Abstracts in alphabetical order of presenter

Posters

The New Zealand Marine Pest Porthole

Hernando Acosta[1], Brendan Gould[1], Simon McDonald[1], Graeme Inglis[2], Brent Wood[2]
Ministry of Agriculture and Forestry[1], NIWA[2]

The ultimate goal of the biosecurity system is to protect the economy, environment and people of New Zealand from the risks associated with, and consequences of, the introduction and presence of non-indigenous species. Marine surveillance activities are an essential component of this system and allow MAF to collect, collate, analyse and interpret information on the presence, distribution or prevalence of risk organisms and the plants or animals that they affect. A key component of this system is to ensure that people involved in marine biosecurity have immediate access to surveillance information when required. MAF Biosecurity New Zealand, NIWA and other agencies that contribute to early detection, eradication and management of marine pests and diseases maintain datasets on current distribution and biosecurity status of non-indigenous species within New Zealand. However, the availability of these data is currently limited. A key goal of the Biosecurity Surveillance Strategy (Goal 12) is increased awareness of, and appropriate access to, surveillance data and other information that supports biosecurity activities. MAF Biosecurity New Zealand and NIWA, in association with SilverStripe Ltd, are developing the New Zealand Marine Pest Porthole: a web-based information portal that provides data on key marine biosecurity surveillance activities. The main features of this portal include (i) a web-mapping application showing sites surveyed for non-indigenous marine organisms and distribution records for individual species, (ii) the ability to interrogate data from a range of marine biosecurity datasets (e.g., Port Biological Baseline Surveys, Marine High Risk Site Surveillance, the Marine Invasives Taxonomic Service), and (iii) a searchable catalogue allowing downloading of information and reports. By providing marine non-indigenous species information to stakeholders and the public, the New Zealand Marine Pest Porthole will build capacity across the biosecurity system. A greater capacity of groups and people external to MAF Biosecurity New Zealand will increase the overall participation across the biosecurity system, thus, enhancing biosecurity management in New Zealand.

Steroidogenic activity in ovary and pyloric caeca during the annual reproductive cycle of common New Zealand starfish *Patiriella regularis*

Khalid Alqaisi[1], Dave Grattan[1], Miles Lamare[1], Katherine Wynne-Edwards[2], Mark Lokman[1]
University of Otago[1], University of Calgary[2]
alqkh943@student.otago.ac.nz

Steroid hormones play important roles in regulation of growth, development and homeostasis in vertebrates. However, vertebrate sex steroid hormones, such as progesterone, testosterone and estradiol-17β, have also been identified in starfish. But until now, the specific role of steroid hormones in reproduction and their synthesis in echinoderms is not yet clear and still debated. *Patiriella regularis* is New Zealand's most commonly rocky shore starfish. It has been used in many studies because it is abundant and its development is typical of asteroids. There is, nonetheless, little information available about oogenesis and steroidogenesis in this starfish. The present study therefore focused on the reproductive cycle of female *P. regularis*, dividing it into stages on the basis of histological analysis and gonad and pyloric caeca indices. Accordingly, the reproductive cycle of this starfish can be divided into five stages; oocyte growth primarily occurs in winter and spring and spawning in summer. This study also investigates steroid biosynthesis and steroidogenic enzyme activity in pyloric caeca and ovary during a reproductive cycle of *P. regularis* using HPLC coupled with tandem mass spectrometry (LC-MS/MS).

pH-stat technique to investigate of the kinetics of calcium carbonate dissolution

Zhaleh Adhami , Patila Amosa, Keith Hunter, Kim Currie
University of Otago
Zhaleh.adhami@chemistry.otago.ac.nz

Ocean acidification is a process which leads to an ongoing reduction in the pH of the world's oceans due to increased uptake of anthropogenic CO_2 from the atmosphere. Increased acidity can impact negatively on marine ecosystems. One of the most severe effects is the slowing down or inhibition of calcification as well as enhancing calcium carbonate dissolution rates in calcifying organisms. The proposed study will apply the pH-stat technique to investigate the effects of the nature of $CaCO_3$ used and of the seawater composition on the kinetics of calcium carbonate dissolution at steady-state disequilibrium. In every experimental run, a sample of CaCO3 (calcite or aragonite) in synthetic seawater will be titrated in an open cell system by 0.02 M HCl at 25 degrees Celsius. Based on the volume of HCl consumption as a solid carbonate dissolves changes in the mass of the sample over a period of time and thereby rate of dissolution can be calculated. Experiments will be conducted at different values of $CaCO_3$ saturation state. The empirical equation $R = k(1-\Omega)^n$ (where k and n are constants) will then be used to describe the kinetics of dissolution.

Physiological comparisons between the temperate brachiopod *Liothyrella neozelanica* and the Antarctic brachiopod *Liothyrella uva*.

Matthew Baird, Miles Lamare, Daphne Lee
University of Otago
mattiejb@gmail.com

Brachiopods occur throughout modern day oceans ranging from polar to tropical environments. This extensive range provides an exciting opportunity to gain insight into how marine invertebrates have adapted to differing climates and habitats. *Liothyrella neozelanica* is a temperate brachiopod found within Doubtful Sound, New Zealand, whilst its sister species *Liothyrella uva*, is a polar brachiopod found within the Southern Ocean. By studying and comparing the biological attributes of both species, we can begin to understand how they have become specifically adapted to their environments. Furthermore, through these differences it may be possible to see how brachiopods and other marine invertebrates may be affected in the future in response to threats including climate change and changes in patterns of primary productivity. Research comparing seasonal changes in biochemical composition (i.e. protein, lipid and carbohydrate levels), metabolic rates (respiration & excretion) and reproduction of *L. neozelanica* and *L. uva* has been undertaken. Metabolic and biochemical differences between the two species are emerging and may reflect the stark contrast in temperature and productivity found between the two environments of the two species. As research continues these differences will gain greater clarity and provide further insight into how brachiopods and other marine invertebrates may respond in the future to environmental change.

Modelling Distribution of Natant Decapod Shrimps in the Ross Sea, Antarctica

Md. Zeenatul Basher[1], Mark J. Costello[1], David A. Bowden[2]
University of Auckland[1], NIWA[2]
zbasher@gmail.com

This study modelled the distribution of natant decapod crustaceans to identify what environmental variables most influenced their distribution and predict their distribution in the Ross Sea, Antarctica. Nine species were recorded, namely *Nematocarcinus lanceopes*, *Chorismus antarcticus*, *Notocrangon antarcticus*, *Pasiphaea scotiae*, *Pasiphaea cf. ledoyeri*, Dendrobranchiata, *Petaldum* sp., *Pasiphaea* sp. and *Lebbeus* sp. The geographic distribution of *N. lanceopes* and *N. antarcticus* was predicted from samples of 59 individuals and over 390 video observations from 19 locations between 72 and 2300m depth during the New Zealand IPY-CAML research voyage (TAN0802) in 2008. The Maximum Entropy (MaxEnt) species distribution modelling technique was used with environmental data layers from three datasets comprised of distance from shore, depth, slope,

rugosity, ice coverage, bottom temperature, bottom salinity, current speed, chlorophyll-a, dissolved O2, silicate, nitrate and phosphate concentration. The predicted distributions of the species were validated using independent species distributions records. Models having different spatial resolutions ranked the variables differently. The most important environmental variables influencing the species distributions were bathymetry and ice concentration for *N. lanceopes*, while bottom temperature and chlorophyll-a concentration contributed most to the distribution of *N. antarcticus.*

Recent mass strandings of long-finned pilot whales on Stewart Island

Emma Beatson,[1] Steve O'Shea[1], Karen Stockin[2], Severine Dewas[1]
Auckland University of Technology[1], Massey University[2]
emma.beatson@aut.ac.nz

Preliminary biological data are reported from two recent long-finned pilot whale (*Globicephala melas*) mass strandings on Stewart Island. Post-mortem sampling was conducted on 19 (out of 28) animals that stranded at West Ruggedy Beach on 14 February 2010, and 105 (out of 107) animals that stranded at the south end of Mason Bay on 20 February 2011. Sex, total body length (TBL), teeth, stomach contents and reproductive samples were collected from both events. The sex ratio in both stranding events was biased towards females, 54.5% and 65.7% respectively, although mature males were present in both groups. Males ranged in total body length (TBL) from 213 to 570cm (mean=413, SD=108, n=45), and females from 196 to 485cm (mean=391, SD=67, n=79). Females matured sexually at body lengths of 300 to 400cm. Of 8 sexually mature females identified from the West Ruggedy stranding, 37.5% (n=3) were resting, 62.5% (n=5) were pregnant and none were lactating; of 41 sexually mature females identified from the Mason Bay stranding, 58.5% (n=24) were resting, 29.3% (n=12) were pregnant, 9.8% (n=4) were lactating, and one whale was simultaneously pregnant and lactating. Evidence of ingested prey was found in the stomachs of the majority (94.1%) of the pilot whales examined from both strandings. Analysis of stomach contents, ageing of teeth and further processing of reproductive samples is currently underway to provide the first comprehensive data set on age, growth, male and female reproductive parameters, and diet of pilot whales in this region. These data contribute to a long-term study on the biology and conservation status of pilot whales (*Globicephala* spp.) in New Zealand waters.

Stable isotope analysis in ecological studies: the NIWA analytical facility

Julie Brown, Sarah J Bury
NIWA
j.brown@niwa.co.nz

NIWA's Thermo Scientific DeltaPlus IRMS stable isotope analytical facility is part of a larger mass spectrometry facility housed at Greta Point, Wellington. The DeltaPlus IRMS supports ecological research for both internal and commercial clients, including applications such as marine biogeochemistry, pollution management, lake restoration, terrestrial and marine conservation, food web studies, aquaculture and fisheries management. The DeltaPlus, a continuous flow isotope ratio mass spectrometer, is linked to an elemental analyser (EA) and determines concentrations and stable isotope ratios of carbon and nitrogen in solid organic samples. Our system is highly sensitive with excellent linearity and is optimised to handle very low level nitrogen samples (e.g. sediments and open ocean phytoplankton samples). Data on linearity, sensitivity and accuracy will be presented.

High resolution seismic imaging of the active Akatore-Green Island Fault System on the Shallow Otago Continental Shelf

Callum Bruce, Andrew R. Gorman, Richard J. Norris
University of Otago
bruca012@student.otago.ac.nz

The offshore extent of the active Akatore Fault, a NE- SW trending reverse fault that runs along the coast SW of Dunedin is poorly constrained. The Akatore Fault is associated with several possible offshore coast-parallel faults based on shallow controlled-source seismic data. Historical earthquakes, including those of 1974 and 1989, are attributed these faults. Single-channel electro-acoustic Boomer seismic reflection data and side scan sonar profiles have been collected on the shallow Otago shelf south of Dunedin, over the last 3 years. The majority of lines were collected along NW-SE azimuths, running from just outside the surf zone (<10 m water depth) to a maximum of 28 km offshore (~75 m water depth). Survey lines were approximately 250 m apart near shore and up to 5 km apart offshore. Boomer subsurface penetration is limited, primarily by the presence of multiple reflections. Primary reflections were recorded from sub-seafloor depths of up to 100 m. Several significant structures were imaged within the survey area, principally the Akatore and Green Island Faults. The Akatore Fault was imaged very near shore in the southern portion of the survey, and a minimum displacement of 55 m was calculated. Offset on the Green Island Fault, a high-angle reverse fault was relatively well constrained to ~200 m (east side up).

Mesozooplankton communities in the Ross Sea and the Pacific sector of the Southern Ocean

Catherine Stevens[1], Evgeny A. Pakhomov[2], Karen V. Robinson[1], Sarah J. Bury[1]
NIWA[1], University of British Columbia, Canada[2]
catherine.stevens@niwa.co.nz; s.bury@niwa.co.nz

Zooplankton communities in the Ross Sea and many parts of the Southern Ocean remain largely uncharacterised. In particular, empirical measurements of mesozooplankton biomass that are vertically resolved are few; such estimates are important components of ecosystem models. Mesozooplankton abundance, biomass and taxonomic composition were determined in net samples collected during the NZ IPY-CAML voyage. Sampling was conducted at 11 stations in the Ross Sea and Antarctic Circumpolar Current region. Numerically, copepods dominated zooplankton samples and were represented primarily by calanoids and cyclopoids. However, locally pteropods and salps made important contributions to mesozooplankton abundance. Maximum zooplankton abundance was located in the uppermost sampled layer, except where salps were plentiful. Overall, small copepods dominated the catches. Ctenocalanus sp. was the principal surface-layer copepod species on the Ross Sea Shelf, while Oithona spp. were highly abundant on and around Admiralty Seamount. On the Ross Sea slope, both *Oithona* spp. and *Oncaea* spp. were dominant, and at the Scott Seamounts, mixtures of *Oithona* spp. and *Ctenocalanus* sp. occurred. Peak mesozooplankton biomass was usually located in the upper 200 metres of the water column and cumulative values ranged from 0.64 to 9.13 mg C m^{-2} overall. These levels are low compared to other Antarctic regions.

Changes in the physiological biomarker responses of New Zealand green mussels, *Perna canaliculus* in response to acute cadmium exposure

Rathishri Chandurvelan, Dr Sally Gaw, Dr Chris Glover, Assoc Prof Islay Marsden
University of Canterbury
rch118@uclive.ac.nz

Cadmium is a toxic trace metal that causes deleterious effects in marine organisms. Biological mechanisms that are indicative of further impacts are a useful tool to assess the potential threat of pollutants to marine biota. Bivalves may be a useful indicator group owing to their widespread distribution in near-coastal regions, the major ecosystems affected by toxicants. Preliminary research established NZ green mussel (*Perna canaliculus*) as the most sensitive of several bivalve species tested. Subsequently physiological markers were assessed in this species to determine cadmium

toxicity mechanism and identify potential markers of cadmium exposure. Cadmium was shown to significantly impact feeding and digestive capacity, with a 89.5% decrease in clearance rate, a 39% decrease in absorption efficiency and a 63.5% increase in excretion rate shown at 4 mg L^{-1}. Combined these data indicated that cadmium had a significant negative impact on mussel scope for growth. The results obtained are clear evidence that cadmium causes severe physiological stress by affecting the health and growth potential in green mussels. This study has demonstrated the feasibility of employing *Perna canaliculus* as a bioindicator for NZ coastal regions and application of physiological biomarkers as a sensitive and cost-efficient tool in biomonitoring of coastal pollution.

The effects of sedimentation on the growth and mortality of juvenile *Haliotis iris* and their living habitat (crustose coralline algae)

Caitlin Chew, Dr. Chris Hepburn, Dr. Wayne Stephenson
University of Otago
checa985@student.otago.ac.nz

Coastal sedimentation is one of the most significant land-based sources of degradation of rocky coasts. There are a range of direct and indirect ecological effects that result from both increased turbidity and sediment deposition. Currently, gaps in knowledge make it difficult to predict the effects of sedimentation on individual species and ecological assemblages on rocky coasts. There is a need for further research into the effects of sedimentation on coastal ecological systems and their constituents. The purpose of this experiment is to determine the effects of sedimentation on the growth and mortality of juvenile *Haliotis iris* and their living habitat (crustose coralline algae). The growth and health of *H. iris* will be measured via changes in length, weight and righting time of individuals, and a PAM fluorometer will be used to monitor photosynthetic activity for coralline algae as a response to two levels of sedimentation. It is hypothesised that sedimentation will inhibit growth, decrease health and increase mortality of H. iris and decrease the health of crustose coralline algae.

Deployment of a telemetered water quality monitoring system in Tasman Bay

Paul Barter[1], Kent Headley [2], Paul Coenen[2], Paul Gillespie[1], Chris Cornelisen[1]
Cawthron Institute[1], Monterey Bay Aquarium Research Institute, USA[2]
chris.cornelisen@cawthron.org.nz

The establishment of observation platforms that provide robust, long-term datasets for state of the environment (SOE) monitoring of New Zealand's coastal waters is imperative in the face of changing and intensifying land uses and climate change. In April 2011, Cawthron, in collaboration with the Monterey Bay Aquarium Research Institute (MBARI) deployed a long-term, real-time monitoring system in Tasman Bay. The state-of-the-art telemetered system, named TASCAM (TASman Bay, CAwthron, and MBARI Mooring) utilises inductive communication technology. In simple terms, the system uses the steel mooring cable as its transmission medium to talk to the mid-water instruments, and eliminates the need for electrical cables. The OASIS (Ocean Acquisition System for Interdisciplinary Science) controller developed by MBARI is used for the collection, storage, and telemetry of data from a wide range of instrumentation, including conductivity-temperature-depth sensors, fluorometric sensors, an Acoustic Doppler current profiler, and a met system. TASCAM is intended to provide time-series data to a range of end users, including Councils for SOE monitoring, researchers, the aquaculture industry, commercial and recreational fishers, and ports/harbours. TASCAM provides a model for future standardised systems for monitoring the state of New Zealand's coastal waters and will make an important contribution to international ocean observation networks.

Sharks, Drugs, and chalarosomum!

Matthew Crane, Christy Benton, Adelle O'Neill, Haseeb Randhawa
University of Otago
matthew.crane@otago.ac.nz

The New Zealand Marine Studies Centre has had trouble keeping draughtsboard sharks (*Cephaloscyllium isabellum*) alive for more than a year in captivity. Recent necropsies have shown a large number of tapeworms (*Calyptrobothrium chalarosomum*) in the intestines of these sharks. Dissection of wild caught draughtsboard sharks showed no significant difference in parasite biomass between captive and wild caught draughtsboard sharks. This raised a question: are cumulative effects of multiple stressors causing the parasite load, normal in the wild, to become too much for a captive animal? This study tested the efficacy of different dosages of a known mammalian anthelmintic. This was done with wild caught draughtsboard sharks in laboratory conditions. Once the most effective dose rate was established a number of sharks were released into the normal display environment. Half of these were treated at the determined dose rate and half were untreated. All were tagged and monitored to determine whether treated animals survived longer than untreated animals. The stress of a captive environment can have adverse effects on the shark's immune system. Ratios of different blood cells and blood pH levels were used as indicators of stress and measures of recovery from stress, respectively, between treated and untreated sharks.

The effects of sewage outfall on the marine environment.

Matthew Desmond
University of Otago
matt.des@hotmail.com

The disposal of wastewater and sewage is an ever threatening problem as population growth increases. This problem comes as land based treatment methods either struggle to effectively dispose of rising amounts of waste or are not economically feasible in certain areas where they are needed. The alternative to this problem is often the discharge of sewage, which may or may not be treated, into the ocean. This has the potential to cause adverse unknown effects to the physical and biological characteristics of the immediate oceanic environment. This study looks at the effects of land sewage disposal on the neighbouring marine ecosystem within the East Otago Taiapure area. It specifically focuses on the influence to the blue mussel *Mytilus edulis galoprovencialis*, with a community-based stance of providing knowledge for such a valuable resource.

Reproductive potential of Päua, *Haliotis iris* and models for sustainable customary harvesting using mätauranga

Gaya Gnanalingam
University of Otago
gaya.gna@gmail.com

Blackfoot Paua (*Haliotis iris*) a species unique to New Zealand is of considerable importance, as a significant customary fishery for Mäori, a much-valued recreational fishery for all New Zealanders and as one of the few remaining commercially viable abalone fisheries in the world. Paua are unfortunately in decline and stock management needs to take into account knowledge of paua biology and ecology in order to restore populations. The aims of this research are to assess the reproductive potential of different size classes and use this information to predict the impacts of different harvest strategies. In particular, comparing a strategy based on mätauranga Mäori (traditional ecological knowledge) of harvesting intermediate sized paua, and the current regulatory regime of maximum legal size. Reproductive potential will consider both the number of eggs produced by individual paua and the quality of these eggs, using a measure of their lipid content. Egg quality will also take into account the food available in the paua habitat. Fertilisation rates of these eggs will provide the final measure of reproductive output, which will be tied to size frequency and density data to model the different harvest strategies.

Relationship between particulate matter and optical side-scattering in the Hahei Marine Reserve

Carole Guggenheim, Ben Trinik, Kay Vopel
Auckland University of Technology
kay.vopel@aut.ac.nz

Suspended particulate matter concentration (PM) is an important parameter in coastal ecosystem studies. For example, PM is used to determine when sediments and associated contaminants are resuspended and transported. Because it is often impractical to measure PM at high temporal and spatial resolution with laboratory techniques, surrogates and approaches have been developed to provide such resolution. In one approach, a defined volume of water is illuminated in situ with near-infrared (NIR) light to measure how much of this light is scattered by suspended particles at 90° relative to its path. The conversion between this side-scattering and PM is constrained, however, because light scattering is affected by particle properties. If properties of particles in coastal regions differ then establishing region-specific conversion factors becomes imperative. We ask to what degree the relationship between PM and NIR side-scattering varies in New Zealand's coastal waters. To begin to answer this question, we established a conversion factor for particles suspended in the Hahei Marine Reserve from a known particle source, a landslide in the eastern region of the reserve. In addition, we used this conversion to contrast the effects on PM of a natural disturbance event (landslide) with that of human land use.

Do pore water solutes mediate bacterial metabolism and juvenile bivalve behaviour?

Aysha Hohaia, Dr. Kay C. Vopel[1], Conrad A. Pilditch[2]
Auckland University of Technology[1], University of Waikato[2]
oompaz@hotmail.com

Climate change models predict an increase in the frequency of extreme rainfall and thus the supply of terrigenous sediments to coastal waters. Understanding how this supply affects coastal ecosystems has become important for coastal managers worldwide. Here we describe an experiment designed to investigate how thin surface deposits of terrigenous clay affect settlement decisions of benthic juvenile recruits. This experiment builds on previous studies that revealed evidence for a link between bacterial activity in the sediment underlying terrigenous clay deposits and the behaviour of the recruits on the surface of the deposit: reduced end products of the anaerobic microbial decomposition of organic matter diffuse upwards across the terrigenous clay deposit informing the recruit about poor substrate suitability. This effect results from an increase in the diffusive distance for the transport of oxygen from the seawater into the clay-underlying sediment, that is, a reduced supply of oxygen to the sediment. To test this model, we will study the behaviour of juvenile Macomona liliana in a laboratory flume. We hypothesize that juveniles that reject the surface of terrigenous clay deposited onto organic-rich coastal sediment will not reject the surface of the same clay if it was deposited onto sterile coastal sediment.

Understanding the biogeochemical cycle of trace metals: Speciation in the Kaipara Estuary

Birthe Kortner, Sylvia Sander, Keith A. Hunter
University of Otago
bkortner@chemistry.otago.ac.nz

The trace elements zinc and copper act as essential micronutrients in aquatic ecosystems. They fulfil important roles in biochemical pathways, but also exhibit toxic properties at higher concentrations. Therefore, depending on the geochemical characteristics of the ecosystem, microorganisms have developed strategies for metal homeostasis. The mechanisms for uptake and detoxification of trace metals largely depend on their chemical speciation and are often specific for each element. Kaipara Harbour, which is the largest estuary complex in New Zealand, is a highly dynamic transition zone between freshwater systems high in nutrients and the saline, relatively nutrient-poor marine system. This chemical variability is further enhanced by tidal and seasonal fluctuations as well as

anthropogenic activities. An increased understanding of the speciation pathways, especially the identification of organic ligands involved in the complexation of trace elements, can provide valuable information about the regulation of bioavailability and toxicity by aquatic organisms. These questions are to be addressed in a three-year research project to be carried out at the University of Otago. Insights gained can then be used to assess the water quality in Kaipara Harbour and monitor changes associated with increased human use of the area.

Predation by the sea star *Astrostole scabra* on New Zealand rocky reef prey communities: Implications for the management of exploited paua (*Haliotis iris*) populations.

Rory Kyle
University of Otago
roryj_kyle@hotmail.com

Astrostole scabra (Asteroidea) is a generalist predator of New Zealand's temperate rocky reef ecosystems. Recent observations suggest that *A. scabra* abundance may be increasing, limiting the recovery of Haliotis iris populations depleted by overfishing. Wave action has a strong influence in rocky reef ecosystems, and is known to directly reduce asteroid predation success by reducing speed of movement and successful capture rates. Therefore *A. scabra* interactions with prey are expected to change in relation to wave-exposure. The aim of this research is to asses *A. scabra* interactions with prey communities, to determine: 1) if wave exposure limits predation, 2) if *A. scabra* diet varies between reefs subjected to different levels of wave-exposure, and 3) if the recovery of depleted *H. iris* populations is limited by *A. scabra* predation. Preliminary results indicate *A. scabra* abundance, movement and predatory success is negatively impacted by water motion. Predator-prey interaction parameters (including: predator preference, prey escape rates, and density of prey and A. scabra populations) will be examined experimentally, and via field surveys. Parameters will be incorporated into a predictive model, to investigate the likely effect of *A. scabra* predation at specific reefs, based on wave-exposure. This research will be shared with Taiäpure and Mäitaitai managers to develop site specific management techniques for restoring H. iris populations.

Sea star fertilisation and larval development under in vitro simulated ocean acidification

Maria Gonzales-Bernat, Miles Lamare
University of Otago
miles.lamare@otago.ac.nz

Most marine species (ca. 70% of marine invertebrates) have external fertilisation and dispersive larvae that play a key role in marine populations dynamics so understanding on the effects of ocean acidification (OA) and on marine populations requires knowledge of larval responses. The response of larvae to OA scenarios has mainly been undertaken on calicifying larvae (such as molluscs and echinoderms) with few studies on non-calcifying larvae. Equally important is understanding how high latitude species respond to OA given that polar sea surface waters will be affected earliest (i.e. an undersaturation of calcite and aragonite). We examined responses to OA in the larvae of two species of sea stars, an Antarctic species *Odontaster validus* and a New Zealand species *Pateriella regularis*. We examined fertilisation, larval development and morphology and survival in these species when exposed to ambient seawater (pH 8.1 or pH 8.2), to seawater pH predicted for 2100 (pH 7.7 and pH 7.6) and an extreme seawater pH of 7.0, adjusted by bubbling CO_2 gas into filtered seawater. Fertilization in *Odontaster validus* and *Patiriella regularis* for the predicted scenarios of seawater pH in 2100 was robust. Larval survival in both species was not significantly reduced when reared at pH 7.8, but mortality increased significantly when pH dropped below 7.6. Normal size and shaped larvae were observed for *O. validus* and *P. regularis* reared in pH 7.8 seawater, however pH levels below 7.6 resulted in smaller and under-developed larvae in both species. Overall, this study indicated that sea star reproduction and larval viability was largely unaffected at pH levels predicted for the year 2100, increasing our understanding of the robustness of larvae to pH changes in a lesser studied but important marine group.

Habitat-forming coldwater corals show affinity for seamounts in the New Zealand region

Kevin Mackay, Di Tracey, Ashley Rowden, Tanya Compton
NIWA
k.mackay@niwa.co.nz

Determining the distribution of habitat-forming scleractinian corals in the New Zealand region is necessary in order to understand the ecological significance of these taxa and the likely impact of anthropogenic activities on their persistence. Historical records from early publications, research trawl survey, commercial fishing bycatch, and recent biodiversity surveys were compiled for the habitat-forming coral species *Madrepora oculata*, *Solenosmilia variabilis*, *Goniocorella dumosa*, *Enallopsammia rostrata*, and *Oculina virgosa*. These data were used to describe the observed depth, geographic distribution, and geomorphic habitat associations of the study corals in the region. A boosted regression trees analysis was also used to identify which of eleven environmental variables best describe the distribution of the five species across the New Zealand region, and to predict their spatial distribution. The contribution of the environmental variables differed greatly between species, but consistently identified depth and seamount occurrence as important factors describing coral observations. The models identified that *M. oculata*, *S. variabilis* and *E. rostrata*, occurred in deep waters (>1000 m) where seabed slopes were steep, tidal current and orbital velocities slow, sea surface primary productivity low, and where seamounts generally occur. By contrast, *G. dumosa* and *O. virgosa* were found in relatively shallower waters, where sea surface primary productivity was high and tidal current speeds were generally fast. Spatial predictions were consistent with the recorded observations and identified that all species apart from *O. virgosa*, were distributed throughout the region and were found primarily between ~200-2000 m.

Accessing bathymetry around New Zealand

Kevin Mackay, Helen Neil
NIWA
k.mackay@niwa.co.nz

In July 2010, NIWA released the New Zealand regional bathymetric dataset free for download over the worldwide web at http://www.bathymetry.co.nz. These data represent bathymetry at national scale that encompassed New Zealand's Exclusive Economic Zone (EEZ) in a variety of data formats including: raster data in a 250m resolution digital terrain model as a ESRI binary grid, jpeg and tiff; and contour data in 50m intervals from the coast to the 250m isobath, from then 250m intervals in ESRI shapefile, and MapInfo MID/MIF. Currently there have been over 1,000 downloads from this site. Bathymetric compilation, interpretation, and terrain model was made by the Charting Around New Zealand (CANZ) group at NIWA. Bathymetry was compiled from data held at a variety of national and international data archives, including: the National Institute of Water & Atmospheric Research (NIWA); Royal New Zealand Navy; National Geophysical Data Centre (U.S.); South Pacific Applied Geoscience Commission (Fiji); published scientific papers; recent swath bathymetric surveys funded by NIWA, Institute Francais de Recherche pour Exploitation de la Mer (IFREMER), France; Seabed Mapping New Zealand Limited and Land Information New Zealand (LINZ). Ongoing plans for data release include the NIWA paper chart archive in a digital format and multibeam bathymetry datasets at a survey level.

Digitising the New Zealand Marine Sediment database

Kevin Mackay, Helen Neil, Helen Bostock, Anne-Laure Verdier
NIWA
k.mackay@niwa.co.nz

NIWA (and its predecessor NZOI) have been collecting and analysing sediment from the seafloor around New Zealand and the South Pacific since the late 1950s. The station details (such as station ID, position, and date) were traditionally logged in ledger books and the sediment analysis (grainsize analysis: % sand, % mud, % carbonate) was filed in paper folders. We have just completed a data rescue project involving the digitisation of sediment analysis of ~28,000 samples, reconciling the data with the existing station database, and transferring the data into a GIS. One of the immediate results

from this data rescue project has been the obvious grainsize distribution patterns around New Zealand's shelf. This information will aid with marine benthic habitat classification and other marine sediment resources. The newly digitised data also provides a way of quality controlling highly suspicious sediment sample locations, which maybe the result of errors in the original station position data entry. The next stage of this project will be to create a public searchable web interface for this data and provide data storage for all New Zealand marine sediment data. Please contact us if you have any published grainsize, carbonate, general sedimentary data, to contribute to the database.

Te Whaka a Te Wera Mataitai

Nigel Scott, Te Whaka a Te Wera Mataitai Management Committee
Stewart Island
nigel.scott@ngaitahu.iwi.nz

From earliest time Te Whaka a Te Wera (Paterson Inlet) has held spiritual significance to the Tängata Whenua and provided a rich food basket of mahinga kai to sustain Ngäi Tahu Whänui. For centuries Te Whaka a Te Wera has provided safe haven for mariners seeking shelter and replenishment from the often tempestuous waters of Te Ara a Kiwa (Foveaux Strait). With a maximum depth of 45 metres, the Inlet's combination of rocky reef, sand and soft mud floor bottom is an important habitat for a prolific and diverse range of marine life, including at least 56 different species of fish. The Inlet's estuaries, beaches, reefs and islands continue to provide a bountiful harvest of kaimoana (seafood), enjoyed by locals and ever increasing numbers of visitors. In recognition of the continuing special significance of Te Whaka a Te Wera, Rakiura Mäori, together with support from the Stewart Island community, successfully sought and secured legislative protection with the establishment of Te Whaka a Te Wera Mätaitai in December 2004. This poster will outline the current fisheries management provisions that have been established in Paterson Inlet through the mätaitai reserve.

Population connectivity of New Zealand Sole (*Peltorhamphus novaezeelandiae*) from two, neighbouring South Island regions.

Patricia Mockett, Stephen Wing
University of Otago
patricia.mockett@gmail.com

A key objective of marine ecology is to gain an understanding of the processes driving and maintaining population dynamics, an important factor being the connectivity between subpopulations of organisms. The objective of this study was to determine the level of connectivity between subpopulations of New Zealand Sole, *Peltorhamphus novaezeelandiae* from the neighbouring Otago and Southland regions of New Zealand. *P.novaezeelandiae* individuals of a full range of size classes were collected from five study sites surrounding the Otago Harbour and three study sites in the Foveaux Strait. Both of these regions exhibit unique hydrological and geographical characteristics which have a strong influence on associated biological communities. Morphology and growth data was used to test the hypothesis that populations of *P. novaezeelandiae* could be differentiated by region. Differentiation of growth and morphology is consistent with a low degree of mixing in these populations, implying the existence of separate stocks. Conversely homogeneity of these measures among these regions implies more uniform conditions or mixing of these populations. This commercially harvested species is sparsely documented in the scientific literature and the information provided by this study is in itself an important tool in its management.

Is There A Green House Around New Zealand From Oceanic N_2O Emissions?

Muhammed Nayeem Mullungal[1], Robert Van Hale[1], Russell.D.Frew[1], Cliff Law[2]
University of Otago[1], NIWA
nayeemmuhamed@gmail.com

Nitrous oxide is an atmospheric trace gas which was first identified as an agent in stratospheric ozone depletion and later classified as an important greenhouse gas with a global warming potential 300

times that of CO_2 on a molecular basis. It has important implications for atmospheric chemistry and global climate change. Its concentration of 275ppbv (pre-industrial period) in the ambient air is increased to the current value of 320 ppbv and oceans account for 25-30% of global N_2O emissions. But still the marine nitrous oxide source and processes are a dilemma due to the paucity of data. Two microbial pathways, nitrification and denitrification; dominate N_2O production with their N_2O source product varying with oxygen availability. The study area involves the 60 km Polaris transect and sampling stations of the GP 13 NZ-GEOTRACES, all around New Zealand. This study focuses on the processes responsible for the marine N20 formation and its seasonal and spatial distribution in the ocean along with its exchange with atmosphere by applying stable isotopes. Study involves measurement of N_2O using GC and IRMS both in ocean and surrounding air along with dissolved oxygen.

Organic Complexation of Metals in Deep-Sea Hydrothermal Vent Systems

Zach Powell[1], Andrea Koschinsky[2], Sylvia G. Sander[1]
University of Otago[1], Jacobs University Bremen, Germany[2]
zpowell@chemistry.otago.ac.nz

Deep-sea hydrothermal vents form along tectonic plate margins where seawater seeps through cracks and interacts with molten rocks, scavenging high concentrations of dissolved metals and gases. The mineral rich fluid exits either through super-hot vents forming black or white smokers; or after subseafloor mixing with seawater in diffuse low temperature vents. Both subsequently support a chemosynthetic primary producing biota. Until recently, it was assumed that the majority of metals released were precipitated close to the source and the net flux to the open ocean was negligible. However, the discoveries of metal-binding organic compounds have been shown to greatly increase the flux of hydrothermally-derived trace metals to the global ocean. Neither the chemical nature, nor the exact sources of these compounds are yet known, but it is thought that they are produced by the hydrothermal biota and/or abiotically at high temperature and low pH conditions. This work aims to determine the source(s) and primary function of these metal-binding organic compounds, and their contribution to the global biogeochemical cycling of trace metals. This will be investigated using hydrothermally-influenced seawater from the Kermadec Arc, with electrochemical and mass spectroscopy techniques, and geochemical modelling.

Is ammonium assimilation able to reduce oxidative stress in *Ulva*?

Ralf Rautenberger, Catriona Hurd, David Burritt
University of Otago
ralf.rautenberger@botany.otago.ac.nz

Eutrophication of coastal ecosystems resulting from anthropogenic land-use is an increasingly growing problem in coastal ecosystems. Thus, rapid growth of opportunistic green macroalgae can lead to large blooms. In contrast, these algae can be simultaneously exposed to high radiation conditions, which might have a great impact on photosynthesis. Massive production of reactive oxygen species (ROS) is detoxified by superoxide dismutase (SOD) in the first instance as well as by other enzymes and metabolites of the ascorbate-glutathione-cycle. If ROS production exceeds the scavenging capacity, reduced macroalgal growth or even cell death is a consequence of cellular oxidative stress. The research undertaken with a clone culture of *Ulva* sp. serving as a model organism was addressed to characterize the interactive effects between these two antagonistic environmental factors physiologically. The possible effect of ammonium (NH_4^+) assimilation on detoxification of ROS was the central subject of the studies. The competition between ammonium assimilation and the Mehler reaction for electrons, which originate from the photosynthetic electron transport, was investigated in physiological laboratory studies. Ecological implications on *Ulva's* survival under unfavourable field conditions might be drawn from the revealed physiological results.

Skeletal allometry of the southern New Zealand serpulid *Galeolaria hystrix* (Polychaeta: Serpulidae) in Big Glory Bay, Stewart Island

Marc Andri Riedi, Abigail M. Smith
University of Otago
riema699@student.otago.ac.nz

The serpulid tube worm *Galeolaria hystrix* Mörch, 1863 (Polychaeta: Serpulidae) is common in southern New Zealand and is known to occur individually as well as in dense aggregations. The worm secretes a calcareous protective tube and is usually found subtidally. In Big Glory Bay, Paterson Inlet, Stewart Island *G. hystrix* appears in three different settings; as individual worm attached to rocks, as individual worm living within the sediment or as whole worm aggregations forming so called subtidal patch reefs. Serpulid aggregations enhance local biodiversity by acting as habitat, shelter or as food source for other marine organisms. Despite its importance as temperate reef-builder in New Zealand, *G. hystrix* is little studied. This poster compares the allometry (length, diameter, weight) of the worm's carbonate tubes found in the three different settings. The combination of these allometric results with tube growth rate measurements (ongoing study) will allow the calculation of carbonate production by whole *G. hystrix* reefs by simply analysing a photograph. These results will then demonstrate the importance of *G. hystrix* as an ecosystem engineer and its influence on local carbonate sedimentation.

Free amino acids extraction from oligotrophic seawater and its impact on the oceanographic nitrogen fixation

Amandine Sabadel
University of Otago
asabadel@chemistry.otago.ac.nz

Evaluating the impacts of climate-induced environmental alterations affecting ecological patterns and processes remains a very challenging aim for worldwide marine scientists and oceanographers. Toward this goal, compound-specific stable nitrogen isotope analysis of amino acids by gas chromatography/combustion/isotope ratio mass spectroscopy (GC/C/IRMS) constitutes a fine new approach. First introduced in the 1970s by [Matthews et Hayes, 1978], this method has now been proved to be very efficient and reliable. Moreover, isotopic tracing techniques provide the means of identifying recent nutrient sources for consumers, and allow inferences about the spatial and temporal distribution of organisms which move between isotopically distinct habitats. The NZ-Geotraces cruise of June 2011 is a perfect opportunity to elaborate a vertical and horizontal pattern of nutrient, suspended matter and phytoplankton/zooplankton's distribution, in the southern Pacific Ocean. The close relationship of these data to the hydrographic properties of this transect will be highlighted with accuracy. Then, the study will aim to describe the relative importance of various sources of nutrients to higher trophic-level organisms in the marine ecosystem by applying this analytical method. Secondary aim is to improve the extraction of chosen amino-acids from seawater.

Estuary Benthic Habitat Mapping

Nathan Singleton, Hilke Giles
Waikato Regional Council
Nathan.Singleton@waikatoregion.govt.nz

Waikato Regional Council has a statutory obligation to protect natural resources of the coastal environment. The availability of baseline data is vital to enable the detection of adverse effects that may occur as a result of human activities. Especially in the case of the smaller estuaries we often lack basic data to inform resource consent decisions pertaining to ecological effects of an activity. In 2007/2008 an ‘estuary benthic habitat mapping’ project was initiated in selected Waikato estuaries. The main goal of the mapping project is to derive comprehensive information on the distribution and abundance of common intertidal benthic species (mainly shellfish), and substrate type to inform the

sustainable management of our estuaries. Five estuaries have been mapped to date: Kawhia Harbour, Aotea Harbour, Otahu Estuary, Tairua Harbour and Wharekawa Harbour. The most common species in these estuaries were the bivalves *Austrovenus stutchburyi*, *Paphies australis* and *Macomona liliana*, and gastropods *Diloma* sp., *Cominella* sp., and *Zeacumantus* sp. We found that the majority of *A. stutchburyi* (71-80%) and *P. australis* (69-90%) in most estuaries were juveniles. Extensive seagrass beds occur in each estuary apart from Otahu Estuary. A range of sandy surface sediment types were found over the estuaries.

Seismic oceanography - Processing petroleum industry multi-channel seismic data for water column targets

Matthew Smillie, Andrew R Gorman
University of Otago
smima003@student.otago.ac.nz

Little is known concerning the fine structure of water masses associated with the Sub-tropical Front southeast of the South Island. Multi-channel seismic reflection data acquired perpendicular to this front, which is locally coincident with the north-flowing Southland Current over the Great South Basin, reveal acoustic reflections of thermo-haline boundaries from within the water column. Visible structures include eddies and internal waves associated with interactions between various water masses and the varied seafloor topography in the region. A comparison of two petroleum industry data sets collected in March 2006 (DUN-06 collected by the Pacific Titan) and summer 2007-2008 (OMV-08 from the Wavefield Inseis Discoverer II) has been made. These surveys are in close proximity to each other, which enables preliminary temporal interpretations of the variability of the Southland Current / Subtropical Front. Data processing, including detailed acoustic velocity analysis, stacking and migration was completed using GLOBE Claritas.

The role of siderophores, oxalate and light in the iron dissolution kinetics of Australian dust

R.S. Sruthi Thalayappil, Imelda Velasques, Sylvia Sander
University of Otago
sruthitrs@chemistry.otago.ac.nz

Iron binding ligands play a paramount role in the biogeochemical cycling of iron in the ocean. The results of recent studies confirm that iron binding ligands are produced by microorganisms due to iron limitation (e.g. siderophores) or released from particles during a remineralisation process. Desert dusts are iron-laden, whereas phytoplankton in remote regions are anaemic. It is still not well understood how much iron dissolves from aerosol particles deposited into the surface ocean. The aim of our experiments is to measure the rate of iron dissolution from different iron dusts (of Australian origin) in the absence and presence of siderophores, oxalate and light. In the presence of light the reduction of Fe(III) to Fe(II) is an important factor and dissolution rates are in general higher than in the dark. In this project we will isolate and characterize iron binding ligands from natural seawater including the subantarctic waters sampled during the Munida time-series transect cruises. These and model siderophores such as deseferrioxamine B and aerobactin will be used in ship-board and laboratory manipulation experiments to see how they influence the dissolution of iron from aerosol and dust particles relevant for the subantarctic waters of the Southern Ocean.

Variation in coastal suspended particulate matter composition over spatio-temporal scales and the influence on suspension feeding communities

Tiffany Stephens, Stephen Wing
University of Otago
tiffany3@uw.edu

Coastal marine systems are dynamic, where communities are challenged with sudden changes in physical and biotic forcings. Suspended particulate matter (SPM), a complex community of living phytoplankton, organic matter derived from macroalgae, and detritus, is quick to respond to environmental variability in terms of both abundance and composition. SPM is also a key energy and

nutrient source for basal trophic levels, the effects of which propagate through food webs. Current literature reflects a 'SPM is good' mentality but often fails to recognize that variation in SPM composition might influence benthic structure. For example, some consumers (e.g. *Mytilus californianus* and *Balanus glandula*) select specific particles out of the water column and reject others, likely a mechanism to cope with feeding competition. Identifying SPM sources, delineating SPM composition, and the spatio-temporal nuances of such has been largely neglected. As part of my research, I will sample the water column and benthos along continental shelves in Antarctic, sub-Antarctic and sub-tropical systems. I will utilize stable isotope and other biomarker techniques to describe how basal organic matter from SPM is routed through contrasting coastal food webs. I will focus on suspension feeders to identify potential changes in benthic community structure in varying SPM regimes.

Distribution and abundance of Hector's dolphins (*Cephalorhynchus hectori*) along the Otago coastline, New Zealand

Jennifer Turek
University of Otago
turje034@student.otago.ac.nz

Hector's dolphins are endemic to New Zealand and listed as Endangered. Populations have decreased to approximately 27% of 1970 estimates, largely due to bycatch from fisheries. Even with new protection measures introduced by the Minister of Fisheries in 2008, several Hector's dolphin populations are predicted to continue declining. Otago Hector's dolphins have the potential to link other Hector's dolphin populations both north and south of the region. Therefore, effort has been focussed on the Otago coastline from Oamaru to Taieri Mouth, performing the first extensive Hector's dolphin survey in this area. By undertaking along-shore transects in small boats, distribution and abundance data has been collected which will be used to estimate the population size and geographic distribution of resident Hector's dolphins. These data will assist the Department of Conservation (DOC) in developing an effective management plan for Hector's dolphins in the area. In addition, these data will allow DOC to provide recommendations in order to minimise the impact of Port Otago's Next Generation dredging proposal on local Hector's dolphins.

Cues, not an endogenous rhythm, control the water-column entry by benthic copepods

Kay Vopel[1], David Thistle[2]
Auckland University of Technology[1], Florida State University, USA[2]
Kay.vopel@aut.ac.nz

Individuals of some benthic species swim out of or away from the sediment surface into the water column, i.e., they emerge. Individuals of both emergent and nonemergent benthic species can be entrained by near-bottom flows. Both emergence and entrainment are of interest, e.g., for their roles in benthopelagic coupling, but the controlling factors are poorly understood. Our experiments with benthic copepods from contrasting environments showed that a factor (or factors) associated with the onset of darkness, rather than an endogenous rhythm, controls their dusk emergence. In addition, we argue that entrainment and emergence can interact in at least two ways: (1) light-induced changes in oxygenation of the sediment pore water may affect the entrainment flux of benthic copepods, and (2) if large numbers of individuals are entrained in the time leading up to sunset, few will remain in the sediment to be part of the dusk peak in emergence.

Reversing a functional extinction of giant clams in the South Pacific: Communicating with project advocates and adversaries

Charles Waters
University of Auckland
CharleyWaters@gmail.com

Reversing the functional extinction of native Tridacnidae giant clams to a remote atoll in the South Pacific requires a solid understanding of tridacnid developmental biology and marine ecology. That is the easy part. A more formidable challenge is engaging governmental, political, economic, and local community audiences in a dialog that generates genuine project support. Conservation projects can be at risk without stakeholder comprehension of concepts such as sustainable harvesting, ecological systems, stewardship, or the future, as examples. Six years of experience as a volunteer scientist for the Cook Island Ministry of Marine Resources (MMR) has yielded several useful principles for effectively communicating my enthusiasm for marine biology to a variety of audiences. My poster presentation attempts to show how truth, credibility and good science are merely starting points in the education process. Imagination, keen awareness of audience values, identifying individual learning styles, passion for the topic, and basic communication strategies are also important. While these concepts can apply to many topics, characteristics unique to complex marine organisms and environments often require special handling. Scientists must begin sharing responsibility for unravelling some of the complexities of science before expecting well-informed participation and support by the stakeholder community in protecting and restoring marine environments. Personal lessons learned from my communication successes and failures may benefit others attempting to implement conservation initiatives.

Southern right whale vocalisations: a pilot study at the Auckland Islands

Trudi Webster, Steve Dawson
University of Otago
trudi.webster@xtra.co.nz

The Southern right whale (SRW) was hunted to near extinction and is endangered. The Auckland Islands (AI) are the stronghold for SRWs in New Zealand waters, and are likely their primary calving/breeding grounds. Although well studied in some right whale populations, acoustic behaviour of SRWs has received little attention in Australasia. This research aims to provide a quantitative analysis of vocal repertoire, quantify associations between vocalisations and behaviour, analyse temporal variation in calls and measure background noise. A successful pilot study was conducted as part of a winter 2010 AI expedition. Acoustic recordings were made on a custom-built hydrophone array to localise sounds and a calibrated Sonatech hydrophone to allow precise measurement of sound levels. A pinger deployed during recordings provided a reference sound source. In total, 24 recordings were made comprising 20+ hours of SRW vocalisation and environmental noise data. Initial analysis showed that SRWs are vocal day and night and that a wide variety of stereotyped vocalisations occur (e.g. gunshots, upcalls, moans). Background noise was dominated by snapping shrimp. Further fieldwork will be conducted in winter 2011 and 2012, with the addition of an autonomous acoustic recorder to sample data throughout the year.