



## Green engineering in the marine environment

Inter-tidal rocky reefs are an important feature of Sydney Harbour's stunning foreshore. The inter-tidal zone forms the link between land and sea. Organisms living in this zone must be able to cope with rapid and extreme environmental changes. Exposure to sun, UV and air during low tide and high temperature and salinity changes make inter-tidal rocky shores a tough place to live. A first line of defence against this harsh environment is shelter; preferably a shell or house of some sort. This is the realm of snails, tubeworms, barnacles and oysters!

Artificial structures in Sydney Harbour extend well beyond the inter-tidal. Urban sprawl into the marine domain is becoming a reality. Sydney Harbour is home to more than 40 marinas, ferry and cruise ship terminals, 35,000 recreational vessels, countless private jetties and wharfs as well as board walks. Unfortunately, most marine foreshore and infrastructure developments lack the innovative design solutions required to prevent ecological impacts and provide essential ecosystem services such as maintaining or restoring native biodiversity.

SIMS' scientists, Professor Johnston and Drs. Dafforn and Mayer-Pinto are working with Lend Lease to provide these innovative design solutions and are exploring opportunities for improving the sustainability outcomes of the foreshore development at Barangaroo in Sydney. Lend Lease has been at the forefront of green building developments in Australia and has a world-class sustainability plan for Barangaroo. Much focus has been placed on the development of 'green' buildings through enhancing diversity in landscaping and green roof areas. However, the marine side of foreshore developments is often less of a focus. The relationship with SIMS will extend these principles of green building into the aquatic environment and the scientists are working with Lend Lease on how to design marine structures to enhance endemic biodiversity and support important ecosystem services (e.g. water filtration and pollution abatement). The idea of a "park above and a park below" the waterline at Barangaroo is a concept that will bring biodiversity back to an area of the city that has been predominantly used by industry for the past century.



Clark Island in Sydney Harbour, showing a typical inter-tidal rocky reef.



Typical harbour seawall. The blocks are for research into the differences in bacteria on natural and artificial structures.  
*Photo: Katherine Dafforn*

Save the Date

## 2014 Emerald Dinner

Thursday 9 October 2014 at 6.30pm

Sergeants Mess, Chowder Bay Road, Mosman

Raising funds to support vital marine research at SIMS

For any enquiries please email [foundation@sims.org.au](mailto:foundation@sims.org.au) or contact SIMS: (02) 9435 4600



Guest of Honour & Speaker

**Don McIntyre**

Recipient of the 2012  
Australian Geographic  
Lifetime Adventure Award

left: Whale in Sydney Harbour photo by Emma Birdsey

# RV Investigator

## A new research vessel for Australia

Two-thirds of Australia's Exclusive Economic Zone (EEZ) lies under water, making it the third largest zone in the world. Yet only 12% of our ocean territory has been mapped. With a research fleet of one, it's an enormous challenge.

After more than a decade of proposals, designs and development, Australia's new Marine National Facility research vessel, *Investigator* is now undergoing sea trials and training, before it will embark on its first voyage in 2015. The purpose-built 93.9 metre blue-water vessel is equipped with technical prowess not seen before in Australia.

Commissioned by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and available to all Australian scientists and their international collaborators, *Investigator* has been designed to suit the needs of as many science disciplines and research questions as possible. The Marine National Facility is owned and operated by CSIRO on behalf of the nation. Overseen by an independent Steering Committee, sea time is highly competitive. Applications are internationally peer-reviewed and independently assessed, in terms of the quality of the science and their contribution to the national interest.

There is room on board for up to 40 scientists – 4 times that on the recently retired *Southern Surveyor* – and for up to 60 days. The vessel has two 5 m deep drop-keels, rather like centre-boards of a sailing dinghy, to deploy instruments, sample sea water, listen to acoustics, and record ocean currents in real-time. Back aft is a large gantry to deploy fibre-optic cable to observe and sample the sea floor and tow oceanographic instrumentation for phytoplankton and zooplankton.

At least 12 SIMS scientists are anxiously awaiting the fate of three separate applications for a voyage; to the Coral Sea; to the ice edge off the Totten Glacier; and to where our East Australian Current separates from the coast. Iain Suthers has a proposal to examine the remarkable production that occurs off Port Macquarie and Forster, which drives an ecosystem cascade from plankton to fish and white sharks. Martina Doblin plans to explore the Coral Sea and Tasman Sea for the plankton that regulates the climate. Dr Leanne Armand plans to examine sediment cores from the Southern Ocean and off Antarctica to help unravel the long-term and short-term changes occurring there.



*RV Investigator* undergoing sea trials in Singapore. This ship will be a dramatic leap forward in capability. The previous vessel, the *Southern Surveyor* was a refurbished North Sea trawler. For Rudy Kloser, an acoustics research scientist at CSIRO and Group Leader of the Deep Water Ecosystems Status and Predictions Team, one of the greatest achievements in designing and building the *Investigator* is its quiet signature.

"We're going from a rattle box, designed for fish capture, to a vessel that is designed to be very silent," says Rudy Kloser. "This means that we can do a lot more research and get a lot more resolution from our acoustic instruments."

Onboard *Southern Surveyor*, researchers weren't able to collect fish biomass data further than 1,500 metres in depth. On the *Investigator*, they expect to explore marine life down to at least 3,000 metres. And while acoustics tends to target the whole ecosystem, it can delineate different sorts of species groups, which may prove useful in the future.

## Prestigious award for Professor Emma Johnston

The Australian Academy of Science has awarded the Nancy Millis Medal for Women in Science 2014 to Professor Emma Johnston. The citation reads in part:

"Professor Emma Johnston, ARC Australian Research Fellow and Director of the Sydney Harbour Research Program at the Sydney Institute of Marine Science, is one of Australia's most exceptional researchers and research leaders in the area of marine ecology. While the majority of ecologists have retained a focus on natural drivers of ecosystem diversity and function such as competition, predation and recruitment, Professor Johnston has applied the conceptual underpinnings of ecology to investigations of the most important drivers of ecosystem dynamics in the current day – human activities. By applying ecological principles to the study of human impacts, Johnston has created a highly original program of research that not only progresses our fundamental knowledge in ecology, but also directly enables significant improvement in the management of marine systems."



# fantasea

## Harbour Hike

in support of



**Sunday 7 September 2014**  
**Father's Day**

**'Hike to help the Harbour'**

**Fantasea Harbour Hike** is an annual community event, now in its fourth year, that aims to raise much needed funds for the Sydney Harbour Research Program which is developing the science that will enable us to look after our magnificent Harbour for future generations. Traditionally held on Father's Day, the event is an easy to moderate 12km walk along the northern Harbour foreshore paths starting under the iconic Sydney Harbour Bridge at Kirribilli, past majestic federation homes, beautiful bays, classic boats, bountiful bushland and spectacular views of the city, all while having fun understanding more about Sydney Harbour's unique marine environment and history along the way.

The walk culminates with the SIMS Marine Festival at Clifton Gardens Reserve, Chowder Bay, the home of Sydney Institute of Marine Science (SIMS). The event is vital in drawing the media and public's attention to the wellbeing of the jewel in Sydney's crown and is a wonderful opportunity to introduce the public first hand to the stunning Harbour foreshores. Registrations for 2014 are now open at [www.harbourhike.com](http://www.harbourhike.com)

### **New video about SIMS**

We are delighted to announce that a new video about SIMS is available on our web site. Go to SIMS' home page and click the link to ABOUT SIMS. The link to the video is on this page.

We are most grateful to Dakota Media for their support in producing this video. We asked Dakota Media for a high quality professional video portraying the exciting and important work that SIMS does to-day. The video does a great job in capturing the extent of the SIMS environment from on the water to in the lab.

We are most appreciative also of the support of Tracey Holmes as SIMS' Ambassador and Presenter on the video as she takes us on a tour of SIMS and introduces us to SIMS' scientists.



## People at SIMS

### **Rebecca Neumann (University of NSW)**

#### **Best student oral presentation at International Temperate Reefs Symposium**

Rebecca Neumann was awarded the 2011 Thyne Reid Doctoral Fellowship at SIMS. In January, 2014 she was awarded 'Best student oral presentation' at the 10th International Temperate Reef Symposium in Perth for her talk entitled "The role of chemical defences of kelp in fighting disease". To receive this kind of recognition at an international conference is a great achievement.

Rebecca's PhD thesis is about environmental stress, chemical defences and disease in the habitat-forming kelp *Ecklonia radiata*. Marine organisms live in a soup of millions of microbes, many of which can cause disease and can therefore harm marine life. Environmental change has been associated with emerging diseases and increases in environmental stressors such as climate change and pollution may lead to a general increase of microbial caused disease in our coastlines.

Impacts of diseases are likely to be greatest when key habitat-forming species are affected, such as corals in the tropics and large seaweeds (kelps) in temperate areas, given the extreme diversity of marine life they support.

Kelps, as well as other marine organisms, produce chemicals that act as a defence against nasty microbes. Environmental changes, however, can potentially disrupt these natural defences and thus increase the susceptibility of kelps to disease. In her PhD, Rebecca is using the kelp *Ecklonia radiata* - the main habitat-forming species across temperate Australia - as a model system to understand how environmental change influences disease and what are the consequences to coastal marine communities. Understanding the mechanisms of incidence of diseases on key habitat-formers and its consequences is crucial to managing and conserving our natural systems.

Photos: Top - Sydney Morning Herald Bottom - Tamsin Peters



### **Lincoln Critchley (Macquarie University) - 2014 Doctoral Fellowship at SIMS**

Seawalls are common throughout Sydney Harbour. It is expected that there will be an increase in the use of coastal armouring, such as seawalls, as the population rises. In addition to the intended role of seawalls in protecting coastal property and containing land reclamation efforts, they also have unintended ecological repercussions. Lincoln's PhD aims to investigate some of these ecological consequences and assist developers and managers in their efforts to maintain ecosystem services when planning for future population growth.

Effects of coastal armouring include changes to the shoreline profile, introduction of new substrate and changes to the transfer of materials between the land and sea. Flow-on effects of these changes can influence the ecology of coastal communities. For example, seawalls reduce inter-tidal area and therefore beach and foraging area for shorebirds and other coastal predators. Seawalls also introduce new substrate, providing space for novel species to establish themselves and alter community structure. Further, while seawalls are created to reduce erosion, they effectively disrupt replenishment of the coastline by restricting the natural flow of sediments and organic material between the land and sea.



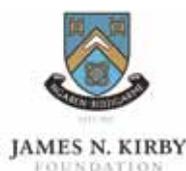
Lincoln Critchley collecting grab samples for water quality analysis at a constructed wetland.

Photo: James R. Egan

## SPONSORS OF SIMS



## MAJOR SUPPORTERS OF SIMS & SIMS FOUNDATION



## FOUNDING PARTNERS OF SIMS FOUNDATION



The Sydney Morning Herald

smh.com.au



### Trustee of SIMS Foundation

SIMS Foundation Limited

#### Directors

Charlie Shuetrim AM, Chair  
Ian Dardis  
Brian Greig  
Dr. John Keniry AM  
Arthur Koumoukellis  
Kim McKay AO  
Heather Power  
Professor Peter Steinberg  
Professor Frank Talbot AM

#### Auditors

Duncan Dovico

### CONTACT US

SIMS Foundation:  
Building 19  
Chowder Bay Road,  
Mosman, NSW 2088

Tel: (02) 9435-4600  
foundation@sims.org.au

### TO MAKE A DONATION:

Go to [www.sims.org.au](http://www.sims.org.au)  
and follow the prompts or  
contact us directly at  
[foundation@sims.org.au](mailto:foundation@sims.org.au).

### MARINE MASTERS COURSE IS BOOMING:

SIMS' masters course in Marine Science and Management is now in its third year with 41 students presently enrolled. Students register at either Sydney University, Macquarie University, University of Technology Sydney or the University of New South Wales, and study six units at their registered institution. But they also undertake two additional units chosen from courses across the other institutions, meaning that we can really cover the entire breadth of marine science and management. Possible subjects for study range from courses on conservation of Australian wildlife, molecular biology, oceanographic processes, environmental mapping and monitoring through to waves, beaches and coastal infrastructure.