

SEAGRASS RESEARCH AT CHOWDER BAY

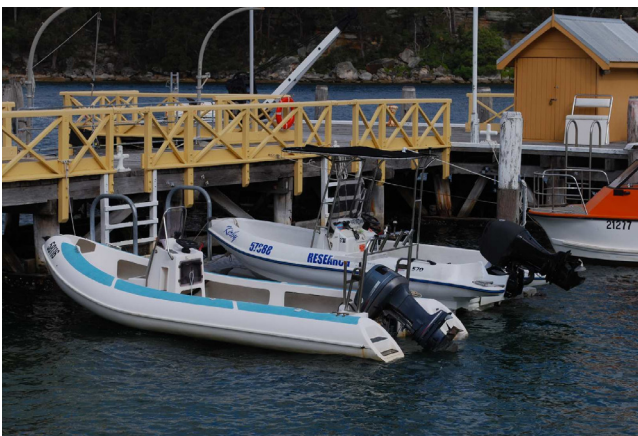
BY DR JOHN RUNCIE, SCHOOL OF BIOLOGICAL SCIENCES

Research part of European Action Network “Seagrass productivity, from Genes to Ecosystem Management”

In May 2011, researchers Professor Rui Santos and Dr João Silva (Centre for Marine Sciences, University of the Algarve, Portugal) and myself (Dr John Runcie) carried out a field research programme examining the photophysiology of seagrasses in Sydney Harbour. The study used submersible chlorophyll fluorometers to examine 24 hour changes in photosynthetic efficiency-related parameters of the seagrasses *Zostera marina*, *Halophila ovalis* and the invasive macroalga *Caulerpa taxifolia*. Simultaneous measurement of the underwater light intensity during each deployment enabled measured changes in photosynthetic efficiency to be interpreted in the light of ambient light; sunny days correspond to greater changes in the ability of the seagrasses and macroalga to do photosynthetic work. Seagrass and macroalgae samples are also being analysed for biochemical properties that will help explain the capacity of these species to acclimate to naturally changing light conditions, with samples collected predawn and at midday.

The study was carried out at SIMS which provided benchspace and boat access. The ability to readily access the field site at any time, the proximity of a SIMS boat as a working platform and the convenience of the dive shop Plunge Diving next door to provide compressed air cylinders and prompt refills enable the field programme to proceed quickly and efficiently. All this, even while the labs were undergoing refit. All involved were pleased to be able to conduct their research in this environment. The central location also worked well, with Sydney only 30 minutes away for the occasional evening visit once the seagrass work was done for the day.

The research has direct relevance to the overall global decline in seagrasses, which has been linked to poor water quality allowing less light to reach seagrasses. This project forms part of an overall seagrass research effort supported by the European Union of which Prof. Santos has been instrumental in establishing.



Boat jetty in front of the Sydney Institute of Marine Science.



John Runcie diving off a boat off Chowder Bay.



JULY 2011

The main objective of the COST Action ES0906: Network "Seagrass Productivity, from Genes to Ecosystem Management" is to provide the scientific basis for estimating and preserving the goods and services arising from the productivity of European seagrass ecosystems under anthropogenic pressure. The aim is to form a Europe-wide network that integrates expertise in physiological ecology, ecological genomics, and conservation-resource management. There are six primary tasks: (i) establish continuous, in-situ measurement devices for seagrass productivity, (ii) establish a modelling and monitoring tool based on seagrass light requirements, (iii) understand

seagrass responses to global changes, (iv) assess seagrass genetic adaptive variation at photosynthesis-related loci, (v) evaluate the effectiveness of existing and new seagrass-health ecological indicators, and (vi) provide guidelines to improve the conservation and management of seagrass-dominated ecosystems. Dr Silva's travel was supported as a Short Term Scientific Mission for this overall project. The University of Sydney has an MoU with the programme and is the first Non-COST Institution. Interested parties should contact Dr John Runcie

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MARINE BIOLOGIST IN STEVE SIMPSON'S LAB

Dr Mathieu Pernice has recently joined the School of Biological Sciences (SoBS, USYD) as a visiting collaborator, after 3 years of postdoctoral research at the Centre for Marine Studies (University of Queensland). Mathieu completed his PhD on bacterial symbioses in Nautiloids at the University Pierre and Marie Curie in Paris (2006). In September 2008, he was awarded a 3 years Marie Curie outgoing postdoctoral fellowship which brought him from Europe to Queensland. Mathieu has pursued research into coral-dinoflagellate symbiosis in both the evolutionary and physiological context.

The nutritional interaction between corals and symbiotic dinoflagellate algae creates the foundation of coral reef ecosystems. Whilst we now recognize the threats of future climate change on the reef, very little is known about the impact of a rapidly changing environment on the nutritional biology of this essential symbiosis. To get a better understanding of the nutritional interactions between corals and symbiotic dinoflagellates, Mathieu is presently developing a collaborative project with Prof. Stephen J. Simpson (SoBS, USYD) aiming to understand the ability of coral-dinoflagellate symbiosis to acquire and metabolize essential nutrients. Using an innovative combination of molecular and isotopic approaches, Mathieu intends to trace acquisition and transfer of nutrients in corals under a range of climate-change scenarios. Mathieu hopes to develop his broad range of skills and extensive experience in the field of symbiosis to collaborate and expand research



Dr Pernice preparing coral samples on Heron island for some molecular and isotopic analyses in order to measure assimilation of essential nutrients.

goals in the area of marine sciences at the University of Sydney.

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USIMS SHOWCASE 2011

BY EDWINA TANNER AND DR INKE FALKNER

The USIMS showcase was held on Friday afternoon on the 6th May 2011 in the RC Mills lecture theatre. The symposium was well attended with representatives from many disciplines of marine science outlining their current research developments. A short summary of the presentations under their related disciplines is as follows:

Marine Ecology

Assoc Prof Ross Coleman and Dr Will Figueira, directors of the Centre for Research on Ecological Impacts of Coastal Cities, gave an overview of the current research activities in the Centre. Research topics include the evolution of predator-induced defences in barnacles, the role of habitat structure in determining abundances, and enhancing biodiversity on seawalls amongst others. Will Figueira's group is currently investigating the effects of climate change on local and tropical fish species, in particular the temperature threshold for tropical fish range extensions and the effects of temperature on predator and prey performance in fish. However, Will's research interests extend well beyond climate change issues. He is also examining the fish diversity in different zones of marine parks and their surroundings as well as the effects of apex predators e.g. sharks on the trophic structure of coral reefs.

Marine Geophysics

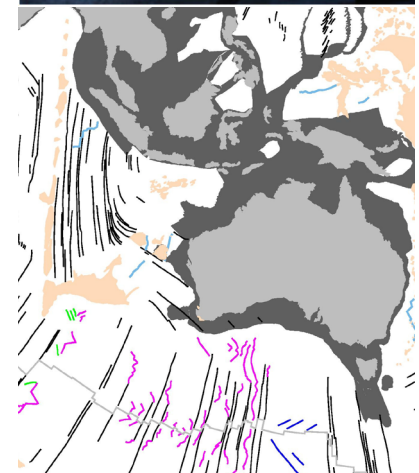
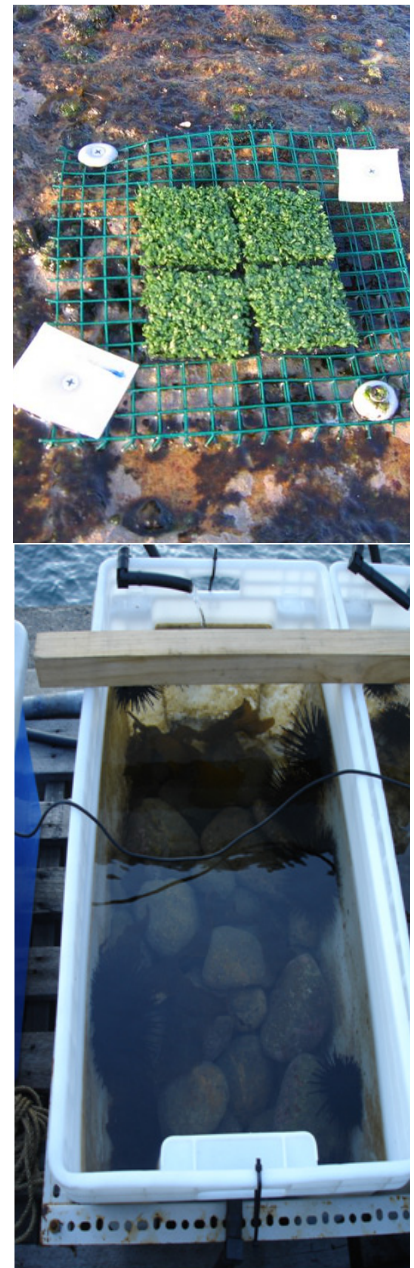
PhD student Kara Matthews, Dr Tom Landgrebe and Dr Joanne Whittaker represented the EarthByte research group. Their presentations linked together research being conducted on mapping the tectonic fabric of the seafloor and fracture zones. They described how a link can be made between subduction zone interactions and their association with giant earthquakes. Jo also described an upcoming research cruise she will be undertaking on the Southern Surveyor to the Perth Abyssal Plain. The research objectives of the cruise are to understand the formation history

of the Perth Abyssal Plain and the crustal nature and tectonic history of a number of surrounding submerged plateaus with an aim to enhance the understanding of the Eastern Gondwana break-up.

Ocean Technology

Dr Stephan Williams described the marine systems research being undertaken at the Australian Centre for Field Robotics (ACFR). This is a large teaching and research centre with 35 academic staff, 30 technical staff and close to 50 post graduate students. Stefan is leading the Integrated Marine Observing System (IMOS) Autonomous Underwater Vehicle (AUV) Facility. Stefan described the studies being done by the universities AUV called Sirius that is capable of undertaking high resolution survey work. He described the progress being made in mapping and visualising benthic environments that are used by other research groups within the university such as the GeoReef Laboratory.

Edwina Tanner from the University of Sydney Institute of Marine Sciences is leading the development of the Sydney Harbour Environmental Data (SHED) facility project. SHED is a marine observation system for Sydney Harbour that is building a tool for automatic environmental monitoring and ongoing research. The project collaborators include Prof Gavin Birch and PhD student Serena Lee from the School of Geosciences who have been monitoring and modelling the health of the harbour waterways, Profs Ian Jones and Phil Mulhearn of the Ocean Technology Group, the eResearch arm of the universities Information and Communications Technology (ICT) group, Chris Sharman and Greg Timms from the CSIRO TasMAN project and Intersect who are funding the project. The project aims to build a prototype system that will display the marine climate of Sydney Harbour at the University and Sydney Institute of Marine Science - to inform the public of daily harbour conditions and - to be used for ongoing research.



Artificial habitat on rock platform (top); sound recording of sea urchins (middle); Tectonic fabric map of the ocean basins (bottom).

USIMS NEWS

SUCCESSFUL STEPS GRANT APPLICATION

Assoc Prof Peter Cowell and Dr Ana Vila-Concejo have been awarded \$31,230 as part of the STEPS (Strategic Teaching Enhancement Projects) Grant Scheme to help develop the new capstone unit "Topics of Australian Marine Science" for the Master of Marine Science and Management.

MARINE SCIENCE EXHIBITION

As part of their ongoing effort to promote the diversity of marine science research conducted at the University of Sydney USIMS developed the marine science exhibition "Focus on Marine Science" which is showcased at the SciTech Library foyer from 25 July to 6 August. The exhibition celebrates the wealth of marine science research at the University. Please visit <http://www.library.usyd.edu.au/about/whatsnew/exhibitions/> for more information.

ELAINE BAKER TO HOST ANOTHER TRAINING WORKSHOP FOR PACIFIC ISLANDERS

In July Dr Elaine Baker and her colleagues hosted another training workshop on the Delineation of the Outer Limits of the Continental Shelf beyond 200 nautical miles at the School of Geosciences. The project partners have secured funding of \$1 million for an additional 3 years. The workshop will ...This is one of the projects Elaine is working on as part of the UNEP/ Grid-Arendal marine programme.



USIMS SHOWCASE 2011 CONT.

Climate Research

Dr Jody Webster from the GeoReef Laboratory described the research being conducted by his group on the past, present and future of coral reefs and canyons. The GeoReef group is particularly interested in coral reef and carbonate platform systems, both modern and ancient, and their associated sedimentary systems; as tools to address fundamental questions in paleoclimate variability and tectonics, and in turn the influence of these factors on the geometry, composition and evolution of these sedimentary systems. Their research projects tend to take the group to beautiful places e.g. the Great Barrier Reef, Tahiti, Hawaii, Seychelles and Papua New Guinea.

Marine Mammals

Adjunct Prof Doug Cato described the Behavioural Response of Humpback whales to Seismic Surveys (BRAHSS) project. This is a large project with Doug being the principle investigator and Edwina Tanner and Dr Inke Falkner from the University of Sydney being project managers. The University of Queensland and Curtin University are collaborators. BRAHSS has been funded for 4 years by the Oil, Gas and Petroleum (OGP) industry to conduct research into the response of migrating whales to air gun arrays. The first field experiment took place at Perigian Beach, Queensland, during September – October 2010. The field work included teams of volunteers being stationed on boats and on shore to follow and monitor whale behaviour from a number of vantage points as air guns were fired according to the experimental design. This project will continue at Perigian this year and then move to Western Australia for the final two years.

Student Daniel Harrison described a beaked whale habitat mapping project that he is working on in collaboration with Adjunct Prof Doug Cato, Edwina Tanner, Natalie Soars and Dr Michelle Blewitt. This project has been funded by the Australian Marine Mammal Centre to analyse and model beaked whale habitat. Doug Cato and his team collected data in an area off Cato Island using towed surface and deep floating hydrophone arrays. The data was laboriously processed for "clicking" sounds indicative of beaked whale presence. Daniel described how the data has been put into a propriety Geographic Information System (GIS) called EASy that has been developed by Dale Kiefer at the University of Southern California. Daniel has included various data types into the GIS project including the in-situ "sightings" recorded from the acoustic monitors, satellite imagery and data from the CSIRO Bluelink model. A multivariate analysis will be carried out next to determine the habitat preference of the beaked whales in the area.

Dr Michelle Blewitt described the work she has done with Dr Eleanor Bruce and Allison Runck (an honours student) in modelling the distribution and habitat selection of the bottlenose dolphins in Jervis Bay. For the study they used two long term datasets of dolphin observations in the Bay collected by the Jervis Bay Marine Parks Authority (2001-2007) and by a commercial whale-watching operator (2002-2009). The research investigated the use of predictive ecological modelling for cetacean-habitat relationships, through the case study of distribution and habitat selection of the Ind-Pacific bottlenose dolphin in Jervis Bay. General Additive Models (GAMs) were selected as the suitable modelling approach used for this research, based on species response and the nature of available sighting and environmental data.

Coastal Environments

Assoc Prof Peter Cowell spoke briefly about the importance of research being conducted in the coastal geomorphology and dynamics, in particular in light of different climate change scenarios. He emphasized how crucial it is for a country such as Australia to understand coastal processes.

USIMS SHOWCASE 2011 CONT.

Marine and Developmental Biology

Prof Maria Byrne, director of One Tree Island, gave an overview of the varied research activities carried out in her laboratory. Students, postdocs and research assistants are working on a range of topics including the impacts of ocean warming and acidification on marine invertebrates, the evolution of development in the Echinodermata (where is the head and the tail in a seastar with radial symmetry), Beche de mer (sea cucumbers) population dynamics and reproduction amongst other topics. Their research takes them to the most remote and exotic places e.g. One Tree Island at the Southern Great Barrier Reef, Scott and Davies Stations in Antarctica. However, a lot of the research is carried out at our door step along the NSW coast which is considered a hotspot for global warming.

USIMS Overview

As the final speaker Dr Inke Falkner briefly summarised the USIMS activities over the previous year. USIMS participated in a number of Science Alliance activities such as Science in the City, Giant Science and Degree in a Day. USIMS also coordinated a one-week work experience program for high-school students with academics from the Schools of Biological and Geosciences participating in the program.

For this year USIMS is planning to organise a marine science careers night, a marine science harbour cruise and a limited number of student internships.



Maria Byrne holding a Beche de mer (top); Edwina Tanner playing the Great Ocean Wheel game with a group of primary school kids (bottom).

NEW UNIT OF STUDY - TOPICS IN AUSTRALIAN MARINE SCIENCE

BY DR INKE FALKNER

The new Master of Marine Science and Management has been approved at the University of Sydney and its three partner universities. Academics from the four partner universities are now developing the capstone unit for the new program "Topics in Australian Marine Science" or TAMS.

TAMS will exploit SIMS' role as the NSW node of the Integrated Marine Observing System (IMOS), which is a national initiative to study the coasts and open ocean around Australia. With support from NSW IMOS scientists and staff from the eMII (eMarine Information Infrastructure) facility in Tasmania the course will introduce students to IMOS and the diversity of data that is generated by the facility. Through a series of case studies and exercises students tackle a number of research questions by analysing

environmental data available at the IMOS Ocean Portal (<http://imos.aodn.org.au/webportal/>). The case studies will make use of oceanographic data from moorings (sea surface temperature, velocity, salinity, turbidity), satellites (ocean colour, altimetry), argo floats (temperature, salinity) and ocean gliders (currents and eddies). Students will be taught how to extract, analyse and interpret these data sets using a number of MATLAB GUIs (graphical user interface). These GUIs are being developed by eMII staff and will be made available on the Ocean Portal website.

Please contact Inke at inke.falkner@sydney.edu.au if you have any questions regarding the new Masters program and TAMS.

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