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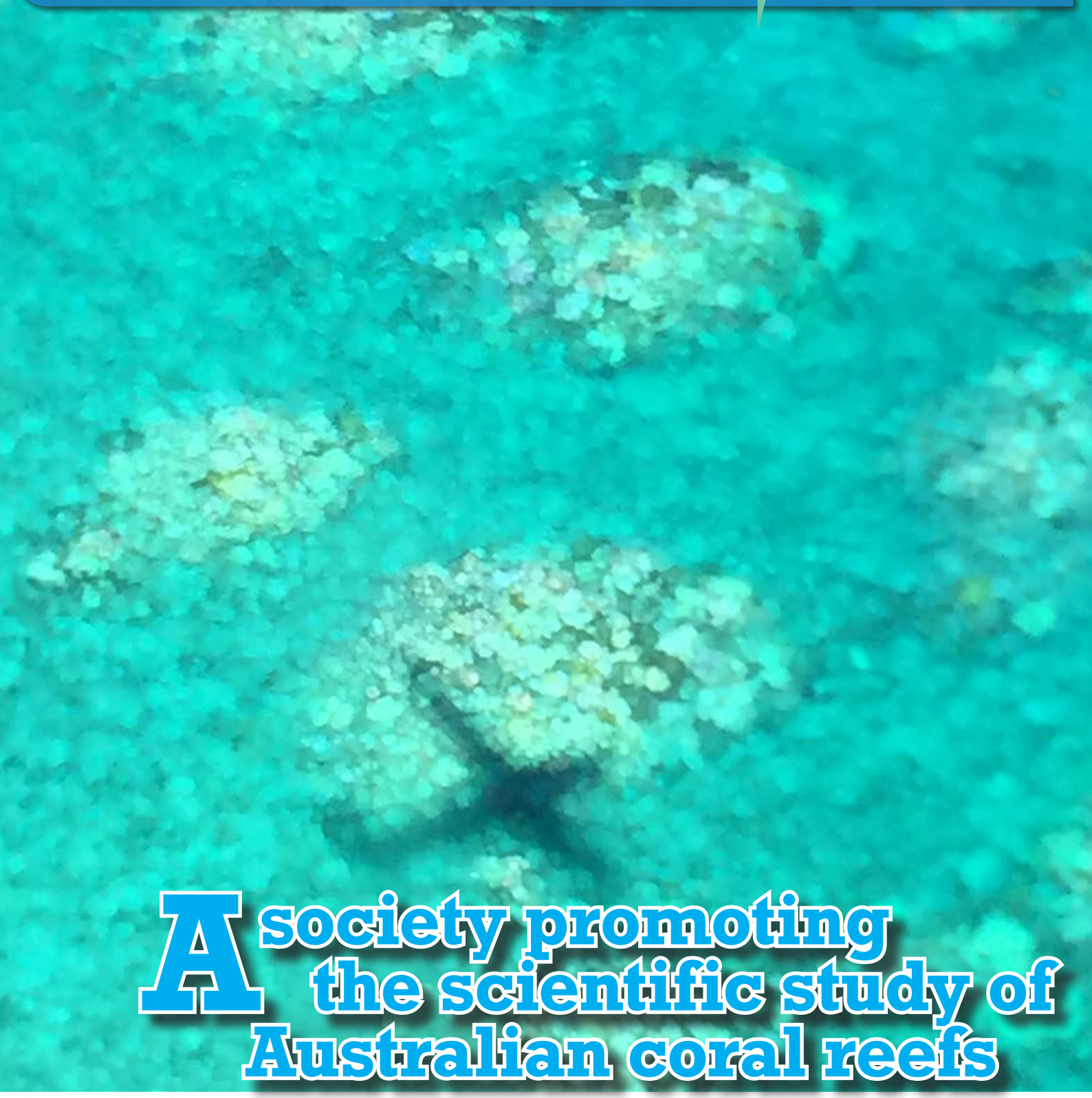
Australian Coral Reef Society Newsletter

Founded in 1922



A society promoting the scientific study of Australian coral reefs

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Editorial foreword

Dear Members,

Since our last newsletter, the outlook for the Great Barrier Reef has worsened. With a second mass bleaching event in two consecutive years, the "centre is now the new north" has become a bleak catch phrase for Australian coral reef scientists. This has been a focal area for the ACRS in 2016 – 2017, and we include observations on Australian coral bleaching in North-Western Australia and also images from the recent 2017 bleaching.

It has been a busy year for the ACRS Council, with eight policy submissions in 2016-2017 on topics ranging from reserve management, to mangroves, to governance of the Great Barrier Reef Marine Park Authority, alongside policy recommendations for elections. For a second year in a row, several ACRS Councillors also advocated for Australian coral reefs at the "Science Meets Parliament" Event hosted by Science and Technology Australia in Canberra (see page 6 for more details). We hear from people currently working out on Australian reefs on topics such as High Latitude Coral Symbiosis (page 23), the effects of elevated water temperatures on tropical Wrasse (page 29), underwater 3D mapping (page 27) and how the underwater world provokes the imaginations of writers and artists alike (page 25).

The 13th International Coral Reef Symposium was held in Honolulu, Hawaii from 19th – 24th June 2016. This brought together 2,500 coral reef scientists, policy makers and managers from 70 different nations in a forum consisting of 88 sessions under the theme "Bridging Science to Policy". We used the conference as an opportunity to highlight Professor Terry Hughes winning the ACRS 2016 Australian Established Researcher Medal (see page 12).

On International Women's Day, we questioned five female coral reef scientists from established, senior researchers to PhD students about their work, motivations, aspirations and successes. Their profiles reveal a diverse array of interests and career pathways. Collectively, their stories (page 13) show the valuable and inspiring contributions made by each of them to coral reef science. These stories also suggest that the coral reef scientific community still has some way to go to address gender equality issues, but that there are also some effective female role models who inspired these women to pursue a career in coral reef research.

We review Iain McCalman's book "The Reef: A passionate history", which documents a variety of relatiuonships people have had with the Great Barrier Reef through twelve stories, tracing an arc from terror to nurture and wonder. Even for those who have visited the reef many times, this collection brings new refreshing stories that collectively demonstrate how scientific understandings of the reef can be combined with the variety of ideas it engenders (the sensual, the spiritual, the aesthetic).

We hope that you enjoy the 2016-2017 Newsletter of the Australian Coral Reef Society,

Editorial team: Sarah Hamylton, Carrie Sims and Gus Porter

The Australian Coral Reef Society boasts a talented membership, both in the sciences and other pursuits. Many of the photos in this edition of the newsletter were taken by ACRS members.

Cover photo: taken during the 2017 bleaching event by the National Bleaching Taskforce (image provided by Professor Terry Hughes, ARC Centre of Excellence for Coral Reef Studies). The image is an aerial view of bleached reefs in the northern Great Barrier Reef.

Message from the President

The last twelve months have been an extremely busy time for the ACRS, with development of some new initiatives (including the student writing retreat), and numerous submissions to government agencies on topics ranging from the management planning process for the Commonwealth Marine Reserve Networks to the Queensland Fisheries Management reform. The discussion around coral reefs in Australia and globally over the past year has, however, been dominated by the 2016 bleaching event that severely impacted reefs across the world, and the 2017 bleaching that is currently unfolding on the Great Barrier Reef (GBR). The 2016 bleaching was the most severe and extensive event impacting Australia's coral reefs, with approximately two-thirds of corals in the relatively pristine northern GBR bleaching and dying. Now, less than 12 months on, the GBR is experiencing another major bleaching event. Although the spatial extent and severity of the 2017 bleaching is still being documented, it is clear that coral reefs cannot persist under scenarios of such frequent bleaching. Despite these clear and devastating impacts of climate warming on coral reefs, it is extremely disappointing to see the continued push for the development of the Adani Carmichael coal mine and discussions of 'clean coal' by some government and interest groups. Now, more than ever the ACRS has a critical role to inform and influence decision makers to provide some hope for reefs into the future. With this in mind the ACRS sent three Councilors to the recent Science meets Parliament event in Canberra (21-22 March). The event was extremely productive, with the councilors meeting with numerous Members of Parliament and their advisors to discuss the many issues facing Australia's coral reefs and the critical need for action on climate change.

2016 also saw the ACRS hold its first Student Writing Retreat on Magnetic Island (9-13 June). The week-long retreat was a huge success and it is extremely rewarding to see many of the manuscripts developed during the retreat starting to appear in the scientific literature. I would like to extend a special thank you to Jenni Donelson, Katie Motson, and Steve Doo for their tireless efforts in organising and coordinating the retreat, and for the many councilors and members of the ACRS that volunteered their time to assist in reviewing student manuscripts. The ACRS also had a strong representation at the 13th International Coral Reef Symposium in Honolulu, and provided financial support to 36 student and early career members of the Society to attend the conference. I thank all of those recipients for being ambassadors for the ACRS and staffing the ACRS booth, all of the councilors and members that carried ACRS merchandise to and from Hawaii, and Jenni Donelson and Steve Doo for coordinating and organizing the ACRS booth.

The ACRS has done well in 2016 with a strong membership and healthy financial position. A huge thank you to our Treasurer Jenni Donelson, Membership Manager Giverny Rodgers, Secretary Selma Klanten, and Web Manager Ross Hill for their tireless efforts in filling these roles. I'd also like to thank Sarah Hamylton and her team for putting together this newsletter, Becky Fox and her team for assessing the student research and travel grants, and Selina Ward for again putting her hand up to lead the organisation of the ACRS Annual Scientific Conference. There are so many more tasks performed by the ACRS and I am extremely grateful to have such a wonderful group of enthusiastic councilors who are always willing to assist, often at very short notice. Thank you to David Booth, Anna Scott, Elizabeth Madin, Roger Beeden, Gus Porter, Steve Doo, Mike McWilliam, Paloma Matis, Katie Motson, Stephanie Duce, and Carrie Sims.

Lastly, I would like to express my sadness and deepest sympathies at the passing of a dear friend and colleague Sylvain Foret. Sylvain was not only a brilliant coral reef scientist but also a wonderful and caring person who would brighten a room with his presence and infectious smile. He will be dearly missed.

On behalf of the ACRS I wish you all the best for the coming year and look forward to seeing you at the 90th ACRS Conference in Townsville 16-18 July.

Andrew Hoey

ACRS President

Note: Aboriginal and Torres Strait Islander readers should be aware that this publication may contain images or names of people who have passed away.

Australian Coral Reef Society in 2016

As a scientific Society, ACRS frequently makes submissions to government departments and press releases to the media regarding issues which affect Australian coral reefs. In the **2015 ACRS Newsletter Dr Selina Ward** wrote *"I don't recall a time when the GBR has been the topic of so much debate and political importance...With this backdrop, our expertise has been sought for comment and review..."* None foresaw the devastation still to come to Australia's reefs.

ACRS continues to play a very important role in providing advice, comment and submissions for all matters relating to Australian reefs and at times other marine habitats. Our views are frequently sought by government agencies, industry groups and corporations.

We are currently in a crucial period for the future of the Great Barrier Reef. It is our responsibility as marine scientists to share our knowledge and help government and the general public to understand the issues facing Australia's reefs and make sense of the wide range of reef views making the media at present - from Breitbart to GBRMPA.

Below is a list of our recent submissions and policy documents. As always we are very keen to get input from our membership for these submissions and will seek expertise for each document, so please contact us if you are interested in contributing.

Dr Selina Ward, ACRS Councilor

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Renew your membership!

Donate - it's tax-deductable!

background photo: C. Sims

ACRS submissions in 2016:
more at australiancoralreefsociety.org/submissions

*ACRS submission on the Commonwealth marine reserve management planning process

*ACRS comment on the fisheries management reform in Queensland green paper

*ACRS science-based policy plan for the Great Barrier Reef - Discussion: Advancing Climate Action in Queensland

*ACRS science-based policy plan for the Great Barrier Reef - Comments on reef policy plans in the 2016 election

*ACRS science-based policy plan for Australia's coral reefs - Benefits of mangroves - Science brief for Hon. Mark Butler MP

*ACRS science-based policy plan for Australia's coral reefs - Science brief for Hon. Mark Butler MP

*ACRS science-based policy plan for Australia's coral reefs

*ACRS Press Release, 6 April: Great Barrier Reef faces devastation without immediate action experts warn

ACRS 2015 photo contest winners: L to R -K. Wolfe, M. Palacios and K. Anderson

Join us

for the upcoming AGM

19 May 2017

James Cook University, Townsville

SmP 2017

ACRS President and Councilor meet Hon. Bill Shorten

A Hitchhiker's Guide to Policy: How to navigate the political realms of science.

In its 18th year, President Andrew Hoey and student council members Mike McWilliam and Katie Motson had the privilege of venturing to the nation's capital to attend **Science meets Parliament**, an annual and prestigious event hosted by Science and Technology Australia. With more than 200 scientists in attendance, the event aims to facilitate collaboration and communication between scientists and parliamentarians, providing scientists with the tools required to build long-lasting and effective relationships with decision makers.

In a time of pseudo-science, misinformation and scare-mongering, the **critical thinking, objectivity, and integrity** that comes with a scientific mind and education is argued to be just what the doctor ordered to cure our current political ails. Nowhere is this more true than in coral reef science, where many problems and solutions in reef conservation lie in governance. With this in mind, we approached the event eager to find out how issues concerning coral reefs were understood and dealt with inside parliament, and **spread the word** of recent developments in reef conservation.

The first day was professional development, focused around communication with the media, policy makers and to prepare us for

meeting parliamentarians. To put science on the front page, scientists are advised to find the **sexiness and quirkiness** in their own research. Unfortunately, a sexy story sometimes isn't enough. To ensure that your story and your message aren't lost, scientists are encouraged to keep it simple, concise and entertaining. Most importantly, to avoid any misinformation - encourage journalists to ask those 'stupid' questions they may be too shy or embarrassed to ask, to **guarantee that the message you convey, is the message that gets printed**. And finally, be proactive - don't wait for the journalist to call you, as it may never happen. Instead, research who is writing about your field of work and develop relationships with trusted journalists in your area of research.

In preparing to meet with our parliamentarians, we were encouraged to remember that politicians are human, and that as scientists we should try to humanise ourselves. Indeed, they may be equally as intimidated by us, as we are them. We were also advised to take the time to research our politicians, to form a personal connection and lasting impression, and to prepare a message that is concise and targeted to their constituency. The Hon. Arthur Sinodinos, Minister for Industry, Innovation and Science, urged us to ***'build a relationship (with parliamentarians), not a one night stand'***. Therefore following up your meeting, and maintaining the conversation with your parliamentarian, is crucial.

L to R: Mike William, Katie Motson and Andrew Hoey

After a full day of chatting to fellow nerds, from **astronomers and maggot farmers to whale-snot collectors**, we were now ready to put these lessons into practice and meet our parliamentarians. This began with a dinner at Parliament House, and continued the next day where we had formal meetings with members of parliament. We were fortunate enough to speak with several parliamentarians about coral reef issues, including the Environment Advisor to the Hon. Bill Shorten, Leader of the Opposition. Many of our conversations were **heavily focused on the recent and ongoing coral reef bleaching**, and the urgent need to transition from fossil fuels to renewables. We were pleased to see so many of the talks focused around energy and the environment, and that many policy makers already understood some of the problems facing coral reefs and were often keen to learn more. We were also confronted with the staggering amount of work that coral reef scientists can and must do to communicate their science, promote solutions and keep coral reefs issues at the forefront of policy.

Following a year of vast global political change, and critical developments in all scientific fields, scientists are encouraged now, more than ever, to **navigate the unchartered waters of politics and policy**. Whilst delving into the unknown realm of politics and policy can seem terrifying to even the most seasoned of scientists, Anna-Maria Arabia, CEO of the Australian Academy of Science, assures us that ***'scientists can be politically active without politicizing their science'***. So we implore you to 'get out of the lab and tell your story!' (Dr. Bobby Cerini, CEO, Inspiring Australia) as, in the words of Dr. Alan Finkel, the Chief of Science Australia, to secure our global future ***'we need beakers not (survival) bunkers and beakers need bankers and backers'***. And the best way for our science to have an impact is through effective science communication – with our peers, our public, our media and perhaps most importantly – our parliamentarians.

By Student Councilors Katie Motson and Mike William

90th Australian Coral Reef Society Conference

Rydges Hotel, Townsville

16 - 18 July 2017

australiancoralreefsociety.org/conference

#ACRS2017

Welcome Function - Reef HQ Aquarium hosted by GBRMPA
Sunday 16 July 2017

Conference keynote speakers to include:
Distinguished Professor Terry Hughes, James Cook University
Professor Nick Graham, Lancaster University

Australian Research Council Centre of Excellence for Coral Reef Studies will sponsor the **National Student Mentoring Day** to be held on Wednesday 19th July 2017.

Coral Finder Workshop (BYOGUIDES) 15 - 16 July 2017 hosted at James Cook University, Townsville

Student Travel Award Deadline: 5 May 2017

T-Shirt Design Competition Deadline: 26 May 2017
WIN a 5 year ACRS membership.
Email entries to: stephanie.duce@jcu.edu.au

Australian Government
Great Barrier Reef Marine Park Authority

background photo: S. Kim

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University of Sydney

Ms Katie Motson
James Cook University

Ms Stephanie Duce
James Cook University

Ms Carrie Sims
The University of Queensland

background photo: M. Priest

Congratulations to all the ACRS Award Recipients for 2017

Applications received for the 2017 ACRS awards represented a wide range of topics of relevance to the future of Australian coral reefs, highlighting the many and varied interests of our members.

Terry Walker Prize

Emmanuel Marquez-Legorreta (UQ)
"Visual learning in a changing world"

Danielle Simmons Prize

Alexia Graba-Landry (JCU)
"The effect of temperature on algae-fish interactions on coral reefs"

ACRS Research Prize

Zoe Loffler (JCU)
"The changing susceptibility of Sargassum to grazing vs. browsing fishes"

This year ACRS funded **36 travel awards** for students attending the **2016 International Coral Reef Symposium** in Hawaii, USA. The ARC Centre of Excellence for Coral Reef Studies was a generous co-sponsor of 12 of these awards.

background photo: M. Beger

The ACRS Medal

ACRS as the oldest organisation worldwide to study and protect coral reefs (since 1922), award a prestigious medal to recognise high achievers in the research and conservation of Australian coral reefs.

The
2016 Australian Established Researcher

was Distinguished Professor and ARC Australian Laureate Fellow

Terry Hughes

for his contribution to research into the linkages between coral reef ecosystems and people.

photo: C. Caballes

Female Scientists in the Spotlight

On International Women's Day, ACRS questioned five female coral reef scientists from established, senior researchers to PhD students about their work, motivations, aspirations and successes. Here are their replies...enjoy!

Pat Hutchings

1. **Brief introduction (who, what, where)**

I recently retired from a career at the Australian Museum in Sydney to become a Senior Fellow. My interests are the systematics and ecology of polychaetes (seaworms) around Australia and the South Pacific, especially in mangroves and seagrasses. My reef studies led me to having a major commitment to coral reef management. I have commented on many plans of management (too many to count) and served on the World Biodiversity and World Heritage committee of GBRMPA.

2. **Tell us a bit about your recent work and what you hope to achieve over the next 1 to 2 years**

Exploring polychaete families using both molecular and morphological techniques. Updating and revising the book "The Great Barrier Reef – Biology, Environment and Management" edited by myself, Mike Kingsford and Ove Hoegh-Guldberg. This will come out in early 2018 and, as with the first edition, all royalties will go to the ACRS.

3. **Who or what has motivated or inspired you to carry out your research?**

In 1970 Dr Frank Talbot appointed me from the other side of the world, on the word of the then Director of the Natural History Museum in London. Shortly after my arrival I went on my first field trip to One Tree Island and began a lifelong interest in coral reefs. I then went on a trip with Dr Talbot to check out potential sites for another research station in the northern GBR with a potential benefactor. This was Lizard Island Research Station which is one of the major coral reef research stations.

I have met some very supportive people during my career. Many of my students are now friends and colleagues. I still enjoy my work, love field work, seeing animals alive and conveying this enthusiasm to the next generation. I have worked hard, but this is not a problem when you are enjoying the work! I am stubborn and rarely willing to accept no, there are usually ways around a problem.

Finally I have served on numerous federal and state government committees as well as being on Council for several scientific societies. If one joins these groups, then one needs to play an active role. If you are not willing to do this then do not accept the role. I have found working on such committees very rewarding and one learns so much outside your narrow research interests.

4. **To what do you attribute your success?**

Some luck, hard work, being able to work in some beautiful parts of the world. I still get a buzz when I go collecting or for a dive- so am lucky I chose a job or rather a passion that I still want to follow even after all these years.

Believing in oneself. Take a deep breath when you receive a critical review of a paper, swallow your pride and see if the reviewer really has some valid points and take them on board, or realise they are completely wrong. Then explain to the editor and hope or else submit elsewhere.

Several times I have been referred to as the "token female". All one can do is to ignore it and show them that you are their equal or in many cases their superior, but without being overbearing or being dominant.

5. **What gender equality issues do you perceive as being the most challenging for coral reef scientists, and do you have any suggestions for how they can be overcome?**

Gender equality issues exist not only in coral reef studies but in biological sciences as a whole. This is not going to change until we get more women into research positions, who must in turn support the next generation of women. Unfortunately in the current publish or perish environment, some women forget to support the more junior female staff or students, especially as they move up the ladder. This mentoring is critically important.

I cannot stress enough the importance of young graduate students to have female role models and realizing that anything is possible. We need better schemes to allow women to have time off to have a family without jeopardizing their careers.

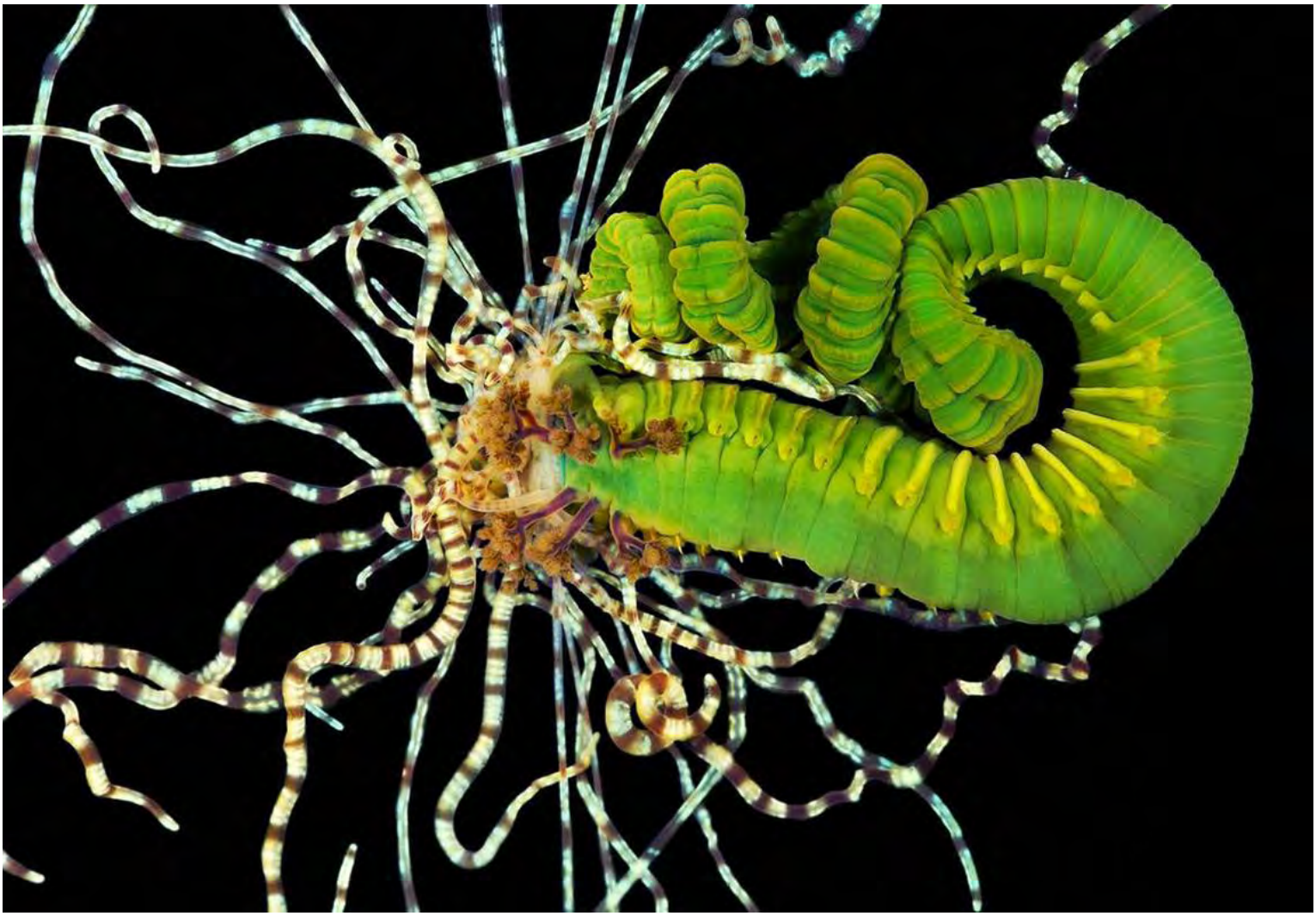


photo provided by P. Hutchings, photo credit Alexander Seminov: Terebellid

Stephanie Duce

Attaching pressure sensors to measure waves on a badly bleached coral reef at Kume Island in southern Japan. Photo credit: Ana Vila-Concejo.

1. **Brief introduction (who, what, where)**

I am a spatial scientist and coral reef geomorphologist. I love measuring the natural world and looking for patterns that help us understand and manage it better. I have just commenced a lecturing position at James Cook University in Townsville.

2. **Tell us a bit about your recent work and what you hope to achieve over the next 1 to 2 years**

Recently I have been studying the form, function and evolution of the coral reef "spur and groove zone". This is the zone where the reef meets the open ocean and is often thought of as providing a "natural breakwater system" for the reef.

I have been measuring the waves and currents to work out how the features dissipate wave energy protecting the reef behind them. I have also collected and dated coral cores to understand how the features grow and change over thousands of years. They seem to play an important, and so far little understood, role in the growth evolution of reef platforms! Over the next couple of years I hope to continue this work with the view to using lessons from spurs and grooves to improve how we design coastal infrastructure. I am also excited to start new collaborations with the excellent researchers here at JCU and am looking forward to teaching the next generation of spatial scientists!

3. **Who or what has motivated or inspired you to carry out your research?**

I can't remember where I first heard it but I often think of this quote from Silent Spring by Rachel Carson:

"Those who contemplate the beauty of the earth find reserves of strength that will endure as long as life lasts."

It's a bit corny but, I think the beauty of nature inspires me to study, understand and try to protect the natural world.

4. **To what do you attribute your success?**

Always taking opportunities when they arise, working hard and enjoying what I do. Working in the environmental consulting industry for a few years before undertaking my PhD also helped me a lot. I learnt valuable skills, learnt what I wanted to do and appreciated the freedom of academia a lot more. The experience definitely made me a better researcher and more employable!

5. **What gender equality issues do you perceive as being the most challenging for coral reef scientists, and do you have any suggestions for how they can be overcome?**
Besides the unavoidable challenges brought about by the biological inequity in child-baring, I believe some of the biggest gender equality issues relate to the way women and girls are socialised and raised. For example, being a successful scientist these days involves quite a lot of self-promotion (e.g., doing newsletter profiles!). This is something girls and women in particular are taught (though not explicitly) to avoid and many feel uncomfortable doing. I also think the expectations of society (e.g., women are the primary housekeepers and caregivers) can subconsciously become our own expectations causing us to pressure ourselves to try and uphold these traditional roles while also being "modern working women". These subtle, often unconscious things are hard to change. By being aware of them, challenging them and having excellent female and male role models at all levels we will continue to progress.

Camille Mellin

1. **Brief introduction (who, what, where)**
My name is Camille Mellin, I am a Research Scientist at the Australian Institute of Marine Science, currently funded by an ARC Discovery Early Carrier Research Fellow Award. I am a quantitative ecologist interested in coral reef ecology, biodiversity and resilience, and I developed strong modelling and spatial analysis skills over the years to address these topics.

2. **Tell us a bit about your recent work and what you hope to achieve over the next 1 to 2 years**
My main project at the moment is to develop a metapopulation model for the crown-of-thorns starfish (Acanthaster planci) that will allow us to predict the risk and magnitude of outbreaks under future scenarios of climate and land use change on the Great Barrier Reef, providing unprecedented support to decision making and natural resource management. Parallel to this model is another one that will forecast coral cover on the Great Barrier Reef in response to multiple scenarios of future environmental conditions and management actions. Completing these two models is my main objective over the next two years, along with addressing more global questions on the influence of human pressure on fish diversity patterns across the Indo Pacific.

3. **Who or what has motivated or inspired you to carry out your research?**
The latter project builds upon a long-term international collaboration with research institutions from France, USA, New Caledonia (where I did my PhD), Kenya and Australia that I have developed over the years. Building this network allowed me to meet some very inspiring people, including other women in science who are also juggling kids, family life and the challenges of being a coral reef ecologist! They made me realise that everything is achievable if you really want it…

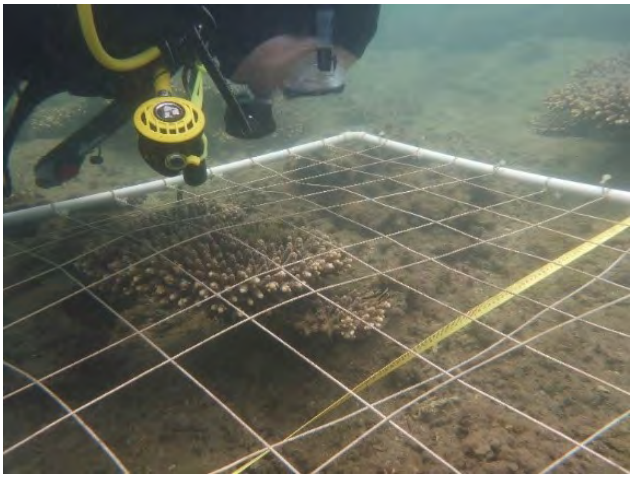
4. **To what do you attribute your success?**
I decided to be a marine biologist when I was 10, and I guess my strong determination is part of the reasons why I have succeeded so far.

5. **What gender equality issues do you perceive as being the most challenging for coral reef scientists, and do you have any suggestions for how they can be overcome?**
Aiming to be a productive coral reef ecologist while also being a mother implied forgetting about field work (including traveling to paradise locations and diving on pristine reefs!) for a couple of years and concentrate on writing papers, attending conferences etc. in order to maintain a good track record and a broad network … given the other time-consuming commitments such as family life and running a household! I am not sure if such challenges will ever be overcome, but I am confident that they are getting more and more recognized in e.g. research funding applications or gender equality conditions in recruitment processes. Regardless, my advice to any young women in coral reef ecology would be to persevere and follow your dreams!

Carrie Sims

1. **Brief introduction (who, what, where)**
I am a PhD student at the University of Queensland, Brisbane studying coral community ecology. My dissertation focus is at local reef scales and examines how density-dependent processes and species interactions may mediate successful coral recruitment. However my background and interests span across taxonomy, biogeography, connectivity and symbioses in the sea.

2. **Tell us a bit about your recent work and what you hope to achieve over the next 1 to 2 years**
My current research aims to better understand the importance of biotic (intra- and inter-species) interactions in influencing coral recruitment success. The next 2 and a bit years for me is really about focusing on a successful PhD completion.
I will be heading into the field shortly so I dearly hope the corals are happy and healthy, they spawn well and no uncanny events hinder experiments. Broader than that I hope to develop essential ecology research and field skills, and provide useful data for the manage ment and conservation of reef corals.



2016 coral bleaching surveys in the sub-tropics. Photo credit: Nicole Kyriacou.

3. **Who or what has motivated or inspired you to carry out your research?**
Nature inspires me daily. I grew up in the outdoors where my parents taught me to be inquisitive about nature and the importance of understanding and protecting it. My curiosity naturally grew from there, and academic studies showed me another way to understand and protect nature through scientific research.

4. **To what do you attribute your success?**
I attribute my success to the morals instilled in me growing up. I was never told that my gender may limit my abilities or options in any way. I have also been lucky enough to study under wonderful mentors during my Undergraduate and Honours years who have happened to be mainly female and have helped to shape me. But overall I attribute my success to following my passions, this keeps me driven on my path.

5. **What gender equality issues do you perceive as being the most challenging for coral reef scientists, and do you have any suggestions for how they can be overcome?**
I am and have been very lucky to be surrounded by women in the marine sciences, at my level and above, and it is fantastic. One of the main areas I feel needs addressing is the structural barriers in the workplace that lead to gender inequity. The work place structure needs to evolve into a place that utilises and integrates the different roles we go through in our personal lives, reduce unconscious bias, and shift away from seeing it as a hindrance to our professional roles.

Cathie Page

1. **Brief introduction (who, what, where)**
I spent ~13 years living and working in Townsville and on Magnetic Island after moving to Townsville to complete my Bachelors of Science at James Cook University. After my honours research on bleaching I worked at AIMS in their long-term monitoring team as a benthic ecologist. I loved these years of days on the reef, but eventually decided to persue an interest in coral disease and complete my PhD. My PhD research included large-scale coral disease surveys in numerous GBR regions. I was lucky to spend lots of time on boats and at amazing research stations working. After I completed my thesis and my daughter was born in 2007 we moved to Perth where I worked as a marine consultant on a large and complex integrated monitoring program. After having a second child we retreated to family in Brisbane and have lived here now for almost 6-years. I have specialist skills in coral taxonomy, ecology and in particular coral disease. I am also experienced in impact assessments and in assessing large and complex coastal development projects. I now work at the Department of Environment and Heritage Protection (EHP) in Brisbane as a Principal Environmental Officer.

2. **Tell us a bit about your recent work and what you hope to achieve over the next 1 to 2 years**
I have been working at the Department of Environment and Heritage Protection since late 2015. My initial role was in the Coastal and Marine Assessment team assessing and conditioning proposals under various Queensland legislation. In this role I assessed several large-scale coastal

developments proposed for QLD, for example the Sunshine Coast Airport Expansion that will require the dredging of 1 Mm^3 of sand from Moreton Bay and its placement on land near endangered species habitats and a National Park. It's a really interesting area to work in and requires a very broad understanding of ecology and biology as well as an ability to collaborate and communicate with a range of technical specialists. I don't think many people outside of government have a very good understanding of what we do in an environmental department. It's in part about developing policy and legislation, but also about ensuring development is as sustainable as possible. I'd encourage anyone interested in effecting change to consider government as an option. I'm not sure what to expect of the next few years. I'm enjoying my current work and I'm still learning every day. I still keep a hand in monitoring work on the GBR. I still love time at sea.

3. **Who or what has motivated or inspired you to carry out your research?**

When I started out in marine science I was particularly inspired by the coral taxonomy work being done by Carden Wallace. Her attention to detail was incredible. I was lucky enough to work with her in the field and I was very inspired by her dedication and passion. I've had the pleasure of working with so many other inspirational women in marine science.

4. **To what do you attribute your success?**

Gosh, that's a hard question. I have always loved the ocean and I think just a generally high level of interest in the topic has helped. I've been lucky to have worked on some really large projects and relish the challenges these complex programs throw up. I also like working with other technical specialists and good communication skills are key to productive working relationships that are required in assessing such large projects.

5. **What gender equality issues do you perceive as being the most challenging for coral reef scientists, and do you have any suggestions for how they can be overcome?**

Although there are a lot of women working in marine science it is still very challenging for women to work and achieve recognition once they have children. When you have young children it's difficult to maintain your work or publication outputs and remain competitive, particularly if you don't want to work part-time. Certainly I chose to work in industry for a period when my children were young because it was easier to find a part-time job in this area as a marine scientist at this time. It was still very challenging to make positive and significant contributions to marine science while balancing the needs of young children. I don't see an easy solution to this issue, but flexibility in a work place is essential.

A HUGE THANK YOU TO ALL THE FEMALE SCIENTISTS WHO PARTICIPATED.

Writer's block? No Way!

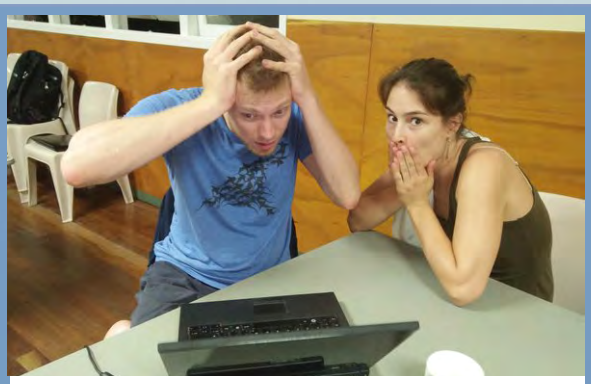
Writing can be one of the toughest and most daunting aspects of science, made even harder by the modern-day and administrative distractions of emails, meetings and of course - composing that perfect Tweet. As researchers we are constantly being told "publish-or-perish" with publication expectations only rising every year. For most of us the struggle of getting our results from the visual displays and conference presentations we so enjoy to a written journal or thesis format is real.

That is why, in May 2016, the **ACRS hosted its first-ever writing retreat** for 20 of its student members. Set in the green and picturesque locale of Apex Camp in **Magnetic Island's Picnic Bay**, the aim of the retreat was to provide a productive and focused environment in an inspiring and somewhat remote location. In their tropical surrounds, absent of quality internet access 😱, students were **tasked to create a rough draft of a manuscript** over the course of 3.5 days. The only pre-requisites of the retreat were that students arrived with their data analysis complete, their methods section drafted and their thinking caps packed.

That's a wrap! Students celebrating the end of a productive writing retreat.

Each day focused on a different aspect of the manuscript, with **Day #1** focusing on the results, **Day #2** the discussion, **Day #3** the introduction and **Day #4** the abstract. The day began with workshops discussing structure, content, do's, don'ts, tips and tricks for each section, after which students were free to ask questions, talk through ideas with **experienced researchers**, let their creative juices flow and produce a draft, ready for peer-review and feedback in the afternoon.

Dr Sue-Ann Watson and Pam Kamya discuss feedback.



Patrick Buerger and Kathryn Berry shocked at how much feedback they received!

photos: B. D'Anastasi

The retreat sought to provide students with **feedback on their drafts** from a range of experienced academics and their peers, as well as **learning about writing** through providing feedback to others. Peer-review sessions comprised of 3-4 students and were held at the same time as experienced researchers provided feedback to students on site and remotely.

Within a matter of hours, students had received feedback from an experienced reviewer and two to three peer reviews. After receiving their feedback, students were then free to make any edits and **develop their draft** further based upon their comments.

Samples of the student feedback on the retreat courtesy of B. D'Anastasi and P. Matis.

"The feedback was so useful and timely, the best part of the retreat!"

"I got more done than expected… and more feedback than expected which was so helpful."

Overall, **20 students** from **10 different research institutions** across Australia attended the retreat, with students traveling from Sydney, Melbourne, Wollongong, Coffs Harbour, Brisbane, the Gold Coast and Townsville. **Since the retreat**, 2 out of 10 students surveyed have submitted thesis chapters from the retreat and 1 currently has their manuscript under review.

Many thanks to Dr Tom Bridge, Dr Andrew Hoey, Dr Mia Hoogenboom and Dr Sue-Ann Watson for volunteering their time to come out to the island to assist with workshop days, as well as providing feedback and assistance. **Thanks also** to those that took the time each day to provide off-site feedback to students including Prof. Dave Booth, Dr Rebecca Fox, Dr Selma Klanten, Dr Selina Ward and Dr Marian Wong.

The ACRS is planning to host another student writing retreat in early 2018 so keep your eyes peeled for #ACRSwriting2018!


Credit: M. Priest


Credit: T. Hawkins


Credit: C. Caballes

INSPIRATION FROM THE REEF


Credit: S. Kim


Credit: C. Caballes


Credit: C. Sims


Credit: M. Priest

High latitude coral symbioses are genetically distinct from tropical counterparts

Dr Eugenia Sampayo
Marine Palaeoecology Laboratory, School of Biological Sciences, The University of Queensland | ARC Centre of Excellence for Coral Reef Studies; e.sampayo@uq.edu.au

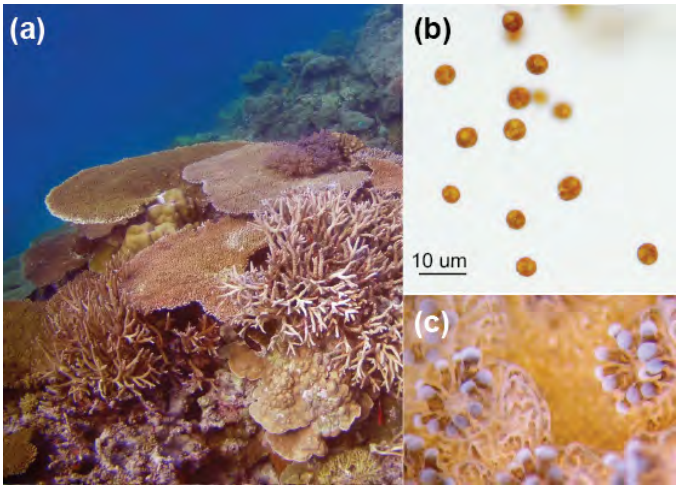


Fig 1: The diversity and success of corals (a) relies on a symbiosis with single celled *Symbiodinium* (b) that occupy tissues (c) in high densities (give corals their brown colouration).

The mutually beneficial symbiosis between reef-building corals and photosynthetic dinoflagellates of the genus *Symbiodinium* allows corals to occupy a wide range of marine habitats (**Fig. 1**). The single-celled *Symbiodinium* receive nutrients (needed for photosynthesis) that are limiting in the water column from the coral. In turn, the symbionts provide the coral with the majority of its daily food requirements, in the form of sugars produced during photosynthesis. **The ability of corals to thrive in specific habitats depends on the combined tolerance limits of both partners**, and corals can occupy a broad distribution range by associating with symbionts specialised to certain environments.

As climate change continues to increase ocean temperatures, thermal conditions at higher latitudes may become more beneficial to tropical coral species (and their symbionts). While differences in coral communities between tropical and subtropical high-latitude regions are well described, **little is known about the species of symbionts present at higher latitudes.** This is surprising given the fact that the symbionts play a significant role in defining tolerance limits and distribution ranges of their coral hosts. My work uncovers the species diversity of symbionts residing in high latitude corals and tests if similarities exist between species assemblages of high-latitude and tropical coral reefs. Understanding these connections is relevant to determine which tropical species could successfully migrate to subtropical regions and whether subtropical specialists are likely to survive as ocean conditions shift.

Corals from **nine high-latitude coral communities along the eastern Australian coast** were sampled (**Fig. 2**) and symbionts identified using molecular methodologies. A comparative analysis between high latitude and tropical Great Barrier Reef (GBR) coral symbioses was done to detect 1) the level of community overlap (how many species exist in both regions), and 2) the environmental factors that limit species boundaries.

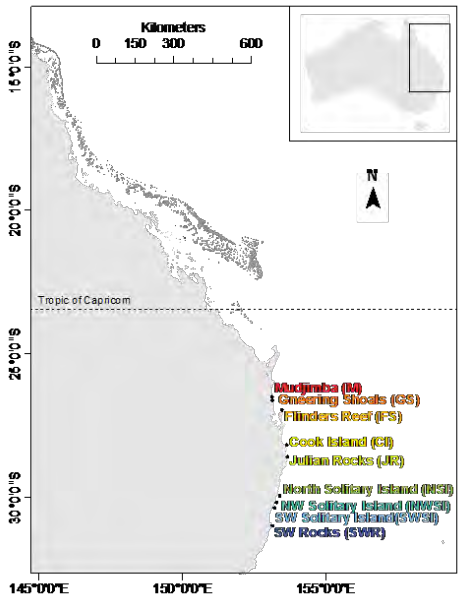


Fig 2: Study sites in high latitude regions (colour range from red to blue with increasing latitude reflects a reduced average sea surface temperature (SST).

The number of symbiont species decreased as the number of available coral hosts decreased towards higher latitudes. However, the relative number of symbionts present per available host was stable irrespective of latitude and was no different between high-latitude and tropical communities (**Fig. 3**). This suggests that **symbiont species diversity is primarily 'capped' by the number of hosts** available rather than regulated by environmental conditions. Approximately **50% of symbiont species** identified from these nine reefs were novel species and are likely **endemics** to the region or to marginal high-latitude reef communities.

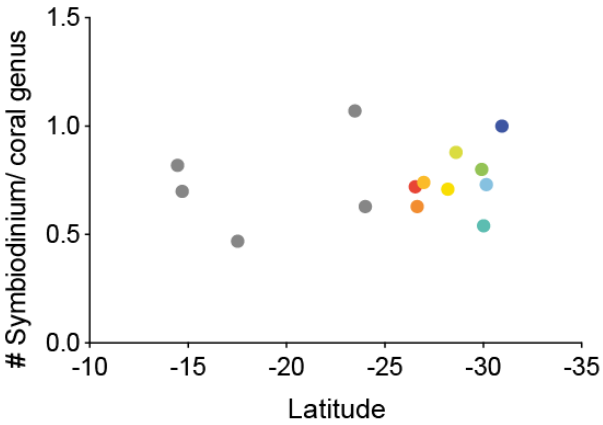


Fig 3: Ratio of Symbiodinium species per available host genus is stable with increasing latitude (tropical locations (GBR): grey dots; high latitude locations: coloured dots - see Fig. 2)

A large proportion of symbiont species (~ 80%) were also host specialists (specific to a single coral genus). Two host generalist symbionts (i.e. occupy two or more coral genera), *Symbiodinium* C22a and C1c, were broadly distributed across all high latitude sites. These two host generalist symbionts represent **high latitude specialists in terms of environmental preference (environmental high latitude specialists)**. In tropical sites they are largely uncommon and are replaced (**Fig. 4**) by the widespread tropical generalists *Symbiodinium* C3 and C1.

Overall coral species exhibited **significant latitudinal discontinuity in their associated symbionts** (not shown). Changes in community composition were linked to long-standing environmental conditions rather than correlated with latitude. Regionally, differences in symbiont assemblages were linked to available light (average available photosynthetically active radiation), long-term average sea surface temperature (SST) and SST fluctuations. Many species exhibited biogeographical breaks in species composition around the same areas, suggesting that isolation between regions has led to local symbiont pools. Local adaptation in combination with genetic discontinuity of symbionts within a coral species has the potential to restrict the migration of corals outside current range margins, particularly for species that associate with restricted range symbionts (endemics) or host specialists.

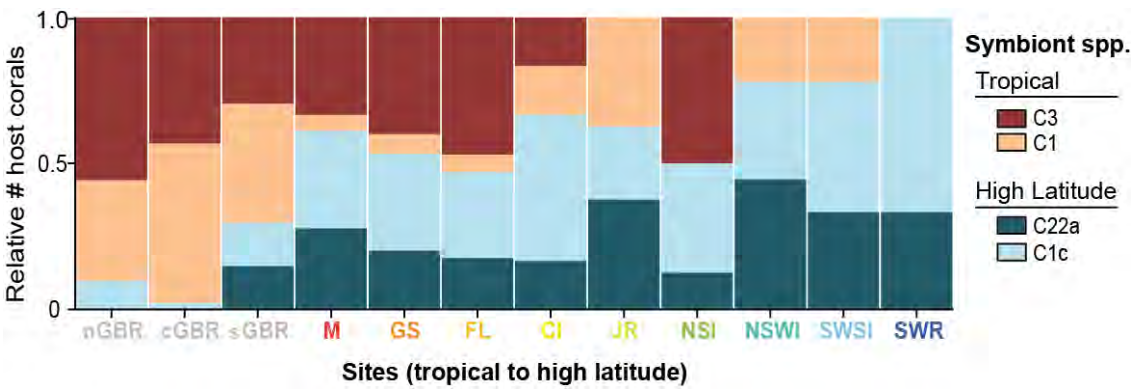


Fig 4: Tropical host generalist *Symbiodinium* C1 and C3 are replaced by subtropical generalist species C22a and C1c (occupy a larger relative number of hosts). See Fig. 2 for study site names.

By: Dr Killian Quigley
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"Shark Alley" August 15, 2016

Learning to Look

I'm a lecturer in English at Vanderbilt University, in Nashville, Tennessee. In August of last year, I had the extraordinary privilege of traveling with colleagues to One Tree Island for a several-day stay. My research asks **how the undersea's imaginative and aesthetic provocations – the ways it's been revelatory for writers and artists – relate to its scientific aspects**. Elizabeth Kolbert, author of The Sixth Extinction, described her experience of swimming an One Tree Island lagoon as *"like trying to catalog a dream"* – and I'm fascinated, precisely, by the tendency for submarine lives to challenge and confuse definition, sensation, and representation. Seafaring scholars have long recognized that such confusion can, paradoxically, open new vistas: recounting a research expedition to the Gulf of California, marine ecologist Ed Ricketts and Nobel laureate John Steinbeck claimed that close observation of intertidal invertebrates had yielded not only new taxonomic data, but novel aesthetic impressions, and even a radically original, *"non-teleological"* philosophy of nature and of life. Ricketts and Steinbeck's mantra was that *"all life is relational"*, and my own inquiries into literature, art, and science are motivated by wondering **how different ways of looking at and sensing the world are relational**, as well.

At One Tree Island, I began a **classificatory enterprise** of my own, based not so much on taxonomic categories as on artistic ones. My notes, drawings, and photographs record not only the names of corals, mollusks, fish, and so on, but the colors, lines, shapes, and surfaces that comprise them – an aesthetic catalogue, if you will (see image "Shark Alley").

I was inspired to do so by an impulse like the one that gripped the American artist Georgia O'Keeffe, who drew upon the ocean's shapely resources in numerous works of the 1920s and 1930s. To look at her pastel Pink shell with Seaweed (c. 1938) is to **submit one's eye to the spiral lines of the large, sinuous mollusk at its center**. An earlier sequence of six oil paintings, collectively titled Shell and Old Shingle (1926), enacts a kind of combinatory reaction. At first, the two objects simply rest next to one another, and their juxtaposition is jarringly stark. But in the pictures that follow, they interact, and by the last, they've actually amalgamated. The form that results is neither one thing nor the other: its contour curves in on itself like some charcoal calla lily, or perhaps an ascetic, dusky nudibranch. Most intriguing of all, however, is a work called simply **Clam Shell** (1930, see image below), where O'Keeffe's subject so dominates the pictorial frame that what could have been a delicate still-life looks like a boundless shelly landscape.

Georgia O'Keeffe, Clam Shell (1930), Metropolitan Museum of Art

What O'Keeffe urged her audiences to ponder were the ways that looking closely at oceanine form could bring about a salutary perspectival disorientation.

Contemplate, her images seem to say, these colors and lines. Permit them to work upon your vision, and your imagination, in a fashion unlike the shapes and scenes you may know more familiarly. What Ricketts and Steinbeck, and many other scientists and artists besides, show us is that reorganizing our fields of vision along oceanine lines can be not only fantastic, but foundational for new and actionable knowledge.

"*Can public emotions be stirred,*" the scientist and educator Peter J. Auster has asked, "*in the service of protecting marine biodiversity?*" I argue that biodiversity is an aesthetic, as well as an ecological, category, and that one of the most challenging, and most important, activities humanists can engage in at present is the development of new techniques for envisioning the sea, and new languages for describing it. This is, of course, partly a matter of rediscovery – of plumbing the histories of literature and art for examples of a special kind of sensibility, **one that not only recognizes but exults in the ocean's uniqueness, and seeming strangeness.** This will involve training our eyes not only on grand things, like barrier reefs, but on delicacies – on, for instance, those tiny creatures in the Gulf of California, which Ricketts called "*the good, kind, sane little animals.*" Those sorts of animals fixed my attention at One Tree Island – **a tiny spot, terrestrially speaking, but a measureless laboratory for developing our sense of the ocean, and of its earth.**

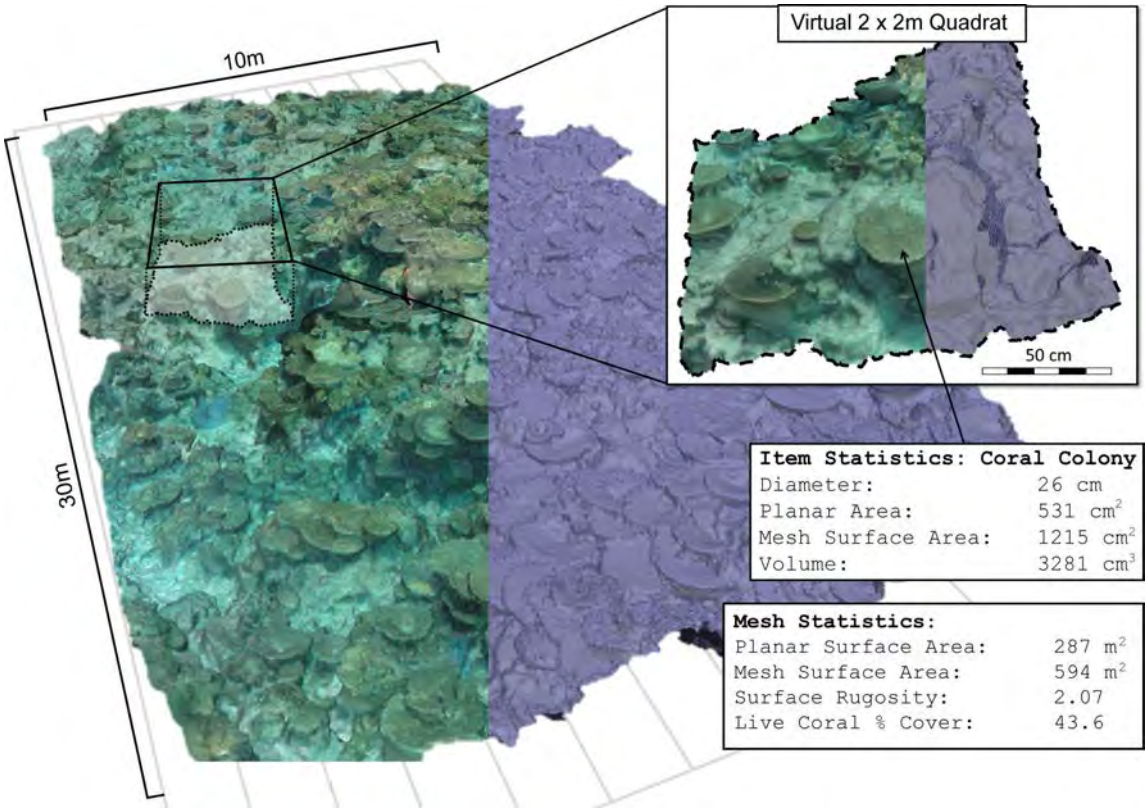
"Two-Tree Island" August 16, 2016

3D mapping for marine ecology:

The University of Sydney's 3D Ecological Modeling Hub

by Augustine (Gus) Porter, Renata Ferrari, Will Figueira

Habitat structural complexity (HSC) is a fundamentally important driver of many ecological and physical processes, and one of the reasons coral reefs support such diversity. HSC is also a strong predictor of a reef's susceptibility to physical and ecological changes such as bleaching and regime shifts. But methods of quantifying this integral characteristic of a substrate have lagged with many studies still using methods from the 1970s. Despite some recent advances, measuring HSC under water has remained either extremely expensive or difficult, time consuming and imprecise.



At the University of Sydney's Ecological 3D Modeling Hub we are bringing new marine mapping technologies into the ecological realm. Emerging 3D imaging technologies are making it possible to record high-resolution 3D maps across multiple spatial extents using inexpensive open-source tools. It is now possible to map large areas quickly and at low cost, capturing reef scale complexity information. In addition to being inexpensive and openly available, these methods can capture HSC with exceptional precision and resolution. Despite the large scales mapped, model resolutions remain high (e.g. 20-30mm for mapping done with the Complexity Mapping Platform). This allows assessment of changes in complexity over time, or other HSC variables explaining the distribution and abundance of resident fauna.

These tools are currently being used to map the effects of stressors such as bleaching and cyclone damage on the GBR.

Recent findings from the University of Sydney 3D Ecological Modelling Hub:

1. Close-range-photogrammetry using off-the-shelf tools can generate highly accurate and precise metrics of habitat structural complexity (i.e. surface area, volume, surface rugosity) from individual colony-scale to 1000+ m^2.

2. Coral reefs do NOT always flatten after massive bleaching. This study found a shift from plating corals to stag horn corals as a consequence of the 2011 massive bleaching event in Western Australia- and an associated and significant increase in surface rugosity.

3. Soft corals also provide significant structure to coral reefs and should be considered by studies that examine structural complexity.

4. Seafloor mapping that can quantify habitat structure (both complexity and community) can usefully inform management and conservation planning of marine parks.

5. Contrary to expectations, benthic community composition in high-latitude coral reefs shifted from plating Montipora spp. to stag horn Acropora spp. after bleaching.

Full-capture 3D mapping in the marine environment is an exciting new capability that USyd is developing and keen to apply in partnership with other research, industry and management organizations.

TURNING UP THE HEAT ON TROPICAL CORAL REEF FISH

From the publication: Motson, K. & Donelson, J.M. 2017. Limited capacity for developmental thermal acclimation in three tropical wrasses. Coral Reefs.

From October 2015 to September 2016, Earth's surface temperatures were the warmest since records began in 1980, with an average global thermal anomaly of 0.99 °C above the mid-20th century average. This, combined with an El Niño, gave rise to a global, mass coral bleaching event, with the Great Barrier Reef (GBR) among the worst reefs affected. With 93% of the GBR affected in the global mass-bleaching event, we have some understanding of how increasing sea surface temperatures are affecting corals, but **what do we know about the effects of increasing sea surface temperatures, such as those observed in 2016, on coral reef fish?** My research looked at the thermal developmental acclimation capacity of three species of tropical wrasses: *Halichoeres melanurus, Halichoeres miniatus and Thalassoma amblycephalum*.

New recruits of ***H. melanurus, H. miniatus* and *T. amblycephalum*** were collected from the Cairns region of the GBR and were transported to the Marine and Aquaculture Research Facilities Unit at James Cook University. Individuals were divided into a control, present day (29 °C) and +2 °C (31 °C) temperature treatment and allowed to acclimate for 11 weeks. After the 11-week acclimation period, several metrics of metabolic, swimming and burst escape performance were tested at both the temperature fish were acclimated to (developmental temperature) and the opposing temperature (testing temperature), allowing us to distinguish whether acclimation had occurred.

Each of the three species tested showed a limited capacity for thermal developmental acclimation of their metabolic, swimming and burst escape performance. For many of the traits tested, **development in the +2 °C treatment resulted in poorer performance than those reared under present day conditions** (29 °C). Relative to controls, all species were shorter in length with development at +2 °C, while *H. melanurus* and *T. amblycephalum* were also in poorer physical condition (**Fig. 1**). Metabolic performance in all species was negatively affected by development and testing at 31 °C, with reduced resting and maximum metabolic rate and net aerobic scope in all species (exception: *T. amblycephalum* MO^2 Max and aerobic scope). Swimming performance was also negatively affected by increases in developmental temperature, with *H. melanurus* and *H. miniatus* reaching lower gait transition and critical maximum swimming speeds relative to controls.

Locomotor metrics of burst escape performance were less affected by temperature, with response distance, c-start duration and response speed maintained in *H. miniatus* and *H. melanurus* between the two temperature treatments. Response latency however was the most sensitive performance metric to testing and developmental temperature and was the only trait in this study to show some evidence of beneficial acclimation in *H. melanurus* when reared at +2 °C and tested at 31 °C.

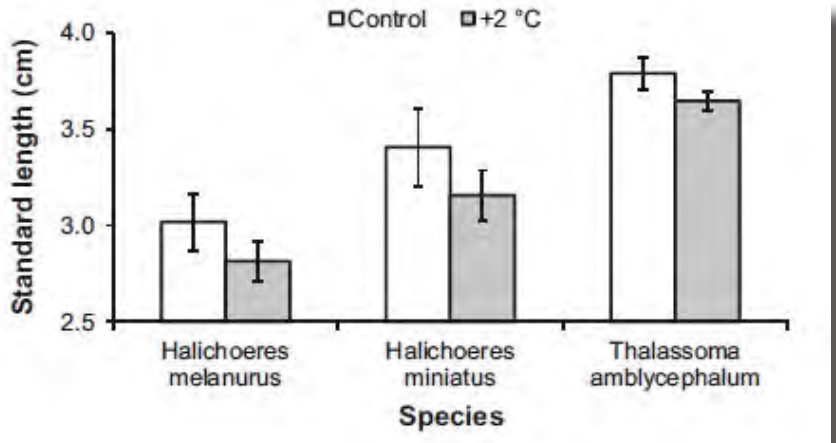


Fig. 1 Mean standard length (±SE) of *Halichoeres melanurus* (control: $n = 10$; +2 °C: $n = 12$), *Halichoeres miniatus* (control: $n = 8$; +2 °C: $n = 8$) and *Thalassoma amblycephalum* (control: $n = 15$; +2 °C: $n = 14$) reared at control and +2 °C developmental treatments

This study was one of the first of its kind to study a **combination of performance parameters, with many parameters differing in their thermal sensitivity and capacity for plasticity**. This holistic approach is vital to improving our understanding of the whole-animal and ecological implications of increasing sea surface temperatures in the future.

By Katie Motson

Bleaching at Moore Reef, Townsville, GBR. 18th March 2017. Credit Ciemon Caballes

The 2016 coral bleaching event in North-Western Australia

Aerial view of a bleached inshore Kimberley reef in April 2016.
Credit: Steve Comeau.

Although the Great Barrier Reef was in the international spotlight during the 2016 mass bleaching event in Australia, coral reefs on the other side of the continent also experienced unprecedented bleaching and coral mortality. The bleaching event primarily impacted inshore and offshore coral reefs in Western Australia's remote Kimberley region, while the Pilbara, Ningaloo Reef and other reef systems further south were not affected by the heatwave. This demonstrates that regional-scale mass bleaching can now occur in WA during both strong El Niño and La Niña years.

As part of Australia's National Coral Bleaching Taskforce, we conducted extensive in situ bleaching monitoring before, during and after the predicted bleaching event along the entire WA coastline with colleagues from the ARC Centre of Excellence for Coral Reef Studies at the University of Western Australia. In the southern Kimberley, we also conducted additional aerial surveys of ~30 reefs to assess the situation on a regional level.

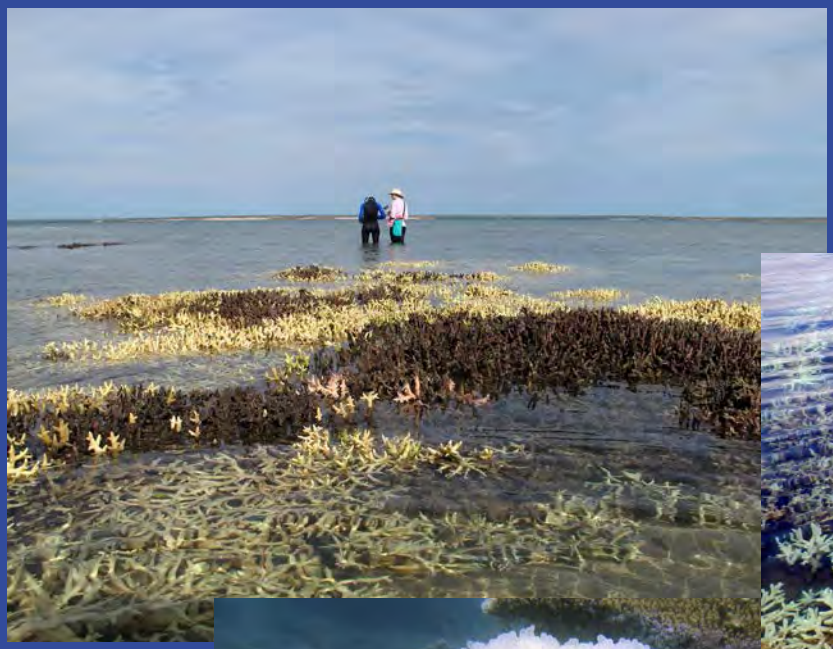
Widespread bleaching in WA's northwest

Although heat stress peaked in late March/April, we already observed some bleaching (<10%) in January at our long-term study site near Cygnet Bay in the Kimberley. By early April, these corals had suffered almost 100% mortality and up to 80% of all other corals were now severely bleached, including massive corals, soft corals and anemones.

These trends were confirmed by aerial surveys of ~30 inshore Kimberley reefs including 380 km^2 Montgomery Reef, which showed that almost all surveyed reefs had at least 50% bleaching. Offshore Kimberley reefs such as Scott or Seringapatam Reef fared even worse, as researchers from the Australian Institute of Marine Science (AIMS) reported 60-90% bleaching in shallow lagoon waters. Similarly, researchers from Curtin University reported 70-90% bleaching in shallow waters at Christmas Island. However, only minor bleaching (<10%) was documented by AIMS at the Rowley Shoals.

Pilbara, Ningaloo Reef and other reefs further south escaped bleaching

The good news is that many coral reefs in WA, including World Heritage site Ningaloo Reef, escaped bleaching. No bleaching has been reported in the Pilbara, at Ningaloo, the Abrolhos Islands or Rottnest Island off the coast of Perth. This is great news because some of these locations are still recovering from major bleaching in 2010-11 and 2013.



Bleached and dead staghorn coral exposed at low tide near Cygnet Bay, Kimberley, in April 2016. Credit: Chris Cornwall.

Bleached coral communities near Cygnet Bay, Kimberley, in April 2016. Credit: Morane Le Nohaïc.

Bleached anemones near Cygnet Bay, Kimberley, in April 2016. Credit: Chris Cornwall.

Taking stock of the 2016 bleaching event in WA

At this point it is still too early to know the full impact of the 2016 bleaching event on WA's coral reefs with scientists continuing to analyse data from field trips obtained in the latter part of last year to assess coral mortality and recovery. However, most of the severely bleached corals observed in April near Cygnet Bay in the Kimberley have now died, with AIMS reporting similar findings from Scott Reef.

This is the first time that regional-scale bleaching has been documented on inshore Kimberley reefs. According to local Indigenous Rangers and Traditional Owners who assisted in the monitoring, this appears to be unprecedented as such events had never previously been described in their rich local history of the coastal environment. This highlights the threat that such extreme heatwaves pose to coral reefs because the unique Kimberley corals are one of the most stress-resistant coral in the world.

It is now also clear that global ocean warming is catching up with WA coral reefs which until the extreme marine heatwave of 2010/11 had been largely spared from major bleaching events. They are now at risk of regional-scale bleaching during both El Niño (as in 2016) and La Niña years (as in 2010-11), though in different geographical areas.

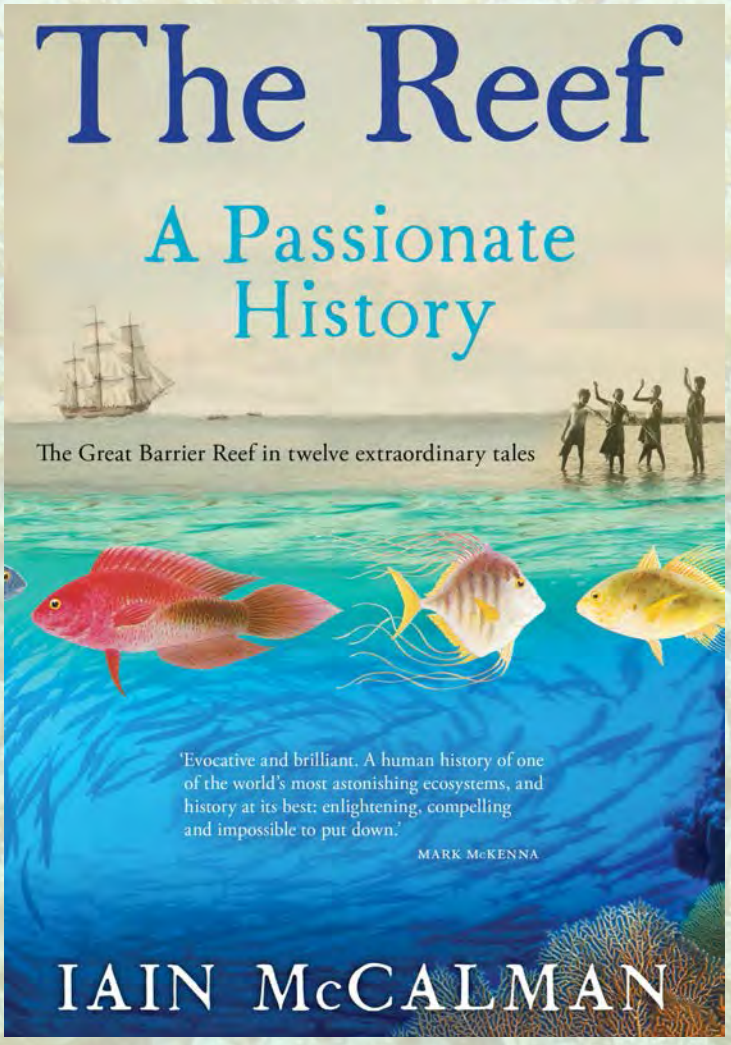
by Verena Schoepf, Ryan Lowe and Malcolm McCulloch

Dead coral communities exposed at low tide near Cygnet Bay, Kimberley, in October 2016.
Credit: Verena Schoepf.

Dead overgrown coral communities near Cygnet Bay, Kimberley, in October 2016.
Credit: Verena Schoepf.

Book Review

by Sarah Hamylton



Public attitudes towards nature change. Man eating tigers or threatening dark jungles are increasingly seen as endangered species and fragile rainforests. In a similar vein, Iain McCalman's book uses twelve stories spanning the late-eighteenth century to modern day to show how changing attitudes have guided peoples' interactions with the Great Barrier Reef. Tracing an arc from terror to nurture and wonder, these stories demonstrate that coral reefs are 'products of human perception… imagined into existence down the centuries' (Robert Macfarlane, Mountains of the Mind).

McCalman describes the terror that the reef invoked in the age of European Discovery, telling us how Cook's Endeavour ship (1770) entered an inescapable maze of reefs and, how the crew fought through the night to keep their ship afloat after hitting a reef. We learn about the motivations of Matthew Flinders (Investigator, 1802) and Joseph Jukes (Fly, 1842), who charted the treacherous bays of the Torres Strait, that had wrecked many trading schooners.

Perhaps some of the lesser known characters are those who nurtured the reef- among them Scottish shipwreck survivor Barbara Thompson, who was rescued by the Kaurarea in the Torres Strait after eloping with a sailor. Five years later in 1849 she joined the passing HMS Rattlesnake and shared stories of her everyday work patterns on Muralag Island, telling how social relations, seasonal foraging and food preparation were governed by the reef.

Another nurturer was the aspiring English marine biologist William Kent, who left behind a notorious Victorian childhood crime to pursue a fisheries job in Tasmania. Edible oysters and pearl shells took him to Thursday Island off the tip of Cape York Peninsula, where he became an artist-cum-marine scientist and spent many happy years describing the reefs and collecting specimens for London's Natural History Museum.

We learn how the campaign to save 'dead' Ellison Reef from being mined for limestone brought a poet, forester and artist together to fight what later became the 'Great Reef War' against further mining and oil exploration. This culminated in the Whitlam Government's Great Barrier Reef Marine Park Act, which formed the Great Barrier Reef Marine Park Authority. In these final stories through the voices of environmentalists such as Charlie Veron and Marie Stafford Smith, corals make the transition from dangerous marine monsters become the canaries of climate change, with the reef itself on death row.

Contemporary concerns for the reef's environmental health stress the importance of McCalman's central argument, that "It is only by melding our specialised scientific understandings of the GBR and the ideas it engenders – the sensory, the spiritual, the aesthetic- that we will fully appreciate why it demands we be its global caretakers". Even for those who have visited the reef many times, this collection brings new stories and refreshing ways of getting to know the Great Barrier Reef. These are becoming increasingly important as the current age of reef wonder coincides with the Anthropocene.

The Great Barrier Reef in twelve extraordinary tales!

background photo by A. Baird

TRADITIONAL OWNERS CARING FOR COUNTRY THROUGH RESEARCH AND MONITORING

Research partnership initiatives are being developed by Traditional Owners to support face to face meetings with research organisations to discuss and plan a way to progress future research opportunities for all parties. The Great Barrier Reef Marine Park Authority's Indigenous Partnerships program is facilitating this through Traditional Use of Marine Resources Agreements (or 'TUMRAs'). There are currently eight accredited TUMRAs in place.

The challenge:
In most cases, research partnerships are not inclusive of Traditional Owners, simply due to research organisations not having an existing relationship with Traditional Owner Groups.

The solution:
The outcomes of research partnership initiative trips have been very positive, resulting in successful joint-research projects. This initiative looks to establish those lines of communication for Traditional Owners and Research Organisations to maximise outputs of future research. Researchers may not know who to talk to or the research priorities for different groups. Traditional Owners want to guide and be involved in research and monitoring that occurs on their sea country. So there is a need to bring the two together, to get them talking and to facilitate research partnerships.

Here are some of our stories:

Lama Lama (Princess Charlotte Bay)
The area of land and sea that Yintjingga protects extends from the Massey River in the north, to the Normanby River at the top end of the Lakefield National Park in the south. They also look after the offshore islands and reefs within Princess Charlotte Bay.

On their 2nd Scientific Research Trip, Lama Lama met with another Traditional Owner Group as well as AIMS, JCU, Reef HQ Aquarium and GBRMPA with a focus on traditional caring for country, micro-plastics, turtle health, coral bleaching and cultural heritage management.

"This was an important trip for Lama Lama People. We wanted to let the researchers know how important it was for them to acknowledge the voices of the Traditional Owners and that we expect to be involved in all work happening on our land and sea countries. We are looking to develop mutually beneficial working partnerships between Lama Lama and researchers for the future. "

-Traceylee Forester (Lama Lama TUMRA Coordinator).

Yuku Baja Muliku (Archer Point/Cooktown)

The Yuku Baja Muliku people are the Traditional Custodians of Archer Point, which is located 20km South of Cooktown, North Queensland. We have a fully operational turtle rehabilitation centre at Archer Point. We are active in the research space, with long term monitoring of seagrass beds, fire and pest management, and more recently water quality and mussel research in partnership with JCU and BWG Environmental.

For more information on this project search YBM Mussel Research on Researchgate.

Yirrganydji (Cairns/Port Douglas)

We are the Yirrganydji Traditional Owners of the coastline between Cairns and Port Douglas in North Queensland. Our customary knowledge, practices, lores and identities as Traditional Owners are inter-connected with our land and sea country. It is a priority for us to be actively engaged, building partnerships and working together with others to efficiently and effectively manage our sea country, which is partly within the Great Barrier Reef. We are involved in numerous research projects ranging from bird monitoring (Michaelmas Cay), reef health, crown-of-thorns starfish control, shark tagging and jellyfish monitoring.

"Our research strategy will detail our research priorities, capabilities and opportunities for researchers to partner with us."

-Gavin Singleton (Yirrganydji TUMRA coordinator)

Sybille Hess: 2016 ACRS Terry Walker Award

Living on murky reefs: How will fish cope with an increasingly turbid environment?

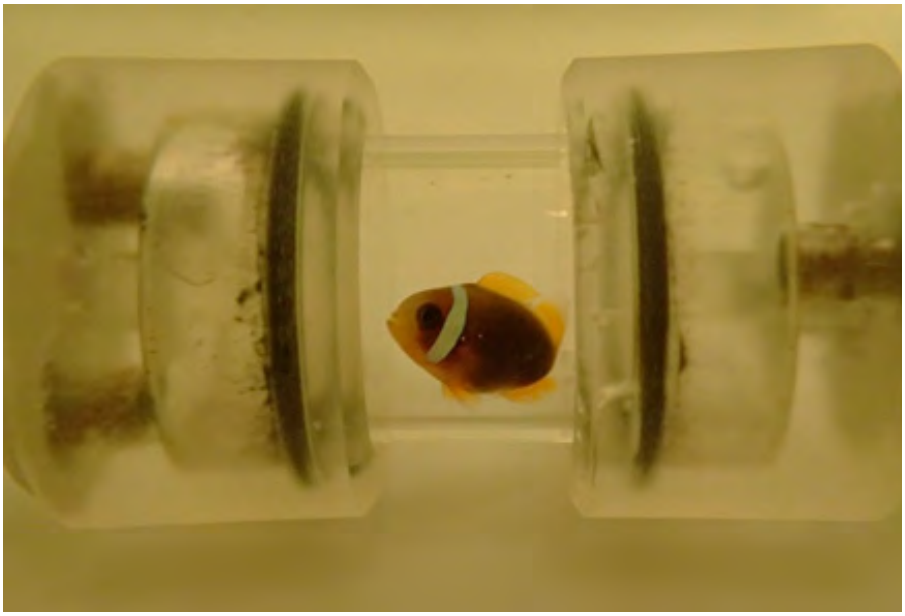
A clownfish pair and anemone on a turbid reef. Image by Joleah Lamb.

Over the past decades, turbidity has emerged as an important threat to coral reefs worldwide[1]. Rapidly expanding coastal development including the building of infrastructure, agriculture, and mining have increased the run-off of sediments (e.g. silt and clay). Dredging and shipping compound this problem by re-suspending sediments from the ocean floor, thereby further increasing turbidity in coastal waters. Turbidity has a profound impact on coral reef fish assemblages; it is well known that fish abundance and diversity decline as reefs become more turbid[2]. The aim of my PhD research has been to examine why some fish species struggle to live on turbid reefs, which can help us to identify species and life stages that may be especially threatened by human caused increases in turbidity.

Histological section of the head of a juvenile clownfish. The gill filaments are located below the eye (purple circle in the centre). Image by Leteisha Prescott.

Does turbidity cause respiratory problems in fish?

Fish gills are an amazing organ; the gill epithelium often consists of merely two cell layers, and is intricately folded to provide an extensive surface area for respiration. Sediment particles can irritate and damage these delicate tissues, and clog the gills[3]. The funding provided by the Australian Coral Reef Society allowed me to examine how suspended sediments may interfere with gill function. To do so, I exposed recently settled reef fish to a range of suspended sediment concentrations for a week. To test gill function, I exercised the individuals to complete exhaustion (by chasing them around in a bucket). Then I immediately transferred them to miniature respirometry chambers, where their oxygen consumption was monitored as they recovered from the chase. One of the fish species, indeed, had a reduced capacity for oxygen uptake after they were exposed to suspended sediments; in other words, these fish had trouble breathing, and struggled to



Juvenile clownfish sitting in a respirometry chamber while its oxygen consumption is recorded.

take up the oxygen they needed during exercise.

Huffing and puffing fish athletes

Imagine how strenuous it would be to go on a run with congested airways; coral reef fishes living on turbid reefs with damaged gills must feel very much like this. The impact of suspended sediments on gills may constrain the ability of fish to perform various activities, such as competing for shelter and escaping from predators, and may reduce their chances of survival. By affecting gill structure and respiration, suspended sediments may thus contribute to the observed declines of fish abundance and diversity. However, I found that some reef fish species were surprisingly tolerant to suspended sediments; some were able to maintain their oxygen uptake despite gill damage, and others didn't even show gill damage under high suspended sediment concentrations. The reasons behind these findings still remain a mystery, but could help explain why some fish species suffer when suspended sediments increase, while others seem unaffected. This will be an important topic for future research, and may help to inform management.

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Stephanie Gardner: 2016 ACRS Danielle Simmons Award

Sniffing out the secrets of the sea

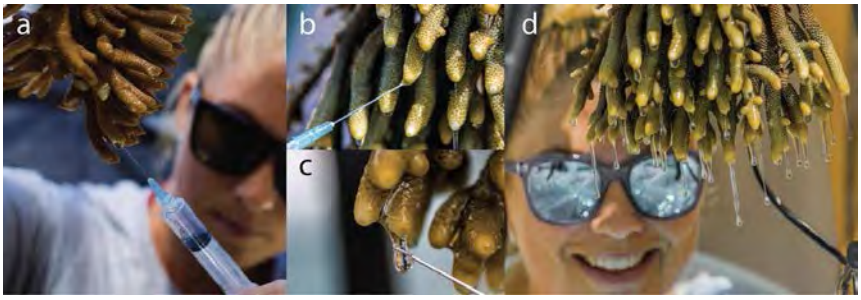

Figure 1. a) Coral mucus collection from *Acropora millepora* using a sterile syringe, b) mucus collection from the tip of the coral colony as the coral secretes mucus under thermal stress, c) close up of mucus collection, showing the tip of the syringe in a droplet of mucus and d) colony of Acropora millepora held upside down in the air to enable mucus collection, showing the long strings of mucus secreted.

The production and degradation of dimethylsulphoniopropionate (DMSP) in the coral microbiome during climate-related stress

I study a sulphur molecule with a very distinctive smell that is best described as the 'smell of the sea'. This molecule, called dimethylsulphoniopropionate (DMSP), has a global scale impact due to its functional role in marine biogeochemistry and ecological processes and upon release into the atmosphere, it acts as precursor of cloud formation. The Great Barrier Reef is considered as a DMSP-production hotspot (Fischer and Jones 2012; Raina et al. 2013), however the underlying physiological function(s) and regulation of DMSP production in corals is still unknown (McLenon and DiTullio 2012).

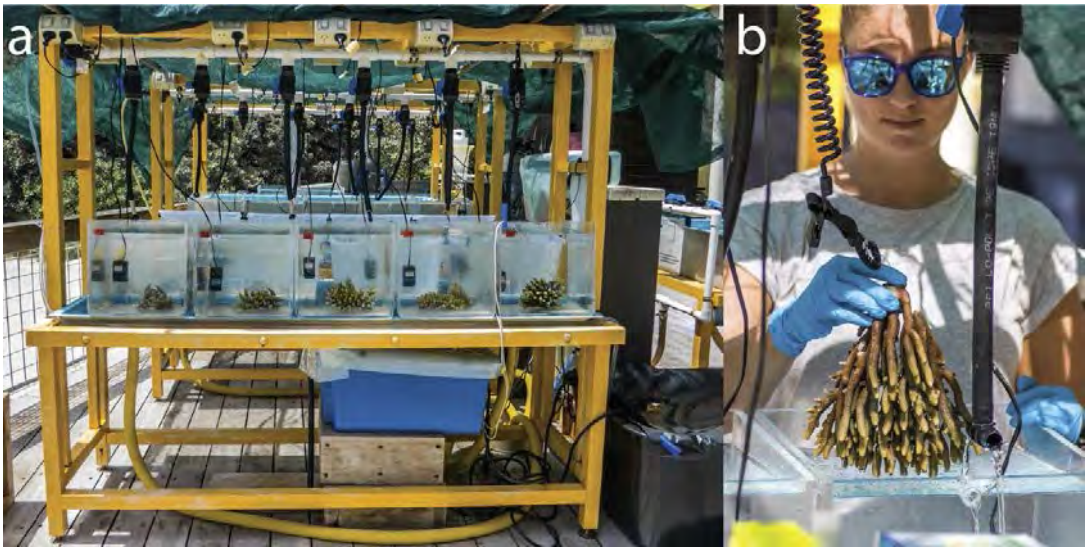

Figure 2. a) Experimental set-up of flow-through aquaria at Heron Island Research Station and b) a colony of Acropora millepora being held out of the water to collect coral mucus during one of the sampling time-points.

Corals produce high concentrations of DMSP, which is then degraded by their associated bacteria via two main pathways to either sustain their growth or to produce a climate-active gas called dimethylsulfide (DMS). However, we still do not know how these two competing pathways are influenced by thermal stress and what this means in terms of biogeochemical cycling if one pathway is favoured over the other (Simó 2001).

This is important to understand how thermal stress will influence the production of the climate-active gas DMS, and therefore local and regional climate.

With the funding provided by the Danielle Simmons Research Award, we conducted a field based experiment at Heron Island Research Station, which was the first to explore the influence of thermal stress on DMSP degradation in reef-building corals to better understand the impact this may have on the release of DMS. The main aim was to link DMSP availability with bacterial community compositions and the dominant metabolic route used to catabolise DMSP in Acropora millepora under thermal stress. We focussed on two microniches; the coral holobiont and the surface mucus layer.

We exposed colonies of Acropora millepora to an increase in water temperature from 27°C to 32°C over 7 days (Figure 1). Physiological stress was monitored twice daily and subsampling was conducted every second day to collect coral mucus, holobiont and water samples (Figure 2). Direct quantification of intracellular concentrations

of DMSP were measured using 1H nuclear magnetic resonance (NMR) spectroscopy at the Australian Institute of Marine Science (AIMS) in collaboration with Dr Cherie Motti and we found among the highest reported DMSP concentrations in coral mucus, ranging between 1254 – 3969 nmol/mm^2 under thermal stress (Figure 3). Samples were also screened for DMSP degrading genes, and we have successfully confirmed the presence of both degradation pathways in coral-associated bacteria using qPCR.

The findings from this work will provide a new direction for understanding how bacterial communities may influence the production and degradation of DMSP in coral reef ecosystems under a changing climate and will ensure the delivery of important new insights in sulphur-cycling and its impact on coral health.

Acknowledgements
I am truly grateful to the Australian Coral Reef Society for providing me with the opportunity to complete this research using the funding from the Danielle Simmons Award. This research was also supported by the School of Life Sciences, University of Technology Sydney and a PADI Foundation Grant. I would like to thank Matthew Nitschke and Lisa Fujise for their assistance in the field, as well as the staff at Heron Island Research Station. I would also like to extend thanks to Bonnie Laverock, Jean-Baptise Raina, Katherina Petrou and Peter Ralph. Corals were collected under the Great Barrier Reef Marine Park Authority permit G14/36977.1

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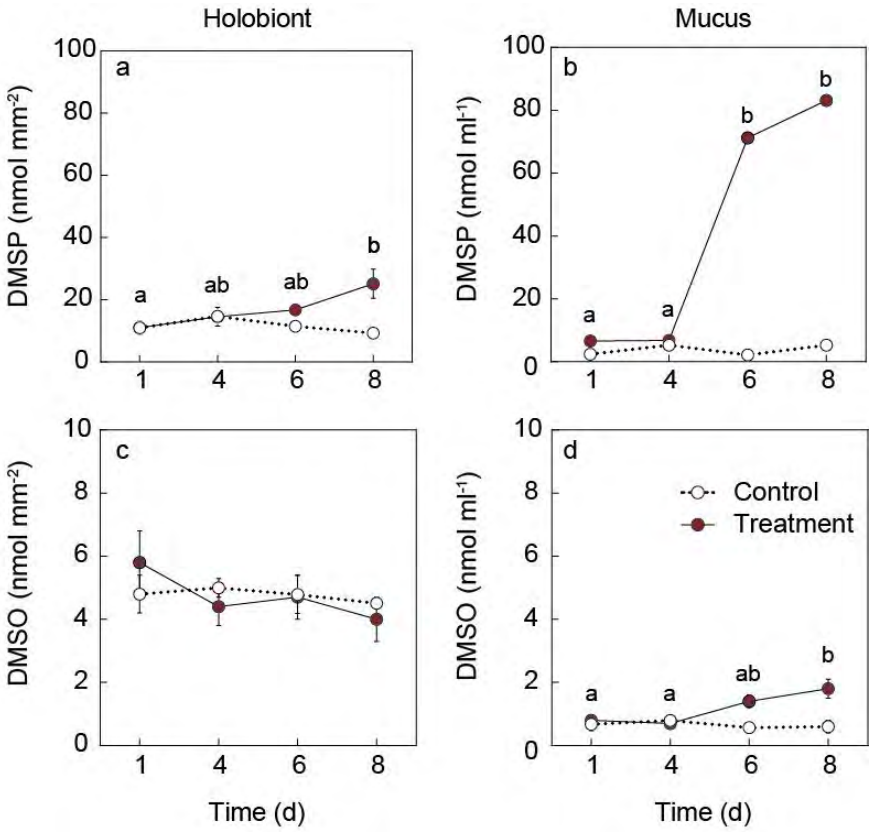


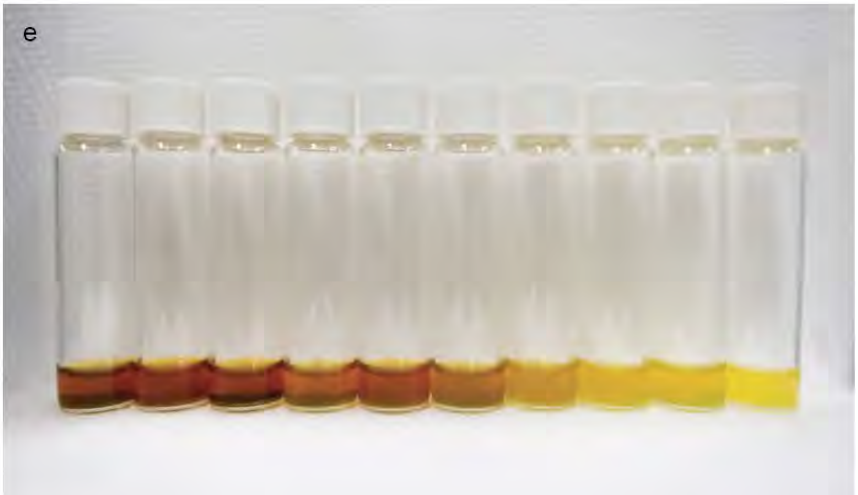


Figure 3. Intracellular concentrations of DMSP from the a) holobiont and b) mucus and dimethylsulphoxide (DMSO) from the c) holobiont and d) mucus of Acropora millepora for the control (white circles) and treatment (red circles). Letters indicate significant differences. Averages ± SE shown (n = 5). e) The range of colours found from coral holobiont extracts in methanol before preparing samples for 1H nuclear magnetic resonance (NMR) spectroscopy at the Australian Institute of Marine Science (AIMS), Townsville.

Eva McClure: 2016 ACRS Student Award

Redundant or resilient: The impact of cyclones on Great Barrier Reef Marine Reserves and herbivorous fish communities

I was the fortunate recipient of an Australian Coral Reef Society Student Research Award in 2016, to support a study on cyclonic impacts on Marine Reserves and herbivorous fish communities on the northern Great Barrier Reef (GBR). The generous funding supported bench fees and the hire of a large research vessel at Lizard Island Research Station, allowing for a cross-shelf comparison of the ecologically important group of herbivorous fishes following recent climatic disturbances of both cyclones and, unexpectedly, coral bleaching.

This project forms a crucial part of my PhD research, which evaluates whether Marine Reserves remain effective as fisheries management and conservation tools when subject to multiple levels of environmental and anthropogenic influence, such as the sedimentation gradients you might find across a continental shelf. Beyond the traditional use of Marine Reserves as fisheries management tools, I am also investigating whether Reserves can have the wider effects of promoting coral reef resilience and recovery; allowing reefs to bounce back or resist disturbance by maintaining strong ecological function through the protection of reef communities. Recent cyclone activity and catastrophic coral bleaching events on the northern GBR, and typhoon activity in my other study site, the Philippines, provide a good opportunity to put this rarely tried theory to the test throughout my PhD research.

For the current project, I worked with an incredible team on the northern GBR in October-November 2016. Herbivorous fish from the families Acanthuridae and Siganidae were the focus of this study. Interestingly, these fish are preferentially targeted as a food fish in the Philippines, and thus only gain protection within Marine Reserves. On the GBR however, herbivores are generally not targeted in either commercial or recreational fisheries. Comparing Reserve effect in different exploitation regimes will help us understand how selective fishing of ecologically important fishes on reefs under multiple stressors may influence coral reef ecosystem dynamics. In particular, we will gain insights into the functional impacts of large-bodied herbivores and, ultimately, the potential for reef resilience and recovery following acute disturbances like cyclones.

Acknowledgements:
I sincerely thank the Australian Coral Reef Society for funding this research; ACRS support allowed me to not only collect data towards my PhD, but foster collaborations between fellow PhD candidates. Many thanks to Sea World Research and Rescue Foundation and the ARC Centre of Excellence for Coral Reef Studies for funding the remainder of this research.
Invaluable field assistance from Alexia Graba-Landry, Zoe Loffler, Elena Smith, Laura Richardson, Andrew Hoey and staff of Lizard Island Research Station made this project both possible and fun. Finally, I would like the thank my supervisors Dr. Andrew Hoey and Prof. Garry Russ for their constant support

Kennedy Wolfe: 2016 ACRS Student Award

Biology and ecology of the commercially exploited sea cucumber, Stichopus herrmanni

Fig. 1: Dried bêche-de-mer sea cucumbers fetch a high price in the Asian market.

Research on coral reefs **has a strong bias** towards scleractinian corals and reef fishes. However, non-coral marine invertebrates, including echinoderms, represent the greatest biodiversity need greater attention. Sea cucumbers are harvested globally for the lucrative bêche-de-mer product (Fig. 1), with many species in a perilous state of conservation. Stichopus herrmanni (Fig. 2), listed as Vulnerable to extinction by the IUCN, is currently a major fisheries target on the Great Barrier Reef (GBR) and elsewhere. However, there remains a paucity of data on the biology and ecology of this species to inform management – an issue for bêche-de-mer sea cucumbers globally. My research bridged fundamental knowledge gaps for S. herrmanni, providing information imperative to its conservation biology.

Population biology – We found distinct spatial variation in the size and density of S. herrmanni across six sites on Heron Reef, GBR. The smallest individuals found were 10 cm long (Fig. 3), some of the only juvenile S. herrmanni ever documented. Juvenile nurseries of sea cucumbers are rarely observed in nature, making this an important observation for understanding the recruitment and population biology of tropical sea cucumbers. The distribution of larger S. herrmanni in deeper lagoon areas suggests intra-reef connectivity and adult migration, which could increase spawning success (Fig. 2).

Ecological roles – Little is known about the ecological roles of sea cucumbers in lagoon sediment habitats, including when they spawn and what they eat. My research examined seasonal variation in movement, bioturbation (sediment turnover), feeding and gonad development of S. herrmanni over three years at One Tree Reef, GBR. This was the most comprehensive in situ analysis of the feeding ecology of a tropical sea cucumber. We found S. herrmanni exerts the highest reported contribution to bioturbation for a sea cucumber (Fig. 4). Stichopus herrmanni is a generalist feeder, influencing trophic interactions (e.g. algae, infauna) in its sediment environment. Gonad development peaks in summer, suggesting S. herrmanni spawns during warmer months on the southern GBR. These findings redefine the perception that tropical sea cucumbers are not ecologically important, a misconception that has facilitated their global exploitation.

Fig. 4: Stichopus herrmanni bioturbation, releasing 'clean sand' and altering seawater chemistry.

Biogenic buffering – The bioturbation and digestion of carbonate sediment in the low-pH sea cucumber gut may influence reef carbonate chemistry (Fig. 4). Using lagoon sediment mesocosms, my research also examined the potential for S. herrmanni to alter reef carbonate dynamics under present-day and near-future (+570 ppm) ocean acidification scenarios. Through its feeding biology, this species alters benthic communities (e.g. algae, infauna) and modulates carbonate chemistry dynamics (e.g. pH, total alkalinity) in lagoon environments. This suggests that large tropical sea cucumbers may serve an important role in mitigating the impacts of ocean acidification on coral reefs. Maintenance of community dynamics and associated compensatory feedback mechanisms (biogenic buffering) are important for coral reef ecosystem resilience in the face of global change, an unappreciated feature of the feeding biology of tropical sea cucumbers.

Sun W. Kim: 2016 ACRS Student Award

Coral fitness gradient in a changing environment

Corals form the cornerstone of over $6 billion reef industries in Australia, yet they are severely threatened by climate change. Whilst historical and contemporary coral range shift records suggest corals' ability to modify their ranges and persist through climatic changes, forecasting overall coral range dynamics (e.g. expansion at the leading edge, and contraction at the trailing edge) under climate change remains challenging. This difficulty is partially attributable to the asymmetry in the focus of current research, which is heavily skewed toward fitness and physiological responses of corals under acute conditions in the tropics. The results of these investigations are valuable for understanding ecological and evolutionary dynamics at the trailing edge, yet provides little insight into predicting patterns at the leading edge. Therefore, fundamental to accurate predictions of coral range dynamics is an understanding of biological traits governing fitness (e.g. reproduction, metabolism, genetic diversity) along a wide range of coral species distribution, particularly near the leading edge.

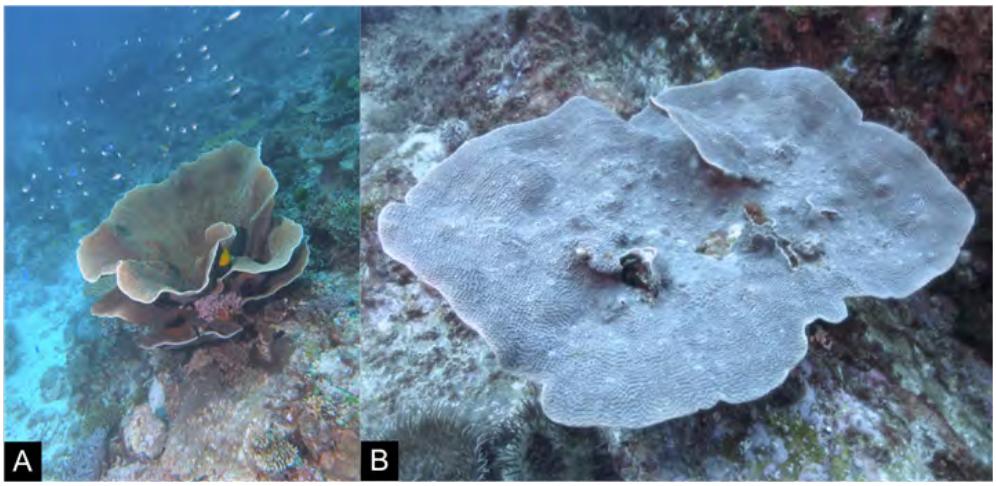


Figure 1. Morphology of one of the study species, Turbinaria mesenterina, varies with environmental conditions. Does this affect physiological and genetic traits as well? A) Heron Island, B) The Solitary Islands.

In 2016, I was fortunate to receive the ACRS student research award. The award permitted me to expand the spatial scope of my study from limited high-latitude coral reefs to a wider expanse including GBR locations. Data from additional tropical locations will allow juxtaposition of corals' biological traits along a tropical to subtropical gradient. I have collected small coral fragments from several locations between Heron Island and the Solitary Islands. These small fragments were further subsampled in order to assess intraspecific reproductive, physiological, and genetic variability along the wide geographic and environmental gradients. The fragments are being analysed at the moment and I anticipate completing the analyses in early 2017. Results from the trait analyses will be integrated to assess comprehensive fitness gradient of coral populations under different environmental conditions. The knowledge gained from this study will provide novel insights into the range of adaptive capacity of corals under different environmental conditions, and thus improve our ability to foresee corals' responses to climate change over substantial latitudinal gradient.

Figure 2. Sampling a coral fragment - Heron Island

News from our Research Stations

One Tree Island Research Station

One Tree Island Research Station (OTIRS) is located ~50 nm offshore from the central Queensland coast on the outer Great Barrier Reef. The whole of the One Tree Reef, lagoon system and its surrounding waters are designated as a Scientific Research Zone and offer a unique opportunity for field studies at a site free of human disturbances. The research station provides easy access to study sites within the lagoon at any stage of the tide and an excellent base for studies of neighboring islands in Capricorn Bunker Group.

One Tree Island (OTI) had a great 2016. While other areas in GBR were sadly experiencing some of the worst bleaching on record, the small proportion of corals at OTI that did bleach have staged an almost complete recovery. OTIRS hosted a range of events in 2016 including fieldtrips for the Coastal Symposium and workshop on 'Arts, Science, Oceans'. Early in the season worked closely with Queensland Parks and Wildlife Service to install acoustic monitoring stations around the island in effort to estimate numbers of nesting bridled terns. As always, OTIRS is very proud to facilitate a diverse range of exciting new and ongoing scientific research including:

- growth rates, demography and life history of reef fish
- range expansion of tropical herbivorous fish into temperate waters due to ocean warming
- abundance and habitat use of coral-reef fishes
- long term monitoring of corals and fishes
- calcification and cementation processes of reefs
- post-bleaching impact assessment
- geomorphology of coral reefs by mapping of sediments and remote sensing

In 2016 we really extended our reach to a broader range of disciplines. In August an international contingent of arts, humanities and social science scholars from Nashville's Vanderbilt University and the University of Alabama visited OTIRS to immerse themselves in the coral reef environment as part of the 'Arts, Science, Oceans' colloquium hosted by the University of Sydney. These scholars are addressing threats to coral reef ecosystems from political, economic and historical perspectives, and applying an interdisciplinary approach to engage the public in addressing the issue. (See "Learning to Look", p25 of this newsletter).

Another remarkable project conducted at OTIRS was the work undertaken by UQ's Institute for Molecular Bioscience to study the therapeutic effects of cone snail venom in the development of pain modulating drugs.

The Carnegie Institution for Science conducted its ninth expedition to One Tree Island, this time to study the effects of ocean acidification on a coral reef community. This year the experiment involved flowing CO^2-enriched seawater over a natural coral reef community without artificial confinement. The biological response was analysed in the temporary state-of-the-art carbonate chemistry laboratory at One Tree Island Research Station.

Every year OTIRS offer students an opportunity to conduct their field studies in this unique area by providing an ACRS Postgraduate Student Award. OTIRS offers accommodation for up to 28 people, flow-through sea-water wet-lab, bio-lab, dry/teaching lab and seven vessels available to researchers for easy access to the lagoon and outer reef.

One Tree Island Research Station by the numbers:
18 research projects conducted at OTIRS in 2016
104 visitors from 16 institutions in 4 different countries
10,000 nesting sea birds
1 New Zealand Fur Seal

Heron Island Research Station

Image: Professor Peter Harrison and his team from Southern Cross University collecting coral spawn from Heron reef flat after the large coral spawning event in November.

It was wonderful to see so many ACRS members pass through the station again in 2016. It was another year of diverse research with climate change once again a key focus along with developmental biology, geology and ecological studies.

Heron Reef and the Capricorn Bunker group was very fortunate to experience very little bleaching in comparison to the more northern reefs in the GBR. We hope that the array of climate change research that is occurring on the station can advance our understanding of these events and how reefs respond.

Improvements and innovation were at the forefront in 2016. We finalised procurement of a rigid hull inflatable vessel for research purposes towards the end of the year. The vessel will be built in early 2017 for introduction into the fleet in the middle of the year.

We also installed a research grade weather station. This weather station is recording an array of climatic data including photosynthetically active radiation, solar radiance, temperature, humidity, rainfall and barometric pressure. The interface to make this data available to researchers will be completed in early 2017.

In the laboratories we expanded our capacity for drying and storing specimens with the addition of a new drying oven and a second -80C freezer. We also expanded our snap freezing and frozen shipment abilities with a second dry shipper and third liquid nitrogen dewar purchased.

Image: The new weather station taking pride of place amongst the solar panels on the Boat Shed roof.

Image: Dr Chris Roelfsema presenting his remote sensing work to interested Heron Island Resort guests at the station's annual Open Day.

Sustainability was another big focus in 2016. We joined UQ Sustainability's Green Office Program and rolled out a range of sustainability improvements across the facility, such as soft plastic recycling and an increase in battery recycling. These initiatives will continue into 2017 and we hope you'll support them each time you visit.

We look forward to welcoming the coral reef community back in 2017 for more exciting research.

Kimberley Marine Research Station

KIMBERLEY MARINE
RESEARCH STATION

News - Lustre Exhibition and Oz Geo
The "Lustre Exhibition" opens in the Australian Maritime Museum (Sydney 17th Feb until August). A collaboration between West Australian Museum and Yawuru (Broome Traditional Owners) with Cygnet Bay Pearls as the Major Industry Sponsor.
KMRS and Cygnet Bay Pearl Farms have been involved in a story for Australian Geographic which comes out April 2017. KMRS interns were interviewed as part of a wider story to explain what research has been conducted and how it has contributed to the scientific community.

Local coral bleaching. Photo: G. Firman

Corals
In January of 2016 inshore Kimberley coral reefs suffered mass coral bleaching event. The health of the coral was monitored throughout the year by Verena Schoepf of UWA. She assessed bleached corals, recovery and polyp recruitment using coral tiles. KMRS has established a coral baseline and monitoring program which will be used to monitor the health of Cygnet Bay's coral pools. In the future, KMRS hope to expand this program by expanding the abiotic parameters measured to encapsulate the wider impacts on coral health in and around Cygnet Bay.

Turtle Tagging
Mat Vanderklift (CSIRO) visited Cygnet Bay in April to tag Green sea turtles in hope of expanding the genetics, life cycle feeding and travel patterns. Mat was assisted by the Bardi Jawi Rangers and children from One Arm Point school and Save the Children.

Fish Recruitment
In July Milly Piggott, a PhD candidate from UWA finished her field work on juvenile fish recruitment in the coral pools for commercially relevant species. KMRS is now awaiting her results.

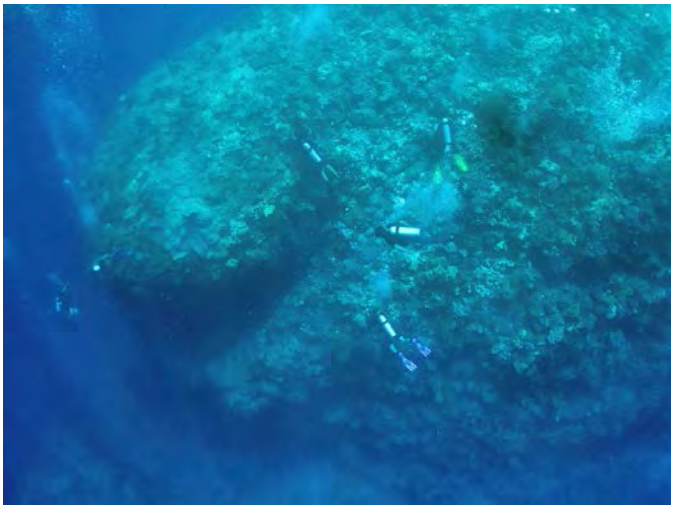
Oyster settlement
At the beginning of 2016 KMRS began to investigate the spatial and temporal variation in the settlement of rock oysters around Cygnet Bay. There is an emerging trend that the spat prefer settling on the middle shore of the intertidal coast. The program will be continued by the KMRS interns.

Water quality and Phytoplankton
Toward the end of 2016 the KMRS interns explored phyto-plankton community's around Cygnet Bay. KMRS intends to establish a long term plankton monitoring program which would feed into national and international data bases. Our aim is to helping fill the current knowledge gap around this fundamental ecosystem driver in the Northwest of Australia and monitor for changes over time.

2017
As well as continuing the three monitoring programs, this year KMRS will be aiding Dr. Christopher E. Cornwall a Research Fellow from School of Earth and Environment at the University of Western Australia. He and his team will be taking coral sample from around Shell Island and on the top of Tallon Reef to assessing the impacts of a warming climate will affect the coralline algae.

Lizard Island Research Station (Australian Museum)

Bleaching was the big event in 2016. **Acroporid corals were hit particularly hard** – we estimate that at least 90% have died – and the spawning in November was, unsurprisingly, a fizzer. The good news is that an enormous number of tiny (< 5 cm diameter) acroporid colonies survived the bleaching. They are growing rapidly with many now 10-15 cm in diameter.

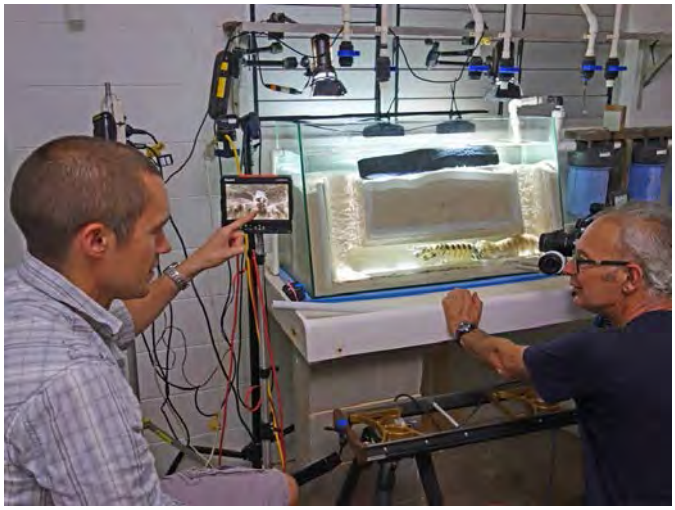


The changes are being documented by at least two research groups. A multi-institutional team has been studying coral communities at Lizard since long before the first cyclone in 2014. They have coral community level data throughout all the changes - including impressive, large-scale 3D images - and their recently-collected settlement panels will show the outcome of the 2016 spawning. In a separate project, species-level surveys of corals and fishes have been conducted at a large number of sites around the Lizard Island Group on three occasions: 2011 (pre-impact), 2015 (after the first of two cyclones) and January 2017 (following the second cyclone and major bleaching). These projects will give a good picture of the changes that have happened so suddenly and provide a baseline for future research.

The Lizard Island Reef Research Foundation continues to provide essential support for LIRS. It has now funded 99 doctoral and postdoctoral fellowships to the value of more than $1.3 million. Seven new Fellowships were awarded for 2017. These projects will make use of the enormous changes that have occurred at Lizard Island in recent years to better understand the effects of such disturbances and to help predict future trajectories.

Research aimed at minimising the effect of COTS on reefs continued, despite the outbreak 'busting' at Lizard Island in 2015. We want to be ready for the next outbreak, with early warning systems in place and effective control measures to tackle it. Support from the LIRRF and the Ian Potter Foundation is making this happen.

Also thanks to those Foundations, LIRS will build a cyclone shelter in 2017. This will minimise disruption to ongoing research by alleviating the need for everyone to evacuate when the next cyclone threatens.



In 2016, researchers from 38 institutions in 10 countries conducted 106 research projects, and 102 new publications were added to the LIRS contributions list. Lizard Island Field Guide (http://lifg.australianmuseum.net.au) now includes more than 1,800 species.

Dr Anne Hoggett & Dr Lyle Vail, Directors
Lizard Island Research Station
PMB 37, Cairns QLD 4892, Australia
Email: lizard@austmus.gov.au

UQ's Moreton Bay Research Station

2016 has been an exciting year for MBRS, with the addition of new labs, new researchers, and generous philanthropic donations. We'e also had the honour of hosting several prestigious teaching and research workshops.

Our long running postgraduate teaching course, the Australian Course for Advanced Neuroscience (ACAN), just celebrated its 11th anniversary. Founded by Australian Chief Scientist and philanthropist Dr Alan Finkel, the course has recently changed institutes from ANU to UQ's Queensland Brain Institute.

The first four recipients of the MBRS Scholarships in partnership with Sibelco Australia have been awarded in 2016, covering topics as wide as hydrodynamics of North Stradbroke Island through to the identification of new fish parasites. This scholarship, along with the Honours, PhD and Community Research Scholarships, has given us an influx of twelve new postgraduate researchers. Additionally, long-term industry partner Dr Geoff Nette from IMBCR has generously donated over $30k of scientific equipment, including a HPLC and a Thermo Savant freeze drier. This equipment, along with his annual gift to the Indigenous Science Scholarship, makes IMBCR one of our longest and most generous supporters.

We hosted teachers from the Australian Science Teachers Association and the Marine Teachers Association of Queensland. In both instances, we incorporated professional development training for the participants, taking them into the field and introducing them to a wide range of scientific field techniques and methodologies. While UQ's Prof Tom Cribb has been leading a group of international experts in the International Parasitology Workshop, with the goal of identifying 200 new species of fish parasites by the end of the year. A goal they are well on their way to achieving.

News and Events

Caring for Country:
In 2015, MBRS had the pleasure of hosting the Quandamooka Yoolooburrabee Aboriginal Corporation and Healthy Waterways and Catchments mangrove survey team. The project is part of a large Caring for Country grant that is providing support to traditional owners to survey and care for the mangroves of Moreton Bay.

UQ whale researcher awarded MBRS scholarship
School of Veterinary Science PhD student Fletcher Mingramm said his research was helping to answer questions on humpback whale pregnancy status, male reproductive activity and stress. "This study was established to develop and validate non-lethal hormone-monitoring techniques to provide data needed for more efficient and accurate management." The Australian humpback population is increasing by more than 10 per cent a year, while neighbouring populations in the South Pacific are not, and researchers are not sure why.

MBRS hosts annual dolphin survey

The station recently hosted expedition team members from the Moreton Bay Dolphin Research Project – now in its third year. Dolphin Research Australia Inc. members conduct annual surveys of the population abundance, trends and health of the Indo-Pacific bottlenose and Australian humpback dolphins, a vulnerable species.

Australia's Chief Scientist visits MBRS

Australia's newest Chief Scientist, Dr Alan Finkel AO, officially opened the prestigious neuroscientist training course being held at Moreton Bay Research Station. The Australian Course in Advanced Neuroscience (ACAN) is an intensive three-week program that was established by Dr Finkel over 12 years ago. The course trains the best and the brightest early career neuroscientists from across Australia and New Zealand. The course attracts some of the world's leading neuroscientists, exposing the students to cutting-edge neuroscience research techniques.

Science Week 2016:

Our very own Dr Kathy has been celebrating National Science Week with all the students and staff from Dunwich State School! This year's theme was Robots, Droids, and Drones. Every group got to make their own robot! Preps made balancing robots, while years 1 and 2 made gliding robots. The rest of the school used Snap Circuits and Little Bits to make a whole range of automated creations! Every session was finished off with a Mad Science laugh!

Time-lapse at Heron Island. Credit Mark Priest

We invite you to keep in touch

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