



THE UNIVERSITY OF  
**WESTERN  
AUSTRALIA**

Oceans Institute

# Annual Report 2016



An underwater photograph showing a diver in silhouette on the left, surrounded by a large school of colorful fish (purple, pink, and orange) swimming towards the right. In the bottom right corner, there is a large, dark coral reef structure. The water is clear and blue.

“The UWA Oceans Institute engages in fundamental and applied research to support evidence-based decision-making. Our collaborations are the key to addressing the challenges facing our oceans, coasts and estuaries.”

— PROFESSOR ERIKA TECHERA, OCEANS INSTITUTE DIRECTOR 2017



Cover image:  
Seringapatam Reef, Western Australia ©Joan Costa  
Inside cover:  
Rowley Shoals, Western Australia ©Kim Brooks/AIMS

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# Objectives

## Vision

UWA Oceans Institute is advancing research knowledge to support the delivery of ocean solutions by addressing ocean challenges.

Bringing together UWA's multidisciplinary research strengths in areas such as oceanography, ecology, engineering, resource management and governance, the Oceans Institute continues to explore opportunities for innovative marine research and ocean technology, delivering ocean solutions in Western Australia and worldwide.

# Priorities

- Further the frontiers of knowledge in ocean research and technology.
- Foster and promote interdisciplinary marine-related research across traditional science, engineering, social and policy boundaries.
- Provide excellence and leadership in ocean research and technology, locally and worldwide.
- Provide a focal point for quality training of postgraduate students in ocean research.
- Address the needs of Australian society, government and industry for safely operating in the marine environment.
- Promote innovative collaborative opportunities in marine research and technology in Western Australia.
- Articulate a science-based, intelligent and innovative use of marine resources to create opportunities for human and economic development.
- Generate the knowledge needed to reconcile the sustainable use of ocean resources with the conservation of its biodiversity.



“UWA Oceans Institute has an important leadership role to play in protecting the Indian Ocean. Our location and expertise in marine research ideally positions the Institute as a research gateway across the Indian Ocean region.”

— PROFESSOR SHAUN COLLIN,  
UWA OCEANS INSTITUTE DEPUTY DIRECTOR

© Chris Cornwall

# Executive Summary



**2016 has been a busy and important year at UWA Oceans Institute. The completion of the Indian Ocean Marine Research Centre (IOMRC) represents a new and exciting chapter – these new facilities on our campus and at Watermans Bay will provide an excellent foundation for the Oceans Institute to continue to excel in world-class marine research. The following pages reveal just a little of the breadth and depth of our multidisciplinary research capabilities, and our combined and dedicated passion to provide ocean solutions for humanity’s grand challenges.**

This year we continued to strengthen our links with our close network of international, national, regional and local collaborators. Some of the international destinations our members visited included Mauritius, Seychelles, Fiji, Malaysia, China, Sri Lanka, Japan, South America, the Middle East, Europe and the United States. We were represented at leading global conferences on a range of themes and hosted many of our international friends including colleagues from Zhejiang University in China, the University of Puerto Rico at Mayaguez and the Leibniz Centre for Tropical Marine Ecology.

Harnessing renewable energy from our oceans continues to be an important part of our research agenda. In May, the Australian Renewable Energy Agency

(ARENA) awarded a \$1 million grant to UWA to reduce the cost of wave-energy converters by optimising their location and arrangement. The project is in association with Carnegie Clean Energy, a key collaborator with the Oceans Institute.

We are a step closer to understanding the ecological significance of offshore infrastructure and the interplay between fish and subsea pipelines, thanks to cross-disciplinary research undertaken this year. This research was the first in Australia to examine the role fish play in shaping the seabed beneath pipelines.

Our diversity of research interests and expertise is demonstrated by the variety of important research to come out of the Institute this year. This includes the discovery that rising sea levels may be of benefit to some shallow reef systems, new knowledge of how dolphin mothers can identify their calves based on a ‘signature whistle’, and the unique visual systems of crustaceans.

The \$10 million ARC Research Hub for Offshore Floating Facilities was launched in April. The Offshore Hub consists of five interlinked multidisciplinary projects that will connect research and industry, and aims to create solutions for critical engineering challenges in the next half of the 21st century and beyond.

Science Communication was a strong addition to our postgraduate students’ schedule with the introduction of the Postgraduate Student Video Competition. The competition gives our students a chance to communicate complex research visually and in a way that connects with a broad audience. The finalists were presented with their awards at the launch of the new

Woodside OceanWorks Space. This is a new collaborative space housed at IOMRC Crawley, designed to spark innovation in ocean engineering, and jointly supported by Woodside FutureLab and the University of Western Australia.

It has been greatly rewarding to serve as the 2016 Interim Director of UWA Oceans Institute and to work so closely with this committed, dynamic and resourceful leadership team.

I would like to take this opportunity to welcome Professor Erika Techera as the new Director of the Oceans Institute. Professor Techera, Dean of Law at UWA, took up her new role at the beginning of 2017. My sincerest thanks to Professor Shaun Collin, who continues to provide the Oceans Institute with dedicated and inspired leadership in his role as Deputy Director. I would also like to acknowledge General Manager Ms Tracy Parker for her hard work and commitment to the Institute. Ms Parker has been instrumental in overseeing the development and completion of the IOMRC and helped to facilitate a smooth transition for academics, staff and students into the new premises. As the Oceans Institute settles into its new home at IOMRC, I look forward to watching it expand and foster even greater advancements in multidisciplinary marine research, to help us better understand our oceans now and in the future.

Professor Peter Davies  
Interim Director, Oceans Institute  
Pro Vice-Chancellor (Research)

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IOMRC building in Crawley reaches completion. Staff and students from UWA, AIMS, CSIRO and Fisheries Division of the Department of Primary Industries and Regional Development, WA co-locate in the purpose-built \$63 million facility, enhancing the strong research culture.

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ARC Research Hub for Offshore Floating Facilities is launched. The Hub is provided with \$10 million in ARC funding as part of the ARCs Industrial Transformation Research Programme, linking industry and researchers for the next five years.

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16 undergraduate students from the Ocean College of Zhejiang University travel to UWA Oceans Institute to take part in the Oceans College – Oceans Institute Summer Program. The visit is part of a planned annual exchange scheme.

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World Oceans Day is celebrated with an address from Professor Peter Klinken, Chief Scientist of WA, providing his insights on the importance of conservation to ensure a sustainable and diverse marine future.

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At a research workshop at IOMRC Watermans Bay in November, members from the IOMRC Partnership present their broad research areas, current and future, to identify future opportunities for collaboration.

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Oceans Institute PhD student work is the focus of the Annual OI Postgraduate Symposium, with 19 presentations highlighting current research.

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UWA Oceans Institute satellite event is held as part of the 2016 *Our Ocean Conference* in Washington, D.C. Professor Jessica Meeuwig gives a public lecture on the Importance of Marine Protected Areas for Our Oceans.

# 2016

## A Snapshot

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Professor Malcolm McCulloch, Dr Verena Schoepf, Dr Chris Cornwall, Dr Steeve Comeau and PhD students Claire Ross, Harry Clarke, Lucy Georgiou, Rebecca Green, Taryn Foster and Renee Gruber attend the 13th International Coral Reef Symposium in Hawaii.

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Pilbara Marine Conservation Symposium comprises 21 presentations and attracts more than 100 participants from UWA, CSIRO and Department of Parks and Wildlife.

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*The New York Times* publishes Dr Verena Schoepf's research on Great Barrier Reef coral bleaching.

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Professor Mohammed Bennamoun receives the annual UWA Vice Chancellor's Research Mentorship Award.

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Professor Mark Cassidy delivers the Hsue-Shen Tsien Lecture of Engineering Science in China.

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Links across the Indian Ocean region are strengthened with three OI members delivering a professional course in Mauritius on the coastal impacts of climate change. Government officials from across the Indian Ocean rim attend.

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Professor Greg Ivey chairs the 20th Australian Fluid Mechanics Conference, hosted by UWA in December.



# Highlights



# UWA Oceans Institute moves into IOMRC

**The six-storey Indian Ocean Marine Research Centre (IOMRC) in Crawley was completed in 2016, and UWA Oceans Institute moved into its new \$63 million home.**

UWA Oceans Institute is a key player in the most ambitious and prestigious interdisciplinary marine partnership in the southern hemisphere: the Indian Ocean Marine Research Centre. This dynamic, high-level research partnership brings together CSIRO, the Australian Institute of Marine Science (AIMS), the Fisheries Division of the Department of Primary Industries and Regional Development, and UWA Oceans Institute researchers and infrastructure.

The IOMRC partnership was created to further our multifaceted knowledge of the Indian Ocean, and the centre will continue to build Australia's international marine research status through stimulating, innovative and synergistic research, as well as the training of the next generation of researchers.

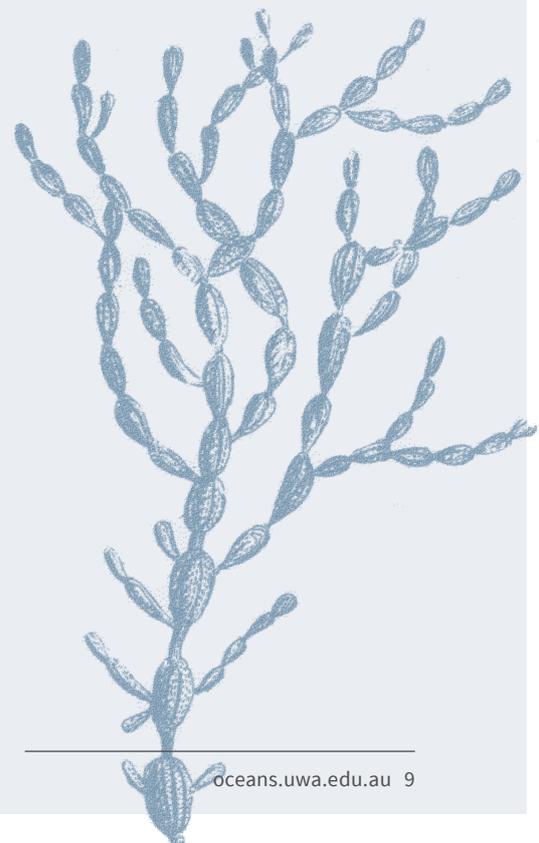
"The scale of research at the IOMRC and its multidisciplinary focus are unique," says Professor Shaun Collin, Deputy Director of UWA Oceans Institute. "Through IOMRC we can go outside traditional boundaries of marine research to solve complex problems and influence government policy and industry practice."

A second IOMRC facility, the \$13 million refurbishment of the Watermans Bay Marine Centre, was completed in 2015. The laboratory at IOMRC Watermans Bay has the ability to draw clean seawater from the Indian Ocean and

pump it into the facility, making it one of a few laboratories of its type in the world with such capabilities. UWA is currently working towards equipping the building with an undersea observatory facility.

Focusing on solution-oriented ocean research in this new multimillion-dollar purpose-built facility represents an exciting and energising new period for UWA Oceans Institute.

"We are embarking on our next phase of growth as our researchers move into exceptional facilities and participate in the formation of new research hubs and collaborative opportunities, with academics here and overseas," says Professor Collin. "The marine science infrastructure available to UWA is among the best in the world."



©Joel Barbitta



# High academic accolades for Oceans Institute members

Four Oceans Institute members have been awarded prestigious research grants from the Australian Research Council. Dr Ana Martins Sequeira, Dr Sam Stainer and Dr Steeve Comeau were all awarded DECRA (Discovery Early Career Research Awards) grants, and Dr Julie Trotter was awarded an ARC Future Fellowship Grant.

Dr Ana Martins Sequeira swimming with a whale shark in Ningaloo, Western Australia © AIMS



## Dr Julie Trotter

Dr Julie Trotter, Principal Research Fellow at UWA's School of Earth Sciences and Oceans Institute member, will use her ARC Future Fellowship to help resolve important questions of ocean-climate interactions and the long-term capacity of the ocean CO<sub>2</sub> sink.

The project will study the geochemical compositions of deep-sea coral skeletons collected from the Perth Canyon, Tasman Sea, and Ross Sea

(Antarctica), between depths of ~400-1800m. The live-caught and fossil corals will provide long-term environmental records from the present-day to pre-industrial era as well as the Last Glacial Maximum (~25 ka), which represent key periods of major climate change.

The deep-sea coral skeletons record ambient seawater conditions (e.g. temperature and pH) as they grow, offering a unique opportunity to understand long-term environmental changes in these deeper waters within the heart of the ocean-climate system. These records are expected to provide a clearer understanding of Earth's long-term responses to anthropogenic CO<sub>2</sub> emissions and global warming.

Resolving seawater carbonate chemistry and temperature records for these periods will help determine the

impact of increasing CO<sub>2</sub> and global warming in the Southern Ocean, and hence its capacity to sequester CO<sub>2</sub> and heat into the ocean interior over both short and long timescales, which is central to predicting future climate-change scenarios.

"The Southern Ocean is a key part of the ocean climate system, where ~75% and ~40% of the ocean's anthropogenic heat and CO<sub>2</sub> budget is sequestered. So understanding how these waters have been responding to such changes, and constraining their natural variability, is very important for determining past and future climate-change scenarios," says Dr Trotter. "Deep-sea coral geochemistry is one of the few means to resolve temporal changes within these waters, which are the least understood component of the system."



## Dr Ana Martins Sequeira

Dr Ana Martins Sequeira from the Oceans Institute and School of Biological Sciences will lead a project using satellite-tracking data to understand global movement of marine megafauna such as sharks, whales and turtles for sustainable exploitation of marine resources while conserving biodiversity.

Marine megafauna are negatively impacted by rapidly expanding developments in the marine environment such as the oil and gas industry, port infrastructure, coastal and offshore fisheries, and shipping. However, the extent of such impacts is currently unknown, due to our limited understanding of how, where and why these animals move.

By applying innovative analytical approaches to the largest marine megafauna tracking dataset, Dr Sequeira's research aims to significantly advance the field of movement ecology in order to increase our ability to predict marine megafauna behaviour while offering practical applications for conservation and management of these species.

"This research will broaden our understanding of the mechanisms that underpin the movement of marine megafauna and help promote scientific breakthroughs in the field of movement ecology," says Dr Sequeira. "This will enhance national capacity and set global standards for the analysis of large ecological datasets, while supporting the conservation and management of economically important, charismatic and threatened species."



## Dr Sam Stainer

Dr Sam Stainer is currently the Research Fellow for the OFFshore ITRH Novel Anchors and Subsea Foundations project stream within CEME/COFS at UWA. He has a background in applying both numerical and experimental techniques to solve a broad range of geotechnical engineering problems.

Dr Stainer's project, "Unlocking the changing strength of fine-grained soils in numerical analyses", will develop methods to numerically simulate strain-softening-hardening in fine-grained soils.

"Numerous numerical models that can simulate complex soil behaviour already exist, however, most rely on accurate definition of model parameters that are very difficult to calibrate," says Dr Stainer. "Through a blend of cutting-edge physical and numerical modelling techniques this project aims to remove the measurement and interpretation biases associated with traditional numerical model parameter calibration, by assessing the validity of the model parameters more directly from photographic evidence of the real soil behaviour."

The proposed method will allow the changing strength of soil (decreasing as well as increasing) to be reliably incorporated into numerical simulations of soil behaviour, potentially allowing practising engineers to reduce uncertainty in design and make the development of civil infrastructure cheaper.

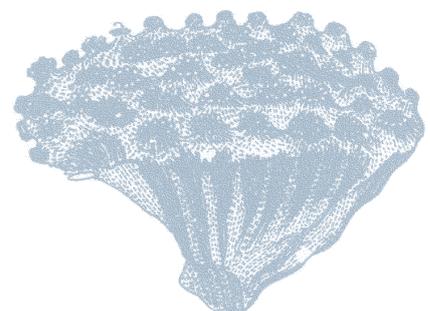


## Dr Steeve Comeau

Dr Steeve Comeau is an Oceans Institute member and ARC Discovery Early Career Researcher Award (DECRA) Fellow in Program 3 at the University of Western Australia node of the ARC Centre.

Dr Comeau's DECRA project uses geochemical proxies, including boron isotopes, to study how ocean acidification affects coral calcification mechanisms. His experiments are primarily carried out at the recently refurbished Indian Ocean Marine Research Centre at Watermans Bay, Perth.

Dr Comeau and his colleagues have developed a complex experimental system that tightly regulates multiple environmental parameters, such as pH variability and flow, to examine how they affect calcification and growth of corals. His innovative research is supported by fieldwork that extends from the remote Kimberley region in the north to Rottnest Island in the south, where Dr Comeau studies the role of seasonal and daily environmental variability on reef calcification. He envisions the purpose of his research is "to improve our ability to assess the future of corals, and to help policy-makers take adequate measures to preserve coral reefs".



# What impact does marine life have on subsea pipelines?

A cross-disciplinary team of researchers at the Oceans Institute has discovered fish can play an important role in shaping the seabed beneath pipelines.

The research by PhD student Simon Leckie, Dr Henning Mohr, Dr Scott Draper, Dr Dianne McLean, Professor David White and Professor Liang Cheng explored subsea pipelines along the North West Shelf of Australia to observe the remarkable interplay between marine life and pipeline engineering.

This research was the first in Australia to examine the roles fish play in shaping the seabed beneath pipelines. Fish excavate material in a way that interacts with the sediment-transport processes, which in turn are driven by the tide and internal waves.

“Fish appear to use and maintain these holes, perhaps as a safe haven or to access prey,” says Dr McLean.

The data also revealed that after pipelines are laid on the seabed, the level of the seabed around them (its ‘embedment’) can change due to transport of sediment towards (sedimentation) and away (scour) from the pipeline. These changes are poorly understood in the pipeline engineering process, preventing the creation of a more robust design approach. While there has been significant numerical and physical modelling of these processes, until this study there have been very few comparisons to field data.

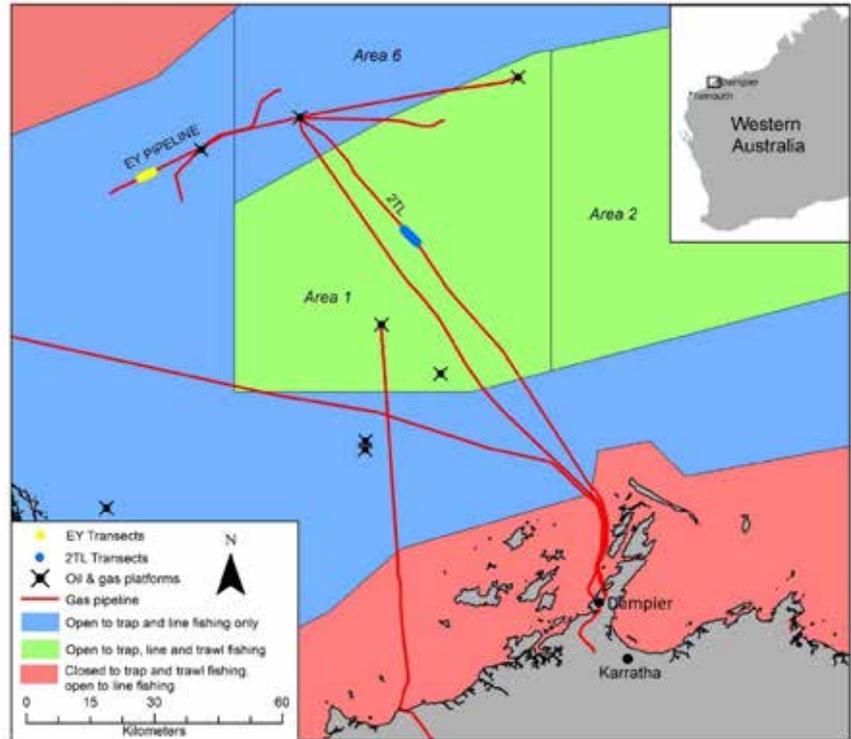


Figure 1 above: Location of the surveyed section of each pipeline on the North West Shelf of Western Australia. Main commercial fishery areas are indicated and can be viewed in further detail in Newman et al. (2015). The Pilbara Line Fishery can operate throughout Pilbara waters.

UWA Oceans Institute researchers analysed the changes to pipeline embedment brought on by sediment mobility in three pipelines on the North West Shelf and upper continental slope. The pipelines traverse a range of soil, metocean and marine habitat conditions, providing a unique opportunity to study the influence of these variables on pipeline embedment change.

In previous studies, the erosion of sediment from around the pipeline (scour) had been thought to dominate the changes, but this new research revealed the direct sedimentation against the pipeline was the most important driver of embedment change for the ocean conditions at this particular location.

“Dr McLean’s insights solved a conundrum that had been puzzling us engineers for a while. We couldn’t understand why we saw certain shapes of cavity beneath the pipeline – they seemed impossible from a hydrodynamic perspective. It was only when Dr McLean recognised a grouper rooting beneath the multiphase flowline of one of Woodside’s production systems that the penny dropped.”  
 – Professor David White, Oceans Institute member and Shell EMI Chair

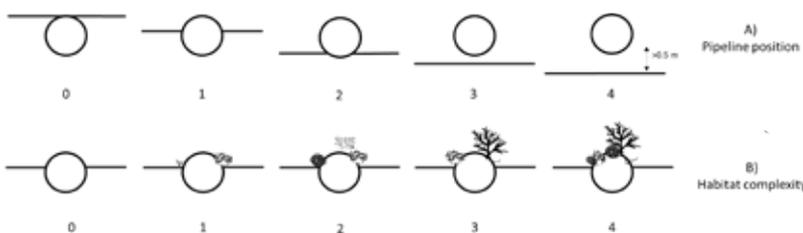


Figure 2 left: Method of assessing pipeline position: (A) with 0 = buried, 1 = more than half buried, 2 = resting on seafloor, 3 = span < 0.5 m and 4 = span > 0.5 m; and (B) habitat complexity with 0 = none, 1 = low and sparse, 2 = moderate height and medium density, 3 = high height and medium density, 4 = high height and dense coverage.

# Signature whistles: how dolphin mothers reunite with their calves



**In 2016, UWA Oceans Institute member and behavioural biologist Dr Stephanie King released research into the underexplored area of dolphin vocal signals, specifically how dolphin calves can identify their mother based on a ‘signature whistle’.**

Bottlenose dolphins are a highly social species well known for their use of individual identity signals, termed ‘signature whistles’. Given that dolphin calves are highly mobile when born, it is important to understand how mothers and calves recognise one another and what vocal mechanisms they might use to reunite.

The research, published in *Marine Mammal Science and Behavioural Processes*, revealed female bottlenose dolphins increased signature whistle production five-fold in the first four weeks postpartum. This temporary increase in maternal signature whistle-use allows calves to imprint on their mother’s signature whistle in the first few weeks of their lives. This is crucial to their survival because calves are not born with their own signature whistle but develop it within their first few months. Mothers may be unable to acoustically recognise their calves before this time, hence the necessity for a calf to recognise its mother’s signature whistle in the event of separation.

The study also examined the vocal behaviour of mothers as their calves grew older and became more independent. This was done by examining the pattern of a female bottlenose dolphin when retrieving both her three-month-old calf and a selection of inanimate objects. She frequently used her signature whistle to retrieve her calf and rarely produced

her whistle when asked to retrieve an object. This means that as a calf grows older and wanders further from its mother, she will use her signature whistle as a signal to indicate that she wants her calf to return to her.

This research highlights both the importance of vocal imprinting and maternal signature whistle-use in aiding mother-calf reunions in bottlenose dolphins, and significantly adds to a broader understanding of the evolution of mother-offspring recognition in the animal kingdom.



All images on this page © Stephanie King/  
The Alliance Dolphin Project



Accession No. 1955/0Q92, *Panoramic view of King George's Sound, part of the Colony of Swan River (detail)* 1834 {published}, hand-coloured etching and aquatint, 18 x 274.5cm (image), State Art Collection, Art Gallery of Western Australia, Transferred from Batty Library, 1955. Photographer: Bo Wong

# Buried treasures: uncovering the history of Barmup Settlement

**Old Farm Strawberry Hill in Albany is one of the state's most significant heritage locations. Now managed by the National Trust of Australia (WA), it was originally an Aboriginal camping site and meeting place called Barmup and also where, after 1826, the British established their first working farm overlooking the sheltered harbour of King George Sound.**

In 2016, UWA Oceans Institute member, Professor and ARC Future Fellow Alistair Paterson, along with fellow UWA archeologists Dr Sean Winter and Dr Emile Dotte-Sarout, and student Callum Forsey, published their long-running research into Aboriginal and British uses of the landscape and the settlement at Barmup.

Nearly two decades of historical archeological research have uncovered multiple uses of the site, from its beginnings as solely Noongar Mineng landscape around the site, to the arrival of the colony's first farm. The research has uncovered the history of the early buildings associated with Governor Stirling, who stayed at the

site, and other early colonists, plus material and environmental evidence for the various phases of life at the site.

UWA researchers have dismantled the assumption of Strawberry Hill as solely a British upper-class site. During the 19th and early 20th centuries, Indigenous people, indentured servants and convicts, Chinese market gardeners, women, children and others all left their footprints on this historical location on the coast of WA.

Mineng people have collaborated with UWA archaeologists and UWA students to create a research program focused on Aboriginal and British uses of the landscape and the settlement. Different phases of investigation, each with different aims but often involving training of UWA students, have rewritten the history of the site and provided the National Trust with a range of positive heritage outcomes. In particular, the hidden histories of the undocumented residents of the site have been uncovered through analysis of archaeological material from what was once a British-style country estate in Western Australia.

Professor Paterson emphasises the maritime links to this region. "Supported by significant cross-cultural relationships with Mineng people, the farm at Strawberry Hill was part of success of the British settlement at Albany, which was a centre for the sealing and whaling industries on the southern coast and a harbour for ships sailing to and from other Australian colonies."



Excavating on site at Old Farm Strawberry Hill, Albany. ©Alistair Paterson



# Kelp forests decimated during 2011 heatwave

**A heavily decimated kelp-forest ecosystem, stretching along 100km along Western Australia's coastline, is showing no signs of recovery five years on from a catastrophic heatwave in 2011.**

UWA Oceans Institute and School of Biological Sciences researcher Associate Professor Thomas Wernberg led a joint research team from CSIRO, AIMS, WA Museum, DPaW, Curtin University, The Australian National University and several other international research partners in a study focusing on the effect of a marine heatwave on the kelp-forest ecosystems.

The research team analysed data collected between 2001 and 2015 along 2,000km of the Western

Australian coastline and showed how the heatwave, combined with decades of ocean warming, broke down long-standing biogeographic boundaries with lasting consequences.

“Temperatures exceeded anything previously experienced by these kelp forests and they collapsed, allowing turf algae, tropical and subtropical fish, seaweed and coral to increase rapidly,” says Professor Wernberg.

The report, published in *Science*, found that five years on from the heatwave, widespread habitat loss had occurred, with many cool-water fishes, seaweeds and invertebrates declining or disappearing, replaced by reef communities resembling those typical of more tropical regions.

The findings are significant because these kelp forests are the biological engines of Australia's Great Southern Reef. Like trees in a forest or corals on a tropical reef, the kelp forests are the foundation of the ecosystem. The Great Southern Reef covers 71,000sqkm, stretching from south of Brisbane to north of Perth, weaving through the waters of five Australian states.

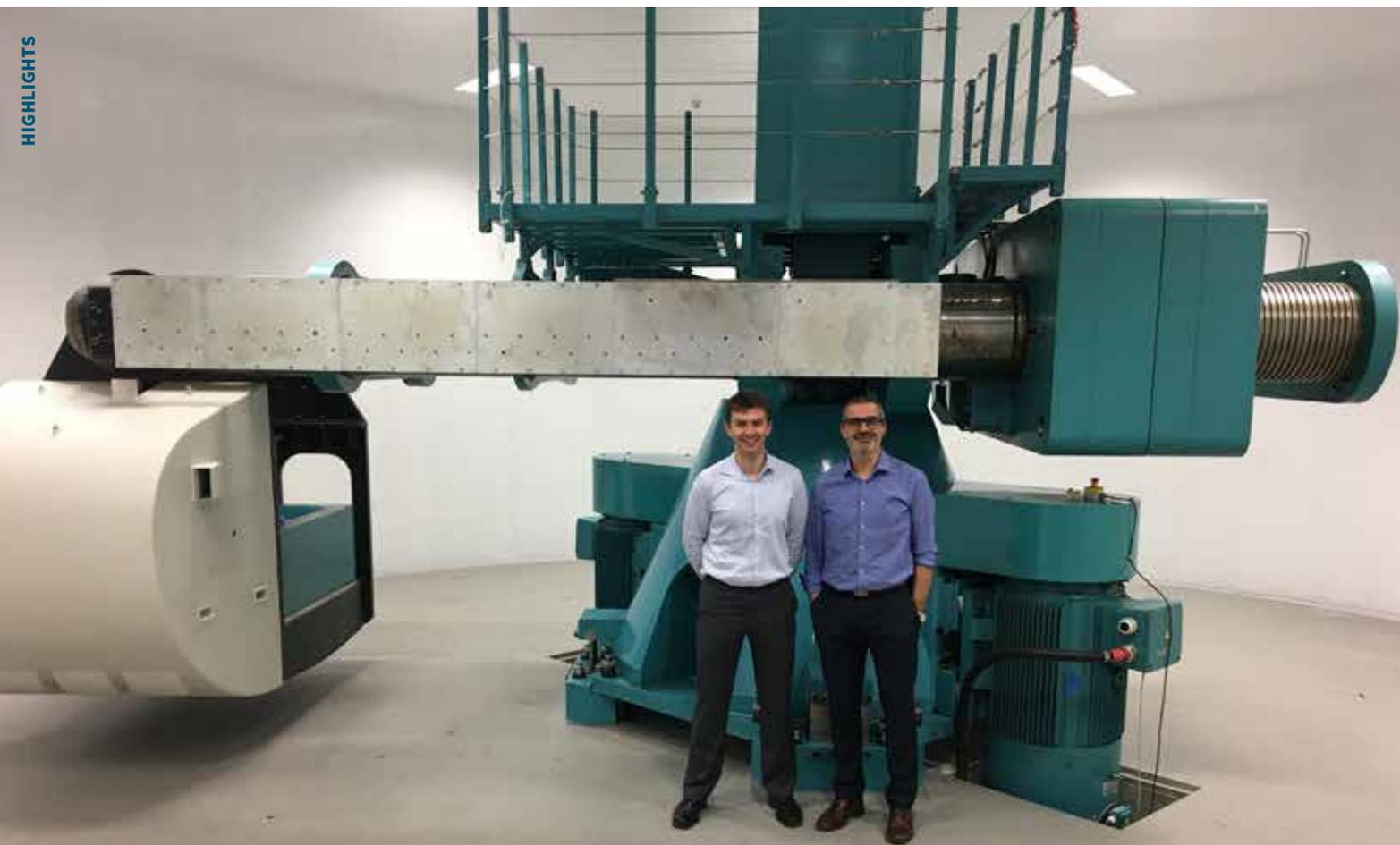
Globally acknowledged as a vital part of the ocean, the kelp forests of the Great Southern Reef contain unique and diverse marine life. These highly productive, structurally complex communities of seaweeds are a biodiversity hotspot for sponges, crustaceans, chordates, bryozoans, echinoderms and molluscs. Between 30 and 80 per cent of species cannot be found elsewhere.

Economically, the Great Southern Reef is estimated to be worth \$10 billion per year because it is the powerhouse of Australia's most valuable fisheries and reef-related tourism.

These findings provide a strong warning of what the future might be like for Australia's temperate marine environment and the importance it provides to countless Australians.

Ecklonia Radiata, Albany © Joan Costa





## New centrifuge arrives at IOMRC

**In September 2016, a 42 tonne fixed-beam centrifuge was lowered by crane into its new home at the Indian Ocean Marine Research Centre, Crawley.**

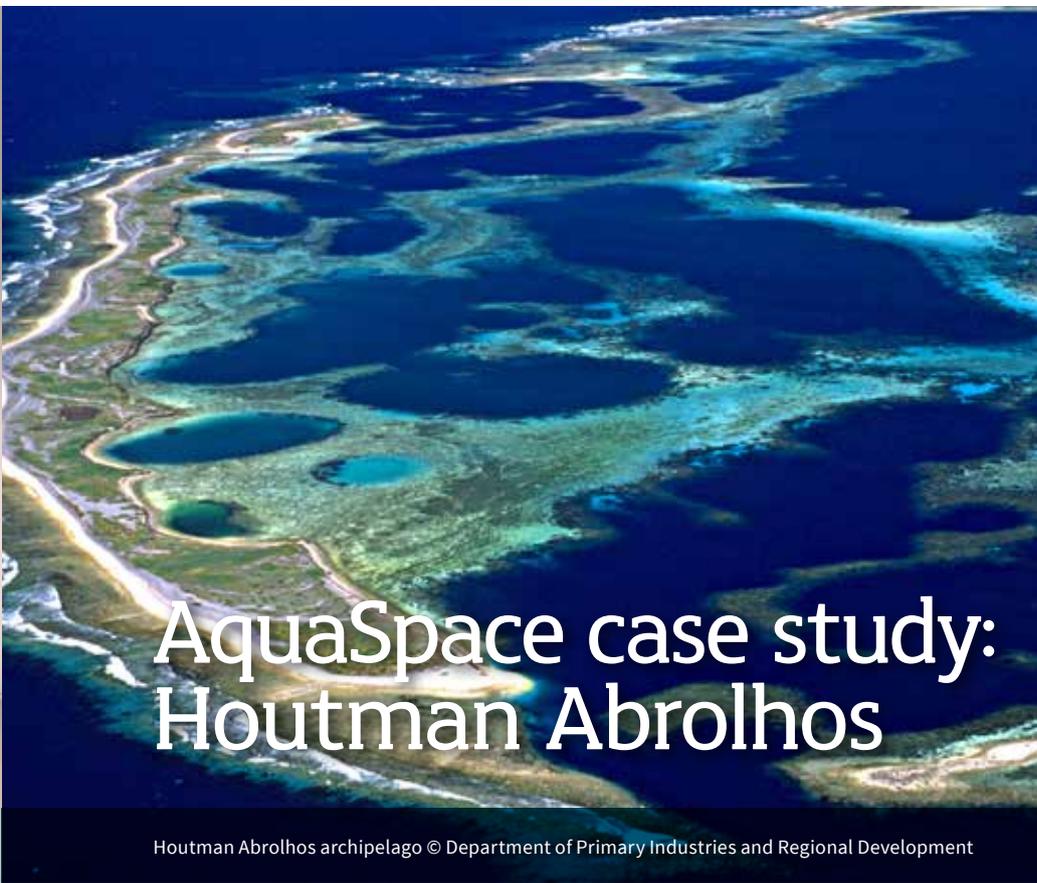
The arrival of the centrifuge, the biggest in the Southern Hemisphere, makes UWA the only geotechnical modelling facility in the world to operate three centrifuges. The centrifuge is part of the National Geotechnical Centrifuge Facility (NGCF), which is a collaboration between six Australian universities: UWA, The University of Newcastle Australia, University of Wollongong, The University of Queensland Australia, Monash University and The University of Adelaide.

The NGCF is run by the Centre for Offshore Foundation Systems (COFS) and headed by Oceans Institute member Professor Christophe Gaudin. The NGCF aims to service the national and international geotechnical engineering community by developing safe and economical geotechnical structures, notably for the offshore oil and gas and renewable energy industry.

The new centrifuge functions by spinning reduced-scale foundation models at incredible speeds in order to simulate the stresses experienced by the soil in full-scale conditions. With a 10m diameter, the new centrifuge is capable of spinning 2,400kg of soil at a centrifuge acceleration of 100 times the Earth's gravity, which is a force 10 times greater than an astronaut would experience during their training.

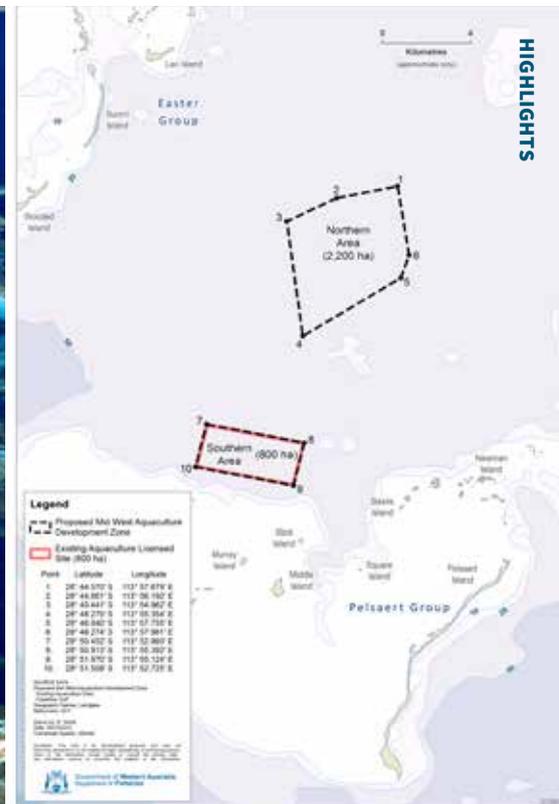
Data from the centrifuge modelling is applied to full-scale structures to help design pipelines, anchors and other offshore infrastructure.

“This is a big milestone for us,” says Professor Gaudin, who has been planning the development and installation of the centrifuge facility since 2012. “It’s been a huge effort from the whole team at the National Geotechnical Centrifuge Facility. The inception of the NGCF started about four years ago. Following a funding application to the Australian Research Council, and UWA support to house it in the new IOMRC building, it took three years of detailed preparation to design the lab, design the centrifuge, develop all the associated equipment, organise its manufacturing and transport from France and finally assemble it here at UWA.”



# AquaSpace case study: Houtman Abrolhos

Houtman Abrolhos archipelago © Department of Primary Industries and Regional Development



Aquaculture zones in the Houtman Abrolhos archipelago © Department of Primary Industries and Regional Development

HIGHLIGHTS

**UWA Oceans Institute member Dr Ana Martins Sequeira is leading research at the Houtman Abrolhos archipelago within the global aquaculture research project, AquaSpace. AquaSpace is a project funded by the European Commission and has 16 fresh- and marine-water case-study sites around the world, including Europe, the United States and China. The Houtman Abrolhos is the only Australian case study in the global project.**

The objective of AquaSpace is to provide increased space of high-quality water for aquaculture by adopting the Ecosystem Approach to Aquaculture (EAA) and using Marine Spatial Planning (MSP) to deliver food security and increased employment opportunities through economic growth.

The three pillars of the Ecosystem Approach to Aquaculture are ecological sustainability, social equity and harmonisation of multiple uses: in short, the ability for many people to make a living within the aquaculture industry and to co-exist with other industries such as tourism, without doing harm to the marine environment.

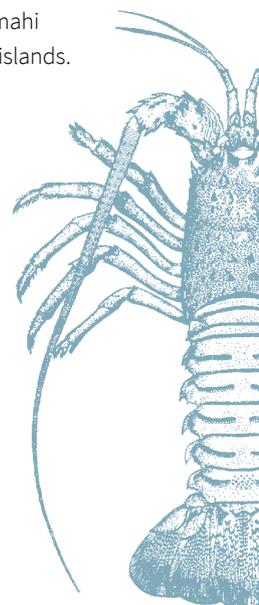
“AquaSpace brings together a large multidisciplinary and multinational team of experts to empower sustainable aquaculture growth in response to the current food-security challenge,” says Dr Martins Sequeira.

The Houtman Abrolhos archipelago was chosen as the Australian study site to investigate four key industry-wide aquaculture challenges: policy/management issues; spatial conflict issues; environmental issues; and economic issues. The waters around the Houtman Abrolhos islands have a status of Fish Habitat Protection Area and are managed by Fisheries Division of the Department of Primary Industries and Regional Development for the conservation of fauna and flora, tourism and recreational activities, as well as for the purpose of fishing and aquaculture industry.

The Fisheries Division of the Department of Primary Industries and Regional Development is supporting AquaSpace-related research by providing invaluable information about the local constraints to aquaculture development, and the data necessary for the development of an ecosystem model addressing finfish production in the Houtman Abrolhos archipelago.

The archipelago is a unique marine area where tropical and temperate species co-exist and is currently one of the most active aquaculture locations in Western Australia. There are 120 licensed fishers for western rock lobster (*Panulirus cignus*), which is the most valuable commercial fishery in Western Australia and has been active since 1904. There are also eight pearl farms producing the highly prized black pearl from black-lipped pearl oysters raised in hatchery, as well as some licensed finfish and scallop fisheries. Additionally, a total of 3000ha of suitable space is being designated for the aquaculture of yellowtail kingfish and mahi mahi around the Pelsaert group of islands.

**“Our research in the Houtman Abrolhos will contribute to the sustainable development of the new finfish aquaculture industry while continuing to embrace other existing uses in the region.”**  
**— Dr Martins Sequeira.**





# Decommissioning: a global challenge facing offshore industries

**A multi-disciplinary approach to decommissioning offshore infrastructure continued to be strongly researched by UWA Oceans Institute members in 2016.**

In the coming decades, the oil and gas industry is facing the prospect of decommissioning significant numbers of installations at the end of their lives. Tens of thousands of wells, thousands of platforms and many thousands of kilometres of seabed pipelines sit in the ocean, forming an underwater network of natural-resource infrastructure.

This year, UWA Oceans Institute member and Dean of Law Professor Erika Techera, and Professor of Offshore Geomechanics and Oceans Institute member Susan Gourvenec explored current national and international legal frameworks and engineering options around whether it is better to decommission disused oil platforms in situ or remove them from the sea floor.

**There are estimated to be 69 oil and gas platforms in Australian waters, with 30 of those more than 25 years old and 32 ceasing production in the coming decade. In Southeast Asia almost half of the region's 1700 offshore installations are more than 20 years old or approaching retirement.**

UWA Oceans Institute research suggests decommissioning is not a one-size-fits-all approach. While some offshore oil and gas facilities will respond better to complete removal there are other cases where they are best left in water or relocated to provide marine habitats ('rigs to reefs'). There is no optimal decommissioning solution and each piece of infrastructure brings with it its own unique cost, legal requirements and environmental considerations.

In the US and EU, where the oil and gas industry was established early, government and industry have already had to explore the scientific, engineering, economic, legal and environmental challenges of decommissioning. However, Australia's offshore oil and gas

industry is younger and, as a result, the fate of decommissioned offshore infrastructure is still an emerging issue.

It is clear that further research is needed both in terms of engineering options and potential law reform to allow for in situ decommissioning in Australia, as well as work by marine scientists, economists and other social scientists including sociologists to explore community concerns.

UWA Oceans Institute decommissioning research continues to be at the forefront of this international marine issue with our members expertise actively contributing to robust and relevant conversations with academia, government, industry and relevant society stakeholders.

# ARC Research Hub for Offshore Floating Facilities launched at UWA

**The \$10 million ARC Research Hub for Offshore Floating Facilities, known as the OFFshore Hub, is a multidisciplinary research initiative that launched in April 2016. The aim of the hub is to tackle critical engineering challenges for offshore oil and gas projects by improving designs and operating procedures.**

The OFFshore Hub involves five interlinked multidisciplinary projects that will develop new technologies to unlock safe and more efficient offshore projects, spanning both design and operations.

The projects are in the areas of ocean forecasting, riser and mooring longevity, vessel motion and offloading, novel anchoring, and subsea foundations. The research program involves a blend of physical and numerical modelling, supported by fieldwork analysis of observations from existing facilities.

The OFFshore Hub utilises and expands on UWA's existing facilities in order to deliver successful outcomes for the extensive research program. This includes working closely with the National Geotechnical Centrifuge Facility (NGCF) and the ocean-data collection and modelling facilities at the Oceans Institute. Woodside's FutureLab initiative supports industry-academia collaboration via a collaborative space – known as OceanWorks – in the Indian Ocean Marine Research Centre, as well as the RiverLab community for offshore fieldwork on Perth's Swan River.

The OFFshore Hub industry partners are Shell, Woodside Energy, Bureau Veritas and Lloyds Register. Each partner organisation is helping to shape the research directions, collaborate in the research activity, drive the technology transfer and assist with the mentorship of the researchers and students.

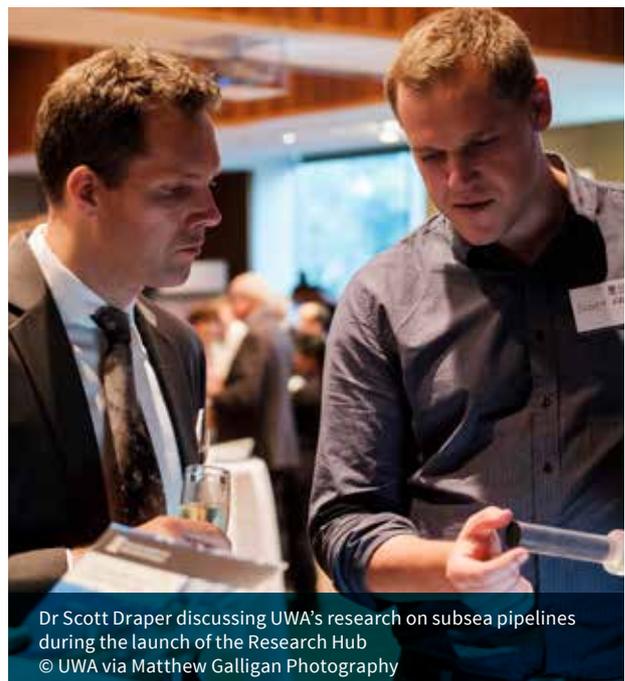
“With the breadth of expertise within the Hub and our multidisciplinary approach, expert advice can be offered from ‘sky to seabed,’” says Professor David White, Director of the OFFshore Hub and UWA Oceans Institute member.

The hub is part of the Australian Research Council Industrial Transformation Research Program. “The hubs are powerful tools for connecting research and industry with the partnership, providing a competitive edge for products, processes and services,” says UWA Deputy Vice-Chancellor (Research), Professor Robyn Owens. “They are a unique training environment and provide a highly skilled workforce with the expertise to unlock Australia's energy resources and strengthen our contribution to the global energy engineering business.”

The Industrial Transformation Research Hub for Offshore Floating Facilities (OFFshore Hub) is based at the UWA, with a node at Western Sydney University.



At the launch of the ARC Hub and Training Centre (L-R) Professor Eric May, ARC's Dr Fiona Cameron, Senator Linda Reynolds and Professor David White. © UWA via Matthew Galligan Photography



Dr Scott Draper discussing UWA's research on subsea pipelines during the launch of the Research Hub © UWA via Matthew Galligan Photography

# Shark Shield™ proven to effectively deter white shark predatory behaviour

**In July, UWA Oceans Institute researchers Professor Shaun Collin and Dr Ryan Kempster released their final test results of a study that examined the effectiveness of the Shark Shield™ shark deterrent.**

The three-year, WA State Government-funded study concluded the Shark Shield Freedom 7™ produced an effective deterrent field on average of 1.3m from the device's electrodes. It was found to prevent white sharks from interacting with a static bait nine times out of ten on their first approach.

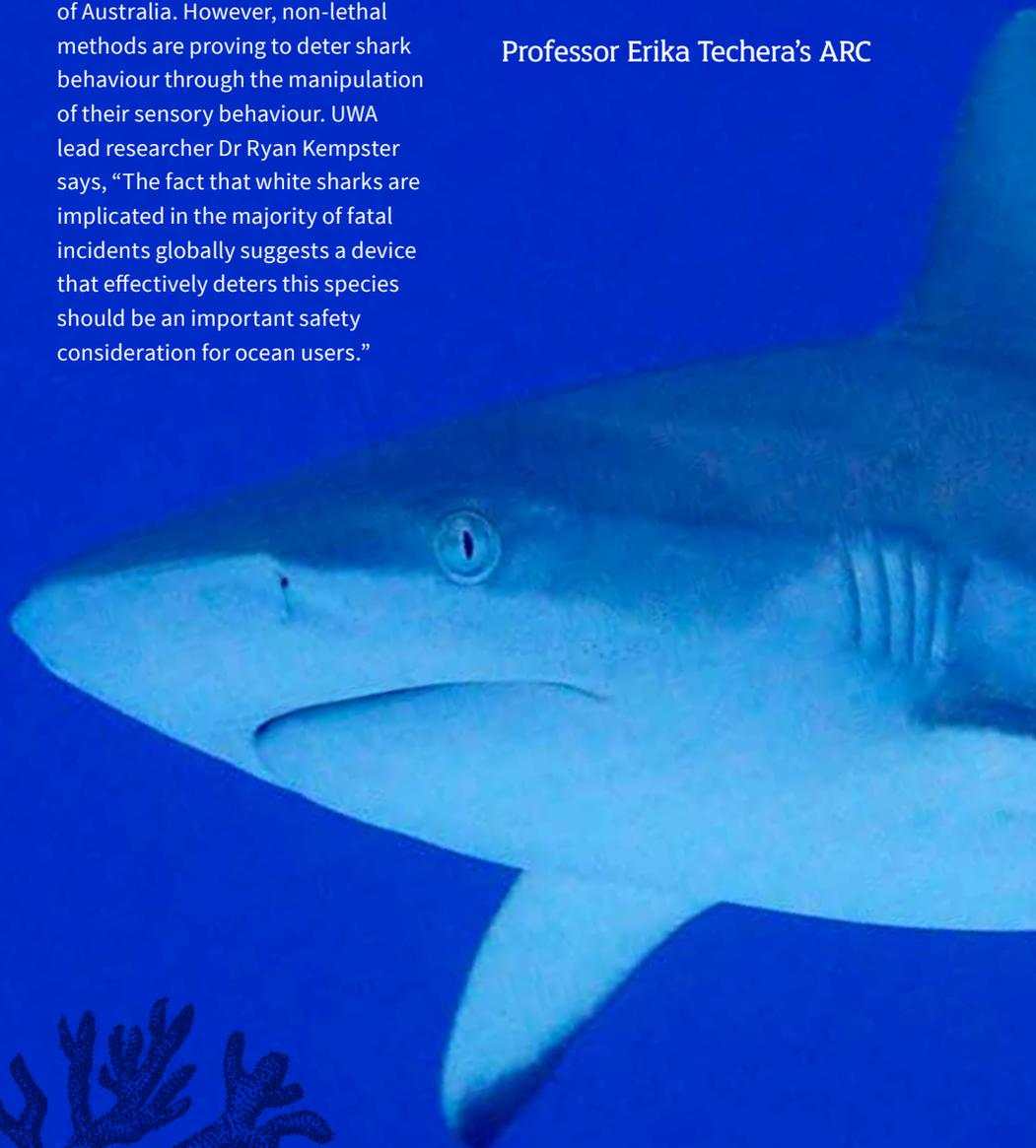
The Shark Shield Freedom 7™ is a portable electronic device emitting an electromagnetic field that repels sharks by over-stimulating their electrosensory system. By measuring the electric field gradient produced by the Freedom 7™ the study aimed to determine the strength of the gradient that elicits a deterrent response in white sharks.

The experiments were carried out at Seal Island, Mossel Bay in South Africa, which was chosen for its large white-shark population, its calm ocean conditions and a large population of seals. The research involved the deployment of custom-built Remote Monitoring Research Apparatus (ReMoRA) equipped with an inactive (control) or active Freedom 7™ deterrent. A total of 322 encounters were analysed from 41 individual white sharks of two to four metres in length.

Despite the low rate of attack, shark bites continue to gather global attention because of the potentially serious outcomes. This has resulted in an ongoing public debate regarding the introduction of shark culling versus the protection of these apex predators. The risk that shark attacks pose has led to the adoption of a range of lethal shark-control programs in different parts of Australia. However, non-lethal methods are proving to deter shark behaviour through the manipulation of their sensory behaviour. UWA lead researcher Dr Ryan Kempster says, "The fact that white sharks are implicated in the majority of fatal incidents globally suggests a device that effectively deters this species should be an important safety consideration for ocean users."

The study found no evidence to support the common theory that electric deterrents attract sharks from greater distances. Instead the research provided overwhelming evidence of the effectiveness of the Shark Shield Freedom 7™ on the behaviour of white sharks. Additionally, the experiments proved an accurate method for testing the effectiveness of any new shark deterrents entering the market in the future.

**Professor Erika Techera's ARC**



Discovery Project, “Improving the global governance of sharks: obstacles, options and opportunities”, reached completion in 2016. Her research delivered key insights to protect the future survival of sharks. This research is critical in light of the poor conservation status of sharks, despite their importance for marine ecosystems. Emerging science indicates sharks play a critical role in maintaining marine ecosystem health, yet current governance regimes have not been effective, and many

shark species continue to diminish. Effective laws are vital to improving sharks’ conservation status. Professor Techera’s Discovery Project addressed key challenges in shark governance by examining current obstacles preventing existing laws from working better, identifying best-practice global governance options, and highlighting opportunities for reform of international laws and institutions for shark conservation and management.

Significant media and public attention accompanied the announcement of the findings. “It is important that robust scientific evaluation of these types of devices is carried out so that the public can make more informed decisions about how they can reduce their risk of encountering a shark,” says Professor Collin.

The research was made possible by a \$220,573 grant from the WA State Government Shark Hazard Mitigation Applied Research Program and UWA. The study was the largest to date of the effectiveness of a range of shark deterrents, including the Shark Shield™. The final results of the research paper, published in PLOS ONE, involved scientists from UWA, Macquarie University, Flinders University and Oceans Research in South Africa.

# Dr Scott Draper named as 2016 Woodside Early Career Scientist

Dr Scott Draper, Oceans Institute member and School of Civil, Environmental Mining and Engineering researcher and lecturer, was awarded the prestigious Woodside Early Career Scientist Award at the 2016 Premier Scientist Awards in Perth. The achievement recognises an outstanding scientist who is within the first five years of completing their highest degree and has demonstrated excellence in a field of science, scientific research or technological advancement. The awards were hosted by WA Chief Scientist Professor Peter Klinken and were attended by WA's top scientists and researchers.

"I am very honoured to win this award and grateful for the opportunity it affords me to publically thank the many people I have worked with and who have inspired and mentored me throughout my five years at UWA," says Dr Draper.

Dr Draper is known internationally for his research in offshore fluid mechanics. He has developed models to optimise the configuration of offshore wind and tidal turbines for renewable energy, to predict seabed scour and to estimate the stability of offshore structures in extreme wave conditions. His research on marine renewable energy provided the

first accurate assessment of marine renewable energy resources in the UK. Dr Draper has published more than 50 peer-reviewed papers, has worked on multiple Australian Research Council projects and has supervised award-winning PhD and master's students.



# Professor Erika Techera wins top academic honour

excellence and expertise.

Oceans Institute member and the first female dean of The University of Western Australia's Law School, Professor Erika Techera, has been named Academic of the Year at the Lawyers Weekly 2016 Australian Law Awards, held in Sydney.

Awarded for the first time this year, Academic of the Year recognises the academic who is most effectively shaping legal undergraduate and juris doctor (JD) students, instilling a passion for the law, professional

Professor Techera said she was honoured to receive the inaugural award and thanked her colleagues for their support. "It has been most rewarding to work with and assist students from different backgrounds and with a range of interests at both Macquarie University and the University of Western Australia," says Professor Techera. "I thank them all, and my fellow academic colleagues, for their support and encouragement."

Dr Techera specialises in international and comparative environmental law with a focus on marine environmental law and heritage law and policy. Her current research explores the international governance arrangements for sharks, indigenous customary marine management, and marine environmental governance around the Indian Ocean rim. She is also exploring legal frameworks to support marine protected areas and marine spatial planning.

# Research finds ocean acidification causes deformities in young coral skeletons

**In February this year, researchers from the Oceans Institute and the ARC Centre for Excellence for Coral Reef Studies discovered that by 2100 our increasingly acidic ocean may contribute to smaller, more porous and malformed skeletons in coral recruits.**

These tiny animals are essential for replenishing the reef and recovery after disturbances, and the fact they are unable to withstand increasing ocean acidification is alarming to the future health of coral reefs.

Lead author, PhD graduate Ms Taryn Foster, says new coral recruits are usually around 1mm in diameter and so are “more vulnerable to stressors like predation, overgrowth and storm damage”.

“They need to be able to build robust skeletons and do this quickly, in order for them to move out of these small and vulnerable-sized classes,” says Ms Foster. “Unfortunately, ocean acidification is making this task more difficult.”

Fellow Oceans Institute members and ARC Centre researchers, Australian Laureate Fellow Malcolm McCulloch, Research Assistant/Professor Jim Falter and Associate Professor Peta Clode also contributed to the research, published in the journal *Science Advances*.

The team mimicked future oceanic conditions that will exist under a business-as-usual scenario for carbon emissions. In this scenario, both water temperature and CO<sub>2</sub> levels increased significantly within the ocean.

At the Centre for Microscopy, Characterisation and Analysis at UWA, 3D X-Ray microscopy and scanning electron microscopy were used to both visualise and quantify changes in the skeletal formation. The findings revealed that coral recruits were unable to build normal skeletons under acidified conditions.

The research found that elevated levels of CO<sub>2</sub> contributed to deformities in coral skeletons and reduced overall skeletal deposition. Oceans Institute member Professor Malcolm McCulloch said these deformities “ranged from gaps, fractures and disrupted symmetry to large sections of missing skeleton, and we also saw deep pitting and a corroded-looking skeletal surface in high CO<sub>2</sub> corals”.

The project was funded by the ARC Centre of Excellence for Coral Reef Studies.



Images © Joan Costa

# UWA Marine Renewable Energy research team wins ARENA funding

In May 2016, the Australian Renewable Energy Agency (ARENA) awarded a \$1 million grant to UWA to work on the deployment of arrays of wave-energy convertors.

The four-year, \$3.5 million project in collaboration with Carnegie Clean Energy (CCE) aims to reduce the cost of energy produced by wave-energy convertors (WECs) by optimising their location and arrangement to produce maximum power generation and minimise initial construction costs.

UWA Oceans Institute members Professor Christophe Gaudin, Professor Ryan Lowe, Dr Conleth O'Loughlin, Dr Jeff Hansen, Professor Mark Cassidy and Dr Yinghui Tian are part of the successful team that brings together a multidisciplinary group of geotechnical, coastal and offshore engineers, along with industry project managers and hydrodynamists at CCE. The Deputy Director of UWA's Centre for Offshore Foundation Systems, Professor Christophe Gaudin, commented that while wave-energy technology is now widely accepted as a viable source of clean electricity, there are still many challenges to overcome for it to be commercially viable.



(L-R) Dr Conleth O'Loughlin (UWA), Professor Ryan Lowe (UWA), Research and Intellectual Property Coordinator Mr Daniel Taylor (Carnegie Clean Energy), Professor Christophe Gaudin (UWA) and Dr Jeff Hansen (UWA)

"One of the key objectives of the wave-energy industry today is to produce commercially viable wave farms by placing multiple wave-energy convertors together in an array," he says. "Our research will focus on the infrastructure required to install and operate large arrays of wave-energy convertors at sea and notably on the foundation engineering where we think big savings can be made."

The UWA and CCE team will focus on a cross-disciplinary and integrated approach over the four years to adopt and evaluate the combined influence of wave properties, seabed bathymetry and geotechnical characteristics. Two postdoctoral researchers have been appointed and two PhD opportunities have been created to accommodate the scope and breadth of the research.

The project outcomes will be of critical value for the entire renewable wave-energy industry as it attempts to transition from single, or a small number of, demonstrator devices to full commercial deployment of multiple devices integrated in larger arrays.

Currently, the technology comes directly from the oil and gas industry and if renewable energy is to be a viable energy source for Australians in the future, there is a need for a more streamlined approach when designing foundations for wave-energy convertors, particularly around wave loadings and soil conditions.

This project compliments the ongoing research collaboration between UWA and Carnegie Clean Energy on extreme load avoidance and foundation stability, funded through the Australian Research Council.

# Top geological honours go to Professor Malcolm McCulloch

**Professor Malcolm McCulloch, ARC Laureate Fellow, Oceans Institute member, School of Earth Sciences member and Deputy Director of the ARC Centre of Excellence for Coral Reef Studies at The University of Western Australia, was presented the A.E. Ringwood Medal in 2016.**

The A.E. Ringwood Medal is awarded for exceptional research advances in the knowledge of fundamental Earth processes, especially through studies involving petrology and geochemistry.

Professor McCulloch's early work included pioneering research on the Nd-isotope tracer (initially at the California Institute of Technology (Caltech) with his PhD supervisor Professor Gerry Wasserburg), and investigating the timing and nature of the evolution of the solar system.

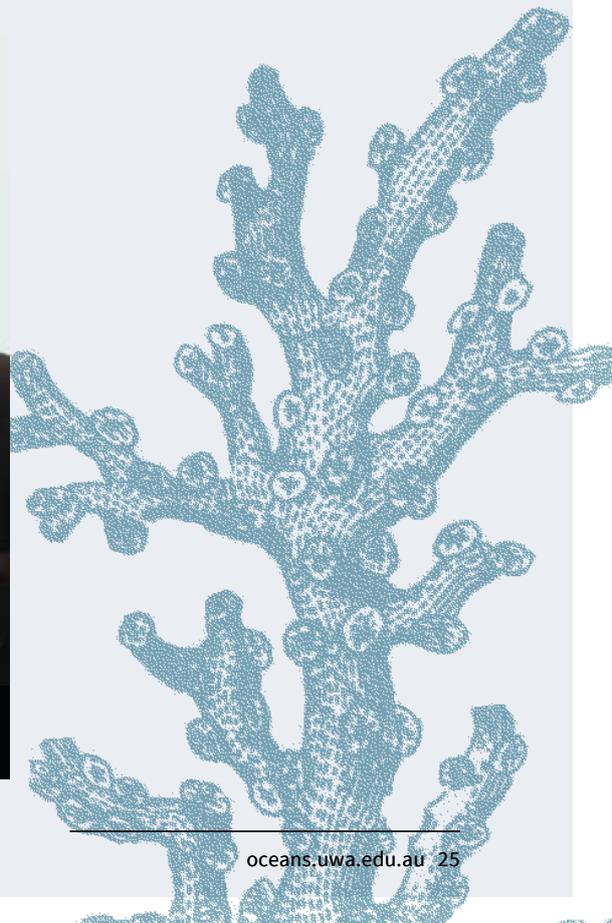
Upon completing his doctorate he returned to Australia to take up a position at the Australian National University within the Research School of Earth Sciences (RSES), where he spent the next three decades researching and publishing seminal works on crustal evolution and the evolution of both the convecting and lithospheric mantle domains. In the early 1990s he shifted focus to environmental sciences where, among many initiatives, he developed various geochemical proxies, such as B isotopes and Sr/Ca and Ba/Ca ratios, key indicators of coral reef palaeoenvironments such as pH, temperature and sediment input. His work on the Great Barrier Reef has assisted with policy changes regarding farming practices within the catchment systems.

Professor McCulloch's excellent science and prodigious output (more than 300 journal articles and over 30,000 citations) have been recognised internationally – he is a Fellow of the Royal Society (London), Fellow of the American Geophysical Union, Fellow of the Geochemical Society, and Fellow of the Australian Academy of Science. In 2009, he moved to the University of Western Australia as a Western Australian Premier's Fellow, and is now an ARC Laureate Fellow. He also leads the UWA node of the ARC Centre of Excellence for Coral Reef Studies.

The award is named after Professor Ted Ringwood (1930-1993), one of the world's outstanding geochemists. For much of his career, Professor McCulloch worked in the department that Professor Ringwood helped to create.



Professor Malcolm McCulloch accepting the A.E. Ringwood Medal 2016 from Dr Graham Carr (past President of the Geological Society of Australia). Photo courtesy of GSA.





Mantis shrimp

# Polarisation vision: insights from mantis shrimps

**The extraordinary eyes of stomatopods (mantis shrimp) work in fascinating ways that may help design novel, robotic vision systems.**

UWA Oceans Institute member, Associate Professor Julian Partridge, was among a team of researchers investigating how and why these charismatic shrimp-like crustaceans roll their eyes when they visually inspect highly-polarised objects.

The study, published in *Nature Communications*, is the first to document an animal displaying dynamic polarisation vision using rapid, rotational eye movements allowing stomatopods to quickly analyse the way objects polarise light.

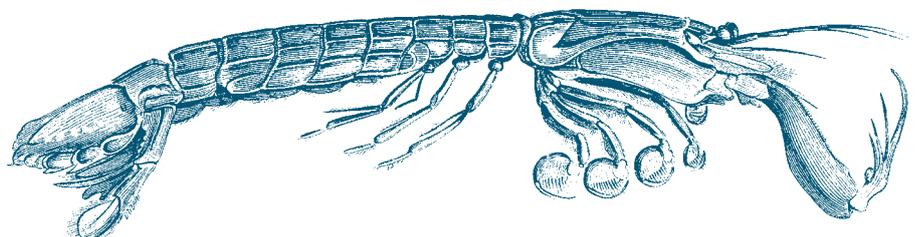
Mantis shrimp have an extraordinarily complex visual system. Their eyes are divided into three sections: the dorsal and ventral hemispheres; and a mid-band of two to six rows of light receptors

across the centre of the eye. They have up to 12-channel colour vision and can see both linear and circular polarised light. Vision is key in much of their behaviour, be it finding food or mates, or avoiding predators.

Stomatopods are an unusually inquisitive group. As they look around, these stalk-eyed crustaceans employ an extensive repertoire of eye movements. Their highly-mobile eyes can move together or separately and have exceptionally free, rotational movements. Typically, they only occasionally fix a gaze on scenes or objects and generally explore their visual environment with a series of rapid pitch, yaw and torsional (roll) rotations of their eyes.

This study showed when mantis shrimp are shown a highly polarised object they quickly roll their eyes to maximise the polarisation contrast they see with their two ocular hemispheres. This is a new finding that suggests a novel way to analyse polarisation images.

“As humans, we lack polarisation vision and have little natural insight about what information it can provide. What stomatopod dynamic polarisation vision suggests is a new way to design a sensor for the rapid assessment of polarisation,” Professor Partridge said. “No-one has tried to make a dynamic polarisation imager but for small, low-cost, low-weight sensors, mantis shrimp may have a trick that we too, can adopt.”



# The practice of marine biodiversity offsetting: what Australians think?

**UWA Oceans Institute researchers Dr Abbie Rogers and Associate Professor Michael Burton have been investigating how Australians react to marine biodiversity offsets. Do people think this is an acceptable practice, and how do they think offset policies should be designed?**

Understanding the social acceptability of biodiversity offsets is important in order to properly design offset policy. This project, funded by the National Environmental Research Program's Marine Biodiversity Hub, used economic valuation methods to measure community preferences for both current and prospective offset policy characteristics in the context of protecting migratory shorebirds and seagrass habitat affected by development.

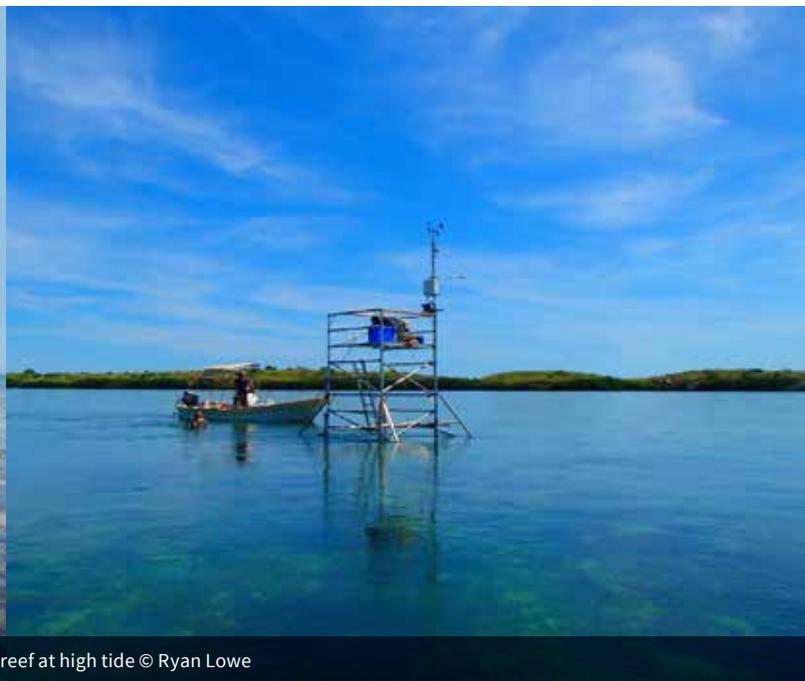
A survey sample of 2,700 Australians revealed that offsetting was accepted by the community as a means to allow economic development.

Substituting protection of a species impacted by a development for a more endangered species was a desirable policy characteristic, as was having the offset implemented by a third party or the government, rather than the company responsible for the development.

Direct offset activities (e.g. replacing like-for-like habitats) were preferred over indirect (e.g. research and education programs), and there was a strong aversion to locating the offset at a site other than where the impact occurred.

Their research was published in *The Australian Journal of Agricultural and Resource Economics and Conservation Biology*. The data was also compiled in a report, "Community acceptance of marine biodiversity offsets in Australia: a pilot study" for the NERP Marine Biodiversity Hub, The University of Western Australia, Crawley.





Devices recording ocean and atmospheric conditions over a Kimberley reef at high tide © Ryan Lowe

# Rising sea levels could benefit some reef systems

**In 2016, Professor Ryan Lowe from UWA's Oceans Institute and School of Earth Sciences completed a three-year study of the environmental conditions of poorly explored reef systems in the northern Kimberley region of Australia, with support from WAMSI (Western Australian Marine Science Institution).**

The team, which included OI researchers Renee Gruber, Dr Graham Symonds, and Dr Jim Falter, focused in part on assessing the processes that drive local temperature variations within the reef systems in the region.

The Kimberley coast is home to some of the most remote and pristine coral systems on the planet but also is the location of one of the world's most extreme tidal ranges, with tides sometimes swelling to more than 12m.

Water temperatures in reefs are increasing with global ocean warming, and coral-reef organisms are known to be especially vulnerable to elevated temperature stresses that can lead to mass bleaching and mortality.

UWA researchers have now developed a model to accurately predict temperature variations within shallow reef systems, based on local tidal conditions, solar heating properties and reef structures.

The data found that temperatures within shallow reefs could differ substantially from the surrounding ocean. This is significant because it means future patterns of bleaching and other stresses on reefs depend on our capacity to predict conditions in reef environments.

The research, published in the international journal *Science Advances*, revealed extreme temperature fluctuations in the reef reaching 38°C and varying by more than 10°C over a single tidal cycle.

“Over a 15-day cycle, the water temperature became most extreme when the low-tide period drifted to align with maximum heating by the sun at noon, which warmed the shallow water on the reefs,” says Professor Lowe. “These temperatures reach particularly extreme values in reef

regions with strong tides where the tidal range is greater than the average reef water depth. As a consequence, by studying a number of tide-dominated reefs globally we found that even a modest rise in sea level could help lower the water temperature of the reef and may also partially reduce reef heat extremes in the world's future warming oceans.”

Much of the focus of recent research has pivoted on understanding how regional ocean-warming patterns, driven by climate change, are impacting reef systems. Additionally, significant attention has been given to short-term climate patterns such as marine heatwaves associated with the El Niño-Southern Oscillation cycle. Yet scientists currently lack the ability to predict how tides control temperature extremes across a wide geographic range of reef systems and how projected rising sea levels and reduced reef growth rates will alter the thermal conditions within reef waters. This new model created by Oceans Institute researchers is the first step towards solving this research gap.



# Newspapers, gender and recreational fishing in Australia, 1957–2000

Analysis of 40 years of a fishing column in Perth's *Sunday Times* newspaper has illuminated women's changing participation in recreational fishing, while also exploring the complex relationship between the mass media and gendered cultures of recreational fishing.

Environmental historian and Oceans Institute member Associate Professor Andrea Gaynor led a team of researchers analysing the tabloid newspaper's fishing column. The purpose of the research was to provide

a much-needed insight into how women have historically participated in recreational fishing in WA, and how this participation was both represented and shaped by the mass media.

The team analysed a set of scanned fishing column articles from Perth's *Sunday Times*, ranging from 1957 to 2000, to determine what percentage of articles contained references to women or girls. The results were charted, and the researchers then set out to explain the trends through close reading of article content with reference to the broader historical content. The research, published in *Geoforum*, highlighted the gendered nature of

Australian recreational fishing cultures in the second half of the 20th century. It showed how women have consistently participated in recreational fishing in various ways, and that until the late 1990s recreational fishing was overwhelmingly represented as a masculine pursuit. The research also highlighted a gap in the cultural understanding of recreational fishing, with very little analysis undertaken to date from geographical and historical perspectives.

"While women were underrepresented in the column this wasn't necessarily because they weren't fishing," says Associate Professor Gaynor. "Rather, the gendered representations of recreational fishing was shaped by a range of factors, from presumed audience and column authorship, to historical factors including the organisation of recreational fishers and anti-feminist backlash."

# Artificial reefs offshore in Western Australia

**Oceans Institute member Dr Scott Draper is part of an engineering team testing the effectiveness of offshore artificial reefs, which are being deployed around Australia. The latest deployment occurred off the coast of Rottnest Island in December 2016.**

The aim of the artificial reefs is to establish a sustainable marine environment to support productive fish communities for recreational fishing.

Dr Draper and colleagues Dr Henning Mohr and Dr Hongwei An from UWA's Civil, Environmental and Mining Engineering School (CEME) undertook research on behalf of Subcon, a company specialising in subsea structures, to test the effectiveness of its innovative artificial-reef designs.

Using a model of a Subcon ReefTemple™ module, CEME investigated how currents and waves would interact with the artificial reef and, importantly, confirm if the structures could and would direct water upwards. This characteristic is important for the ecological health

surrounding artificial reefs as the induced upwelling delivers nutrients and food up into the water column, which is critical for attracting fish.

Subcon has since installed the concrete ReefTemple™ modules at five sites nationally, and Dr Draper says underwater images indicate the structures are covered in marine growth, surrounded by fish.

“Two sites have experienced storm events and are performing how they were designed, both hydrodynamically and as a productive habitat,” says Dr Draper.

The CEME team was also involved in testing the design of Subcon's newest FishTower™ modules, which were deployed off Rottnest Island in December. These artificial reef structures were commissioned by Recfishwest and were funded by recreational fishing licence money which is being invested in habitat-enhancement projects designed to create sustainable, accessible, enjoyable and safe fishing experiences on the WA coast.

The conditions at Rottnest Island are far harsher than those experienced by the reefs submerged off the east coast of Australia. Proving the artificial reefs would not be displaced by the large tidal surges and swells off Rottnest was critical. To do this, the research team looked at a radically different design and performed experiments to estimate the hydrodynamic loads on the structure, which allowed Subcon to determine the optimal ballast.

This research involved tank testing at UWA's internationally renowned O-Tube flume facility. The O-Tubes are flumes through which water is rapidly recirculated, simulating extreme underwater wave and current conditions. Together, the large and mini O-Tubes are revolutionising research on pipeline stability design and sediment transport.

“With the O-Tube, we are able to replicate currents at the seabed in extreme storms,” says Dr Draper. “This allows us to properly investigate the stability and reliability of subsea structures, like the artificial reefs, in the harsh offshore conditions common to Western Australia's coastline.”



# Restoration Ecology: an integral tool for marine conservation

**In 2016, UWA Oceans Institute member Professor Gary Kendrick was part of an international study examining how marine ecosystems can be restored to their original state.**

The research, published in *BioScience*, found the current approach to marine-ecosystem management was failing to protect our oceans adequately. The study revealed that where ecosystems were already heavily degraded, restoring marine ecosystems to their original state is not a realistic long-term goal. Ecological restoration would not provide a substitute for the conservation of ecosystems, but a more effective management strategy is required that takes into account the alarming and accelerated degradation of the marine environment.

“There are more benefits in trying to improve the overall health of marine ecosystems than trying to restore them

to their original natural state, which is not achievable in the long term,” says Professor Kendrick. “Restoration management can be achieved by highlighting the costs and benefits to communities from restored versus non-restored marine ecosystems.”

Marine ecosystems play a crucial role in supporting human health and wellbeing, from our food supply and coastal protection to the Earth’s climate. This is why urgent changes are needed to curb the damage occurring to marine ecosystems after centuries of human-induced modification.

The data collected during the research found that, due to human activity, marine ecosystems were being destroyed or disappearing at alarming rates, many faster than can be restored.

Whereas current conservation and natural-resource-management policy operates largely on the basis

of regulating and restricting human behaviour, a successful ecological restoration approach would encompass both social and ecological elements of conservation for a common outcome.

Professor Kendrick says present management approaches and tools are inadequate to address the problem, calling for a critical change in science and policy.

“When planners fail to address the impact that society has on ecosystems or disregard their behaviours and values in the planning process, people will often ignore reserve boundaries, leading to the failure of reserves to protect marine resources and diversity,” says Professor Kendrick. “We need to work together so marine reserves are preserved for communities and their success is driven by community-led protection. Where ecosystems are degraded, we need to implement restoration.”



# Collaboration



# Fostering closer ties with our Indian Ocean neighbours

Oceans Institute members Professor Ryan Lowe, Mr Andrew Pomeroy and Mr Arnold van Rooijen travelled to Mauritius in March to deliver a short course on the coastal impacts of climate change to university academics and government officials from Mauritius, Rodrigues and Seychelles.

As part of a 2014 agreement with the University of Mauritius, created to develop stronger strategic ties and facilitate joint Indian Ocean research, both the Oceans Institute and the University of Mauritius have been working together to create opportunities such as this to collaborate, educate and explore common research areas such as ocean engineering, aquaculture, ocean forecasting, marine energy and marine ecology.

“Our aim was to equip participants with scientific knowledge about the physical processes that occur along coasts of reef-fringed islands and how to apply this knowledge to enhance coastal zone management,” says Mr Pomeroy.

Another course is planned for 2017 to build on the knowledge and skill base established during the visit. The value of this collaboration will facilitate a more informed conversation on how best to plan and adapt to the coastal challenges this island nation and those around the Indian Ocean face in the coming decades.

The visit to Mauritius involved strategic meetings with the Australian High Commission, including important dialogues with Her Excellency Ms Susan Coles, Australian High Commissioner to the Republic of Mauritius.



Mauritius coast © David Pannell



Professor David Pannell and Her Excellency Ms Susan Coles, Australian High Commissioner to the Republic of Mauritius, with course participants. © David Pannell

“It’s great to see attention focused on developing strategic links between Mauritius and Australia surrounding the blue economy,” says Professor Lowe.

The course was funded by the Adaptation Fund established under the UN Framework Convention on Climate Change.

**“The relationship between UWA and the University of Mauritius is a great example of neighbourly engagement across the Indian Ocean that will continue to become more productive as time goes on.”**  
— Mr Andrew Pomeroy

In September 2016, Professor David Pannell – Oceans Institute member, Head of School, Agricultural and Resource Economics, and Director of the Centre for Environmental Economics and Policy – returned to Mauritius to deliver a week-long course on cost-benefit analysis applied to climate-change initiatives.

In May, participants from Mauritius, Seychelles, Madagascar, South Africa, Kenya, Mozambique and the

Comoros visited UWA Oceans Institute to participate in a short course on environmental management, funded by the Department of Foreign Affairs and Trade.

The course was aimed at regulators, government researchers, higher-education providers and non-government organisations. It offered the opportunity to gain skills in the key elements of environmental monitoring and management, including best-practice standards for data acquisition and management.

The Environmental Management program trained participants on how to plan and implement blue-economy solutions, develop skills for best practice in both laboratory and field-based techniques, enhance skills for analysis and interpretation of data, and equip participants with the knowledge to develop effective management strategies. Oceans Institute members Professor Chari Pattiaratchi, Professor Christophe Gaudin, Professor Ryan Lowe, Dr Scott Draper, Dr Julian Clifton and Mr Andrew Pomeroy delivered the intensive program over five days.



# Introducing...RiverLab

The RiverLab team at Matilda Bay (L-R top row): Professor David White, Dr Nicole Jones, Dr Britta Bienen, Dr Scott Draper, Dr Hugh Wolgamot, Dr Andrew Grime (L-R bottom row): Dr Wenhua Zhao, Dr Lucille Chapuis, Mr Justin Geldard-Ker, Dr Ian Milne, Mr Brenton Atkinson



**RiverLab – a collaboration between Woodside FutureLab and The University of Western Australia – commenced in 2016. It is a unique initiative aimed at developing innovations in offshore engineering by undertaking research, education and outreach activities within the Swan River.**

One of RiverLab’s flagship projects aims to use the steady and reliable supply of wind waves in the Swan River to explore the performance

and response of temporarily moored offshore structures. Additional projects include using the Swan River to trial prototype devices and sensors, such as those used to measure geotechnical properties and to monitor aquatic life.

Much of the research within the RiverLab is undertaken via final-year masters’ thesis projects, and throughout 2016, seven final-year students signed up for theses within the RiverLab. Justin Geldard-Ker was first, completing his work on measuring and analysing surface waves in the river – a crucial first step to determining the usefulness of the Swan River to explore the performance and response of offshore structures. Justin went on to win two awards based on his thesis work, including an Oceans Institute video competition award and the DN Foster award, endorsed by Engineers Australia.

The additional six final-year students have focused on measuring vessel motions in the river, exploring

the performance of free-fall penetrometers, and undertaking further measurement of surface waves and currents. Oceans Institute members Dr Chow, Dr Draper, Dr Jones, Dr Milne, Dr Wolgamot and Dr Zhao have supervised these projects.

RiverLab has provided data and equipment to support teaching in two undergraduate/masters’ units at UWA, allowed development of two novel offshore engineering devices, brought together academics from two faculties to work collaboratively and facilitated community outreach by taking current measurements during open-water swimming events.

more **15** academics  
than **15** across **2** faculties

**7** final-year students **7** research projects

**2** novel devices /tools being trialled

**2** undergraduate /masters’ units

# IOMRC: Watermans Bay



The Indian Ocean Marine Research Centre, Watermans Bay

**Research at IOMRC Watermans Bay, the Indian Ocean's first seawater facility for broad marine research, was well underway in 2016. UWA Oceans Institute member and Deputy Director of the ARC Centre for Coral Reef Centre for Excellence, Professor Malcolm McCulloch is leading a team of researchers investigating the impacts of ocean warming and acidification on coral and coralline algae.**

Fellow Oceans Institute researchers Dr Steeve Comeau, Dr Christopher Cornwall and Dr Verena Schoepf, together with students and interns, have all been working closely with Professor McCulloch. The first published research experiment found that coralline algae elevate pH at the site of calcification, and that this capacity will be impacted by ocean acidification. This work was published in *Global Change Biology*.

A year-long experiment conducted at Watermans Bay has examined how variability in temperature can influence



(L-R): Dr Verena Schoepf, Dr Chris Cornwall and Dr Steeve Comeau, at Watermans Bay

the susceptibility to bleaching of naturally heat-tolerant Kimberley coral, and its subsequent recovery.

Other work at Watermans Bay is investigating how variability in both temperature, pH, light and water flow can interact with the impacts of ocean warming and acidification. This will provide some of the first insights into how pH at three various scales potentially alters the response of corals to climate change: in bulk seawater;

at the surface of the organism; and internally, at the organism site of calcification.

Collectively, these experiments will provide better predictions, especially over longer time-frames, regarding which organisms or habitats will have greater tolerance to the combined effects of ocean acidification and the abrupt increases in ocean temperatures that cause large-scale bleaching and coral mortality.

# The value of our Kimberley waters

**In 2016, the final report and technical reports for the “Human values and aspirations for coastal waters of the Kimberley” project (funded through the WAMSI Kimberley Marine Research Program) was published.**

This interdisciplinary project, with groups from UWA (OI’s Associate Professor Michael Burton, Ms Alaya Spencer-Cotton and Dr Marit Kragt), Murdoch University (Dr Jennifer Strickland-Munro, Dr Halina Kobryn, Dr David Palmer and Professor

Sue Moore), and The University of Queensland (Associate Professor Greg Brown), identified the values associated with the Kimberley coast using two complementary methods: Public Participatory GIS (Murdoch and UQ) and discrete choice experiments (UWA). The latter quantified values using a spatially explicit design, splitting the coast into six regions. Two samples were recruited: one from locals or those who had a specific connection with the region; and the second from a general sample of Perth residents.

Focusing on the key management question of providing marine sanctuary zones in State waters, the results confirmed that increasing the area of sanctuary zones is valued by WA residents – both those residents who have a direct connection with the region and, importantly, those who live in Perth.

The Perth sample had a tendency to place a greater weight on increases in sanctuary zones in the Dampier Peninsula and North Kimberley, while the local/interest-group sample valued them equally across the coast. There was strong aversion to development along the coast, especially in the more remote northern areas.

## Seaweed sensitivity: increased warming and UVB radiation

**A collaborative study between Zhejiang University’s Ocean College and the Oceans Institute has found that not all seaweed is adversely impacted by climate stressors – in fact some seaweed species are adapting positively to increased warming and exposure to increased UVB radiation.**

Dr Xiao, Dr de Bettignies, Dr Olsen, Dr Agusti, Dr Duarte and Dr Wernberg from UWA investigated how combined warming and elevated UVB radiation affected the juvenile life stages of three important habitat-forming seaweeds found in Western Australia.

The research, one of the first publications to come out of collaboration between researchers

from UWA Oceans Institute and Zhejiang University’s Ocean College, indicates that in a warmer ocean, Sargassum may have an advantage because it is tolerated at a broader range of temperatures. In contrast, *Scytothalia* performed better under increased UVB levels, most likely because of its ability for fast acclimation to UVB radiation. “This suggests the balance between species in future seaweed communities in WA is likely to shift due to climate change,” says Oceans Institute member Dr Ylva Olsen.

The findings also have a significant impact on the future ecology of Australia’s Great Southern Reef. “The kelps and fucooids that were subject to this study form highly productive

and structurally complex habitats and they are key components of the Great Southern Reef,” says Dr Thomas Wernberg, UWA research group leader and Great Southern Reef expert. “These seaweeds are highly vulnerable to environmental stressors and are experiencing rapid decline along many temperate and subtropical coasts.”

The research was published in *PLOS ONE* and was funded by an Oceans Institute Visitors Grant, the National Natural Science Foundation of China, the International Science & Technology Cooperation Program of China, the Australian Research Council, and the Hermon Slade Foundation.

# Oceans Institute members contribute valuable research to the PMCP Partnership

**A landmark \$7.2 million partnership between UWA Oceans Institute and CSIRO, supported by the Gorgon Barrow Island NCB Fund and the Pilbara Marine Conservation Partnership (PMCP), has delivered the first-ever regional-scale assessment of conditions and threats in support of management of the remote and understudied Pilbara coastal zones and coral reefs.**

The five-year cross-disciplinary program comprised three themes and 20 scientists, who visited more than 400 sites between Ningaloo and Dampier, and exchanged significant data with the Western Australian Department of Parks and Wildlife. Two successfully attended large symposia, brought together well over 200 participants, and subsequent stakeholder advisory workshops that engaged industry and government in streamlining management needs were organised in 2015 and 2016.

Oceans Institute's Dr Dianne McLean and Dr Tim Langlois – working within the Partnerships' Fish and Sharks theme – surveyed 340km of coastline and deployed more than 2000 Baited Remote Underwater stereo-Videos (BRUVs) and more than 1,200 Diver Operated stereo-Videos (DOVs). These yielded a wealth of information on fish size and fish abundance for more than 550 species. Their research

revealed that areas with a complex relief and areas of high conservation value contain more and diverse fish. They also showed how fish and shark numbers across the Pilbara region are distributed in relation to their habitat.

Oceans Institute's Professor Malcolm McCulloch, working within the PMCP's Coral Reef Health theme, focused on understanding how coral growth has responded to past and recent changes in regional climate across northern Ningaloo and the Pilbara region. He and his group did this by analysing the physical and geochemical composition of cores collected by drilling long-lived massive corals. The first long-term coral proxy records of ocean temperature and changing water quality for both the Montebellos, as well as the inshore Airlie Island, show that the impact of the 2011-2013 bleaching was unprecedented. The research demonstrated that during the heatwave, temperature increased by 2-4°C and that this anomaly, superimposed on dredging plumes and river terrestrial run-off, goes further back in history, making the Pilbara region very vulnerable.

Oceans Institute's Professor Ryan Lowe from the Environmental Drivers theme achieved novel observations of reef cyclone impacts. By deploying tens of wave gauges to monitor how waves, caused by wind and water levels, vary across different sections of the reef



All images © UWA Marine Ecology Group

in an area with no detailed historical data, Professor Lowe captured two large cyclone events: TC Olwyn and TC Quang. These two cyclone events generated wave heights of up to 9m offshore, which allowed waves of up to 1.5m into shallow lagoons, scouring up to 2m of the sand dunes. Professor Lowe has also developed models from these observations to assess impacts of tropical cyclones and patterns of historical warming in the region.

Collective research from the partnership will generate more than 30 peer-reviewed articles.

# Devastating mass bleaching in remote reefs off north WA

**A team of Oceans Institute researchers, led by Dr James Gilmour and on board the AIMS research vessel *Solander*, embarked on three research expeditions in 2016 to monitor the effect of the third global mass bleaching event on the remote oceanic coral reefs of northwest Australia.**

Benthic surveys were conducted before, during and after the bleaching event in the shallow reefs by divers, and by using dropcams in the deeper lagoons. Whilst little bleaching was observed at Ashmore and the

Rowleys, at Scott and Seringapatam extreme and widespread bleaching and mortality (60 per cent to 90 per cent of communities) occurred at shallow sites. For the first time, bleaching was also observed in the deep (~40m) lagoon of South Scott. During the period of peak thermal stress, the team observed bleaching severity at some sites increase from 'moderate' to 'severe'.

Thermistors and CTD (conductivity, temperature, depth) profiles revealed unprecedented water temperatures throughout the entire reef system, due to the combination of record

global surface temperatures and ocean warming, exacerbated by a strong El Niño. Analysis of local and regional oceanographic conditions will contribute to an understanding of the full extent of the bleaching event.

The Scott Reef system has previously demonstrated a remarkable ability to recover from mass bleaching, but the return time of similar events in comparison to these recovery rates is uncertain. The team, including OI alumni Dr Taryn Foster and PhD candidate Rebecca Green, will return to the offshore atolls in 2017 to continue with the long-term monitoring programme that AIMS established in 1996.



# Collaboration with the US Geological Survey and OI members

**Researchers from the US Geological Survey and University of Western Australia journeyed to Ningaloo Reef in May and June 2016 to embark on the most extensive study ever of how coral reefs shape our coasts. The UWA research team, which included Professor Ryan Lowe, Dr Jeff Hansen, Dr Mark Buckley, Mr Andrew Pomeroy and Mr Mike Cuttler, joined a team led by the head of the US Geological Survey Coral Reef Project, Curt Storlazzi. They deployed 90 instruments in 44 places to cover 2.5 km of the Ningaloo World Heritage Site, which is Australia's largest fringing reef.**

The team measured waves, currents and water-level variations, and used specialised instruments to measure how sediment is transported in the water column as well as along the seabed. While much is known about how waves and currents act along traditional sandy beaches devoid of reefs, not much is known about how these processes are modified when they interact with a reef structure. The reef can radically transform waves and currents, which in turn drastically affect how sand moves from reef to the shoreline.

As coral reefs break down over time, their rubble makes up the sand that forms beaches along reef coastlines. The research team collected data to understand how the sand is transported to and from beaches behind reefs, specifically looking at the individual sand ripples to establish if this is a mechanism for sand to migrate across the lagoon to the shoreline. By understanding these patterns, marine researchers can gain greater insight into the protective role of reefs and gain an insight into what may happen to coral reef coastlines globally.



# Challenger mission creates maritime history

Launching in Fremantle in November 2016, the ocean glider *Challenger* set sail for Galle in Sri Lanka – a journey of 6,200km. This is the longest voyage ever attempted by an autonomous underwater vehicle, and it is expected the glider will take approximately eight months to reach its destination.

The glider's successful crossing of the southern Indian Ocean is an historic event. As *Challenger* heads north to Sri Lanka and eventually back to South Africa, it will complete a world-first circumnavigation of the Indian Ocean basin, expected to take two years to complete.

The *Challenger* glider mission will capture and communicate unprecedented undersea data to assist in determining how changes in currents, temperatures and salinity affect weather patterns, giving climate researchers an insight into how our weather systems are changing.

The mission is truly an international collaborative expedition with IMOS researchers in Sri Lanka and South Africa working in close association with their Australian colleagues to ensure its success. The endeavour is part of a partnership between UWA and Rutgers

University, facilitated through IMOS and the US Integrated Ocean Observing System (IOOS).

**The Integrated Marine Observing System (IMOS) is a national collaborative research infrastructure, supported by Australian Government. It is operated by a group of institutions as an unincorporated joint venture, with the University of Tasmania as Lead Agent, in partnership with CSIRO, Australian Institute of Marine Science, Bureau of Meteorology, Sydney Institute of Marine Science, University of Western Australia, Curtin University and the South Australian Research and Development Institute. IMOS delivers sustained and systematic observations of Australia's coastal and open oceans to provide data of global significance.**

(L-R) Mr Chip Haldeman, Rutgers glider pilot; Nick D'Adamo, Intergovernmental Oceanographic Commission (IOC) of UNESCO and IOC IIOE-2 Coordinator; Professor Scott Glenn, Rutgers; Professor Chari Pattiaratchi, UWA; Dr Christopher Back, Liberal Senator for WA and Chair, Senate Foreign Affairs, Defence & Trade Legislation Committee and Mr Dennis Stanley, UWA glider pilot. Photo credit: Yasha Hetzel

The UWA Oceans Institute operates the IMOS Ocean Glider and Ocean Radar Facilities. These facilities are part of a national IMOS network and have international significance.

Oceans Institute's Professor of Coastal Oceanography and leader of the IMOS Ocean Gliders Facility, Professor Chari Pattiaratchi, is part of the team navigating the *Challenger* glider.

"The research will be able to assist in predicting ocean trends in the future," says Professor Pattiaratchi. "This will be helpful for mariners and shipping routes but most importantly it's to look at how the ocean climate is changing. We want to collect data across the ocean basins and see how the temperature and salinity changes with depth. We are then able to compare previous measurements taken 40 years ago and see how the ocean has changed."

# Post-disaster recovery processes in Fiji

**As part of a UWA Research Collaboration Award (RCA), a group of UWA researchers visited Ba Province in Fiji in late 2016, travelling to communities historically affected by flooding.**

The research team included Ocean Institute Members and UWA School of Agriculture and Environment researchers Dr Natasha Pauli, Dr Bryan Boruff, Dr John Duncan and Ms Gracie Irvine, an honours exchange student from University College London. Other members of the field team included researchers from the University of the South Pacific, University of Auckland, and University of Sydney.

The field trip was part of a larger, three-year (2015-2018) project on climate-change adaptation in post-disaster recovery processes, led by Professor Andreas Neef, from the School of Social Sciences, University of Auckland, and funded by the Asia-Pacific Network for Global Change Research.

By adopting an integrated and participatory action-research approach, the project aims to explore how rural communities living in flood-prone river basins in Cambodia and Fiji are responding to increasing incidents of floods under the influence of climate change and other risk factors, such as environmental degradation.

The research team visited four communities along the Ba River that were affected by Category 5 cyclone Winston in 2016. Three of these communities have a substantial reliance on livelihood activities in coastal and/or estuarine environments. The three villages had all been affected by flooding, particularly the very severe flood of 2012.

In each community, researchers sat with members of the community (women, men, youth and some mixed groups) and had a discussion around their livelihoods and the effects of natural hazards such as cyclones, floods and droughts on these activities. The discussions were facilitated by the use of large satellite images on which participants could annotate and map areas of their lands and coastal waters that were important to them.

Using both scientific and local knowledge, the multidisciplinary research team will use these discussions to help develop integrated maps of risks and vulnerabilities.

The outcome of the climate-focused project will help policymakers and development agencies better understand the importance of local institutional knowledge, and provide scientifically based information concerning climate impacts to help local communities further build resilience in the face of climate change.



Mapping session © K Bennett



Bagging shellfish © N Pauli

# Regional Collaboration



## USA

Researchers continued collaborations with leading global marine research organisations WHOI and Scripps Institution of Oceanography

10 UWA Researchers travel to Hawaii to attend the 13th International Coral reef Symposium.

US Geological Survey Coral Reef Project join forces with OI researchers to embark on the most extensive study ever of how coral reefs shape our coast.

Professor Amos Winter, Chair and Professor: Earth and Environmental Systems Department Indiana State University and US Virgin Island Commonwealth Climatologist visits the Oceans Institute as a visiting scholar.

## Europe

Dr Kathleen Schwerdtner Manez of the Leibniz Centre for Tropical Marine Ecology visits the Oceans Institute as a visiting scholar.

## Indian Ocean Region

OI Researchers travel to Mauritius to deliver professional short courses on the coastal impacts of climate change to university academics and government officials from countries along the Indian Ocean rim.

Ocean glider Challenger sets sail for Galle in Sri Lanka- the journey is expected to take ten months and is the longest voyage ever attempted by an underwater autonomous vehicle.

Africa and the Middle East Participants from Madagascar, Kenya, South Africa, Seychelles and Mauritius participated in a workshop run by Oceans Institute Members on the sustainable health of the marine Exclusive Economic Zones surrounding nations in the Indian Ocean region.

The Blue Economy Research Institute of the University of Seychelles continued to collaborate with OI researchers. In 2015 an MOU was signed with the Institute designed to focus on developing academic and cultural interchange in teaching, training, research and other activities.

## Local

A collaborative study between UWA, The Australian Institute of Marine Science (AIMS) and the Department of Parks and Wildlife has found that artificial light can effect the survival of wild sea turtle hatchlings.

Research by scientists from OI, AIMS and partners from Australian and International institutions has shown that fish, corals and trees in north-west Australia respond to climate change with simultaneous growth patterns. The research found that during El Nino years, growth of the four study species (two types of marine fish, one coral and one tree) slowed, whereas in La Nina years with warmer sea temperatures and generally wetter years, growth rates increased.

Researchers from UWA and AIMS have raised concerns about the whereabouts of the world's biggest whale sharks after finding that the largest sharks observed in recent years were smaller than those recorded a decade ago.

## Asia Pacific Region

Keynote lecture delivered by Professor Mark Cassidy at the Chinese Academy of Sciences, Beijing.

OI Researchers visit Ba Province in Fiji to speak to local communities historically affected by flooding.

Oceans Institute researchers contribute to Asia Pacific Network for Global Change Research, headed by Professor Andreas Neef from the School of Social Sciences, University of Auckland.

16 undergraduate visitors from Zhejiang University Oceans College. The visit was part of a planned annual exchange program under the MOU between ZJU and OI.

Universiti Terengganu under an MOU with UWA continues to explore joint research programs, co-supervise students, staff and visitors and explore development in on-line training.

# Media and Outreach

**The Oceans Institute is committed to communicating its research outputs to a diverse audience and facilitating conversations around ocean-solution-orientated research.**

From supporting PhD students via the Postgraduate Seminar Series and the Postgraduate Symposium to promotion via mainstream media, the Oceans Institute has an excellent track record of delivering timely, relevant and effective media coverage to communicate our members' research as well as engaging with the community via outreach events and public lectures.

In 2016, coverage of the Institute's research spanned print, online, television, and radio media at local, national and international levels, confirming that our research is in constant demand. Oceans Institute produced more than 200 media releases in 2016, generating national and international media commentaries, nationally and internationally. Respected online, print and broadcast media publications picked up our members' research.

The Institute's website, social-media channels, UWA news centre and the hosting of international symposia are all key indicators of the Oceans Institute's commitment to communicate our highly influential and peer-reviewed findings.

Oceans Institute and ARC Centre for Coral Excellence researcher Verena Schoepf's study on super corals featured in a documentary series *Women and Oceans* for German/French TV broadcaster ARTE. The series featured five episodes on female marine scientists working in the world's five oceans.

The UWA Oceans Institute has a committed social-media presence with international interaction. The Institute's Facebook and Twitter channels continue to prove an effective means of engaging with a local audience, academic members and key stakeholders. @UWAoceans boasts more than 1600 followers on Twitter and @UWAOceansInstitute has close to 3000 followers on Facebook and more than 3000 Facebook page likes. Followers include a broad range of international and national research institutions, industry and government, media, NGOs, community groups and individuals.

# Science Communication and CommOCEAN 2016

In 2016, postgraduate students launched the first Oceans Institute Student Video Competition. The idea behind this competition was not only to showcase the diverse postgraduate research conducted at the Institute, but also to equip the postgraduate students with the skills to effectively communicate that research. A series of workshops on storyboarding, camera techniques and video editing was delivered alongside the competition, to support students in their video productions. In its first year, the video competition was a huge success, with 15 video submissions across a variety of research areas. The six winning videos were announced at the opening of the Woodside FutureLab OceanWorks, the competition sponsor.

The video competition proved to be very effective in motivating students to produce their first-ever research videos.

PhD student Gundula Winter travelled to the CommOCEAN conference in Bruges in December 2016 to present on the positive outcomes of running the OI Student Video Competition. There was great interest among marine scientists and science communicators from around the world in establishing similar events at their institutes. Overall, the consensus at the conference was to strive to improve ocean literacy worldwide because the community can only protect the ocean if it is empowered with knowledge. This is why science communication is an essential skill for the next generation of marine researchers.



## 2016 Postgraduate Symposium

The annual Oceans Institute Postgraduate Symposium in November 2016 was the first event to be held in the new IOMRC Auditorium. Nineteen students from a wide range of disciplines presented their research in mixed sessions, which also attracted a number of staff and members of the public. The mixed sessions

were highly welcomed, because they facilitated dialogue and better understanding among students from various disciplines. Discussions and networking followed at the Sundowner event. During the symposium, Gundula Winter handed over her postgraduate representative duties to Ana Giraldo Ospina and Manuel Herduin.

# Oceans Institute Members celebrate National Science Week

Shark Bay © Caroline Ochieng-Erftemeijer

OI members were heavily involved in this year's National Science Week events, both on campus, with presentations and participation at UWA's Open Day on August 14, and in satellite events throughout the state.

At the Cultural Centre, more than 25,000 people attended the Perth Science Fair. The WA Marine Science Institution (WAMSI) tent was the venue for Oceans Institute Artist in Residence Angela Rossen and Oceans Institute PhD students Charlotte Brinkmanis, Dan van Hees, Lauren Peel and Gundula Winter to relay their passion for marine science to interested members of the public.

Using an iScopeStand to enhance the optics of smart phones by magnifying subject matter up to 25 times, visitors to the Perth Science Fair were able to gaze upon fernlike hydroids, feeding bryozoans and tubeworms, busy amphipods and delicate pink coralline algae. To enhance their experience even further, this technology allowed attendees to capture still and moving images on their own digital devices.

"For most people, the biota of the ocean comprises iconic species like dolphins, leafy sea dragons, whales and coral reefs," says Ms Rossen. "They have no idea that perhaps the most important are the tiny biota that support whole systems."

In Broome, Oceans Institute member Professor Ryan Lowe, alongside a local astronomer, presented to the community on why the Kimberley boasts the second-largest tidal movements in the world.



The Oceans Institute at the Science Fair at Shark Bay © Caroline Ochieng-Erftemeijer

More than 250 people attended the presentation, as Professor Lowe explained how "the moon and sun generate the forces to produce tides around the globe, and in the Kimberley other factors play out as well. Having a very wide and relatively shallow continental shelf causes the tides to be amplified and resonate as they rise out of the deeper waters onto the shelf. In particular regions such as Collier Bay, tides are also further enhanced by the shape of the coastline that funnels the tides towards the coast."

As part of the Science Fair in Shark Bay, Oceans Institute member Dr Caroline Ochieng Erftemeijer spoke on her research into the seagrasses of Shark Bay, to a full audience of more than 100 people.

OI members also engaged in the innovative 24 Hours of Biology event, aimed at promoting science to all ages, and creating memorable hands-on experiences around biological ideas. This free event, held across the August 20-21 weekend, had 12 science-filled hours each day, with 23 events and



Ms Angela Rossen showing the ocean's tiny wonders at the 2016 Perth Science Fair © Angela Rossen

26 presenters involved. Oceans Institute member Charlotte Birkmanis presented on 'How sharks rule the reef', while Ms Anna Cresswell presented on Ningaloo Reef. The event attracted more than 300 attendees who participated in talks, workshops and shows created by local Perth biologists.

Angela Rossen also represented the Oceans Institute at the 2016 Perth leg of the World Biotech Tour with an educational activity in which children discover and record marine plants, epiphytes and associated invertebrate communities. The World Biotech Tour is a multi-year initiative that brings biotechnology to life at select science centres and museums worldwide. The program, supported by the Association of Science-Technology Centres (ASTC) and Biogen Foundation, is scheduled to run from 2015-2017.

# 2016 IAS Distinguished Visiting Fellow delivers public lecture on marine renewable energy



**In May, Professor Guy Houlsby, Professor of Civil Engineering at Oxford University, delivered his public lecture, “Marine renewable energy: technology, opportunities and challenges”, in association with The Institute of Advanced Studies, the Oceans Institute and the Centre for Offshore Foundation Systems (COFS).**

The lecture discussed wind, waves and tides as potential sources of renewable energy and detailed how the industries developing them are all at different stages of maturity.

Professor Houlsby suggested tidal power, still at an earlier stage of development, is a much more difficult resource to understand and exploit than wind. “Although existing technologies to extract tidal power may work, significant progress is needed towards developing more effective means of exploiting the tides.” In spite of a host of different devices being suggested, none has yet proven to be commercially viable.

The lecture also addressed the developments in all three of the marine renewable technologies, examining both their present state of development and future opportunities.

Since its inception in 2000, The Institute of Advanced Studies (IAS) at the University of Western Australia (UWA) has been an active foundation for the intellectual life of the community, supporting the wide dissemination of ideas and research at UWA. IAS continues to support the research of UWA Oceans Institute and the two institutes consistently work together to explore opportunities for early-career researcher development, master classes, visitors and public events.

Visit [ias.uwa.edu.au](http://ias.uwa.edu.au) and follow [Twitter@IAS\\_UWA](https://twitter.com/IAS_UWA) for more on The UWA Institute for Advanced Studies.

# Visiting scholars

The Oceans Institute Visitor Program – launched in 2012 – continued in 2016. The Oceans Institute visitor grants further opportunities for collaborations between members and highly regarded national and international researchers to mentor, share knowledge and enhance the international reputation of the Institute.



## Visitor Profile: Professor Amos Winter

In early 2016, the Oceans Institute welcomed Professor Amos Winter, Chair and Professor: Earth and Environmental Systems Department, Indiana State University and US Virgin Island Commonwealth Climatologist.

As a guest of Professor Malcolm McCulloch, Oceans Institute Director and Co-Director of the ARC Centre of Excellence for Coral Reef Studies, Professor Winter was able to provide the Oceans Institute with an international perspective on management and operation of university marine programs in the context of his extensive high-level experience in the USA. Additionally, his experience in managing effective strategies for key marine resources in the Caribbean framed conversations around the extreme pressures from local demands on marine resources such as fishing, as well as more regional pressures such as climate change.

While visiting the Institute, Professor Winter delivered a seminar to Oceans Institute staff, postdoctoral researchers and students. He worked closely with Professor McCulloch to prepare a manuscript on globally significant paleo climate change using new information from sclerosponge research. Additionally, Professor Winter met with postgraduate students and postdoctoral researchers across the UWA campus, and visited field sites at Rottneest Island.



## Visitor Profile: Dr Kathleen Schwerdtner Máñez

Dr Kathleen Schwerdtner Máñez of the Leibniz Centre for Tropical Marine Ecology visited the Oceans Institute in March and delivered a public lecture in conjunction with IAS (Institute of Advanced Studies) entitled, “Looking back to go forward: why marine management needs lessons from the past”.

This lecture focused on marine environmental history (MEH) and its relevance to marine management. Case studies from the Indonesian Archipelago were used to demonstrate the practical relevance of information about the past for modern marine management.

Dr Kathleen Schwerdtner Máñez is a human ecologist with a strong background in ecology and social sciences. She has studied landscape ecology and nature conservation and holds a PhD in Agricultural Economy. For more than a decade, Dr Schwerdtner Máñez has worked on small-scale fisheries including European inland pond fisheries and coastal fisheries in tropical developing countries. She is the editor of the first textbook on marine environmental history, *Perspectives on Oceans Past* (2016), which contains a chapter that she has authored on gender issues in fisheries.

Dr Schwerdtner Máñez is also currently a consultant with Place.Nature.Consultancy





# The next generation of reef-saving scientists begin their journey

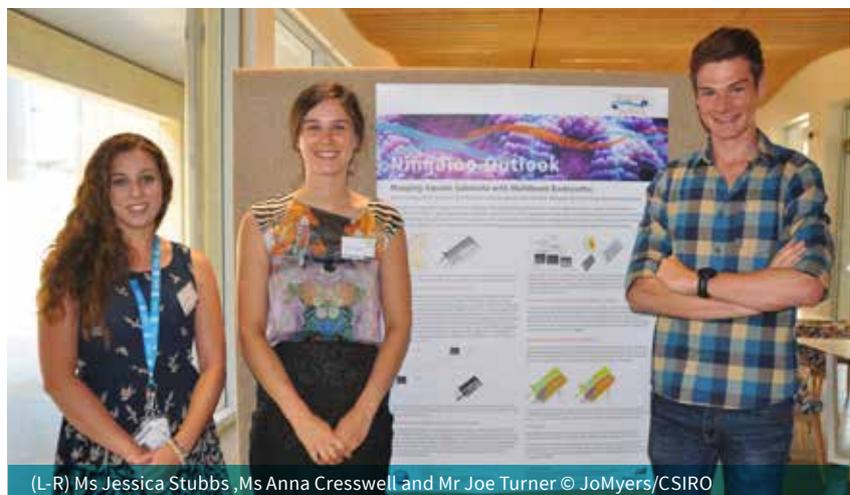
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**The UWA Oceans Institute has teamed up with CSIRO and BHP to ignite protection and conservation research at Ningaloo Reef.**

Early in 2016 the three participants of the Ningaloo Outlook Marine Research Scholarship commenced their PhD journey. Mr Joe Turner from the UK, Ms Anna Cresswell from Tasmania and Ms Jessica Stubbs from Western Australia were selected from more than 70 applicants to lead the next generation of Ningaloo Reef research. All three are all based out of UWA, with co-supervision by scientists from CSIRO.

Each PhD project focuses on a different element of Ningaloo’s ecosystem, providing a significant boost in our knowledge about Ningaloo Reef. Ningaloo Outlook is a marine research partnership between CSIRO and BHP, with training and education support from UWA. A total investment of \$5.6 million over five years will help to gather new knowledge on the Ningaloo’s shallow and deep (mesophotic) reefs, and iconic sharks and turtles.

The Ningaloo Reef is one of the longest fringing coral reefs in the world and is home to a huge diversity of marine life. Its importance is world-renowned, having been declared a UNESCO World Heritage Area in 2011 for its biological diversity. It is intended this research will better inform managers and



(L-R) Ms Jessica Stubbs, Ms Anna Cresswell and Mr Joe Turner © JoMyers/CSIRO

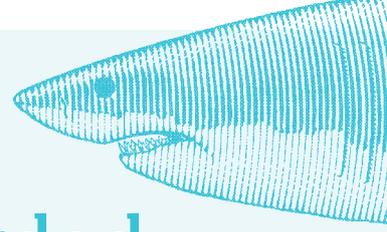
decision-makers responsible for the conservation and management of the Marine Park and World Heritage Area.

Mr Joe Turner is an accomplished scuba diver with extensive tropical water marine research experience, including projects in Indonesia, the Seychelles, the Philippines, and WA’s Montebello Islands. Joe holds degrees as a Master of Science in Tropical Coastal Management and a Bachelor of Science (Hons) in Marine Zoology from the University of Newcastle upon Tyne in the United Kingdom. Joe is researching Ningaloo’s mesophotic reef habitats.

Ms Anna Cresswell brings a lifelong love of the ocean and substantial field experience to the project, having undertaken marine research in Samoa, Tonga, and numerous sites in Tasmania. She joins the team from the University of Tasmania, where she

graduated with a Bachelor of Science with majors in Applied Mathematics and Zoology and first class Honours in Marine Science. Anna’s research couples modelling and maths with field measurements to investigate the resilience of Ningaloo’s shallow reefs to acute climatic disturbances, and the changes to fish and coral communities that have occurred in the last decade.

Ms Jessica Stubbs has a longstanding interest in marine turtles and reef ecosystems, having studied both in her undergraduate degree and while working as a scientist and research assistant. Jessica joins the team from the University of Western Australia where she was awarded first-class Honours in a Bachelor of Science majoring in Marine Science and Zoology. Understanding the ecology and energetics of green turtles at Ningaloo is the basis of Jessica’s research.



# Professor Shaun Collin awarded H Barry Collin Research Medal

In 2016, Deputy Director of the Oceans Institute, Professor Shaun Collin was announced as the recipient of the H Barry Collin Research Medal. The medal is awarded annually by Optometry Australia to honour outstanding contributions to the advancement of knowledge in optics, vision science or clinical optometry. This award is of special significance to Professor Collin because the medal is named after his father, Emeritus Professor Barry Collin.

Professor Shaun Collin is a world leader in neurobiology and comparative vision. He has forged a distinguished and exciting research career by integrating the fields of neuroscience and marine science, publishing more than 250 international scientific publications on sensory systems, primarily of aquatic vertebrates. He is a Winthrop Professor at UWA and a Western Australian Premier's Research Fellow.

Professor Shaun Collin with the 2016 H Barry Collin Research Medal and his father, Emeritus Professor Barry Collin. © Sandra Shaw (Optometry Australia)



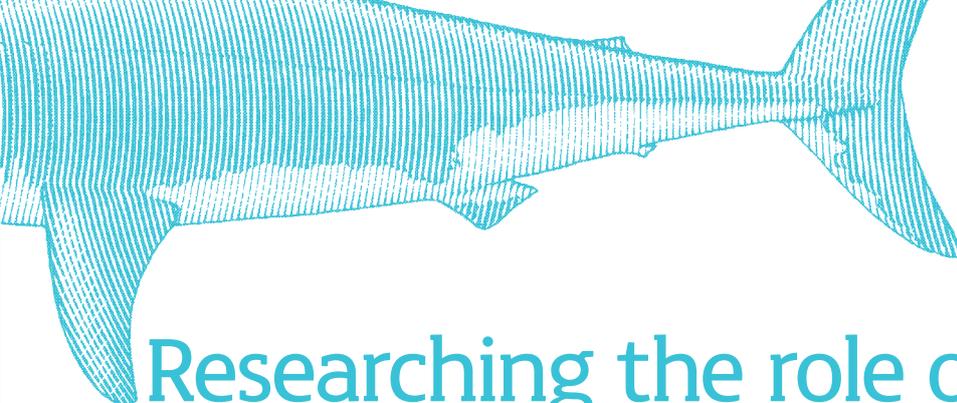
Dedicated to investigating the neural basis of behaviour in a range of vertebrates, with a particular focus on sharks, he uses a range of techniques including anatomical, electrophysiological, molecular and bioimaging approaches.

As well as serving as Deputy Director of the Oceans Institute, Professor Shaun Collin also leads the UWA Neuroecology Group, which he formed in 2009. This multidisciplinary team works to decipher and understand how animals perceive and process sensory input from the natural world, under different environmental conditions. The research group is a highly respected, peer-reviewed team, with more than 240 collaborators worldwide.

Over the past three years, Professor Collin has been funded by the Western Australian Government to develop and test shark deterrents using his knowledge of the sensory systems of sharks and their relatives. Based on his Neuroecology Group's discovery of colour blindness in sharks, shark deterrent wetsuits have been developed and novel repellents tested using bubbles, lights, electric fields and sound to change shark behaviour.

"I am honoured and humbled to receive this award created in honour of my father's contribution to optometry and vision science and which was presented to him 40 years ago," he says. "I am a third-generation vision scientist, with my father and grandfather both being optometrists."

*Emeritus Professor Barry Collin was not a member of the award Selection Committee.*



# Researching the role of sharks in reef recovery

**Oceans Institute PhD student Emily Lester was awarded the 2016 Keiran McNamara World Heritage PhD Scholarship, to research the impact of overfishing of sharks on marine ecosystems.**

The scholarship, open each year to WA university students, is named in memory of the late Keiran McNamara, who was Director-General of the Department of Environment and Conservation (previously CALM) and worked tirelessly to secure World Heritage status for Shark Bay, Ningaloo Coast and Purnululu.

The McNamara family donated \$500,000 to fund the scholarships to build on Mr McNamara's life's work, to ensure the advancement of knowledge and expertise in conservation and management of WA's World Heritage areas.

Ms Lester's research is timely. Sharks are being fished out of coral reefs at alarming rates, making it critical to understand the role they play in an ecosystem and to assess the impact that removing them could have on the reefs.

"Through my research I will be using techniques including life-sized models of sharks to see how a shark's presence influences the behaviour of reef fish," says Ms Lester. "Sharks might play an important role in regulating the behaviour of fish so that recovery from these disturbances is accelerated."

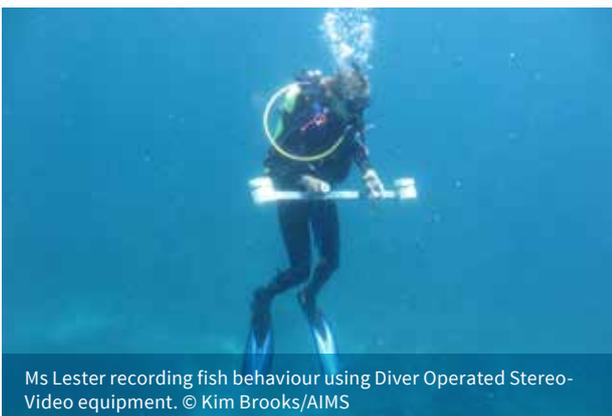
In partnership with the Global Finprint Project, the data collected through the research will be used improve global knowledge of the role of shark and fish on ecosystems in the Ningaloo Coast World Heritage Area and highlight the importance of the area within the Indian Ocean.

**UWA Oceans Institute and ARC Centre for Coral Reef Excellence PhD student Claire Ross won the Indian Oceanographic Commission IMarEST competition in October for her talk on the seasonal growth and physiology of coral in Bremer Bay.**

Ms Ross is currently researching the environmental and biological controls on the growth and physiology of high-latitude corals at their extreme geographical limits in the southwest region of WA.



Ms Emily Lester and her Research Assistant, Ellen D'Cruz, after conducting four weeks of fieldwork at Lizard Island on the Great Barrier Reef. © Emily Lester



Ms Lester recording fish behaviour using Diver Operated Stereo-Video equipment. © Kim Brooks/AIMS



Dr Cordelia Moore and Emily Lester deploying a model of a blacktip reef shark at the Ningaloo Reef. © AIMS

# 2016 Media Broadcasts and Publications



## Newspaper

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The Washington Post  
 The New York Times  
 The Sunday Times  
 Herald Sun Melbourne  
 The Australian  
 The Guardian  
 Guardian Express  
 Daily Telegraph  
 The Sydney Morning Herald  
 Mid West Times  
 Melville Times  
 Sound Telegraph Rockingham  
 Southern Gazette  
 Subiaco Post  
 Cockburn Gazette Community  
 The West Australian  
 The Saturday Age

Weekend West  
 Mandurah Mail  
 Carins Post  
 Courier Mail  
 Geelong Advertiser  
 Headline News Today  
 Northern Territory News  
 Townsville Bulletin  
 Weekend Post  
 Adelaide Advertiser  
 Northern Territory News  
 Weekly Times  
 The Fremantle Herald  
 Golden Plains Miner  
 Sunday Telegraph  
 Sunday Mail Brisbane  
 Bay Post

Bega District  
 News Weekly Merimbula  
 Hobart Mercury  
 Augusta Margaret River Mail  
 Bunbury Mail  
 Busselton Dunsborough Mail  
 Albany Advertiser  
 The Chronicle  
 The Daily Examiner  
 Canberra Times  
 Joondalup Weekender  
 Newcastle Herald  
 St George & Sutherland Shire Leader  
 Southern Argus  
 Northern Star



## Radio

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ABC Local Radio Perth  
 ABC North West WA  
 6PR 882 Talk Radio Perth  
 SBS Radio Danish



## Television

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CBS News  
 Fox News Network & CNBC  
 ARTE France  
 BBC Worldwide  
 ABC News Perth  
 Channel 7 Perth



## Digital News

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ABC News Online  
 WA Business News  
 National Geographic  
 Aussie Network News  
 Science Network  
 Science News  
 AAP Newswire  
 Xinhua News Agency  
 The Conversation  
 WA Today  
 Yahoo  
 Oil and Gas Australia  
 Australasian Science  
 Energy News Bulletin  
 Australia's Paydirt  
 IFL Science

# Support Us

The UWA Oceans Institute welcomes philanthropic support to advance its mission to provide innovative and effective solutions to challenges facing the world's oceans and to pioneer global research that fosters and promotes inter-disciplinary marine related research across traditional science, engineering, health, socio-cultural and policy boundaries. The generosity of our donors has enabled the Institute to invest in academic posts and programmes, student activities, infrastructure and research.

The following are ways through which your support can help the UWA Oceans Institute continue to produce cutting edge ocean research:

- Give via your will/Leaving a Bequest
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- Contribute to a PhD Scholarship
- Oceans Community support

Donate online at: [campaign.uwa.edu.au/give-now](http://campaign.uwa.edu.au/give-now) or complete and mail this form:

## Donation

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Yes! I would like to make a donation of \$..... to the University of Western Australia to progress the research of the Oceans Institute.

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# Governance and Membership



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### Ms Gundula Winter

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UWA Oceans Institute Administration Officer

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UWA Oceans Institute Accounts Officer

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**Ms Sylvia Defendi**

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**Ms Emily Glover**

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Engineering**Ms Caroline Kerr**School of Animal Biology and UWA Oceans  
Institute**Mr Anton Kuret**

School of Earth and Environment

**Ms Alessandra Mantovanelli**School of Civil, Environmental and Mining  
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**Ms Clare Peter**  
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School of Civil, Environmental and  
Mining Engineering

**Mr Dennis Stanley**  
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Mining Engineering

**Mr Warren Starr**  
Safety, Health and Wellbeing

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CSIRO

**Dr Tim Cooper**  
BHP

**Dr Katrina Davies**  
University of Queensland

**Dr Martial Depczynski**  
AIMS

**Prof Carlos Duarte**  
King Abdulah University of Science &  
Technology

**Dr Paul Erftemeijer**

**Dr Staurt Field**  
Department of Parks and Wildlife

**Dr Rebecca Fisher**  
AIMS

**Dr Kim Friedman**  
Food and Agriculture Organization of  
the United Nations (FAO)

**Dr James Gilmour**  
AIMS

**Dr Ivan Haigh**  
University of Southampton

**Dr Nick Hardman-Mountford**  
CSIRO

**Dr Thomas Hatton**  
EPA

**Dr Andrew Heyward**  
AIMS

**Dr Thomas Holmes**  
Department of Parks and Wildlife

**Dr Ross Jones**  
AIMS

**Mr Hamish Jolly**  
AIMS

**Dr John Keesing**  
CSIRO

**Dr Mark Meekan**  
AIMS

**Dr Brad Norman**  
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**Dr Zoe Richards**  
WA Museum

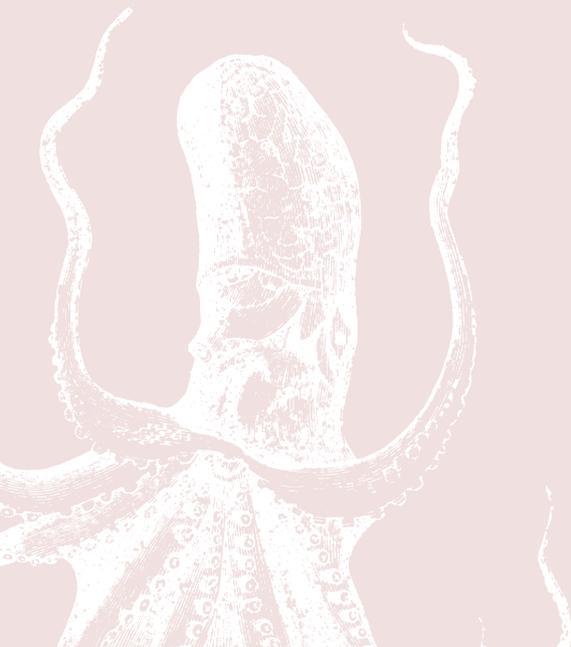
**Dr Christine Schoenberg**  
WA Museum

**Dr Luke Smith**  
Woodside

**Dr Michele Thums**  
AIMS

**Dr Jim Underwood**  
AIMS

**Dr Shaun Wilson**  
Department of Parks and Wildlife



# PhD Students

## School of Agricultural and Resource Economics

---

Matthew Navarro **AH**  
Johanna Zimmerhackel **AR**

## School of Animal Biology

---

Issam Al-Rasady **JM**  
Shanta Barley **JM**  
Blair Bentley **NM**  
Charlotte Birkmanis **JM**  
Victoria Camilieri-Asch **SC**  
Marjorie Cattaneo Fernandez **JM**  
Luciana Cerqueira Ferreira **JM**  
Lucille Chapuis **SC**  
Michael Kelly **SC**  
Anton Kuhar **SC**  
Jonathon Mitchell **SC**  
Nicolas Nagloo **JH**  
Beverley Oh **JM**  
Joyce Ong **JM**  
Lauren Peel **SC**  
Laura Ryan **JH**  
Jessica Stubbs **NM**  
David Tickler **JM**

## Centre for Microscopy, Characterisation and Analysis

---

Pia Bessell-Browne **PC**  
Gerard Ricardo **PC**

## Centre for Offshore Foundation Systems

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Jayden Chee **DW**  
Miaoju Chen **CP**  
Michael Cocjin **DW**  
Cathal Colreavy **CO**  
Youkou Dong **MR**  
Minh Tri Duong **CG**  
Shengsheng Fan **MR**  
Adrain Ferguson **GK**  
Nicole Fiuamana **CG**  
Denfeng Fu **CG**  
Chao Han **MC**

Manuel Herduin **CG**  
Minjung Jun **MC**  
Kai Xiang Koh **SH**  
Simon Leckie **DW**  
Joonmo Lee **MC**  
Jiayue Liu **MC**  
Huiting Liu **SD**  
Hongliang Ma **MUH**  
John Morton **CO**  
Shah Neyamat Ullah **DW**  
Colm O'Beirne **CO**  
Raffaele Ragni **MC**  
Anamitra Roy **CO**  
Stefanus Safinus **SH**  
Chao Sun **SG**  
Yifa Wang **MC**  
Fan Yang **SD**  
Fuming Yang **MC**  
Ehssan Zargar **SD**  
Tianyuan Zheng **MC**  
Tao Zhou **MC**

## School of Civil, Environmental and Mining Engineering

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Samantha Andrzejczek **CP**  
Paul Branson **GI**  
Liah Coggins **AG**  
Jayden Chee **DW**  
Miaoju Chen **CP**  
Adriano Condez **DW**  
Vahid Etminan Farooji **RL**  
Wen Gao **DW**  
Terry Griffiths **DW**  
Mohammed Hadi Bahmanpour **CP**  
Yucen Lu **DW**  
Tanzihah Mahjabin **CP**  
Jennifer Penton **CP**  
Syeda Rafiq **CP**  
Sarik Salim **CP**  
Taj Sarker **RL**  
Tamara Schlosser **NJ**  
Mark Schneider **DW**  
Dunja Stanisic **DW**  
Danielle Su **CP**  
Lei Tian **GI**  
Joe Tom **DW**  
Mirjam Van der Mheen **CP**  
Joey Voermans **GI**  
Moritz Wandres **CP**  
Hongchao Wang **DW**  
Phillipa Wilson **CP**

Weidong Yao **SD**  
Xiantao Zhang **DW**  
Wencai Zhou **NJ**  
Zefeng Zhou **DW**  
Andrew Zulberti **GI**

## School of Earth and Environment

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Kaylee Anderson **JT**  
Harry Clarke **MM**  
Michael Cuttler **RL**  
Edwin Drost **RL**  
Lucy Georgiou **MM**  
Maria Gonzales-Bernat **JC**  
Rebecca Green **RL**  
Renee Gruber **RL**  
Martin James McLaughlin **CP**  
Claire Ross **MM**  
Laura Segura **RL**  
Johan Risandi **RL**  
Arnold van Rooijen **RL**  
Gundula Winter **RL**

## Law School

---

Caroline Coombs **ET**  
Stephanie Price **ET**

## School of Plant Biology

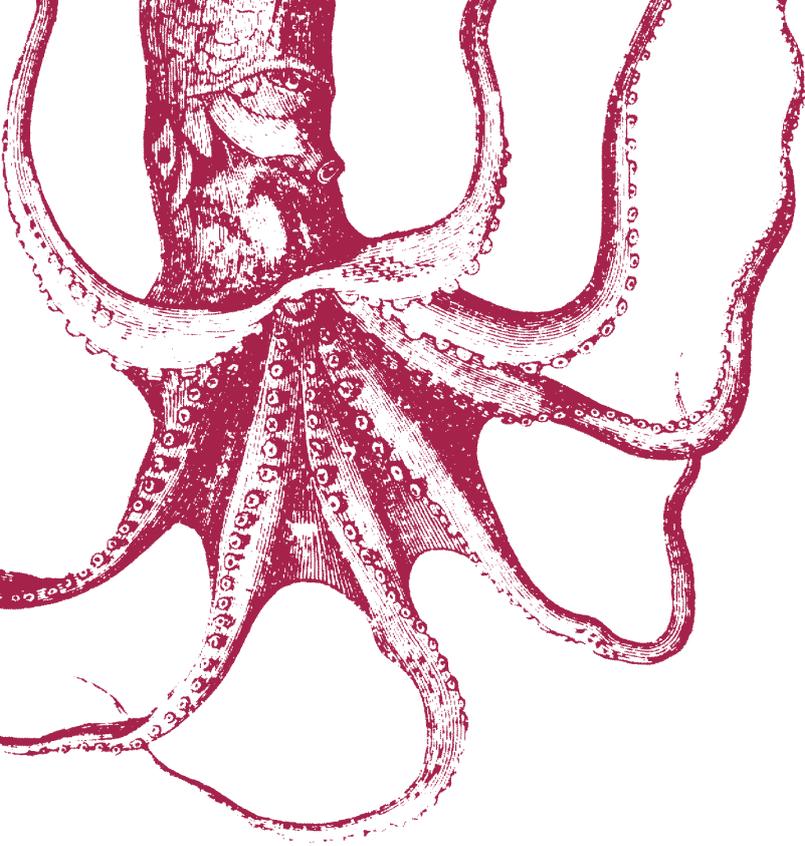
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Nahlah Alsuwaiyan **TW**  
Anna Cresswell **TL**  
Harriet Davies **TW**  
Jordan Goetze **JP**  
Emily Lester **TL**  
Belinda Martin **GK**  
Yannick Mulders **TW**  
Ana Giraldo Ospina **GK**  
Camilla Piggott **TL**  
Katie Sambrook **GK**  
Tiffany Simpson **TW**  
Sandra Straub **TW**  
Brian Strehlow **GK**  
Chenae Tuckett **TW**  
Joe Turner **GK**  
Daniel Van Hees **GK**  
Maria De La Paz Vilas **MAH**

## School of Social Sciences

---

Mark Polzer **AP**



**KEY: Supervisors**

- AG:** Anas Ghadouani
- AH:** Atakelty Hailu
- AP:** Alistair Paterson
- AR:** Abbie Rodgers
- CG:** Christophe Gaudin
- CO:** Conleth O’Loughlin
- CP:** Chari Pattiaratchi
- DW:** David White
- ET:** Erika Techera
- GI:** Greg Ivey
- GK:** Gary Kendrick
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- JH:** Jan Hemmi
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- JP:** Jane Prince
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- MAH:** Matthew Hipsey
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- MUH:** Muhammad Hossain
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- NJ:** Nicole Jones
- NM:** Nicola Mitchell
- PC:** Peta Clode
- RL:** Ryan Lowe
- SC:** Shaun Collin
- SD:** Scott Draper
- SG:** Susan Gourvenec
- SH:** Shazzad Hossain
- TL:** Timothy Langlois
- TW:** Thomas Wernberg

**Distribution of Oceans Institute Members**



**TOTAL 93**

# Research Grants and Publications



# Research Grants

PROJECT TITLE	FUNDING BODY	AMOUNT	OCEANS INSTITUTE RESEARCHER
Delmar Driven Anchor - Centrifuge Testing	Delmar Systems Inc	\$252,050	Associate Professor Christophe Gaudin, Dr Conleth O'Loughlin
Utilising industry ROV imagery to increase knowledge of marine ecosystems globally	UWA Research Impact Grants	\$19,977	Associate Professor Julian Partridge, Dr Dianne McLean, Professor David White, Dr Paul Thomson, Professor Shaun Collin
The Thermal-Hydraulic Characteristics of Stratified Gas-Liquid Flows	Western Australian Energy Research Alliance WAERA ex Woodside R2D3	\$12,000	Associate Professor Zachary Aman
Centre for the Integrated Modeling and Analysis of Gulf Ecosystems II (C-IMAGE-II)	Technical University of Hamburg-Harburg TUHH ex University of South Florida	\$74,146	Associate Professor Zachary Aman
Ecolab Pty Ltd - Water-oil interfacial tension (IFT) tests - Performance of pipeline injection chemicals	Nalco Company	\$9,750	Associate Professor Zachary Aman
Pluto Unisim Model Development	Western Australian Energy Research Alliance WAERA ex Woodside R2D3	\$9,000	Associate Professor Zachary Aman, Dr Darren Rowland, Mr Brendan Graham, Professor Eric May
Pluto Emulsion Characterisation	Western Australian Energy Research Alliance WAERA ex Woodside R2D3	\$74,200	Associate Professor Zachary Aman, Dr Einar Fridjonsson, Professor Michael Johns, Professor Eric May
Terahertz radiation for sensing water vapour in gas pipelines	UWA Research Collaboration Awards	\$25,000	Associate Professor Zachary Aman, Mr Gino Putrino, Professor Michael Johns, Associate Professor Vincent Wallace, Dr Axel Zeitler
Synergistic Injection Chemistry Desktop Study	Western Australian Energy Research Alliance WAERA ex Woodside R2D3	\$24,300	Associate Professor Zachary Aman, Professor Eric May
Pluto Water Handling Laboratory Study	Western Australian Energy Research Alliance WAERA ex Woodside R2D3	\$ 1,000	Associate Professor Zachary Aman, Professor Eric May
Movement patterns of marine megafauna at unprecedented global scales	ARC Discovery Early Career Researcher Awards	\$372,000	Dr Ana Martins Sequeira
Applied Research Project 7 - Shoals	Australian Institute of Marine Science (AIMS)	\$46,545	Dr Dianne McLean
Port Coogee Artificial Reef Scientific Surveys	Waitt Foundation Rapid Ocean Conservation ROC	\$ 7,091	Dr Dianne McLean
A Comparison of fish assemblages associated with the Griffin pipeline and adjacent seafloor, north-west Australia	BHP Billiton Iron Ore Pty Ltd	\$ 317,647	Dr Dianne McLean, Associate Professor Julian Partridge, Mr Todd Bond
Pipelines as habitat for fish: a pilot study	Woodside Energy Ltd	\$ 30,000	Dr Dianne McLean, Mr Todd Bond, Associate Professor Julian Partridge, Dr Timothy Langlois

PROJECT TITLE	FUNDING BODY	AMOUNT	OCEANS INSTITUTE RESEARCHER
Environmental Livelihood Security (ELS) for climate-smart landscapes: a preliminary investigation for informing agricultural policy in the South Pacific	Australian Centre for International Agricultural Research ACIAR	\$ 250,000	Dr Eloise Biggs, Dr Eleanor Bruce, Dr Bryan Boruff, Dr Nathan Wales
Assessing the ecosystem-wide risks of threatened species translocation	University of Queensland ex ARC Linkage Projects	\$ 21,000	Dr Eve McDonald-Madden, Dr Nicola Mitchell, Professor Mark Burgmann
Deep-sea coral ocean-climate records of the last glacial and recent eras	ARC Future Fellowships	\$ 776,000	Dr Julie Trotter
Effects of Environmental Change on Tropical Montane Forest Amphibian and Birds in Peninsular Malaysia	University of Southampton	\$ 66,474	Dr Kelvin Peh, Dr Nicola Mitchell, Dr Amanda Ridley
Northern Australian Environmental Resource Hub - Project Plan 2 - 2016-2019	Charles Darwin University ex National Environmental Science Program NESP	\$ 1,885,900	Dr Michael Douglas, Mr Matthew Hipsey, Associate Professor Samantha Setterfield, Dr Sarah Prout Quicke, Professor David Pannell
Caisson anchors for deep water oil and gas developments in calcareous soils	ARC Discovery Projects	\$239,000	Dr Muhammad Hossain, Professor Yuxia Hu
Ecohydrologic functioning of ephemeral streams	ARC Linkage Projects	\$610,000	Dr Pauline Grierson, Assistant Professor Grzegorz Skrzypek, Professor Dr Peter Cook, Professor Craig Simmons, Dr Shawan Dogramaci
Samphire survey on the Fortescue Marsh	Rangelands Natural Resource Management (NRM) Western Australia	\$8,700	Dr Pauline Grierson, Dr Alison O'Donnell, Professor Timothy Colmer
Annual rainfall variability and extreme drought over the late Holocene	ARC Discovery Projects	\$485,000	Dr Pauline Grierson, Dr Edward Cook, Assistant Professor Grzegorz Skrzypek
Distribution of spinifex (Triodia) cytotypes within Roy Hill seed collection zones	Roy Hill Iron Ore Pty Ltd	\$34,706	Dr Pauline Grierson, Dr Matthew Barrett
Examining the relationship between fishery recruitment, essential benthic habitat and environmental drivers in Exmouth Gulf	WA Department of Fisheries ex FRDC	\$150,000	Dr Renae Hovey, Professor Gary Kendrick
Virtual work integrated learning for engineering students	Office for Learning and Teaching OLT	\$270,000	Dr Sally Male, Winthrop Professor Mohammed Bennamoun, Professor James Trevelyan, Professor Farid Boussaid, Professor Ian Cameron, Professor Nicoleta Maynard, Professor Moses Tade, Dr Ferdous Sohel, Dr Michael Garrett, Dr David Pointing, Professor Douglas Hargreaves

PROJECT TITLE	FUNDING BODY	AMOUNT	OCEANS INSTITUTE RESEARCHER
Offshore Floating Facilities Hub and RiverLab Data Interface	Western Australian Energy Research Alliance WAERA ex Woodside R2D3	\$ 6,000	Dr Scott Draper, Professor David White, Professor Liang Cheng, Dr Ian Milne
Investigation of Lateral Resistance and Conformity of Subsea Pipelines, Umbilicals to Irregular Seabeds	Western Australian Energy Research Alliance WAERA ex Woodside R2D3	\$12,000	Dr Scott Draper, Professor Liang Cheng, Mr Hongwei An, Professor David White
Kelp Export : fuel for adjacent communities in changing arctic ecosystems - KELPEX	Norwegian Institute for Water Research NIVA ex Norwegian Research Council	\$65,209	Dr Thomas Wernberg
Global threats to kelp forests from heatwaves, herbivores and diseases	ARC Discovery Projects	\$385,000	Dr Thomas Wernberg, Dr Adriana Verges, Professor Peter Steinberg
MHRIF Round 20 - Wayne Davies	Medical & Health Research Infrastructure Fund	\$13,425	Dr Wayne Davies
Innovating offshore anchoring design to survive extreme sea states	UWA Research Collaboration Awards	\$20,000	Dr Yinghui Tian, Dr Conleth O'Loughlin, Professor Mark Cassidy, Dr Lizhong Wang, Mr John Morton
Scale Inhibition Using Alginates (2016)	WA Energy Research Alliance WAERA ex Chevron	\$140,000	Mr Brendan Graham, Associate Professor Zachary Aman, Professor Eric May
Recreational Fishing Initiatives Fund - Fisher deployed shark bite-off video surveys and testing of shark deterrents	WA Department of Fisheries	\$27,700	Mr Jonathan Mitchell, Dr Timothy Langlois, Dr Dianne McLean, Professor Shaun Collin
Cause Effect Pathway for Seagrass Diebacks in Naval Waters and Across Cockburn Sound	Aurecon Australasia Pty Ltd	\$81,818	Mr Matthew Fraser, Professor Gary Kendrick
Long-term monitoring of seagrass communities on behalf of the Cockburn Sound Management Council (CSMC)	Western Australian Marine Science Institute (WAMSI)	\$44,818	Mr Matthew Fraser, Professor Gary Kendrick, Dr Michael Rule
Prediction in complex aquatic environments: response models for key south-west estuaries	WA Department of Water	\$31,818	Mr Matthew Hipsey
Water quality changes in Vasse-Wonnerup estuary system in response to surge barrier dynamics	WA Department of Water	\$63,636	Mr Matthew Hipsey
Model Framework for Estuarine Reporting	WA Department of Parks & Wildlife	\$60,000	Mr Matthew Hipsey
Impact of water level manipulation in Great Lake	Hydro Tasmania	\$8,500	Mr Matthew Hipsey
Economic Evaluation of ABC Waters Design Features Implemented by the Private Sector & Public Agencies	CRC for Water Sensitive Cities ex National University of Singapore	\$129,570	Mr MD Sayed Iftekhhar, Professor David Pannell, Dr James Fogarty, Dr Maksym Polyakov

PROJECT TITLE	FUNDING BODY	AMOUNT	OCEANS INSTITUTE RESEARCHER
Assessment of Shark Attack Avoidance/Repellent Technology	UNSW Global Pty Ltd (Unisearch) ex Shark Attack Mitigation Systems Pty	\$196,439	Mr Ryan Kempster, Ms Caroline Kerr, Professor Shaun Collin, Dr Kara Shaw
Fluid resonance in the gap between two side-by-side offshore floating structures with square bilges	UWA Research Collaboration Awards	\$26,320	Mr Wenhua Zhao, Dr Jianmin Yang, Dr Paul Taylor, Dr Rodney Eatock Taylor, Dr Thomas Adcock, Mr Hugh Wolgamot, Professor David White, Dr Scott Draper, Dr Ian Milne
Functional Redundancy of Seaweed Canopies	Equity Trustees Limited Holsworth Wildlife Research Endowment	\$7,000	Mr Yannick Mulders, Dr Thomas Wernberg
Increasing the resilience of frog species to climate change through strategic genetic translocations	Equity Trustees Limited Holsworth Wildlife Research Endowment	\$5,000	Mrs Tabitha Rudin-Bitterli, Dr Nicola Mitchell, Associate Professor Jonathan Evans
Adaptation to the extreme: mechanisms of heat tolerance in corals from the Kimberley region, Western Australia	UWA Research Collaboration Awards	\$26,785	Ms Verena Schoepf, Dr Luke Thomas
The relationship between plant functional traits and primary production in temperate seagrass meadows	UWA Research Collaboration Awards	\$20,895	Ms Ylva Olsen, Dr Camilla Gustafsson, Dr Renae Hovey, Mr John Statton, Mr Matthew Fraser
CRC WSC Research Program Delivery in Western Australia	CRC for Water Sensitive Cities	\$332,000	Professor Anas Ghadouani
Ecological regime shifts for re-engineering water pollution management	ARC Discovery Projects	\$372,500	Professor Anas Ghadouani, Mr Matthew Hipsey, Dr Matthew Linden, Doctor Frederik Hammes, Professor W Mitch, Professor Doctor Michele Prevost
Feasibility for an Artificial Surfing Reef	WA Department of Sport & Recreation	\$17,000	Professor Charitha Pattiaratchi
eReefs Glider Missions	University of Tasmania ex Australian Institute of Marine Science AIMS	\$181,000	Professor Charitha Pattiaratchi
UWA Coastal modelling at Barrow Island	BMT Oceanica Pty Ltd ex Chevron	\$38,625	Professor Charitha Pattiaratchi
Intelligent training (iTraining) for the human Achilles tendon [ARC Funds]	Griffith University ex ARC Linkage Projects	\$130,000	Professor David Lloyd, Professor Ming Zheng, Professor Rod Barrett, Professor Jillianne Cook, Associate Professor Daniel James, Dr Thor Besier
Intelligent training (iTraining) for the human Achilles tendon [Partner Org Funds]	Griffith University ex ARC Linkage Projects	\$170,000	Professor David Lloyd, Professor Ming Zheng, Professor Rod Barrett, Professor Jillianne Cook, Associate Professor Daniel James, Dr Thor Besier
The capture of motile particles by subaquatic structures	UWA Research Collaboration Awards	\$20,000	Professor Gregory Ivey, Mr Marco Ghisalberti, Professor Roman Stocker

PROJECT TITLE	FUNDING BODY	AMOUNT	OCEANS INSTITUTE RESEARCHER
MB Hub - Project D3 - Evaluating and monitoring the status of marine biodiversity assets on the continental shelf	University of Tasmania ex National Environmental Science Program NESP	\$129,000	Professor Jessica Meeuwig, Dr Philippe Bouchet
Understanding Measuring and Managing the Benefits of Urban Waterways	University of South Australia ex ARC Linkage Projects	\$14,371	Professor Lin Crase, Dr Peter Morison, Associate Professor Michael Burton, Associate Professor Darryl Maybery, Professor John Rolfe, Dr Dan Rigby, Dr Amber Clarke
Xenotec OcuScience ERG System (Electroretinogram)	NHMRC Equipment Grants	\$47,000	Professor Mariapia Degli-Esposti, Emeritus Professor David Hunt, Professor John Forrester, Dr Christopher Andoniou, Dr Livia dos Santos Carvalho, Dr Samuel McLenachan, Dr Jan Hemmi, Dr Fred Chen
Entrepreneur's Program - Histology of Laser Ablated Bone Tissue	Department of Industry Innovation and Science - AusIndustry: Innovation Connections	\$10,017	Professor Ming Zheng
Entrepreneur's Program - Histology of Laser Ablated Bone Tissue	Daniel Fick Pty Ltd	\$10,017	Professor Ming Zheng
MHRIF Round 20 - Ming Hao Zheng	Medical & Health Research Infrastructure Fund	\$29,213	Professor Ming Zheng
Data Analysis and Business Intelligence	WA Department of Regional Development	\$168,981	Professor Paul Flatau, Dr Bryan Boruff, Associate Professor Lisa Wood, Dr Kaylene Zaretsky
Advancing single-cell analysis and isolation in Western Australia	ARC Linkage Infrastructure Equipment Facilities	\$410,000	Professor Ryan Lister, Professor Michael Berndt, Professor Shaun Collin, Professor Alistair Forrest, Dr Elin Gray, Dr Joel Gummer, Dr Andrea Holme, Dr Garth Maker, Professor Ian Small
Advancing single-cell analysis and isolation in Western Australia	Murdoch University	\$50,000	Professor Ryan Lister, Professor Michael Berndt, Professor Shaun Collin, Professor Alistair Forrest, Dr Elin Gray, Dr Joel Gummer, Dr Andrea Holme, Dr Garth Maker, Professor Ian Small
Advancing single-cell analysis and isolation in Western Australia	Edith Cowan University	\$20,000	Professor Ryan Lister, Professor Michael Berndt, Professor Shaun Collin, Professor Alistair Forrest, Dr Elin Gray, Dr Joel Gummer, Dr Andrea Holme, Dr Garth Maker, Professor Ian Small

PROJECT TITLE	FUNDING BODY	AMOUNT	OCEANS INSTITUTE RESEARCHER
Advancing single-cell analysis and isolation in Western Australia	Curtin University of Technology	\$50,000	Professor Ryan Lister, Professor Michael Berndt, Professor Shaun Collin, Professor Alistair Forrest, Dr Elin Gray, Dr Joel Gummer, Dr Andrea Holme, Dr Garth Maker, Professor Ian Small
Redefining sediment transport predictions in benthic ecosystems	ARC Discovery Projects	\$285,000	Professor Ryan Lowe, Dr Marco Ghisalberti, Professor Heidi Nepf, Professor Matthew Reidenbach
The behavioural and physiological indicators of sleep in sharks	Sea World Research & Rescue Foundation	\$18,385	Professor Shaun Collin, Associate Professor Jennifer Rodger, Mr Michael Kelly, Dr John Lescu, Professor Jelle Atema
AIMS/UWA Postdoc Funding	Australian Institute of Marine Science (AIMS)	\$894,692	Professor Shaun Collin, Professor Peter Davies
Rice and seagrass roots in anoxic sediments: coping with soil phytotoxins for productive wetland crops and aquatic ecosystems	UWA Research Collaboration Awards	\$26,151	Professor Timothy Colmer, Professor Gary Kendrick, Associate Professor Ole Pedersen, Professor Mikio Nakazono, Associate Professor Hiro Takahashi
New Approaches to Quantifying the Properties of Gravel Soils and for Sampling Inverted Soils to Improve Crop Management	WA Department of Agriculture & Food DAFWA Royalties for Regions	\$469,035	Winthrop Professor Mohammed Bennamoun
The impact of marine wrack degradation on water quality in the Jurien Bay Boat Harbour.	Western Australian Department of Transport	\$175,000	Professor Carolyn Oldham, Professor Paul Lavery, Dr Matt Hipsey, Dr Kathryn McMahon
The Next Generation Offshore Foundation to Harness Ocean Renewable Energies in Deep Waters	Australian Academy of Technology and Engineering	\$7,000	Dr Yinghui Tian
RoboCrab: An integrative approach to understanding natural escape decisions	ARC Discovery Projects	\$437,500	Hemmi, J., Partridge, J.C., Webb, B
<b>Total</b>		<b>\$11,955,906</b>	

# Oceans Institute 2016 Publications

## Journal Articles

Abbott B, Baranov V, Mendoza-Lera C, Nikolakopoulou M, Harjung A, Kolbe T, Balasubramanian M, Vaessen T, Ciocca F, Campeau A, Wallin M, Romeijn P, Antonelli M, Gonçalves J, Detry T, Laverman A, de Dreuzay J, Hannah D, Krause S, **Oldham C**, Pinay G (2016) Using multi-tracer inference to move beyond single-catchment ecohydrology. *Earth Science Reviews* **160**:19-42

Abelson A, Halpern B, Reed D, Orth R, **Kendrick G**, Beck M, Belmaker J, Krause G, Edgar G, Airoidi L, Brokovich E, France R, Shashar N, De Blaeij A, Stambler N, Salameh P, Shechter M, Nelson P (2016) Upgrading Marine Ecosystem Restoration Using Ecological-Social Concepts. *BioScience* **66**(2): 156-163

Abram S, **Acciaoli G**, Baviskar A, Kopnina H, Nonini D, & Strang V (2016) Special Module: Plenary Debate from the IUAES World Congress 2013: Evolving Humanity, Emerging Worlds, 5–10 August 2013. *Anthropological Forum* **26**(1): 74-95

Adams M, **Hovey R**, **Hipsey M**, Bruce L, Ghisalberti M, **Lowe R**, **Gruber R**, Ruiz-Montoya L, Maxwell P, Callaghan D, **Kendrick G**, O'Brien K (2016) Feedback between sediment and light for seagrass: Where is it important? *Limnology and Oceanography* **61**(6): 1937-1955

Adcock TAA, Taylor P, **Draper S** (2016) On the shape of large wave-groups on deep water -The influence of bandwidth and spreading. *Physics of Fluids* **28**(10)

Adiyanti S, Eyre B, Maher D, Santos I, Golsby-Smith L, Mangion P, **Hipsey M** (2016) Stable isotopes reduce parameter uncertainty of an estuarine carbon cycling model. *Environmental Modelling and Software* **79**: 233-255

Adyel T, **Oldham C**, **Hipsey M** (2016) Stormwater nutrient attenuation in a constructed wetland with alternating surface and subsurface flow pathways: Event to annual dynamics. *Water Research* **107**: 66-82

Afaq Ali Shah S, **Bennamoun M**, Boussaid F (2016) Iterative deep learning for image set based face and object recognition. *Neurocomputing* **174**: 866-874

Akhfash M, **Aman Z**, Ahn S, Johns M, May E (2016) Gas hydrate plug formation in partially-dispersed water-oil systems. *Chemical Engineering Science* **140**: 337-347

Alam MR, **Bennamoun M**, Togneri R, Sohel F (2016) A joint Deep Boltzmann Machine (jDBM) Model for Person Identification using Mobile Phone Data. *IEEE Transactions on Multimedia* **19**(2)

Allshouse M, **Ivey G**, Xu J, Beegle-Krause CJ, **Lowe R**, **Jones N**, Peacock T (2016) Revealing the impact of windage on ocean surface Lagrangian coherent structures. *Environmental Fluid Mechanics* **17**(3): 473-483

Almahasheer H, Aljowair A, **Duarte C**, Irigoien X (2016) Decadal stability of Red Sea mangroves. *Estuarine, Coastal and Shelf Science* **169**: 164-172

Almahasheer H, **Duarte C**, Irigoien X (2016) Nutrient limitation in central red sea mangroves. *Frontiers in Marine Science* **3**(DEC)

Almahasheer H, **Duarte C**, Irigoien X (2016) Phenology and Growth dynamics of *Avicennia marina* in the Central Red Sea. *Scientific Reports* **6**(NOV): 00271

**Aman Z**, Koh C (2016) Interfacial phenomena in gas hydrate systems. *Chemical Society Reviews* **45**(6): 1678-1690

**Amman Z**, Di Lorenzo M, Kozielski K, Koh C, Warrier P, Johns M, May E (2016) Hydrate formation and deposition in a gas-dominant flowloop: Initial studies of the effect of velocity and subcooling. *Journal of Natural Gas Science and Engineering* **35**:1490-1498

**Andrzejczak S**, **Meeuwig J**, Rowat D, Pierce S, Davies T, Fisher R, **Meekan M** (2016) The ecological connectivity of Whale Shark aggregations in the Indian ocean: A photo-identification approach. *Royal Society Open Science* **3**(11): 160455

Arrieta J, **Duarte C**, Montserrat Sala M, Dachs, J (2016) Out of thin air: Microbial utilization of atmospheric gaseous organics in the surface ocean. *Frontiers in Microbiology* **6**(JAN)

Asif U, **Bennamoun M**, Sohel F (2016) Unsupervised segmentation of unknown objects in complex environments. *Autonomous Robots* **40**(5): 805-829

Atkinson C, Martin K, Fraser G, **Collin S** (2016) Morphology and distribution of taste papillae and oral denticles in the developing oropharyngeal cavity of the bamboo shark, *Chiloscyllium punctatum*. *Biology Open* **5**(12): 1759-1769

Austin C, Tan M, Croft L, **Meekan M**, Gan H, Gan H (2016) The complete mitogenome of the bluespotted ribbontail ray *Taeniuray lymma* (Forsskål, 1775) (Elasmobranchii: Myliobatiformes: Dasyatidae). *Mitochondrial DNA* **27**(5): 3205-3207

- Austin C, Tan M, Lee Y, Croft L, **Meekan M**, Pierce S, Gan H (2016) The complete mitogenome of the whale shark parasitic copepod *Pandarus rhincodonicus* norman, Newbound & Knott (Crustacea; Siphonostomatoidea; Pandaridae)-A new gene order for the copepod. *Mitochondrial DNA* **27**(1): 694-695
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- Barley S**, Mehta R, **Meeuwig J**, **Meekan M** (2016) To knot or not? Novel feeding behaviours in moray eels. *Marine Biodiversity* **46**(3): 703-705
- Barley S**, **Meeuwig J** (2016) The power and pitfalls of large-scale, unreplicated natural experiments. *Ecosystems* **20**(2): 331-339
- Beck A, Murphy D, Carey-Smith R, Wood D, **Zheng M** (2016) Treatment of Articular Cartilage Defects with Microfracture and Autologous Matrix-Induced Chondrogenesis Leads to Extensive Subchondral Bone Cyst Formation in a Sheep Model. *American Journal of Sports Medicine* **44**(10): 2629-2643
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- Bhaskar A, Beesley L, Burns M, Fletcher T, Hamel P, **Oldham C**, Roy A (2016) Will it rise or will it fall? Managing the diverse effects of urbanizations on base flow. *Freshwater Science* **35**(1): 293-310
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- Bluteau C**, **Jones N**, **Ivey G** (2016) Estimating turbulent dissipation from microstructure shear measurements using maximum likelihood spectral fitting over the inertial and viscous subranges. *Journal of Atmospheric and Oceanic Technology* **33**(4): 713-722
- Bluteau C**, **Jones N**, **Ivey G** (2016) Acquiring long-term turbulence measurements from moored platforms impacted by motion. *Journal of Atmospheric and Oceanic Technology* **33**(11)
- Boo G H, Le Gall L, Miller K, Freshwater D, **Wernberg T**, Terada R, Yoon K, Boo S (2016) A novel phylogeny of the Gelidiales (Rhodophyta) based on five genes including the nuclear CcsA, with descriptions of *Orthogonacladia* gen. nov. and *Orthogonacladiaceae* fam. Nov. *Molecular Phylogenetics and Evolution* **101**: 359-372
- Borum J, Pedersen O, Kotula L, **Fraser M**, **Statton J**, Colmer T, **Kendrick G** (2016) Photosynthetic response to globally increasing CO<sub>2</sub> of co-occurring temperate seagrass species. *Plant, Cell and Environment* **39**(6): 1240-1250
- Boschetti F** (2016) Models and people: An alternative view of the emergent properties of computational models. *Complexity* **21**(6): 202-213
- Boschetti F**, Cvitanovic C, Fleming A. & Fulton E. (2016) A call for empirically based guidelines for building trust among stakeholders in environmental sustainability projects. *Sustainability Science* **11**(5): 855-859
- Boschetti F**, **Price J** & Walker I. (2016) Myths of the future and scenario archetypes. *Technological Forecasting and Social Change* **111**: 76-85
- Boschetti F**, Walker I & **Price J**. (2016) Modelling and attitudes towards the future. *Ecological Modelling* **322**: 71-81
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- Botero A, Cooper C, Thompson C, **Clode P**, Rose K & Thompson R. (2016) Morphological and Phylogenetic Description of *Trypanosoma noyesi* sp. nov: An Australian Wildlife Trypanosome within the *T. cruzi* Clade. *Protist* **167**(5): 425-439
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- Britton D, **Cornwall C**, Revill A, Hurd C & Johnson C. (2016) Ocean acidification reverses the positive effects of seawater pH fluctuations on growth and photosynthesis of the habitat-forming kelp, *Ecklonia radiata*. *Scientific Reports* **6**: 26036
- Brown A, Bejder L, Parra G, Cagnazzi D, Hunt T, Smith J & **Allen S**. (2016) Sexual dimorphism and geographic variation in dorsal fin features of Australian humpback dolphins, *Sousa sahalensis*. *Advances in Marine Biology* **73**: 273-314

- Brown A, Bejder L, Pollock K, & **Allen S.** (2016) Site-specific assessments of the abundance of three inshore dolphin species to inform conservation and management. *Frontiers in Marine Science* **3**(FEB): 00004
- Brown C, O'Connor M, Poloczanska E, Schoeman D, Buckley L, Burrows M, **Duarte C**, Halpern B, Pandolfi J, Parmesan C & Richardson A. (2016) Ecological and methodological drivers of species' distribution and phenology responses to climate change. *Global Change Biology* **22**(4): 1548-1560
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- Cao Y, **Boruff B** & McNeill I. (2016) Defining Sufficient Household Preparedness for Active Wildfire Defense: Toward an Australian Baseline. *Natural Hazards Review* **17**(1)
- Cao Y, **Boruff B** & McNeill I. (2016) Is a picture worth a thousand words? Evaluating the effectiveness of maps for delivering wildfire warning information. *International Journal of Disaster Risk Reduction*. **19**: 179-196
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- Cheng L, An H, **Draper S** & **White D.** (2016) Effect of wave boundary layer on hydrodynamic forces on small diameter pipelines. *Ocean Engineering* **125**: 26-30
- Cheng N & **Cassidy M.** (2016) Combined loading capacity of spudcan footings on loose sand International Journal of Physical Modelling. *Geotechnics*: **16**(1): 31-44
- Cheng N & **Cassidy M.** (2016) Development of a force-resultant model for spudcan footings on loose sand under combined loads. *Canadian Geotechnical Journal* **53**(12): 2014-2029
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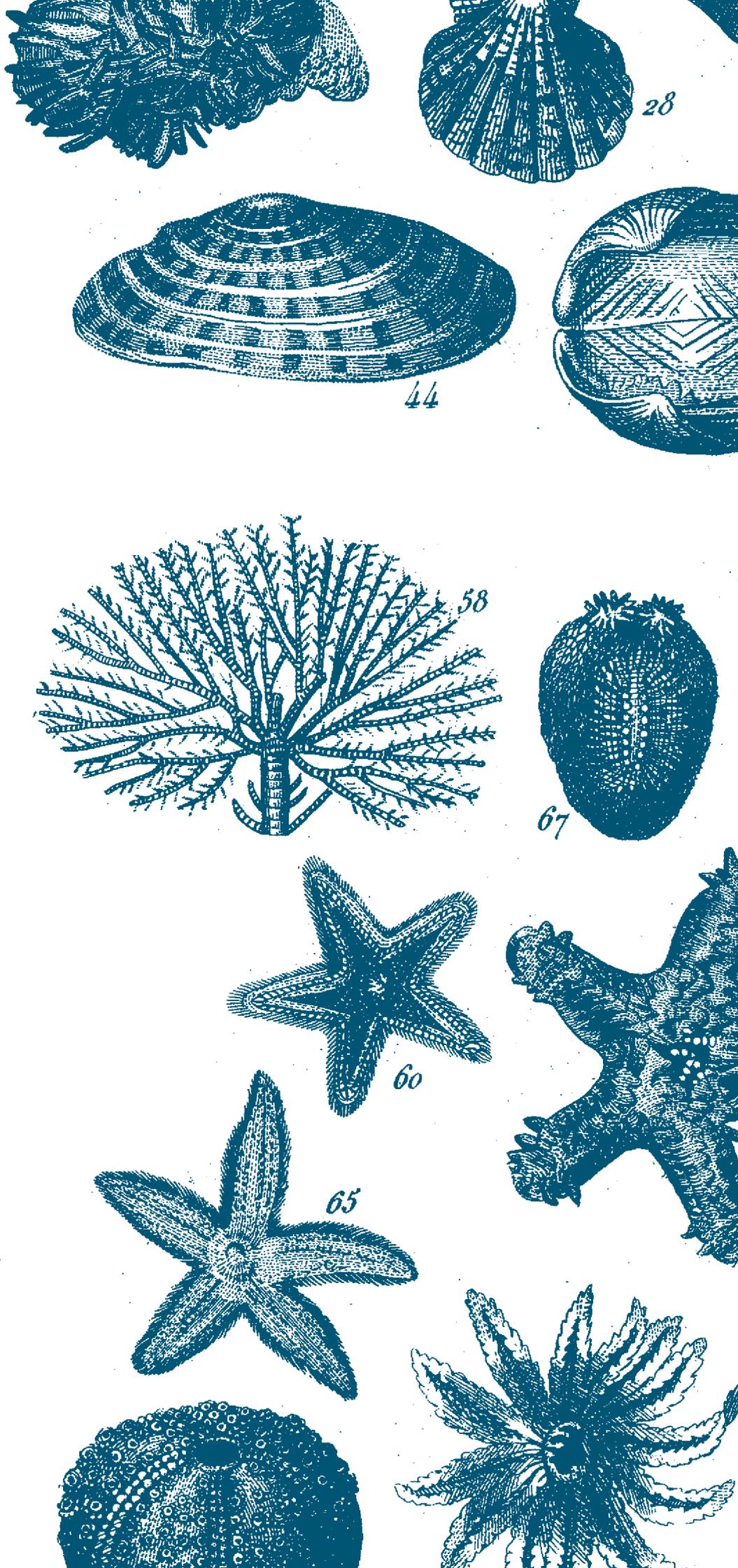
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# 2017

## Looking Forward

“I am delighted to have been appointed the new Director of UWA Oceans Institute. I look forward to working with Professor Peter Davies, Pro Vice Chancellor (Research) and Acting Director in 2016, Professor Shaun Collin, who has been Deputy Director and a significant influence on the Institute over the last few years, together with the Senior Leadership Team, Advisory Board and all Institute members. There will be an exciting start to 2017 as most staff will be moving into the IOMRC building on the UWA Crawley campus in January. The completion of the IOMRC buildings, and the co-location of staff from UWA, CSIRO, AIMS and Fisheries Division of the Department of Primary Industries and Regional Development, brings many opportunities for enhanced collaborations in marine science and beyond. 2017 will also see considerable global attention on marine issues, with the first UN Oceans Conference being held in June. It is hoped that this focus will result in increased momentum for change, and UWA Oceans Institute will be well-placed to contribute to identifying multi-disciplinary solutions to the many challenges facing our oceans.”

— Professor Erika Techera  
Oceans Institute Director 2017

### Oceans Institute 2017 Strategic Priorities

- Strengthen and spread capacity in marine research
- Invest in internationalisation
- Enhance high-performance culture

### Oceans Institute 2017 Operational Priorities

- Enhance research profile
- Advance Oceans Institute’s international development
- Engage in knowledge transfer
- Invest in international research and programs
- Develop strategic partnerships
- Increase available resources





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### **UWA Oceans Institute**

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**The University of Western Australia**  
**M470, 35 Stirling Highway**

Perth WA 6009 Australia

Tel: +61 8 6488 8116

Email: [oceans@uwa.edu.au](mailto:oceans@uwa.edu.au)

 [/UWAOceansInstitute](https://www.facebook.com/UWAOceansInstitute)

 [@uwaoceans](https://twitter.com/uwaoceans)

[oceans.uwa.edu.au](http://oceans.uwa.edu.au)