by brown boobies' is not known, but they have been seen using plastics in their nests in the Swain Reefs. Preliminary findings indicate that marine debris is prevalent on these offshore islands with close to 90% of this debris made up of plastics. Seabird interaction with this debris will be discussed and the implications for management of these species and habitats detailed.

Feeding ecology of *Parma mccullochi* (Pomacentridae) and its ecological role in fish herbivory in temperate algal-dominated reefs

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Pomacentridae is one of the most representative families of herbivorous fishes inhabiting both tropical and temperate reefs, with 29 genera and more than 350 species. The abundance of Pomacentridae in Western Australian waters is amongst the highest in the world, especially the genus *Parma*, which is the most abundant in temperate reefs. Despite the high abundances of *Parma mccullochi* in temperate waters of Western Australia, and their likely importance in removing algae from reefs in the region, there is a lack of information on their diet composition and their impact on the reef algal community. This study aims to examine the role of *P. mccullochi* as herbivores on temperate algal-dominated reefs in the metropolitan waters of Perth, Western Australia. The first stage of the study focuses on the dietary composition of *P. mccullochi* through gut content and stable isotope analyses, particularly examining ontogenetic differences in the diet. The second stage of the study focuses on the impact of the feeding activity of *P. mccullochi* on the algal community and recruiting algae on temperate reef, through examining algal composition inside and outside *P. mccullochi* territories, and through an exclusion experiment using recruitment tiles. As this study in its first year, the poster will outline the planned approach of the study, and highlight preliminary results and conclusions.

Anti-proliferative and Anti-metastatic Activities of Marine Sponges collected from the South Australian Coastline

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This study was to search for novel chemotherapeutic compounds from marine sponges collected from the coastline of South Australia. Non-polar and polar extracts from twelve sponge species were screened for anti-cancer activity against three types of human cancer cell lines: colon cancer DLD-1, lung cancer A-549, and prostate cancer DU-145. Using non-polar extracts, ten out of twelve species tested showed anti-proliferative effect on all three cell lines tested, especially A-549, as detected by the Crystal Violet assay. The IC₅₀ values ranged from 1.0 to 40 µg/ml. However, no significant anti-proliferative effect was observed after treatment with polar extracts. To identify the active compounds, the most active extract from the sponge *Acarnid* sp. was selected for fractionation using n-hexane (F1), dichloromethane (F2), butanol (F3), 50% methanol (F4), and 100% methanol (F5). The cytotoxicity of each fraction was tested on the A-549 cell line. F2 and F3 were found to be active, with IC₅₀ values of 0.5 and 5 µg/ml, respectively. Anti-metastatic activity of F2 and F3 on A-549 cell line was investigated at non-toxic concentrations (0-0.25 µg/ml for F2 and 0-1.25 µg/ml for F3). Treatment with F2 at 0.25 µg/ml at 48 h inhibited the abilities of motility (approximately 40%), migration (57%), and invasion (72%) of A-549 cells compared with the untreated control, as detected by the Wound Healing, Migration and Matrigel Invasion Boyden chamber assays. However, F3 did not show anti-metastatic activity under the tested conditions. Taken together, the sponge extracts exhibit potential anti-cancer activity. These extracts are currently undergoing further analysis to identify the active constituents and to investigate the underlying anti-cancer mechanisms.

MITs: The NIWA MAFBNZ Marine Invasives Taxonomic Service

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Increasing awareness of the potential impacts of invasive marine species and the need for the accurate identification of specimens collected through biosecurity projects led to the creation of the Marine Invasives Taxonomic Service (MITs) in late 2005, within the National Institute of Water and Atmospheric Research Ltd (NIWA). MITs provides a centralised service responsible for the identification, curation and storage of marine specimens collected under Biosecurity New Zealand surveys (a department of the Ministry of Agriculture and Forestry) as well as incidental collections made by the public. Since its establishment, MITs has received approximately 40,000 sample lots and identified over 70,000 specimens. From these ~1200 species have been identified, of which 276 are alien to New Zealand.

Thin terrestrial sediment deposits on intertidal sandflats: effects on bivalve burial behaviour and porewater chemistry

Wilson presenting: Hohaia, Aysha, Kay Vopel, Peter Wilson*

Refer 'Hohaia' for abstract.

Benthic Macroinvertebrate Community Response to ongoing Low-level Metal Contaminated Sediments

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Assessments of estuarine ecosystem health or anthropogenic impact should comprise some level of benthic macroinvertebrate community assessment. In order to interpret macroinvertebrate community response to anthropogenic impact there must be an understanding of ecosystem thresholds, i.e. for a community change to occur, what concentration must be exceeded and over what time period. Previous research into benthic community response to anthropogenic impact has described an opportunistic community within the contaminated zone that is gradually replaced by a more 'balanced' community. This trend has largely been described in relation to large industrial spills or highly polluting effluent drains and it gives useful information on community response to very toxic events that are composed of a variety of contaminants. It does not however give direct cause and effect evidence for individual pollutants, nor does it give information on how abundance and species distribution changes with long-term exposure to lower concentrations of pollution. Also lacking are benthic community endpoints that are relevant for monitoring 'cleaner' or less contaminated environments. We are currently investigating estuarine macrobenthic community response to specific metal concentrations in the sediment using direct field manipulation over a seasonal timescale. Intertidal sediments at Little River, Port Phillip Bay, Australia were spiked with copper (50 ppm) and zinc (150 ppm) using a slow release method of metal spiked plaster blocks. At bi-monthly intervals the macroinvertebrate community were collected and sorted. It is predicted that these results combined with physical and chemical data from the site will elucidate any avoidance behaviour displayed by macroinvertebrates to low (beneath Australian guidelines) metal contamination. Results will also demonstrate the changes in species abundance and distribution in response to ongoing contamination. This study will assist in determining real world tipping points for estuarine ecosystems, especially those not receiving large industrial effluents but rather ongoing low concentration anthropogenic waste.

Phylogenetic Diversity of Cultivable Actinobacteria Associated with Ascidians *Styela plicata* and *Molgula manhattensis* from the South China Sea

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The cultivable diversity of actinobacteria was investigated from the ascidians *Styela plicata* and *Molgula manhattensis* collected in coastal waters of the South China Sea. A total of 111 purified actinobacteria were cultivated using five different actinobacteria selective media. There are significant differences among the number of species and genera of isolates recovered from various media, illustrating the importance of optimizing the isolation conditions. Molecular techniques were applied to investigate actinobacterial species diversity. The phylogenetic affiliation of the microbial isolates was assessed using a combination of 16S rRNA gene amplification-restriction fragment length polymorphism (RFLP) analysis and 16S rRNA gene sequencing. The 16S rRNA genes of isolates were digested by restriction enzyme HhaI and assigned to 29 and 21 different groups respectively, according to their restriction enzyme pattern. The phylogenetic analysis based on sequencing results revealed a high and distinctive diversity of actinobacteria associated with these two ascidian species. The results demonstrate that marine ascidians are excellent sources of marine actinobacteria currently under exploited for the discovery of new marine natural products.

Effects of moderate nutrient enrichment on seagrass trophic pathways

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The simple paradigm that nutrient enrichment has negative effects on seagrass ecosystems derives largely from extreme eutrophication events (e.g. fish kills, anoxia, toxic algal blooms), yet moderate nutrient enrichment, which is typical of urbanized catchments, could have positive effects on seagrass ecosystems through increases in productivity. We tested the hypothesis that moderate nutrient enrichment would enhance primary (algal epiphytes) and secondary (invertebrate grazers) production, leading to an increase in the growth and condition of seagrass-associated fish. Our approach involved field comparisons of developed (i.e. urbanized) vs. undeveloped catchments. Results showed that fish in undeveloped catchments had significantly higher (~20%) lipid content (as a proxy for condition) compared to fish from developed (enriched) catchments, even though the abundance of grazing invertebrates (their food source) and epiphytic algae was considerably lower in undeveloped catchments. We suggest that direct negative effects of catchment development – such as toxicity from associated pollutants – might explain why fish did not respond positively to moderate nutrient enrichment despite an apparent increase in food availability. In conclusion, our results suggest that moderate levels of nutrient enrichment were not beneficial to seagrass-associated fish

Upper Ocean Heat Balance off the West Coast of Australia

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The poleward Leeuwin Current, a warm eastern boundary current, dominates the surface circulation off the west coast of Australia. It carries warm and fresh tropical waters southward with a clear seasonal cycle and cools by about 5°C along its path. Understanding the upper ocean thermodynamics in the Leeuwin Current region is important to understand its impacts on the marine ecosystem off the west coast of Australia. A heat budget analysis is performed using a high resolution (~2km) hydrodynamic model ROMS (Regional Ocean Modelling System). The regional ROMS model is downscaled from a global model OFAM (Ocean Forecasting Australia Model) and its result is validated against IMOS monitoring temperature data and satellite TMI (TRMM Microwave Imager) SST. Seasonal variation of upper ocean heat balance off the west coast of Australia is presented in this study. Preliminary analysis shows that upper ocean heat budget is predominantly balanced between the Leeuwin Current heat advection and heat flux across the air-sea interface. Meanwhile the daily water flux of the Leeuwin Current calculated from the model shows its variation at different time scales. Both coherence spectral and numerical experiments suggest that remote wind control the variation of the Leeuwin Current flux at longer time scale (1~3 months) while local wind control the variation at shorter time scale (a few weeks).