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Oceans Institute

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GREY NURSE (SAND SHARK)

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OI heads WA shark mitigation challenge

The Western Australian government announced \$2 million in funding for shark hazard-reduction research, following one of the worst years for shark attacks in the State's history with five fatal shark attacks.

The grants for research will be spread over the next three years, with \$646,000 over two years allocated to fund three major Oceans Institute studies into shark detection and deterrents.

WA Premier's Fellow, Winthrop Professor Shaun Collin, who leads the Neuroecology Group at UWA's Oceans Institute, is a world leader in shark sensory biology. His project will test the effectiveness and improve understanding of the existing "shark shield" which emits an electronic pulse said to repel sharks.

Associate Professor Nathan Hart's project has received funding to develop

and test new shark deterrents, including the innovative use of bubble curtains, strobe lights and sub aquatic sounds. He is already working with Professor Collin to develop shark attack deterrent wetsuits in a project co-funded by WA company Dunbar Harper and the WA Government.

"There are only a few scientific studies about the hearing abilities of sharks. We're in fact the only group working at this currently in the world and what we're interested in is what frequency range and intensity range sharks of various species can hear," Professor Collin said.

"We have set-ups within the laboratory to test the hearing capabilities of a whole range of species. Based on that knowledge, we can then develop a sound of the right intensity and frequency that we know the sharks will respond to, which is uncomfortable to them and will change their behaviour.

"There is still a lot to learn but we do know that every species is different in relation to how developed a certain sense is."

Winthrop Professor Mohammed Bennamoun, from UWA's School of Computer Science and Software Engineering, has been funded to develop advanced vision systems for automatic shark detection. Professor Bennamoun's recent research project used the latest 3D imaging and biomechanical techniques to quantify swimmers' movement patterns.

Professor Collin said hazard prevention technologies are a way to try to protect both humans and sharks, by providing an alternative to the practice of shark culling.

"These animals form a very important part of the food chain and they are being decimated worldwide. If we start culling because of these attacks, which are still extremely rare, we are also going to upset the fine balance of our aquatic ecosystems."

Director's welcome

Leading Solution Science

The general impression my colleagues and I share, that the Oceans Institute is in the trajectory of progress we all wish to see, was ratified independently toward the end of last year. The ERA assessment, ranking Australian universities in terms of world benchmarks included good news for UWA in general and the UWA Oceans Institute in particular.

Specifically, the three areas to which the UWA Oceans Institute contributes were ranked all above average, with UWA progressing from the 8th ranked university in Australia in Oceanography to the 2nd Australian university and top in Australia for Environmental Sciences and Management, and Ecology. The assessment encompassed until March 2011.

Given the steep improvement in our KPIs, we should position ourselves to be ranked at the top in all three categories for the 2014 assessment, which will encompass achievements up to March 2013.

A new leadership team (see below) will strengthen the capacity of the UWA Oceans Institute to continue to improve.

Whereas the UWA Oceans Institute is a recent development, yet to reach two years of age, marine science has a long record at UWA, and, as you can read in Di Walker's essay in this newsletter, we can join the University's 100th anniversary in our own right.

The University's centennial motto is "UWA gives back", and the UWA Oceans Institute indeed strives at providing service to the WA community.

Our success with three UWA projects funded under the State's recently awarded shark attack mitigation research package is indeed a demonstration that researchers at the UWA Oceans Institute are committed to solution science.

We also held the second dialogue in our "Ocean Solutions Dialogues" series, this time devoted to discussing "Spatial Planning for the Safe and Sustainable Operation in the Marine Environment", dedicated to discussing the scientific underpinnings necessary to reconcile growth and wealth with conservation outcomes in our oceans. A number of initiatives and actions were identified that will help align our partners, industry and government with our vision of how to provide much needed leadership in this area.

2013 will also be an exciting year beyond UWA's Centenary when the



entire nation focuses on the Indian Ocean as Australia takes up the Chair of the Indian Ocean Rim Association for Regional Cooperation in October. The six priority areas for cooperation of this body are: Maritime Safety and Security, Fisheries Management, Disaster Risk Management, Academic and Science & Technology Cooperation, and Tourism and Cultural Exchanges, all highly relevant to our research portfolio. We look forward to contributing to making Australia's Chair a resounding success!

Winthrop Professor Carlos W. Duarte
Director, UWA Oceans Institute

The leadership team

UWA OI will continue to strengthen its leadership and governance by developing a new leadership team. The leadership team includes:

Oceans Institute Director:

- Winthrop Professor Carlos Duarte

Oceans Institute General Manager:

- Tracy Parker

Oceans Institute Deputy Director:

- Professor Erika Techera, Faculty of Law

Leadership Team:

- Winthrop Professor Shaun Collin
- Winthrop Professor Gary Kendrick
- Winthrop Professor Mark Cassidy
- Professor Alistar Robertson (Adviser)



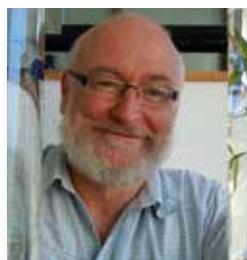
TRACY PARKER



ERIKA TECHERA



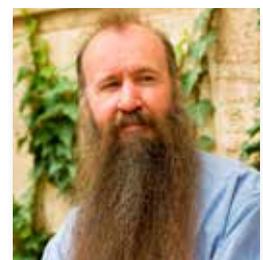
SHAUN COLLIN



GARY KENDRICK



MARK CASSIDY



ALISTAR ROBERTSON

Are our oceans a carbon sink?

It's thought that the continental shelf pump acts as a mechanism to transport carbon from coastal waters to the interior of the adjacent deep ocean and therefore acts as a sink for atmospheric CO₂.

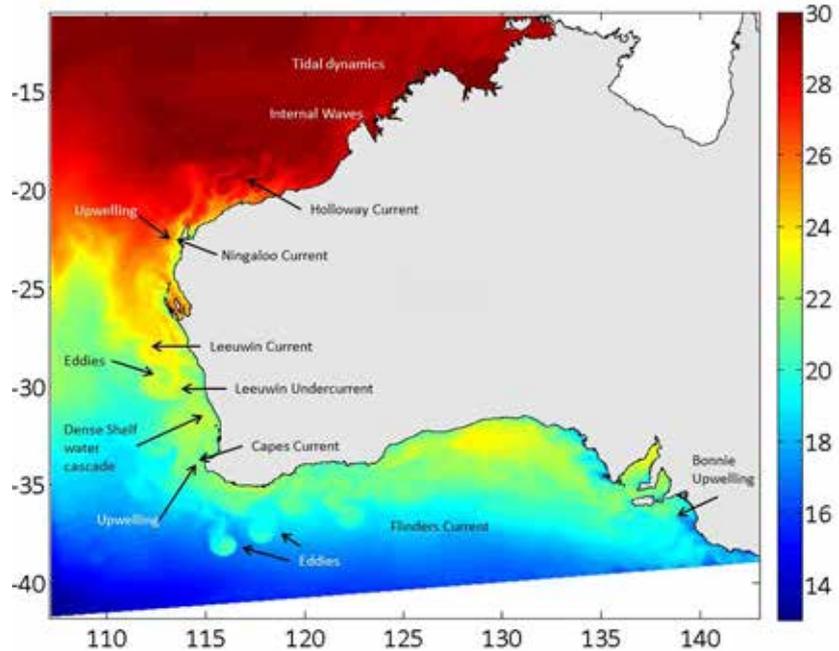
A national study led by UWA Oceans Institute's Winthrop Professor Chari Pattiaratchi aims to investigate ocean-shelf exchange on Australian continental shelves which includes tropical, sub-tropical and temperate regions.

The majority of the work is undertaken at the Oceans Institute by Dr Sarath Wijeratne, who has used the Regional Ocean Modelling System to simulate the shelf and slope regions between the Gulf of Carpentaria and Bass Strait.

"The hydrodynamic model, for the first time, considers all of the major forces in the region: tides, meteorology (winds and atmospheric pressure) and density gradients, to reproduce the major surface and subsurface features," Chari Pattiaratchi said.

"The hydrodynamic model is linked with a biogeochemical model to simulate yearly flow patterns with the aim of estimating carbon fluxes for the region and compare them to global estimates.

"Improved understanding of exchanges between shelf seas and the



ROMS MODEL SHOWING THE SIMULATED SURFACE TEMPERATURE DISTRIBUTION IN FEBRUARY AND THE MAJOR CURRENTS AND PROCESSES.

deep ocean are important for studying climate, the carbon cycle and marine ecosystem function."

The project, *Ocean-shelf exchange with an emphasis on the roles of waves, tides, eddies and cross-shelf flows on carbon exchange*, has been underway for 12 months and is funded through the Australian National Network in Marine Science (ANNIMS).

Collaborators include the University of Tasmania's Roger Proctor and James Cook University's Peter Ridd as well as researchers from the Oceans Institute (Kendrick, Duarte, McCulloch, Hanson) and others from across Australia.

A workshop has been planned in Sydney in February 2013 to discuss the results to-date and to develop a work plan for the next 12 months.

Blue carbon cluster launch

The Australian Government has launched a new initiative to further the knowledge and estimates of coastal carbon stocks around Australia. The OI is part of four research teams from eight Australian research institutions working with CSIRO as part of the Marine and Coastal Carbon Biogeochemistry Cluster (MCCBC) to improve those estimates.

The MCCBC is a three-year research program to assist CSIRO in accelerating the development and delivery of marine, climate and ecological data.

Coastal vegetation such as seagrasses, mangroves and salt marshes can sequester carbon up to 100 times faster and more permanently than terrestrial forests, as the carbon is stored in the peat below the coastal plants. The carbon sequestered,

termed Blue Carbon, is maintained for thousands of years.

As part of the national collaborative effort, OI researchers will contribute to assessing the capacity of Australian coastal habitats to collect Blue Carbon and determining how this capacity can be used in strategies to mitigate climate change.

MCCBC Cluster Co-Leader, OI's Carlos Duarte, described the initiative as vital if Australia is to have confidence in its carbon sources, sinks and their rates of change.

"Australia contains a large fraction of the world's seagrass and mangrove forests within its extensive coastal area, but many of these have been damaged in the past. The work under the MCCBC will provide solid underpinnings for the concept that conserving and restoring our coastal habitats represents a cost-



C-RICH SEDIMENTS BENEATH SEAGRASSES – ENRIC BALLESTEROS CSIC SPAIN

effective strategy to rebuild carbon sinks and mitigate climate change, while delivering valuable ecosystem services to society."

The program has secured \$3 million from the CSIRO *Wealth from Oceans* flagship, with in-kind support from UWA, University of Technology Sydney, University of Queensland, Southern Cross University, Edith Cowan University, Griffith University, University of New South Wales and the Australian Institute of Marine Science.



D surveying an Australian marine frontier

POD OF THREE KILLER WHALES

Researchers from The University of Western Australia’s Oceans Institute, the Australian Institute of Marine Science (AIMS), Geoscience Australia (GA), and the Museum & Art Gallery of the Northern Territory (MGNT) have teamed up to map marine biodiversity in remote corners of the Timor Sea.

A 21-day survey on board the AIMS Vessel RV Solander, and undertaken under the auspices of the National Environmental Research Program Marine Biodiversity Hub (www.nerpmarine.edu.au), yielded valuable insights into the distribution, abundance and richness of marine species within the Oceanic Shoals Commonwealth Marine Reserve, supporting the Australian Government’s marine bioregional plans.

As part of this work, Oceans Institute and Centre for Marine Futures postdoctoral fellow Dr Tom Letessier and Oceans Institute and School of Animal Biology PhD student Phil Bouchet used a new and pioneering underwater video camera system called ‘SISSTA’ (Stereo-Imagery System for Shark and Tuna Assessment) to capture footage of a variety of open water species such as sharks, tunas and other large predatory fishes.

The goal of this research was to determine how these relatively mobile species interact with submerged topographic features such as shoals, pinnacles, and valleys, and whether such features are associated with hotspots of oceanic biodiversity.

Oceans Institute NERP project leader, Professor Jessica Meeuwig: “Marine reserves include a range of habitats and it is important to understand their value to relatively mobile, open water species as well as the more commonly studied resident species,”

The SISSTAs are deployed 10 metres below the ocean surface for up to 3 hours and each unit is fitted with a bait chamber to attract animals into the field of view of two stereo cameras.

“We completed a total of 117

deployments across three different survey areas, and generated in excess of 760 hours of video footage. It was an incredible success,” Dr Tom Letessier said.

Mr Bouchet and Dr Letessier also recorded sightings of large predators such as cetaceans and seabirds whilst en route, including killer whales, false killer whales, Indo-Pacific dolphins, and over 400 seabirds from more than seven families.

“There is a strong indication that this part of the Timor Sea may be of importance to several mobile marine mammal species at various stages of their life cycles,” Mr Bouchet said.

The NERP Marine Biodiversity Hub is a national marine research collaboration supporting the evidence-based management of Australia’s marine environment. It is funded by the Department of Sustainability, Environment, Water, Population and Communities.

More details about the survey and SISSTA footage can be found at www.nerpmarine.edu.au/rv-solander-blog



SPOT TAIL SHARK

Testing coastal vulnerability

Oceans Institute researchers Professor Ryan Lowe and PhD students Mark Buckley and Andrew Pomeroy have just completed a major six-week international study on the dynamics of wave transformation across coral reefs to assess the coastal vulnerability of reef-protected shorelines.

The large-scale laboratory experiments were commissioned by UWA in the unique 55m long Deltares Scheldt wave flume in Delft, the Netherlands, and were conducted using a scaled fringing reef prototype that was built to mimic the steep morphological characteristics and bottom roughness properties of natural coral reefs.

The study is the most detailed of its kind and will provide new insight into how coral reefs protect coastlines by attenuating wave energy from extreme storms (e.g. cyclones) and tsunamis, including the response to sea level rise.

The experimental program had two components: a detailed study of wave breaking and wave transformation across coral reef flats led by Mark Buckley and a study of sediment transport processes and beach profile evolution led by Andrew Pomeroy with scaled-sediments added to the lagoon.

Prof. Lowe said the results will have far-reaching impacts on our understanding of the natural hazards facing topical coastlines and low-lying islands that are abundant throughout Australia and more broadly throughout the Indo-Pacific region.

"A major objective of this research is to develop and validate a new generation of numerical models that can be applied to improve predictions of wave impacts and coastal erosion behind both coral and rocky reef structures," he said.

The study was supported by Prof. Lowe's ARC Future Fellowship and a UWA Research Collaboration Award with Dutch coastal engineering collaborators Dr Ap van Dongeren and Prof. Dano Roelvink.



L-R: ANDREW POMEROY, AP VAN DONGEREN, MARK BUCKLEY AND RYAN LOWE

World's biggest fish needs to swim near the surface

Whale sharks, the world's biggest fish, can dive to chilly waters hundreds of metres deep but they need to return to the surface to warm up, according to a new study led by OI/AIMS researcher Dr Michele Thums.

The findings published in the *Journal of the Royal Society* deliver new insights into the little-known behaviour of these gentle giants of the sea.

Whale sharks have been known to undertake regular dives to around 100 metres and then return to the surface relatively quickly, the so-called "bounce" or "yo-yo" dives. But the research team, including UWA Adjunct Professor Dr Mark Meekan of the Australian Institute of Marine Research, discovered that whale sharks could also undertake very long, deep dives lasting more than two hours.

"When we looked at our data, we found that the whale sharks spent regular intervals at the surface between diving bouts. This pattern of returning to the surface looked similar to the patterns seen in air-breathing marine animals, so we were curious as to why fish that do not breathe air would do it," Dr Thums said.

The study involved four whale sharks: three at Ningaloo Reef off the North West coast of Western Australia and one

at Christmas Island. The sharks were tagged with time-depth recorders which also recorded water temperatures.

The researchers found that after the deepest and coldest dives – an average 340 metres deep with temperatures of about 14 degrees Celsius – the sharks spent the longest time at the surface, an average of 145 minutes.

Dr Thums concluded that they need to do so to regulate their body temperature – in effect, to warm up after spending time in the deeper, colder parts of the sea.

"Whale sharks, like many other fish are ectothermic, which means that their body temperature is similar to the surrounding water temperature and they can't regulate their body temperature through internal physiological processes. So, behavioural mechanisms such as spending time in the warmer surface waters are needed to warm them, similar to a reptile basking in the sun to warm up and then moving under a rock once sufficiently warmed," Dr Thums said.

A better understanding of the whale sharks' behaviour will help in developing effective conservation and management strategies, as well as predicting responses to environmental changes.

WHALE SHARK (PHOTO: ROB HARCOURT)

Jellyfish numbers unchanged

Despite widespread belief that the world's jellyfish population is exploding, a new international study suggests that there is no real evidence of a global increase in jellyfish over the past two centuries.

The results of the study, "Recurrent Jellyfish Blooms are a Consequence of Global Oscillations", appeared in *Proceedings of the National Academy of Science*.

The research was led by Dr Rob Condon of the Dauphin Island Sea Lab in Alabama, US, with experts from the Global Jellyfish Group, a consortium of 30 researchers including lead co-author Winthrop Professor Carlos M. Duarte, of UWA's Oceans Institute.



FRIED EGG JELLYFISH (*COTYLORHIZA*) FROM ALICANTE, SPAIN, FORMS BLOOMS ALONG THE MEDITERRANEAN COASTLINE. (PHOTO CREDIT: MEAGHAN SCHRANDT).

The key finding of the study shows global jellyfish populations undergo concurrent oscillations with successive decadal periods of rise and fall, including a rising phase in the 1990s and early 2000s that has contributed to the current perception of a global increase in jellyfish. The previous period of high jellyfish numbers during the 1970s went unnoticed.

"There are major consequences for getting the answer correct for tourism, fisheries and management decisions as they relate to climate change and changing ocean environments," Professor Duarte said.



CRAMBIONE MASTIGOPHORA BROOME, AUSTRALIA
(PHOTO: JAMES BROWN)



PORTUGUESE MAN-O-WAR (*PHYSALIA SP.*) ARE COMMON IN THE WORLD'S OCEANS. (PHOTO CREDIT: ELIZABETH CONDON).

"The important aspect about our work is that we have provided the long-term baseline backed with all data available to science, which will enable scientists to build on and eventually repeat these analyses in a decade or two from now to determine whether there has been a real increase in jellyfish.

"The more we know, the better we can manage oceanic ecosystems or respond accurately to future effects of climate change," Professor Duarte said.



SALP BLOOM OFF THE COAST OF NEW ZEALAND (PHOTO CREDIT: SEACOLOGY)

100 years of Marine Science at UWA – a long and distinguished history

In this the first of our two-part centenary special, the Oceans Institute's highly cited marine ecologist, Honorary Senior Research Fellow, Emeritus Professor Diana Walker, takes a look at what impact marine science at UWA has had over the last century.

In the next edition, one of the founding members and mentors of the UWA Oceans Institute, Professor Alistar Robertson, maps the future direction for ocean solution research.

Imagine a world without satellite images available from Mr Google, no GPS fixes to navigate the world's ocean, and no lap-top computers. That was only thirty years ago! Go back another thirty and most Australians were only just starting to be able to afford a car, SCUBA diving was just emerging from its naval origins and a report to Jacques Cousteau said that only 10 aqualung sets had been sent to the USA because the market there was saturated!! Plastics, especially that scourge of the oceans, polystyrene, only became available in the late 1950s. Scientists' offices then had sinks and light microscopes but no labs with the wonderful technologies available today. And in 1913, when UWA began, the world was an even more different place.

Early days at UWA had a focus on achieving growth and economic development for the State of Western Australia, and although there was an awareness of fisheries as important, the marine environment was not particularly viewed as a source of wealth. Our

knowledge of the Southern Oceans was largely based on voyages of exploration from Europe, and from the forays of sealers and whalers into the Antarctic, where whale blubber provided lamp oil for lighting before electricity was available. In 1892, William Saville Kent, a British marine biologist, became Western Australia's Commissioner of Fisheries, a position he held for three years. He made the first observations of tropical fauna at the Abrolhos in 1897², providing the earliest evidence of a warm water flow down the west coast of Australia³. Saville Kent's work on for both edible and pearl oyster fisheries set the stage for ideas only now being followed up in the Oceans Institute. He also examined and reported on fish, bêche-de-mer, corals, sponges, dugong and turtles during this period⁴.

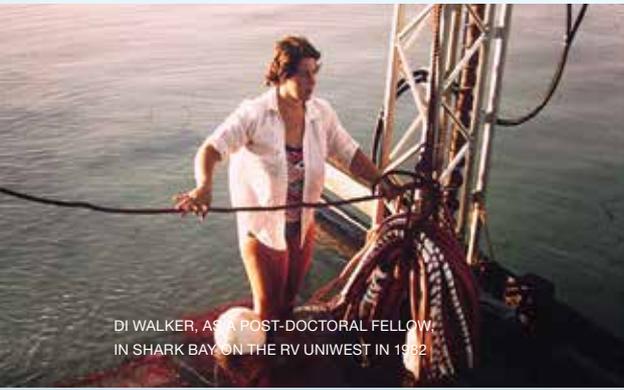
A famous early marine appointment to The University of Western Australia was William Dakin (1883–1950). In 1912, Dakin applied for the chair of biology in the "new" University of Western Australia. On the withdrawal of a more favoured candidate, Dakin, described by the electors as 'bright, keen and with a good manner', was appointed, arriving in

1913. To further his physiological studies, he twice visited the Houtman Abrolhos archipelago; to widen the zoological impact, he became president of the local Royal Society in 1913-15. In Perth, where a university was a novelty, Dakin helped to gain acceptance for it. In 1919, Dakin reported on a southwards current between Geraldton and the Abrolhos Island when northerly winds blew.⁵ Always ambitious, he left UWA for a chair at the University of Liverpool before returning to Australia where he seemed to settle at the University of Sydney. He was most famous for his book *Australian Seashores*⁶ (REF), produced by Isobel Bennett and Elizabeth Pope after his death in 1950, which continued to be re-printed until 1992.⁷

UWA's inspiring 20th century marine scientists

At The University of Western Australia, biologists, geologists and geographers continued to "seek wisdom", advance our knowledge of organisms and their environments, and train students.

Joseph Hefetz Gentilli joined the Department of Geography in 1939 and was associated with UWA until his



DI WALKER, AS A POST-DOCTORAL FELLOW, IN SHARK BAY ON THE RV UNIWEST IN 1982



DIVERS PREPARING TO LAY OUT A GRID FOR SAMPLING SEAGRASS RECRUITMENT IN TWO PEOPLE BAY 2003 (PHOTO: DIANA WALKER)

Emeritus Professor Arthur McComb, Botany, UWA 1962-1989

Emeritus Professor Arthur McComb had a seminal influence on a generation of researchers, supervising some 30 PhD students. His gentle, unassuming manner combined with his effectiveness and incisive thinking have resulted in major shifts in our understanding of aquatic ecosystems. His work has been of considerable management significance, especially in relation to the accession of nutrients from catchments and their effects in receiving waters. Examples include the Blackwood River Estuary with Ernest Hodgkin, Cockburn Sound, and the Peel-Harvey Estuarine System. Cockburn Sound, a marine embayment bordering a recently industrialised area on the eastern shoreline of the Sound, had been a prolific seagrass environment, and a favoured recreational fishing location. Seagrasses had died back in the Sound, and subsequently phytoplankton blooms had become prominent. The death of seagrass was traced to enhanced growth of algal epiphytes on leaf surfaces, while the distribution and concentration of nutrients and phytoplankton in the water was traced back to a fertiliser factory. An improved sewage works was also becoming more important as the population of Perth increased. These studies were instrumental in the State Government expending some \$40 million in re-routing the sewage effluent to a more appropriate site, while industry responded by reducing levels of wastes entering the Sound. Dr A W Chiffings, and Dr M L Cambridge were students associated with this work.

Cambridge brought Dr John Kuo's attention to seagrasses, another major thrust for marine research at UWA, this time in the Centre for Microscopy. She had brought some specimens of *Posidonia* to Kuo and asked for his help. These specimens did not fit the existing descriptions of *Posidonia australis*, Hook.f. and the outcome was the description of, first, two new species of *Posidonia*¹⁶, then another four more leathery ones¹⁷.

At Professor Kuo's retirement Feitschrift in 2011, I spoke on how his research had provided the taxonomic backdrop to the development of our understanding of the role and functioning of Western Australian seagrasses over the last 35 years. His detailed anatomy and taxonomy has allowed us to strengthen seagrass research in

death in 2000. He built an international reputation as a geographer, studying subjects ranging from cartography, migration and economic geography, to climatology, physiography, ecology and biogeography. Over his long career as a researcher and educator, Gentilli published hundreds of articles and more than a dozen books (the best known one was *Climates of Australia and New Zealand*) and was an important influence on the professionalization of the field of geography in his adopted land. From his ground breaking research on West Australian climate and winds^{8,9} he became known as the "Grandfather of the Leeuwin Current". The 1991 Symposium on the Leeuwin Current allowed his work to be acknowledged by others before his death. The Royal Society Special Issue 1991 (Volume 74¹⁰), organized and edited by Pearce and Walker, provides an interesting historical and contemporary multidisciplinary perspective. The more recent 2007 Leeuwin Current Symposium¹¹, also organised by Alan Pearce, shows how much marine science has moved on even in the 16 years between the two symposia.

Ernest Pease Hodgkin joined UWA's Department of Zoology in 1946 as an entomologist, but rapidly became involved with the marine and estuarine environment of Western Australia. He attracted a legion of keen and enthusiastic students, many of whom have carried on his traditions of getting out in the field and carrying out painstaking research. He became an Inaugural Australian Marine Sciences Association Councillor in 1963, and remained on Council for some 15 years. He organised a symposium in 1983¹².

Ernest Hodgkin led the first integrated study of a major WA waterway, the Hardy Inlet and Blackwood River, in the 1970s. This study led to a number of other large multidisciplinary studies, including the

internationally recognised Peel-Harvey Estuary study with Professor Arthur McComb, which led to the construction of the Dawesville Channel. Both Ernest and Arthur were awarded Royal Society of WA medals in 1997 for their research in marine and estuarine environments in Western Australia.

Papers, photographs and other material used by Dr Ernest Hodgkin are now held by the UWA Library Scholars Centre. Much of this material (1945-1998) was used in government reports and journal articles about particular estuary systems e.g. Blackwood and Peel-Harvey and the South Coast (Estuarine Study Series Volumes 1-8) published by the Environmental Protection Authority. The material was also the basis of the book Ernest Hodgkin's Swanland. In September 1998, shortly before his death at the age of ninety, and with a paper in press¹³, Ernest Hodgkin set up a Trust Fund and made a substantial bequest from his estate to continue the work that was so important to him – research and education to promote sound management of Western Australia's estuaries. He selected trustees for this bequest from the ranks of his ex-students and colleagues, many of whom were UWA graduates, now holding positions in state government, or UWA academic staff.

The December 2005 publication of 'Ernest Hodgkin's Swanland, Estuaries and Coastal Lagoons of Southwestern Australia', by Dr Anne Brearley, published by UWA Press¹⁴, was significant for the university as the book was launched by the then Premier of Western Australia, Dr Geoff Gallop, overlooking the Swan River at the Maritime Museum, Fremantle. Vice Chancellor of the day, Professor Alan Robson, who had also supported the book's production by UWA Press, spoke at the launch. It was attended by a veritable "who's who" of marine science in Western Australia, many of them Hodge's ex-students and colleagues.¹⁵

what is its biogeographical centre, and current research in the Oceans Institute by Winthrop Professor Kendrick¹⁸ and colleagues has also benefitted.

The Peel-Harvey system, near Mandurah, was in the 1970s showing evidence of intense eutrophication, with accumulations of macroalgae and extensive blue-green algal blooms. The cause of eutrophication was established as nutrients derived from the river systems. Collaborative work with the then Department of Conservation and Environment, the Department of Agriculture and other state government institutions, together with a management study which McComb jointly directed with Ernest Hodgkin, led to the conclusion that altered procedures for applying fertiliser will improve the estuary, but that a dramatic improvement in the short-term would only be achieved by cutting a new channel to the ocean. These proposals were accepted; the channel was constructed at a cost of some \$37 million, and there have been no subsequent blue-green blooms. Dr Rod Lukatelich (BP and EPA), Dr David Gordon and Dr Paul Lavery (now Professor at ECU) were students associated with this research.¹⁹

Gary Kendrick had been associated with Arthur McComb's research as an undergraduate field assistant in the Peel Harvey in 1970s, and work in Shark Bay with me in the 1980s. After a Masters at the University of British Columbia he returned, via the Galapagos, to carry out his PhD research on *Sargassum* with me in 1988. The Winthrop Professor, and inaugural Director of the Oceans Institute, he was the first Marine Science lecturer appointed to coordinate the new degrees and to teach new units in 1998.

Brian Warren Logan 1933-2008 – Department of Geology, 1963-1995

Dr Brian Logan, who served, with a small break, for 40 years as a member of staff of the Department of Geology at UWA, gained a BSc at UWA in 1955, First Class Honours in Geology in 1957, and a PhD at UWA in 1960. He served as Assistant Lecturer in Geology, UWA, 1955: Research Scientist, Department of Oceanography and Meteorology, Texas A & M University, 1959-63: Lecturer and Senior Lecturer in Geology, UWA, 1963-71: and Reader in Geology, UWA, from 1971 until his early retirement in 1995 to become an Honorary Senior Research Fellow. His subsequent work

in industry was interrupted for some time by illness.²⁰

Logan's significant work in relation to marine environments in WA was carried out in Shark Bay, as a modern analogue of ancient environments because of its stromatolites, and subsequently in Lake Macleod. His research was conducted from small boats, without satellite imagery to assist, and involved long vessel transects, with the attendant difficulties of weather. Brian told me, as a young newly arrived post-doctoral fellow in 1982, that it was now too difficult and expensive to do research in Shark Bay and that the same structures were visible on dry land in Lake Macleod. His views may have been influenced by the death of a student on a field trip to Shark Bay in 1965.²¹

An examination of where students of these academics ended up, in academia, in state and federal government, and in environmental consulting, would provide clear insights into their effectiveness as scientists, educators, mentors and leaders!

Into the 1980s and growth in Marine Science at UWA

Shark Bay Research 1981-1984
In 1981, UWA decided to launch a Marine Science initiative to bring together a multidisciplinary team, with funding for a full professor and three post-doctoral fellows across different science departments, to focus on a special area – Shark Bay. Professor Arthur McComb, UWA Botany, was instrumental in bringing this project to success. Professor Steve V Smith and Dr Marlin Atkinson were brought over from Hawaii. Smith and Atkinson specialised in biogeochemical budgets (carbon, nutrients, water, sediments), at local, regional, and global scales.^{22, 23} Other postdoctoral fellows brought to UWA were Dr Bob Dunlop, with Prof Emil Ghisalberti (Chemistry), who was to examine natural products

chemistry and the chemical signals in the sediments, and Dr Diana Walker (Botany) to work with Arthur McComb, on seagrass and algae. Our recent work in Shark Bay²⁴ has proved there is still work to be accomplished.

In the Zoology Department, Drs Mike Johnson and Bob Black, arrivals from the USA in the 1970s, carried out seminal work on intertidal mollusc ecology and genetics, again proving foundations for current research. Dr Jane Prince, a UWA graduate, also has a long association with Johnson and Black and taught invertebrate Zoology to generations of undergraduate students at UWA. Dr Anne Brearley, an Honorary Research Fellow in Plant Biology and the Oceans Institute, and with a long association with the WA Museum, has worked across plant and animal boundaries since her Honours project with Di Walker in the early 1990s.

These four scientists with more than 100 years' combined experience at Ningaloo, have made research trips to Ningaloo Marine Park since the 1970s. Their latest Ningaloo work is an intensive study of intertidal invertebrate assemblages, part of a Western Australian Marine Science Institution (WAMSI) project. Black and colleagues have collected and analysed information from 20 sites between North West Cape and Gnaraloo Station. More than 200 species of macroinvertebrates have been studied by the team. A specific study on giant clams, *Tridacna*, an iconic species within the Ningaloo Marine Park, was undertaken, to understand how their numbers fluctuate throughout the length of the park. It is also important to assess the effect of protection within sanctuary zones on their growth and survival.²⁵

Oceanography

The roots of the current growth for UWA through Oceanography began when Arthur McComb and Jörg Imberger joined forces to start the Centre for Water



GARY KENDRICK PREPARING TO TAKE WATER SAMPLES, AS A RESEARCH STUDENT IN SHARK BAY IN 1982 (PHOTO: DIANA WALKER)



DIVERS ON SCUBA SAMPLING ROCK WALLS OFF ESPERANCE 2003 (PHOTO: G A KENDRICK)

Research (CWR) in 1982.

This first linking of biology with fluid dynamics was to prove very productive for UWA, eventually evolving into the present School of Environmental Systems Engineering, with essential links into the Oceans Institute.

Leading UWA Physical Oceanographers over the last quarter of a century include Prof. Charitha Pattiaratchi who holds Bachelors, Masters and PhD degrees from the University of Wales, UK. He currently holds the positions of Winthrop Professor of Coastal Oceanography and Head of the School of Environmental Systems Engineering.

Prof. Pattiaratchi's research interests are in coastal physical oceanography and coastal sediment transport, with emphasis on field experiments and numerical modelling. He has played an active role in examining climate change effects in coastal regions of Western Australia and particularly in terms ocean currents, wind and wave climate, sea level variability, coastal flooding and beach stability.

Professor Greg Ivey, Deputy Dean/ Deputy Dean (Research) in the Faculty of Engineering Computing and Mathematics, and Winthrop Professor of Geophysical Fluid Dynamics in the School of Environmental Systems Engineering and the UWA Oceans Institute, has a BEng (Hons) and MEngSc (UWA), and a PhD (University of California, Berkeley). He has worked at the National Water Research Institute in Burlington, Ontario and the Australian National University, and has been a visiting professor at the Institute de Mecanique de Grenoble, Stanford University, and the Massachusetts Institute of Technology. His research is in the area of physical oceanography, focusing on ocean mixing, internal waves and currents in both the coastal and open ocean environments and has been fundamental to offshore developments on the North-west Shelf.

The first appointment in Biological Oceanography, after Steve Smith and Marlin Atkinson, in 1998 was Dr Anya Waite, now Winthrop Professor, with research interests in Ocean Productivity.

At UWA, for the first 90 years, although the location and the science were exciting, and several careers were launched at UWA, the absence of a central focus and administrative commitment meant that UWA continued to carry out marine science in a

piecemeal and un-coordinated fashion through the late 1980s and 1990s. The departments of Botany and Zoology, and of Geology and Geography continued to have high numbers of undergraduate students wishing to pursue their interests in the local marine environment, and many PhD students graduated during this period. But in the words of former Pro Vice-Chancellor for Research, Professor Michael Barber, "UWA's Marine Science difficulty" meaning marine science struggled to emerge from the existing structure and although researchers achieved excellence within their own departments, they were unable to give UWA a strong profile across four faculties and numerous departments. In the mid-1990s, we, (Dr Ian Eliot, Geography, Dr Brenton Knott, Zoology and Associate Professor Di Walker, Botany), established three Marine Science degrees in the Faculty of Science: Marine Biology, Coastal and Marine Geoscience, and Marine and Coastal Management, jointly taught across those departments, whilst in the Faculty of Engineering there was a Marine and Coastal Engineering degree, where our links to Dr Chari Pattiaratchi in CWR were very productive. Joint teaching and more students followed.

As the research and teaching gained strength and international reputations improved, more academic appointments were made.

The future

And in 2013, a century after UWA began, there is a clear path forward for Marine Science at UWA, at the Oceans Institute.

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Dialogue for ocean solutions



The UWA Oceans Institute recently led the second of its Oceans Solutions Dialogues workshops ahead of a full series planned for 2013.

The topic for discussion explored marine spatial planning for a safe and sustainable operation in the marine

environment. The group looked at the barriers to spatial planning and management in the marine environment and why law and policy in marine areas is more difficult to work with than on land.

The Ocean Solutions Dialogues are a series of workshops where OI researchers, researchers from other

institutions, government, industry and community stakeholders get together to address ocean-based solutions to meet society's challenges.

By establishing the Ocean Solutions Dialogue, the OI will:

- Provide a collaborative framework for contributing ideas and influence.
- Raise awareness of problems affecting our Oceans.
- Engage industry, government and the community with a focus on the direction of future research.
- Facilitate debate and discussion on emerging issues.
- Identify collaborative initiatives and opportunities to deliver competitive advantages to Australian-based industry and businesses.

To ensure the dialogue produces effective outcomes small groups of 15-20 are taking part in the workshops.

A report on each workshop is to be made available to the public, summarising the problem discussed as well as the views and pathways toward solutions.

The workshops are to generate initiatives, resources and potential projects to be developed to deliver the solutions as well as identifying those who will lead them.

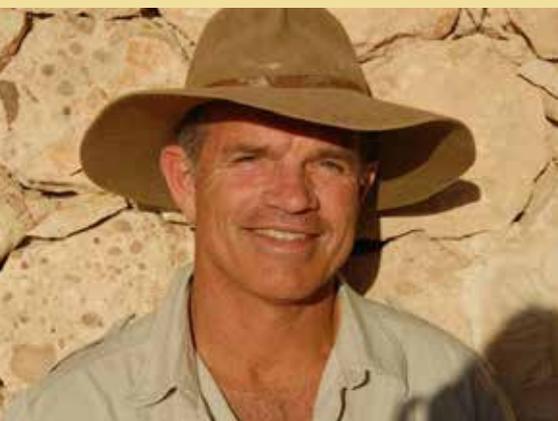
This year the OI will be hosting Ocean Solutions Dialogues to discuss:

- The oceans as a source of water.
- The role of science in addressing risks and responding to emergencies and disasters in the marine environment.
- The oceans as a source of food.
- The oceans as a source of energy.
- The oceans as a source of key bioresources.

More information can be found at www.oceans.uwa.edu.au/strategy/dialogue/workshops



Raising awareness of ocean science



CHAIR OF OCEANS COMMUNITY JACK CLOUGH

Increasing public awareness of the activities and roles of the Oceans Institute and extending public involvement with marine science is the aim of the newly formed Oceans Community.

Chairman Jack Clough says while the national and international marine science communities are being increasingly reminded of the Institute's scientific contributions, a key aim for the Oceans Community will be to help the Institute in its communication and engagement

with the public, business, industry and government.

"The Oceans Community will support the Oceans Institute by helping to raise awareness of the excellence of its marine research as well as its scientific potential," Mr Clough said.

"One of the activities of the Oceans Community in 2013 will be to host public presentations with local and international scientists sharing their knowledge of contemporary marine issues.

"Many Australians live near the coast and already have an involvement with our marine environment. Membership of the Oceans Community will provide opportunities for those who want to better understand marine issues and contribute in some way to the marine environment.

"The Oceans Community believes a greater public awareness of and engagement with the Oceans Institute's 'grand challenges' – the safe and sustainable provision of food, water, energy and bioresources from the oceans – will help to achieve more understandable and acceptable outcomes for the whole community."

New masters provides real insights

A new unit offered by the Faculty of Science to prepare students for a career caring for WA’s oceans is proving a hit, with three times the expected number of students enrolling in it.

Marine Conservation and Fisheries Management is a six-week unit for Honours and Masters students offered by the Faculty of Science involving staff from the UWA Oceans Institute and the Schools of Plant Biology and Agricultural Resource Economics.

“This was a brand-new unit which we offered in the second semester to facilitate a practical understanding of how marine conservation and fisheries management function in Western Australia in comparison to the rest of the world,” said Dr Timothy Langlois. “We were aiming to have 12 students – but we ended up with 35.”

OI Research Fellow Dr Langlois co-designed the unit with Professors Euan Harvey, Ben White and Michael Burton.

“The unit aims to give students first-hand experience in some of the intricacies of managing and conserving the marine environment around Western Australia,” says Dr Langlois. “It also allows them to integrate that knowledge with marine conservation and fisheries management.”

Instead of lectures, the unit focused on five 7-hour workshops with guest speakers including key scientists, agency managers and industry and peak body groups.

“The Department of Fisheries and the Department of Environment and Conservation were our major partners,” Dr Langlois said.

“We also had representatives of groups such as the WA Fishing Industry

Council, RecFishWest, WWF, the Conservation Council, and the Greens.

“The students really appreciated the chance to interact with professionals in the marine management and work through the real-life questions facing marine professionals.”

Typical feedback from the students includes:

- “Meeting and having conversation with industry and government professionals was highly enlightening”
- “Most real-life subject I have done” and
- “The best aspects were the high level of interaction we had with Euan, Tim and the peak body groups in the classroom”.

Ocean solutions at OI: Wave energy



CETO POWER SCHEMATIC

autonomous unit– which has a rated power of 80kW–off Garden Island in 2011.

“Carnegie Wave Energy welcomes the opportunity to collaborate with the Oceans Institute across its many areas of expertise to broaden the understanding of how the ocean can be used in a sustainable fashion for the provision of electricity and potable water to coastal communities,” Carnegie Wave Energy Research and IP Manager Dr Laurence Mann said.

A range of scientists within the Oceans Institute are starting to develop programs spreading from the optimisation of foundation systems and wave energy harvesting to the interactions between wave energy parks and marine life, thereby helping provide a model of how full scale wave energy parks could operate in Western Australia.

Australia has arguably the best potential of marine renewal energy resources, waves and tidal, in the world. Western Australia is bordered by substantial resources of wave energy generated from storms in the Southern and Indian Oceans that provide a significant energy source to the South of the state, and the Kimberley tides in the North offer some of the largest tidal fluctuations in the world.

To explore the full potential of this under-utilised renewable wave energy, OI is partnering with Carnegie Wave Energy Limited to establish joint research.

Carnegie Wave Energy, a company operating off Fremantle, WA, is the inventor, owner and developer of the patented CETO wave energy technology that converts ocean swell into zero-emission renewable power and desalinated fresh water. It successfully tested its CETO 3 commercial scale

Red Sea research



OI PROF. PETA CLODE RED SEA RESEARCH CENTRE (KAUST) AND DIRECTOR PROF. XABIER IRIGOYEN
(PHOTO: GUIOMAR DUARTE AUGUSTI)

OI continues to strengthen its ties with the Red Sea Research Center, establishing joint research and skills exchanges between The University of Western Australia and the King Abdula University of Science and Technology, Saudi Arabia.

Following a visit to Saudi by OI Director Carlos Duarte and Professorial Fellow Susana Agustí in March 2012, Red Sea Center Director Xavier Irigoyen travelled to Perth recently to discuss new projects that will get underway in 2013.

"The Western Australia coastline and the Red Sea share many similarities and by combining our skills and research efforts, the Oceans Institute hopes to establish a long-term working relationship with KAUST that will advance knowledge and research in both institutions," Professor Duarte said.

Ongoing joint projects will continue to gather information on the ecology of mesopelagic fish; biodiversity of coral reef fish; the diversity of coral symbionts and its significance for their resistance to stress; and the development and operation of ocean observation systems based on gliders.

In 2013 OI's Malcolm McCulloch, Julie Trotter and Jens Zinke will be involved in coral coring and processing in the Red Sea as part of a project to understand Red Sea coral reef paleoreconstruction.

Shaun Collin, Fanny de Busserolles and KAUST's Stein Kaartvedt will develop a program to study vision systems of Red Sea lantern fish and use advanced video techniques to examine the fish assemblages of the mesopelagic ocean.

OI scientists Euan Harvey and Jean Paul Hobbs will coordinate with KAUST colleagues to develop stereo-cameras in different areas of the Red Sea to research deep fish communities.

UWA and KAUST scientists are also developing a course on ocean processes and ecosystems for mid-level oil and gas operators.

Technical and management experience from within OI will contribute to programs being established to develop a Red Sea Glider-based observation program and the operation of a microscope and visualisation facility at KAUST.

Joint research projects are also to be established that will compare oceanographic and ecosystem dynamics off the coast of Western Australia with the Red Sea to better understand their circulation and biogeochemistry.

And OI seagrass experts Carlos M. Duarte, Gary Kendrick and John Statton will work with KAUST toward restoration of Red Sea seagrass and mangrove ecosystems.



PHOTO ABOVE AND BELOW: XABIER IRIGOYEN



OI staff visit Zhejiang University



WA GOVERNOR'S DELEGATION TO CHINA FOR THE OPENING OF THE UWA-ZJU JOINT SYMPOSIUM

In late 2012, staff and students from the UWA Oceans Institute visited Zhejiang University as part of a delegation travelling with the Governor of Western Australia, His Excellency Malcolm McCusker.

His Excellency Malcolm McCusker officially opened the 2nd UWA-ZJU Joint Symposium in Integrated Water Management and Protection "From Catchment Processes to Ocean Dynamics" which was jointly chaired by Professor and Dean Weiping Liu, Zhejiang University, and Professor Anas Ghadouani from the UWA Oceans Institute. Staff and students from both Zhejiang University and UWA gave

presentations outlining a broad range of current research.

On day two of the visit, UWA Oceans Institute staff were invited to attend the Zhejiang College of Ocean Science and Engineering, Oceanographic Center where many synergies in research interests were discussed.

Following the successful visit, UWA and Zhejiang scientists have continued discussions regarding joint projects as well as exploring opportunities for a more formal collaboration.

The UWA Oceans Institute looks forward to hosting a reciprocal visit of delegates from Zhejiang University in March 2013.

Blue water researcher visits



DR PAOLO MONTAGNA, INSTITUTE OF MARINE SCIENCE (ISMAR-CNR) IN BOLOGNA, ITALY

Paolo Montagna, a leading Research Scientist from the Institute of Marine Science (ISMAR-CNR) in Bologna, recently spent two months at UWA as part of the OI visitor program.

ISMAR-CNR is the largest Italian institution for ocean sciences with an

envious capacity for blue water as well as ROV-based research, having a regular presence in the Antarctic as well as Atlantic and Mediterranean oceans.

During his visit to the UWA Oceans Institute, Dr Montagna worked closely with Dr Julie Trotter and Professor Malcolm McCulloch, undertaking some novel geochemical experiments using boron isotopes in both shallow and deep-water corals.

Studies were undertaken on a unique collection of deep-water coral samples collected using an ROV as well as laboratory specimens cultured under different pCO₂ conditions, addressing the critically important question of how marine calcifiers are responding to the ongoing effects of ocean acidification.

Marine virus expert visits



DR DOLORS VAQUÉ, INSTITUT DE CIÈNCIES DEL MAR (CSIC), BARCELONA, SPAIN

Recently the Oceans Institute's Dr Susana Agustí hosted a three week visit by Senior Research Scientist at the Marine Science Institut (CSIC), and Editor in Chief of the International Journal *Scientia Marina*, Dr Dolors Vaqué.

The internationally renowned biological scientist shared some of her expertise in the role of virus in the ocean at a seminar and workshop and discussed future collaborations on marine microbial ecology with Professor Susana Agustí and OI Director Professor Carlos M. Duarte.

"I had the opportunity to interact and discuss scientific issues dealing with marine microbial ecology with OI PhD and masters students as well as with Post-docs and senior scientists," Dr Vaqué said.

"I hope this visit was the beginning for future interactions and collaborations with the Oceans Institute (UWA)."

Albany update

In November OI Director Professor Carlos M. Duarte delivered the UWA Albany, Skywest Public Lecture in Albany.

The topic of conversation was *Opportunities in exploring the planet's last frontier*. Carlos talked about the need to change present trends in society by exploring ocean based solutions to ensure the best possible future for humanity.

News briefs

OPSAG

OI Director, Professor Carlos M. Duarte, accepted an invitation to become a member of Australia's Oceans Policy Science Advisory Group (OPSAG) contributing to the expert working group on Marine Science Communication.

OPSAG promotes co-ordination and information sharing between Australian Government marine science agencies and the broader Australian marine science community.

Spanish National Award

On Dec 12, 2012, Professor Duarte was presented with the Jury's Special Award on Science Communication from the Spanish Foundation of Science and Technology, Spain's national award on Science communication.

IOMRC Artist-in-Residence



JOAN COSTA

Award winning marine science photographer Joan Costa will be the IOMRC's Artist-in-Residence for the next three months.

The 2012 World Press Photo award winner has worked with OI Director Carlos Duarte in the Arctic and on the Global Malaspina Expedition.

The Spanish snapper will work with researchers at the OI's organisations to capture a portfolio of high-quality images on the researchers and their work.

His visit is supported by AIMS, CSIRO, OI, UWA's Vice-Chancellor and The Institute of Advanced Studies.

An exhibition of Costa's work at OI will be unveiled at the opening of the Indian Ocean Marine Research Centre's Watermans Bay facility later in the year.

Emerging talent

Matt Fraser has won the Hodgkin Trust Scholarship Prize for 2013 to further understand the processes in estuaries in Western Australia. His research will work to determine the suitability of Anion Exchange Membranes for monitoring phosphorus concentrations in the Swan River.



MATTHEW FRASER

Asha's now a senior TED

Blue whale researcher Asha de Vos has been selected to become a senior TED Fellow for two years starting from 2013.

TED – the renowned international 'technology, entertainment and design' program – conducts thought leadership conferences around the world where it highlights the work of young world-changers and trailblazers.

Asha, a PhD candidate with the UWA Oceans Institute, was a 2012 TED Fellow. The senior fellowship will allow Asha to raise awareness of her research on the unique non-migrating blue whales off Sri Lanka at several conferences around the world.

Randolph delivers COFS vision

Winthrop Professor Mark Randolph delivered the inaugural Lloyd's Educational Trust oration, titled *Geotechnical engineering on and off the North-West Shelf of Australia* to a full house of oil and gas industry leaders and the cream of WA's engineering community.

The internationally renowned civil engineer and founder of the Centre for Offshore Foundation Systems (COFS) at UWA Oceans Institute outlined how COFS came about and the innovative technologies it has helped develop to serve the offshore oil and gas sector.

Michael Franklin, the Director of The Lloyd's Educational Trust (LRET) spoke of how Mark Randolph and Mark Cassidy began the discussion that led to COFS becoming one of LRET's research centres of excellence worldwide.

LRET currently provides some \$2.4 million to COFS to help fund The Lloyd's Register Educational Trust Centre of Excellence and the LRET Chair of Offshore Foundation Systems.



PROF. YOO SANG CHOO, PROF. MARK CASSIDY, PROF. MARK RANDOLPH, MICHAEL FRANKLIN AND TIM SHANAHAN AT THE LLOYD'S EDUCATIONAL TRUST ORATION. (IMAGE: TONY MALKOVIC)

COFS book is a best seller

A book written by two researchers at COFS has briefly hit the top of the Amazon book sales list.

Offshore Geotechnical Engineering is written by Winthrop Professor Mark Randolph and Professor Susan Gourvenec. The 530-page book arose from a course on offshore geomechanics taught at COFS since 1998 as part of UWA's undergraduate and Masters programs.

The book features much of COFS' recent research output, as well as covering the fundamentals of soil mechanics and offshore geotechnical design, and provides a useful reference for professional engineers in the offshore industry.



IMOS in the Pilbara

In February 2012, as a result of co-investment in the Integrated Marine Observing System (IMOS) by the WA State Government, two mooring sites were established off the Kimberley and Pilbara regions with four and three stations across the continental shelf, respectively.

The Oceans Institute hosts the Western Australian node of IMOS led by Winthrop Professor Chari Pattiaratchi and managed by Dr Agi Gedeon.

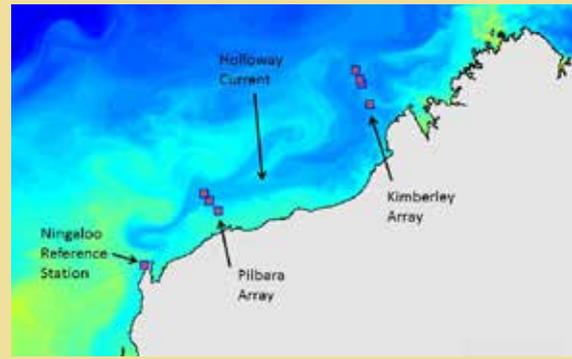
Preliminary analysis of six months of the data (February-August 2012) confirmed the presence of the Holloway Current, a surface current believed to flow towards the south-east, parallel to the coastline, along the north-west shelf which provides a passage to transport warmer, lower salinity water from northern Australia into the Leeuwin Current.

In the latter part of 2012 an initiative was launched by WAMSI (West Australian Marine Science Institution) and IMOS with the aim of managing risks in the marine environment and impacts

on natural resources while sustaining development and achieving economic growth in the region. The leaders of this initiative are Dr Peter Rogers (WAMSI), Professor Pattiaratchi and Dr Gedeon (WAIMOS and OI).

This has created an opportunity for WAMSI and IMOS together with government and industry, to develop a regional ocean observing and prediction system to provide information on managing risk in offshore maritime operations; dredging operations and nearshore coastal developments; oil spill contingencies; search and rescue missions; coastal impacts and hazards; development impacts on marine ecosystems, fisheries, and aquaculture; and, climate change impacts on the region. It would also help the Environmental Protection Authority to understand and manage the cumulative impacts of development in the region.

The moorings are maintained and serviced by the Australian Institute of Marine Science and will continue at least to June 2014.



LOCATION OF THE WAIMOS PILBARA AND KIMBERLEY MOORING ARRAYS OVER A SIMULATED SALINITY FIELD SHOWING THE HOLLOWAY CURRENT.

A steering committee, with Dr Rogers as Chair and with representation from IMOS, CSIRO, AIMS and Industry, has been established to develop a detailed proposal through consultation with all the stakeholders.

A submission to the WA Department of Commerce's Innovation Investment Facilitation Program to develop the proposal was successful and a series of workshops are planned for the first half of 2013.

Indian Ocean Marine Research Centre, Crawley – Update



ARTIST IMPRESSION, INDIAN OCEAN MARINE RESEARCH CENTRE, CRAWLEY

The University of Western Australia will become the home for leading collaborative marine research into one of the world's least explored marine environments.

The Indian Ocean Marine Research Centre, a collaboration between the Australian Institute of Marine Science (AIMS), CSIRO, the Department of Fisheries (Western Australia) and UWA's Ocean's Institute, will be accommodated in a new \$62 million facility built at UWA's Crawley campus.

The exciting project is made possible through the support of the four collaborating partners and a \$34 million grant from the Australian Government, through the Commonwealth Investment Fund.

The Indian Ocean Marine Research Centre facility is being designed to target a Five Star Green rating – a benchmark in sustainable development – and will include offices and workstations for researchers, technicians and post-graduate students; flexible wet and dry

laboratories with PC2 capability; flexible collaborative spaces; and a ground level multi-purpose lecture theatre linked to a large interaction space with an external courtyard. Other external areas include undercover field staging, loading bays, technical areas and boat storage.

The development application for the facility was lodged in November 2012. The anticipated timeframe for construction is two years, with occupancy anticipated in 2015.

You can keep up to date about this project at uwa.edu.au/iomrc

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