EDITH COWAN UNIVERSITY
School of Natural Sciences

Centre for Marine Ecosystems Research

RESEARCH HIGHLIGHTS

2012-2013

CONTENTS

PRINCIPALS' REPORT

Glenn Hyndes and Paul Lavery
Co-Principals, Centre for Marine Ecosystems Research

CMER underwent its first 5-year review in 2013, and received positive support from the panel, highlighting its strong research environment and links to industry. This has provided us with confidence in our approach to research and research training, and has helped us direct our focus for the next five years.

Members of the CMER have a strong track record of obtaining external research income from a wide range of industry and national competitive sources. In 2012 and 2013, CMER members were involved in grants totalling over $1.3M, and published 43 research papers in high impact journals. As usual, a notable feature of the publication record is the large number of collaborative papers, reflecting the close and complementary research occurring within the group as well as with external research collaborators. Staff supervised 20 HDR students.

Through its research activities CMER has maintained strong engagement with the WAMSI, playing key roles in WAMSI 2 nodes. CMER staff have also assisted the Dept. of Environment and Conservation with data collection for the Walpole-Nornalup Inlets Marine Park, involving 3rd year students to achieve research-informed teaching outcomes, which has resulted in a journal article being accepted for publication. CMER also led one of the 6 CRN projects based at ECU, which has established a close relationship with UWA's Ocean's Institute, CEAB, Spain, and University of Otago, New Zealand. It has also established new collabrations with University of Southern Cross.

HIGHLIGHTS IN HABITAT CONNECTIVITY AND TROPHIC INTERACTIONS

Habitat connectivity and trophic interactions form one of the main focal topics of research in CMER. The two projects outlined here convey the broad research undertaken by CMER's postgraduate students. A PhD student investigated kelp distribution effects on the trophic dynamics of surrounding habitat, and the iconic Black Swan was the focus of a Masters student looking at grazing pressure of seagrass.

SOURCE AND SUPPLY OF SEAWEED WRACK TO ADJACENT HABITATS

Export of kelp detritus is a major mechanism which strongly affects the trophic dynamics of surrounding habitats in temperate marine ecosystems. Throughout his PhD, Thibaut de Bettignies has helped to refine our understanding of the origin of kelp detritus. His work have led to the presentation of an alternative model that integrates kelp phenology, biomechanics and environmental forcing as drivers of the form and timing of detrital export. The results demonstrated the dominance of kelp erosion in autumn-early winter, analogous to the seasonal leaf fall of deciduous trees, whereas dislodgement was a minor and constant process throughout the year.

The outputs of a novel biomechanical model of kelp dislodgement demonstrated the effect of seasonal kelp erosion in minimizing kelp susceptibility to dislodgement via a drag-reducing form of the kelp when water velocities associated with large winter storms increased. Thibaut's findings not only helped to define the modality of kelp export but also threw light on the ability of kelp to survive severe and seasonal storm events.

Tagged kelp to monitor simultaneously the two main sources of kelp fragments from kelp forest: whole kelp dislodgment from the inability to relocate tagged kelp within a control plot and erosion measurement through a modified hole-punch method. Photography: T. de Bettignies.

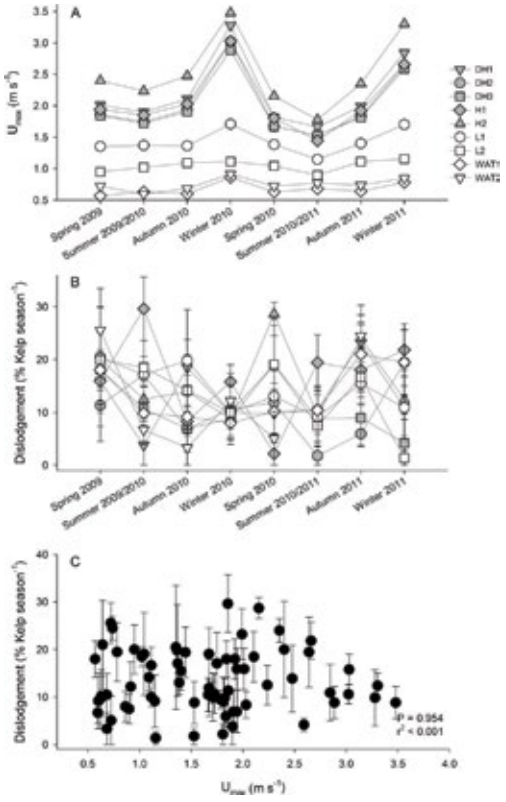


Figure 1: Decoupling of kelp dislodgement from seasonal peak in water velocity. (A) Seasonal variation of maximum water velocities at the nine reefs surveyed in Marmion. (B) Seasonal variation of kelp dislodgement rate (mean ± SE) at the same nine reefs.

For more information see:

- de Bettignies, T., M. S. Thomsen, and T. Wernberg. 2012. Wounded kelps: patterns and susceptibility to breakage. *Aquatic Biology* 17:223–233.
- de Bettignies, T., T. Wernberg, and P. S. Lavery. 2013a. Size, not morphology, determines hydrodynamic performance of a kelp during peak flow. *Marine Biology* 160:843–851.
- de Bettignies, T., T. Wernberg, P. S. Lavery, M. A. Vanderklift, and M. Mohring. 2013b. Contrasting mechanisms of dislodgement and erosion contribute to production of kelp detritus. *Limnology and Oceanography* 58:1680–1688.

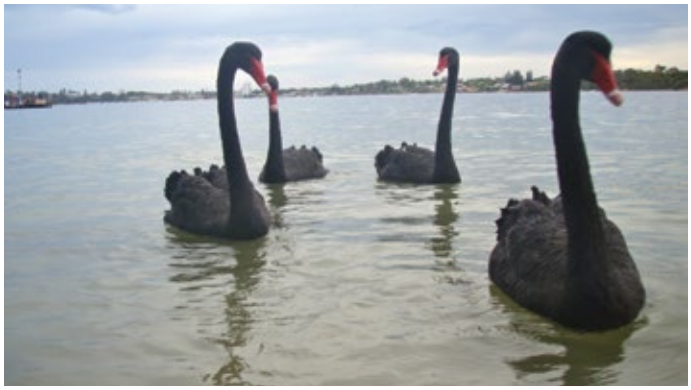
THE ICONIC BLACK SWAN

The Black Swan (*Cygnus atratus*) is WA's faunal emblem, it's on the State flag and it's a much-loved visitor at any waterside picnic. Given this, it is truly astonishing just how little ecological research has been devoted to this icon of the west. Gary Choney's Masters project is building on earlier work by CMER visitor Johan Eklof, Kathryn McMahon and Paul Lavery to begin addressing some of the critical knowledge gaps.

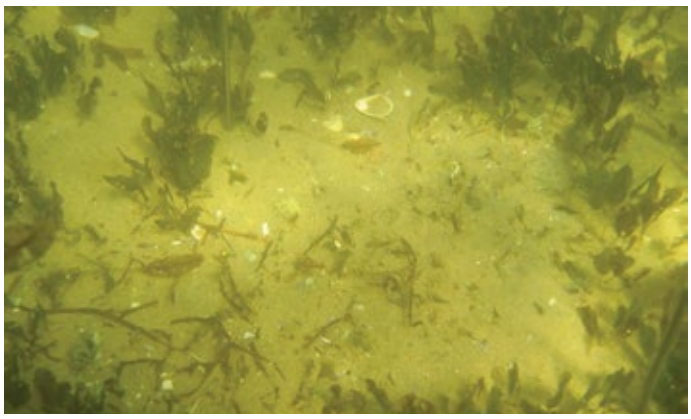
Gary's research has examined grazing interactions between the black swan and the seagrass *Halophila ovalis* in the Lower Swan River estuary. The spatial and temporal variation in swan abundance has been documented across 45 sites in four seasons and at different times of day. Further investigations sought to determine what sort of grazing pressure the swans exerted on seagrass in the estuary, whether this varied over the year and how the seagrasses cope with this pressure. Gary's findings to date have revealed a large variation in swan abundance over the year, with the highest number of swans present during autumn (185 swans), intermediate numbers in summer and winter and the lowest in spring (53). It seems that the swans may move to ephemeral wetlands on the coastal plain during winter, but move back to the estuarine refuge during the dry, summer months.

The study has also identified a number of hotspots for swan abundance. It appears that sites with high abundances of swans are those with high cover of natural vegetation on the river bank, sub-tidal seagrasses and a shallow sloping seabed. Conversely, sites with jetties and dogs had low swan numbers. Using repeat visits to sites where swans graze, the study has revealed that swans graze more seagrass biomass in summer and autumn than in spring and winter. However, because seagrass production is at its greatest during the times grazing is at its most intense, the net result is an almost constant grazing pressure throughout the year, with swans consuming 6 - 25% of daily seagrass production.

Further experiments are underway to determine what impact the swan grazing has on the seagrass growth and reproduction.



Black Swans in the lower Swan River Estuary



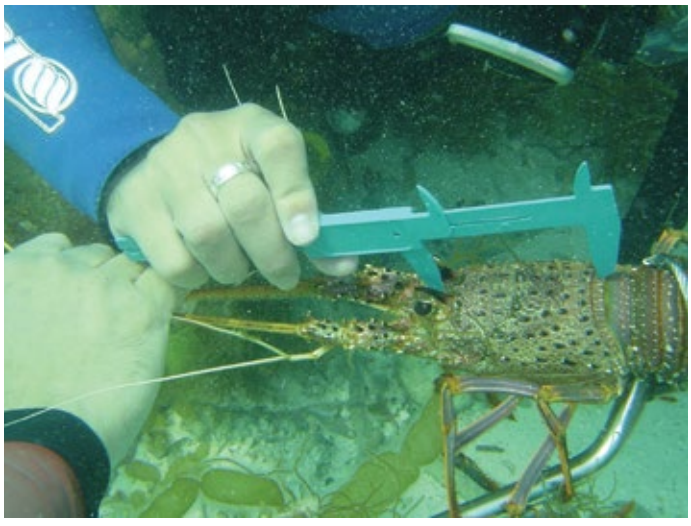
A circular grazing scar leaf after Black Swans have fed on a *Halophila ovalis* meadow

HIGHLIGHTS IN CONSERVATION AND FISHERIES BIOLOGY

This wide-ranging research theme covers a diversity of projects in CMER with a focus on integrating marine ecology with coastal planning and management through improved understanding of ecosystem processes. This Research Highlights looks at studies on the reproductive biology of coral trout at the Abrolhos Islands in relation to effects of fishing pressure, and the impact of rock lobster fishing on benthic ecosystems.

LOBSTER DENSITY AND ECOSYSTEM DIVERSITY

With the move towards an ecosystems approach to fisheries management, it is vital to have knowledge of the potential impacts of fisheries on ecosystems and associated floral and faunal communities. This formed the basis for a study on the potential effects of the rock lobster fishery on macroalgal and epibenthic invertebrates coastal reefs and seagrass meadows. Using a gradient of lobster density, we investigated the extent to which *P. cygnus* influenced the structure of molluscan assemblages within seagrass meadows and reefs. Contrary to our expectations, *P. cygnus* did not have a consistent effect on molluscan assemblage structure, although it did have a negative effect on the abundance of Trochidae in seagrass meadows in winter and spring and on Turbinidae on reefs in winter (see Figure 2). Our results indicate that *P. cygnus* may play a role in regulating the abundance of trochids, but its effect on molluscan assemblages is limited and temporally inconsistent. This is likely to reflect the species' omnivorous diet, the patchy distribution of its food sources, the lack of dominant grazers/space occupiers in this system, and other environmental factors such as wave exposure. While our study is correlative in nature and can therefore not provide mechanisms leading to the patterns observed, this study provides the first important step to understanding the ecosystem structuring role of *P. cygnus* in shall-water ecosystems.



Measuring rock lobster

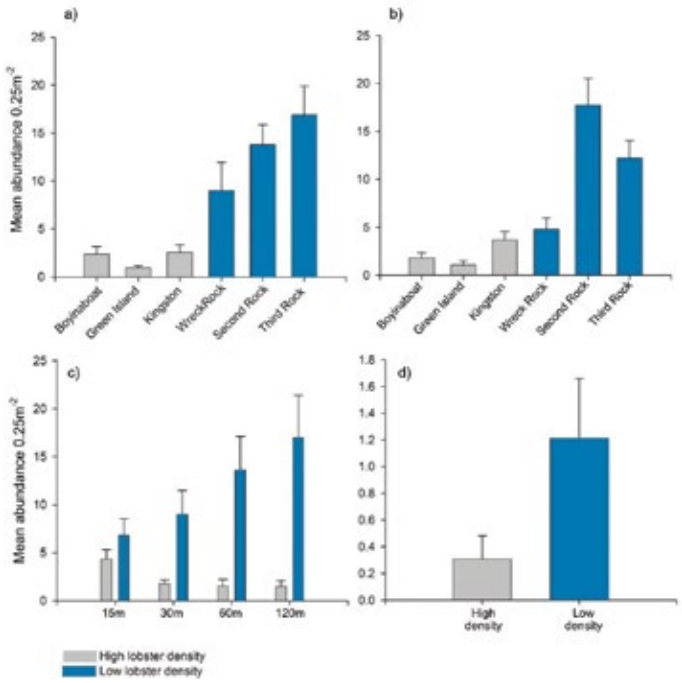


Figure 2: Mean (±SE) abundance per 0.25m2 of a) Trochidae in high and low lobster density treatments in seagrass meadows in winter; b) Trochidae in high and low lobster density treatments in seagrass meadows in spring; c) Trochidae in high and low lobster density treatments with increasing distance from the reef in spring and; d) Turbinidae in high and low lobster density treatments on the reef in winter

CORAL TROUT

As part of his PhD project, Jason How is examining the biological and ecological aspects of the leopard coral grouper *Plectropomus leopardus*, which is a common reef fish throughout the Indo-Pacific region and a major target of both commercial and recreational fisheries. The population in Western Australia shows some significant biological differences to its eastern Australian population. Most noticeable is the strong size-related cue over their protogynous sex change, and the lack of the typical social mechanisms regulating sex change for this family, which has resulted in a spatially explicit pattern in spawning omission. It appears that fishing pressure is likely to be the main cause behind this spawning omission. Spawning was restricted to areas where fishing pressure was light (i.e. within protected areas, (Figure 3), and fish were able to attain a size where they could become male. In addition, histology, underwater visual census and acoustic tracking were used to determine the spawning aggregation dynamics of leopard coralgrouper at some of these spawning sites. Unlike the eastern Australian population, spawning was not limited to the new moon for fish at the Abrolhos Islands, but also encompassed the full moon, with a distinct difference between male and female attendances at aggregation sites. Females only attended aggregations during these lunar phases, while males moved to the aggregations almost daily during the spawning season. The findings of PhD project provide evidence that management measures must take into account local species-specific biological and ecological characteristics.

The Leopard Coral Groper *Plectropomus leopardus*

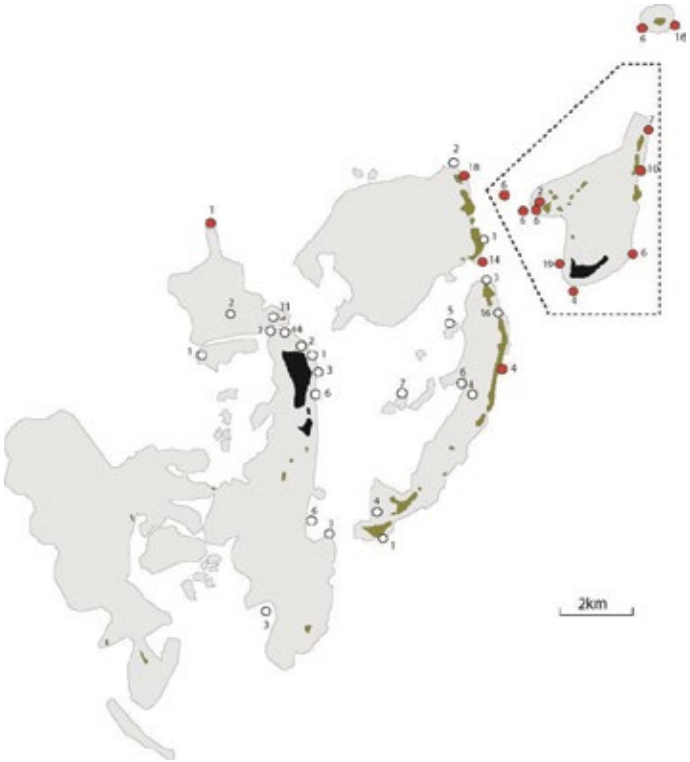


Figure 3: Location of spawning sites (black circles) and non-spawning sites (open circle) in the Easter Group with number of females above size at first maturity sampled over all seasons. Map shows "inhabited "islands (black); uninhabited islands (brown); intertidal reef (light grey); and the boundary of the MPA (dashed line).

HIGHLIGHTS IN HUMAN IMPACTS OF ECOSYSTEMS PROCESSES

With a growing population in Western Australia and over 90% residing within 50 kilometres of the coast, CMER has continued to lead research into the increasing range of human impacts in coastal marine systems. Research in this theme stress the importance of not only understanding coastal ecosystems response to human impacts, but also drawing on the immense value these systems offer to mitigate those impacts. Blue-carbon reserves assessment and 3D modelling project summarised here are just two of several studies CMER is currently involved in.

BLUE-CARBON AND THE SEAGRASS BLUES

CMER researchers have been undertaking the first national assessment of the Blue-Carbon reserves contained in Australia's seagrass meadows. Most people are aware that forests lock up carbon dioxide from the atmosphere. This is commonly referred to as 'green carbon'. Until now, the carbon captured by marine plant systems, so-called 'Blue-Carbon', has largely been ignored in carbon accounting. However, the CMER study has shown that seagrass meadows lock away between 4 and 10 times more atmospheric carbon than our forests. Gram-for-gram, they are big hitters when it comes to snatching carbon out of the atmosphere.

Paul Lavery has teamed up with CMER adjunct professor Miguel-Ángel Mateo from CSIC in Spain) to take sediment cores from seagrass meadows across Australia. The cores were then analysed to determine how much carbon had been sequestered into the sediments by the seagrasses. This information was supplemented by data for additional meadows from post-doc Oscar Serrano and PhD student Mohammad Rozaimi.

It was conservatively estimated that Australia's 92,500 sq km of seagrass meadows contain more than 155 million tonnes of carbon. At a carbon trading price of $35 a tonne predicted by the Federal Government for 2020, that indicates a multi-billion dollar asset that can be used

Researchers core a seagrass meadow destroyed by boat moorings, to determine how much carbon has potentially been released back to the atmosphere

for tradable carbon credits. And this value is only for the top 25 cm of sediments, since that was as deep as the initial cores could go. The true extent of the carbon restores is likely to be several times larger than the initial estimate. Realising this value depends on the approach that governments take to carbon trading. Irrespective of that, the research is informing the fledging trading market and allowing us to realise the enormous stores of carbon embedded in these valuable ecosystems. Unfortunately, however, seagrass meadows are under serious threat from pollution and coastal development, with about 0.7% of the world's meadows lost each year. Every square kilometre lost releases 1.6 tonnes of carbon back to the atmosphere.

The research is on-going with current efforts directed at understanding what factors are important in making one type of seagrass meadow better at capturing and storing carbon than others. CMER researchers are about to enter into a major national collaboration on Blue Carbon, the CSIRO Coastal Carbon Biogeochemistry Cluster, involving seven universities and the CSIRO.

3D MODELLING REVEALS SEAGRASS RESPONSE TO LIGHT REDUCTION

CMER researcher Dr Kathryn McMahon, in collaboration with Environmental Computer Science Ltd Director Dr John Hedley, designed a three dimensional model of seagrass canopies to investigate the effect of canopy structure and reduced light on photosynthesis. The first stage of the research was aimed at creating a seagrass canopy model for complex seagrasses like *Amphibolis griffithii*. Then, determining the variables to incorporate into the design which replicate a range of natural and anthropogenic conditions seagrass meadows are subjected to with a focus on light attenuation. The model was developed using data from studies of plant morphometrics and a previous study investigating light attenuation effects.

The model accounts for variables like wave motion, branch and stem length, and movement of leaves, their position in the layered canopy, and changing exposure to sunlight (Figure 4). Results revealed the relationship between light levels, canopy density and canopy-scale photosynthesis is complex and non-linear. The model has increased understanding of seagrass response to light reduction at a canopy scale, helping to establish seagrass resilience to human activity related stressors (such as dredging). For example, ascertaining the length of time seagrass survives in reduced light conditions and whether there is a seasonal aspect to seagrass vulnerability. This could greatly influence environmental management strategies and prove a useful tool to improve predictions of the impact and monitoring of light reduction events on seagrass meadows.

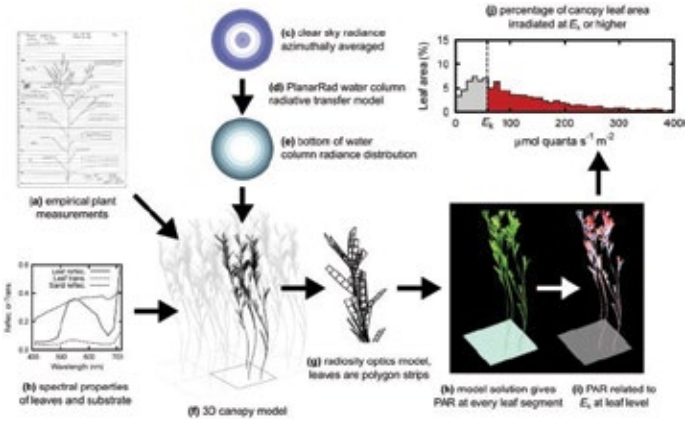


Figure 4: Overview of model, (a, b) empirical data informs construction of 3D canopy model (f), (c, d, e) A plane-parallel model estimates directional radiance incident on the top of the canopy, (f, g, h) a geometric optical model handles radiative transfer to and between leaf segments, (i, j) PAR distribution over leaf area is reduced to the percentage of the canopy irradiated above leaf-level photosynthetic saturation, Ek.

Prior research applied individual leaf analysis to determine the amount of light required for photosynthesis in a given species or plant to understand leaf-level response to light. Field studies measure and analyse benthic light at canopy-scale. This study presents an integration of these two, bridging the gap between canopy- and leaf-scale. Further research extends this study to look at the effect of canopy structure and density on photosynthesis, and these effects should be considered when assessing, predicting and monitoring impacts from coastal developments.

COLLABORATIVE RESEARCH NETWORK

Since late 2011, the CMER has been leading a large, collaborative research program examining the roles of water movement and connectivity in our coastal environments. The CRN (Collaborative Research network) is a suite of six research programs across ECU, one of which is focused on marine science. Led by Paul Lavery, the marine program is developing capability in two inter-connected themes: Eco-hydraulics, which is exploring the role of water movement in the ecology of our marine ecosystems; and Coastal Connectivity, or the way our marine and coastal habitats are connected to each other through the movement of materials and genes. Understanding these processes is crucial to spatial management of the nation's marine resources.

The CRN allows CMER to bring together researchers from ECU and The University of WA (UWA), as well as the University of Otago and the Spanish Council for Scientific Research in a $1.7 mill. program of research, including $0.9 mill. from the Department of Innovation, Industry, Science, Research and Tertiary Education. The

research activities are spread over several sites and include: Post-doctoral fellowships, visiting researcher fellowships, postgraduate scholarships, professional exchanges among laboratories and a suite of workshops designed to focus on key questions related to the research themes.

Three postdoctoral researchers joined CMER during 2011-12 as part of the CRN. Dr Christin Säwström has been leading projects on the role of microbes in coastal connectivity. Dr Kathryn McMahon is studying genetic connectivity among marine communities in WA and Indonesia and Dr Dolors Pujol has joined CMER from Spain to work on the role of water movement on ecological processes at a variety of spatial scales. In addition, several new postgraduate students to commenced their CRN-related studies, including Udhi Herawan from Indonesia (genetic connectivity), Maryam Abdolahpour from Iran (eco-hydraulics) and Flavia Tarquinio from Italy (microbial tropho-dynamics). All of these students are co-supervised by our colleagues at UWA (Professors Gary Kendrick, Carlos Duarte, Carolyn Oldham and Marco Ghisalberti) and work with colleagues at Otago and Barcelona.

Although the CRN is still in its early days, it is already proving to be a very effective international network of researchers and promises to yield exciting research outcomes and wonderful postgraduate and postdoctoral research opportunities.

Costal Connectivity: offshore seagrass meadows, temperate reef, rocky shores and dune systems are connected through the movement of material driven by wind and waves

CMER MEMBERS

ECU STAFF

PAUL ARMSTRONG

With several years' experience in marine and aquaculture research, Paul joined CMER in 2013 as a Research Technician. Prior to and after completion of a Master of Applied Sciences in Aquaculture in 2010, Paul was involved in research projects with the University of Tasmania (Australian Antarctic Division), and CSIRO working with aquatic fauna such as krill and other invertebrates, and oyster and salmon selective breeding programs. His technical ability has been pivotal in developing laboratory experimental design in projects CMER is currently undertaking such as dredging impacts on seagrass beds in northwest Australia.

ROB CZARNIK

After completion of a Post Graduate Diploma of Science (Biological Sciences) Rob was employed as a research assistant for Dr Britta Munkes, Dr Pippa Moore, Dr Adriana Vergès and Dr Christine Hanson. In 2012, Rob took on the role of Field Safety and Support Officer where he provides expert advice and assistance to postgraduate students and staff on the preparation of Risk Analysis and Management Plans and ensures CMER operates under legislative, training and competency requirements. In addition, Rob is actively involved in the field operations of many of CMER's research projects.

DR MEGAN HUGGET

With more than a billion microorganisms per litre of seawater, the biodiversity of microbial communities and the functional roles that they play in the marine environment are enormously significant. Megan's research focuses on the function and diversity of marine microbes, and falls into two themes: prokaryote-eukaryote interactions in the marine environment and the function and diversity of bacterioplankton communities. She has been involved in several studies investigating the genome content and architecture of many numerically abundant bacterioplankton species via whole genome sequencing projects, as well as investigating bacterioplankton diversity in response to a large storm event, and across several coral atolls in the Northwestern Hawaiian Islands.

ASSOCIATE PROFESSOR GLENN HYNDES

Coastal marine and estuarine environments are highly complex systems prone to high levels of human disturbance resulting from the concentration of Australia's population along the coastal regions. It is, therefore, crucial to develop a high level of understanding of the complex ecological processes in these coastal environments. The movement of animal and plant material from one habitat to another forms

an important process of habitat connectivity in the coastal, marine landscape. This forms the focus of Glenn's research activities. His studies have examined the trophic links among habitats using a combination of experimental and biomarker (stable isotopes and fatty acids) approaches to trace key food sources through the food web. Glenn's work has also examined the importance of different coastal habitats, particularly seagrasses, to fish communities, the ecosystem effects of consumers on shallow coastal biodiversity.

PROFESSOR PAUL LAVERY

Paul's research interests relate to the functioning of benthic marine ecosystems and how they respond to human-induced pressures. His research has focused on seagrass ecosystems and how to improve the way we predict, monitor and management impacts. Currently, he has three major areas of research interest: (1) The impact of dredging on seagrasses and other primary producer ecosystems, currently with a focus on tropical species; (2) Connectivity and trophic subsidies among coastal marine ecosystems (in collaboration with Glenn Hyndes). Much of this work has relied on stable isotope and other biomarker techniques to understand how materials transported from one habitat supporting productivity in adjacent habitats; and (3) the carbon capture and storage potential of seagrass ecosystems, and their role in offsetting the impacts of atmospheric carbon emissions.

ROSIN MCCALLUM

Roisin's role at CMER is part of a collaborative project between ECU, UWA and CSIRO, investigating the impacts of dredging on seagrasses in the north-west of Australia. Roisin joined CMER in 2013 after completing a Master's degree at Southern Cross University in Marine Science and Management. Her interest in marine ecology research encompasses the interactions between biogeochemistry of sediments and water, in particular seagrasses and macro algae. Roisin is also a representative for Work, Health and Safety at the centre and manages CMER's laboratory.

DR KATHRYN MCMAHON

Kathryn's main research area is coastal marine ecology, specifically focusing on seagrasses in both tropical and temperate environments following three main themes: human impacts in seagrass ecosystems; seagrass-grazing interactions; and phylogenetics. Her research into human impacts (e.g. nutrient enrichment, light reduction associated with dredging) has focused on developing ecophysiological tools to assess health or measure impacts. Secondly, with plant-grazing interactions Kathryn is interested in understanding the strategies plants use to cope with grazing, especially related to sexual reproduction. Thirdly, Kathryn's uses molecular tools to investigate the relationship of seagrass taxa.

DR OSCAR SERRANO GRAS

Oscar joined CMER in 2012 with over 7 years research expertise in marine ecology, palaeo-ecology and marine biogeochemical cycles. With a focus on carbon sequestration and paleo-ecological reconstruction from sedimentary deposits, Oscar's research includes investigating the capacity of seagrass ecosystems as a globally significant carbon sink, and the variability in carbon storage of seagrass habitats and between seagrass species. His research is largely centred on marine ecosystem response to climate change.

DR CHRISTIN SÄWSTRÖM

Christin is a marine microbiologist and has undertaken postdoctoral research positions in Sweden and Australia since gaining her PhD in 2006. Joining CMER in 2012, her primary focus is in aquatic microbial ecology exploring whole community processes and energy flow in this relatively new area of marine ecosystem research. Christin has investigated the complexities of these communities including characterizing marine microbial diversity and function in marine habitats of Western Australia, exploring virus aquatic ecology, and environmental influences on virus and host interactions particular to sub-tropical systems.

ASSOCIATE PROFESSOR UTE MUELLER

Geostatistical techniques were developed for the estimation and simulation of the spatial distribution of mineral reserves, but are equally applicable to other natural resources. Ute's research interests include the development and application of simulation and estimation of fisheries data.

ADJUNCT STAFF

DR RUSS BABCOCK

Russ is based at CSIRO Marine and Atmospheric Research, and leads research to better understand how human activities influence coastal ecosystems such as kelp forests and coral reefs. Research programs focus on issues such as fishing impacts and the effectiveness of marine reserves as conservation tools. Other projects have focused on the impacts of sedimentation on both temperate and coral reef ecosystems.

DR RAY MASINI

Ray is based at the Department of Environment and Conservation. His research has focused on Western Australian marine ecosystems generally, with particular emphasis on the tropical arid ecosystems of the central west and north-west coasts. More recently this focus has moved north to the tropical Kimberley coast. His research interests include nutrient-effects ecological modelling and environmental management strategy and policy formulation. Ray has been centrally involved in the planning and management of a range of multidisciplinary marine environmental studies around the State's 13,000 km coastline. Ray's interests also include knowledge transfer and application, particularly as they relate to the three-way interaction between research, environmental policy formulation and environmental management.

DR BRITTA MUNKES

Britta is a benthic ecologist, interested in community processes. Her research focuses on the impact of human-induced environmental stressors (nutrient pollution and altered food webs) as well as interacting physical factors on benthic communities. Britta is particular interested in the effects of these stressors on the resilience and biodiversity in seagrass communities. Her goal is to understand about processes leading to changes in competition strength between seagrasses and algae, between top-down (grazers) and bottom-up (nutrient enrichment) effects. Britta is based at the troubles.

DR MADS SOLGAARD THOMSEN

Mads's research focuses on how anthropogenic stressors, in particular bio-invasions, nutrient pollution and climate change, impact the structure, productivity and biodiversity of aquatic communities. Mads combines manipulative experiments, analysis of long-term monitoring data and literature-based meta-analysis to test how patterns in biological communities are generated and maintained. This research provides predictions on how coastal habitats will respond to anthropogenic stressors and recommendations for conservation strategies needed to ameliorate their impacts.

DR FERNANDO TUYA

Fernando's research is driven by the need to develop rules and models to explain the patterns of organization of marine populations and communities from local to macroecological (biogeographical) scales. From this general interest, Fernando is particularly interested in ecological processes shaping temperate reefs from small to large geographical scales, trophic linkages between reefs and adjacent seagrass meadows, effects of human perturbations on natural communities and the role of Marine Protected Areas in preserving marine biodiversity and fishery resources. As a tool to improve the public perception and awareness of marine biodiversity, he has contributed to the dissemination of the marine flora and fauna of the Atlantic Ocean through books and open-access monographs.

DR MAT VANDERKLIFT

Mat is a marine ecologist based at CSIRO Marine & Atmospheric Research. His research interests include ecological linkages between habitats, the use of stable isotopes to study trophic ecology, factors influencing the abundance of flora and fauna, the ecological importance of consumers (herbivores and carnivores) and the effects of human use of marine ecosystems.

POSTGRADUATE RESEARCH STUDENTS

JASON HOW (PhD)
Accessing the potential benefits of marine protected areas to adjacent fished areas.

MR ALDO TURCO (PhD)
Investigating the strength of herbivory pressure on seaweeds along a latitudinal gradient.

MOHAMMED ROZAIMI JAMALUDIN (PhD)
Carbon preservation in seagrass meadow ecosystems.

CHARU LATA SINGH (PhD)
Role of microbial assemblages in affecting the nutrient cycling associated with wrack and in supporting the food webs of surf zones and sandy beaches.

MARYAM ADOLAHPOUR (PhD)

EVE LITH (PhD)
Integrate various sources of data to assess the recreational fishery in Western Australia.

HANNAH CAMERON-CALUORI (Masters)
A preliminary investigation of the potential effects of the invasive Mozambique tilapia *Oreochromis mossambicus* on the native fish assemblages of Lake MacLeod, Western Australia.

BEN JONES (Masters)
Hydrodynamic influences on the structure of epibenthic fauna communities inhabiting the seagrass species, *Posidonia sinuosa*.

PETER MALANCZAK (Masters)
Relationships between spawning and recruitment of *Nematalosa vlaminghi* with hydrological characteristics within an estuary: can this species be used as an indicator of estuarine health?

UDHI HERNAWAN (PhD)
Genetic connectivity of the seagrass *Thalassia hemprichii* in the Indo-Australian Archipelago.

FLAVIA TARQUINIO (PhD)
Ecological role of prokaryotes associated to seagrass leaves and their contribution to the plant's nutrient requirement.

SIMONE STRYDOM (PhD)
Influence of light spectra (light quality) on the frowth and development of seagrasses through their life history phases.

GARY CHONEY (Masters)
Impact of swan grazing on the seagras Halophila avalis in the Swan/Canning Estuary.

THIBAUT DE BETTIGNIES (PhD)
Source and supply of seaweed wrack to adjacent habitats.

AINSLIE DENHAM (PhD)
Geostatistical spatiotemporal modelling of king prawn catch rate in the Shark Bay managed prawn fishery.

PIERRE BOUVAIS (PhD)
Impact of dredging activities in north-western Australia on filter feeders assemblages.

ANDREW MACKEY (PhD)
Dynamics of isotopic baselines with a temperate coastal ecosystem in relation to the surrounding biochemical environment.

ERIC AIDOO (PhD)
Spatial Modelling of Recreational Boat-Based Fishing in Western Australia.

CANDACE WILLISON (Masters)
Rates and processes of *Posidonia sinuosa* degradation in south-west Australia

FEDERICO VITELLI
Feeding ecology of *Parma mccullochi* (Pomacentridae) and its impact on temperate algal dominated reefs.

CURRENT RESEARCH PROJECTS

TITLE	RESEARCHERS	FUNDING AGENCY
The role of Kyphosus spp in reef ecosystems	Hyndes, Turco	ANZ Executors and Trustee Co Ltd
Spatial and temporal variability in 13C and 15N stable isotope signatures of primary producers and consumers on temperate reefs	Hyndes, Mackey	
Ecological connectivity of Kimberley marine communities - WAMSI Kimberley Research Program	McMahon	Aust. Institute of Marine Science
Carbon preservation in seagrass ecosystems - characterising Australia's Blue-Carbon reserves	Lavery, Jamaludin	Aust. Institute of Nuclear Science and Engineering
Coastal Carbon Biogeochemistry Cluster	Lavery, Säwström	CSIRO
Effects of suspended sediment on filter feeders	Lavery	
The Role of Herbivory in Ameliorating the Effects of Nutrient Enrichment in Marine Ecosystems.	Lavery, Munkes	
Quantification of the Biodiversity of the Lake MacLeod Northern Ponds	Horwitz, Froend, Hyndes, McMahon	Dampier Salt Ltd
Protection of coastal ecosystems and marine resource management	Lavery, Hyndes, McMahon, Kendrick, Oldham, Säwström, Ghisalberti (UWA)	Dept of Innovation, Industry, Science and Research
Ecophysiology of Benthic primary producers (Consequences of reduced light availability in seagrass meadows for fauna and fisheries	Lavery, McMahon	Dept. Parks and Wildlife
Collaborative Temperate Marine Research	Hyndes	
Seagrass health survey (Becher Point to Fremantle Region)	Lavery	
Microbes, the missing link in Coastal Landscape Connectivity	Hyndes, Säwström	

TITLE	RESEARCHERS	FUNDING AGENCY
Boat-based recreational boat fishing activity in Western Australia: a long term profile	Hyndes, Graham, Mueller	Dept. of Fisheries
Characterising marine microbial diversity and function in key benthic habitats of Western Australia	Lavery, Säwström	Edith Cowan University
Improving capacity to predict impacts of dredging - modelling light and the response of seagrasses	Lavery, McMahon	
Organic Carbon Preservation in Estuarine Seagrass Meadows of Western Australia	Säwström, Jamaludin	Ernest Hodgkin Trust
Seagrass TIME – Trophic Cascades in Marine Ecosystems	Lavery, Munkes	European Commission
Improving the experiential design and statistical rigour for estimating state-wide recreational catch by boat based anglers	Lavery, Hyndes, Meuller, Graham	Fisheries WA
Seagrass Monitoring Program for Geographe Bay	McMahon	Geocatch
Insights into carbon preservation in seagrass sediments: the microbial community structure and its role in carbon degradation and remineralisation	Jamaludin	Holsworth Wildlife Research Endowment
Beach Wrack Dynamics in Geraldton	Hyndes	Northern Agricultural Catchments Council
Research Study into Seagrass Wrack Movement in Geographe Bay	Lavery, McMahon	UWA
Defining thresholds and indicators of Primary Producer response to dredging related pressures	Lavery, McMahon	Western Australian Marine Science Institution
Benthic primary productivity and herbivory	Hyndes, Säwström	
Defining thresholds and indicators of Primary Producer response to dredging related pressures	Lavery, McMahon	
Impact of Dredging on Coral Communities	Lavery, McMahon	Woodside Energy Ltd

PUBLICATIONS

JOURNALS

Babcock R.C. (2013) Leigh Marine Laboratory Contributions to Marine Conservation. New Zealand Journal of Marine and Freshwater Research DOI: 10.1080/00288330.2013.810160.

Cannon, JW., **Mueller, U.,** Hornbuckle, J., Larson, A., Simmer, K., Newnham, J., Doherty, D., (2013), Economic implications of poor access to antenatal care in rural and remote Western Australian Aboriginal communities: an individual sampling model of pregnancy. *European Journal of Operations Research*, 226(2), 313-324.

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Thomsen, MS., de Bettignies, T., Wernberg, T., Holmer, M., Debeuf, B. (2012) Harmful algae are not harmful to everyone. *Harmful Algae* 16:74-80

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Mackey, AP., Atkinson, A., Hill, SL., Ward, P., Cunningham, NJ., Johnston, NM., Murphy, EJ. (2012) Antarctic macrozooplankton of the southwest Atlantic sector and Bellingshausen Sea: Baseline historical distributions (Discovery Investigations, 1928-1935) related to temperature and food, with projections for subsequent ocean warming. *DEEP-SEA RESEARCH PART II-TOPICAL STUDIES IN OCEANOGRAPHY*. 59:130-146.

Kendrick, GA., Waycott, M., Carruthers, TJB., Cambridge, ML. Hovey, R., Krauss, SL., **Lavery, PS.,** Les, DH., Lowe, RJ., Vidal, OMI., Ooi, JLS., Orth, RJ., Rivers, DO., Ruiz-Montoya, L., Sinclair, EA., Statton, J., van Dijk, JK., Verduin, JJ. (2012) The Central Role of Dispersal in the Maintenance and Persistence of Seagrass Populations. *Bioscience* 62:56-65.

De Bettignies, T., Wernberg, T., Lavery, P., (2012), Size, not morphology, determines hydrodynamic performance of a kelp during peak flow. *Marine Biology: international journal on life in oceans and coastal waters,* 160(4), 843-851, Germany, DOI: 10.1007/s00227-012-2138-8.

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Grote, J., Thrash, C., **Huggett, M.,** Landry, Z., Carini, P., Giovannoni, S., Rappe, M., (2012), Streamlining and Core Genome Conservation among Highly Divergent Members of the SAR11 Clade. *mBio*, 3(5), e00252-12, DOI: 10.1128/mBio.00252-12.

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Saunders, MI., Thompson, PA., Jeffs, AG., **Sawstrom, C.,** Sachlikidis, N., Beckley, LE., Waite, AM., (2012), Fussy feeders: Phyllosoma larvae of the Western Rocklobster (Panulirus cygnus) demonstrate prey preference. *PLoS ONE*, 7(5), e36580, DOI: 10.1371/journal.pone.0036580.

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BOOKS

Gerard, P., Bazairi, H., Bianchi, CN., Boudouresque, C., Buia, MC., Clabaut, P., Harmelin-Vivien, M., Mateo, M., Montefalcone, M., Morri, C., Orfanidis, S., Pergent-Martini, C., Semroud, R., **Serrano Gras, O.,** Verlaque, M., (2013), Mediterranean Seagrass Meadows: Resilience and Contribution to Climate Change Mitigation. *International Union for Conservation of Nature*, 40, Gland, Switzerland and Malaga, Spain.

CONFERENCE ATTENDANCE & PRESENTATIONS

VI International Sandy Beach Symposium, Mpekweni, South Africa, 23-28 June 2012, a new paradigm in the face of global change.
Attendee: Simone Strydom.

SWCC 3rd Biennial South West Marine Conference.
10th May 2013.
Presentation by: Dr Kathryn McMahon: Seagrass health monitoring in Geographe Bay

Indo-Pacific Fish Conference, Okinawa, Japan,
24th-28th June 2013.
Presentation by: Aldo Turco: Important habitat characteristics for three key herbivorous fish species (Kyphosidae) in temperate waters of Western Australia

Dr Oscar Serrano, Audrey Cartraud, Federico Vitelli, Pierre Bouvais and Dr Kathryn McMahon.

AMSA Golden Jubilee Conference. 7-11 July 2013.
Gold Coast, QLD. Shaping the Future.
Presentations by:

Prof. Paul Lavery	Estimates of carbon stocks and accumulation rates by seagrass habitats incorporating inter-habitat variability
Dr Oscar Serrano	Influence of water depth on C stocks, accumulation rates and origin in seagrass meadows
Assoc. Prof. Glenn Hyndes	Importance of reef-derived kelp in seagrass food webs
Dr Christin Säwström	High metabolic diversity of heterotrophic bacteria in Western Australian sub-surface coastal seagrass sediments
Mohammad Rozaimi	Variability in sediment organic carbon accrual estuarine Posidonia australis meadows from south-western Australia

Australian Marine Sciences Association (AMSA) &
New Zealand Marine Sciences Society (NZMSS)
National Conference, Hobart. July 1-5, 2012.
Marine Extremes and Everything Inbetween

Combined Biological Sciences meeting. Perth Convention Centre, Sept 30-Oct 3 2013. Attendee: Dr Kathryn McMahon - Presentation: Canopy structure and position influence photosynthetic canopy saturation state.

ECU Research Week:– Centre for Marine Ecosystems Research Showcase - Research for Better Marine Management.
Presentations by:

Assoc. Prof. Glenn Hyndes	The role of an herbivorous fish as an ecosystem engineer in temperate algal-dominated reefs
Dr Kathryn McMahon	Modelling light capture in complex seagrass canopies – interactions with leaf area index, water motion and shading
Dr Christin Säwström	Microbes in seagrasses: their role in nutrient cycling
Prof. Paul Lavery	Carbon Sequestration by Australian seagrasses

53rd Estuarine and Coastal Sciences Conference, 13-17th October 2013. Shanghai, China. Estuaries and Coastal Areas in Times of Intense Change. Presentation by: Andrew Mackey: Dynamics of isotopic ratios in primary producers and consumers within a temperate coastal ecosystem

Coastal and Estuarine Research Federation Conference, San Diego, 4th-6th November, 2013. Importance of reef-derived kelp in seagrass food webs. Attendee: Glenn Hyndes

The 9th World Sponge Conference. Fremantle, Australia. Nov 4-8th 2013. New Frontiers in Sponge Science. Presentation by: Dr Megan Huggett: Characterising marine microbial diversity and function in sponges of Western Australia

SEMINARS

Dr Bonnie Laverock (University of Western Australia) – Marine sediment microbial ecology

Glenn Shiell (Quantitative Ecologist, BMT Oceanica) – Blending academic excellence with quality environmental consulting

Zoe Car – Seeing through others' eyes: towards a hybrid ecology of marine turtle and dugong in Australia

Dr Pippa Moore (Abyerystwthy University) – The impacts of climate change on the structure of shallow-water marine systems

Dr Oscar Serrano (Centre for Marine Ecosystems Research) – Insights in the matt of Posidonia oceanica: biogeochemical sink and palaeoecological record

Dr Christin Säwström (Centre for Marine Ecosystems Research) – The Scales and balances: The use of dimensionless numbers to characterize transport, reaction and eco-hydraulic connectivity

Dr Megan Huggett (Centre for Marine Ecosystems Research) – Marine microbial ecology: diversity and function

WORKSHOPS

Australian Seagrass Habitats: Conditions and threats
2nd Workshop - 19-22 March 2013
Funded: Australian Centre for Ecological Analysis and Synthesis
Attendees: Dr Kathryn McMahon

CMER Attendee - Dr Kathryn McMahon back row far right

South West Catchment Council Marine Workshop 2013 - Developing a report card of south-west marine environment
Friday, 11 May 2013
Attendees: Dr Kathryn McMahon

International Blue Carbon Scientific Workshop
Sydney, Australia. May 15-17, 2013
Attendees: Dr Oscar Serrano.

The role of microbes in connecting coastal ecosystems – elucidating how microbes can facilitate connectivity in coastal ecosystems

2 day workshop June 2013 @ ECU
Part of the Collaborative Research Network between ECU and UWA. Coordinators: Dr Christin Sawstrom, Assoc. Prof. Glenn Hyndes, Prof. Paul Lavery and Dr Megan Huggett

Invited collaborators included Prof Peter Steinberg UNSW), Prof Bradley Eyre (USC) and Dr Bonnie Laverock (UWA)

Workshop attendees

Modelling approaches for the dating or carbon accumulation is seagrass cores
Cap Salinas, Mallorca. 25-27th June 2013. Attendees: Dr Oscar Serrano and Prof. Paul Lavery (video link). Workshop to assess the potential of a Monte Carlo statistical approach to determine the minimum number of samples and levels necessary for describing correctly temporal trends, and increase the analytical cost-benefit.

Ecological Windows Workshop
Perth, Australia. Oct 29-30th, 2013. Attendees: Dr Kathryn McMahon, Prof. Paul Lavery and Simone Strydom as part of the WAMSI Dredging Theme 9 research.

COMMUNITY AND GOVERNMENT ENGAGEMENT

Body/Event	Role	Name
Ecological Communities Section of the Federal Government Department of Sustainability, Environment, Water, Population and Communities - application to list *Posidonia* seagrass meadows as a threatened ecological community under the EPBC Act	Expert Speaker	Kathryn McMahon
Technical Advisory Panel for Swan River Trust	Member	
Technical Advisory Panel for Swan River Trust	Member	Glenn Hyndes
Northern Agricultural Catchment Council Beach walks 2013 - A series of beach walks to present the value of beach wrack to community and school groups.	Expert Speaker	
Western Rock Lobster Technical Advisory Panel	Member	
WAMSI Operations Group	Member	Paul
WAMSI Governors Board (Proxy)		

RESEARCH LINKS

GOVERNMENT

Australian Institute of Marine Sciences (AIMS)
Department of Parks and Wildlife (WA)
Department of Fisheries (WA)
Department of Primary Industries, Victoria
Great Barrier Reef Marine Park Authority
Queensland Environmental Protection Authority
Swan River Trust (WA)
Northern Agricultural Catchment Council
Environmental Protection Authority (South Australia)
WA Marine Science Institute
South Australia Water

AUSTRALIAN RESEARCH

ARC-NZ Vegetation Function Network
Fisheries Research and Development Corporation
Tasmanian Aquaculture and Fisheries Institute
Western Australian Marine Sciences Institute (WAMSI)
CSIRO Marine and Atmospheric Research
- Wealth from Oceans Flagship (Coastal Carbon Biogeochemistry Cluster)
- Strategic Research Fund for the Marine Environment (SRFME)

INTERNATIONAL

Université de Nice, France
Université P Sabatier – Toulouse III, France
Otago University, New Zealand
CIIMAR, University of Porto, Portugal
Spanish Council for Scientific Research (CISC), Spain
- Centre for Advanced Studies of Blanes (CEAB)

University of Barcelona, Spain
University of Las Palmas de GC, Spain
Stockholm University, Sweden
- Stockholm Marine Research Centre

Dauphin Island Sea Lab, USA
University of Florida, USA
University of South Alabama, USA
University of Virginia, USA
Autonomonous University of Barcelona, Spain
University of Satiago, Spain

INDUSTRY

Chevron
Oceanica Consulting Pty Ltd
Woodside Oil and Gas

AUSTRALIAN UNIVERSITIES AND SCHOOLS

Albany Senior High School
Griffith University
James Cook University
Murdoch University
The University of New South Wales
The University of Queensland
The University of Western Australia
University of Technology, Sydney
Southern Cross University, NSW
University of Queensland

ALUMNI – WHERE ARE THEY NOW?

Helen Barwick (Honours)
MWH Global, Nelson, NZ.

Ms Rebecca Ince (Honours)
Department of Planning, WA.

Dr Muriel Brasseur (PhD)
Oxfordshire Animal Behaviour Centre, United Kingdom.

Dr Alan Kendrick (Research Associate)
Department of Parks and Wildlife, WA.

Dr Catherine Collier (PhD)
James Cook University, Qld (Post Doctoral Fellow).

Dr Lachlan MacArthur (PhD)
Apache Energy Limited, Perth WA

Dr Karen Crawley (PhD)
BMP Oceanica, Perth WA

Mr Peter Michael (Honours)
PhD Candidate, UWA
(previous Chevron and SKM, Barrow Island WA)

Mr Chris Doropoulos (Honours and Research Assistant)
University of Queensland (PhD).

Dr Rory McAuley (PhD)
Department of Fisheries, WA.

Mr John Eyres (Masters)
Department of Fisheries, WA.

Ms Nadia Tapp (Masters)
Department of Fisheries, WA.

Dr Adam Gartner (PhD)
BMP Oceanica, Perth WA

Mr Andrew Tennyson (Research Assistant)
Apache Corporation, Perth WA

Ms Emily Gates (Honours and Research Assistant)
University of Western Australia, WA

Dr Mark Westera (PhD)
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Ms Sophie Harrison (Masters)
INPEX, WA

Mr Nick Wood (Honours)
Director of Outreach, Scitech

Ms Karina Inostroza (Honours and Research Assistant)
BMP Oceanica, Perth WA

Dr Pippa Moore (Research Associate)
Aberystwyth University, UK.

Dr Adriana Verges (Research Associate)
University of NSW, NSW

Thomas Wernberg (Postdoctoral Research Fellow)
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Mr Dave Holley
Department of Parks and Wildlife, Shark Bay WA

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FURTHER INFORMATION
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B Garnett-Law 5/15