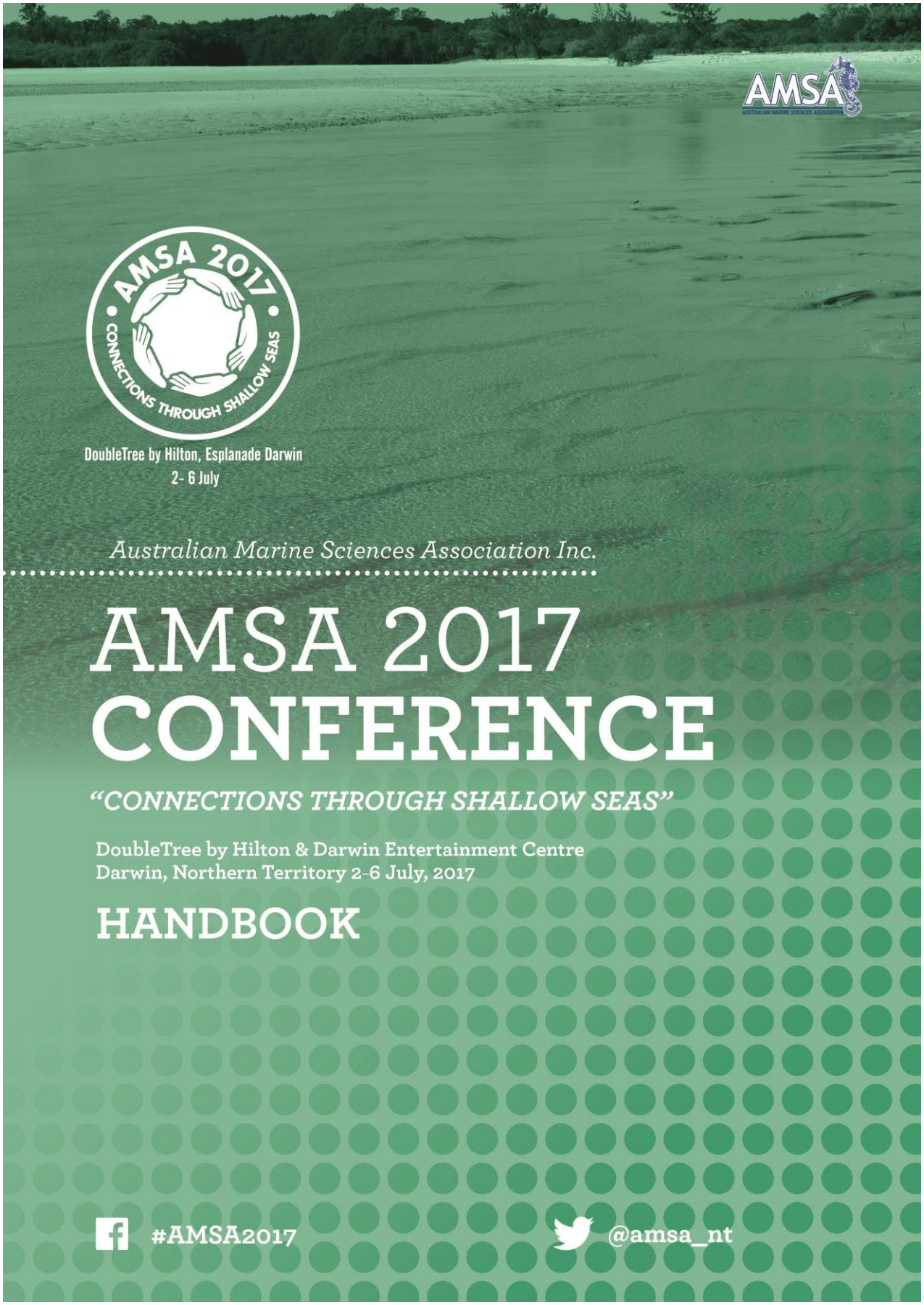

DoubleTree by Hilton, Esplanade Darwin
2- 6 July

Australian Marine Sciences Association Inc.

AMSA 2017 CONFERENCE

"CONNECTIONS THROUGH SHALLOW SEAS"

DoubleTree by Hilton & Darwin Entertainment Centre
Darwin, Northern Territory 2-6 July, 2017

HANDBOOK

#AMSA2017

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Australian Marine Sciences Association Inc.

AMSA 2017
CONFERENCE

"CONNECTIONS THROUGH SHALLOW SEAS"

Doubletree by Hilton and Darwin Entertainment Centre
Darwin, Northern Territory, 2–6 July 2017

HANDBOOK

Australian Marine Sciences Association Inc 2017

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Dr Edward C.V. Butler (AMSA 2017 Convenor), Science Leader – NT, Australian Institute of Marine Science, Arafura Timor Research Facility, Brinkin, Darwin.
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Contents

The 'DARWIN WELCOMES DELEGATES' program connects delegates with local businesses who provide delegate specific products; special offers; discounts; 2 for 1 offers; upgrade offer; special gift or bonus for purchase. The program is a customer service initiative which aims to improve the delegate experience in the Top End and make delegates feel special.

Delegates can access the information via a dedicated, customised landing page which welcomes the delegates and provides a platform for all the products and services on offer. On arrival to the conference in Darwin, delegates are provided with a Special Privileges Card which they present to the participating businesses to redeem the product or service or book selected products online.

tourismtopend.com.au/darwinwelcomesdelegates

For more information please contact:
Janine Fidock - Marketing Manager - (08) 8980 6024 - 0408 253 071
marketing@tourismtopend.com.au

DARWIN CONVENTION CENTRE

Northern Territory CONVENTION BUREAU

TOURISM TOP END
wild life - wild land

Welcome from AMSA President

It gives me great pleasure to welcome all delegates, sponsors and exhibitors to the 54th annual AMSA conference, Darwin 2017 – Connectivity Through Shallow Seas. The conference will no doubt be as engaging and stimulating as is the location in which it is set. The theme of the conference captures much of what is unique about the top end of Australia and places it within the broader context of the marine science that you all do so well and with so much passion. I think you'll find the local organising and science committees have done a stellar job and put together a program that will keep you engaged from one end of the week to the other. As you move from talk to talk, be sure to spread the word on all the interesting things you see using our twitter feed @amsa_marine #AMSA2017 and like our AMSA Facebook page.

Amongst the bevy of excellent plenary talks this year we will also be taking the time to recognize the winners of AMSAs most prestigious awards. The Jubilee award was first given in 1988 to recognize an active marine scientist who has made an outstanding contribution to marine research in Australia during their career. This year's recipient, Prof. Peter Steinberg from the Sydney Institute of Marine Science and University of New South Wales, is well deserving and you'll hear about his pioneering work in the area of chemical ecology and integrated, "micro-macro" approaches to environmental microbiology. The Association's Technical Award this year will be presented to Brent Womersley from Fisheries Victoria in recognition of his outstanding achievements in the support of marine science. And we showcase the next generation of marine scientists by giving the Allen Award, supporting an outstanding postgraduate student to attend an international conference, to Paige Kelly from the Institute for Marine and Antarctic Studies, University of Tasmania & Antarctic Climate and Ecosystems CRC.

Be sure also to check out the host of events we have organised surrounding the conference including the Public Forum on northern Australia development and the balance for shallow northern seas, a series of workshops on Indigenous Engagement, Getting Published, Connectivity and Coastal Habitat Utilisation, and the latest in Novel Technologies, and of course the many social events including the registration mixer, student night and of or course the Gala Dinner. Have an excellent meeting!

Regards,

Will

Message from the Organising Chair

Welcome to Darwin in the dry season! It's probably a reprieve from wintry conditions further south, but AMSA 2017 is not here for a respite in the warmth. We are looking to immerse you in a full-on program of marine science and related activities; you will probably need the break after it.

Our theme 'Connections through Shallow Seas' has set the tone: looking first at the marine science linkages and connectivity across the north of Australia, and then turning to the overtones of the social and the socio-economic--interactions with Traditional Owners around the coast, and also with our near-neighbour countries to the north. As well as charting a slightly different thematic course this meeting, we have sought to give the event a Top End flavour. Just how well we have lived up to these goals will be yours to evaluate during and after the conference.

The scientific program with 17 symposia and four general sessions is replete with diversity, and not by any means anchored to the North. I also commend to you our Plenary and Invited Speakers, and the special plenary session around a decade of IMOS. Our appreciation goes to the Scientific Committee—especially the Chair—and the many symposia convenors, who have translated ideas into tangible conference sessions.

The workshops build on the scientific program with fundamental subjects—Indigenous engagement, getting published, the latest in technologies, and system connectivity; the last is coupled with a tour of its subject, Darwin Harbour. Our workshop subcommittees have done an excellent job in assembling an extra dimension to the conference.

Northern Development was placed firmly on the national agenda in the run up to the last Federal election; it has ebbed and flowed since then. However, through all of the talk to this point, the focus has been squarely on matters terrestrial. Even with the debate on the damming of northern rivers, the arguments on either side have rarely moved into their estuaries, or beyond to our shallow seas. We are looking to tackle this shortcoming in the AMSA 2017 Public Forum on the Monday evening, where the topic is: *Northern Development – How does marine fit? | Australia's Shallow Tropical Seas – Resource and/or Refuge?* We have assembled a panel and convenor with a broad spectrum of perspective and experience.

The traditional social elements of an AMSA conference are all there: icebreaker, student night and gala conference dinner, along with the photo competition. At other times during your visit, you can be partaking of Darwin tourist mainstays, such as the Deckchair Theatre and the markets.

Our many sponsors are critical supporters of AMSA 2017, without them we could not have brought this event to fruition. They are recorded fully elsewhere in this handbook. We are very grateful to each and every one of them for their contributions.

My sincere thanks go to members of our two committees--the organising committee and the scientific committee. For the organising committee, I have relied on the volunteer spirit among a small community of marine scientists in Darwin. They have stood up when asked and shared in the diverse range of tasks required to be done to make a scientific conference. Our professional conference organiser—Agentur: Britta Decker and team—has also performed outstandingly to translate the organising committee's aspirations operationally and commercially.

Organising Committee

Shannon Burchert	Student Activities	NT Government
Edward Butler	Convenor & Chair / Sponsorship	AIMS
Katherine Dafforn	AMSA National Council representative	UNSW
Britta Decker	Professional Conference Organiser	Agentur P/L
Sharon Every	Secretary / Treasurer	CDU
Karen Gibb	General Member	CDU
Madeline Goddard	General Member	CDU
Krystle Keller	Student Activities	CDU
Kelly Mackarous	Workshops	NT Government
Samantha Nowland	Workshops	NT Government
Claire Streten	Scientific Committee Chair	AIMS
Jacqueline Taylor	General Member	AMCS
Vinay Udyawer	Photography Competition / Assistant Secretary	AIMS

Message from the Scientific Chair

At the final stages of writing the conference handbook I'm starting to realise how much of a wonderful conference AMSA2017 is going to be. On behalf of the scientific committee, "Welcome to the amazing Northern Territory!", we hope you have a great time at the conference, and while visiting the spectacular sites we have here in the Top End.

At the close of the symposia call, the scientific committee had received over 20 proposals. The high number of submissions is a testament to the hard work put in by *Lynnath Beckley* and *Edward Butler* encouraging AMSA members to be involved in this year's conference. Thank you to Lynnath and Ed for getting the conference preparations off to a great start. By the end of March the conference had received over 300 abstracts. The large number of abstracts received is due to the commitment and the efforts of not only the scientific committee but also symposium conveners who promoted the proposed program for AMSA2017 through their networks - something they probably regretted when they realised they had to review so many abstracts. Not only did the conveners promote the conference on our behalf, they also met the very quick turnaround time for reviewing abstracts with ease which made the life of the scientific committee that little bit easier. Most importantly though, the conveners proposed a great range of topics for the symposia which has resulted in the scientific program at AMSA2017 attracting new groups to attend the conference, including a number of Indigenous ranger groups. Thank you to all the conveners for their contribution to the scientific program, in no particular order; *Peter Steinberg, Zoe Richards, Holly Raudino, Carol Palmer, Jason Tanner, Zhi Huang, Jamie Treleaven, Amanda Parr, Lynnath Beckley, Karlie McDonald, Stuart Field, Kelly Waples, Fiona Valesini, David Williams, Kim Picard, Karen Gibb, Rachel Przeslawski, Ana Lara-Lopez, Hugh Kirkman, Allyson O'Brien, Terry Walshe and Craig Steinberg*. The scientific committee would also like to thank our plenary and invited speakers for accepting our invitation to lead off the conference each day. In particular we would like to thank *Tim Moltmann* for supporting the 'decade of IMOS' session at the conference and for his assistance with developing the schedule for this part of the program. The scientific committee hope the presentations at AMSA bring inspiration to your new collaborative marine research projects (created during all the conference social events, of course) and we look forward to hearing about them at AMSA2018 in Adelaide.

Scientific Committee

Lynnath Beckley	General Member	Murdoch University
Edward Butler	Organising committee	Australian Institute of Marine Science
Maria Byrne	General Member	The University of Sydney
David Griffin	General Member	CSIRO Oceans and Atmosphere
Robert McCauley	General Member	Curtin University
Mark Meekan	General Member	Australian Institute of Marine Science
Ruth Patterson	General Member	Northern Territory Government
Claire Streten	Chair	Australian Institute of Marine Science
Alicia Sutton	General Member	Murdoch University

Acknowledgement of Country

We would like to acknowledge that this conference is being held on the traditional lands of the Larrakia people. We wish to pay our respect to elders, both past and present.

Donna Jackson will facilitate the AMSA2017 Welcome to Country, Donna isa Larrakia woman from the Browne family. Her areas of expertise include: Welcome to Country speeches, Bush tucker tastings & walks & lectures History and environment walks & lectures. Donna holds a diploma in Applied Science: Natural & Cultural Resource Management from Batchelor Institute of Indigenous Education (BIITE) and currently works as Manager of Larrakia Rangers.

AMSA 2017 Annual General Meeting

The 2017 Annual General Meeting will be held at 12.30 pm on Wednesday 5 July 2017 at the AMSA 2017 National Conference in Ballroom 1, DoubleTree by Hilton, Darwin Esplanade, Darwin. Registered members of AMSA are entitled to vote.

About AMSA

The Australian Marine Science Association Inc. (AMSA; www.amsa.asn.au) is Australia's peak professional body for marine scientists from all disciplines and for over 50 years has promoted all aspects of marine science in Australia.

AMSA operates with a membership network of individuals and corporate affiliates as a not-for-profit organisation. Its activities and resources are largely funded by membership contributions, donations from benefactors and surpluses from events. As well as operating nationally, AMSA has active branches in most States and Territories. Membership is open to professional marine scientists, students and corporate bodies engaged in marine research, policy or management.

AMSA works to promote marine science, through:

- Hosting an annual conference which address marine science issues in Australia and abroad
- Holding workshops, symposia and training at branch and national levels
- Publishing three issues of the Australian Marine Science Bulletin each year
- Publicly recognising outstanding marine scientists, technicians and students through annual AMSA awards
- Providing weekly eNews with information about events, jobs and the latest marine science news
- Representation of members views to government
- Maintaining up to date position papers on matters of interest
- Providing access to resources via our website
- Providing commentary and digital information via social media

AMSA membership is open to those working and studying in all disciplines of marine science.
Supporting

AMSA through membership provides direct support for efforts in marine science research.

Membership Benefits include:

- Access to member communications (AMSA Bulletin, e-News and other such material)
- Reduced registration fee at the AMSA Annual Conference
- Participation in activities of state branches
- Eligibility for student awards and prizes
- Opportunity to stand as a council member or office bearer
- Opportunity to contribute to position statements and submissions on marine science and government
- policy
- Affiliate membership of Science and Technology Australia (STA)
- Networking of scientists for development of research opportunities and multidisciplinary collaboration,
- and dissemination of knowledge about marine science to the wider public

The Venue

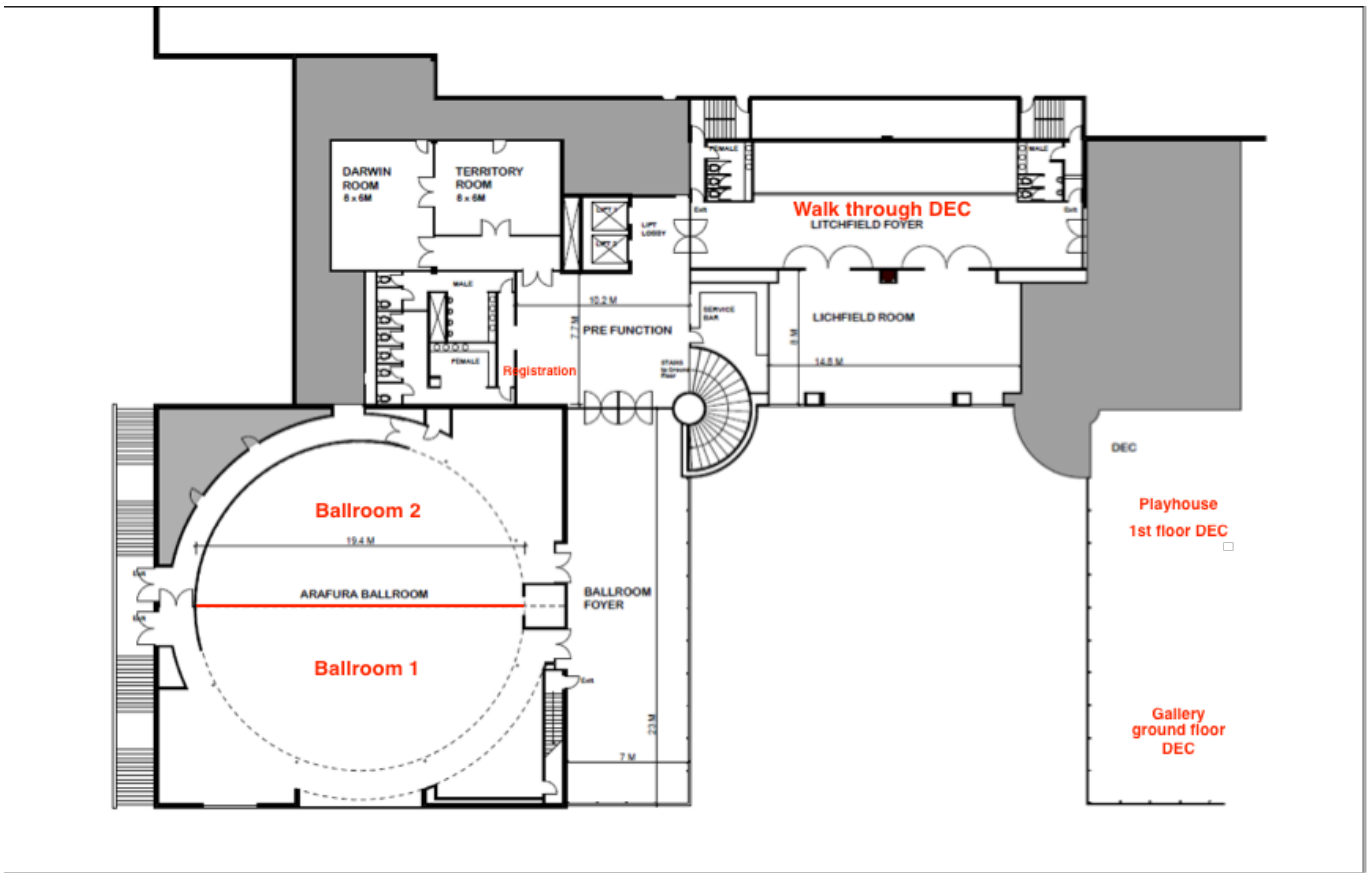
DoubleTree by Hilton and Darwin Entertainment Centre, Darwin - Northern Territory

Our conference will be held at Doubletree Hilton Darwin Esplanade & Darwin Entertainment Centre Complex overlooking the Darwin Harbour and the Esplanade Parkland.

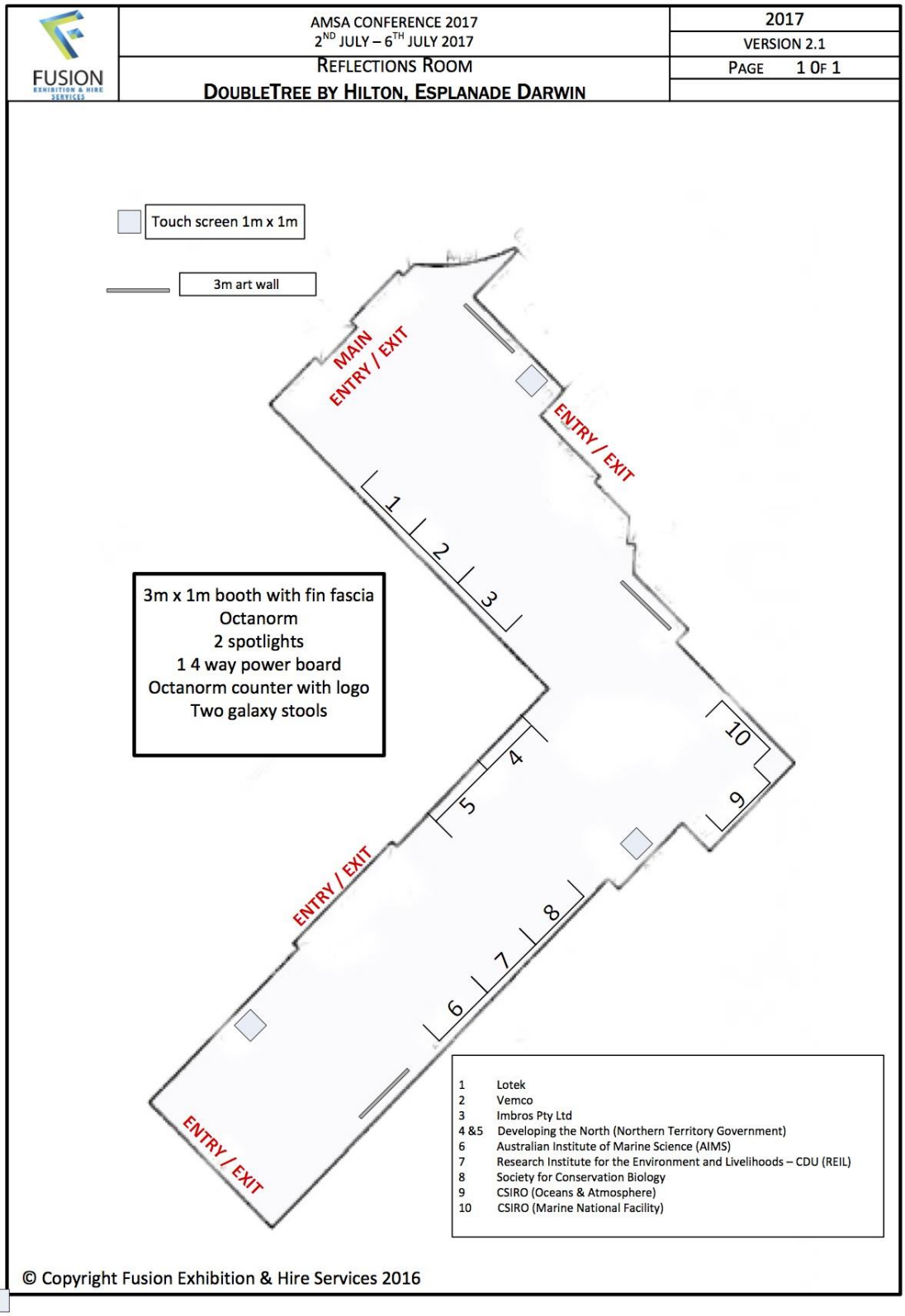
It is only a 15 minute drive from Darwin International Airport and offers easy access to Stuart Highway. The hotel is within walking distance of the city centre, many major businesses and government offices and historic attractions like the War Memorial and Parliament House.

116 The Esplanade, Darwin, Northern Territory, 0800, Australia

Conference Venue Floorplan



Exhibition Floorplan / Reflections Room



Conference Structure

For session details, refer to the Timetable pages.

Each morning, we start of with a plenary session in the Playhouse Theatre, Darwin Entertainment Centre.

Please note we are working across two venues that are interconnected to form the meeting complex. The Doubletree by Hilton is our main conference venue and first access point.

Morning Tea will be served in the Reflections Room, Doubletree by Hilton where the exhibition space is located.

After morning tea, concurrent sessions will commence in the breakout rooms and continue throughout the day.

Every effort will be made by the chairs to keep to the allotted times, allowing delegates to move between rooms and presentations.

The conference will be opened on ***Monday*** by the NT Minister for the Environment and Natural Resources, Hon Lauren Moss MLA.

Tuesday morning's plenary session will include the announcements of the winners of the 2017 AMSA Technical Award and 2017 Allen Award.

On the ***Wednesday*** morning, the 2017 AMSA Jubilee Award winner will be announced and invited to make a presentation.

The scientific program finishes at 15:10pm on ***Thursday***, with the Conference Dinner being held in the evening at the Darwin Botanical Gardens, Heritage Lawn.

Student Awards will be presented at the Conference Dinner.

Speakers Room

The Speakers Prep Area will be in the Territory Room next to the Registration/Information. The team from Paperless Events will be able to assist you with uploads.

Presenting Electronic Posters (PEP)

PEP stands for "Presenting Electronic Posters" and is a format offered instead of the traditional printed poster. PEPs combine a short 5 minute oral presentation with an online version of your presentation that is accessible to anyone at the conference and afterwards. The PEP format provides an excellent opportunity for presenters to utilise electronic, digital and visual displays to share their research online and to interact with delegates on an individual basis. PEPs will be on display for the entire conference in the Exhibition Area in the Reflections Room where lunch and morning/afternoon teas will be served.

Exhibition Booth Display

Exhibition booth displays from our sponsors and exhibitors will be in the Reflections Room for the duration of the conference and can be accessed throughout the conference, Sunday to Thursday. All refreshments will be served in this area during the conference to enable maximum time for delegates to meet Exhibition Stand holders. All exhibitors have put in enormous cost and effort to exhibit to the marine science audience. Please make them feel welcome.

Conference Dress Code

Dress for the conference is business-casual comfortable clothing. Ties and jackets are not necessary. Dress for the Gala Dinner on Thursday 6 July is smart/casual.

Guidelines for Parallel Sessions

Moving Between Sessions

The program schedule allows for common timing among all concurrent sessions so that delegates have the opportunity to move from room to room within a single session. When leaving and entering rooms, please be considerate of others around you and do so as quietly as possible. Please also ensure that you move to the middle of rows and fill all available seats within the rooms.

Speakers

Speakers, **please upload your talk to** amsa2017.paperlessevents.com.au **prior to your arrival at the conference**. If you have not uploaded your talk to the website prior to arrival please go to the speakers room the day prior to your presentation to upload your presentation.

Session Chairs

The Session Chair is responsible for ensuring the smooth running of the session. Should you notice the Session Chair is not in the room at the scheduled start time of your session, please contact the Registration Desk as a matter of priority.

Timing Allocation

To ensure the smooth running of the conference, it is important that all presenters keep to time.

- Long oral presentation have been allocated 15 minutes presentation time and 5 minutes question time.
- PEP presentations have been allocated 5 minutes presentation time.
- Session Chairs will assist presenters to keep to time.

Session Chairs will provide a 5 minute and 1 minute warning for oral presentations to ensure presenters adhere to times. A one minute warning will be provided for PEP talks.

General Information

Registration Desk

We welcome you to update your delegate registration to include any workshops or social events you would like to attend by logging on to your registration page HERE

The AMSA 2017 Registration & Information Desk is located in the DoubleTree by Hilton Esplanade Pre-function area.

All delegates must be registered in order to attend the AMSA 2017 Conference. Please wear your AMSA 2017 delegate pass at all conference sessions.

The Registration Desk will operate at the following times:

Sunday 2nd July 2017
4pm -7pm
AMSA2017 Welcome Function
Watergardens & Reflections Room
Doubletree by Hilton Esplanade, 116 Esplanade

Monday 3rd July 2017
7am - 5pm
Pre-Function Foyer
DoubleTree by Hilton Esplanade, 116 Esplanade

Tuesday 4th July 2017
7.30 am – 5pm
Pre-Function Foyer
DoubleTree by Hilton Esplanade, 116 Esplanade

Wednesday 5th July 2017
7.30 am – 5pm
Pre-Function Foyer
DoubleTree by Hilton Esplanade, 116 Esplanade

Thursday 6th July 2017
7.30 am – 3.30pm
Pre-Function Foyer
DoubleTree by Hilton Esplanade, 116 Esplanade

Alterations to the Program

The Conference Committee reserves the right to make such alterations to the program as circumstances dictate and will not accept responsibility for any errors, omissions or changes

made to the program. All alterations to the program will be announced at the morning welcome and on the Message Board located near the Registration Desk.

Conference Proceedings

Abstracts will be accessible from the commencement of the conference at the AMSA2017 paperless events web site: amsa2017.paperlessevents.com.au.

Mobile Phones and Pagers

As a courtesy to other participants, please ensure that all mobile phones and pagers are turned off or in silent mode during all presentations.

Conference App and Wireless Internet Access

Information on how to access the free Wi-Fi will be available at the registration & information desk.

Bags

Please see conference organising staff at the Registration Desk. Delegates who wish to bring luggage with them on the final day of the conference are asked to bring their luggage to the Registration Desk for storage. If you have a flight departing the night of the dinner talk to the conference organiser about arranging your luggage to be brought to the dinner site for easy departure from there.

Message Board

Messages may be left with the conference organising staff at the Registration Desk. The message board will be located near the Registration Desk. Please check this board regularly.

Catering

Morning teas, lunches and afternoon teas will be served in the Reflections Room / Exhibition Area of the Doubletree by Hilton.

If you have advised the Conference Organiser of special dietary requirements, please identify yourself to the waiting staff for assistance.

Smoking

Smoking is prohibited in all areas of DoubleTree by Hilton and Darwin Entertainment Centre, Darwin.

Emergency Evacuation Procedures

In the event of an emergency, (for example a fire-alarm), delegates will be advised of the status of the emergency via loudspeaker.

Please only evacuate when advised to do so. Doubletree by Hilton and Darwin Entertainment Centre staff will be on hand to advise you of any action that needs to be taken. When asked to evacuate, please calmly make your way to the nearest assembly area and await further instructions.

Local Services

If you have any question regarding your participation in the conference or stay in Darwin please talk to our Conference Coordinators Agentur, Britta Decker, amsa2017@agentur.com.au, 0417-875901..

They are long term locals and can assist you with your questions.

International Visitors General Information

Our country's calling code is "61"; access is available for all mobile phones (cell-phones) and internet access is also available at most hotels, libraries and internet cafes.

When calling from outside Australia, leave out the leading "0" from the STD area code or mobile telephone number. For example, if you are calling Geelong from outside Australia, first dial your country's international access number then dial "61", then dial "3", then dial the local phone number. The electrical current in Australia is 220–240 volts, AC 50Hz. The Australian three-pin power outlet is different from most other countries so you may need an adaptor.

Travel

Airport to Darwin City

The airport is only 15 minutes drive from the city centre. Darwin Airport Shuttle, a 24-hour scheduled service for all domestic and international flights, is a convenient and reliable transport to and from the airport. Private hire vehicles and chartered coach buses are also available.

Getting Around
Darwin is a compact city with dining and entertainment destinations often a short walking distance from hotels. Chartered coach services can provide transfers to offsite venues and sightseeing trips within Darwin and surrounds

Bus Services

Public buses in Darwin are run by Buslink and Territory Transit with most services operating seven days a week.

Timetables can be accessed here https://nt.gov.au/driving/public-transport-cycling/public-bus-timetables-maps-darwin

Taxis

Tel 131008, please ask the Registration Desk to assist with booking your taxi

Car Parking

Undercover parking is available for $ 9 per day, with access via both Mitchell St and Esplanade. Hotel guests have complimentary parking and will receive a parking token to exit the carpark from reception

Dining

Darwin offers a wide array of cuisine to choose from with many restaurants conveniently located on the waterfront. A great resource to use when looking for somewhere to dine is.

http://northernterritory.com/things-to-do/dining-and-entertainment?gclid=CLyR7rf-xdQCFYiXvQodAywAxA

Social Activities and Events

Welcome Reception

Sunday, 2nd July 2017, 6.00pm – 7:30pm
Watergardens and Reflections Room

Doubletree by Hilton Esplanade, 116 Esplanade
The AMSA 2017 Welcome Reception is a relaxed event, which provides a perfect opportunity to mingle with your fellow associates.

Drinks and canapés will be provided.
Entry to this event is included for Full Conference delegates.
Ticket information can be found online and can be purchased simply by adding the appropriate ticket onto your registration after logging into your profile.

Daily Yoga To Start The Conference Morning

Monday 3rd, Tuesday 4th, Wednesday 5th, and Thursday 6th July; 6.15am – 7.15am on the above days on Esplanade / Opposite the Doubletree Hilton Esplanade

Start your conference morning with a gentle flowing class of yoga to suit all levels with an emphasis on meditative movement to breath. An opportunity to gently awaken the body, steady the mind, create a focus and intention for the day ahead.

By Gold Coin Donation

Public Forum

Monday 3rd July 2017, 7.00pm
Playhouse Theatre, Darwin Entertainment Centre
Northern Development – How does marine fit? | Australia's Shallow Tropical Seas – Resoure and/or Refuge?

Northern Development was placed firmly on the national agenda in the run up to the last Federal election; it has ebbed and flowed since then. However, through all of the talk to this point, the focus has been squarely on the landward. Even with the debate on the damming of northern rivers, the arguments on either side have rarely moved into their estuaries, or beyond to our shallow seas. We are looking to tackle this omission in the Public Forum at the 2017 annual conference of the Australian Marine Sciences Association.
Members of the public are invited to join AMSA 2017 conference delegates in an exciting 'Q & A'-style event.

Entry to this event is included in all delegate registrations and free for the public, but it is required to secure your complimentary ticket via NTix

Student Night

Tuesday, 4th July 2017
7:00pm - 10pm
The Precinct, 7 Kitchener Drive, Darwin Waterfront

A social event for students and their professional guests has been organised at The Precinct, Darwin Waterfront, a 15-minute walk from the conference venue.
This will be a great opportunity to mingle with your fellow budding marine science enthusiasts and test your wits in a Trivia Quiz. It also provides a chance to unwind and chat about the exciting presentations you've seen at the conference over a complimentary drink and light refreshments.
AMSA–Northern Territory Branch is proud to support and provide complimentary pizzas for the student night.
Ticket price for this event is included in student registration.

Conference Gala Dinner

Thursday 6th July, 2017
6.30pm – 11.30pm
Heritage Lawn, George Brown Botanical Gardens.

Bus Shuttle from & to the Double Tree Hilton Esplanade will be provided

This is our chance to celebrate a fantastic conference with good food, drinks, music, company and dancing.
It will also be when the student prize winners are announced, and of course a chance for the students to judge their predecessors in the annual The Sherwood™ award for over-40s dancing.

The Conference Gala Dinner is kindly sponsored by Charles Darwin University, Research Institute for the Environment and Livelihoods.

Entry to the Conference Dinner is included for Full Conference delegates.

Each year AMSA considers nominations for the highest awards given out by the Association; the Jubilee, Technical and Allen Awards. These prestigious awards recognize the outstanding contribution of scientists, technical officers and students to the pursuit of marine science. It is with great pleasure that I announce the following winners for 2017. The contribution of these individuals has gone well above and beyond and we, as an Association, are grateful. I hope you will join me congratulating the winners. I also hope you can join us for the formal presentation at AMSA 2017 in July in Darwin.

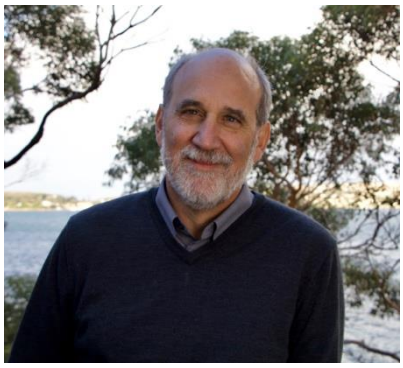
Will Figueira

President, AMSA

AMSA Jubilee Award

This award for excellence in marine research is presented to a scientist who has made an outstanding contribution to marine research in Australia.

Professor Peter Steinberg is a renowned authority in the areas of marine chemical ecology and surface colonisation (including biofilms), as well as a leading proponent of the "macro-micro" approach to environmental microbiology. He received his Ph.D from the University of California, Santa Cruz and is currently a Professor in the School of Biological, Earth & Environmental Sciences at the University of New South Wales as well as the Director and CEO of the Sydney Institute of Marine Sciences. Throughout his career he has blended traditional marine experimental ecology with natural products chemistry. Indeed, he is widely considered as one of the founders of marine chemical ecology. Moreover, Steinberg's multidisciplinary approach to understanding the colonisation of surfaces integrated marine ecology with molecular microbiology, larval biology, biofilms and synthetic chemistry to fundamentally change the way we think about interactions of both prokaryotes and eukaryotes with surfaces in the sea. This work resulted in both the first natural inhibitor of bacterial cell-cell signalling (quorum sensing) as well as the first characterised and quantified natural chemical inducer of settlement for a marine invertebrate. Most recently, over the last 10 years Professor Steinberg has incorporated cutting-



edge environmental sequencing and 'omics into his work, becoming a leader in integrating ecological theory and concepts with environmental microbiology, or the "macro-micro" approach.

AMSA Technical Award

This award recognises outstanding achievements in the field of technical support for marine sciences, to celebrate the valuable contribution logistical and support services make to enabling marine research.

Brent Womersley has been a technical officer at Fisheries Victoria since 2001, and the chief technical officer in the fisheries research section for about the last decade. Brent has been an integral part of most field research at Fisheries Victoria over the last 13-14 years. He not only provides hands-on research assistance, but is also responsible for logistical support for at times up to 5 research vessels, tow vehicles, dive operations and equipment, including Nitrox compressor, and a warehouse of field equipment. Throughout his career Brent has proved extremely versatile, adapting and acquiring new skills as required to best support the programs he is involved in. Brent has consistently maintained a high level of support for all projects he's involved in and is well respected amongst his colleagues for his unflappable nature and ability to always finds a way to get the work done. He has been a reliable leader and/or member of numerous campaigns, spending 1000's of hours at sea and 100s of hours underwater in the service of science.

Allen Award

The Allen Award is to support an outstanding postgraduate student to attend an international conference each year, in any field of marine science, with the aim of providing the student with the opportunity to gain international experience and contacts. By attending the international conference the student will serve an important role as an ambassador for Australian marine science through improving awareness in the international scientific community of the work of Australian research students.

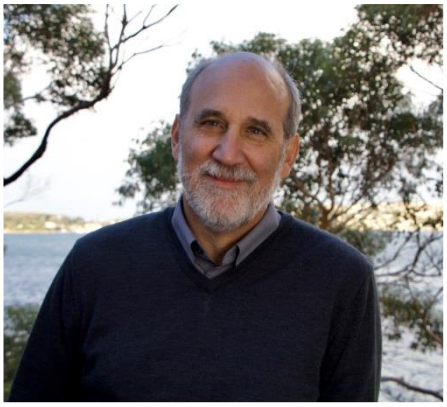
Paige Kelly is a student at the Institute for Marine and Antarctic Studies, University of Tasmania & Antarctic Climate and Ecosystems CRC. Paige's PhD research is examining the co-occurrence of salps and Antarctic krill in the Southern Ocean; she is applying a range of techniques from classic microscopy to chemical assays such as bomb calorimetry and stable isotope analysis, and finally incorporating modelling designed to understand energy flow to higher predators. In particular, Paige will examine two important energy pathways in the Southern Ocean: that which moves primary production through krill to top predators and the alternative and poorly understood HNAN-salps-higher predators pathway. If reduced duration and thickness of sea ice eventually reduce krill biomass in the Southern Ocean, then salps could become the biomass-dominant species; however, at present our understanding of salps in the ecosystem is very poor. Paige's research is both timely and important for addressing this issue. With the award Paige will be attending two conferences, the 3rd International Symposium On Krill and the Scientific Committee on Antarctic Research (SCAR) Biology Symposium 2017.

Speakers

Plenary speakers

Peter Steinberg (2017 Jubilee Award Winner)

Director and Chief Executive Officer | Sydney Institute of Marine Science
Professor of Biology | University of New South Wales



Peter Steinberg is the inaugural Director and CEO of the Sydney Institute of Marine Science (SIMS), Professor of Biology at The University of New South Wales, and Visiting Professor at the Singapore Centre for Environmental Life Sciences Engineering (SCELSE) at Nanyang Technological University in Singapore. He has 30+ years experience in a diversity of biological and ecological fields. He has been a Fulbright Scholar, a Queen Elizabeth II Fellow and CEO of an ASX-listed biotechnology company. He is a member of the Board of Australia's Integrated Marine Observing System (IMOS), a member of the National Marine Science Committee, and on the editorial boards of leading scientific journals. His research interests include: seaweed & coastal ecology; impacts of environmental change; bacterial biofilm biology and fouling; environmental technology, and; rehabilitation of coastal systems.

Talk Title: Drugs, bugs and seaweeds: multidisciplinary marine science.

I have been motivated throughout my career by the desire to integrate disparate areas of science, across scales ranging from the molecular to the biogeographical, and by the desire to translate those studies into broader societal outcomes. Early in my career in California I was part of the establishment of the new field of marine chemical ecology, integrating natural products chemistry and benthic ecology. I showed that herbivores of temperate coastal seaweeds were profoundly affected by seaweed defensive chemicals. Moving to Australia from California in the mid 80's, we found that these interactions were fundamentally different, and proposed that this was due to the difference in the structure of food webs acting over evolutionary time. Following this work at biogeographical scales, I shifted to focus on chemically mediated interactions at much smaller scales, in particular how seaweed metabolites mediated interactions between marine bacteria (including pathogens) and their seaweed hosts. Together with microbiologist colleagues, we showed that these compounds acted in a unique way, by interfering with bacterial cell-cell communication, or quorum sensing. The applied aspects of this finding led to the exploration of novel, non-biocidal antibacterials, now being developed by Unilever. The study of this interaction between bacteria and higher marine organisms, together with the broader revolution in environmental gene sequencing technologies ('omics), led me to focus increasingly on "macro-micro" interactions, integrating the significantly disparate fields of environmental microbiology and benthic ecology. This has included studies of the impact of disease on seaweed forests, and the testing of eukaryotic ecological theory in microbial communities. In the last ten years, much of my research has been done in the context of the impacts of environmental change in coastal systems, and how to build resilience into these systems in the face of these impacts. The later studies include rehabilitation projects in which we are restoring underwater kelp forests, and a variety of approaches to the "green engineering" of the marine built environment. Our research has incorporated art, community engagement, and citizen science in

order to build strong government and community support for the sustainable use of coastal environments. Finally, together with colleagues in NSW and WA, I have come full circle, returning to where I started - herbivory on seaweeds - in studies of the tropicalisation of temperate kelp forests.

Professor Helene Marsh

Distinguished Professor | James Cook University

Helene Marsh FAA, FTSE is a conservation biologist with some 40 years' experience in research into species conservation, management and policy with particular reference to tropical coastal and riverine megafauna. Helene is committed to informing interdisciplinary solutions to biodiversity conservation problems and has collaborated widely with colleagues in other disciplines including the social sciences. See https://research.jcu.edu.au/portfolio/helene.marsh The policy outcomes of her research include significant contributions to the science base of the conservation of marine megafauna in Australia and internationally at a global scale (IUCN, UNEP, Convention for Migratory Species) and by providing advice to the governments of some 14 countries. Helene has received international awards for her research and conservation from the Pew Charitable Trust, the Society of Conservation Biology and the American Society of Mammalogists. Helene chairs the Threatened Species Scientific Committee, a statutory committee that makes recommendations to the federal Minister for Environment and is a member of the Reef 2050 Plan Independent Expert Panel. She is past President of the international Society of Marine Mammalogy and Co–chair of the IUCN Sirenia Specialist Group. She is on the editorial boards of Conservation Biology, Endangered Species Research and Oecologia.

Talk Title: Ecological and cultural connections of our marine megafauna: challenges and opportunities for their conservation

Australia's tropical coastal waters support a rich megafauna that includes more some 30 species of marine mammals and six of the world's seven species of marine turtles. These species have strong ecological connections with many localities in the southern hemisphere. Humpback and minke whales make winter migrations from the Antarctic to breed. Members of five species of sea turtles that nest in Australian waters spend part of their life cycle in the Indian or Pacific Oceans. Loggerhead post-hatchlings travel as far as South America; green, loggerhead, leatherback, olive riddle and hawksbill turtles tagged at Australian nesting beaches have been caught in the waters of south-east Asian and Pacific countries. Species endemic to northern Australian coastal seas including the snubfin dolphin, Australian humpback dolphin and the flatback turtle seem to be restricted to the Sahul Shelf. Although individual dugongs have been tracked hundreds rather than thousands of kilometres, the species has ecological connections with the Western Province of PNG and possibly Timor Leste through Ashmore Reef. The sharing of dugong and turtle meat reinforces the cultural connections between coastal Indigenous peoples in remote Australia and their urban diaspora. These ecological and cultural connections provide both opportunities and challenges for conservation. All these species are listed as Matters of National Environmental Significance; some only because of their status as migratory species. Migrating humpback and minke whales and nesting loggerheads are major tourist attractions. However, several species are threatened by impacts that originate beyond Australia's jurisdictions such as marine debris. International commercial take beyond Australia's jurisdiction is a very high risk to our hawksbill turtle stocks and fisheries bycatch outside Australian waters is a very high risk to south-west Pacific loggerheads. Australia could capitalise on these connections to play a greater role in capacity building to conserve our region's rich coastal marine megafauna.

Julie Hall

Director | Sustainable Seas National Science Challenge

Julie has extensive experience in biological oceanography, with a focus on food web dynamics in both marine and freshwater ecosystems with a special interest in microbial foodwebs. As the international chair of the IMBER (Integrated Marine Biogeochemistry and Ecosystem Research) project she was responsible for leading the development and implementation of a multidisciplinary Science Plan that addresses the interaction of marine biogeochemistry and ecosystems and their response to global change. This is a wide ranging project which includes experimental and observational studies and modelling of natural and social systems. In addition her involvement in a range of projects associated with the Global Ocean Observing System has given her a broad knowledge of marine observation systems, data management and the integration of observations and models. Most recently Julie has become Director of the Sustainable Seas National Science Challenge in New Zealand. This is a large interdisciplinary project developing frameworks, tools and approaches to support ecosystem based management of New Zealand's marine resources to address the Challenge objective of "Enhancing the utilisation of our marine resources within environmental and biological constraints".

Talk Title: Integrating social science, economics, indigenous knowledge and marine science to under pin decision making for management of our marine environment.

There is an increasing demand for marine biophysical science to be put into the wider context of socio-economic impacts and indigenous knowledge to support more informed decision making in the management of our marine environment. International research programmes such as IMBER "Integrated Marine Biogeochemistry and Ecosystem Research" has developed a strong socio-economic strand to develop an understanding the sensitivity of marine biogeochemical cycles and ecosystems to global change and predicting ocean responses to global change and the effects on the Earth System and human society. In New Zealand the development of the Sustainable Seas National Science Challenge has led to an interdisciplinary research programme which integrates Mātauranga Māori, social, economic and marine biophysical research into an integrated programme to address the objective to "Enhance utilisation of our marine resources within environmental and biological constraints". There are many challenges in developing and undertaking truly interdisciplinary research projects and programmes. What have we learnt? What are the key consideration? How do we work to ensure the findings are integrated into decision making?

Dr Alistair Hobday

Senior Principal Research Scientist |CSIRO Oceans and Atmosphere

Dr Alistair Hobday is a Senior Principal Research Scientist with CSIRO Oceans and Atmosphere. His current research focuses on investigating the impacts of climate change on marine biodiversity and fishery resources, and developing, prioritising and testing adaptation options to underpin sustainable use and conservation into the future. He co-developed the Ecological Risk Assessment for the Effects of Fisheries (ERAEF) approach to risk-based management for fisheries, which has been applied in more than 15 countries around the world. He is also leading development of seasonal forecasting applications to support decision-making in marine environments.

Talk Title: Bluefin, connectivity, climate, and adaptation

Marine species typically rely on different environments at different life history stages. If preferred environments are located in different spaces, individuals must move. Such movements connect disparate regions, peoples and activities, offering a range of conservation and management challenges. Southern bluefin tuna are an exemplar of large scale ocean movements, with spawning in the Indonesia-Australian Bight, juvenile habitats in southern Australia, and non-breeding adults roaming the southern ocean. I will consider how we can better manage such wide-ranging species, particularly given the projected effects of climate change. Is dynamic management a climate-ready option, or will shifts in jurisdictional boundaries be more pragmatic? Is connectivity a challenge to adaptation, or an advantage? In times of rapid change, will pro-active management based on scientific prediction be possible, or should management supported by monitoring be responsive and flexible?

Invited speakers

Mr Tim Moltmann

IMOS Director | University of Tasmania

Tim Moltmann is the Director of Australia's Integrated Marine Observing System (IMOS), based at the University of Tasmania in Hobart. In this role he is responsible for planning and implementation of a large national collaborative research infrastructure program, which is deploying a wide range of observing equipment in the oceans around Australia and making all of the data openly available to the marine and climate science community and other stakeholders. Tim is a highly experienced Australian research leader. He has been Director of IMOS for seven years, and before that worked at the Commonwealth Scientific and Industrial Research Organisation (CSIRO) for over a decade, rising to be Deputy Chief of the Marine & Atmospheric Research Division based in Hobart. He has a particular interest in research infrastructure, and has played a lead role in major national projects relating to large research vessels, observing systems, and national marine information infrastructure. Tim's national roles include being Chair of Australia's National Marine Science Committee, Co-Chair of Australia's Forum for Operational Oceanography, and a member of national committees on Marine Biodiversity research, Environmental Information, and integrated monitoring and reporting for the Great Barrier Reef. He has worked in primary industries and fisheries at State Government level, and has extensive background experience in private industry in Australia and the UK. His international roles include being Chair of the Global Ocean Observing System Regional Alliance Forum, and an ex officio member of the Global Ocean Observing System Steering Committee. He is Australia's representative on resources forums for the Indian Ocean and Tropical Pacific observing systems. He has contributed as an invited expert to planning and review of marine research infrastructure programs in Canada, the USA, Brazil and Singapore.

Talk Title: Implementing the National Marine Science Plan

In August 2015, the National Marine Science Committee released a decadal plan (2015-25) for Australian marine science aimed at 'Driving the development of Australia's blue economy'.

Whilst national frameworks for marine science have been developed in the past, this was the first national plan developed through direct engagement with the broader Australian marine science community. This engagement involved development of community white papers, holding a National Marine Science Symposium, and wide circulation of a draft plan for comment before finalisation and release.

The 2015-25 National Marine Science Plan made eight high level recommendations as follows:

1. Create an explicit focus on the blue economy throughout the marine science system.

2. Establish and support a National Marine Baselines and Long-term Monitoring Program, to develop a comprehensive assessment of our estate, and to help manage Commonwealth and State Marine Reserves.

3. Facilitate coordinated national studies on marine system processes and resilience to enable understanding of development and climate change impacts on our marine estate.

4. Create a National Ocean Modelling System to supply the accurate, detailed knowledge and predictions of ocean state that defence, industry and government need.

5. Develop a dedicated and coordinated science program to support decision-making by policymakers and marine industry.

6. Sustain and expand the Integrated Marine Observing System to support critical climate change and coastal systems research, including coverage of key estuarine systems.

7. Develop marine science research training that is more quantitative, cross-disciplinary and congruent with the needs of industry and government.

8. Fund national research vessels for full use.

The plan also identified a number of other initiatives and activities to be pursued.

In this presentation we review progress on implementing the 2015 National Marine Science Plan some two years down the track, and outline current thinking about 'what next?'. Particular emphasis will be given to mechanisms designed to ensure ongoing engagement of the broader Australian marine science community in implementation of a plan that so many contributed to developing.

Professor Nic Bax

Senior Principal Research Scientist |CSIRO Oceans and Atmosphere

Professor Nic Bax is currently a Senior Principal Research Scientist with CSIRO's Oceans and Atmosphere Flagship and Director of the National Environmental Science Program Marine Biodiversity Hub at the Institute for Marine and Antarctic Studies, University of Tasmania. He has led research into fisheries and ecosystem assessments, invasive species, biodiversity management and the transfer of research into policy. Professor Bax works closely with the Convention on Biological Diversity and co-chairs the Global Ocean Observing Systems Biology and Ecosystems Panel.

Talk Title: Australia's 2016 State of Environment Report for the Marine Environment. Where are we and where might we be going?

SOE 2016 is the 5th national assessment written by independent experts to provide information on environmental issues to the public and decision makers. Over 150 expert scientists and managers contributed to report on and review the 70+ individual assessments. All expert input is archived on AODN. Following the DPSIR model, assessments covered, driver, pressure, state and management effectiveness. Population growth and demographic change are drivers increasingly likely to shape Australia's environment challenges in the coming decades - our 2016 population of 24 million is projected to grow to an increasingly urbanised and coastal population of 39.7 million by 2055. The main pressures facing the Australian environment remain unchanged since 2011: climate change, land use and invasive species, with marine debris and plastics a relatively recently additional threat in the marine environment. Cumulative impacts are an increasing source of concern. Main findings for the marine environment are:

- Improved single sector management and new regulations have reduced some historical pressures
- Most marine habitats, communities and species groups are in good condition overall, although individual species and communities are of concern.
- 8 additional species and 1 ecological community have been listed under the EPBC Act since 2011, however management and mitigation of threats has been limited.
- Humpback whale populations have recovered to the point where their listing could be reconsidered.
- Record high water temperatures caused widespread coral bleaching, habitat destruction and species mortality in 2011–16
- Marine debris and cumulative impacts require a new coordinated, risk-based management response including improved monitoring.

Moving forward, we need to focus on key pressures and risks while effectively addressing the complex mix of drivers, pressures and risks, including the interaction between the economy and the environmental. A sustainable environment requires leadership and action across all levels of government, business and the community, including improving environmental information, data and analysis across jurisdictions, sectors and between government and the private sector and civil society. We need a national policy and clear vision to effectively contribute to and achieve protection and sustainable management of Australia's environment.

Torres Strait Regional Authority - Jerry Stephen, Hilda Mosby and Frank Loban

Jerry Stephen | Deputy Chairperson and Member for Ugar

In August 2016 Mr Jerry Stephen was elected for the second term to the TSRA Board. Mr Stephen's previous term on the Board was 20012-2016. At the inaugural meeting of the TSRA Board in September 2016 Mr Stephen was elected as the Deputy Chairperson and Portfolio Member for Fisheries. Mr Jerry Stephen Jr, an Ugaram Le from Ugar (Stephen Island), was born and educated on Waiben (Thursday Island). He identifies as both Aboriginal and Torres Strait Islander, as his grandfather was traditionally adopted to the Wuthathi Tribe. During his last term Mr Stephen focused his work on and contributed to a number of regional issues including fisheries, native title, environmental management and regional governance. Mr Stephen has also worked in partnership with the Torres Strait Island Regional Council, Prescribed Bodies Corporate and the Ugar community Elders to address local issues and progress the development of a proposed concept plan for the Ugar rock-groyne. Mr Stephen has over 20 years experience working in the private and public sectors. His work has included the delivery of Australian Government programmes throughout the Torres Strait. Mr Stephen's will continue to work vigorously to address regional issues across Zenadth Kes (Torres Strait), including being an active member on a number of committees such as Prawn Fisheries, Finfish Fisheries, Native Title, Scientific Studies and the Raine Island Reference Group.

Hilda Mosby | TSRA Portfolio Member for Environmental Management

Ms Hilda Mosby was elected as the Member for Masig in September 2012. This is Ms Mosby's second term on the TSRA Board and first as Portfolio Member for Environmental Management. Ms Mosby has more than 17 years experience in the Australian Public Service, working for the Australian Quarantine and Inspection Service (now part of the Department of Agriculture and Water Resources), and for the Department of Immigration and Citizenship as a Movement Monitoring Officer. Ms Mosby is currently employed as the Senior Housing Officer for the Torres Strait Island Regional Council. Community involvement has been a paramount focus for Ms Mosby, who is an active member on committees dealing with education, health, justice, fisheries and Native Title in her community of Masig. Of key concern to Ms Mosby is the impact of coastal erosion on low-lying Torres Strait communities, including her own community of Masig. The preservation of Torres Strait culture through language, music and art is another area that Ms Mosby is passionate about and she will continue to advocate for the best outcomes for the cultural wellbeing of Torres Strait Islander and Aboriginal people in the region.

Frank Loban | Senior Ranger Supervisor – Near Western Cluster

Frank Loban is a descendent of the Maluiligal and Guda Maluiligal nations of the western Torres Strait and has worked in natural resource management with the TSRA now for over 10 years. In various roles with the TSRA Frank has done a lot of work with community based management of sea based resources within the Torres Strait region and has worked alongside traditional owners, local, state and commonwealth government colleagues, Papua New Guinea Treaty villagers and various Aboriginal groups from the Australian mainland. Frank has also assisted with project managing various sea based projects over the years that looked at dugong and turtle populations, nesting and foraging dugongs and turtles, intertidal and subtidal seagrass monitoring and coral monitoring. Previously Frank was a member of the Indigenous Advisory Committee to the Commonwealth Environment Minister for a term of four years until a change in government. Frank has also attended the bilateral meetings between Australia and Papua New Guinea as a part of the Torres Strait Treaty process on behalf of TSRA on several occasions. Frank currently resides on Badu Island in the Torres Strait and is employed as the Senior Ranger Supervisor for the Near Western Cluster of the Torres Strait.

Talk Title: Traditional management of marine resources in the Torres Strait'

Traditional use of marine resources are part of Aboriginal and Torres Strait Islander peoples' cultures, customs and traditions; satisfy personal, subsistence or communal needs; and are essential for the health and wellbeing of Indigenous coastal people in Australia. More than 150 Indigenous clan groups along the Australian coastline continue a longstanding connection with sea Country, leading to traditional use of marine resources across a large area of Australia.

Dugong and marine turtles are key cultural species that are customarily hunted and harvested by many coastal Indigenous communities in northern Australia. The hunting of dugong and turtle is an expression of the continuance of long cultural traditions. Recent scrutiny of the impact of traditional harvesting on dugong and marine turtle populations, including animal welfare implications, has created some conjecture and even conflict between the desire to conserve dugong and marine turtle populations, and Indigenous interest in managing the diversity of threats (e.g. marine debris and vessel strikes) and in maintaining rights to traditional use.

Support to address knowledge gaps and build on existing momentum for long-term community management of cultural resources remains a challenge for some Indigenous communities. Appropriate and effective monitoring approaches are needed to determine trends in traditional use and any impacts. A lack of understanding by the public and policy-makers about established cultural rights to traditional use undermines the collection and sharing of harvest information with broader stakeholders. Sensitivities and complexities surround the management of traditional use of marine resources, and need to be identified and handled appropriately

Community-based Dugong and Turtle Management Plans, developed to date by 14 individual Torres Strait Islander communities, are being implemented on a voluntary basis throughout the Torres Strait with the assistance of the TSRA. The Plans incorporate traditional knowledge with science and management to ensure the sustainability of populations and allow communities to self-determine

the best regulations. Both turtle and dugong have immense spiritual significance and play a vital part in the ecology and cultural economy of the region.

Moninya Roughan

Group Leader | Coastal and Regional Oceanography Lab, School of Mathematics and Statistics
UNSW

Moninya Roughan is a physical oceanographer specialising in coastal and shelf processes. Moninya's research focuses on improving dynamical understanding of coastal ocean circulation, including physical forcing mechanisms, nutrient enrichment processes and their biological impact. She uses a combination of ocean observations and numerical models. Moninya has authored over 50 publications including peer-reviewed journal papers, book chapters, international conference papers, consultancies and technical reports. Her work has been funded by a variety sources including the Australia Research Council, a number of Australian Federal and State Government programmes, the US Office of Naval Research and private consultancies. Over the past 10 years, Roughan has led the design, deployment and ongoing development of one of the most comprehensive ocean observing systems in the southern hemisphere since the inception of IMOS in 2007. Focussed on the East Australian Current, which flows downstream to New Zealand, Roughan and her IMOS team have deployed a network of moorings, HF radar, autonomous ocean gliders and floats along the coast of southeastern Australia to investigate the impact of the East Australian Current and its impact on the continental shelf circulation along Australia's most populous coastline. Prof Roughan leads a team of PhD students, postdocs and field technicians who are all active researchers. Together they have successfully completed over 100 mooring deployments on the NSW continental shelf and more than 20 autonomous glider missions. She has conducted fieldwork from Antarctica to Torres Strait, spending more than 100 days at sea on large and small research vessels. She has lived and worked in the USA, Europe and Australia, now resides in NZ. Roughan has a PhD in Physical Oceanography from UNSW Australia (2002), and spent 4 years at Scripps Institute of Oceanography as a postdoctoral scholar (2002-2006). Most recently she spent 10 years at UNSW Australia as an academic and research scientist.

Talk Title: Using 10 years of IMOS Observations to Understand Continental Shelf Processes Along SE Australia

The East Australian Current (EAC) flows as a swift jet over the narrow shelf of southeastern Australia, shedding vast eddies at the highly variable separation point. It transports heat and biota poleward and dominates the shelf circulation. These characteristics alone make it a dynamically challenging region to measure, model and predict.

Over the past 10 years NSW IMOS have developed and deployed one of the most comprehensive observing systems in the southern hemisphere. We use data from a network of shelf moorings, an HF radar system measuring surface currents and more than 25 autonomous glider missions along the coast of SE Australia, combined with the 70 years of data from the Port Hacking National Reference Station and the deep EAC transport mooring array to shed new light on the dynamics of the EAC and its impacts on the shelf circulation.

We use these vast data sets in conjunction with state of the art data assimilating numerical models to understand the spatio-temporal variability of shelf processes and water mass distributions on synoptic, seasonal and inter-annual timescales. We have quantified the cross shelf transport variability inshore of the EAC, the mechanisms driving upwelling, the dynamics of productive submesoscale eddies, the seasonal cycles in shelf waters, temperature trends and marine heatwaves and to some extent variability in the biological (phytoplankton) response. I will present a review of some of the key results from a number of recent studies.

Richard Brinkman

Research Program Leader |Sustainable Coastal Ecosystems and Industries in Tropical Australia, Australian Institute of Marine Science

Dr Richard Brinkman leads the Sustainable Coastal Ecosystems and Industries in Tropical Australia Research Program at the Australian Institute of Marine Science, Townsville, Australia. Richard is a physical oceanographer/numerical modeller with a background in applied environmental fluid dynamics and significant expertise in conducting observational and modelling based research on Australia's tropical coasts and marginal seas. He has strong experience in identifying research needs of stakeholders to deliver outcomes that benefit their operations, and has delivered projects for clients ranging from state and federal government agencies, natural resource management bodies, and a range of industries with coastal and marine interests. Richard's research interests fall within the broad topic of coastal oceanography with a focus on coupling shelf and ocean circulation, sediment dynamics on tropical coasts and physical-biological interactions at regional and local scales. His emphasis is always on delivering scientific outputs that are accessible, usable and impactful to end-users.

Talk Title: Sustainable Development of the North's Blue Economy – the role of IMOS to date, and into the future

Northern Australia is resource rich and uniquely positioned for growth, supporting existing and potential future expansion of the agriculture, fishing, aquaculture, tourism, subsea mining and oil and gas industries. Existing and likely new and expanding ports will facilitate trade critical to the economic growth of these industry sectors and the region. The North is also home to iconic coral reef and mangrove systems, major fisheries, a multibillion-dollar tourism industry and a wealth of Aboriginal and Torres Strait Islander heritage values dating back more than 60,000 years. Supporting the sustainable development of the North's Blue Economy will require careful assessment of marine environmental sustainability. Fit-for-purpose baseline data on marine environmental conditions and ecological assets has, for a decade, been delivered through IMOS observing infrastructure across Northern Australia. From managing ports and shipping activities, understanding the marine impacts of tropical agriculture and grazing, through to assessing the use of marine protected by threatened and endangered species, IMOS has provided enabling data sources to build understanding of Australia's Northern marine regions and support their sustainable development.

Robert Harcourt

Professor of Marine Ecology and Facility Leader |Animal Tracking, Integrated Marine Observing System, Dept of Biological Sciences, Macquarie University

I started snorkelling at age four and knew right then I wanted to be a marine scientist. I was an undergraduate at Adelaide and was lucky enough to be awarded a PhD scholarship to Cambridge where I spent two fantastic years in Peru studying South American fur seals. There a severe El Niño year wrought havoc on the otherwise highly productive Peruvian marine ecosystem, impressing upon me the importance of environmental variability to natural systems. From Cambridge I postdocced and lectured in Mexico, the USA, Scotland and New Zealand. I returned to Australia 20 years ago and run the Marine Predator Research group at Macquarie, where I have worked, and continue to work with some great people on a whole range of marine wildlife. Since 2006 I have lead the Integrated Marine Observing System Animal Tracking facility. My research has focused on individual differences and evolutionary mechanisms, combining observation and experimental manipulation of behaviour in the field with genetic methods and the use of technology to 'open a window' into the world of marine predators. Our research has helped transform our understanding of how animals cope with environmental extremes as they forage and breed in the oceans. In my spare time I am a keen bodysurfer, kayaker and scuba diver and dedicated underwater photographer. I am also learning to ride a longboard, slowly....

Talk Title: IMOS Animal Tracking, 10 years of age and going strong

In the first decade of IMOS, the IMOS Animal Tracking Acoustic Facility laid the foundation of a national acoustic receiver network for the Australian research community thereby facilitating the development of large scale, collaborative research using acoustic tracking methods. Acoustic tracking is now demonstrably a powerful tool for observing animal movements in Australasian coastal and continental shelf ecosystems. The IMOS Acoustic Network makes it possible for animals to be monitored over scales from 100s of meters to 100s of kilometers. Tracking animals using these tags has proven invaluable for research and monitoring of habitat use, home range size, effectiveness of marine protected areas, refinement of stock assessments, timing of long-term movements and migratory patterns, and examining biotic and abiotic factors that dictate animal distribution and movements. The IMOS Acoustic Network includes IMOS funded infrastructure: an array of receivers and a centralised database plus a large body of co-invested infrastructure to provide a coastal network totalling over 2200 acoustic receivers. There are 208 registered users on the IMOS Acoustic database. The first series of installations for IMOS AT was deployed off Ningaloo Reef in 2007. In Nov 2016, the IMOS Animal Tracking Database held more than 75 million detections from 121 species acoustically tagged across the country, with more than half of these species contributing to commercial and/or recreational fisheries. Over 5,700 animals have been acoustically tagged by the IMOS-Animal Tracking community, and on average 75% of individuals within each species have been detected by the network. The majority of animals were detected within 10 km of the tagging location (n=3006), but 240 individuals from 23 species were detected >500 km from the tagging location. IMOS AT has made important contributions to our understanding of the marine environment including refinement of the methods used in animal tracking, assessing the efficacy of MPAs, non-lethal population assessment and large scale animal movements.

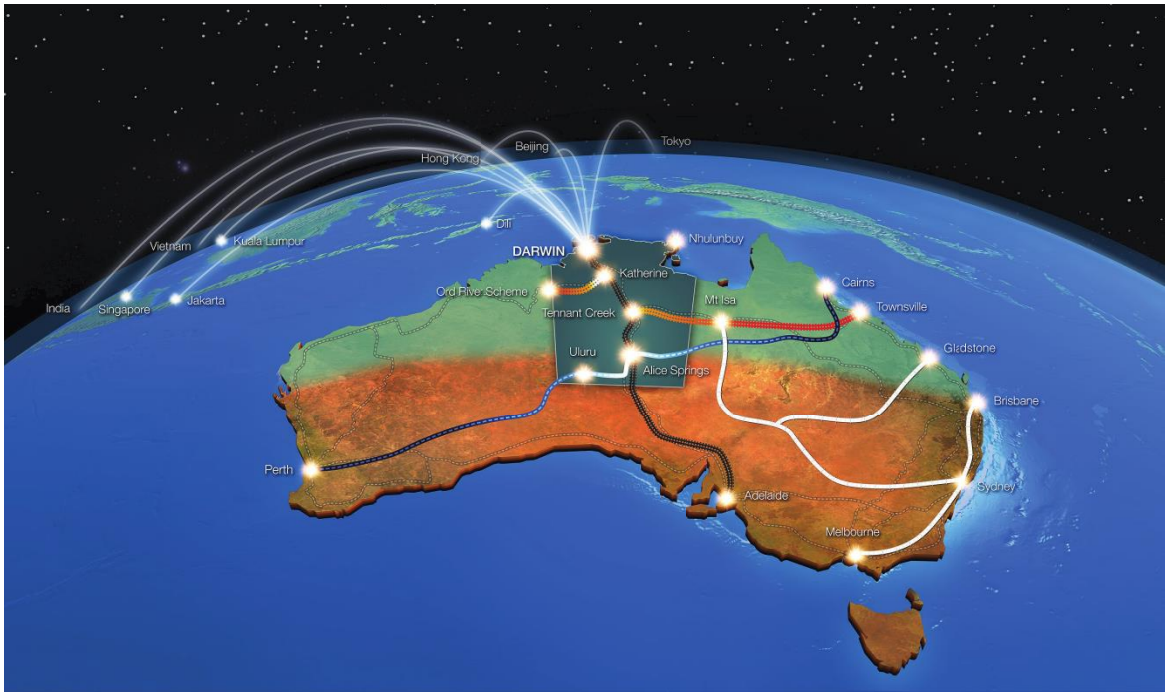
Anthony Richardson

Professor | Mathematics, Faculty of Science, University of Queensland; CSIRO Oceans and Atmosphere

Professor Anthony J. Richardson is a mathematical ecologist at the University of Queensland and CSIRO Oceans and Atmosphere. He leads a team of dedicated IMOS plankton biologists at CSIRO. His research interests are in the use of mathematical and statistical tools to understand human impacts on marine ecosystems and how best to conserve biodiversity.

Talk Title: A decade of IMOS Plankton Observations

Plankton form the base of the marine food web and are sensitive indicators of ecosystem health and global change. Biogeochemical, ecosystem and size-based models show that plankton play a pivotal role in ecosystem dynamics, fishery productivity and system resilience. Plankton – both phytoplankton and zooplankton – are a key component of the biological observing system within IMOS. It comprises two parts: the seven National Reference Stations for phytoplankton and zooplankton, and the Australian Continuous Plankton Recorder (AusCPR) survey along the east and south coasts of Australia and the Southern Ocean. This talk describes the extensive and varied plankton data collected by IMOS, illustrates the role it has played in ecosystem assessments, highlights its importance in modelling initiatives, and emphasises what we have learnt about marine ecosystems from plankton changes in terms of ocean acidification, climate change, biodiversity, fisheries and ecosystem health over the past decade.



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- Extensive strategic assets, infrastructure and natural resources unique to its location.
- Darwin has a deep water port.
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- With the key rail-port link from Adelaide to Darwin already providing the backbone, opportunities to link road and rail routes will provide a multiplier effect for trade.

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AMSA Student Prizes

The Ron Kenny Prizes

The Ron Kenny Student Presentation Prize for the best full-length oral presentation of research results and the Ron Kenny Student Poster Prize for the best poster display of research results. The prizes are named in honour of Assoc. Prof. Ron Kenny, a foundation member of the Association and editor of its *Bulletin* for nine years until his death in August 1987. The purpose of the prizes is to reward excellence in scientific work by students in any field of marine science, and to encourage a high standard of scientific communication. The prizes are provided by a special Trust Fund maintained by AMSA, and are the Association's major form of recognition and encouragement of student effort.

Peter Holloway Oceanography Prize

The prize, originating in 2002, is awarded to the best full-length student oral presentation related to Oceanography. This prize is partly funded by interest on funds donated to AMSA by the Australian Physical Oceanography Division of AMSA when it ceased to function as a separate entity in mid-2002, and from the Peter Holloway Memorial Symposium at AMSA2004 in Hobart. Peter Holloway was a highly distinguished, physical oceanographer, internationally recognized for his contribution to the observation, theory and numerical modeling of internal waves (Obituary from Marine and Freshwater Research and Obituary from EOS).

Sea World Research & Rescue Foundation Prize

The Sea World Research and Rescue Foundation (SWRRFI) has made a commitment to support the annual AMSA conference by donating a prize for the Best Student Poster in the area of Science and Conservation of Marine Vertebrates. The winning student must agree to their poster to be included as an insert in the annual SWRRFI newsletter which is distributed to the scientific, zoological, education, corporate and general communities both nationally and internationally. The SWRRFI Committee and Sea World are pleased to be able to offer financial support to students through this forum and look forward to a rewarding association with AMSA and its members.

Fisheries Research Development Corporation Prize

The Fisheries Research and Development Corporation (FRDC) student prize was first awarded in 2002. FRDC student prizes are supported by funding from the FRDC on behalf of the Australian Government. The FRDC sponsored prizes are to be given to any category of student presenting within one year of completing their respective study course. The subject matter of the talk/poster must be consistent with Programs 1 or 2 of FRDC's Research and Development Plan, namely Natural Resources Sustainability and Industry Development. If no suitable winners are identified, a prize will be withheld. As a condition of acceptance of this prize, FRDC is to be provided with profiles, photos and write-ups of the prize-winners and their research for consideration for publication in FRDC's regular newsletter, or social media.

Ernest Hodgkin Estuary Research Prize

Donated by The Committee of the Ernest Hodgkin Trust for Estuary Education and Research, this prize is to be awarded annually for the best student presentation on research that will facilitate a greater understanding of estuarine processes and management.

Victorian Marine Science Consortium Prize

The Victorian Marine Science Consortium (VMSC) is a consortium of five Victorian tertiary institutions (Deakin University, Monash University, RMIT University, The University of Melbourne and Victoria University), together with CSIRO, EPA Victoria, and the State Government's Marine and Freshwater Fisheries Research Institute (MAFFRI). VMSC operates marine teaching and research laboratories at Queenscliff, on the entrance to Port Phillip Bay, a large embayment on the southeast coast of Australia. The VMSC facilities are available through negotiation to anyone with an interest in marine science.

The VMSC Management Committee aim to provide encouragement to young scientists and have sponsored an annual student prize for best presentation on temperate marine sciences made at the AMSA annual conference.

Eligibity - apply to all AMSA Student Prizes

- Must be a financial student* member of AMSA
- The work presented has to have been done as part of the research project to fulfil the requirements of the award of a research degree (i.e. PG Diploma, Honours, Masters or PhD) and be presented within 12 months of graduation from the respective degree

- All student members are eligible and, if no longer a student at the time of the conference, can be considered for prizes if presenting work done for their research degree if it was submitted within the twelve months preceding the conference
- The date the degree was awarded must be vouched for by the thesis supervisor
- The student is responsible for ensuring that approval from University and/or funding organisations has been granted for the presentation

Award Rules – apply to all AMSA Student Prizes

- The Presentation and Poster (PEP Talk at AMSA 2017) Prize awards shall be decided by AMSA Council or its appointed Committee. If there are more than five suitable entries in either category, a second prize of such amount as decided by Council may be awarded in that category. A written citation will accompany each prize;
- The prizes shall be awarded on the determination of a Prizes Committee appointed by the Council of the Association, representing both the Council and the Conference Organising Committee. The decision of the Prizes Committee shall be final;
- The Prizes Committee, noting the dual objectives of recognising and encouraging student effort, may take the age and experience of students into account in reaching its decision;
- In judging the oral presentation, the Prizes Committee shall consider clarity of expression, originality, the standard of the scientific contribution, and the presentation (including the ability to stay within the allotted time);
- Oral presentation and posters may include review of expository materials, progress reports, or substantive research results;
- In judging the posters (PEP Talks at AMSA 2017), the Prizes Committee shall consider effective use of the poster medium to communicate information, originality and standard of the scientific contribution. Expensive, high-quality graphics and similar digital material provided by institutions or external agencies will not be a major consideration;
- Council reserves the right not to award the prizes, or to award only the first prize in each case, if it deems that entries are not of sufficient calibre;
- A brief personal profile and a photograph of the winner are to be submitted by each prize winner to the *Bulletin* Editor by the end of the month in which the conference is held for publication in the AMSA *Bulletin*.

Conference Themes, Symposia and Workshops

Conference symposia

S1: How can marine science better guide environmental decision-makers? (Convener: Terry Walshe)

The global oceans are facing pressures from a complexity of stressors driven by local, regional and global factors. This complexity is amplified by risks to a diversity of environmental, social and economic interests. Further, the science reporting on the state of the oceans and what it means for people and economies is often opaque, techno-centric and not easily translated to policy advice. As a consequence, environmental policy-makers are often left with judgment calls as the only practical solution, rather than transparent decision-making informed by the best available science. The purpose of this session is to bring a group of enthusiastic speakers and a large audience together around this problem in the marine research and policy arena. Presentations are invited from a wide range of field to bring their approaches and examples of useful decision analyses to the table.

Sponsor of How can marine science better guide environmental decision-makers?

S2: Sustainable estuaries and societal benefits: linkages, challenges and future trade-offs. (Convener: Fiona Valesini)

There are few other environments where the concepts of 'connectivity' and 'sustainability' across natural-societal realms come into sharper focus than in estuaries. These diverse and productive ecosystems provide connective pathways from catchment to coast, and are major nuclei for people given the extensive societal benefits they provide. Seven of the eight Australian capital cities and 22 of the 32 largest cities globally are located on estuaries, which has, however, led to them becoming among the most degraded of all aquatic ecosystems. Resultant threats to food security, safety, livelihoods, culture and diversity provide clear evidence of the tight interdependence between environmental and societal sustainability in these systems. Maintaining or remediating estuarine health is a global challenge, reflecting their complexity, often highly modified states, myriad of uses and users, conflicts over preserving ecological vs economic interests and the need for truly collaborative efforts across research disciplines, stakeholders and institutions. Presentations are invited in the areas of: Understanding trade-offs in estuarine and societal health, estuarine and/or societal health indices, resilience and 'tipping points, quantifying estuarine ecosystem services, approaches for supporting adaptive management across estuarine-societal systems, and Forecasting system change under future scenarios.

Sponsor of Sustainable estuaries and societal benefits: linkages, challenges and future trade-offs. – Regional Estuaries Initiative

S3: Building resilient urban ports and harbours through globally integrated research and management (Conveners: Beth Strain and Peter Steinberg)

The World Harbour Project brings together 26 international harbours and ports tackling issues around the multiple uses of harbours. The WHP facilitates programs investigating and restoring ecosystem functioning and the development of management best-practices through 4 working groups – Water and Sediment Quality, Green Engineering, Conflict Resolution, and Education. Presentations are invited from researchers working in harbours worldwide, both scientific and social science perspectives.

Sponsor of Building resilient urban ports and harbours through globally integrated research and management – World Harbour Project

S5: Ecological diversity and connectivity in the tropical eastern Indian Ocean (Convener: Zoe Richards)

The Indo-Pacific is an extremely large marine realm that unites two oceans via a restricted Coral Triangle corridor. A large body of research exists that describes the patterns and processes responsible for the diversity in the Central and West Pacific but the Indian Ocean has up until now been largely neglected. This symposium session will showcase the results of recent research conducted in the NE Indian Ocean and highlight the diversity and ecological connectivity in the region. The session will explore how the diversity of the region is currently managed and how traditional knowledge and new technologies could be further incorporated into future management to safeguard the unique marine resources of the NE Indian Ocean.

S6: Remote sensing techniques for marine sciences (Conveners: Zhi Huang and Jamie Treleaven)

Marine Remote Sensing has been evolving towards a multi-platforms and multi-sensors integrated system. A range of optical, radar and acoustic sensors can be mounted on a variety of platforms such as satellites, aeroplanes, ships, and airborne/underwater AUVs to detect and monitor marine and coastal phenomena from local to global scales. Successful applications of remote sensing technology have been demonstrated in all disciplines of marine sciences including marine geology, oceanography and marine biology and ecology. As a result, the National Marine Science Plan (2015-2025) has called for the increased and improved use of remote sensing technology to help tackle the challenges currently facing Australia's marine estate. This symposium aims to demonstrate current and future applications of remote sensing technology in marine estate. Presentations are invited from all aspects of marine remote sensing, in particular, the applications related to the theme of this conference ("Connections through shallow seas") and the applications of emerging marine sensors such as Himawari 8 and Sentinel 3.

Sponsor of Remote sensing techniques for marine sciences - Bureau of Meteorology

S7: The use of acoustics for the exploration and management of the marine environment. (Conveners: David Williams and Kim Picard)

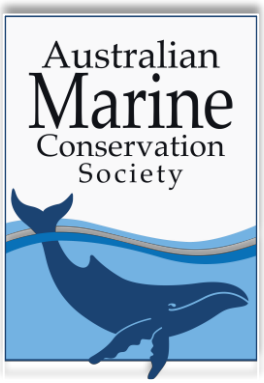
The field of acoustics is developing rapidly due to quantum changes in electronic miniaturisation and availability of smaller and at the same time more powerful computing facilities. Acoustics work well in sea water, the signal can readily propagate through the water column and the result can be rich in information on ocean currents, suspended matter, ocean bed properties, net material fluxes, imagery and fish passage. Acoustic technology can be used from both fixed and moving platforms and is suitable to use from all our existing vessels as well as the newer platforms such as ROV's and AUV's. Acoustic methods encompass both passive and active acoustics. Passive acoustic examples are fish tagging methods and noise logging. Both have revealed new insights in biological oceanic processes and have allowed new links between biology and physics to be formed. Active acoustic examples are current profilers and multi beam echo sounders. The rapid advancement of these technologies are allowing never before seen detail in ocean processes to come to light in reasonable simplicity and in near real time. Presentations are invited from all acoustic related fields.

S8: Noise impacts on marine life (Convener: Rachel Przeslawski)

The extent to which anthropogenic noise in the world's oceans impacts marine fauna is a subject of growing concern. Sources of marine anthropogenic noise include high-intensity acute sounds produced by activities such as military exercises, oil and gas exploration, pile-driving as well as lower-level chronic noise generated by commercial shipping and recreational and commercial fishing vessels. Many marine animals, from small invertebrates to large cetaceans, make extensive use of underwater sounds for important biological activities such as intraspecific communication, predator avoidance, navigation, larval orientation, foraging and reproduction. Potential effects of anthropogenic sound sources on marine animals range from disturbance that may lead to displacement from feeding or breeding areas, to auditory damage, tissue trauma and mortality. Alternatively, some marine species may experience no effect of exposure to intense sources, particularly if the spectral level does not exceed hearing thresholds. Presentations are invited from ecology, physics, and policy to showcase leading research on noise impacts on Australian marine life.

S9: Integrating science to support management in the Kimberley (Conveners: Stuart Field and Kelly Waples)

The Kimberley, considered one of the last great wilderness areas, is subject to a slow increase in human pressures in the form of industry development and tourism. The Kimberley marine coastal system represents a complex and dynamic environment characterised by an extreme tidal range, ria coastline, turbid waters and fringing coral reef systems that support a high level of biodiversity including iconic marine fauna such as dugongs, turtles and whales. Aboriginal people have inhabited the Kimberley coastal region for countless generations and possess a strong attachment to country. Their responsibility for the sustainable management of Kimberley coastal country spans millennia and continues in the present day through their healthy country plans. In 2011 the Western Australian government announced the Kimberley Science and Conservation Strategy which includes the creation of a network of marine protected areas to conserve these valuable marine resources in collaboration with Traditional Owners. Building a regional understanding of the Kimberley waters and associated habitats and wildlife is critical to the long term conservation management of this unique marine environment. This symposium will present a range of research across themes and disciplines to provide an integrated picture of the physical, biological and social world of the Kimberley marine environment that can be used to support sustainable joint management of the region.



Sponsor of Integrating science to support management in the Kimberley

S10: Climate impacts on marine system structure and function: molecules to ecosystems (Conveners: Karlie McDonald and Alistair Hobday)

The effects of anthropogenic global environmental change on biotic and abiotic processes have been reported in aquatic systems across the world. This global change has manifested in marine systems through altered oceanographic, biogeochemical and hydrological mechanisms that regulate marine system structure and functioning at different spatial and biological scales. Complex synergies between concurrent environmental stressors and the resilience of the system variables to trophic cascades, which vary in space and time, determine the capacity for marine systems to maintain structure and functioning with global environmental change. Consequently, to effectively understand, quantify and predict climate impacts on marine systems, an interdisciplinary approach that facilitates the exchange of knowledge and the development of new methods across spatial and biological scales is required. The objective of this session is to integrate scientific knowledge of climate-induced change on the functioning of marine systems through the presentation of innovative research findings and technologies across multiple spatial and biological scales. Presentations are invited on novel approaches and recent advances in methods that utilise extensive datasets at different spatial and biological scales to further process-based understanding of marine system functioning in a globally changing environment. A special issue of Marine and Freshwater Research will be developed in association with this symposium.

S11: Crossing boundaries with marine genomics: new techniques, applications and integration. (Convener: Allyson O'Brien)

Genomics is a rapidly advancing field of research that is used in many different disciplines worldwide. The application of genomics has relatively recently been used to study organisms in marine environments. This symposium will provide the opportunity to bring together students, researchers and practitioners using genomics in the Australian marine environment. Any field of research that is adapted for a new system provides opportunities for interactions between different disciplines. We would like to encourage speakers to present research that demonstrates the combination of genomics with other disciplines such as ecotoxicology, ecology, biogeography, invasive species management, environmental monitoring, marine megafauna, fisheries and aquaculture. Presentations could also focus on innovative ideas and solutions solving challenges associated with using genomics in the marine environment; including sampling design, laboratory protocols and bioinformatics.

S12: Migratory fishes and their fisheries (Convener: Lynnath Beckley)

Around Australia, there is a diverse range of fishes that migrate over various distances (and sometimes between jurisdictions) through estuaries, coastal waters and across oceans (e.g., barramundi, Australian herring, tuna, sharks etc.). Many of these fish species are targeted by commercial, recreational, subsistence and/or traditional fisheries. In this symposium, papers will be encouraged that combine new information on the migratory behaviour and pathways of fishes with the human dimension in terms of the fisheries they support.

S13: Commonwealth Marine Parks: research for management (Convener: Amanda Parr)

Australian Marine Parks, also known as Commonwealth Marine Reserves, cover around a third of Australia's Exclusive Economic Zone and include sub-Antarctic to tropical environments. This symposium will address the range of knowledge about these vast and diverse offshore marine environments and discuss how this knowledge is, or can be, used in managing Australian Marine Parks. Presentations are invited that address the following questions: How do we improve our scientific understanding of these ecosystems? How to integrate our knowledge across marine science disciplines? How do we best ensure that the information is useful for managers? What are the highest priorities for research in Australian Marine Parks?

Australian Government
Parks Australia

Sponsor of Commonwealth for Marine Parks research management - Parks Australia

S15: Great Australian Bight – seeking whole-of-system understanding (Convener: Jason Tanner)

The Great Australian Bight (GAB) is part of the world's longest southern facing coastline. Its unusually broad continental shelf also supports the world's largest temperate carbonate production system and has high levels of benthic biodiversity and endemism. Previous marine research in the GAB was concentrated in coastal waters and more recently on the continental shelf. The deep water assemblages and ecosystems of the GAB are poorly understood. Commonwealth and State governments, existing commercial users and a diverse range of

academic, community and environmental groups have identified the need to develop a better understanding of the region's environmental values, regulatory needs and development potential of the GAB. A complex array of ecological, economic and social issues needs to be addressed to optimize management of future activities. This symposium will include results from a large, integrated study of the ecological processes and socio-economic importance of the GAB that is being conducted through a collaborative research partnership involving two research agencies (CSIRO, South Australian Research and Development Institute), two universities (University of Adelaide, Flinders University of South Australia) and BP Australia.

S16: Observing the tropical northern waters (Conveners: Ana Lara-Lopez, Craig Steinberg and David Williams)

Many of Australia's most precious marine natural assets are located in the tropical northern seas. This area spans the iconic Ningaloo Reef in the west to the Great Barrier Reef in the east with the neighbouring Kimberley, Kakadu and Daintree rainforest in between. In addition, it is a region of major economic activities such as mining, agriculture, shipping, fishing, urban development, tourism and recreation. With the Integrated Marine Observing System completing its first decade, and a commensurate development of modelling systems and capability, this is allowing an unprecedented ability to gain an understanding of the coastal and marine environment and the extent to which they can accommodate economic development. For this symposium, we are seeking papers that showcase the available observational data and modelling applications in Australia's Northern waters and what we are learning from them.

S17: Swimming the Talk: Management of Marine Megafauna in Australian Waters (Conveners: Carol Palmer and Holly Raudino)

There are knowledge gaps for most marine megafauna species in Australia and many have an unresolved conservation status. Resources are limited which necessitates prioritisation of effort to those species where management actions will have the greatest on-ground benefit. However, this generally excludes actions that may resolve the conservation status of marine megafauna species. Given increasing pressure to develop northern Australia in particular, resolving the conservation status or at least determination of current population trends of vulnerable coastal species should also be a priority. Presentations are invited on the conservation of marine mega fauna.

S18: Marine spatial planning (Convener: Hugh Kirkman)

Marine spatial planning allows all stakeholders to take part in planning and managing marine and coastal issues. Ecosystem-based management and resource use, marine protected areas shipping, cable and pipeline placement, offshore structures, fisheries, aquaculture, coastal development, climate change, ports and channel dredging, are all issues where the stakeholders need to integrate, govern and plan. Presentations are invited from researchers and managers involved in marine spatial planning.

S20: Small-scale commercial marine harvest: challenges and opportunities (Convener: Karen Gibb)

Artisanal and small-scale aquaculture programs represent foundational fisheries and aquaculture programs that could provide the catalyst for rolling out commercial fisheries ventures for remote and Indigenous communities locally and regionally. Sea-based aquaculture has the potential to drive new growth in remote communities, generating economic and employment opportunities for Indigenous people. However there are significant challenges in these small-scale programs – particularly when establishing governance and economic frameworks, quality assurance and compliance standards. However these additional requirements can also provide opportunities for up-skilling and economic opportunities. There is mounting evidence that co-operative knowledge, respected and shared, is pivotal if the venture is to be successful. This symposium will provide an opportunity to explore these issues. Presentations are invited in the areas of: Artisanal, Indigenous and small-scale aquaculture, opportunities and examples of shared knowledge in a range of enterprises, and lessons learnt that might inform the development of other small-scale aquaculture enterprises.

Conference Themes

G1: Marine fundamentals

Talks in this session will cover a broad range of topics that are not covered in other symposia: marine ecology, marine biology, marine chemistry, marine geology and oceanography.

G2: Marine food security

Talks within this general session will cover the topics: aquaculture, biosecurity and marine fisheries

G4: Arafura and Timor Seas Ecosystems

Talks in this session will cover all aspects of marine science in the Arafura and Timor Seas (this session is looking for a regional focus, including studies under the Arafura & Timor Seas Ecosystem Action (ATSEA) program)

G5: Looking to the future

Talks in this session will look to the future issues facing the marine environment as well new opportunities, future collaborations.

Workshops

Indigenous engagement workshop

Title: 'Furthering sea country research through advancing Indigenous collaborations with marine scientists'

The NZMSS and AMSA 2016 Indigenous engagement workshop was held to provide the opportunity to start discussions and identify issues around Indigenous engagement in marine science. A major driver for the workshop was the need for more effective and meaningful collaborations between

marine scientists and Indigenous groups in the area of sea country research. The follow up Indigenous engagement workshop being held at AMSA2017 intends to start the conversation around what is needed to develop collaborations through:

- Sharing examples of successful engagement: how did the partners get started on their collaborative research projects, why do they think these collaborations worked, how did the partners work together to troubleshoot problems along their journey and what were some potential road blocks that would have stopped their collaboration.
- Providing marine scientists with information on some key resources that are available to help them begin, so they can start on their journey of appropriate Indigenous engagement.
- Panel discussion around how and when to engage and what is still required to have successful engagement in sea country research collaborations.

This exchange of experiences, resources and knowledge will facilitate achieving the workshop objective 'To promote Indigenous engagement in marine science by sharing information on successes and identifying what can be done to advance meaningful collaborations'.

The Sydney Institute of Marine Science

Established in 2005 and based at Chowder Bay on Sydney Harbour, SIMS (www.sims.org.au) is NSW's leading multidisciplinary marine institute. Formed through a collaboration of its founding partners, the University of NSW Australia, University of Sydney, Macquarie University and University of Technology Sydney, the collaborative structure of SIMS now includes five NSW universities, two NSW State Government Departments and the Australian Museum. SIMS has over 100 scientists and graduate students associated with the Institute, representing a broad diversity of skills in marine science. SIMS is located in Sydney, Australia's largest city, and as humanity becomes increasingly urbanised on a global scale, cities across the world must manage the challenges brought about by increasing population, development and competing uses in their waterways. In recognition of the need to address urban marine and estuarine sustainability, SIMS initiated The World Harbour Project (www.worldharbourproject.org) in late 2014. The World Harbour Project (WHP) aims to help build resilient and productive global urban ports and harbours through an increased understanding of shared values and threats. The Project is a global network of 26 partner cities, including Darwin, the host city of this year's AMSA Annual Conference. SIMS and the World Harbour Project are pleased to sponsor Symposium S3: *Building resilient urban ports and harbours through globally integrated research and management.*

sims sydney institute of marine science

world harbour project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AMSA Conference Program in Brief

The featured schedule was accurate as of the final print date. Please be aware that this is, therefore, subject to unforeseen last minute changes.

Sunday 2nd July 2017

18:00	Welcome Function	Reflections Room, DoubleTree by Hilton

Monday 3rd July 2017

8:15	Registration opens	Foyer Darwin Entertainment Centre
8:30 – 8:45	Conference Welcome	Playhouse Theatre, Darwin Entertainment Centre
8:45 – 8:55	Official opening	Playhouse Theatre, Darwin Entertainment Centre
8:55 – 9:30	Helene Marsh Plenary Address	Playhouse Theatre, Darwin Entertainment Centre
9:30 – 9:50	Tim Moltmann Invited	Playhouse Theatre, Darwin Entertainment Centre
10:00 – 10:30	Morning Tea	Reflections Room, DoubleTree by Hilton
10:30 -12:30	Concurrent Sessions	Various rooms
12:30 – 13:30	Lunch	Reflections Room, DoubleTree by Hilton
13:30 – 15:10	Concurrent Sessions	Various rooms
15:10 – 15:40	Afternoon Tea	Reflections Room, DoubleTree by Hilton
15:40 – 17:00	Concurrent Sessions	Various rooms
19:00	Public Forum	Playhouse Theatre, Darwin Entertainment Centre

Tuesday 4th July 2017

8:15	Registration opens	Foyer Darwin Entertainment Centre
8:30 – 8:35	Conference Welcome	Playhouse Theatre, Darwin Entertainment Centre
8:35 – 8:45	Presentations of Technical Awards	Playhouse Theatre, Darwin Entertainment Centre
8:45 – 9:20	Julie Hall Plenary Address	Playhouse Theatre, Darwin Entertainment Centre
9:20 – 9:40	Nic Bax Invited	Playhouse Theatre, Darwin Entertainment Centre
9:40 – 10:00	TSRA Invited (Jerry Stephen, Hilda Mosby and Mr Frank Loban)	Playhouse Theatre, Darwin Entertainment Centre
10:00 – 10:30	Morning Tea	Reflections Room, DoubleTree by Hilton
10:30 -12:30	Concurrent Sessions	Various rooms
12:30 – 13:30	Lunch	Reflections Room, DoubleTree by Hilton
13:30 – 15:10	Concurrent Sessions	Various rooms
15:10 – 15:40	Afternoon Tea	Reflections Room, DoubleTree by Hilton
15:40 – 17:00	Concurrent Sessions	Various rooms
19:00	Student night	The Precinct, Darwin Waterfront

Wednesday 5th July 2017

8:15	Registration opens	Foyer Darwin Entertainment Centre
8:30 – 8:35	Conference Welcome	Playhouse Theatre, Darwin Entertainment Centre
8:35 – 8:45	Presentations of Jubilee Award	Playhouse Theatre, Darwin Entertainment Centre
8:45 – 9:20	Jubilee Award Plenary Address	Playhouse Theatre, Darwin Entertainment Centre
9:20 – 9:55	Alistair Hobday Plenary Address	Playhouse Theatre, Darwin Entertainment Centre
9:55 – 10:30	Morning Tea	Reflections Room, DoubleTree by Hilton
10:30 – 12:30	Concurrent Sessions	Various rooms
12:30 – 13:30	Lunch	Reflections Room, DoubleTree by Hilton
13:30 – 15:10	Concurrent Sessions	Various rooms
15:10 – 15:40	Afternoon Tea	Reflections Room, DoubleTree by Hilton
15:40 – 17:00	Concurrent Sessions	Various rooms
17:30 – 20:30	Using Novel Technologies to Answer Key Questions in Marine Science workshop	Ballroom, DoubleTree by Hilton

Thursday 6th July 2017

8:15	Registration opens	Foyer Darwin Entertainment Centre
8:30 – 8:35	Conference Welcome	Playhouse Theatre, Darwin Entertainment Centre
8:35 – 8:55	Moninya Roughan Invited	Playhouse Theatre, Darwin Entertainment Centre
8:55 – 9:15	Richard Brinkman Invited	Playhouse Theatre, Darwin Entertainment Centre
9:15 – 9:35	Robert Harcout Invited	Playhouse Theatre, Darwin Entertainment Centre
9:35 – 9:55	Anthony Richardson Invited	Playhouse Theatre, Darwin Entertainment Centre
9:55 – 10:30	Morning Tea	Reflections Room, DoubleTree by Hilton
10:30 -12:30	Concurrent Sessions	Various rooms
12:30 – 13:30	Lunch	Reflections Room, DoubleTree by Hilton
13:30 – 15:15	Concurrent Sessions	Various rooms
15:15 – 15:40	Afternoon Tea	Reflections Room, DoubleTree by Hilton
15:40 – 17:00	Concurrent Sessions	Various rooms
19:00	Gala Dinner	

Friday 7th July 2017

9:00-15:00	Indigenous Engagement workshop	Ballroom, DoubleTree by Hilton
15:15 – 16:45	Getting Published workshop	Charles Darwin University Waterfront 21 Kitchener Dr, Darwin City.

Saturday 8th July 2017

11:00 – 19:00	Connectivity and Coastal Habitat Utilisation workshop (includes Sea Darwin Sadgroves creek tour)	Charles Darwin University Waterfront 21 Kitchener Dr, Darwin City

Full schedule

	Sunday 2nd July 2017				
14:00	**Registration opens -** Reflections room, DoubleTree by Hilton Darwin Esplanade				
18:00	**WELCOME FUNCTION -** Reflections room, DoubleTree by Hilton Darwin Esplanade				
	Monday 3rd July 2017				
7:30	Registration opens				
	Room: Playhouse theatre				
8.30-8.35	**Welcome to Country**				
8.35-8.45	**Introduction: Edward Butler**				
8.45-8.55	**Official Opening: Honourable Lauren Moss MLA**				
8.55-9.30	**Plenary address: Professor Helene Marsh '** *Ecological and cultural connections through coastal seas enabled by marine megafauna '*				
9.30-9.50	**Invited speaker: Mr Tim Moltmann** *'Implementing the National Marine Science Plan'*				
9.50 -10.30	**Morning tea**				
	Session 1: Playhouse theatre	**Session 2: Ballroom 1**	**Session 3: Ballroom 2**	**Session 4: Litchfield room**	**Session 5: Gallery**
	S3: Building resilient urban ports and harbours through globally integrated research and management	S5: Ecological diversity and connectivity in the tropical eastern Indian Ocean	S17: Swimming the talk: management of marine megafauna in Australian waters	S15: Great Australian Bight – seeking whole-of-system understanding	G1:Marine fundamentals
	Chair: Peter Steinberg and Beth Strain	Chair: Zoe Richards, Kathryn McMahon and Jim Underwood	Chair: Holly Raudino and Carol Palmer	Chair: Jason Tanner	Chair: Claire Streten
10:25- 10:30	**Peter Steinberg:** Introduction to the symposium				
10.30-10.50	**Niels Munksgaard:** Metal and metalloid concentrations in Darwin Harbour sediment: influence of urban development	**Zoe Richards:** The Kimberley - Australia's great unsung coral sanctuary	**Carol Palmer:** A Preliminary Study of the Movement Patterns of False Killer Whales Pseudorca crassidens in Waters of the Northern Territory, Australia.	**Ben Baghurst:** The Great Australian Bight Research Program - seeking whole of system understanding	**Fallen Teoh:** Comparative whole membrane proteomics analyses of marine cyanobacteria
10.50-11.10	**Elisabeth Strain:** The efficacy of eco-engineered interventions for enhancing the native biodiversity of seawalls in harbours across the globe.	**Fabio Boschetti:** Setting priorities for conservation initiatives at the interface between ecological connectivity, ocean circulation and ecological dynamics	**Holly Raudino:** Identifying critical habitat for dolphins in North Western Australia	**David Griffin:** Circulation of the Great Australian Bight: the influence of waves and the Leeuwin Current. Presented by Peter Oke	**Rachel Manassa:** Photosynthetic acclimation to desiccation stress in Zostera muelleri

	Monday 3rd July 2017				
	Session 1: Playhouse theatre	**Session 2: Ballroom 1**	**Session 3: Ballroom 2**	**Session 4: Litchfield room**	**Session 5: Gallery**
	Symposium S3	Symposium S5	Symposium S17	Symposium S15	G1:Marine fundamentals
	Chair: Peter Steinberg and Beth Strain	Chair: Zoe Richards, Kathryn McMahon and Jim Underwood	Chair: Holly Raudino and Carol Palmer	Chair: Jason Tanner	Chair: Claire Streten
11.10-11.30	**Katherine Dafforn:** The ecological consequences of urban seascapes at the microbial scale	**Kathryn McMahon:** Patterns in diversity of seagrasses in the tropical Indian Ocean	**Rachel Groom:** Distribution and abundance of Dugong in the Northern Territory	**John Middleton:** The ocean circulation and dynamics of the Great Australian Bight: model results and validation	**Talia Stelling-Wood:** Using functional traits to predict biodiversity in subtidal macroalgae systems.
11.30-11.50	**Sarah Kienker:** Australasian differences in Stakeholder attitudes towards ecological engineering of Marine artificial structures	**Jim Underwood:** Expect the unexpected: remarkable genetic divergence among and within the wild coral reefs of the Kimberley	**David Curmi:** Monitoring and management of sea turtles and other marine megafauna in the Thamarrurr Region - where to from here?	**Nicole Patten:** Shifts in plankton community composition in the Great Australian Bight: New insights into food web dynamics. Presented by Paul van Ruth	**Euan Provost:** Climate-driven disparities among ecological interactions threaten kelp forest persistence
11.50-12.10	**Keliang Chen:** Challenges and Experiences in Xiamen's Blue Bay Remediation Action	**Made Pharmawati:** Microsatellite DNA analysis of genetic diversity in Enhalus acoroides in Indonesia	**Duane March:** Assessing states of health and disease in stranded green sea turtles (Chelonia mydas)	**Jochen Kaempf:** Discovery of Widespread Autumn Phytoplankton Blooms in the Great Australian Bight	**Victor Shelamoff:** Patch characteristics of Ecklonia radiata influence associated community structure
12.10-12.15	***PEP*** **- Jeff Tsang:** Assessment of Arsenic Bioavailability in Darwin Harbour Sediment	***PEP*** **- James Gilmour:** Scales of stock-recruitment and the resilience of isolated coral reefs	***PEP*** **- Ricardo Alvarez:** Spatial distribution patterns in South American in-shore dolphins.	**Lisa-ann Gershwin:** Siphonophores: fearsome predators in oceanic food webs	***PEP*** **- Megan Carve Luzardo:** Impacts to seagrass from the herbicide Fusilade Forte® in management of Spartina anglica infestations
12.15-12.20	***PEP*** **- Shin Ushiama:** Designing fish-friendly seawalls	***PEP*** **- Oliver Berry:** Isolation of oceanic and coastal populations of the harvested mother-of-pearl shell *Tectus niloticus* in the Kimberley. Presented by Mike Travers			***PEP*** **- Francesca Gissi:** Using the SeaSim facility for ecotoxicology - testing the effects of Ni and Cu on the adult hard coral *Acropora muricata.*
12.20-12.25	***PEP*** **- Stuart Pearson:** Jakarta Bay as an opportunity for collaborative and integrative research and the need for knowledge brokering	***PEP*** **- Catherine Kim:** Biodiversity of coral reef cryptofauna in relation to coral habitat and reef fish communities in Timor-Leste			***PEP*** **- Allyson O'Brien:** Going back to basics: population dynamics and ecotoxicology
12.25-12.30	***PEP*** **- Jean Chai Yee:** Yard in the marinas - the initiation of WHP in Penang	***PEP*** **- Katrina West:** The application of eDNA metabarcoding for marine biodiversity monitoring at the Cocos-Keeling Islands.			
12.30-13.30	**Lunch**				

	Monday 3rd July 2017				
	Session 1: Playhouse theatre	**Session 2: Ballroom 1**	**Session 3: Ballroom 2**	**Session 4: Litchfield room**	**Session 5: Gallery**
	Symposium S3	Symposium S5	Symposium S17	Symposium S15	G1:Marine fundamentals
	Chair: Peter Steinberg and Beth Strain	Chair: Zoe Richards, Kathryn McMahon and Jim Underwood	Chair: Holly Raudino and Carol Palmer	Chair: Jason Tanner	Chair: Claire Streten
13.30-13.50	**John Lee:** Assessment of human-induced change and biological risk posed by contaminants in estuarine sediments: a scheme for assessing global harbour estuaries	**Thor Saunders:** Optimising the management of tropical reef fish	**Luciana Ferreira:** The trophic role of a large marine predator, the tiger shark Galeocerdo cuvier	**Rudy Kloser:** Exploring the slope/offshore Great Australian Bight (GAB) pelagic habitat paradox	**Brendan Lanham:** Clams benefit mobile fauna by creating algal beds with low predation pressure
13.50-14.10	**Rebecca Morris:** From grey to green: efficacy of eco-engineering solutions for nature-based coastal defence	**Joseph DiBattista:** Evolution of Pygmy Angelfish: A Model Group to Study Species Boundaries in the Eastern Indian Ocean and Beyond	**Mark Meekan:** Photo-id studies using spot patterns of whale sharks - are they pointless?	**Ryan Downie:** Mesozooplankton abundance, biovolume and size structure within pelagic ecosystems of the Great Australian Bight. Presented by Anthony Richardson	**Ezequiel Marzinelli:** Restoration of underwater forests: "Operation Crayweed"
14.10-14.30	**Stuart Pearson:** World Harbour Project: Conflict and the Future in the World's Harbours	**Joseph Turner:** Mesophotic coral ecosystems: A global perspective and putting Ningaloo in context	**Lyn Irvine:** The spatial and temporal distribution of humpback whale calves in the Ningaloo Marine Park. Presented by Chandar Salgado Kent	**Caroline Sutton:** Micronekton community in the Great Australian Bight	**Anna Lafratta:** Importance of habitat selection to successfully develop Blue Carbon projects.
14.30-14.50	**Ana Bugnot:** Learning from nature: Using meta-analyses to ecologically inform foreshore infrastructure designs	**Ana Hara:** New knowledge on the marine Crustacea of northern Western Australia.	**Fletcher Mingram:** Sources of Variation in Cetacean Blubber Hormone Levels: Implications for Management of Post-mortem Sampling	**Alan Williams:** The deepest systematic collection of benthic fishes in Australian waters - continental slope and rise of the Great Australian Bight	**Christian Salinas:** Impact of eutrophication on carbon storage in seagrass meadows

	Monday 3rd July 2017				
	Session 1: Playhouse theatre	**Session 2: Ballroom 1**	**Session 3: Ballroom 2**	**Session 4: Litchfield room**	**Session 5: Gallery**
	Symposium S3	Symposium S5	Symposium S17	Symposium S15	
	Chair: Peter Steinberg and Beth Strain	Chair: Zoe Richards, Kathryn McMahon and Jim Underwood	Chair: Holly Raudino and Carol Palmer	Chair: Jason Tanner	
14.50-14.55	***PEP*** **- Mirjam Kaestli:** The bacteria of Darwin Harbour: spatiotemporal patterns in a tropical macrotidal estuary subject to urbanisation	***PEP*** **- Oliver Berry:** Complex ocean currents promote adaptive diversification and lower dispersal in a tropical reef fish from north-western Australia. Presented by Mike Travers	**Gary Truong:** Using environmental drivers to model blue whale acoustic detection variability	***PEP*** **- Mark Doubell:** Contrasting water column structure and mixing processes across the Great Australian Bight Presented by John Middleton	
14.55-15.00	***PEP*** **- Ruby Garthwin:** Fine-scale approach to assess the impact of recreational boat moorings on seagrass physiology in a threatened Posidonia australis meadow	***PEP*** **- Joseph DiBattista:** Genomics reveals fine-scale Patterns of Dispersal for a Reef Fish along the ecologically significant Coast of Northwestern Australia		***PEP*** **- Paulina Cetina-Heredia:** Nitrate sources, supply, and phytoplankton growth in the Great Australian Bight: and Eulerian-Lagrangian approach	
15.00-15.05	***PEP*** **- Chandar Salgado Kent:** Dolphin Foraging Behaviour in the Busy Fremantle Inner Harbour, Western Australia			***PEP*** **- Kathryn Wiltshire:** Assessing environmental suitability of the GAB region for key deep-sea benthic taxa using species distribution modelling. Presented by Jason Tanner	
15.05-15.10				***PEP*** **- Paul van Ruth:** Variations in productivity in the Great Australian Bight: Uncovering hidden influences on the food web	
15.10-15.40	**Afternoon tea**				

	Monday 3rd July 2017				
	Session 1: Playhouse theatre	**Session 2: Ballroom 1**	**Session 3: Ballroom 2**	**Session 4: Litchfield room**	**Session 5: Gallery**
	Symposium S3		Symposium S17	Symposium S15	G4:Arafura Timor Seas Ecosystem Action
	Chair: Peter Steinberg and Beth Strain		Chair: Holly Raudino and Carol Palmer	Chair: Jason Tanner	Chair: Edward Butler
15.40-16.00	**Augustine Porter:** 3D Mapping and Fishes at Breakwalls: An Ecoengineering Opportunity		**Ricardo Tapilatu:** Utilizing drone technology to assess leatherback sea turtle (Dermochelys coriacea) hatchling fitness in Papua Barat, Indonesia	**Franzis Althaus:** Benthic invertebrate megafauna of the deep Great Australian Bight	**Catherine Kim:** Drivers of kilometre-scale coral reef benthic composition in Timor-Leste
16.00-16.20	**Nina Schaefer:** Rocking urban design: how features of natural rock pools can inform ecological engineering		**Sam Gaylard:** Legacy pollutants in ports, PFAS and its implications for dolphins	**Jodie van de Kamp:** Diversity and abundance of microbial hydrocarbon degradation pathways in the offshore environments of the Great Australian Bight. Presented by Lev Bodrossy	**Peter Mous:** Assessing catch composition and fishing grounds of Indonesian dropliners and longliners targeting deepwater snappers and groupers in the Timor and Arafura Seas
16.20-16.25	**Emma Jackson:** Seagrass ranching: Transplant grow out to recover seagrass clonal integration			**Jason Tanner:** Infaunal assemblage structure in the deep Great Australian Bight	***PEP*** **- Kim Picard:** Fine-scale variability of raised geomorphic features on the Sahul Shelf, North-western Australia
16.25-16.30					***PEP*** **- Jochen Kaempf:** Physical Drivers of Majestic Phytoplankton Blooms in the Northwestern Arafura Sea
16.30-16.35					***PEP*** **- Harriet Davies:** A participatory approach to benthic habitat mapping in a highly turbid marine environment
16.35-16.40					
16.40-17.00	**Hongzhe Chen:** Study of plastic marine debris around a seaside tourist city			**Tim Ward:** Scientific findings of the Great Australian Bight GAB Collaborative Research Program	
19:00	**Public forum: Northern Development – How does marine fit? | Australia's Shallow Tropical Seas – Resource and/or Refuge? - Playhouse Theatre of the Darwin Entertainment Centre**				

	Tuesday 4th July				
7:30	Registration opens				
	Room: Playhouse				
8.30-8.35	**Daily Introduction**				
8.35-8.45	**Presentation of the Allen and the Technical Awards**				
8.45-9.20	**Plenary address: Dr Julie Hall '** *Integrating social science, economics, indigenous knowledge and marine science to under pin decision making for management of our marine*				
9.20-9.40	**Invited speaker: Professor Nic Bax** *'Australia's 2016 State of Environment Report for the Marine Environment. Where are we and where might we be going?'*				
9.40-10.00	**Invited speakers: Mr Jerry Stephen, Ms Hilda Mosby and Mr Frank Loban** *'Traditional management of marine resources in the Torres Strait'*				
10.00 -10.30	**Morning tea**				
	Session 1: Playhouse theatre	**Session 2: Ballroom 1**	**Session 3: Ballroom 2**	**Session 4: Litchfield room**	**Session 5: Gallery**
	S3: Building resilient urban ports and harbours through globally integrated research and management	S10: Climate impacts on marine system structure and function: molecules to ecosystems	S6: Remote sensing techniques for marine sciences	S13: Commonwealth Marine Parks: research for management	G1:Marine fundamentals
	Chair: Peter Steinberg and Beth Strain	Chair: Alistair Hobday	Chair: Zhi Huang and Jamie Treleaven	Chair: Amanda Parr	Chair: Claire Streten
10:25- 10:30		**Karlie McDonald:** Introduction to the symposium			
10.30-10.50	**Mariana Pinto Mayer:** Can we increase services provided by coastal infrtructure with ecoengineering?	**Juan Diego Gaitan-Espitia:** Climate extremes - responses of a tropical dinoflagellate to marine heat waves	**Sharyn Hickey:** Is climate driving temporal mangrove change? A remote sensing approach	**Amanda Parr:** Integrating science and management needs	**David Griffin:** Surface drift and the search for MH370
10.50-11.10	**Rebecca Fisher:** Accounting for opposing objectives and environmental uncertainty in deriving thresholds for managing dredging impacts near coral reefs.	**Janine Ledet:** Diet and temperature interact to affect survival and fecundity of a marine herbivore	**Stephen Sagar:** Extracting the intertidal extent and topography of the Australian coastline from a 28 year time series of Landsat observations	**Scott Nichol:**Integrated seabed mapping and geoscience in support of marine park management	**Krystle Keller:** Multispecies presence and connectivity around a designed artificial reef to assess local fish production-attraction.
11.10-11.30	**Kay Davis:** Can we engineer coastal defence structures to support more natural biota as oceans acidify?	**Kristen Brown:** Effects of ocean warming and acidification on the ecophysiology of a common coral-algal interaction	**Janet Anstee:** Preparing for satellite imaging spectrometers to improve knowledge of our reefs: COral Reef Airborne Laboratory 2016 overflight of the GBR and Torres Strait: CSIRO Activities	**Grant Smith:** Sea Surface Temperature Forecasts for evaluating Coral Bleaching Risk in the Great Barrier Reef	**Cyntia Harayashiki:** Effect of inorganic mercury on yellowfin bream (Acanthopagrus australis) behaviour

	Tuesday 4th July				
	Session 1: Playhouse theatre	**Session 2: Ballroom 1**	**Session 3: Ballroom 2**	**Session 4: Litchfield room**	**Session 5: Gallery**
	Symposium S3	Symposium S10	Symposium S6	Symposium S13	G1:Marine fundamentals
	Chair: Peter Steinberg and Beth Strain	Chair: Alistair Hobday	Chair: Zhi Huang and Jamie Treleaven	Chair: Amanda Parr	Chair: Claire Streten
11.30-11.50	**Maria Vozzo:** Wave energy alters biodiversity by shaping intraspecific variation of a habitat-forming species	**Karlie McDonald:** Marine climate hotspots as indicators of primary productivity in a changing global environment	**David Antoine:** Why would "satellite remote sensing scientists" spend time doing fieldwork?	**Elizabeth Botha:** A review of remote sensing-derived products and tools to support marine park management.	**Rene van der Zande:** Intermediate levels of environmental variability yield faster coral growth at a risk of increasing mortality
11.50-11.55	***PEP*** **- Adam Davey:** World Harbours Project: Eco-engineering for biodiversity - preliminary observations and lessons learnt from Hobart Harbour. Presented by Catriona Macleod	**Ryan D Lewis:** No evidence of alternative stable states in the dynamic between the habitat-forming seaweed Hormosira banksii and coralline turf		**Vinay Udyawer:** Needles and haystacks: using spatial modelling to find rare sea snakes in the North West Marine Region	**Aria Lee:** Exotic polychaete species identified using integrative methods.
11.55-12.00	***PEP*** **- Beth Strain:** Eco-engineering built infrastructure for marine and coastal biodiversity: which interventions have the greatest ecological benefit?				
12.00-12.10					
12.10-12.15		***PEP*** **- Ezequiel Marzinelli:** Marine 'holobionts': seaweed-microbe interactions in a changing environment	***PEP*** **- Fang Yuan:** Regional Copernicus Data Hub: Sentinel Data Access and Contributing to Marine Science. Presented by Adam Lewis	**Ben Radford:** Filling in the gaps in data-poor CMRs: the role of spatial predictive models	***PEP*** **- Amandine Schaeffer:** Sub-surface intensification of marine heat waves: the role of stratification and local winds. Presented by Moninya Roughan
12.15-12.20		***PEP*** **- Karlie McDonald:** Interdisciplinary knowledge exchange across scales in a globally changing environment	***PEP*** **- David Blondeau-Patissier:** Satellite Detection of Oil Pollution in the Great Barrier Reef using ESA's multi-sensor Sentinel missions. Presented by Janet		***PEP*** **- Jason Tanner:** Biogeography of southern Australian deep sea fauna
12.20-12.25		***PEP*** **- Nicole Said:** Minimising the Effects of Light reducing Activities on a widely distributed Seagrass. Presented by Kathryn McMahon			***PEP*** **- Thais Galvao:** Mapping of coral reef at Santa Cruz de CabrÃ¡lia, Brazil, based on satellite image WorldView-2 by using depth invariant index method.
12.25-12.30					***PEP*** **- Oleg Makarynskyy**: Recent sediment investigations in an enclosed tropical harbour
12.30-13.30	**Lunch**				

	Tuesday 4th July				
	Session 1: Playhouse theatre	**Session 2: Ballroom 1**	**Session 3: Ballroom 2**	**Session 4: Litchfield room**	**Session 5: Gallery**
	S12: Migratory fishes and their fisheries	Symposium S10	Symposium S6	Symposium S13	G1:Marine fundamentals
	Chair: Lynnath Beckley	Chair: Alistair Hobday	Chair: Zhi Huang and Jamie Treleaven	Chair: Amanda Parr	Chair: Aria Lee
13.30-13.50	**Toby Patterson:** Cyclical migration dynamics in juvenile southern bluefin tuna	**Adriana Verges:** Latitudinal variation in seagrass herbivory: global patterns and explanatory mechanisms	**Vincent Raoult:** How reliable is structure from motion on coral reefs? Quantifying error rates compared to traditional methods	**James Gilmour:** Constancy of change on NW Australia's remote coral atolls: demographic, local and climatic drivers in an uncertain world	**Patrick Fitzgerald:** Nuanced effects of the invasive Mytilus galloprovincialis on mussel bed communities in Coffin Bay, South Australia.
13.50-14.10	**Paige Eveson:** Modelling surfacing rates of southern bluefin tuna in the Great Australian Bight	**Pia Bessell-Browne:** Cumulative impacts: thermally bleached corals have reduced capacity to clear deposited sediment	**Pallavi Govekar:** Use of ACSPO VIIRS L3U SST in the Australian Bureau of Meteorology	**Marji Puotinen:** In which of Australia's north and northwest region CMRs and KEFs are 13 key biotic taxa likely the most widespread?	**Graeme Clark:** Diffuse tolerance facilitates marine bioinvasion
14.10-14.30	**Pratiwi Lestari:** A multi-technique investigation of population structure of tunas in Indonesian archipelagic waters.	**Nathan Janetzki:** Thermal extremes: the response of three intertidal snails to boulder surface temperature	**Zhi Huang:** Use of MODIS data to investigate the spatial and temporal variability of the Bonney upwelling in the past 14 years	**Rachel Przeslawski:** Small macrofauna in marine management: Polychaetes of the Oceanic Shoals CMR region	**Debra Doolan:** The risk of introduction of invasive species associated with interstate vessel movements.
14.30-14.35	**Anung Widodo:** Characteristics of tuna fisheries associated with FADs in Indonesian waters. Presented by Wudianto	**Paulina Cetina-Heredia:** Strengthened currents override the effect of warming on lobster larval dispersal & survival	***PEP*** **- Aero Leplastrier:** Dynamics and connectivity of the Bonney Coast Upwelling on a daily scale using the Himawari-8 dataset. Presented by Zhi Huang	**Andrew Warmbrunn:** Cleaning up the Coral Sea Commonwealth Marine Reserve	**Sonia Sánchez:** Defining Important Penguin Areas: localizing feeding hotspots and understanding the role of environmental conditions on foraging success
14.35-14.40			***PEP*** **- David Blondeau-Patissier:** Phenology of Trichodesmium blooms in the Great Barrier Reef Lagoon, Australia. Presented by Arnold Dekker		
14.40-14.45			***PEP*** **- Sarah Murfitt:** Applications of unmanned aerial vehicles in intertidal reef monitoring		
14.45-14.50			***PEP*** **- Denise Perez:** Determining light - use efficiency of seagrass and coral reef communities for remote sensing applications.		

	Tuesday 4th July				
	Session 1: Playhouse theatre	**Session 2: Ballroom 1**	**Session 3: Ballroom 2**	**Session 4: Litchfield room**	**Session 5: Gallery**
	Symposium S12	Symposium S10	Symposium S6	Symposium S13	G1:Marine fundamentals
	Chair: Lynnath Beckley	Chair: Alistair Hobday	Chair: Zhi Huang and Jamie Treleaven	Chair: Amanda Parr	Chair: Aria Lee
14.50-14.55	**Kylie Scales:** Dynamic ocean management: near real-time spatial ecoinformatics for reducing bycatch in marine fisheries		***PEP* - David Antoine:** The Australian Integrated Marine Observing System (IMOS) radiometry task team: a community effort towards improved field ocean colour measurements		***PEP* - Sara Pastorino:** Shallow marine life of New Zealand's subantarctic islands.
14.55-15.00					***PEP* - Caitlin Rae:** Dietary composition of Ocypode convexa on sandy beaches in mid-west region of Western Australia.
15.00-15.05					
15.05-15.10					
15.10-15.40	**Afternoon tea**				
	Session 1: Playhouse theatre	**Session 2: Ballroom 1**	**Session 3: Ballroom 2**	**Session 4: Litchfield room**	**Session 5: Gallery**
	Symposium S12	Symposium S10	Symposium S6	Symposium S13	G1:Marine fundamentals
	Chair: Lynnath Beckley	Chair: Alistair Hobday	Chair: Zhi Huang and Jamie Treleaven	Chair: Amanda Parr	Chair: Aria Lee
15.40-16.00	**Russ Babcock:** Environmental and individual influences on the movement and migration of Lethrinus nebulosus on Ningaloo reef	**Tracey Rogers:** Change in isotopic signatures suggest food web shift off the western Antarctic Peninsula	**Tim Lynch:** Metrics, parameters and results from fisheries and wildlife studies with the CSIRO Ruggedized Autonomous Gigapixel Systems (CRAGS)	**Rick Stuart-Smith:** Tracking biodiversity values and threats on shallow rocky and coral reefs	**Christine Crawford:** Overview of currents, nutrients and plankton of southeastern Tasmanian coastal waters from a five year field study
16.00-16.20	**David Crook:** Restoration of a traditional aquaculture system for short-finned eels (Anguilla australis) at Lake Condah (Tae Rak) in south-western Victoria	**Paul York:** Changes in fish and prawn assemblages following a climate-driven decline in tropical seagrass meadows	**Arnold Dekker:** Earth Observation's Role in Sustainable Development Goals: relevant Geospatial assessments of Freshwater, Estuaries, Coasts and Oceans	**Terry Walshe:** Should we monitor the bleeding obvious?	**Lesley Clementson:** The distribution of cyanobacteria in the waters of the Great Barrier Reef

	Tuesday 4th July				
	Session 1: Playhouse theatre	**Session 2: Ballroom 1**	**Session 3: Ballroom 2**	**Session 4: Litchfield room**	**Session 5: Gallery**
	Symposium S12	Symposium S10		Symposium S13	G1:Marine fundamentals
	Chair: Lynnath Beckley	Chair: Alistair Hobday		Chair: Amanda Parr	Chair: Aria Lee
16.20-16.40	**Rik Buckworth:** Spanish mackerel: metapopulations and management	**Michelle Linklater:** A hidden oasis for corals? Exploring past and present-day coral distribution in a subtropical setting		**Steffan Howe:** Piloting a new approach to Monitoring Victoria's Marine Protected Areas in Point Addis Marine National Park.	**Joseph Crosswell:** Carbon and nutrient cycling along the river-ocean continuum in Princess Charlotte Bay: observational methods to characterize the dominant biogeochemical pathways.
16.40-16.45		**Will Figueira:** Coral bleaching and structural complexity: refining tools and assessing impacts		***PEP*** **- Zhi Huang:** A surrogacy approach to evaluate the habitat potential of Australian submarine canyons	***PEP*** **- Carlos Rocha:** Towards biogeochemical modelling of the East Australian Current system. Presented by Moninya Roughan
16.45-16.50				***PEP*** **- Rachel Przeslawski**: Development of field manuals for marine benthic monitoring in CMRs	***PEP*** **- Adriana Verges:** Operation Crayweed: raising awareness about underwater forests in Sydney and beyond
16.50-16.55					***PEP*** **- Matthew Adams:** Identifying robust bioindicators for seagrass light stress over several timescales. Presented by Kathryn McMahon
16.55-17.00					***PEP*** **- Megan Skelton:** Are seahorses and pipefish losing critical habitat to a problem alga?
19:00	**Student night at 'The Precinct', Darwin Waterfront. All Welcome**				

	Wednesday 5th July			
8:00	Registration opens			
	Room: Playhouse			
8.30-8.35	**Daily Introduction**			
8.35-8.45	**Presentation of Jubilee award winner by Will Figueira**			
8.45-9.20	**Jubilee Award winner presentation: Prof Peter Steinberg** *'Drugs, bugs and seaweeds: multidisciplinary marine science'*			
9.20-9.55	**Plenary address: Dr Alistair Hobday** *'Bluefin, connectivity, climate, and adaptation'*			
9.55 -10.30	**Morning tea**			
	Session 1: Playhouse theatre	**Session 2: Ballroom 1**	**Session 3: Ballroom 2**	**Session 4: Litchfield room**
	S9: Integrating science to support management in the Kimberley	S2: Sustainable estuaries and societal benefits: linkages, challenges and future trade-offs	S7: The use of acoustics for the exploration and management of the marine environment.	S20: Small-scale commercial marine harvest: challenges and opportunities
	Chair: Stuart Field and Kelly Waples	Chair: Fiona Valesini, Kieryn Kilminster and Chris Hallett	Chair: David Williams and Kim Picard	Chair: Karen Gibb
10.30-10.50	**Stuart Field:** The Kimberley Marine Research Program - Integrating Science into marine conservation management.	**Peter Scanes:** Threats and Risks to sustainability of NSW estuaries	**Ben Scoulding:** Evaluating active-acoustic methods for assessing snapper (Chrysophrys auratus) spawning aggregations in Western Australia	**Jerry Stephen:** Fishing in the Torres Strait: success through community participation.
10.50-11.10	**Haliana Kobryn:** Evaluating conflict potential in the marine and coastal areas of the Kimberley region through public participation GIS	**Chris Hallett:** Lessons for improved monitoring and reporting of estuarine condition across Australia	**Miles Parsons:** Marine Soundscape Ecology: Throwing a snapper in the works	**Trevor Hutton:** Harvest Strategy development for Torres Strait commercial fisheries
11.10-11.30	**Hector Lozano:** Integrated land-sea modelling of the Kimberley	**Rebecca Swanson:** Assessment of estuarine health in a heavily urbanised and industrialised estuary	**David Williams:** Use of Acoustic Techniques for the Determination of Circulation Patterns and Net Sediment Transport, Marine Supply Base, Darwin Harbour.	**Ian McLeod:** Seven pearls of wisdom for working in partnership with Traditional Owners towards shellfish restoration in Australia
11.30-11.50	**Ming Feng:** Climate drivers of marine heatwaves off the Kimberley coast	**Angus Ferguson:** Sustainable load assessments for Lake Macquarie using ecosystem response modelling and empirical data	**Justy Siwabessy:** Modelling the distribution of hard seabed in Darwin Harbour using angular backscatter response. Presented by Kim Picard	**Samantha Nowland:** The tropical rock oyster Indigenous economic development project: challenges, success and opportunities
11.50-12.10	**Peter Bayliss:** Integrating Indigenous knowledge and survey techniques to develop a baseline for dugong management in the Kimberley	**Kerry Trayler:** Flood 2017 - Impacts on environmental and social values of an urban estuary	**Oleg Makarynskyy:** Using acoustic current profilers and drifting buoys for current measurements in estuarine environments	**Anna Padovan:** Multiple approaches to assess artisanal food safety

	Wednesday 5th July			
	Session 1: Playhouse theatre	**Session 2: Ballroom 1**	**Session 3: Ballroom 2**	**Session 4: Litchfield room**
	Symposium S9	Symposium S2	Symposium S7	Symposium 20
	Chair: Stuart Field and Kelly Waples	Chair: Fiona Valesini, Kieryn Kilminster and Chris Hallett	Chair: David Williams and Kim Picard	Chair: Karen Gibb
12.10-12.15	**Verena Schoepf:** Will Corals from the naturally extreme Kimberley Region be able to cope with Climate Change?	***PEP*** **- David Deeley:** Are Process Indicators Better Than Inventory Indicators For Determining Estuarine Ecosystem Health?	***PEP*** **- Kim Picard:** Integrating marine acoustic technologies to map the seabed of macro-tidal coastal environments	***PEP*** **- Roy Deng:** Development of an empirical Harvest Control Rule for supporting management of the Torres Strait Panulirus ornatus lobster fishery
12.15-12.20		***PEP*** **- Katherine Dafforn:** Assessing the impacts of land-based discharges on ecosystem structure and function of urban waterways.	***PEP*** **- Miles Parsons:** Shallow water shark detection with sonar	***PEP*** **- Cassandra Pert:** 'Barrens of gold': sea urchin farming as a driver of ecological restoration
12.20-12.25		***PEP*** **- Simon Townsend:** Towards a long-term monitoring program for Darwin Harbour.		***PEP*** **- Kimberley Hunnam:** Preliminary characterisation of Timor-Leste sardine fisheries from a food security perspective
12.25-12.30				***PEP*** **- Shannon Burchert:** Shellfish quality assurance in the Northern Territory
12.30-13.30	**Lunch AMSA Annual General meeting (Ballroom 1)**			
	Session 1: Playhouse theatre	**Session 2: Ballroom 1**	**Session 3: Ballroom 2**	**Session 4: Litchfield room**
	Symposium S9	Symposium S2	S8: Noise Impacts	Symposium 20
	Chair: Stuart Field and Kelly Waples	Chair: Fiona Valesini, Kieryn Kilminster and Chris Hallett	Chair: Rachel Przeslawski	Chair: Karen Gibb
13.30-13.50	**Christopher Cornwall:** Calcification of reef-forming species in the Kimberley under variable pH regimes, today and in a future high CO2 ocean	**Sabine Dittmann:** Ecological responses to flow characteristics in estuaries	**Rachel Przeslawski:** The Gippsland marine environmental monitoring project: An integrated approach to understanding the potential impacts of marine seismic surveys on fish and invertebrates. Presented by Andrew Carroll	**Graham Edgar:** Rapid ongoing decline in populations of large-bodied Australian fishes despite world-best management practices
13.50-14.10	**Michele Thums:** Modelling the spatial distribution of humpback whales in the Kimberley region of Western Australia	**Mathew Taylor:** Direct and indirect interactions between estuarine habitats and commercially important species of penaeid shrimp. Presented Troy Gaston	**Alec Duncan:** How can impulsive marine seismic air gun signals impact marine fauna?	**Matthew Taylor:** Determining the contribution of estuarine habitats to the diets of commercially important fisheries species in the Hunter River. Presented by Tim Smith
14.10-14.30	**Ruby Garthwin:** Characterising fish herbivory on tropical seagrasses: relating environmental variables to feeding rates	**Claudia Trave:** Protect or repair: insight into shoreline habitat complexity in Australia's urbanized tropical estuaries	**Cameron Sim:** Applying science and collaboration to enhance environmental impact assessment for sound-generating activities	**Tessa Mazor:** Trawl exposure and protection of Australia's seabed fauna
14.30-14.35	**David Deeley:** Broadening and deepening the connections - Bi-cultural marine monitoring partnerships	**Victoria Cole:** Is oyster restoration of heavily urbanised estuaries possible?	***PEP*** **- Andrew Carroll:** Assessing the behavioural response of sperm whales (Physeter macrocephalus) to marine seismic surveys: A case study from Lord Howe Rise in the Coral Sea	**Yuanike Kaber:** Performance and sustainable management of the grouper (Serranidae) in Dampier Straits marine protected area, Raja Ampat.
14.35-14.50				

	Wednesday 5th July			
	Session 1: Playhouse theatre	**Session 2: Ballroom 1**	**Session 3: Ballroom 2**	**Session 4: Litchfield room**
	Symposium S9	Symposium S2		G2:Marine Food Security
	Chair: Stuart Field and Kelly Waples	Chair: Fiona Valesini, Kieryn Kilminster and Chris Hallett		Chair: Sam Nowland
14.50-14.55	**Lynnath Beckley:** Is the Kimberley coast still a pristine wilderness?	***PEP*** **- Navodha Dissanayake:** The contribution of macroinvertebrates to mudflat functioning: global patterns		***PEP*** **- Peter Mous:** Assessing catch of juvenile tuna around Fish Aggregating Devices deployed in Indonesia's Exclusive Economic Zone
14.55-15.00		***PEP*** **- Sian Glazier:** Constructing a food web for key species in a Ramsar-listed estuarine environment		**PEP - Craig Proctor:** fishIDER – An on-line, bilingual resource for improving fish identification capacity of field personnel in tropical fisheries.
15.00-15.05		***PEP*** **- Marta Sanchez Alarcon:** Understanding seagrass resilience in a changing estuary		***PEP*** **- Edward Butler:** Mercury in Barramundi of the Mary River System—Insights on the Metal's Cycling
15.05-15.10		***PEP*** **- Jessica Merrett:** Marine debris: sources, distribution and management implications for an urbanised estuary		
15.10-15.40	**Afternoon tea**			
	Session 1: Playhouse theatre	**Session 2: Ballroom 1**	**Session 3: Ballroom 2**	**Session 4: Litchfield room**
	S16: Observing the north	Symposium S2	S18: Marine Spatial planning	G2:Marine Food Security
	Chair: Ana Lara Lopez	Chair: Fiona Valesini, Kieryn Kilminster and Chris Hallett	Chair: Hugh Kirkman	Chair: Sam Nowland
15.40-16.00	**Nicole L. Jones:** Vertical mixing on the Australian Northwest Shelf	**Malcolm Robb:** Regional Estuaries Initiative - one year on.	**Hugh Kirkman:** Australia has no marine spatial planning	**Sheridan Rabbitt:** Women's contribution to food security and fisheries management: new data from the Solomon Islands
16.00-16.20	**Hadi Bahmanpour:** Annual and Inter-annual variability of Holloway Current along the shelf edge of North-Western Australia	**Jocelyn Dela-Cruz:** Economic implications of trade-offs to support healthy estuaries under pressure from urbanisation	**Kelsey Roberts:** Do Australia's marine protected areas (MPAs) operate as a network? Modelling functional connectivity within the Australian marine environment.	**Karen Edyvane:** Shifting the problem - trends in IUU fishing and derelict fishing nets in the shared Arafura-Timor Seas
16.20-16.40	**Maxime Marin:** Intra-annual Variability of the North West Shelf of Australia and its Impact on the Holloway Current. Presented by Ming Feng	**Kieryn Kilminster:** Science integration to support management for the Vasse-Wonnerup Estuary during a significant cyanobacterial bloom	**Margaret Andrew:** Spatial tools for coastal biodiversity management: Image-based detection of sea eagle nests and identification of nest site preferences	
16.40-17.00		**Fiona Valesini:** Balancing estuarine and societal health in a changing environment		
17.30-20.30	Work shop: Using Novel Technologies to Answer Key Questions in Marine Science. Location Litchfield Room, DoubleTree by Hilton Hotel Esplanade Darwin			

	Thursday 6th July			
8.15	Registration opens			
	Room: Playhouse			
8.30-8.35	**Daily Introduction**			
8.35-8.55	**Invited speaker: Dr Moninya Roughan** *'Insight into Continental Shelf Processes Along SE Australia from 10 years of IMOS observations'*			
8.55-9.15	**Invited speaker: Dr Richard Brinkman** *'Sustainable Development of the North's Blue Economy – the role of IMOS to date, and into the future'*			
9.15-9.35	**Invited speaker: Professor Robert Harcourt '** *IMOS Animal Tracking, 10 years of age and going strong'*			
9.35-9.55	**Invited speaker:Professor Anthony Richardson** *'A decade of IMOS Plankton Observations'*			
10.00 -10.30	**Morning tea**			
	Session 1: Playhouse theatre	**Session 2: Ballroom 1**	**Session 3: Ballroom 2**	**Session 4: Litchfield room**
	S16: Observing the north	S11: Crossing boundaries with marine genomics: new techniques, applications and integration	S1: How can marine science better guide environmental decision-makers?	G5:Looking to the future
	Chair: David Williams	Chair: Allyson O'Brien	Chair: Terry Walshe	Chair: Kelly Mackarous
10.30-10.50	**Ana Lara-Lopez:** After a decade, what is new in IMOS?	**Simone Birrer:** Molecular ecology in the tropics: Describing sediment microbes and mine-derived pollution in the Torres Strait	**Ryan Baring:** Plausible ecosystem futures as guidance for decision making	**Ben Rae:** Research delivered by new research vessel Investigator during the first two years of operation
10.50-11.10	**Ryan Lowe:** Oceanic drivers of reef heat budgets in northwestern Australia: the role of tides on regional and reef-scales	**Allyson O'Brien:** Using metabarcoding and metabolomics to measure marine community structure and function	**Alice Jones:** Are you sure? Capturing expert uncertainty in marine spatial cumulative impact assessment	**Tanya Whiteway:** National Bathymetry Collaborations and Coordination
11.10-11.30	**Craig Steinberg:** The Darwin National Reference Station: a sentinel for coastal waters in Northern Australia	**Kathryn Wiltshire:** Refining methods for detection of marine pests using plankton tows and qPCR assays	**Tony Griffiths:** A coastal and marine management strategy for the Northern Territory	**Brendan Kelaher:** A big stick approach to improving marine reserve performance
11.30-11.50	**Jessica Benthuysen:** Extreme marine warming across tropical Australia during austral summer 2015-2016	**Fee Moy (Lisa) Lee Nen:** Early detection of MIS from biofouling assemblages in South Australia using next generation sequencing	**Ian Poiner:** Northern Territory Marine Science End User Needs Analysis Project	**Steven Hawes:** An analysis of current trends in connectivity modelling and where to next
11.50-12.10	**Michelle Heupel:** Exploring national-scale fish movements through the IMOS Animal Tracking Facility	**Hannah Ward:** Ecosystem engineers in intertidal sediments: microbial responses to macroinvertebrate exclusion along an environmental gradient	**Jackie Gould:** Environmental decision making in the NT: Indigenous sea country management and how science can support it	

	Thursday 6th July			
	Session 1: Playhouse theatre	**Session 2: Ballroom 1**	**Session 3: Ballroom 2**	**Session 4: Litchfield room**
	Symposium S16	Symposium S11	Symposium S1	
	Chair: David Williams	Chair: Allyson O'Brien	Chair: Terry Walshe	
12.10-12.15	***PEP*** **- Lesley Clementson:** 4 years of observational data from LJCO; an assessment of the bio-optical variability in GBR coastal waters	***PEP*** **- Oliver Berry:** Going with the flow: genomic insights into ecological connectivity in the Kimberley Presented by Jim Underwoood	**Cass Hunter:** The place of Indigenous knowledge at the marine research table. Presented by Mibu Fischer	
12.15-12.20	***PEP*** **- Erin McCosker:** Influence of oceanographic conditions on coastal zooplankton assemblages at three IMOS National Reference Stations in Western Australia	***PEP*** **- Zarah Hockey:** Developing new DNA Markers to more accurately test for human faecal contamination		
12.20-12.25	***PEP*** **- Jennifer Skerratt:** Integrating models into water quality decisions. Presented by Mathieu Mongin	***PEP*** **- Laura Taillebois:** Integration of multiple techniques to elucidate the population structure of coastal reef fish in northern Australia		
12.25-12.30	***PEP*** **- Abbi Scott:** How can herbivores modify ecosystem service delivery in seagrass beds?	***PEP*** **- Georgina Wood:** Using population genetics to design and assess success of marine restoration		
12.30-13.30	**Lunch**			
	Session 1: Playhouse theatre	**Session 2: Ballroom 1**	**Session 3: Ballroom 2**	**Session 4: Litchfield room**
	Symposium S16	Symposium S11	Symposium S1	G5:Looking to the future
	Chair: Craig Steinberg	Chair: Allyson O'Brien	Chair: Terry Walshe	Chair: Claire Streten
13.30-13.50	**Robert McCauley:** Great whale presence in northern Australia based on passive acoustics	**Paul Gribben:** Microbial communities in marine sediments control native/invasive macrophyte interactions	**Patricia Miloslavich:** Identifying biological and ecological Essential Ocean Variables (EOVs) for global sustained observations. Presented by Nic Bax	**Colin Woodroffe:** Response of mangrove ecosystems in northern Australian estuaries to environmental change
13.50-14.10	**Jennifer Skerratt:** Changes in water quality from 2010 to 2016 throughout the Great Barrier Reef. Presented by Mathieu Mongin	**Catherine Cavallo:** DNA analysis of scats reveals effect of breeding constraints and environmental variation on diet in a central place forager	**Catriona Macleod:** Incorporating community concerns into decision-support tools for environmental management of finfish aquaculture. How can social science better guide environmental decision makers?	**Claire Spillman:** Climate proofing strategies using seasonal forecasting for Australian marine industries
14.10-14.30	**Paul G Thomson:** Measuring the underwater light climate on the North West Shelf of Australia using IMOS Slocum gliders	**Setareh Samadi:** Phylogenetic relationships of Panulirus homarus, P. versicolor and Thenus orientalis from Persian Gulf and Oman Sea	**Warwick Noble:** Nearshore marine Aquatic Ecosystem Condition Reports, AECR's or just another headache?	**Paul Hedge:** Engagement of Indigenous communities in marine research: A national-scale survey of marine researchers
14.30-14.50	**Mark Baird:** The biogeochemical state of the Great Barrier Reef (2013-2016): results from a re-analysis using the eReefs model.		**Jason Hartog:** Data delivery and decision-support tools underpinning sustainable fisheries	**Cass Hunter:** Packaging web portals for improved stakeholder usability

	Thursday 6th July			
	Session 1: Playhouse theatre	**Session 2: Ballroom 1**	**Session 3: Ballroom 2**	**Session 4: Litchfield room**
	Symposium S16			G5:Looking to the future
	Chair: Craig Steinberg			Chair: Claire Streten
14.50-14.55	***PEP*** **- Brendan Brooke:** Coastal dynamics of Northern Australia over the last three decades - preliminary insights from the Landsat Data Cube			***PEP*** **- David Deeley:** Indigenous Wisdom Can Inform Human Impact Detection and Mitigation for the Indian Ocean
14.55-15.00	***PEP*** **- Russ Babcock:** Starbug-X: a Compact Autonomous Underwater Vehicle applied to surveys of deepwater reefs at Ningaloo			***PEP*** **- Lincoln Wong:** Respondent driven sampling (RDS) as a cost-effective method for recreational fisheries: a trial with the Tasmania recreational rock lobster fishery
15.00-15.05	***PEP*** **- Hermerson Tonin:** Application of a hydrodynamic numerical model towards implementation of desalination plant at Palm Island, Queensland.			***PEP*** **- Catriona Macleod:** Broadscale Environmental Monitoring - What is it? Who does it? How does it fit in to Marine and Coastal Management? and Can we do better?
15.05-15.10	***PEP*** **- Hermerson Tonin:** Mass Coral bleaching in the far northern region of the Great Barrier Reef and Torres Strait – a numerical modelling study			
18:30 - onwards	**CONFERENCE GALA DINNER. Location Darwin Botanical Gardens**			
	Friday 7th July			
	Workshops			
9:00-15:00	**Furthering sea country research through advancing Indigenous collaborations with marine scientists'** Location: Grand Ballroom, DoubleTree by Hilton Darwin Esplanade.			
15:15 - 16:45	**Getting published'** Location: Charles Darwin University Waterfront, 21 Kitchener Dr, Darwin City.			
	Saturday 8th July			
	Workshop			
11am – 7pm	**Connectivity in coastal habitat utilisation workshop** (includes Sea Darwin Sadgroves creek tour)'. Location: Charles Darwin University Waterfront, 21 Kitchener Dr, Darwin City.			

Abstracts

Identifying robust bioindicators for seagrass light stress over several timescales

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In seagrass, light deprivation induces a range of physiological and morphological responses over several different timescales. These responses can be measured to provide bioindicators of light stress in seagrass, but only if they are sufficiently sensitive to changes in light over well-defined timescales. To identify robust bioindicators of light stress in seagrass, we applied a recently proposed and novel method of analysing correlations between bioindicators and light history to (1) identify which seagrass bioindicators are the most sensitive to light deprivation and (2) estimate the timescale over which these bioindicators respond to light deprivation. Laboratory and field data for several seagrass species, including above-ground and below-ground biomass, cover, $\delta^{13}C$, maximum electron transport rate and rhizome carbohydrates were examined. We also used field data to identify if season or growth/recovery phase affected the response of bioindicators to light history. Our analysis confirmed that physiological bioindicators (e.g. maximum electron transport rate) responded faster to changes in light than morphological bioindicators such as seagrass biomass and cover, and that the timescale for highest correlation between light history and biomass/cover was longer if the seagrass species had long-lived characteristics (e.g. persistent species). The sensitivity of rhizome carbohydrates to light stress was species-dependent, whilst $\delta^{13}C$ was a robust bioindicator in laboratory conditions but not in the field. Physiological bioindicators therefore provide a rapid response to light stress; however, to confirm that these bioindicators can be used for monitoring of light stress in seagrass ecosystems, their sensitivity must be assessed in field conditions. In agreement with Liebig's Law of the Minimum, a principle which states that growth is controlled by the scarcest resource, we found that the best correlation between seagrass biomass/cover and light history was obtained in light-limited conditions. This indicates that seagrass biomass/cover is only an accurate (albeit slow) bioindicator of light deprivation at field locations where light is the limiting resource for seagrass. Overall, the quantification of timescales and robustness of several bioindicators for seagrass light stress presented here is informative for the future design and interpretation of ecological health assessments.

Benthic invertebrate megafauna of the deep Great Australian Bight

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Benthic megafauna were collected between 200 m and 4600 m depths from the central Great Australian Bight (GAB) during two surveys in 2015. Faunal collections over this depth range are unprecedented in Australian waters. In this presentation we describe the composition, distribution and community structure of this component of deep benthic fauna. The collection includes 850 distinct taxa, including 757 authorative identifications to species level for 21 invertebrate groups in 7 phyla provided by a network of collaborating taxonomists from Australian and international museums. At least 19% of the species are undescribed, and many more have uncertain status. There is a marked decrease in species richness (OTUs per sample) from the upper slope (33) to all deeper depths (13). Biomass declines markedly with increasing depth from 1.6 gm^{-2} on the upper slope to 0.3 gm^{-2} on the abyssal rise. The two surveys were aboard the Marine National Facility vessel RV *Investigator*: voyage IN2015_C01 funded through the GAB Deepwater Marine Program (GABDMP) and voyage IN2015_C02 funded through the GAB Research Program (GABRP).

Spatial distribution patterns in South American in-shore dolphins

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In-shore dolphins are potentially the most threatened South American marine mammals species because of their proximity to human influence. To identify the species most at risk, we model the species distributions of in-shore dolphin species. The drivers most important for the species with reduced distribution are the distance to the coast and freshwater availability, whereas the drivers for the species with a wider distribution range are the distance to the coast and bathymetry. According to our distribution analysis, the in-shore dolphin species most vulnerable to anthropogenic impacts are the Chilean, Franciscana and Peale's dolphins. Globally, there is remains limited information on the drivers of distribution of marine mammals due in part to the difficulty of working within the marine environment. Although many marine mammalian species remain Data Deficient under the International Union for Nature (IUCN), our case study shows that SDMs together with historical distribution data, and environmental variables, can be used to identify species most at risk and to target future research and management priorities. This is important because the importance of South America as a global hotspot of marine mammal conservation is well known; however due to regional constraints, there is limited on-the-ground information on the spatial distribution of cetaceans.

Spatial tools for coastal biodiversity management: Image-based detection of sea eagle nests and identification of nest site preferences

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Knowledge of the spatial distribution of ecological values is necessary for effective biodiversity management. Wildlife surveys are more efficient if they can be targeted to locations supporting critical stages of the target species' life history, and spatial planning requires spatial data for all environmental and social targets in the region of interest to meet project goals. However, this spatial information is often sparse. This study demonstrates how spatial knowledge can be generated to support coastal biodiversity management, exemplified by the detection and habitat modeling of nest sites of the white-bellied sea eagle (Haliaeetus leucogaster) in the Houtman Abrolhos Islands, Western Australia. First, semi-automated image analyses were developed to detect nests in high resolution aerial photo data. Nest detection was challenged by high heterogeneity of nests and the surrounding environment, and by a lack of strong distinguishing features between nests and their surroundings. Nevertheless, the semi-automated analyses successfully detected >80% of known nests while labeling <2% of the image objects as candidate nests. The image processing strategies developed by this research will contribute advances to image-based wildlife surveys, enabling the extension of such efforts beyond the simple systems in which they are currently applied. Second, spatial models were developed to explore nest site selection behaviour at several scales and develop maps of preferred nesting habitat. At the island level, sea eagles preferred to nest on large islands with diverse vegetation types in a relatively unfragmented patch mosaic and with abundant shallow-water foraging habitat nearby. Surprisingly, nesting was not associated with island shape, which has been related to nesting preferences elsewhere. Nest sites were also not influenced by anthropogenic disturbances, which may be because these effects are largely historical or ephemeral on the Houtman Abrolhos Islands. Despite the vagility of eagles, most environmental associations were strongest at local scales. These results can inform conservation of sea eagles. Eagles are especially sensitive to disturbances while nesting; knowledge of nest sites and nesting preferences will allow protection of critical nesting habitat.

Preparing for satellite imaging spectrometers to improve knowledge of our reefs: COral Reef Airborne Laboratory 2016 overflight of the GBR and Torres Strait: CSIRO Activities

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High spatial resolution, airborne remotely-sensed observations were collected over the GBR in September-October 2016 as part of the NASA Jet Propulsion Laboratory Earth Venture Suborbital mission: COral Reef Airborne Laboratory (CORAL). This mission is timely for the GBR reefs as it intends to develop an innovative capability for mapping and monitoring reefs from space. The goal of the CORAL project is to provide detailed spatial and spectral data needed to analyse the status of coral reefs and to use this data in new models to predict their future status. CORAL has captured the condition of a representative portion of the world's coral reefs from this uniform airborne data set at an unprecedented high resolution (spectral, spatial, radiometric) - in Australia CORAL collected data over several portions of the GBR, Torres Strait and the Coral Sea Marine Reserves. The combined airborne and in situ data is designed to better understand connections between coral reef condition and bio-geophysical conditions. As these imaging spectrometry measurements will become available from space within the next few years this approach may allow improved prediction of the future of this global ecosystem, providing coral reef managers and policy makers with better information for their decisions regarding resource management and conservation. CSIRO and UQ involvement in the CORAL mission was to provide *in situ* data to calibrate the hyperspectral data and validate ocean colour products (e.g. chlorophyll-a, suspended sediment concentrations, coloured dissolved organic matter and measures of transparency) as well as shallow water bathymetry and substratum type. CSIRO led field teams to collect bio-optical measurements in the Torres Strait, as well as bio-optical data on the Marine National Facility *RV Investigator* cruise to the GBR region in September-October 2016. As project collaborators CSIRO and UQ will have access to all the airborne and *in situ* data collected from the Australian sites and will assist in the distribution of CORAL data to others in the Australian research community. In this presentation we will present preliminary, (a) bio-optical analysis, (b) remote sensing maps, with the objective to give a first impression of advanced CORAL products.

Why would "satellite remote sensing scientists" spend time doing fieldwork?

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From a non-specialist perspective, satellite remote sensing is often seen as an essentially "spatial" science. When it comes to remote sensing of the ocean, the perception is that of scientists looking at fronts, eddies, basin-scale distributions and the like; in other words, making nice pictures of the ocean. The reality is, the job of satellite remote sensing scientists is not that different from that of others looking at the same science questions; they just do it at another scale. The realm of satellite ocean colour radiometry (OCR), which is more specifically addressed in this presentation, is that of a quantitative science grounded into physics. What an OCR satellite does is to collect millions of observations every day on every square kilometre of the global ocean, and to quantitatively interpret these observations in terms of "geophysical quantities", e.g., the phytoplankton chlorophyll concentration. The radiometric observations made by such observing systems are traceable to the S.I. unit system. The final products are tied to these primary quantities through a number of processing steps. Validating the overall process and the final products requires field observations (ocean and atmosphere), and that is why a comprehensive approach of the satellite remote sensing problem requires spending so much time doing fieldwork. This presentation will go back to some basics of satellite OCR remote sensing, will address the quantitative aspect of it, and will also deal with how the remote sensing community currently tries to better determine uncertainties in the final products, which is an expectation of many users of satellite-derived information. These different points will be illustrated in particular through a number of new activities that the Curtin remote sensing and satellite research group (RSSRG) have launched recently.

The Australian Integrated Marine Observing System (IMOS) radiometry task team: a community effort towards improved field ocean colour measurements

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The Australian research community involved into field radiometry measurements have come together in a "Radiometry task team" (RTT), under the auspices of, and thanks to funding from, the Australian Integrated Marine Observing System (IMOS). The objective is to perform activities that can ultimately improve usability of IMOS radiometric data sets for research purposes as well as for validation of satellite ocean colour products. Another objective is to develop a plan for the evolution of radiometry measurements in IMOS for the next decade. The work of this IMOS RTT can be summarized as follows:

1. Evaluate the degree of consistency or inconsistency among existing sea-going radiometers used in the IMOS and wider Australian bio-optical community, through dedicated laboratory and field experiments. Instruments include hyperspectral and multispectral field radiometers, essentially for above-water radiometry measurements.

2. If needed, improve consistency among these instruments

3. Develop a plan for the evolution of radiometry measurements in IMOS for the next decade

We will report on what the Australian community learnt from these activities.

Starbug-X: a Compact Autonomous Underwater Vehicle applied to surveys of deepwater reefs at Ningaloo

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Autonomous Underwater Vehicles have been used for some time in deep water ecological and oceanographic work but because of their size they have required large vessels as platforms for deployment. Due to this their use has been relatively limited in areas inaccessible to large vessels or by the costs of such vessels. The Starbug-X has been designed with all the capabilities of larger AUVs including a CTD, PAR sensors, backscatter, Chl a, CDOM and dissolved Oxygen, as well as stereo camera pairs, but can be deployed from small vessels. This combination of instruments, combined with its sonar positioning beacon, makes the Starbug an ideal tool for collecting accurately geo-located environmental and ecological data from inaccessible areas of the seafloor. The Ningaloo Outlook Program has used the Starbug to survey reefs along the Ningaloo coast, in particular the deeper, mesophotic reaches of the reefs not easily accessible to divers. These surveys have documented benthic cover, particularly coral cover, across the depth gradient from shallow reefs to the lower limits of coral growth. The deepest extent of reef building corals at Ningaloo is approximately 35 meters, considerably shallower than on mesophotic reefs studied in other areas, where corals can be found at depths greater than 100 m. High levels of light attenuation in Ningaloo waters are likely due to a combination of high water column productivity, re-suspension, and CDOM originating in the Ningaloo Lagoon.

Environmental and individual influences on the movement and migration of *Lethrinus nebulosus* on Ningaloo reef

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Spatial management of fish populations can potentially be optimised by incorporating responses to environmental variables such as diel, tidal, lunar and seasonal factors, however individual variability in habitat use and behaviour may complicate such efforts. Acoustic tagging and tracking of 84 *Lethrinus nebulosus* in the Ningaloo Marine Park indicated that sizes of individual habitat utilization kernels were similar across diel and tidal cycles, but varied greatly among individuals. Clearly differentiated diel and tidal habitat use patterns were evident in significant proportions of individuals particularly in relation to tidal phase. For the majority of residents home range sizes were relatively stable over periods of two to four years but in some cases core areas did shift over time. At seasonal time-scales peaks of seasonal activity and home range area were recorded during spawning season (October-December). Long distance return migrations to spawning locations were observed which were among the longest observed for any reef fish (over 130 km). Suspected spawning-related movements were recorded almost exclusively in fish >500 mm FL, and were semilunar, following quarter moons in October-December. Significant individual-level variability in movement and habitat use patterns, evident across multiple temporal scales, has important implications for the management of *L. nebulosus* populations.

The Great Australian Bight Research Program - seeking whole of system understanding

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The Great Australian Bight Research Program is a $20 million, four-year research collaboration involving BP, CSIRO, the South Australian Research and Development Institute (SARDI), the University of Adelaide and Flinders University. It is the first large-scale study of the Great Australian Bight and one of the few whole-of-system studies ever undertaken in Australia. The goal of the Program is to obtain information and understanding to better inform the balance of human activity and sustainability in the region. This has been achieved by collecting and integrating knowledge of ecosystem processes and socioeconomic character to identify and describe key physical, chemical and biological drivers of ecosystem structure, and to evaluate the likely regional impacts of critical stressors on ecological, economic and social values. The Program involved more than 100 of Australia's leading scientists organised around seven themes: Oceanography, Pelagic ecosystem and environmental drivers, Benthic biodiversity, Ecology of iconic species and apex predators, Petroleum geology and geochemistry, Socio-economic analysis, and Integration and modelling. It was supported by two Marine National Facility research voyages in 2013 and 2015 and use of the national Integrated Marine Observing System (IMOS) facilities and data sets. The multi-disciplinary, integrated approach is enabling efficient development and validation of whole-of-system (i.e. ecological and socio-economic) models that elucidate interconnections between components and can be used to inform development decisions and predict, monitor and assess potential future impacts.

Annual and Inter-annual variability of Holloway Current along the shelf edge of North-Western Australia

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Seasonal and Inter-annual variability of circulation in the North-West Shelf of Australia (NWS) is poorly understood due to the lack of direct long-term measurements. The region is characterised as an oceanographically complex region with high signal to noise ratio. As part of the IMOS ANMN (Integrated Marine Observing System-Australian National Mooring Network) co-investment with the Western Australian government, multi-year simultaneous measurements of velocity profiles were conducted at various locations along the shelf to study boundary currents and shelf-scale circulation of the region. This study presents the first coherent picture of seasonal circulation and its inter-annual variability based on new observations. We also make use of a high resolution ocean model with simulation period 2000-2014 to better assess inter-annual variability. Both observation and model results were proved highly important in revealing different aspects of circulation. Unlike previous estimates of negligible mean flow on NWS, the analysis of velocity profiles showed that there is mean south-westward flow of less than 1 Sv (1 Sv=10^6 m^3s^{-1}) known as the Holloway Current (HC). The HC is at its maximum intensity of up to 2 Sv during austral autumn (Apr-Jun) transporting higher temperature, lower salinity tropical waters southward along the shelf where it eventually joins with the well-known major boundary current off Western Australia, The Leeuwin Current. The ocean model was used to study different pathways of HC. The results indicated that HC is formed by two distinct sources: 1) a stronger shallower shelf contribution from the Gulf of Carpentaria (GOC) that coincides with the first peak in HC and 2) a sustained weaker offshore contribution from the Indonesian Throughflow that peaks in Sep-Nov with evidence coming from both observations and model. The analysis of altimetry measurements suggest that the first peak in HC is associated with an anomalous high sea level in the GOC in response to the relatively strong onshore winds from Dec-Feb. The second peak is however maintained by the meridional density gradient in the South-eastern Tropical Indian Ocean due to the Indonesian Throughflow. We also present and discuss inter-annual variability of Circulation and its

The biogeochemical state of the Great Barrier Reef (2013-2016): results from a re-analysis using the eReefs model

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The Great Barrier Reef (BGR) is a 2000 km long reef and lagoon complex, which is a UNESCO World Heritage Area between the Australia's north-eastern coastline and the Coral Sea. Although the GBR is known as one of the best managed reef systems in the world, coral cover has declined over the last decades. To provide management with the most complete information, we have assimilated remote-sensing observations to improve the predicted biogeochemical state of the ~4 km resolution eReefs model, providing skilful estimates of water quality properties from 2013-2016. Unique among the biogeochemical re-analyses undertaken internationally, we constrain the model using remote-sensing reflectance (R_{rs}) rather than derived products like chlorophyll concentration. The data assimilating model improved the estimate of in situ chlorophyll concentration at 12 of the 13 moored observations available during the simulation. In this talk we investigate the output of the re-analysis, with an emphasis on water quality properties (Chl a, TSS and Secchi depth), quantifying the well-known importance of wet season rainfall on inshore water quality, among other properties. The re-analysis was completed in February 24, 2017, in time to provide input to the next GBR report card and is freely-available for the marine science community.

Plausible ecosystem futures as guidance for decision making

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Globally, space in the coastal zone is contested by expanding industrialisation and urbanisation. Coastal urbanisation increasingly conflicts with ecosystem functions and services of estuaries and wetlands. Often, management of conflict between urban progress and environmental preservation is complicated by different stakeholder views of the past, present and unknown myriad of futures. Yet all is not lost, there are ways to reflect on the past, reset our thinking and raise awareness of plausible futures as a guidance system for decision making. We provide a case study of the Barker Inlet and Port River Estuary (BIPE) that consists of diverse coastal wetlands with high conservation value but with a very bleak past, highly urbanised present and unknown future. In order to raise awareness and guide decision making of the BIPE region we held a scenario planning workshop in early 2016. Over the four day workshop with multiple stakeholder groups, we explored plausible futures for the BIPE region subject to the emphasis given for low and/or high environmental and economic benefits. The participants developed four plausible scenarios and considered effects on governance, economy, community, individual well-being, built infrastructure and natural environment. The scenario planning activity also considered land use changes and calculated resulting changes to ecosystem service values (ESV) for each scenario using an established geodatabase and land cover classification with a benefit transfer model. Comparisons of ESV under each scenario were then made based on either stakeholder or expert opinion. Overall, scenarios giving low consideration to environmental benefit led to substantial decrease of ESV compared to current values, while scenarios giving high consideration to environmental benefit led to strong gains. By engaging in the scenario planning and widening their thinking, stakeholders soon became aware of the broader decision making required for the future they want in the BIPE region.

Integrating Indigenous knowledge and survey techniques to develop a baseline for dugong management in the Kimberley

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Dugongs are an important species in marine ecosystems and have high cultural value to Indigenous coastal communities. The coastal waters of NW Australia, encompassing the Kimberley and Pilbara regions down to Shark Bay, is home to one of the largest remaining populations in the world. Until recently there has been limited information on dugong distribution, abundance and Traditional Ecological Knowledge (TEK) in the Kimberley, representing significant knowledge gaps. To date there have been limited human-induced threats to dugongs in the Kimberley, making the area an important stronghold for the species. Cultural harvests over millennia are the only known pressure, however this could change with increasing development pressures in combination with potential climate change impacts. Current and future risks to dugong populations therefore need to be monitored and evaluated using assessment frameworks that integrate both scientific knowledge and TEK, as adopted by the WAMSI dugong project (2014-2017). Key to this approach is the strong collaborative partnerships formed with North Kimberley ranger groups (Balanggarra, Wunambal Gaambera/Uunguu, Dambimangari and Bardi Jawi). We present results for the: (i) baseline aerial survey of dugong distribution and abundance; (ii) integration of TEK and scientific data using a Bayesian likelihood model; and (iii) learnings from a trial satellite tracking movement study. The aerial survey (Oct. 2015) was undertaken with ranger groups after an intensive 5-day training course. The estimated 'minimum' numbers of dugongs in the North Kimberley is 11,839 $\pm$ 1,391 (11.8% SE), an average density of 0.36 $\pm$ 0.04 km^{-2} over 33,165 km^2. A strong positive relationship was found between dugong abundance in survey blocks and the extent of large (>1 km^2) seagrass patches mapped using Landsat imagery (R^2 = 94%, n=7, P=0.002). Dugong distribution and abundance were mapped across a 5 km grid using GIS Kriging methods to identify "abundance hotspots". A Bayesian likelihood model was used to map and identify important dugong areas across the grid, and integrates key knowledge from three sources: (i) TEK; (ii) seagrass extent; and (iii) abundance estimates derived by aerial survey. This approach facilitates continuous updates with new information (or "priors"), a process that underpins adaptive monitoring and management.

Is the Kimberley coast still a pristine wilderness?

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The Kimberley coast, much of which is under native title, is regularly portrayed as a pristine wilderness. However, while there might only be a small resident population, few towns and limited road access to the long coastline, numerous commercial activities such as ports, shipping, aviation, mining, fishing and aquaculture take place. Tourism is also a particularly important, and growing, feature of the Kimberley economy. A recent WAMSI study on human use of the Kimberley coast has drawn into focus the spatial footprint of various human activities in this area and results are summarised in this presentation. Spatially-explicit aerial surveys ascertained the distribution and numbers of people conducting activities along the coast and boats operating in coastal waters. The results show clear seasonality and some nodes of high use, especially near tourist facilities. An analysis of the itineraries of cruise vessels plying the coastal waters of the Kimberley has ascertained that, although collectively they visit >100 sites, the most popular destinations are associated with specific nature-based or cultural attractions along the central and eastern Kimberley coast. Thus, while most of the Kimberley coast still remains physically unaltered from its natural state, there is growing evidence of widespread human use. The Western Australian government has recently implemented several multi-use marine parks in Kimberley coastal waters (Eighty Mile Beach, Roebuck Bay, Horizontal Falls, Lalang-garram Camden Sound and North Kimberley) and these are jointly managed by the Western Australian Department of Parks and Wildlife and the traditional owners. Whilst these marine parks are expected to contribute significantly to the conservation of this remarkable region of Australia, it is incumbent upon their managers to carefully monitor usage of this largely unspoilt coastline so that deleterious impacts can be mitigated or avoided.

Extreme marine warming across tropical Australia during austral summer 2015-2016

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During austral summer 2015-2016, widespread coral bleaching was reported from the Northwest Shelf to the Central Great Barrier Reef, including severe coral bleaching and mortality throughout the Northern Great Barrier Reef. In the Gulf of Carpentaria, there were reports of massive mangrove die-backs and clams bleaching along Groote Eylandt. These events occurred during a marine heatwave that extended across tropical Australia's marine waters. We seek to understand the relative roles of drivers governing interannual and intraseasonal variability during the events that transpired. The me heatwave was instigated by the strong El Niño due to enhanced solar radiation and reduced evaporative cooling. A marine heatwave framework is applied to daily sea surface temperatures, revealing warm anomalies emerging in the Indo-Australian Basin in late spring 2015 and in the Gulf of Carpentaria and the Northern Great Barrier Reef by January 2016. Peak temperature anomalies occurred in March 2016, exceeding 2°C above seasonal average temperatures over a broad spatial extent. In addition, observations are synthesised from in-situ deep-water and shelf temperature measurements, including ARGO floats, shipboard thermosalinograph data, Slocum gliders, moorings, and temperature loggers. A data-assimilating model is used to further examine the circulation and temperatures over this time period. Recommendations are made for future monitoring of marine heat wave events in this region.

Complex ocean currents promote adaptive diversification and lower dispersal in a tropical reef fish from north-western Australia.

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Two important goals of biological conservation are to identify regions of high evolutionary potential, and to manage them at appropriate spatial scales. Yet, characterising adaptive genetic variation and dispersal is a technical challenge, particularly in the marine environment where sampling and observation is difficult. In poorly studied regions, population genomic approaches offer opportunities to simultaneously examine spatial processes as well as contemporary evolutionary diversification. Here we show that a common damselfish from north-western Australia exhibits more spatial genetic structure and greater putative adaptive genetic diversity in a macro-tidal region than a meso-tidal region. Using genome scans consisting of 4,472 SNP loci applied to 847 samples of the damselfish *Pomacentrus milleri*, we detected marked genetic sub-division between the macro-tidal Kimberley bioregion (up to 12 metre tides) and the meso-tidal Pilbara and Gascoyne bioregions (1-5 metre tides). Individually, these bioregions also differed in the extent of population sub-division; spatial autocorrelation was detectable over several hundred kilometres in the Kimberley, but undetectable in the Pilbara. This implies, paradoxically, that substantially stronger currents in the Kimberley promote shorter range dispersal than in the Pilbara, possibly because larval retention zones are created by the region's complex bathymetry, and currents are predominantly tidal rather than along-shore. The Kimberley also exhibited significantly more neutral genetic diversity than the other bioregions, as well as 108 putatively adaptive outlier loci, whereas no outlier loci were detected elsewhere. We conclude that the Kimberley bioregion likely represents an important source of evolutionary novelty in *P. milleri*, and that optimal management of this and similar species would occur on smaller spatial scales than elsewhere in north-western Australia.

Going with the flow: genomic insights into ecological connectivity in the Kimberley

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Obtaining an understanding of ecological connectivity within marine systems is central to the design of marine reserves and the management of harvested species. In practice however, connectivity is spatio-temporally complex, and detailed studies across multiple scales and taxa are needed to reveal the way biogeography, life-history and environment interact. The inshore Kimberley provides a new frontier for connectivity studies because of the unique and dynamic tidal regime and often harsh environmental conditions. It is unclear how such a unique hydrodynamic regime should influence dispersal of marine larvae in the Kimberley. Conceivably it could enhance dispersal, but equally, it could act as a disruptive barrier to dispersal. Here, we discuss eight key findings of the recent WAMSI Ecological Connectivity project, which investigated ecological connectivity in seven organisms (two hard corals, two seagrasses, a mollusc and two fishes) at both fine and broad scales in northwestern Australia.

Isolation of oceanic and coastal populations of the harvested mother-of-pearl shell Tectus niloticus in the Kimberley

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The reef fauna of tropical northwest Australia below latitude 18°S is categorised as oceanic – typical of coral atolls occurring in clear water along the continental shelf edge , or coastal – typical of the turbid and macro-tidal coastal Kimberley region. The distinctiveness of these faunas has been attributed to both their hydrodynamic isolation as well as profound environmental differences, but since few species are common to both reef types, tests of realised connectivity have not been made. Here we use genotype-by-sequencing analysis (5,428 polymorphic SNP loci) of a large harvested mollusc, *Tectus niloticus*, to show that oceanic and coastal populations are indeed highly isolated, but furthermore, that coastal and oceanic populations are likely locally adapted to their distinctive environments. In total, 514 *T. niloticus* were collected from 17 locations, including 15 in the coastal west Kimberley region and two oceanic sites (Rowley Shoals and Scott Reefs). Significant genetic sub-division was evident between the oceanic and coastal sites (distances *c*. 300 to 500 km, neutral F_{ST} = 0.04), with a sub-set of loci exhibited significantly higher sub-division (outlier F_{ST} = 0.40). Significant sub-division was also evident between the two oceanic sites (distance *c*. 400km, F_{ST} = 0.02), but negligible genetic sub-division was evident between coastal sites (distances ≤ 75km), and the recorded subdivision could not be attributed to geographic distance or modelled oceanographic connectivity. Harvested *T. niloticus* populations from the coastal west Kimberley and adjacent offshore reefs represent two genetically and demographically independent units, with the oceanic populations being further subdivided. Existing marine reserves and harvest management for *T. niloticus* in northwest Australia reflect these divisions appropriately.

Cumulative impacts: thermally bleached corals have reduced capacity to clear deposited sediment

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The interaction between local, anthropogenic stressors and larger scale regional/global stressors is often used to explain the current poor condition of many corals reefs. This form of cumulative pressure is clearly manifested by situations where dredging projects happen to coincide with marine heatwaves that cause coral bleaching. A key pressure associated with dredging is elevated sedimentation. In this study, 3 coral species (*Acropora millepora*, *Porites* spp. and *Turbinaria reniformis*), were experimentally induced to bleach by exposing them to a temperature of 31°C for 21 d. The corals were then exposed to a range of sedimentation rates (0, 11, 22 and 40 mg cm^{-2} d^{-1}), and their sediment-rejection ability was quantified after 1 and 7 successive sediment deposition events. Bleached corals were less capable of removing sediments from their surfaces with sediment accumulating 3 to 4-fold more on bleached than normally-pigmented corals. Repeated deposition resulted in a ~3-fold increase in the amount of sediment remaining on the corals, regardless of bleaching status. These results suggest that adaptive management practices should be developed to reduce the impacts of future dredging projects that follow or coincide with elevated sea surface temperatures and subsequent coral bleaching events.

Molecular ecology in the tropics: Describing sediment microbes and mine-derived pollution in the Torres Strait

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Large rivers carry substantial volumes of terrestrial sediments, organic matter and a variety of contaminants into adjacent marine environments. This is of particular interest in areas of ecological significance, such as the Torres Strait in northern Australia. This is the northernmost extent of the Great Barrier Reef and the region supports extensive seagrass meadows. Due to its shared border, the Torres Strait is exposed to runoff from the Fly River (Papua New Guinea), which contains mine-derived sediments which contain elevated copper concentrations. Suspended sediment plumes emanating from the Fly River Estuary have been periodically observed entering northern Torres Strait waters; however the potential impact on seagrass and reef ecosystems remains poorly understood. Genomics provide a sensitive tool to investigate these impacts across the land-sea divide. To determine the spatial distribution of contaminant impacts, we sampled sediment along a grid throughout the Torres Strait. Next-generation amplicon sequencing was applied to investigate changes in microbial sediment communities and thus assess potential ecological impacts. This project is funded by the Australian Government's Natural Environmental Science Program's (NESP) tropical water quality hub and provides the first comprehensive taxonomic assessment of microbial communities in the region. Our results will provide new insight into the impacts of sediment deposition on the Torres Strait for targeted ecosystem management and highlight the enormous potential for genomics in rapid ecosystem impact assessments over large spatial scales.

Phenology of *Trichodesmium* blooms in the Great Barrier Reef Lagoon from 10 years of satellite imagery.

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Trichodesmium sp. is a filamentous bloom-forming marine cyanobacterium that plays a key role in the biogeochemistry of oligotrophic ocean regions because of its ability to fix nitrogen. Naturally occurring in the Great Barrier Reef, its contribution to the nutrient budget is estimated to be of the same order as that entering the marine park waters via catchment runoff. Yet *Trichodesmium*'s cyclicity in the Great Barrier Reef is poorly understood and sparsely documented due to the lack of sufficient and recurrent observations. This study provides the first systematic analysis of *Trichodesmium* spatial and temporal occurrences in the Great Barrier Reef over the 10-year period of the MERIS ocean color mission (2002-2012). The Maximum Chlorophyll Index (MCI) was applied to MERIS satellite imagery of the Great Barrier Reef lagoonal waters. A north (Cape York) to south (Fitzroy) increase in the size, frequency and timing of *Trichodesmium*'s blooms, with surface expressions reaching up to 700 km in length in some instances, was observed. The two southernmost regions of Mackay and Fitzroy accounted for most (70%) bloom events. The bloom timing of *Trichodesmium* varied from May in the North to October in the South of the Great Barrier Reef, with wet season (November~April) conditions being possibly less favorable to *Trichodesmium* aggregations. MODIS Sea Surface Temperature (SST) datasets, the climatic Southern Oscillation Index (SOI), wind speed and field measurements of nutrient concentrations were used in combination with MERIS MCI to assess blooms' driving factors. A low wind speed (<6 m.s-1) was associated with larger (MCI counts>500) surface aggregations. While SOI only partially explained an increase in bloom frequency, MCI was strongly (>60%) correlated with SST in the north but poorly in the south, thus suggesting that other environmental drivers, such as nutrient availability, determine *Trichodesmium* surface aggregations in some regions of the Great Barrier Reef.

Satellite detection of oil pollution in the Great Barrier Reef using ESA's multi-sensor Sentinel missions.

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Environmental programs monitoring the Great Barrier Reef (GBR) must balance the density and frequency of in-situ observations with the number of variables monitored and the financial constraints of such surveys. Remote sensing provides a cost-effective assessment tool for large-scale monitoring such as for the GBR. The GBR is recognized as a high risk area for oil spills by the Australian Maritime Safety Authority (AMSA). As a result of increased marine traffic, ship incidents are more likely and resulting spills may lead to significant marine pollution as well as physical damage to the reef. Some of the oil (hydrocarbon) pollutions from ship incidents that occurred in 2009, 2010 and recently in July 2015 had devastating consequences for the GBR. Therefore a timely, accurate and automated detection of hydrocarbon surface pollution (location, type and source) would significantly advance the coastal management capabilities of the marine park and trigger faster environmental responses. Synthetic Aperture Radar (SAR) are the primary satellite instruments able to detect the accumulation of marine oil slicks during day, night and through clouds. They cannot however distinguish biogenic films (e.g., algal blooms) and other surface features from anthropogenic pollution, therefore multiple satellite sources including optical and thermal imagery are necessary to further characterise their detection and to reduce false-positives. Spatially and temporally consistent imaging of multiple environmental parameters that are directly relevant to oil pollution monitoring are now available of the European Space Agency's (ESA) Sentinel-1 and Sentinel-3 missions. In this talk, we will explain how marine oil pollution can be monitored from space, and why the synergetic use of ESA Sentinel satellites offers an enormous potential for innovation in the context of oil spill monitoring for the GBR.

Setting priorities for conservation initiatives at the interface between ecological connectivity, ocean circulation and ecological dynamics

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We address the question of defining priorities for conservation initiatives based on interplay between ecological connectivity, ocean circulation patterns and ecological dynamics. We estimate networks of connectivity between fringing coral reefs in the North West Shelf of Australia using a particle tracking model based on the shelf circulation. We account for density-dependent population growth by modelling the dynamics of sub-populations in each individual reef. An individual reef's carrying capacity is used as a proxy for overall habitat quality. Changes in habitat quality (=carrying capacity) can occur either as a result of natural processes (climate change, bleaching), human-driven processes (exploitation, pollution) and conservation initiative (protection, restoration). We obtain three main results of conservation significance. First, the dynamics of the ecological network is the result of the interplay between network connectivity and ecological processes on each reef: density-dependence imposes a significant non-linearity on the role an individual reef plays within the network dynamics and thus on the impact of conservation interventions on specific reefs. Second, the role a reef plays within this network dynamics changes considerably depending on the overall state of the system: a reef's role in system maintenance can be different from the same reef's role in system recovery. Third, patterns of network connectivity change significantly as a function of seasonal and yearly shelf circulation trends and non-linearity in network dynamics make mean connectivity a poor representative of yearly variations. From a management perspective, the core message is that defining a priority list of targets for management interventions, that is choosing what reefs should be considered for management intervention, depends crucially on what type of stressors we want to address, which in turn depend on future oceanographic scenarios (which determine the network connectivity), future development and climate change scenarios (which determine habitat quality) as well as whether the ultimate purpose of management is conservation or system recovery.

A review of remote sensing-derived products and tools to support marine park management.

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The overall objectives for marine park management is to conserve and protect the ecological value for which these areas are designated and restore and remediate degraded areas. Effective management and conservation of marine parks requires periodic monitoring to detect environmental changes, however, in situ monitoring is often hampered by their remote location and often vast extents. Satellite remote sensing offers effective spatial and temporal coverage to monitor marine protected areas in the periods between routine in situ monitoring campaigns and after catastrophic events. There are numerous of advantages to incorporating remote sensing-derived data into management decisions. We will outline the current status of remote sensing technology and available tools to support monitoring and management. We will also present an update on the latest developments in sensor technology, advanced computing infrastructure and the near-future forecast for new satellite sensors that will provide improved retrieval accuracy for the estimation of environmental variables. A translation of remotely-sensed scenes into management relevant information products is required for environmental managers to take full advantage of the remote sensing imagery archives.

Coastal dynamics of Northern Australia over the last three decades – preliminary insights from the Landsat Data Cube

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The Landsat archive in the Australian Geoscience Data Cube (AGDC) is structured to enable rapid time-series analysis (1987 – 2017), which makes it especially useful for identifying dynamic characteristics of areas that lack observational records, such as the coast of northern Australia. We developed a visualisation tool that displays the Landsat time series. Preliminary results for three locations demonstrate the utility of being able to rapidly visually scan in detail the full time series. Clearly displayed are the abrupt loss of mangroves due to the passage of cyclones over an estuarine creek (Junction Bay); the gradual though extensive expansion of mangrove (1987 – 1996) and subsequent rapid decline in the southern Gulf of Carpentaria (2013 – present; Burketown); and minor expansion of mangrove in a large stable embayment (Darwin Harbour). Utilising the AGDC enables clear links to be made between rapid change and recorded climatic events (e.g. cyclones), however, more gradual change requires further investigation to determine the influence of trends in broader regional or global climatic parameters.

Effects of ocean warming and acidification on the ecophysiology of a common coral-algal interaction

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Coral-algal interactions are one of the most fundamental aspects of coral reef ecology, as their relative abundance is critical to the structure and function of entire ecosystems. As coral reefs degrade under global anthropogenic stressors, the interspecific interactions between coral and macroalgae are of particular importance because altered competitive dynamics are likely to drive ecosystem shifts. Even so, species interactions are generally ignored in assessments of climate change impacts. In order to gain a more complete understanding of how coral reef communities are influenced by global anthropogenic stressors, we investigated how the ecophysiology of a common coral-algal interaction is influenced by anticipated end-of-the-century ocean warming and acidification conditions. Specifically, we examine the effects of ocean warming and acidification on the survivorship, calcification, and productivity of the common coral-algal interaction between *Acropora intermedia* and *Halimeda heteromorpha* over 8 weeks in two austral seasons. Our results reveal no evidence of contact-induced physiological inhibition, even under the combined stressors of ocean warming and acidification. Both *A. intermedia* and *H. heteromorpha* calcification rates were significantly higher under present day conditions in the summer. Peak *H. heteromorpha* growth occurs when *A. intermedia* needs the most respite from high light and temperatures, with the increase in *H. heteromorpha* biomass likely influencing light conditions through shading and resulting in a 37% increase in *A. intermedia* productivity during the summer. The combined stressors of ocean warming and acidification, however, acted synergistically in the summer, causing decalcification and a significant decline in *A. intermedia* and *H. heteromorpha* calcification rates, respectively. Furthermore, *A. intermedia* experienced significant coral bleaching and mortality due to a reduction in endosymbiotic dinoflagellate densities, a decline in productivity, and a depletion of available host protein content. Although the interactions between coral and macroalgae are often seen to involve negative competitive interactions, the results of our study provide novel insights into how species interactions can modify local environmental conditions through indirect yet positive mechanisms. These positive effects, however, are not enough to mitigate the effects of ocean warming and acidification projected to occur by mid- to late- century.

Spanish Mackerel: Metapopulations and Management

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The narrow-barred Spanish mackerel, *Scomberomorus commerson* (Lacepède 1800), is a large, fast-swimming pelagic predator, found throughout tropical and sub-tropical neritic waters of the Indo-West Pacific. The species has excellent table, nutritional and storage qualities and is renowned as light gamefish. It is targeted in commercial, artisanal and sport fisheries throughout its range. Global landings exceed 300,00 tonnes. Given this importance, and the concerns over some fishery failures, there has been substantial investigation of the spatial dynamics of the species. We review this work. Once regarded as "highly migratory", it is probable that this species has a complex, metapopulation-like. Management of this and other *Scomberomorus* species in Australian fisheries, managed separately in each of Torres Strait and the northern states, is slowly evolving. To add to this process, we ask, "how does this knowledge of the species' spatial dynamics, and ignorance, change the set of questions that fishery managers and researchers need to ask, and those that researchers need to address"?

Learning from nature: Using meta-analyses to ecologically inform foreshore infrastructure designs

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Natural habitats and communities in estuarine environments provide cultural services for society, presenting recreational, educational and artistic opportunities. Amongst others, estuarine communities can provide pleasant aesthetics, an opportunity to learn about the value of ecological systems and important traditional values. Along urban estuaries, however, rocky shore communities are in decline as their habitat shrinks and is replaced by relatively flat and featureless infrastructure that supports low biodiversity. In an ecological countermove, the addition of water-retaining features (e.g. rock-pools) to foreshore infrastructure is increasingly being used to help support and enhance local biodiversity. As the construction of ecologically friendly infrastructure gains momentum, there is an increasing need for the design of these features to be better informed by the characteristics of natural habitats that maximize diversity. Water retaining features in the rocky intertidal have been shown to increase biodiversity by creating micro-habitats for organisms. They act as important refuges from environmental and biological stressors. However, the diversity supported by rock-pools depends on particular physical characteristics, such as position on the shore, depth, volume, micro-habitats, inclination, distance between pools and materials. Based on published literature, we did a meta-analysis to evaluate the effects of position, size, depth and complexity, among others, on diversity. Results suggest that different physical features could drive taxa-specific responses. Fish diversity was related to volume, while diversity of benthic organisms was related to area of rock-pool. In addition, the meta-analysis highlighted a major gap in our understanding of how construction variables, such as material, incline and connectivity, might influence service provision by artificial rock-pools. The results of this study can be directly applied in the design of ecologically-informed foreshore infrastructure. The approach presented here can be used more broadly to evaluate the characteristics of natural habitats that facilitate the establishment of ecological communities to inform the design of urban infrastructure and enhance valuable services provided by estuarine environments.

Shellfish quality assurance in the Northern Territory

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The Department of Primary Industry and Resources is currently working with Indigenous groups to develop a suite of seafood-based enterprises (both sea-based farming and wild harvest) in remote coastal communities. Supporting the development of a small-scale marine enterprise with tropical rock oysters at Warruwi community on South Goulbourn Island is a top priority for the Department. Farming of blacklip rock oysters (*Saccostrea mytiloides*) has shown industry potential and communities are engaging in the development phase. Before the onset of any commercial shellfish industry in the Northern Territory, quality assurance regulations must be addressed. A project funded by the North Australia Marine Research Alliance (NAMRA) in 2013-15 provided Indigenous trainees at Warruwi, with skills and training by undertaking oyster sampling and water monitoring procedures for shellfish quality assurance. This involved one year of monthly data collection for bacteria in water and oysters, toxic phytoplankton in water and biotoxins in oysters. Data collected provided a strong step forward in assessment of South Goulburn Island as a suitable oyster farming zone, with minimal risks identified. No biotoxins were detected in oyster flesh at any time, and water and oyster flesh were mostly well under alert levels for bacteria. However, a small number of exceedance were detected around higher risk times of year; immediately preceding and after onset of the wet season. A knowledge gap exists as to why these increased levels occur during the wet season. There is significant need to determine the threats and whether they can be managed for future oyster farming on Goulburn Island. Further testing is currently underway to achieve a suite of data to satisfy ASQAP requirements. This poster will report on and discuss the shellfish quality assurance data from the Warruwi region to date.

Mercury in Barramundi of the Mary River System—Insights on the Metal's Cycling

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The Mary River and its estuary form a complex, floodplain river system on the Top End coast of the Northern Territory. Only during the wet season is it a fully connected waterway; at other times, it is a series of isolated channel pools and billabongs. Barramundi (Lates calcarifer) range throughout the Mary River system, down its tidal creeks and out into the adjacent coastal waters. As an apex predator, it is susceptible to bio-accumulating mercury. Our earlier results have shown that total Hg concentrations [THg] in fish muscle depend on habitat and are in the order billabongs > mid-reaches > tidal creeks and coastal waters. As a result, the relation of [THg] with total fish length for the full river system is very poor (R^2 = 0.0737; n=123). Although no instances have been detected to exceed the FSANZ guideline afforded barramundi of 1 mg Hg/kg (wet wt), larger specimens in the billabongs can exceed 0.5 mg Hg/kg. However, even for fish of a single year class captured in one billabong, there can be variable mercury burdens. It appears life histories and life styles are influential. A range of additional measurements—stable isotopes (notably C-13 and N-15), otolith microchemistry, etc.—provides the perspective. They give data on life history, carbon (prey) source and trophic position. Importantly, the study of mercury in barramundi in the Mary River system also uncovers information on the distribution and cycling of the heavy metal in this tropical coastal environment.

Assessing the behavioural response of sperm whales (*Physeter macrocephalus*) to marine seismic surveys: A case study from Lord Howe Rise in the Coral Sea

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In April-May 2016, Geoscience Australia (GA), in collaboration with the Japan Agency for Marine-Earth Science and Technology (JAMSTEC), completed a seven week marine seismic survey of the Lord Howe Rise (south Coral Sea). The scientific survey involved the use of a 7800 cubic inch air-gun array to map the full crustal thickness (up to 23 km) of the Lord Howe Rise, an area identified as a potentially important habitat for sperm whales (*Physeter macrocephalus*) and other cetaceans. An essential requirement of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) Policy Statement 2.1 is the application of practical standards to minimise the physical or behavioural impact of offshore seismic noise on whales. In preparing an EPBC Referral to the Department of the Environment and Energy for the survey activities, GA commissioned Curtin University's Centre for Marine Science and Technology (CMST) to undertake acoustic propagation modelling to predict received sound exposure levels and peak-to-peak sound pressure levels of the airgun array, and to assess the expected ranges for potential impacts of acoustic exposure on cetaceans. This modelling predicted sound propagation at levels sufficient to cause physiological damage (i.e. permanent and temporary threshold shifts in hearing) 50–390 m from the source and behavioural responses at distances ranging from 400 m to >250 km. To mitigate against the potential short-range effects, whale observations were undertaken through a combination of visual observation and Passive Acoustic Monitoring (PAM) to allow for real-time, 24-hour detection of whales. Monitoring effort was conducted over 39 days and included 440 hours of visual observations and 450 hours of PAM. A total of 29 marine fauna sightings and 50 marine fauna detections were recorded during this time. Of these, sperm whales accounted for over 70% of sightings and acoustic detections, and resulted in six of seven whale-instigated seismic shutdowns. Analysis of the acoustic data in collaboration with CMST will facilitate an assessment of the behavioural responses of sperm whales to the seismic sounds produced during the survey, and increase our understanding of the distribution and abundance of sperms whales in this remote region of the Coral Sea.

Impacts to seagrass from the herbicide Fusilade Forte® in management of *Spartina anglica* infestations

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Management programs for control of the aggressively invasive saltmarsh grass *Spartina anglica* (commonly known as rice grass) are heavily reliant on large-scale spraying of herbicides such as Fusilade Forte® (FF). The close proximity of seagrass meadows to *Spartina* infestations has raised concern regarding potential impacts from off-target herbicide drift into this vital ecosystem. FF (active ingredient fluazifop-P) is primarily phytotoxic to poaceous grasses by inhibiting acetyl coenzyme-A carboxylase (ACCase), and secondarily through promoting oxidative stress. Knowledge of non-target impacts on other plant species is limited. To assess risks from FF to the non-poaceous seagrass *Zostera nigricaulis*, a study involving laboratory experiments and a field-sampling program coinciding with FF spraying was conducted at Corner Inlet, Victoria. The lab experiment examined photosynthetic performance, pigment content, oxidative stress and ACCase activity of *Z. nigricaulis* following 7-d exposure to FF (0.01-10 mg/L fluazifop-P and a control), and after 14-d recovery in clean seawater. Results indicated that the primary mode of action of FF does not affect *Z. nigricaulis*. However, 7-d exposure to ≥ 0.01 mg/L fluazifop-P significantly reduced photosynthetic pigment content, influenced photosynthetic performance and induced oxidative damage to cellular membranes. During the 14-day recovery in clean seawater, photosynthetic performance and pigment content improved; however, at 7-d recovery plants exhibited significant oxidative damage to cellular membranes. The field-sampling program assessed fluazifop concentrations in seawater and seagrass samples prior to and following application of FF to *Spartina* infestations. Samples were collected from 6 sites within the potential herbicide plume and at a control site over 7 days post herbicide application. Results indicated that FF entered Corner Inlet at a low concentration after spraying and dispersed rapidly. Risk from spraying nearby *Spartina* infestations with FF is low; however, exposure is likely to increase vulnerability of *Z. nigricaulis* to other environmental stressors. Outcomes from this study provide a basis for discussing potential risks to seagrass habitats from ACCase-inhibiting herbicides and provide important data to guide approaches to *Spartina* management.

DNA analysis of scats reveals effect of breeding constraints and environmental variation on diet in a central place forager

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The marine environment is changing dramatically, requiring reliable indicators and proxies to understand changes in resource availability. Understanding how diet composition of marine predators relates to ecosystem or food-web change is an essential step, but conventional diet analysis techniques can be invasive and time-consuming, and therefore limited in sample size. We used dietary DNA-metabarcoding to determine the efficacy of top predator diet composition and diversity as an indicator of marine resource availability. DNA-metabarcoding allows the rapid, accurate interpretation of large numbers of samples. This method has the potential to identify all DNA contained in a predator's scat sample—many to species level—allowing greater dietary coverage and higher resolution than conventional hard-parts and stable isotope analysis. Using DNA-metabarcoding within an integrated monitoring approach, we investigated relationships between environmental variables, central-place foraging limitation, diet composition and breeding output of a marine top predator, the little penguin *Eudyptula minor*. DNA-metabarcoding analysis of scats revealed diet segregation between neighbouring sites (<2km apart), and temporal and breeding stage-based changes to composition of prey species in diet. Notably, this technique identified soft-bodied organisms such as salps and cnidarians as important prey in little penguin diet. These taxa were previously missed by isotopic methods, and underrepresented by hard-parts analysis. We compared diet diversity with Chlorophyll A, sea surface temperature and breeding data to reveal the interplay between environment and breeding stage on diet of opportunistic generalist foragers. When foraging range was most limited by the need to frequently provision chicks, diet diversity was highest, suggesting limited access to preferred prey species. Finally, using breeding data over an entire breeding season, we investigated how diet composition related to breeding output. DNA-metabarcoding allows the collection of numerous samples over extended time periods, with little disturbance to breeding colonies. Coupled with the high temporal and taxonomic resolution, we pose DNA-metabarcoding of predator diet as an important qualitative tool for the understanding of resource availability and ecosystem change.

Strengthened currents override the effect of warming on lobster larval dispersal & survival

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Climate change has induced both strengthening and warming of western boundary currents with widespread implications for the transport and survival of planktonic larvae. However, it has never been explicitly studied whether the effect of these two mechanisms on larval supply for settlement mitigate or enhance each other. Our study estimates changes in larval connectivity and dispersal under an IPCC future climate scenario downscaled to eddy-resolving spatial resolution (1/10°), focusing on the combined and individual impact of ocean warming and current strengthening on larval dispersal. Such understanding is crucial to predict future species distributions, anticipate ecosystem shifts, and design effective management strategies. We simulate contemporary (1990s) and future (2060s) dispersal of lobster larvae using an eddy-resolving ocean model in south-eastern Australia, a region of rapid ocean warming. We show that warming is favourable for lobster larval settlement along southeastern Australia, but that this is more than offset by the intensification of the East Australian Current, so that the end result is a reduction of 10% in the amount of larvae that reach the coast. Thus, accurate predictions of future larval dispersal patterns cannot be based solely on physiological responses of larvae to temperature. We also find a ~270km poleward shift in the settlement peak; these changes in connectivity have the potential to modify the geographical distribution of species in the long-term. Because climate induced responses off southeastern Australia are weaker than in most western boundary currents, our findings suggest that future re-distribution of species could in fact be stronger in other ocean basins.

Nitrate sources, supply, and phytoplankton growth in the Great Australian Bight: and Eulerian-Lagrangian approach

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The Great Australian Bight (GAB), a coastal sea bordered by the Pacific, Southern and Indian Oceans, sustains one of the largest fin fisheries in Australia but the geographical origin of nutrients that maintain its productivity is unknown, and the spatio-temporal variability of phytoplankton growth in the GAB has received little attention. We use 12 years of data and an Eulerian-Lagrangian approach to quantify nitrate supply to the GAB and the region between the GAB and the Sub Antarctic Front (GAB-SAFn), identify phytoplankton growth within the GAB, and ascertain the source of nitrate that fuels it. We find that nitrate concentrations have a decorrelation time-scale of ~60 days; since most of the water from surrounding oceans takes longer than 60 days to reach the GAB, 23% and 75% of nitrate used by phytoplankton to grow is sourced within the GAB and from the GAB-SAFn respectively. Thus, most of the nitrate is recycled locally. Although nitrate concentrations and flux into the GAB are greater below 100m than above, 79% of the nitrate fueling phytoplankton growth is sourced above 100m. Our findings suggest that topographical uplift and stratification erosion are key mechanisms delivering nutrients from below the nutricline into the euphotic zone and triggering large phytoplankton growth. We find annual and semiannual periodicities in phytoplankton growth, peaking in the austral spring and autumn when the mixed layer deepens leading to a sub-surface maximum of phytoplankton growth. This study highlights the importance of examining phytoplankton growth at depth and the utility of Lagrangian approaches.

Study of plastic marine debris around a seaside tourist city

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Xiamen, a famous seaside tourist city in China, is beset by the problems about plastic marine debris in recent years. Tens of thousands of egrets and cormorants are highly threatened by plastic in mangrove area near the city. We decided to find out the crux of this problem, by both investigation and tracing the plastic marine debris including micro-plastic in the Xiamen Bay. Results showed >60% plastic marine debris in the Xiamen Bay were plastic bags and their fragments. Main ingredients of micro-plastic were PE, nylon, PVC and PS, corresponding to food packaging, disposable breakfast boxes, fishing nets and aquaculture floats that listed in our survey. It was a troubling but also funny result, indicating the effect of foodies. It would be a long campaign to change the habits and customs of residents and tourists here.

Challenges and Experiences in Xiamen's Blue Bay Remediation Action

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Xiamen is coastal city with 1565 km^2 land area, 390 km^2 sea area, 234 km coastal line, 3.86 million people, and US $ 14 000. Xiamen is one of four special economic zones, also a free trade zone. With high population density and upstream input of Jiulong River, Xiamen waters are confronted with serious eutrophication problem. In order to restore and maintain the ecosystem and environment of Xiamen bay, Xiamen's Blue Bay Remediation Action was established based on the system and mechanism guarantee. Many comprehensive remediation projects were carried out in Xiamen in recent years including clearing marine aquaculture areas, dredging sediment, reconstruction of mangrove ecosystem, eco-restoration of uninhabited islands, ecological transformation of coastline, reduction of marine debris, construction of National marine park and other activities. This paper will show some challenges and good experiences in the process of eco-restoration in Xiamen bay.

Diffuse tolerance facilitates marine bioinvasion

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Tolerance to anthropogenic contaminants is a trait critical to the success of many species, particularly in highly contaminated areas. Most research has focused on localised tolerance, but mechanisms now exist for the evolution of diffuse, global-scale tolerance, with fundamentally different properties. Vessels coated in copper anti-fouling paint act as numerous mobile, heavily contaminated sites for marine epibiota, selectively transporting copper-tolerant species between contaminated port and harbours. We examined how diffuse (non-localised) tolerance may contribute to bioinvasion by testing the relationship between copper tolerance and marine bioinvasion at a regional scale (99 sites over 7 estuaries). Invader abundance and diversity were positively correlated with environmental copper, and invaders were 60% less sensitive to copper than native or cryptogenic species. Tolerance of a dominant invader (*Watersipora subtorquata*) increased with environmental copper, suggesting regulation of tolerance. We then used a simulation model to explore the basic properties of diffuse tolerance, and discover how its evolution and consequences intrinsically differ from those of localised tolerance.

Shallow marine life of New Zealand's subantarctic islands

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The subantarctic islands south of New Zealand support highly diverse and productive ecosystems. They are of great conservation value, and are key breeding areas for seabirds and marine mammals. However, most work to date has focused on their terrestrial ecosystems, and little is known about their marine life. Due to practical difficulties of underwater research in remote locations, many of their marine habitats remain relatively unexplored. We used Baited Remote Underwater Videos (BRUVs) to sample nearshore marine communities at 40 sites on the Snares, Auckland and Campbell Islands. Most of these areas had not previously been documented. We tested for patterns in community composition within and between islands, and along gradients of exposure. In general, communities of the Auckland and Campbell Islands were dominated by crustaceans (e.g. decorator crabs and squat lobsters), which occurred in dense aggregations at some sites. There were strong trends in community composition along gradients of exposure: inner inlets contained mostly small benthic crustaceans (e.g. isopods), and crustaceans became larger and more diverse towards the ocean. Fishes were relatively rare at these islands, besides a cod that was common at exposed sites. In contrast, the Snares Islands contained a diverse suite of fishes and far fewer invertebrates. The most widespread fishes at the Snares Islands were of the family Labridae (*Notolabrus funicola, Notolabrus cinctus, Latris Lineata, Pseudolabrus miles*) and Nototheniidae (*Notothenia angustata*). Patterns in faunal composition between islands are consistent with biogeographic expectations, and with the geomorphology of the islands. Auckland and Campbell Islands are considered subantarctic and contain large inlets, while the Snares Islands are more temperate (i.e. occur in a separate marine biogeographic region) and consists of steep cliffs that descend into the ocean. Results of these surveys will contribute to plans for conserving these valuable ecosystems.

The distribution of cyanobacteria in the waters of the Great Barrier Reef

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Picoplankton (<2 μm), the smallest phytoplankton in the global oceans significantly contribute to primary production with literature estimates ranging from 14-80%. Picoplankton are comprised of the cyanobacterial species – *Synechococcus* sp. and *Prochlorococcus* sp.. Several methods have been reported for the detection and measurement of cyanobacterial abundance and distribution, but rarely are researchers able to utilize more than 1 or 2 methods. During a recent RV Investigator voyage through the Great Barrier Reef, we investigated three different methods to determine the distribution and abundance of cyanobacteria. We compare the results from each method and report the advantages and disadvantages of each method and discuss whether all methods are equally useful in reporting the abundance of cyanobacteria.

4 years of observational data from LJCO; an assessment of the bio-optical variability in GBR coastal waters

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As part of Australia's Integrated Marine Observing System (IMOS), the establishment of the Lucinda Jetty Coastal Observatory (LJCO) in the coastal waters of the Great Barrier Reef (GBR), was to provide continuous bio-optical data which could be used for calibration and validation of remote sensing imagery, the development of regional algorithms for optically complex waters such as the GBR lagoonal waters and to provide input variables for biogeochemical and bio-optical models. The original LJCO was completely destroyed by cyclone Yasi in February 2011. After more than 2 years the station was re-established with routine fortnightly sampling starting in January 2014. During each trip instruments are checked and cleaned and samples are collected for pigment concentration and composition, CDOM, particulate absorption and TSS. Now with nearly 4 years of data, we are able to determine the variability in bio-optical parameters for the LJCO site is small and comparison of in situ data with model output is favourable. Overall LJCO is a site, providing critical data for the calibration and validation of current and future of ocean colour sensors.

Is oyster restoration of heavily urbanised estuaries possible?

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Oyster reef restoration has been proposed as a solution for improving water quality and enhancing biodiversity in degraded urbanised estuaries. Although restoration has been successful in some parts of the world, ecological patterns and processes are contingent on their location such that the outcome in Australian estuaries is unclear. We tested the plausibility of oyster reef restoration using the native Sydney rock oyster, *Sacosstrea glomerata*, in intermittently open and closed lakes and lagoons (ICOLLs) in New South Wales. Oysters were deployed at six randomly chosen sites within three urbanised estuaries of similar size: Manly Lagoon, Terrigal Lagoon and Avoca Lake. The survival, size, filtration rates, and nutrient flux of *S. glomerata* was determined soon after deployment and three months later. After this time, colonisation of infauna and epibiota to oyster and bare susbtrata were compared. The relative abundances of different size classes using underwater DIDSON (Dual frequency IDentification SONar) video footage were also compared at sites with and without oysters. Growth rates of oysters were similar among estuaries, but survival was greater in Manly Lagoon than in the other estuaries. It was clear that *S. glomerata* grow and survive in the urbanised ICOLLs, but the habitat setting of reef restoration sites must be considered carefully. Oysters and associated assemblages of fauna (infauna and epibiota) reduced the number of particles in the water, which will reduce estuarine turbidity. Furthermore, oysters took up nutrients without making additional contributions to the nutrient loading. Although clear differences in biodiversity (infauna, epibiota, and fish) were not detected between treatments with and without oysters during the three-month experiment, enhancement of biodiversity may be observed over longer time periods.

Calcification of reef-forming species in the Kimberley under variable pH regimes, today and in a future high CO_2 ocean

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Ocean acidification is a global threat to marine life. However, ecological theory suggests that organisms from more variable environments will have greater envelopes of tolerance to that particular stressor. This has been demonstrated with respects to the thermal tolerance of marine life, but to date remains relatively untested in the context of ocean acidification. Reef-forming calcifying species encounter larger changes in pH (the measure of ocean acidity) in shallow habitats dominated by macroalgae and seagrass. Here we document larger diurnal changes in pH in a macrotidal reef system in the Kimberley region of WA (Jalan/Tallon Island) than those published elsewhere previously (1.4 units per day). Here, calcifying reef species daily encounter pH changes an order of magnitude greater than those expected to occur in the open ocean due to ocean acidification within the next 50 years. We measured the short-term calcification and photosynthetic rates of abundant coralline algae and coral species across a range of pH conditions at Tallon Island and a nearby more constant pH site (Shell Island). We also measure the calcification rates of the coralline alga *Hydrolithon reinboldii* and the coral *Goniopora* sp., the only two species found in high abundance at both Tallon and Shell Islands, under 4 experimental regimes approximating the pH conditions at the two sites today and in the future due to ocean acidification. These treatments were 1) low pH variability and ambient mean, 2) high pH variability and ambient mean, 3) low pH variability and low mean, and 4) high pH variability and low mean. Here we will discuss how pH variability and site identity both alter the effects of ocean acidification for the two calcifying species, and how pH *in situ* influences their metabolic rates.

Overview of currents, nutrients and plankton of southeastern Tasmanian coastal waters from a five year field study

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A major data set of water quality (physical characteristics and nutrients) and phyto- and zoo-plankton in coastal waters of Storm Bay at the mouth of the River Derwent, Tasmania was collected from monthly sampling by IMAS at 5-6 sites for five years 2009-2015. The project was conducted primarily for the Tasmanian salmon aquaculture industry before industry expansion commenced in the bay, although the information is also important to other users of southeastern Tasmanian coastal waters. Our results confirm previous reports that Storm Bay is a complex system, influenced by (i) the influx of warmer, saltier and nutrient poor waters of the East Australian Current (EAC), especially during the summer-autumn period, (ii) by the Leewin Current with relatively warmer, more saline and higher nitrate inshore waters compared to shelf waters during winter and spring, and (iii) by periodic intrusion of cooler and nutrient rich subantarctic waters. Freshwater outflow from the Rivers Derwent and Huon can also alter the water properties of Storm Bay, especially during winter. Conditions in Storm Bay are largely determined by the dominant water body at the time, and significant interannual variability was observed which doesn't always follow expected ENSO climatic trends. Phytoplankton and zooplankton abundances and distribution in Storm Bay also revealed complex patterns that fluctuated seasonally and annually, and did not always conform to predictions based on ENSO climatic conditions. The expected distinct spring and/or autumn peaks in phytoplankton biomass were not observed in all years. Diatoms were the dominant phytoplankton group for much of the year; dinoflagellates were also present but at lower concentrations. Gelatinous Hydrozoans tended to be most abundant during years of warmer, low productivity waters. Other gelatinous zooplankton, Thaliaceans such as salps and doliolids, reached highest abundances during average temperature years. Krill, *Nyctiphanes australis*, an important component in the diet of many marine species, were observed in moderate abundance throughout most of the study, which is notable as blooms of this species have not been observed since the 1980's.

Restoration of a traditional aquaculture system for short-finned

eels (*Anguilla australis*) at Lake Condah (Tae Rak) in south-western Victoria

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Lake Condah (Tae Rak) in south-western Victoria, Australia, is one of the world's most ancient examples of traditional aquaculture, consisting of complex systems of traps and ponds used by indigenous people (the Gunditjmara) over millennia to collect short-finned eel (*Anguilla australis*) for consumption and trade. Artificial draining of the lake during the nineteenth century reduced water in the landscape and rendered most of the eel traps inoperable. In this presentation, we describe the traditional eel fishery at Lake Condah and its historical and cultural significance to the Gunditjmara people. We document the impacts of European settlement on the traditional eel fishery, and describe the processes and events, including research on eel migration, that led to the eventual restoration of the lake and reactivation of major parts of the traditional aquaculture system. In addition to restoring an ecological asset to the region, the restoration project provided important benefits to the Gunditjmara people, including enhanced connection to country and culture, opportunities for economic development and employment, and increased capacity for traditional owners to progress and negotiate outcomes within regulatory and administrative frameworks. Aspects considered critical to the success of the Lake Condah restoration project included: building of trust and confidence with key individuals over sustained periods; open and transparent lines of communication with stakeholders; use of strategic and business planning documents to guide activities; commissioning of high quality technical information to support and justify activities; representative leadership structures, and effective use of 'two-way learning' across western scientific and indigenous knowledge systems.

Carbon and nutrient cycling along the river-ocean continuum in Princess Charlotte Bay: observational methods to characterize the dominant biogeochemical pathways.

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Biogeochemical cycling of nutrients and carbon within the coastal Cape York Peninsula play an important role in the health of the northern Great Barrier Reef (GBR) ecosystem, and a fundamental understanding of the controls on these cycles is critical for environmental management. However, Cape York presents unique observational and modelling challenges because it is both remote and diverse. In this study, we focused on Princess Charlotte Bay (PCB) and its tributary rivers, which form the largest estuary system in Cape York and account for the majority of nutrient and sediment loads to the northern GBR. We applied several observation methods to determine the major controls on carbon and nutrient cycling and to quantify the relevant scales of variability. High-resolution spatial surveys showed that during wet season, flood plumes extended 40km across the bay to the interior reefs of the GBR. These plumes were characterized by high dissolved organic matter and low dissolved inorganic carbon (DIC). Flood-borne nutrients were rapidly assimilated nearshore, but chlorophyll remained relatively low throughout the PCB. During dry season, hypersaline conditions acted as a salt plug that trapped material in PCB estuaries. Discrete samples along the estuary axis showed an internal source of DIC and nutrients. This source appeared to be driven by aerobic respiration of organic matter from surrounding salt flats or mangroves. Semi-continuous sampling at anchor stations indicated that that aerobic respiration may be enhanced by tidal exchange and sediment resuspension. Times-series data from moored sensors confirmed that these hypersaline, heterotrophic conditions persist in the PCB estuaries for much of the dry season. Finally, we compared contemporaneous observations in the PCB and other Cape York estuaries, which range from tropical rainforests to tide-dominated coastal catchments. Controls on carbon and nutrient cycling were linked to large differences in seasonality and catchment features. Thus, effective management strategies may require a spatially-explicit approach toward observation and modelling of the of the Cape York coastline.

Monitoring and management of sea turtles and other marine megafauna in the Thamarrurr Region - where to from here?

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The Thamarrurr Region is in the far north-west of the Northern Territory, incorporating 250km of pristine coastline. The marine megafauna that inhabit this coastal area have fundamental spiritual, cultural and economic importance to the Traditional Owners of the Thamarrurr Region, evident in creation stories, song lines and customary use of species. They also hold conservation significance for local, national and international governments and researchers. Whilst sea turtles, dolphins, dugongs and other marine megafauna continue to inhabit these coastal waters, this area is considered one of the most data poor Regions of the Northern Territory. Adhoc survey data over the past 12 years' records Flatback and Olive Ridley turtles, listed as *Vulnerable* and *Endangered* respectively under the *EPBC Act* 1999, nesting in the Thamarrurr Region. However, population numbers and distributions remain unknown. Dolphins, dugongs and other marine megafauna have even greater data deficiency. Threats facing marine megafauna in the Region include changing habitats due to natural changes (weather, tides, climate, etc.), impacts of human activity (existing and proposed developments in the Region), marine debris and marine pollution, overharvesting of turtle eggs in readily accessible beaches, and egg predation by feral animals. Thamarrurr Rangers have been engaged in land and sea management in the Region for 15 years, including regular coastal and sea patrols, monitoring marine megafauna, supporting fisheries research, and the removal of ghost nets and other marine debris. The Rangers currently have two vessels in survey, with trained and experienced local crews. Rangers are starting to work with Traditional Owners, the school and wider community to educate and facilitate a management plan for sustainability of the turtle populations. The Rangers and Traditional Owners are interested in obtaining practical support to aid systematic and robust data collection on marine megafauna, and work through management options that are meaningful and realistic for their Country.

The ecological consequences of urban seascapes at the microbial scale

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Global seascapes are increasingly modified to support high levels of human activity in the coastal zone. Modifications include the addition of defense structures and boating infrastructure, such as seawalls and marinas that replace natural habitats. Artificial structures support different macrofaunal communities to those found on natural rocky shores; however, little is known about differences in microbial community structure or function in urban seascapes. We used surveys of Sydney Harbour to investigate how microbial communities differ between artificial structures (seawalls) and natural habitats (rocky shores). We also tested how pre-seeding structures with native habitat forming species and adding complexity could influence the development of intertidal and subtidal microbial communities with experimental retrofitting of seawalls. Newly formed biofilm was sampled in each instance and 16S/18S rRNA genes sequenced using the Illumina Miseq platform. We found that key heterotrophic bacteria and nitrogen fixers were relatively more abundant on rocky shores while tolerant autotrophic bacteria were relatively more abundant on seawalls. This is the first study to investigate microbial communities on marine infrastructure and how this could be manipulated through retrofitting. Our findings highlight how genomics tools could inform management of urban seascapes and have implications for ecologists and engineers seeking to design environmentally-sustainable marine infrastructure.

Assessing the impacts of land-based discharges on ecosystem structure and function of urban waterways.

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Estuaries are diverse and productive ecosystems that are subject to high levels of disturbance. They are exposed to multiple stressors such as legacy contaminants in sediments and ongoing inputs of nutrients and metals *via* stormwater. We surveyed sediment communities at four locations with large stormwater drains in Sydney Harbour, Australia. Locations were either poorly-flushed embayments or were well-flushed open channels. Sediment was collected monthly during base rainfall (<5mm/day) for 6 months from 3 sites within each location at increasing distance from the stormwater drain (0, 200 and 1000 m). We also collected sediments after 2 large rain events (>150mm in 24h). Next-generation sequencing was used to characterize the microbial community and sediment was subsampled for metals, total organic carbon, total nitrogen and phosphate. Sediment cores were also collected to measure biogeochemical processes including primary productivity, community respiration and nutrient cycling. We observed major shifts in the microbial community related to exposure to legacy contaminants and new stormwater contaminant inputs. We also found trends of decreasing community respiration rates away from storm drains and lowest rates of primary production during base rainfall. The results have implications for future management of stormwater in estuaries and increase our understanding of how to conserve crucial sediment community diversity and function.

World Harbours Project: Eco-engineering for biodiversity – preliminary observations and lessons learnt from Hobart Harbour.

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The World Harbours Project has undertaken a global study to look at whether artificial substrates used to build harbour structures could be better designed; specifically, whether incorporating 3 dimensional structure on surfaces in urbanised/ industrialised areas within harbours can improve biodiversity and ecosystem function. In Hobart we deployed a series of tiles at two very different locations within the harbour in November 2016. Three different types of tile (flat tiles, tiles with 2.5cm high habitat enhancement and tiles with 5cm high habitat enhancement) were deployed on seawalls in the intertidal zone at each site. The tiles were purposely structured to encourage mussel communities to become established. The intention being that this would increase biodiversity both directly and indirectly by adding even more structure to further increase the biodiversity. However, as an additional comparison each tile type was deployed with/ without additional mussels resulting in a total of 7 independent treatments:

1. Flat tiles (textured) with bivalves
2. Flat tiles (textured) without bivalves
3. 2.5 cm high habitat enhancements (textured) with bivalves
4. 2.5 cm high habitat enhancements (textured) without bivalves
5. 5 cm high habitat enhancements (textured) with bivalves
6. 5 cm high habitat enhancements (textured) without bivalves
7. Flat tiles (made of similar material to seawall) without bivalves

We present the results of the conditioning phase of the project – including some "lessons learnt" and some observations on the ecological changes (including some potential "down sides") that are particularly relevant to the Hobart harbour scenario and may have implications for similar studies in harbours worldwide.

A participatory approach to benthic habitat mapping in a highly turbid marine environment

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Maps of benthic habitats that describe the substrate and biotic community structure of the seafloor are considered some of the best surrogates for biodiversity in the marine environment where accurate species distribution data are scarce. Thus, characterisation of the marine environment with benthic habitat maps is becoming increasingly important to advance the understanding of the marine ecosystem and better inform management decisions. In the Northern Territory (NT), due to the vast expanse of unsurveyed area and extremely high turbidity, traditional methods of benthic habitat mapping such as acoustic sounding and satellite imagery are not always feasible. Aboriginal people make up 50% of the coastal population in the NT and have extensive knowledge of the marine environment. Indigenous ecological knowledge (IEK), the empirical knowledge of the natural environment accumulated through multiple generations, can therefore be an excellent source of information for characterizing the marine environment where other data are scarce. This study developed a methodology which combined elements of expert elicitation and participatory mapping techniques to assemble the IEK of Indigenous ranger groups in the NT. The information gathered was then combined to develop benthic habitat maps of the sea country within an Indigenous Protected Area, to identify priority areas for future research and inform management decisions. The methodology developed can provide a cost effective and replicable technique to characterise large areas of the marine environment and facilitates ongoing information exchange and knowledge sharing between western scientists and Indigenous communities.

Can we engineer coastal defence structures to support more natural biota as oceans acidify?

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In response to sea-level rise, coastal defence structures will continue to be built or upgraded to protect infrastructure of value to humans. Such artificial structures and the materials they are made of influence the composition of organisms that grow on them. However, how these structures will physically and chemically change in response to ocean climate change and the effects of these changes on their associated biotic communities remains largely unknown. We investigated the effects of ocean warming, acidification, and type of coastal infrastructure material (concrete, granite and high-density polyethylene (HDPE)) on algal turfs. Experiments revealed that temperature, pH, and substrate material are all significant factors in determining the cover of turf. Seawater acidification resulted in greater covers of turf, though this effect was counteracted by an equivalent reduction of cover in response to elevated temperatures. Concrete supported a greater more turf than granite or high-density polyethylene (HDPE) under all temperatures and pHs, with the highest covers occurring under future conditions. Furthermore, pH and substrate material interacted to alter the photosynthetic health of turfs, where turfing algae on concrete plates in acidified conditions exhibited significantly greater effective quantum yields compared to all other materials and treatment combinations. Overall, we show the impending mitigation efforts to offset impacts from sea-level rise can also be engineered to minimize impacts of oceanic change and support healthy marine biota under future conditions.

Are Process Indicators Better Than Inventory Indicators For Determining Estuarine Ecosystem Health?

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Lengthy data time-series are normally required to describe water quality improvements in seasonal estuaries. Information about the onset of eutrophication may point to likely timeframes for improvements from mitigation measures, but the onset has been difficult to describe, because of a lack of representative historical data when human impacts commenced. For the Swan River, early media reports documented significant macroalgal accumulations in the 1930s in Perth Water, associated with discharges from primary-treated sewage upstream of the Causeway. For the Peel-Harvey Estuary, accumulations of macroalgae were reported anecdotally from the late 1960s, a decade after widespread clearing, draining and fertilizing of acid leaching sands adjacent to catchment waterways. Limited historical TP data were available for the Swan and Peel-Harvey estuaries from the late 1940s, but regular inventory monitoring did not commence until the 1970s. No historical water quality data were available for other southwest estuaries. The nutrient-responsiveness of estuarine periphyton assemblages was postulated as a process, to provide early warning for the onset of eutrophication. Periphyton zone-enrichment studies were undertaken in southwest estuaries. Various rates of slow-release nutrients were introduced around glass plates anchored in situ for 7 days. Installations were located at the downstream end of estuaries extending upstream toward the upper limit of the tidal signal. Periphyton response measured as ash-free dry weight, was broadly related to ambient water quality conditions for zero nutrient additions at all sites and estuaries, with upstream sites having the highest periphyton accumulations. The response of periphyton to additions of nutrients was significant at sites in highly nutrient-enriched west-coast estuaries, like the Swan and Peel-Harvey. Periphyton nutrient response was noted, but was less for south-coast estuaries having a reduced history of nutrient enrichment, such as Hardy and Wilson Inlets and Oyster Harbour. There was almost no response to added nutrients for pristine ocean and estuarine sites. Periphyton accumulation and nutrient response over a 7-day period during the summer flow minima was consistent with nutrient-enrichment history measured by water column nutrient levels over much longer time periods.

Indigenous Wisdom Can Inform Human Impact Detection and Mitigation for the Indian Ocean

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A significant component of IIOE-2, is determining human benefits and impacts. Assembling an evidence base across multiple regions and jurisdictions will be problematic. The impact-detection and mitigation space can be classified on the basis of specificity between cause and effect. 1) Simple: Point-source pollutants which, because of obvious discharge points, are easy to target for pollution control. Acceptable discharges and receiving water quality can be achieved within months of initiating actions. 2) Complicated: Diffuse-source pollutants from agricultural areas are carried by stormwater and its pulsed nature, makes source definition and impact detection difficult. Mitigation is difficult to achieve and even with the best policy development, regulation and community education, detecting improvements in runoff and receiving water quality may take decades. 3) Complex: Heterogeneity in soil-water systems across larger regions having a range of both point-source and diffuse-source pollutants means that lags, thresholds and uncertainties abound. This makes source-definition and mitigation much more difficult. The political will to provide adequate resourcing and to legitimise the required policy and regulatory environment often evaporates long before any real progress in impact mitigation has been achieved. The Peel-Harvey system in WA is an example where construction of the Dawesville Channel to the ocean created rapid improvements in estuarine water quality. Increasing intensification of agriculture and rising urban populations have meant that to date, there have been no net improvements in catchment runoff quality, despite more than 40 years of research, policy, regulatory controls and extension. 4) Truely simple: This is where people across the catchment are culturally-aligned with the catchment's limits. Traditional Indigenous knowledge in all countries can, with its universal notions of holism, integration and obligation, inform an adaptive management approach based upon scenario planning. This inter-generational and incremental approach has the potential to provide many eyes and hands and a consistent local and regional reach enabled within a framework of spiritual and cultural legitimacy. There is now an opportunity to explore Indigenous wisdom as part of impact detection and mitigation across the Indian Ocean region.

Broadening and deepening the connections - Bi-cultural marine monitoring partnerships

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Western science has particular cultural perspectives and processes that inform societal exploitation of marine ecosystem services. Aboriginal people have different perspectives and processes. We are now realising the suite of benefits than flow from authentic bi-cultural marine monitoring, management and R&D partnerships. Processes for negotiating roles and responsibilities and integrating different perspectives and processes have commenced. For traditionally-owned (sea)country, the primacy of an Aboriginal non-dualistic world-view which roots humans through their actions, as being central to ensuring ecosystem health, will need to be established at the outset. This differs from the common western conservation world-view which typically sees humans as a major contributor to adverse impacts and who need to be either controlled or excluded. The Indigenous non-dualistic world-view having primacy, will enshrine indigenous protocols for knowledge integration and transmission as being fundamental. Ensuring that Elders are able to participate fully in co-development of research priorities, scoping enterprise development opportunities and in gleaning early management insights from monitoring data along the way, represent additional opportunities for science-based agencies active in the bi-cultural partnership space. While some Indigenous Marine Ranger (IMR) groups have been in operation for more than 10 years, and have been successfully undertaking a wide range of partnership monitoring activities, many others have partnership aspirations but require support to ramp up their capability. This involves the provision of culturally-translated and operational Standard Operating Procedures (SOPs) that describe important marine habitats and their inhabitants, together with adequate training, resourcing and opportunities for higher learning. It is also important that realistic expectations are established around what is possible with marine monitoring to define baselines and for trend detection. The inherent variability of marine environments can confound poorly-designed monitoring programs. The processes of capacity-building needs to be brokered effectively and sensitively if it is to properly support the future provision of independent and quality marine monitoring services by IMRs which can also facilitate research, knowledge and enterprise co-development opportunities for Traditional Owner partners across the tropical north of Australia.

Earth Observation's Role in Sustainable Development Goals: relevant Geospatial assessments of Freshwater, Estuaries, Coasts and Oceans.

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The UN Sustainable Development Goals (for the UN 2030 Agenda for Sustainable Development) were adopted in September 2015, to be implemented by the UN member states. The Agenda include17 SDG's with 169 targets and many associated indicators to guide national statistics to monitor them. Two SDG's are directly relevant for marine science and earth observations: Goal 6: "Ensure availability and sustainable management of water and sanitation for all" and Goal 14: "Conserve and sustainably use the oceans, seas and marine resources for sustainable development". Also Goal 15 is relevant: "Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss", where aquatic ecosystems depend on wetlands' conditions between the land and the ocean. It is clear that Earth observations will play a significant role globally in assessing progress against these goals, especially in areas where there is no or little in situ monitoring capability such as remote areas and in developing countries. Earth observations can also support the process by helping to achieve some goals or targets. We present examples of the use of Earth observations as an additional tool for monitoring progress against the UN SDG's in inland, estuarine and marine relevant areas. An interesting aspect of the implementation of the UN SDG's is that the National Statistical Offices (NSO) of each of the UN countries will, in principle, be in charge of reporting the relevant UN SDG statistics to the UN. Thus the geospatial information from Earth observations will need to be delivered in a suitable format for official statistics: a learning curve for both Earth observation expert and for national statistical offices. An important development is the provision of fully pre-processed satellite earth observation archives and near real time images in Analysis Ready Data format- making it much easier for non earth observation experts to use these vast geospatial data resources for their applications.

Economic implications of trade-offs to support healthy estuaries under pressure from urbanisation

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Water sensitive urban design (WSUD) is an approach to urban planning that helps mitigate the impacts of stormwater on waterways, and can enhance the ecosystem services and intrinsic values the waterways provide. WSUD is still to be fully integrated in land use planning, possibly due to uncertainty around capital and especially operational costs, and not appropriately targeting all relevant waterway objectives. In this study, we provide a risk-based framework for identifying cost-effective opportunities for mitigating stormwater impacts on waterways through WSUD. The framework relies on an effects based assessment to identify the effectiveness of management responses in achieving objectives, and a cost-benefit analysis to highlight the trade-offs for each management response. The study was focussed on Lake Illawarra in New South Wales (NSW), where extensive urban developments are underway in the western part of the lake's catchment. We found that current management responses, based on a generic set of post development stormwater load reduction targets, are ineffective in achieving waterway objectives under Greenfield development scenarios and can result in over engineered solutions for redevelopment scenarios. We determined an alternative management response based on sustainable loads for the lake, which were derived from ecological health triggers for lake ecosystems in NSW. To achieve the sustainable load, we found that a higher level of WSUD is required in some areas of the catchment resulting in higher capital and operational costs compared to current management costs. However, we also found that costs were much less than current in other areas of the catchment that are already impacted. By explicitly monetising the ecosystem services provided by the lake, we found that the benefits of having areas with a higher level of WSUD outweighed capital and operational costs. To assist with land use planning and implementation strategies, we translated the outcomes of the effects based assessment and cost-benefit analysis into 'benefit' maps that show areas in the catchment posing greatest risk to estuary health, but at same time, providing cost-effective opportunities for WSUD.

Development of an empirical Harvest Control Rule for supporting management of the Torres Strait *Panulirus ornatus* lobster fishery

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In response to a planned change to quota management of the Torres Strait rock lobster (TRL) fishery, an empirical Harvest Control Rule (eHCR) has been developed. The eHCR uses as primary input the updates from an annual preseason diving survey, and is selected to achieve the agreed ecological, economic and social management objectives of the fishery. A key principle is that fishery managers, fishers and key stakeholders utilise pre-agreed (and pre-tested) rules as to how to adjust management recommendations given updates of data and/or model outputs. Four alternative Operating Models are used in the testing process to capture consideration of a lower stock-recruitment steepness parameter, changing the assumption of a hyperstable relationship between catch per unit effort (CPUE) and stock abundance, and a more conservative recruitment scenario. Simulations account for both observation error and implementation error. The final selected eHCR formula is the multiple of the average catch over the last 5 years and trends in the preseason recruiting lobster (1+) and recently-settled lobster (0+) as well as CPUEs from two fishing sectors (TIB and TVH sectors), with different weightings applied to the different data sources.

Genomics reveals fine-scale Patterns of Dispersal for a Reef Fish along the ecologically significant Coast of Northwestern Australia

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An important ecological driver underpinning coastal marine management is dispersal, but it has proven difficult to directly measure in this setting. The coast of Northwestern Australia provides an emerging frontier for implementing new genomic tools, which allows testing of dispersal under a management framework given its diverse and extreme environmental conditions. This study focuses on the Stripey Snapper (*Lutjanus carponotatus*), which is important to recreational, charter-based, and customary fishers in coastal waters throughout the Indo-West Pacific. We collected 1016 *L. carponotatus* samples at 51 locations in coastal Australia ranging from the Northern Territory in the northeast to Shark Bay in the southwest and adopted a genotype-by-sequencing approach to test the influences of extreme gradients in coastal hydrodynamics on realized connectivity via larval dispersal. Hydrodynamic simulations using Connie provided a null model for comparison. Based on 4,402 polymorphic Single Nucleotide Polymorphism (SNP) loci shared across all individuals we demonstrated significant genetic sub-division illustrated in pairwise Fst and STRUCTURE plots between the Shark Bay Bioregion in the south and all locations within the five more northern bioregions. More importantly, we identified a genetic 'transition zone' of retention less than 80 km across the tip of the Dampier Peninsula in the south of the Kimberley Bioregion, which experiences the largest tropical tidal range and some of the fastest tidal currents in the world. These results will be discussed in the context of long term conservation management initiatives of the unique marine environment in Northwestern Australia.

Evolution of Pygmy Angelfish: A Model Group to Study Species Boundaries in the Eastern Indian Ocean and Beyond

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Coral reef fishes comprise the world's most diverse vertebrate communities. Determining how so many coexisting species maintain reproductive isolation is fundamental to understanding the evolution and maintenance of biodiversity on coral reefs. Suture zones, where multiple species-pairs hybridise at biogeographic borders, provide the natural laboratories for studying the maintenance of species boundaries. We here focus on a group of Pygmy Angelfish (genus *Centropyge*), which are known to hybridize at one such suture zone (Christmas and Cocos-Keeling Islands) in the eastern Indian Ocean, and which provide numerous examples of discordance between colour morphology, taxonomy, and evolutionary genetic lineages. Indeed, our previous research showed that the one of these species arose independently in the Indian and Pacific Oceans, but that the three mtDNA lineages align with geography rather than species assignments. Here we add 157 specimens to the previous dataset of 291 specimens, spread across a greater geographic range, to pinpoint the distribution of mtDNA lineages and color morphs. We found that the mtDNA lineages show remarkably strong geographic boundaries corresponding to the Indian Ocean, Central-West Pacific, and Central-South Pacific, but no concordance with species designation. We also test the validity of the 'Black Tiger Centropyge', a taxonomic oddity that is restricted to shoals and atolls off the coast of northwestern Australia, and the newly named *Centropyge cocosensis*, previously assigned to the lineage in the Indian Ocean. We conclude that the Black Tiger Centropyge is not a valid species but an intermediate between sympatric color morphs that correspond to two putative species. Our greater sampling efforts also do not support the genetic distinctiveness of *C. cocosensis* given shared mtDNA haplotypes with two sympatric species. Complimentary field surveys of abundance, distribution, and habitat use, combined with behavioural observations and dietary analysis support this conclusion with new evidence for deliberate mating between species. We therefore urge caution and taxonomic restraint in revising this species complex (among others) until the evolutionary history of the group as well as the ecological system in which they live is fully understood.

The contribution of macroinvertebrates to mudflat functioning: global patterns

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Intertidal soft sediment systems such as marshes, mangroves, algal and sea grass beds contribute in excess of AU$30 trillion in global ecosystem services each year. Benthic macroinvertebrate communities are diverse and play vital roles in soft sediment benthic systems. They have an array of adaptations for inhabiting the fluctuating intertidal environmental conditions. Taxonomic diversity has been widely used in the past to characterise ecosystems, to explore their heterogeneity and the impacts of human activities on ecosystems. However, to understand how these ecosystems deliver services we need to know how they function. Thus, there is increasing interest in understanding ecosystem functioning and its capacity to provide valuable services under increasing anthropogenic stress. The characteristics or 'biological traits' of the ecosystem residents and how they contribute to ecological functioning is thus now a research priority. This study aims to identify the variations in the biological traits of soft sediment intertidal benthic macrofauna from different biogeographic regions and major climatic zones. This information is used to quantitatively compare the trait composition and ecological functioning of mudflats globally. Two major online databases of peer reviewed scientific literature (SCOPUS and the Web of Science) were used to source data on the composition of benthic macroinvertebrate communities in mudflats. The key search terms (mudflat, intertidal mud and macro*) generated 794 papers. Of these only 40% were relevant and approximately half contained data on intertidal macroinvertebrate communities. Only 8% of papers addressed mudflat functioning, 48% of the total were from temperate region and 16% were from the sub tropics. Macroinfaunal and epifaunal species abundance data were extracted together with location information, sampling methodology (mesh size and gear) and sampling procedures. Only data from un-impacted, or near pristine sites, were used. Taxa were classified using their biological characteristics and analysed with Biological Traits Analysis and multivariate statistics. The contribution of each taxa towards selected functions were quantified and the differences between biogeographic regions and climatic zones were explored. The differences between regions were largely attributable to changes in the dominant species and traits composition did not differ. This suggests the global conservation of mudflat functioning.

Ecological responses to flow characteristics in estuaries

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Estuaries are subject to climate induced drought and flood events, which can affect the functioning of estuarine ecosystems. In river systems with regulated flows, science based decision making can improve water management and environmental outcomes. Based on long-term monitoring in the Murray Mouth and Coorong estuary, we present how macroinvertebrates, shorebirds and fish are responding to annual flow characteristics. Estuarine communities are not only affected by flow volumes, but also by the continuity of flow and duration of droughts. Using a newly developed index capturing these flow characteristics has revealed ecological benefits for benthic communities from continuous flow with intermediate flow volumes. Macroinvertebrate functional diversity followed a similar pattern. Shorebird responses to flow characteristics were also comparable to the macroinvertebrate response. For flounder, a key species in the Coorong, the continuity of flow affected abundances more than flow volumes. The length of drought periods had negative effects for macroinvertebrates, shorebirds and fish. Detailed understanding on specific responses to flows and the relationship between flow characteristics and ecosystem functions can inform adaptive management.

The risk of introduction of invasive species associated with interstate vessel movements.

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The risk of introduction of aquatic pests and disease through both biofouling and ballast water associated with international vessel movements are well documented, but particularly for an island country as large as Australia the risks associated with interstate vessel movements can also be significant. There are many different bioregions that make up the Australian coastline, and management of the threat of marine pest and disease risk is generally through state or territory legislation or best practice guidelines. While vessel movements between adjacent bioregions may pose a lower risk, vessel movements across multiple bioregions can present a considerable biosecurity risk. Some examples of high risk vessel movements into NSW waters will be discussed, as well as the management actions taken to avoid the introduction of new invasive species.

Contrasting water column structure and mixing processes across the Great Australian Bight.

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Differences in meteorological and oceanographic processes operating across the Great Australian Bight (GAB) are expected to drive shifts in ecosystem structure and function. To date, however, our understanding of the GAB marine system has been limited by a paucity of *in situ* observations. Here, we use data from CTD and microstructure profiling taken on the *RV Investigator* in December 2015, to outline the background physical, chemical and biological structure of the upper water column (0-800 m) along cross-shelf transects in the eastern and central GAB during the summer season. Upwelling was observed across the shelf-break in the eastern GAB, with downwelling in the central GAB. The highest concentrations of phytoplankton biomass were associated with the depth of the pycnocline in both regions. Analysis of the column stability, given by the Turner angle, suggests double diffusive processes may enhance mixing processes across the region, particularly in the central GAB. Estimates of the mixing efficiency and vertical eddy diffusivity from measures of shear and temperature gradient microstructure across the epipelagic zone (0-200 m) were used to determine the vertical nutrient supply rate along each transect. These observations provide fundamental information on broad- and fine-scale oceanographic processes underpinning variations in lower trophic ecosystem dynamics in the GAB. This work was undertaken through the Great Australian Bight Research Program - a collaboration between BP, CSIRO, the South Australian Research and Development Institute (SARDI), the University of Adelaide, and Flinders University. The Program aims to provide a whole-of-system understanding of the environmental, economic and social values of the region; providing an information source for all to use.

Mesozooplankton abundance, biovolume and size structure within pelagic ecosystems of the Great Australian Bight

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Pelagic ecosystems of the Great Australian Bight serve as important nursery grounds for species of conservation and commercial interest, yet the mechanisms which underpin production and the trophic structure of these ecosystems remain unclear. In this study we aim to characterise the abundance, biovolume and size structure of mesozooplankton communities of the central and eastern Great Australian Bight. Specifically, we compare communities associated with episodic upwellings to background oligotrophic water masses. We use surface and depth integrated net samples and a Laser Optical Plankton Counter to investigate the spatial structure of mesozooplankton communities. The abundance, biovolume and size structure of mesozooplankton within upwelling enriched waters differed when compared to communities associated with background water masses. Mesozooplankton displayed peak abundance between 50-110 m depth, the depth range where strong subsurface chlorophyll layers were observed. A redundancy analysis of surface communities based on size spectra found that the spatial distribution of communities within the Great Australian Bight was related to fluorescence, ammonia, silicate and nitrite. Results indicate that subsurface chlorophyll layers maintain background mesozooplankton communities of the Great Australian Bight and that episodic upwelling events and associated subsurface production increase the biovolume and decrease the size structure of mesozooplankton communities.

How can impulsive marine seismic air gun signals, impact marine fauna?

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Marine petroleum exploration is conducted using low frequency acoustic impulse signals to image subsea geology. The signals used are generated in the water column, have most energy in the range 20 to 150 Hz, are produced by arrays of air guns which simultaneously release high pressure air, and which rely on the impulse signal nature for locating reflections off subsea density discontinuities. The air gun array signals are intense, the impulse nature implies the signals rapidly reach a positive peak, and in the water column a slightly delayed surface bounce can result in the received signal having a large negative peak immediately following the positive peak. In water depths of < 40 m measurements have shown the waterborne signal energy excites the seabed locally and can produce high local acceleration magnitudes at the seabed, measured at up to 7 *g* (gravity) from a single air gun in 10 m of water. In the water column these intense impulse signals can physically excite small animals and cause high shear stress at density boundaries within an animal. A diverse range of marine fauna use density discontinuities as sensors for detecting gravitational orientation, angular momentum, vibration and acoustic signals (hearing). Driven hard enough by close range air gun signals, such sensory systems have been shown to be damaged by air gun signals in lobster and fish, and given a dearth of sampling most likely in other fauna. The high accelerations at the seabed driven by close range air gun signals results in benthic fauna also receiving high shear stresses to internal tissues, which in recent experiments have been shown to seriously physiologically impact scallops. This presentation will outline how air gun signals may impact marine fauna, present examples of experimental results and highlight the unknown implications of loss of fitness induced by exposure.

Rapid ongoing decline in populations of large-bodied Australian fishes despite world-best management practices

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Central to arguments inhibiting establishment of 'no-take' marine protected areas (MPAs) is the contention that biodiversity outcomes may be compromised if fishers are excluded from productive fishing regions, with displaced effort then concentrated within smaller areas where impacts overall may be greater. However, the underlying assumption that stocks in well-managed fisheries remain broadly stable without additional MPAs seems unlikely, by reference to Australia, a global leader in sustainable fishing practices. While management has been intensive, Australian wild fisheries catches have declined consistently over the past decade, by 31% when averaged across individual stocks and by 32% for total catch biomass. These trends reflect declining stocks more than additional precaution in management. Fishery-independent reef monitoring over the same period indicates large fish biomass declined by an average by ~21% on fished reefs across the Australian continent, but did not decline on reefs within MPAs. Sustainable fishing requires a focus on maintenance of ecosystems affected by fishing, not just the production of saleable fish at levels of optimum yield. Improvement in fisheries and conservation outcomes, including rebuilding of stocks to support higher fishery yields, require a more precautionary approach when regulating fishing effort than is currently applied, and also adequate and effective MPAs where fishing is excluded or much more tightly regulated.

Shifting the problem - trends in IUU fishing and derelict fishing nets in the shared Arafura-Timor Seas

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The 'semi-enclosed' Arafura and Timor Seas (ATS) is a global hotspot for illegal, unreported and unregulated (IUU fishing) and also, derelict fishing nets. We investigate temporal and spatial trends in domestic and foreign fishing activity (legal, illegal) in the ATS and also foreign fishing vessel (FFV) sightings in the northern waters of the Australian Exclusive Economic Zone (AEEZ). We also examine trends in derelict fishing nets washing ashore in northern Australia. Our results confirm sharp increases, post-2000, in both industrial foreign fishing (illegal, legal) and Indonesian small-scale fisheries within the Indonesian Exclusive Economic Zone (IEEZ) of the ATS. Including, major increases in 'non-motorised' vessels and motorised vessels less than 5GT. This major increase in fishing activity in the IEEZ corresponds to a 3-fold increase in FFVs (legal, illegal) sightings in northern Australian waters and also, coincides with the arrival and increase in foreign derelict nets on northern Australia shores. Industrial foreign and Indonesian-flagged fisheries – particularly IUU trawling activity – and small-scale Indonesian IUU fisheries (primarily targeting shark) in the Arafura Sea are likely the major sources of these nets. Derelict nets comprised mostly trawl nets (71%) and gillnets/drift nets (12%); with 95% of all identified nets sourced from the nations of Taiwan, Indonesia, Thailand and Korea. Our net data supports consistent under-reporting by these foreign trawl operators in IEEZ waters. Following a decline in 2006 (after major border security operations), Indonesian FFV sightings inside the AEEZ have increased again (ie. 3,035 FFV vessels in 2013), particularly in the Sahul Banks and MOU Box region. While Indonesia (with the support of Australia) has made significant progress in tackling IUU (especially in the Arafura Sea) - there have been increasing reports of IUU fishing in Timor-Leste, particularly in the Timor Sea. Including industrial foreign trawlers which have shifted their Arafura Sea operations, following Indonesian bans for illegal fishing. Strengthening of regional fisheries management in the ATS (particularly under the RPOA-IUU) is urgently required to ensure IUU fishing is tackled - rather than displaced to countries such as Timor-Leste, which currently have very limited capacity for IUU regulation, enforcement and operational management.

Modelling surfacing rates of southern bluefin tuna in the Great Australian Bight

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Large numbers of juvenile southern bluefin tuna (SBT; *Thunnus maccoyii*) migrate into the warm shelf waters of the Great Australian Bight (GAB) each austral summer. Whilst in the GAB, they aggregate in schools that spend substantial periods in the surface layer of the water column. In this study we investigate biological, temporal and environmental factors influencing surfacing rates using a large archival tagging dataset from juvenile SBT that were tagged and recaptured between 1998 and 2009. High frequency data on the vertical movement of SBT collected by these tags were used to calculate the proportion of time fish spent at the surface during each day and night period. Data on horizontal movement derived from the tags allowed us to investigate the influence that environmental conditions present at the location of the fish had on surfacing rates. Although there is high variability in surfacing behaviour within and between individuals, some general patterns emerge. There are clear diel differences in surfacing, with the proportion of time fish spend at the surface tending to be high during most days and either very high (>90%) or very low (<10%) during most nights. As summer progresses, the proportion of time spent at the surface tends to decline. Some interesting but highly complex relationships were found between surfacing rates and the environmental variables considered (including sea surface temperature, chlorophyll, salinity and wind speed), which we discuss. The results from this study have relevance to the commercial purse-seine fishery that catches surface schools of SBT in the GAB during the austral summer, as well as the scientific aerial survey conducted each summer that collects data on sightings of surface schools of SBT in order to derive a relative abundance index used directly in management.

Climate drivers of marine heatwaves off the Kimberley coast

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Episodic anomalously warm sea surface temperature (SST) extremes, or marine heatwaves, amplify ocean warming effects and may lead to severe impacts on marine ecosystems. Coral bleaching events induced by extreme warming events have been observed frequently in recent decades in Indonesian-Australian Basin (IAB) the southeast Indian Ocean, a region traditionally regarded to have resilience to global warming. In this study, we assess the contribution of modes of climate variability, such as El Niño-Southern Oscillation (ENSO), Indian Ocean Dipole, Australian Monsoon, and Madden-Julian Oscillations, to the extreme warming events across the IAB, especially for key coral reef regions such as the Kimberley coast and Scott Reef. We find that in extended summer months, the extreme warming events are more likely to occur at the tropical reefs during eastern Pacific El Niño, driven by enhanced solar radiation and weaker Australian Monsoon. The magnitude of warming is also modulated by the Indian Ocean Dipole and Madden-Julian Oscillations (MJO) activities.

Sustainable load assessments for Lake Macquarie using ecosystem response modelling and empirical data

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The protection of ecosystem services in estuaries from the impacts of eutrophication requires the determination of sustainable nutrient loading rates, which are critical to setting rational management approaches to regulating diffuse and point source pollution. We present an approach taken in a sustainable load assessment for Lake Macquarie, a coastal lake supporting large areas of seagrass under threat from increasing diffuse pollutant loads from the catchment. The maintenance of optimal light and sediment conditions for seagrass formed the basis of defining thresholds for sustainable nutrient loads to the lake. Thresholds were based on interactions between water column stressors, sediment properties, and seagrass health. These empirical relationships were derived from research into biogeochemistry and seagrass processes within the lake and other similar NSW systems. Due to the complex nature of catchment hydrology and lake hydrodynamics, the impact of inputs from the various sub-catchments on lake ecology is highly variable in space and time. As such, it was necessary to use a coupled catchment-hydrodynamic-ecological response model suite to estimate changes in stressors (TSS, light attenuation, dissolved inorganic nitrogen) and ecological response (phytoplankton growth and benthic respiration) throughout the lake as a function of sub-catchment load reductions. Seagrass coverage was added to the model by overlaying the 2009 seagrass coverage layer on the model bathymetric grid. Model simulations were made for the period Nov 1989 to Nov 1991, which included an above average rainfall year (1990) followed by a generally below average rainfall year (1991). Sub-catchments were grouped according to the spatial extent of their impacts, and nutrient loads were iteratively reduced by increments of 10% for each sub-catchment grouping to investigate the impact of load reductions. This approach allowed the identification of sub-catchments where the greatest gains in response to load reductions could be achieved. We suggest that an integrated approach utilising GIS, empirical and mechanistic models is essential for the determination of realistic and spatially defined sustainable loads for large coastal lakes.

The trophic role of a large marine predator, the tiger shark *Galeocerdo cuvier*

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Marine megafauna such as large sharks, marine mammals, billfish and tunas commonly occupy upper trophic levels in marine food webs. The analysis of stable isotopes of carbon and nitrogen of consumers' tissues can provide information on diet, trophic role, inter-specific trophic interactions and migratory movements. Here, stable isotope analyses were used to examine the trophic ecology and role of tiger sharks (*Galeocerdo cuvier*) across their range in Australian waters. Tiger sharks were sampled in habitats on the western (Ningaloo Reef, Shark Bay) and eastern (the Great Barrier Reef; GBR, Queensland and New South Wales; NSW) coastlines of the Australian continent. Multiple tissues (blood, muscle, dermis) were collected from each shark and stable isotope analyses were used to investigate the effects of location, size and sex of sharks on diet and trophic role among these locations. Sharks sampled in reef and seagrass habitats (Shark Bay and GBR) had a stable isotopic composition that reflected a diet based on seagrass sources, whereas sharks at Ningaloo Reef had an isotopic composition that was transitional between pelagic and seagrass food webs. In more temperate habitats off southern Queensland and NSW, sharks had a diet based on pelagic food webs. Tiger sharks occupied roles at the top of food webs at Shark Bay and on the GBR however, they did not occupy the highest trophic level at Ningaloo Reef or off the coast of NSW. Overall, the local environment appeared to be a better determinant of the isotopic composition of tiger sharks than latitude, despite the ability of the species to migrate long distances from the tropics to cool temperate environments. The large spatial variation in $\delta^{13}C$ indicated that diet and trophic role of tiger sharks is influenced by both body size and sex, but is also context- and habitat-dependent, consistent with a generalist, opportunistic diet at the population level. Tiger sharks explore multiple habitats and food-webs, likely adapting foraging strategies to specific prey in different habitats. Therefore, this generalist behaviour may both drive or be driven by scale- and habitat-dependent space use by the species.

The Kimberley Marine Research Program - Integrating Science into marine conservation management

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The West Australian Marine Research Institution (WAMSI), a joint venture partnership of State, Federal, Industry and Academic institutions is addressing this need through its cooperative approach to research program development and framework establishment to enhance science impact and knowledge exchange. The Kimberley Marine Research Program (KMRP), funded through the Western Australian State Government's Kimberley Science and Conservation Strategy and delivered through WAMSI, is a strong example of this process. The KMRP encompasses 25 research projects characterising the physical and biological environment, ecosystem processes and the social values and uses of this vast wilderness over the five year program. The integrated research program is designed to ensure the information necessary for planning and management of marine conservation, is available for both state government and Traditional Owners. WAMSI designs and manages research programs from their inception to ensure the greatest return from WA's public investment in marine science leading to successful knowledge transfer and impact. This process starts with the development of a clear research strategy outlining critical information gaps and questions through to ensuring accessibility of research finding in a clear and concise reporting format and relevant products and tools for management. This enables the greatest impact of these research findings through their incorporation into policy, guidelines and operational actions by managers and other end-users. This process relies on an open and ongoing dialogue between scientists and end-users, driven by an intermediary with an understanding of the needs of both parties. Through a considerable end-user involvement and understanding over the life of the program and individual projects, there is a resulting increase in the uptake of the results, and the overall success of the research program and of sustainable conservation management.

Coral bleaching and structural complexity: refining tools and assessing impacts

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Coral reefs are being subjected to every increasing levels of warming, acidification and storm activity. When they die either through bleaching, algal overgrowth or physical destruction, there is a reduction in one of their key ecosystem services, that of a habitat provider, which has flow on effects for the rest of the system. While we understand that the structural complexity of coral reefs at a course level is a fundamental component of their functional role, we know less about how events like coral bleaching will affect this key ecosystem service over short to medium time periods. This lack of insight comes in part due to the difficulties of accurately measuring the structural complexity of reefs over relevant spatial extents. However recent advances in 3D mapping techniques using photogrammetry are beginning to make this possible. Here, we summarize the results of a study which looked at the precision of these mapping systems over a variety of broad reef habitat types (patch reefs, reef slopes and reef flats) in order to assess the rates of change in complexity and reef geometry that would be detectable. We also applied this knowledge to an assessment of the effects of historic bleaching on reef structural complexity for reefs of One Tree Island lagoon on the Great Barrier Reef. Reef models had resolutions of typically less than 25 mm though there was considerable variation within this range due to the environmental conditions associated with the specific reef types used here (water clarity and depth). The precision with which reefs could be mapped (as assessed by repeat mapping of the same area) was generally related to the resolution of the model but there was also an effect of the underlying complexity of the habitat with more complex environments being less precisely mapped. We observed differences in complexity amongst OTI lagoon reefs which was, in some cases, consistent with their bleaching history and greater than the measurement error of the system. An important conclusion of this work is the need to assess any observed changes in light of the precision of the system used to evaluate them.

Accounting for opposing objectives and environmental uncertainty in deriving thresholds for managing dredging impacts near coral reefs.

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The world's coral reefs face a range of increasing global pressures that reduce their overall resilience, and are being further compounded by local stressors, such as over-fishing, tourism, land reclamation and dredging. While little can be done by local managers to change broad scale pressures, it is hoped that effective management of local pressures can help mitigate broader impacts and maintain local coral reef resilience. Dredging and related activities are common across nearshore marine environments and represent a significant local pressure for which effective management strategies are urgently required. Over the last decade there has been a series of dredging programs off Australia's North West Coast and the data collected during these programs has provided an unprecedented opportunity to explore what happens to water quality during dredging; how this impacts upon coral health; and the spatial and temporal scale of dredging impacts. Here we use novel statistical approaches and mathematical tools to account for uncertainty in deriving in-situ dose-response relationships and thresholds for the environmental management of dredging, based on estimates of the probability of non-zero mortality of corals. Using modified receiver operating characteristic curves we derive thresholds with explicit Type I and Type II errors rates, across the full range of primary stress pathways and exposure dimensions (intensity, frequency and duration). We found strong relationships between coral mortality and a range of water quality exposure metrics, lending support to the use of water quality metrics as management tools for protecting corals during dredging. Thresholds reflecting aversion to a false sense of security in environmental protection or aversion to the costs of false alarms varied substantially for all exposure metrics examined. Metrics based on sediment deposition were more statistically powerful than those based on either light or turbidity, but may be more difficult to implement in practice. Deriving thresholds using the probability of mortality provides an effective means of accounting for environmental uncertainty that would be difficult to achieve through more traditional methods based on actual mortality values, and could be adapted to a range of regulatory settings.

Nuanced effects of the invasive *Mytilus galloprovincialis* on mussel bed communities in Coffin Bay, South Australia

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Marine invasive species pose threat to a range of ecosystems globally by displacing native species, competing for space and resources and altering trophic webs. Successful marine invaders generally have a wide tolerance to environmental conditions and can outcompete native species. This is the case with the highly invasive *Mytilus galloprovincialis*. In recent years, *M. galloprovincialis* has been found living amongst the mytilid mussel beds of Coffin Bay in South Australia, however, the effects of this non-indigenous species on the beds and their associated fauna was unknown. This study investigated effects of *M. galloprovincialis* on the population structure of mytilid mussel species (*Brachiodontes rostratus, Limnoperna inconstans, Limnoperna pulex),* and on the macrofauna community living amongst mussel beds. Sampling was conducted on both rocky shore and soft sediment mussel beds in Coffin Bay. Measurements included density of mussels and their associated fauna, as well as the sizes and biomass of mytilid mussels. Most mussel beds were composed of two or three mytilid mussel species. Soft sediment mussel beds remained unaffected by *M. galloprovincialis* and were dominated by *L. inconstans. M. galloprovincialis* was present in all rocky shore sites, however, only contributed 1-4% of mussel abundances at four out of five sites. The relative abundance of the mytilid species was also affected by the rocky shore profile, with a higher frequency of *M. galloprovincialis* on more vertical substrates. The invasive species has a much larger individual size than the native species. Densities of native blue mussel species were higher than *M. galloprovincialis,* indicating possible competition for space. Benthic communities associated with mussel beds on soft or rocky substrate differed significantly, and also between sampling sites for each substrate factor. Only rocky shore mussel beds in the vicinity of the Coffin Bay township were similar to each other, and also characterised by higher diversity. The community similarities and differences on rocky shores appeared irrespective of the density of *M. galloprovincialis,* and was also affected by accessibility and location in sheltered or exposed shores. The effect of invasive blue mussels on rocky shores can thus vary within a region and requires more site specific assessments.

Towards a long-term monitoring program for Darwin Harbour: mangroves, seagrass, sediment and water quality

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Darwin Harbour is a large (1,220 km^2) macro-tidal waterbody, fringed by mangroves. The catchment includes the cities of Darwin and Palmerston, and an expanding hinterland. The Darwin region is still in an early phase of economic development however, with more than 90% of the harbour's mangroves still intact, and a large proportion of the catchment vegetated with eucalypt woodland. Research is currently taking place or being planned to provide the basis for a long term monitoring program for the harbour's mangroves, seagrass, water quality and sediments. We outline the integrated approach being undertaken, underpinned by the Pressure-Stressor-Response framework, and the links between the planned monitoring programs. The areal extent and composition of mangroves will be monitored at different spatial scales; a similar approach will be taken for water quality whereas sediments monitoring will be more spatially focused. A baseline survey of seagrass meadows will be conducted prior to annual monitoring of a subset of meadows. The large area of Darwin Harbour, its current "good" state, and the need to detect small, incremental impacts are foremost considerations in developing a monitoring program, along with linking anthropogenic and natural pressures to environmental stressors and ecological condition of the harbour. The results of the long-term monitoring program will be communicated to the public through the Darwin Harbour Region report card and other publications and media.

Climate extremes - responses of a tropical dinoflagellate to marine heat waves

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Sea surface temperature (SST) is perhaps the most important abiotic factor that influences a great variety of biological (e.g., metabolic rates, growth rate) and ecological (e.g., trophic interactions, community structure) characteristics of marine species. Alterations of SST, and its spatio-temporal dynamics as a consequence of climate change, are expected to affect not just the physiology and survival of marine organisms, but also their biogeographical distribution. In addition to gradual warming trends, different regions of the world have experienced changes in the frequency and intensity of marine heatwaves (MHWs). These extreme climatic events are caused by a combination of atmospheric and oceanographic processes, having profound influence in the dynamics of marine populations as well as in the community structure and biodiversity patterns of marine ecosystems. A MHW along the Great Barrier Reef during summer 2016, reached the highest temperatures on record and led to widespread and severe coral bleaching. Understanding and predicting biological responses to these short-term extreme events is important when projecting the impacts of climate change. We studied the physiological responses of 6 strains of the dinoflagellate *Symbiodinium* sp. collected across its range. We tested the effect of the MHW pattern, the host source and geographic region on the fitness and resilience of these strains. Our results suggest that different tolerances and sensitivities in *Symbiodinium* strains are conditioned by the intensity, frequency and duration of MHWs. In addition, inter-clonal differences in fitness-related traits indicate that some strains are more resilient to increased temperatures and have some ecological advantages in the face of extreme events projected under climate change.

Mapping of coral reef at Santa Cruz de Cabrália, Brazil, based on satellite image WorldView-2 by using depth invariant index method.

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Coral reefs have an important role in coastal environments. The largest and most diverse reef system of South Atlantic is located in the state of Bahia, Brazil. Anthropogenic and climatic factors are being responsible for reef degradation, sparking and/or intensifying bleaching, which is a worldwide problem. Remote sensing is becoming one of the most important tools for conservation of these environments, especially with high resolution images which are now available. WorldView-2 imagery boasts of the ability to enhance mapping of benthic habitats with the new Coastal Band. One of the biggest problems when mapping coastal areas is the water column interference. The methods to reduce these problems are focused in radiative transfer models, which can be analytic or empirical. The empirical radiative transfer models are interesting for using data contained in the images only, being simple to apply. The Lyzenga's method is widely used because of its simplicity of application to coral reefs with limited information of water properties. The objective of this research was mapping coral reefs using the Depth Invariant Index (DII) method in a WorldView-2 image of Santa Cruz de Cabrália, Bahia state, Brazil, acquired on April 2013. Atmosphere correction was performed with ATCOR 2/3 using the flat terrain, maritime aerosol and tropical condition packets. DII was performed using the coastal, blue, green, yellow and red bands, forming ten pairs of bands. The software ENVI 5.1 was used to perform the ISODATA unsupervised classification. The results show an improvement after the use DII. Many submerged reefs were visualized with the implementation of Lyzenga's method, allowing the identification of the morphology of theses reefs. Some reef borders were not identified without the correction of water column. Before the implementation of the method the mapped reef area was 4,83 km² and after the water column correction it changed to 8,65 km², a difference of 3,81 km². The use of DII methods also allowed a better distinction of classes in the reef. Therefore, the use of Lyzenga's method and the ISODATA classification are for mapping reefs and can be used as a tool for initial exploration of the area.

Fine-scale approach to assess the impact of recreational boat moorings on seagrass physiology in a threatened *Posidonia australis* meadow

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Seagrass meadows in urban areas face multiple stressors due to urbanization such as nutrient run-off, sedimentation and damage from boat propellers and anchors. Boating infrastructure, particularly traditional block and chain moorings, directly damage seagrass meadows by 'scouring' the seagrass bed, resulting in a matrix of fragmented patches in a mooring field. The regionally endangered seagrass *Posidonia australis* is known to recover slowly, if at all, from fragmentation. Previous studies have described the impact of boating infrastructure with a seagrass presence or absence approach, which fails to account for fine- and landscape- scale spatial variation in habitat quality or the ecological functions that seagrass provides. We measured key ecosystem functions of *P. australis* relative to marine infrastructure in Sydney Harbour using a spatially explicit fine-scale sampling design. Using high-accuracy GPS underwater we sampled seagrass at a range of distances from both traditional moorings and alternative 'seagrass-friendly' mooring designs, which aim to avoid directly impacting seagrass. We measured seagrass quality metrics including growth rates of individual seagrass shoots, rhizome barring, seagrass density and epiphyte cover. This study will be the first of its kind to quantify key ecosystem functions of seagrass meadows at a fine- and landscape-scale in relation to mooring fields in Sydney Harbour. In the context of increasing demand for recreational vessel storage, data from this study can aid in the development of effective management plans for threatened seagrass meadows in highly populated estuaries such as Sydney Harbour.

Characterising fish herbivory on tropical seagrasses: relating environmental variables to feeding rates

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Herbivory is an important ecological process that provides a link between primary producers and higher trophic levels, and it is particularly intense in marine environments. Some of the highest levels of herbivory recorded worldwide come from tropical systems such as coral reefs, where studies of species-specific patterns of herbivory have greatly enhanced our understanding of key trophic pathways. In contrast, very few studies have quantified these patterns of fish herbivory in tropical seagrass meadows. We deployed remote underwater video cameras (RUVs) in meadows of two dominant seagrass species *Enhalus acoroides* and *Thalassia hemprichii* at three sites around the islands of the Bardi Jawi Indigenous Protected Area in the remote Kimberley region, Western Australia. We recorded the conservative abundance measure MaxN for all fish species and quantified the bite rates of individual fish on the seagrass canopy in order to establish the identity and feeding rates of the main herbivorous fish species. To determine the environmental traits that best correlate with fish herbivory patterns, we recorded habitat variables including seagrass percent cover, epiphyte cover, visibility and current speed. Of the herbivorous species identified, the rabbitfish *Siganus lineatus* and surgeonfish *Acanthurus grammoptilus* were the dominant herbivores observed to feed on the seagrass canopy (both are highly sought after food by the Bardi Jawi communities), along with the damselfish *Dischistodus darwiniensis. S. lineatus* was recorded feeding mainly on *T. hemprichii* and *A. grammoptilus* mainly on *E. acoroides*, though this pattern varied between sites. Considering the global decline of seagrass meadows, understanding seagrass-herbivore interactions in tropical systems will be critical for future management of relatively un-impacted meadows such as those in the Kimberley region.

Legacy pollutants in ports, PFAS and its implications for dolphins

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Bottlenose dolphins are flourishing within some ports, particularly in the Port River, South Australia. The last decade has seen the highest numbers of bottlenose dolphins in the area since records began, driving an eco-tourism industry within a working port. However, these dolphins are exposed to a range of historic and emerging pollutants, with evidence of chronic health issues in some individuals. Bottlenose dolphins (*Tursiops* spp.) from southern Australia were sampled for PFAS. Dolphins that reside in heavily industrialised regions particularly the Swan River (Western Australia) and to a lesser extent the Port River (South Australia) had some of the highest PFOS concentrations found in marine mammals worldwide. While it is acknowledged that accumulation does not imply impact, the risk from PFAS on dolphin health is unknown. Water Quality Improvement Plans have substantially reduced nutrient loads entering key locations including ports, improving their condition over time. There is evidence to suggest that this environmental improvement is facilitating more iconic biota in working ports. How can management deal with competing interests?

Siphonophores: fearsome predators in oceanic food webs

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Siphonophores… to some, the name has no resonance, but to others, the name recalls the dread of struggling to identify the pieces and parts in zoology class years ago. These strange animals – not quite a colony, not quite an individual – are most notoriously embodied in the fearsome Portuguese Man-o-war or Blue Bottles. But there is a much more profound reason than a searing hot sting to worry about siphonophores: their role in food web dynamics. These pelagic cnidarians may seasonally dominate oceanic ecosystems. Each "colony" bears dozens to hundreds of mouths, which can consume small prey singly or large prey cooperatively. To fish for prey, the colony sets a curtain of tentacles, each armed with thousands of stinging cells. In some species, these *curtains of death* may span 50 metres! In bloom conditions, siphonophores can cripple ecosystems through a combination of predation and competition on fish larvae and other species, assuming the role of apex predator.

Despite their abundance and ecological role, siphonophores are almost completely unstudied in Australia. During the Great Australian Bight Survey 2015 aboard the *R/V Investigator*, we encountered high densities of surface-dwelling blue bottles (*Physalia utriculus*) and a variety of epipelagic and mesopelagic species. By sampling with a combination of high definition video, automated still shots, acoustics, and net samples, we gained new insights into their prevalence and diversity. In this talk, we will detail the utility of this multi-methodological approach, particularly for this group of enigmatic organisms. We will also describe some of our more intriguing findings (spoiler alert: this includes a stunningly wondrous new species!).

Studying these species is essential if we want to fully understand oceanic ecosystems. We have produced a series of practical field identification guides for pelagic invertebrates, including a chapter on siphonophores.

Constancy of change on NW Australia's remote coral atolls: demographic, local and climatic drivers in an uncertain world

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North-western Australia's coral reef atolls sit near the edge of the continental shelf, spanning six degrees of latitude. The atolls are among the world's healthiest coral reefs, largely due to their distance from the coastline and from centres of human activity, and the protection afforded by Marine Parks and Commonwealth Reserves. However, as with all coral reefs, their condition is increasingly threatened by regional, and particularly global, pressures. From a unique suite of long-term data, we identify the key drivers of change to coral communities over two decades, and the types of data that provided these insights. We contrast the emerging regimes of disturbance at the different atoll systems and consider the information required to manage them through an uncertain future.

Scales of stock-recruitment and the resilience of isolated coral reefs

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Knowledge of reproduction and larval connectivity are critical for managing the future of coral reefs through emerging disturbance regimes. We integrated complimentary data to investigate connectivity of coral communities at Scott Reef, an isolated reef system off north-western Australia. Oceanographic models, larval ecology, genetic analyses, and a strong stock-recruitment relationship confirm that the shallow-water (< 20 m) communities are self-seeded over ecological time-steps. Indeed, coral recruitment five years after a catastrophic bleaching event was < 2% of that previously, and took almost a decade to recover. Recovery was therefore not aided by the supply of larvae from either deep-water (> 20 m) communities or from other reef systems in the region. Within the reef system (≈ 60 km), connectivity varied predictably according to reproductive modes and hydrodynamic conditions. Routine distances of dispersal were inferred at roughly 10 km for spawning corals, and less than a few kilometers for brooding corals. For the spawning corals, hydrodynamic patterns matched consistent variation in recruitment among locations, providing insights into source-sink dynamics within the reef system. Hypothetical distances and directions of dispersal were supported by the rates of recovery and changes in the structure of coral communities more than a decade after the mass-bleaching. These results highlight the extent to which coral communities on isolated reef systems are susceptible to repeated severe disturbances, as with the increasing number of reefs becoming more reproductively isolated due to habitat fragmentation.

Using the SeaSim facility for ecotoxicology –testing the effects of Ni and Cu on the adult hard coral *Acropora muricata*

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Ecotoxicology using adult corals is challenging due to the highly sensitive nature of corals to water quality change. We used facilities at the National Sea Simulator (SeaSim) located at the Australian Institute of Marine Science, Townsville to set up flow through experiments to test the effects of nickel and copper on coral and associated microbiota. Acropora muricata corals were collected from Trunk Reef (18° 18.173'S 146° 52.153'E) by SeaSim staff on the 7th June 2016. On board the boat and immediately after collection, fragments approximately 5-8cm were fixed to prefabricated aragonite plugs using superglue Xtra (Loctite Pty. Ltd) and placed in grow out trays. After six weeks acclimation in aquarium conditions at the SeaSim facility skeletal growth over the plugs was observed. Experiments were set up in controlled lighting and under flow through (~2.8mL per min) conditions in 2.5 L experimental chambers on the 14th July 2016. The flow rate was set to create ~80-90% water exchange every 12 hours. The SeasSim chamber design included a magnetic stirrer and stirring mechanism to create water movement in the chamber to optimise coral health. Four replicate containers were used for each of the following doses; control, 50,100, 500, 1000, 10000 µg/L Ni and 5, 20, 50, 100 µg/L Cu. Each chamber contained 3 coral fragments each for different analytical purposes (DNA/RNA analysis, metal analysis using ITRAX /Lazer ablation ICMPS, and for tissue extraction and digestion for ICPMS analysis). After 96 hours exposure coral fragments were collected and appropriately prepared and preserved for the various analysis. Control treatments remained healthy throughout the duration of the experiment. After 36 h exposure, bleaching was observed in corals exposed to 50 and 100 µg Cu/L and 10000 µg Ni/L. At 96 h significant discolouration was observed in nickel treatments 500 and 1000 µg Ni/L. This talk will present new results from the latest analysis of this study.

Constructing a food web for key species in a Ramsar-listed estuarine environment

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The Vasse-Wonnerup Wetland System (VWWS) is an internationally significant coastal wetland which is Ramsar listed primarily due to large abundances of key bird species. While knowledge of the main floral and faunal components (e.g. algae, seagrass, invertebrates, fish and birds) exists, little is known about how the ecosystem functions; specifically, the trophic linkages among key taxa. In this study, a quantitative food web will be created to span the entire spectrum of trophic levels in the system; from detritus to apex predators such as birds and fish, encompassing all major habitats in the system from the freshwater upper reaches to the marine influenced lower reaches. Dietary analyses are being conducted using a variety of techniques including traditional methods, e.g. visual observation and gut contents analysis, and also biochemical methods, e.g. stable isotope analysis and DNA barcoding. Preliminary results indicate a difference in invertebrate fauna during winter and summer which may impact the higher trophic levels feeding preferences in the system. The project will contribute to the conservation of the VWWS by providing managers with core knowledge on its basic function, identifying reliable early-warning signals of wetland health, and helping identify which management actions are likely to help sustain key food sources in the system.

Environmental decision making in the NT: Indigenous sea country management and how science can support it

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There is a paucity of information regarding the functioning of marine ecosystems in the Northern Territory (NT), creating challenges for those making management decisions about them. There is also in the NT a paucity of government-managed marine protected areas (MPAs), and no policy framework to support the creation of additional MPAs. The majority of coastal management in the NT is being undertaken by Indigenous land and sea management groups ('Ranger groups'), who operate on behalf of and under the instruction of Traditional Owners (TO), to address a range of threatening processes impacting on sea country estates. These groups are developing strategic planning documents to address the threats to sea country and guide their management programs, formalised through the creation of sea country Indigenous Protected Areas (IPAs). This paper presents findings from research undertaken for and in partnership with the Crocodile Island Rangers (CIR) in coastal Arnhem Land. The project engaged with traditional owners (TOs) and other senior knowledge holders to develop a strategic management plan for CIR's proposed IPA. I outline the key assets identified within this marine environment, as well as key threatening processes. CIR, like other Indigenous ranger groups, draw on the extensive expertise of TOs and senior knowledge holders regarding local environmental processes and observed changes. In grappling with historically recent and emerging threatening processes, Rangers seek to draw on this expertise, as well as western science, to develop effective management responses. Using the findings from the CIR project, I address themes which emerge regarding how marine science research can best support Indigenous Rangers as key decision makers, and contribute to the effective management of the NT's coastal and marine environments. The emerging network of sea country IPAs in the NT represents a significant contribution to Australia's protected area estate. By working effectively together, Indigenous rangers and the scientific community can inform the development of world class management approaches and a robust policy framework to support the management of social-ecological marine systems in the NT.

Use of ACSPO VIIRS L3U SST in the Australian Bureau of Meteorology

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Sea surface temperature (SST) products within a few kilometres of coasts that can resolve fine-scale features, such as ocean upwelling, are increasingly in demand. In response to user requirements for gap-free, highest spatial resolution, best quality and best accuracy SST data, the Australian Bureau of Meteorology (ABoM) ingests NOAA Advanced Clear-Sky Processor for Ocean (ACSPO) Visible Infrared Imaging Radiometer Suite (VIIRS) 0.02º L3U products into the ABoM Integrated Marine Observing System (IMOS) 0.02º multi-sensor L3S products. The high spatial resolution (0.75 km) and accuracy of VIIRS SST data, in conjunction with existing 1-4 km High Resolution Picture Transmission (HRPT) Advanced Very High Resolution Radiometer (AVHRR) SST data, shows significant improvement in spatial coverage. The improved L3S SST products provide better input for applications such as ReefTemp NextGen Coral Bleaching Nowcasting and IMOS OceanCurrent. It also provides useful insight into the study of SST diurnal variation and ocean upwelling in near-coastal regions. We discuss performance of the new VIIRS+AVHRR L3S products in near-coastal regions and our plan to improve other ABoM SST products by ingesting VIIRS data into those datasets such as RAMSSA and GAMSSA L4 SST analyses.

Microbial communities in marine sediments control native/invasive macrophyte interactions

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Our inability to manage invasive macrophytes stems in part from a lack of understanding of the processes that control their successful establishment and spread. To date, studies have largely considered how above-ground processes control native/invasive plant interactions. Emerging research from terrestrial ecosystems demonstrates that below-ground processes under microbial control can determine the outcome of interactions between native and invasive plants. Whether sediment microbes control native/invasive macrophyte interactions in marine ecosystems is untested. We first show that sediment bacterial communities differ between the native seagrass *Zostera capricorni* and the invasive alga *Caulerpa taxifolia* and that those differences relate to functional changes in sulfur cycling between the macrophytes. Second, by experimentally manipulating the microbial communities we show that intact microbial communities in *Z. capricorni* sediments provide biotic resistance to *C. taxifolia* fragments compared to when they are inactive, and intact microbial communities in *C. taxifolia* sediments have positive feedbacks for fragment growth. Third, in a field experiment, using a similar but different complex of macrophytes, we show that fragments of *C. cylindracea* are similarly reduced when exposed to intact sediments from native *Posidonia oceanica.* Thus, similar to terrestrial ecosystems, microorganisms may indirectly control the success of invasive macrophytes in marine ecosystems.

Circulation of the Great Australian Bight: the influence of waves and the Leeuwin Current

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The Great Australian Bight is one of the less energetic of Australia's marginal seas in terms of the circulation, but one of the most energetic in terms of the wave climate. We thought, therefore, that explicitly including the effects of waves (momentum transfer, mixing, etc) in an ocean model would be an important thing to do in order to accurately represent reality. A subtler effect of waves is the interaction of the Stokes Drift with the Coriolis force. As important as these effects may be, however, we found it was almost impossible to prove that a model with wave coupling was 'better' than a model without. This is partly because available observations are insufficient to discern the difference, and partly because there are too many other confounding considerations, but mostly because the impacts are small compared with other modelling issues. In a sense, therefore, we have shown that the usual approach to approximating the effects of waves is adequate, even in regions where winds and waves are strong. It remains true, however, that it is more correct (in principle) to include atmosphere-wave-current interactions if possible. A 2nd plausible hypothesis for a region with strong local wind forcing is that the effects of remote forcing are of secondary importance. This is not true (for the GAB), either. The Leeuwin Current enters the GAB from the west and has a very significant impact, on both the annual cycle and inter-annual variability. This work was undertaken through the Great Australian Bight Research Program - a collaboration between BP, CSIRO, the South Australian Research and Development Institute (SARDI), the University of Adelaide, and Flinders University. The Program aims to provide a whole-of-system understanding of the environmental, economic and social values of the region; providing an information source for all to use.

Surface drift and the search for MH370

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The sea-floor search for Malaysia Airlines flight MH370 has now (Feb 2017) been suspended, with no sign of the plane having been found in the area suggested by careful analysis of the Inmarsat transmissions. In an attempt to shed further light on the location of the plane, we completed a 3 step project for the Australian Transport Safety Bureau as follows: 1) check that our global ocean model is able to reproduce the long-term drift of undrogued SVP drifters, 2) determine, by fieldwork using full-size replicas, whether found parts of the plane drift faster or slower downwind than undrogued drifters, and 3) do model simulations of the trajectories of all plane parts and assess the most likely location of the crash, taking into account all available information on where debris has been found, and not found, on shores and during the initial 6-week aerial search off Australia. Issues confronted during this work include windage, near-surface shear, Stokes Drift as well as the effect of wave forces on irregular-shaped items. The result of this work was surprisingly precise, with a surprising degree of confidence. We think the plane is in the region slightly north of the region that has been thoroughly searched, just slightly farther away from the '7th arc' than has been already searched, most likely between 36°S and 35°S.

A coastal and marine management strategy for the Northern Territory

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The Northern Territory has an extensive coastline and diverse marine ecosystems. These environments are characteristically unique, both nationally and globally, and they are in a relatively undisturbed condition. The seas and coasts are enormously important to Territorians – culturally, in providing economic benefits, for recreation, and as integral to our identity and lifestyle. There are increasing levels of competition for, and pressures on, coastal and marine resources, and a strategic (risk-based) approach to managing multiple uses has never been more important to the Northern Territory. Protecting our valued coast and marine environments while encouraging sustainable development and use by Territorians requires careful planning, incorporating the best available science and a consultative approach. The NT Government is putting in place a marine and coastal management strategy that will ensure the health and viability of our coastline, support its use by Territorians for recreational and cultural purposes and manage growing demand for our natural resources and foster sustainable industry for the benefit of the economy. The strategy will be based on extensive stakeholder and public consultation and is due to be finalised in 2018.

Distribution and abundance of Dugong in the Northern Territory

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The northern Australian coast is a region of national and international significance for Dugongs. Aerial surveys are an established survey method that allow for a broad-scale assessment of Dugong distribution and abundance which is important for assessing conservation status and guiding conservation actions and decisions. The primary objective of this Dugong aerial survey was to improve current knowledge of Dugong abundance and distribution in Northern Territory coastal waters. We conducted an aerial survey along the entire Northern Territory coastline during October/November 2015, surveying over 93,145 km^2 of the Northern Territory and Commonwealth coastal waters. Sampling intensity of survey blocks ranged from 5 - 9% of the survey area. We sighted a total of 194 Dugongs within transects, including 26 calves (13.4%). Mean group size was 1.4 and maximum group size was six Dugongs. With perception and availability correction factors applied, the population estimate was 8,176 (± 958) Dugongs. The Sir Edward Pellew Island Group and Limmen Bight in the Gulf of Carpentaria had the highest population abundance estimates which were comparable to historical abundance estimates from the Gulf of Carpentaria, suggesting the Northern Territory dugong population is likely stable. Recognising the challenging environmental conditions of NT waters, detailed investigation of the influence of various observer, sighting and environmental variables on sighting recapture rates and the reliability of observations was undertaken. The ability to identify marine megafauna with certainty varied widely between observers and how this is treated when calculating recapture rates had a large effect on estimates. Although observer experience is important, misidentifications and sighting uncertainty are an inherent part of aerial surveys in these marine environments and are likely to substantially affect data quality, particularly when surveying in waters where marine mammal species composition and environmental conditions are similar to that of the NT. To improve dugong population abundance estimates and therefore the management of dugong in the NT, we suggest the application of NT-specific availability correction factors. This dugong survey represents the most comprehensive NT-wide survey conducted in 20 years and the fifth aerial survey of Dugongs in the Gulf of Carpentaria.

Lessons for improved monitoring and reporting of estuarine condition across Australia

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Given the immeasurable value of estuaries and their severe and growing pressures, sound understanding and reporting of estuarine condition are essential for their effective management and sustainable development. In light of this, we present a national synthesis and evaluation of approaches for monitoring, assessing and reporting estuarine condition across Australia. Progress is evaluated against objective criteria that together provide a model of international best practice. We critically assess the limitations, inconsistencies and gaps that are evident across Australian jurisdictions, and identify common obstacles to future progress. Major strengths and successes are also highlighted, together with specific examples of best practice from around Australia that are transferable to other States and beyond. Significant obstacles to greater national coordination of monitoring and reporting practices include inconsistent spatial scales of management, pluralistic governance structures and the lack of any overarching legislation. Nonetheless, many perceptible advances have been made over the last decade across Australia in estuarine monitoring and health assessment, and there is great potential for further progress. Finally, we provide a list of recommendations to address some of the most pressing limitations and gaps, and thereby support improved future monitoring, assessment and reporting for Australian estuaries.

New knowledge on the marine Crustacea of northern Western Australia.

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Northern Western Australia (WA) has an immense stretch of coastline spanning the Pilbara and Kimberley, and contains some of the world's last wilderness areas. Given the variety of marine and coastal ecosystems present in the north-west, and increasing industry pressure (tourism, aquaculture, fisheries and oil and gas industries), it is critical to improve understanding of its biodiversity from scientific, conservation and management points of view. In the last eight years the Western Australian Museum (WAM) has been involved in several major biodiversity assessments of the area (from historic data assessments to large scale surveys). These resulted in diverse taxonomic collections, including around 8,000 crustacean specimen lots, representing over 1200 species. Approximately 70% of these were decapods, mainly brachyurans (crabs). This diversity exhibits a high level of rarity (with ~42% of species represented by a single specimen) and a low level of endemicity, consistent with other taxa in tropical Australia. Collectively, these recent projects are providing new knowledge about the marine biodiversity of northern WA, with many new records for the region and over 30 new species of crustaceans identified. Further new records/species are likely amongst the groups identified to an operational taxonomic unit (OTU). Additionally, the data is assisting in answering ecological questions with projects researching spawning times of crabs and host-specificity of symbiotic crustaceans currently underway. Crustaceans are generally not the taxa with the highest abundance or biomass, although the high degree of novelty (new records and new species) in the region does make them a high priority for biodiversity assessments. In addition, as crustaceans occur in most habitats and can constitute main indicator species of assemblage similarities, they may have been under-considered in assessments of environmental change.

Effect of inorganic mercury on yellowfin bream (*Acanthopagrus australis*) behaviour

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Mercury is a known toxic metal present all over the world. While there are significant studies that investigate the dietary accumulation and effects of methylmercury in marine organisms, there is limited knowledge on the effects of dietary exposure to inorganic mercury. The present study aimed to investigate changes in yellowfin bream (*Acanthopagrus australis*) behaviour after a dietary exposure to mercuric chloride over 4, 8 and 16 days. Exposures occurred daily by offering to juvenile yellowfin bream inorganic mercury-dosed feed at different concentrations (control: 0.2 μg g^{-1}; low: 0.7 μg g^{-1}; medium: 2.4 μg g^{-1}; high: 6 μg g^{-1}). The number of pellets provided and eaten was recorded. At the end of each period of exposure, fish were transferred to a bottom-gridded behavioural test-container and video-recorded for 10 min. Behaviour results showed a preference for the bottom of test container for all fish and most of the times fish remained closed to the sides of container. However, over the periods of exposure, fish from control tended to cross between bottom and top sections more often than exposed fish, while exposed fish tended to swim more across the centre of test-container. The number of sections crossed by exposed fish was lower than the number observed in control fish, which could imply a reduction of the general activity of exposed fish. An increase in the period that fish spent actively swimming was observed with increased exposure time in all treatments. As verified by the number of sections crossed, exposed fish spent less time swimming than control fish in most cases. Although changes in general activity were observed in this study, inorganic mercury in the diet does not seems to affect fish appetite, as feed consumption tended to increase over time in all treatments and exposed fish ate similar amounts to control fish. In conclusion, the reduction in general activity observed due to fish exposure to mercury could have ecological implications, such as increased vulnerability to predation.

Data delivery and decision-support tools underpinning sustainable fisheries.

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In general, Australian fisheries are seen as world leading with regard to research and management, supported by a range of methods and analytical tools. Ranging from qualitative and semi to fully quantitative, the suite of tools can be used to demonstrate sustainability, recommend harvest levels and provide comment on the risks. Communication of the results from these processes and engagement of end-users with the data that is used has often been difficult and here we show a set of data delivery and online decision support tools that have been developed for scientists, fisheries managers and other stakeholders in mind. These online tools are shown to have utility with Industry Partners (southern bluefin tuna fishery in the Great Australian Bight), Fisheries Managers (Ecological Risk Assessment for the Effects of Fishing) and the wider public and concerned stakeholders (Australian Fisheries Healthcheck).

An analysis of current trends in connectivity modelling and where to next

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Biophysical connectivity modelling has consistently used by marine researchers over the past twenty years for estimating connectivity patterns. The outputs of these models have been used for everything from assessing population dynamics to aiding the design and testing the effectiveness of marine protected areas. However, the evolution of biological models has not kept pace with the physical models. Physical models have been progressively improving through utilising higher resolution satellite data and enhanced algorithms. The advancement of the biological models has been slower, with many studies that investigate the connectivity of pelagic marine larvae still implementing the larvae without behavioural traits. We reviewed the current literature (2010-2016) on connectivity driven biophysical models to compare how the implemented biology affects the output. In addition, we discuss how modelling different movement behaviours of pelagic ichthyoplankton influences connectivity patterns based on the results of a recent theoretical study we undertook. These outcomes allow us to understand both the behaviours to prioritise in the implementation of biophysical models for future connectivity modelling studies, and where to focus our efforts in finding unknown information about biological traits of the modelled marine larva.

Engagement of Indigenous communities in marine research: A national-scale survey of marine researchers

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Engagement between scientists and Indigenous people is important because research undertaken in Australia, irrespective of its nature, is likely to have impact on Indigenous Australians. Indigenous engagement can also make important contributions to scientific endeavours and add significant value to the research outcomes. The goal of most Indigenous engagement and participation strategies, as developed by various State and Commonwealth agencies, is to ensure a meaningful two-way engagement relationship in which the interests, rights and Indigenous ecological knowledge of Traditional Owners in land and sea country is recognised. The quality of the relationship between researchers and Indigenous Australians is a key aspect to collaborative research being successful. Indigenous communities and marine researchers both have important roles in identifying opportunities and developing productive relationships. Marine researchers are increasingly wanting, or being asked, to engage with Indigenous coastal communities. However, their motivations and capacity for engaging and their perceptions of engagement and willingness to improve engagement is not well understood. Developing a sound understanding of marine researcher perspectives will enhance capacity for effective engagement based on productive and respectful relationships. This presentation provides a summary results of a recently completed national survey focused on understanding the history, experiences and perceptions of marine researchers and their efforts and interests to improve engagement with Indigenous communities. The survey results provide important insights about how marine researchers in Australia are approaching engagement and what practical things can be done to improve engagement to benefit both researchers and Indigenous communities.

Exploring national-scale fish movements through the IMOS Animal Tracking Facility

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Understanding the movement patterns of marine species is crucial to defining their role in ecosystems as well as developing effective management and conservation policies. The national Integrated Marine Observing System Animal Tracking Facility (ATF) provides a platform to examine the movement patterns of marine species of interest on both small and large spatial scales. These movement data provide crucial information on the functional role of species. This information can also be used to inform management and conservation actions. The variety of species tracked around Australia and housed in the ATF database provides a unique opportunity to compare and contrast how species use space. Comparison of movement patterns within and among species, however, requires a standardised approach. Here we discuss the application of a suite of movement metrics to provide an example of the kinds of analysis that can be completed and outcomes that can be obtained through use of the national scale infrastructure and database. We compare movement metrics from site-attached species to those of more mobile species to demonstrate the spatial and temporal scales at which ATF data can be applied to research, management and conservation questions about fish species and populations.

Is climate driving temporal mangrove change? A remote sensing approach

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Mangroves are halophytes with varying tolerance to abiotic variables including salinity, aridity, tidal inundation, and temperature extremes. As such the changing climate poses significant threats to mangrove distribution and abundance, which in turn affects their ability to store and sequester carbon. This study utilises Landsat imagery to create a timeline of change in mangrove areal cover, and relates such change to climate and tidal data to investigate the role of environmental variables in driving mangrove change. In doing so this study is able to establish a cyclical pattern of mangrove cover at various temporal scales, over 23 years, that is associated with climate variables, including maximum temperature. This study focusses on Mangrove Bay, a semi-arid environment located on the north-west Australian coastline, though presents findings significant to mangroves in arid regions, and globally in a changing climate with global temperature increasing.

Developing new DNA Markers to more accurately test for human faecal contamination

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Escherichia coli is a faecal indicator bacteria (FIB), commonly used to assess water quality. Elevated counts of *E. coli* in waterways is generally considered indicative of the presence of human pathogens or faecal contamination and can lead to the closure of recreational and shellfish harvest sites; however, *E. coli* can originate from multiple sources, and increased bacterial counts may not reflect actual faecal contamination. The aim of this project is to use genetic fingerprinting analysis (GFA) to discriminate human-specific strains of *E. coli* from environmental strains and develop new *E. coli* specific assays for assessment of human faecal contamination. Water was collected from clean (no known pollution) and sewage discharge sites to isolate human effluent and environmental strains of *E. coli.* Real-time PCR targeting *E. coli* specific targets were used to confirm accurate speciation of strains. Genomic DNA was amplified using BOXA1R PCR for GFA. Due to initial poor performance, significant optimisation of published methodology was required. The genetic fingerprints were extremely variable, reflecting the high genetic diversity of the *E. coli* population both between and within the clean and sewage discharge sites. Genomic DNA from 128 different strains of *E. coli* was isolated for whole genome sequencing (WGS). WGS will be used in a genome wide association study to identify genetic makers specific to *E. coli* isolated from human effluent, and absent from the *E. coli* that occurs within the natural environment. Ultimately, we aim to identify specific markers and develop novel assays for identification of human faecal pollution, which will represent a significant advancement in assessing water and shellfish quality, and enable more informed risk management.

Piloting a new approach to Monitoring Victoria's Marine Protected Areas in Point Addis Marine National Park.

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Parks Victoria has established an extensive marine science program for the Victorian Marine Protected Areas (MPAs) that addresses important management challenges, focussing both on improving baseline knowledge of the MPAs as well as applied management questions not being addressed by others. The program has been implemented using a range of different models including consultants, research partnerships with universities, citizen science programs and various other approaches. The Signs of Healthy Parks (SHP) monitoring program forms part of this program and is designed to ensure systematic, robust and integrated ecological monitoring across the MPA network. Building on Parks Victoria's recently completed Conservation Action Planning (CAP) process, the SHP program aims to monitor the health of the parks using a range of environmental indicators that provide information about the natural values and ecological processes in the parks as well as effects of threats and other drivers. The collection of data will be based around focussed monitoring questions which are closely linked to conservation and management objectives for the parks. Historically Parks Victoria's monitoring program has focussed on subtidal and intertidal habitats with the program implemented in a large number of the MPAs from a far back as 1998. The updated monitoring program for the MPAs will be expanded to include a range of other habitats, key natural assets and threats identified through the CAP process. Point Addis Marine National Park has been selected as a pilot for trialling an expanded SHP program in Victoria's system of Marine National Parks and Sanctuaries. A range of monitoring approaches and sampling designs will be utilised to address management focussed monitoring questions. Traffic light style control charts will be incorporated as a standard reporting tool to help feed the results of the monitoring program back into Parks Victoria adaptive management process.

Use of MODIS data to investigate the spatial and temporal variability of the Bonney Coast Upwelling

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The Bonney Coast upwelling is a large seasonal upwelling system along Australian southern shelves, from Cape Jaffa (SA) to Cape Nelson (VIC), during favourable coastal winds. The Bonney Coast upwelling, with nutrient enriched water, has been recognised as a key ecological feature. During the upwelling season (Austral Summer), swarms of krill and aggregations of blue whales are frequently found in this part of the continental shelf. The upwelling is also important in the life cycle of juvenile southern Bluefin tuna and benefits other marine life. The oceanographic characteristics of the Bonney Coast upwelling are well understood through marine surveys and mooring data, as well as satellite images. However, the dynamics of the upwelling system have not been studied in detail. This study aims to map and investigate the spatial and temporal variability of the Bonney Coast upwelling using time-series of MODIS data. The data include more than 170 SST and Chlorophyll-a images (from July 2002 to Dec 2016), with a spatial resolution of ~1km. A combination of Topographic Position Index (TPI) and image segmentation techniques were used to map the spatial extent of the Bonney Coast upwelling. The Chlorophyll-*a* and SST signatures of the upwelling areas have also been extracted. The results confirmed that the Bonney Coast upwelling is indeed a seasonal system that occurs between November and April. The upwelling is often most intensive in February and March. There is strong inter-annual variation. For example, in the summer of 2008-09, upwelling was only identified in February 2009; while, in the summers of 2013-14 and 2015-16, the upwelling was identified in all of the six months. Whether this inter-annual variation is influenced by ENSO events is under further investigation. During intensive upwelling events (e.g., in Feb and Mar), the upwelling influences more than 10,000 km^2 surface area, with the SST anomaly more than 1^oC lower than that of surrounding areas. The upwelling areas often have mean Chlorophyll-*a* concentrations over 0.8 mg/m^3, which is nearly double the mean summer Chlorophyll-*a* concentration for the Australian continental shelf.

A surrogacy approach to evaluate the habitat potential of Australian submarine canyons

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The seascape of the vast Australian continental margin is characterised by numerous submarine canyons (n=753) that represent an equally vast array of geomorphic and oceanographic heterogeneity. Theoretically, this heterogeneity translates into habitats that may vary equally widely in their ecological characteristics. Here we describe the methodology to develop a surrogacy framework to broadly derive estimates of potential habitat condition ('suitability' *sensu lato*) for pelagic and epibenthic megafauna (including demersal fishes), and benthic infauna in all of Australia's known submarine canyons using 22 environmental/ecological variables. We find that the high geomorphic and oceanographic diversity of submarine canyons creates a multitude of potential habitat types. In general, it appears that canyons may be particularly high-quality for benthic species. Canyons that incise the shelf tend to score higher in habitat potential than those confined to the slope. Canyons with particularly high habitat potential are located mainly off the Great Barrier Reef, the NSW coast, the eastern margin of Tasmania and Bass Strait, and on the southern margin. Many of these canyons have complex bottom topography, are likely to be productive, and have less intense sediment disturbance regimes. The framework presented here can be relevant – once refined and comprehensively validated with ecological data - in a management and conservation context to identify canyons (or groups of canyons) that are likely to represent high-value habitat along a vast continental margin where marine planning decisions may require spatial prioritization decisions.

Preliminary characterisation of Timor-Leste sardine fisheries from a food security perspective

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Addressing chronic and seasonal food insecurity is a priority issue in Timor-Leste. Small-scale fisheries targeting small pelagic fish are thought to make useful contributions to household food security and coastal livelihoods. This research is investigating the Timor-Leste sardine fishery from a food security perspective by considering the availability of the fishery resource, physical and economic access by consumers, and household consumption patterns. Based on preliminary findings, sardine fisheries in some locations in Timor-Leste appear to be associated with rainfall and river flow. Fishers use gillnets from both motorised and non-motorised canoes to catch a number of sardine species, as well as a range of other small pelagic fish. Sardines are a popular food among local Timorese consumers as they are more affordable than large fish. Research is ongoing, with the overarching aim to identify opportunities for delivering and sustaining greater benefits from this social-ecological food system, in ways which are relevant to the local context, ecologically sustainable, equitable and financially viable.

Packaging web portals for improved stakeholder usability

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The usefulness of on-line web portals requires more than the provision of accessing, mapping and visualising data. Supporting their use through explicitly guiding users on how to make sense of the portal should not be viewed as secondary to publicising data. The lack of insight into user's perspectives and importantly user needs contributes to a gap between the capacity of web portals and what is actually realised or achieved by users. There is a need to understand user's perspectives in order for web portals to be fully successful in the process of delivering relevant benefits. Barriers exist to the use of on-line portals and in some cases, instruments are developed to lower the barriers. Creating the right environment for on-line systems means key elements must come together before research is actually translated into benefits. Translation of research is about getting the right information, to the right people, and in the right format. On-line systems can improve information accessibility and in many cases, often need to be further packaged according to the target audience and communication preference. Defining what is "right" for particular target groups begins with asking them. In this presentation, we focus on research in the Torres Strait that plans to use community and stakeholder input to improve the use and interpretation of environmental data. By working with communities and stakeholders we aim to understand how to go about developing an improved information system as tailored to the priorities and preferences of key target groups. We present ideas for developing more user-friendly ways to search, summarise and communicate information via on-line and other systems of presenting information.

The place of Indigenous knowledge at the marine research table

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Acknowledging the existence of Traditional Ecological Knowledge is not enough for marine science. Moving beyond this, it is important to develop the practical measures that enable Indigenous knowledge and values to be treated appropriately. Restoring the place of TEK in marine research needs to be supported by scientists engaging, respecting, and reintroducing the traditions of sustainable management into on-ground practices. Potential embedding of TEK in environmental practices should proceed on terms defined by Indigenous peoples as this importantly secures their ownership over their knowledge systems. There should be a place of TEK at the research table and full respect of this knowledge needs to encompass the protection and sharing in accordance with cultural protocols. Researchers need to identify the barriers to, and opportunities for, the involvement of Indigenous knowledge and local people in directing the management of land and sea resources. In the spirit of partnership, it is crucial for researchers to undertake the negotiation at the cross cultural interface between scientific and Indigenous ways of observing. This negotiation may not be straightforward but is crucial to build the platform for TEK to support research and management. In Australia, Indigenous people are increasingly owning and managing sea country. This strong and diverse presence on country presents a great opportunity to work with Indigenous knowledge systems. In this presentation, we draw on our personal motivations as Indigenous researchers to explore pathways to preserve, renew and restore Indigenous knowledge systems. We aim to increase awareness of building mutually conducive and appropriate principles, protocols, and practices that address the gathering, sharing and use of TEK.

Harvest Strategy development for Torres Strait commercial fisheries

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Fisheries management guided by the establishment of formal Harvest Strategies is well founded within the Australian Federal fisheries regulatory framework. However, the development of each HS can require considerable resources, given it is process orientated involving all the stakeholders. Commercially valuable small-scale fisheries in the Torres Strait are at various stages of applying harvest control rules which are a critical aspect of the establishment of each Harvest Strategy. Three fisheries are reviewed as a group, these being the: (1) Tropical Rock Lobster fishery (2) the Beche-de-mer fishery, and (3) the Finfish fishery. All these fisheries are managed under the Torres Strait Treaty which has the primary purpose to protect the way of life of the traditional owners within the Torres Strait Protected Zone. That is, although there are guiding principles for the development of Harvest Strategies at a national level, distinct local level challenges exist with the operationalisation of each fisheries Harvest Strategy. Comparisons across the fisheries exist due to differences in: (a) the available fishery *indicators*, (b) the choice of *reference points*, (c) the current or proposed *assessment method*, and (d) the current and proposed level and frequency of *monitoring*. The latter (a-d) are all highly dependent on each other, which adds to the complexity of the Harvest Strategy development; with the resources required to independently monitor marine harvested stocks often exposing the most relevant trade-offs in terms of value of information and cost. The implementation of the Harvest Strategy framework in each fishery also tends to require some form of adaptive management cycle as stakeholders and various management authorities come to terms with resource variability, uncertainty and trade-offs involving risk and the resources available for assessment. Opportunities exist to capture the most important aspects of the guidelines for the development of Harvest Strategies, these being that they be transparent and inclusive, unambiguous, precautionary and pragmatic.

The spatial and temporal distribution of humpback whale calves in the Ningaloo Marine Park

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Currently, the recognised calving grounds of the Breeding Stock D (BSD) humpback whales are located along the Kimberley coast between Camden Sound and Broome (15°S -18°S). Research in the Ningaloo Marine Park in 2013 and 2015, illustrated that large numbers of calves were being born along or near the Park, suggesting that the calving grounds extend at least 1000 km to the southwest of those that are currently recognised. We conducted aerial surveys in the region between July 19 and September 3, 2016 to examine the spatial and temporal distribution of humpback whale calves in the northern sector of Ningaloo Marine Park during the northern migration. We categorised calves as neonates or post-neonates according to their colour and also recorded behaviour and travel direction. We sighted a total of 1289 humpback whales, including 304 calves, in 689 groups. Just under half (44%) of all groups sighted within the Park contained a calf. Calves were sighted during the entire study period, with peak numbers occurring in early August, coinciding with the time of peak parturition of the BSD population. The majority of the calves were neonates (91.8%) of which many appeared to be recently born. Notably, 94% of the calves sighted were within a 1km corridor along the seaward edge of the fringing reef, indicating that mothers with young calves prefer to 'hug' the reef edge on their northbound journey. The majority (74.3%) of the calves were swimming northwards, 6.9% were milling; 14.1% were resting and just two (0.7%) were swimming southwards. Within the 1km corridor at the back of the reef, 63.8% of groups sighted contained a calf, while outside the corridor 7.4% of groups sighted contained a calf. This improved knowledge on the distribution and timing of young calves within Ningaloo Marine Park will assist management agencies in maximising conservation outcomes for this species that migrates annually along the coast of Western Australian.

Seagrass ranching: Transplant grow out to recover seagrass clonal integration

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Tropical Australian seagrass meadows are highly dynamic, with a dominance of transitory meadows of opportunistic and colonising seagrass species. However, species with more persistent life history traits (*Halodule uninervis* and *Zostera muelleri*) do occur and endure where natural physical disturbance is minimal. Persistent species rely primarily on vegetative clonal growth and are slower to recover from anthropogenic disturbance resulting in net decline. Novel approaches in relation to seagrass restoration techniques are needed for these regions. Transplanting cores by hand remains a popular method in seagrass restoration activities particularly in areas where seed herbivory is high and where mechanical methods are impractical. However, coring results in severance of rhizomes and physiological integration within seagrass clones, compromising natural resistance to poor conditions and resulting in poor transplant survival. Also, common practice with seagrass transplantation advises the immediate or quick transplant of donor cores to the new site. Here we examine how clonal integration manifests across different species local to the subtropical Port Curtis Bay (Queensland, Australia) and the influence of rhizome severance on three intertidal tropical species of seagrass *Z. muelleri*, *Halophila ovalis* and *H. uninervis.* The potential of "growing out" cores prior to planting to improve survival in a subtropical bay with a high frequency of anthropogenic disturbance was assessed. Results showed that rhizome length and the presence of apical shoot positively influenced *Zostera muelleri* rhizome elongation. Plot size only influenced growth and survival when the density of apical shoots was high. Growing out transplants under controlled conditions for three to six months increased growth and survival, compared to recently collected cores and cores retained for over twelve months. Growing out transplants for up to six months may be a viable option for improving transplant success, but only where light regime is good. Practical solutions for growing out transplants in industrial ports are discussed.

Thermal extremes: the response of three intertidal snails to boulder surface temperature

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Temperature has long been recognised as one of the major environmental stressors associated with the structure of marine assemblages on rocky seashores worldwide. However, surprisingly little research has specifically measured the temperature characteristics of different rocky substrates during emersion at low tide, and then evaluated biotic responses to these temperature characteristics. To address this, thermal imaging was used to measure the surface temperatures of hotter siltstone and cooler quartzite boulders, emersed during low tide, at rocky seashores near metropolitan Adelaide, South Australia. Biotic responses to surface temperature were measured for three commonly-occurring grazing snails found on these boulders: *Nerita atramentosa*; *Diloma concamerata*; and *Bembicium nanum*. On mild to very hot sunny days (maximum air temperature 23-40°C) during the southern austral summer, both rocks developed a mosaic of surface temperatures. Instead of warming to a homogenous temperature, each boulder surface had a mosaic of warmer and cooler locations. All three species responded to this surface temperature mosaic, occupying locations that were significantly cooler than maximum surface temperatures, but significantly warmer than minimum surface temperatures. *Nerita atramentosa* and *D. concamerata* generally occupied cooler locations within this mosaic, while *B. nanum* generally occupied warmer locations. All three species avoided upper boulder surfaces during emersion, retreating during low tide to the comparatively sheltered lower surfaces, or the substrate underneath boulders. At the hottest air temperatures, where maximum lower-surface temperatures regularly exceeded 40°C, both *N. atramentosa* and *D. concamerata* were exceedingly difficult to locate attached to lower-boulder surfaces. Instead both species were almost always located on the substrate underneath boulders, which was cooler again than lower-boulder surfaces. These responses show that both *N. atramentosa* and *D. concamerata* respond strongly to these boulder thermal mosaics, and potentially retreat to the substrate underneath boulders when lower boulder surfaces become too hot. In contrast, *B. nanum* appeared to tolerate hotter surface temperatures, and did not respond strongly to boulder surface temperature characteristics. These species-specific responses to surface temperature provide a baseline for investigating how species will behave and persist in intertidal habitats potentially exposed to warming temperatures associated with global climate change.

Biogeophysical remote sensing of the Great Barrier Reef

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The eReefs Marine Water Quality and ReefTemp systems were implemented and declared operational over the Great Barrier Reef (GBR) region by the Bureau of Meteorology's National Operations Centre (BNOC) on 22 October 2013. These systems are based on more than ten years of research by the Commonwealth Scientific and Industrial Research Organization (CSIRO) and their core purpose is to produce accurate estimates of water quality indices and temperature within the optically complex and shallow waters typical of the GBR. Through these systems BNOC delivers daily, weekly, monthly, and annual estimates of Chlorophyll-a concentration (CHL), suspended sediment concentration (Non-Algal Particles - NAP), coloured organic matter concentration (CDOM), light penetration as diffuse attenuation coefficient (Kd), sea surface temperature (SST), and degree-heating days (DHD) for the whole GBR and some offshore regions. Data from July 2002 onwards are available via the eReefs Marine Water Quality Dashboard (www.bom.gov.au/marinewaterquality/) and the eReefs THREDDS catalog (http://ereeftds.bom.gov.au/ereefs/tds/catalogs/ereefs_data.html). I will present an introduction to these systems and then a series of tools and simple case studies that shows how these data can be/are being used by scientists and managers to better investigate and manage the complex factors that affect the ecosystems and water quality of the GBR, along with putting out a call for collaboration to advance the development and use of these datasets into the future.

Current status and limitations of marine microbe satellite observations in the Southern Ocean

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Over the last decade there has been unprecedented cooperation between scientists, policy-makers, and other stakeholders to focus and champion the scientific and societal importance of the Southern Ocean. Many of these efforts identified the value of satellite observations to Southern Ocean science, but until now none have explained or quantified what is actually needed in order to best serve this community and to move this field forward. In order to address this shortage a community review and consultation paper, published in October, identifies how existing satellite capabilities can be used to study the main internationally identified Southern Ocean scientific priorities and identifies potential Southern Ocean specific satellite requirements with the aim of providing international agencies with scientifically driven requirements for future satellites. I will present an overview of the review and its findings and then focus mainly on the on the current status, limitations, and recommendations and additional requirements for marine microbe observations (Chlorophyll, Primary Production, and Biogeochemistry) in the Southern Ocean.

Are you sure? Capturing expert uncertainty in marine spatial cumulative impact assessment

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Understanding impacts on marine environments is necessary to preserve healthy ecosystems and to manage them sustainably, whilst supporting 'blue economies'. Realistic assessments of human impacts on marine ecosystems must consider i) cumulative effects of multiple, coincident threats and ii) the specific vulnerabilities of different marine ecosystems to these threats. One such approach is spatial cumulative impact assessment, which usually involves expert judgement (elicitation) because field and experimental data are often not available. This semi-qualitative approach can introduce uncertainty to the results, which is commonly un-measured or un-reported, making outputs more difficult to interpret. In this study, we use a straightforward and inexpensive method to assess and express uncertainty in expert-elicited data. That is, simply to *ask* experts about their uncertainty, collect data on it, and incorporate these data into the assessment process and results. We carried out a spatial cumulative impact assessment on the marine ecosystems in Spencer Gulf, South Australia. We generated maps of cumulative impact by combining the expert scores for the impact of threats on ecosystems with data on the spatial overlap between ecosystems and threats (exposure scores). This was done for multiple scenarios based on the range of uncertainty in experts' knowledge: 'worst-case', 'best-case' and 'most-likely case'. We used these uncertainty data to both map uncertainty and to simulate confidence bounds around the 'most-likely' cumulative impact results for each of eight ecosystem types found in our study area. By providing the results of spatial cumulative impact assessments alongside a measure of the uncertainty introduced by expert-elicitation, we increased the clarity of the assessment results and aided in their interpretation. We show that asking experts about their level of uncertainty leads to more transparent and better-constrained outputs from spatial cumulative impact assessments, increasing their utility for marine management.

Vertical mixing on the Australian Northwest Shelf

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The coastal shelf in Northwest Australia is a region of strong nonlinear internal wave generation and dissipation that results from strong tidal flows. Here we focus on moored and ship-based observations collected in 100 m of water 4-22 April 2012. The moored instrumentation observed both mean vertical temperature and velocity structure as well as turbulence quantities at two point locations, 7.5 and 20.5 m above the seabed. A nearby Integrated Mooring Observing System (PIL100) provided through-water column observations. A microstructure instrument profiled in the vicinity of this mooring for a 24 h period. The nonlinear internal wave (NLIW) packets were characterised by isotherm displacements of up to 60 m, occurred once per semi-diurnal tidal cycle and generally persisted for 4 h, with periods ranging from 10- 30 minutes. The highest values of ε and K_T generally coincided with the arrival of cold water with each NLIW event, when the largest Thorpe overturns were observed. However, we also observed high values of ε and K_T when there was sustained shear in the water column. The observed values of ε at 7.5 mab were often not predicted by classic boundary layer theory, which assumes a balance between shear production and dissipation. Our direct estimates of K_T demonstrate that using the Osborn model with a constant mixing efficiency can both vastly over-predict and under-predict the mixing rate. Our K_T estimates can be used to improve predictions of processes such as the transport of nutrients, sediment and pollutants.

Performance and sustainable management of the group (SERRANI DAE) in Dampier Straits marine protected area, Raja Ampat

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The research is preliminary study based on the assessment of RRA (*Rapid Rural Appraisal*). This research conducted on November-December 2016, on Traditional Market, Waisai, Raja Ampat Regency, The Province of West Papua. The survey was done by means of direct observation and interviewing to traditional fishermen. They live in Dampier Strait, Marine Protected Area, and sell the fish to the traditional market in Waisai. The aim of the research is to identified and classified groupers in Dampier Strait Marine Protected Area, and developed the fisheries management of groupers for local livelihood had been identifying and classifying based on the morphological characteristics of fish. Based on the results of survey, groupers had identified and classified in 9 species: *Variola albimarginata, Cephalopholis sonnerati, Aethaloperca rogaa, Epinephelus undulosus, Epinephelus ongus, Epinephelus bleekeri, Anyperodon leucogrammicus, Epinephelus fasciatus* dan *Cephalopholis miniata*. The length of fish is average 20-50 cm and weight 0.5 - 3 kg.The selling price of grouper in traditional market is Rp. 15.000-Rp.50.000/fish. Fishermen caught the grouper by long line and the boat engine size 15-40 PK machine. The management of groupers are very important for the sustainable fisheries management, and can developed to marine culture. The prospect of management fisheries resources through marine culture can be done to improve the local economic of community. The fisheries management can be developed with how to conducted the market chains of fisheries in the local, national and international level, so it can being improve the prosperity of the local people, and for development of fisheries sector.

The bacteria of Darwin Harbour: spatiotemporal patterns in a tropical macrotidal estuary subject to urbanisation

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Darwin Harbour is a macrotidal estuary in the Australian wet-dry tropics, subject to increasing urbanisation, with localised poor water quality due to treated sewage effluent and urban runoff. Tropical estuaries are poorly studied compared to temperate systems and little is known about the microbial community-level response to nutrient load. The aim of this study was to analyse the spatial and temporal patterns of the bacterial community across Darwin Harbour and to examine their association with abiotic factors. In particular, we sought to determine if a human impact signal was discernible in the microbiota. Adopting a single impact–double control design, we investigated the bacterial community in water and sediment from four reference creeks and from two others affected by effluent and urban runoff. Samples were taken over two years during neap and spring tides, in the dry and wet seasons. We analysed the 16S rDNA MiSeq data using the QIIME open reference pipeline and used various statistical methods including PERMANOVA, constrained ordinations, spatial eigenvector models and variance partitioning to differentiate spatial, salinity and nutrient-related factors. We found that temporal drivers, namely seasonal and tidal-related effects, had the largest impact upon the water microbiota reflecting the macrotidal nature of the estuary and its location in the wet-dry tropics. The neap-tide water microbiota provided the clearest spatial resolution, while the sediment microbiota reflected current and past water conditions. Differences in patterns of the microbiota between different parts of the harbour reflected the harbour's complex hydrodynamics and bathymetry. Despite these variations, a clear microbial signature, related to effluent, was discernible and nutrients, followed by salinity, accounted for the majority of the explained variation in the water microbiota. Microbial signatures differed between impacted and reference creeks, between effluent and urban runoff, and between effluents from different wastewater ponds.

Discovery of Widespread Autumn Phytoplankton Blooms in the Great Australian Bight

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In this presentation I describe the discovery of previously unknown phytoplankton blooms developing in the Great Australian Bight (GAB) and other regions of Australia's southern shelves during autumn months each year. This discovery dramatically revises the understanding of marine food web dynamics in the GAB, which, apart from occasional upwelling events in its far eastern reaches, was deemed oligotrophic. While the magnitude of phytoplankton blooms is only moderate (~1 mg/m^3), their spatial extent of ~20,000 km^2 is enormous. The timing of the bloom development in May/June coincides with full convective erosion of the surface mixed layer, which allows for recycling of seabed nutrients. Conversely, this feature is only possible due to the overall relative shallowness (<100 m) of the continental shelf. The author postulates that these autumn phytoplankton blooms play a pivotal role in the marine food-web dynamics of the GAB contributing to relatively high abundances of both forage fish (sardines) and upper trophic-level predators (e.g. tuna, whales) in the region. Field expeditions are required to explore the biogeochemical details including productivity inherent with the observed blooms. Another interesting research question is whether the downstream drift of plankton spores from summer upwelling plumes into the central GAB is an agent seeding the observed autumn phytoplankton blooms.

Physical Drivers of Majestic Phytoplankton Blooms in the Northwestern Arafura Sea

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The Indonesian Sea Large Marine Ecosystem is at the confluence of the Pacific and Indian Oceans. It has a composite structure of environmental conditions, with local areas of upwelling, strong wind-driven and tidal currents, and nutrient inputs from rivers or the ocean interior via upwelling or tidal stirring. The system is influenced by monsoonal winds, with a pattern of surface currents varying during the southeast and northwest monsoon. The Arafura Sea stands out in terms of chlorophyll-a concentrations reaching values >3 mg/m3. Satellite data indicate that majestic phytoplankton blooms develop in the northwestern Arafura Sea during the southeast monsoon (June – November) covering an area of >90,000 km2. In this presentation, I will discuss the physical drivers triggering these phytoplankton blooms. Findings confirm that the southeast monsoon creates undercurrents via the classical lee effect driving nutrient-rich Banda Sea slope water into this region. This nutrient-rich slope water is driven over vast distances (~300 km) into the northwestern Arafura Sea where it upwells and/or is entrained into the surface mixed layer. The associated overturning circulation is slow but continuous and it takes 1–2 months before nutrient-rich water appears in surface waters of the region. The predicted pathways of nutrient-rich inflows across the shelf break both north and south of the Ara Islands agree with observational evidence.

A big stick approach to improving marine reserve performance

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Although most no-take marine reserves have a positive influence on marine communities, not all reserves are meeting their conservation objectives. Amidst possible explanations (e.g. size, age and isolation), insufficient enforcement is often speculated to be the key driver of marine sanctuary underperformance. Here, we will provide several examples where enforcement activities are directly linked to greater abundances of fish inside marine reserves compared to surrounding areas. In one case, the implementation of new enforcement initiatives was associated with a 201% increase in annual fine rate and a significant increase in target fish and elasmobranchs in a marine sanctuary relative to areas open to fishing. In another case, the relative performance of marine reserves was related to the number of enforcement actions. From these and other examples, we conclude that increased enforcement guided by risk-based compliance operations may be a useful first step for improving underperforming marine reserves. Additionally, more 'science of the big stick' is needed to get the most out of limited compliance resources.

Multispecies presence and connectivity around a designed artificial reef to assess local fish production-attraction

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A goal of designed artificial reefs (ARs) is to enhance fish abundance, species diversity and fishing opportunities through providing food and refuge for fishes. Quantifying the contribution of ARs to coastal ecosystems and fisheries productivity requires an understanding of fish presence at the structure and connectivity with surrounding habitats. The movements and presence of 10 Eastern Fiddler Ray (*Trygonorrhina fasciata*), 17 Port Jackson Shark (*Heterodontus portusjacksoni*) and 18 Bluespotted Flathead (*Platycephalus caeruleopunctatus*) were monitored using acoustic telemetry around a 700 m^3 designed AR in 38 m depth near Sydney, Australia. Fiddler Rays exhibited an average short-term presence of 43% at the AR, and 26% over the ~20 month monitoring period, which was significantly higher than the other two species. Fish tagged at the AR showed high affinity to the site at which they were tagged compared with fish tagged on natural reef. All three species moved frequently between the AR and the other reefs in the area, indicating strong connectivity throughout the mosaic of habitats. The relatively moderate presence at the AR suggests that these species may contribute to some biomass production at this AR, by incorporating this reef in their natural range. Our findings also indicate that this reef may increase the connectivity between adjacent habitats and aid the dispersion of a range of benthic species.

Dolphin Foraging Behaviour in the Busy Fremantle Inner Harbour, Western Australia

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Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) from the Swan-Canning estuary and Cockburn Sound dolphin communities near the Perth metropolitan region (Western Australia) use the Fremantle Inner Harbour as a key foraging site and for travelling within their home range. Past studies indicate that up to ~45 dolphins use the area intensely between March and May despite high levels of vessel traffic and underwater. This study aims to gain insight into benefits of occupancy by obtaining information on fish species and their distribution and dolphin behaviour in the harbour. We present preliminary results from surveys undertaken during the first (2016) of two peak periods over which the study is being conducted. Visual observations of dolphins quantified the number of groups, group size, group cohesion, and identified individuals using the area. Sonar imaging and baited remote underwater video systems (BRUVS) were used in May 2016 to identify fish species and their distribution. The sounder was a Biosonics DTX Scientific Echosounder with three frequencies 38, 120 and 400 kHz towed by a 4.6 m vessel. Survey tracks covered the range of the Inner Harbour. Five BRUVS stations were positioned strategically in locations the echosounder surveyed and at locations anticipated to have high fish activity as a trial for informing surveys in 2017. Results indicated that dolphins predominantly foraged, often spending time foraging cooperatively along the harbour wharves and walls within the middle of the channel. Dolphins identified primarily belonging to the Swan-Canning Estuary community. Small aggregations of fish were identified by the echosounder at locations near the wharf walls, however high densities throughout the channel were not verified. BRUVS so far analysed captured weeping toadfish (*Torquigener pleurogramma*), tarwhine (*Rhabdosargus sarba*), and western butterfish (*Pentapodus vitta*) as dominant species; most of which do not represent key species targeted by dolphins. Surveys in April 2017 will aim at surveying near structures dolphins forage near using underwater video and drone imagery to capture cooperative dolphin foraging activity. Identifying target prey species and their distribution will determine why the Fremantle Inner Harbour is such a significant hotspot for dolphin occupancy, regardless of intense vessel traffic presence.

Australasian differences in Stakeholder attitudes towards ecological engineering of Marine artificial structures

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A global push is afoot to enhance the biodiversity and functioning of built infrastructure in the marine environment by using ecological engineering interventions. Ecological engineering is the process of combining ecology (how organisms interact with one another and their environment) and engineering principles (function, structure and safety) to enhance built infrastructure (e.g. piers, marinas, groynes, seawalls, and aquaculture). As a result, ecological engineering can benefit both humans and nature. Marine infrastructures are used by a variety of key stakeholder groups but studies rarely assess the uses by these groups. We used a survey questionnaire to investigate differences in attitudes and perceptions towards ecological engineering and the use of coastally inserted structures. The surveys were conducted in 4 harbours: Sydney and Hobart in Australia, and Auckland and Tauranga in New Zealand. This research was used to test the following hypotheses: 1) the majority of survey respondents within the harbour catchment area will be interested and supportive of ecological engineering, 2) respondents with higher education and income, with a longer residency time in more developed harbours (e.g. Sydney and Auckland) are more likely to support ecological engineering than respondents who primarily use the harbour catchment area for travel and transport or require use of man-made structures for work (such as maritime workers), 3) respondents with greater interest will be more willing to contribute to any costs associated with ecological engineering, 4) and will be more interested in the demonstrated outcomes and more likely to identify polluted or degraded sites as priority areas for ecological engineering than those expressing less interest or support for ecological engineering. Results may indicate that the majority of respondents are supportive of ecological engineering in building or retrofitting marine built infrastructure, irrespective of the level of development in the harbour or their use of the structure. In New Zealand, indigenous stakeholders are more involved in the planning process than aboriginal Australians which could yield interesting results. Greater consideration of public perceptions and values is imperative in developing multifunctional built infrastructure in harbours.

Science integration to support management for the Vasse-Wonnerup Estuary during a significant cyanobacterial bloom

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The Vasse-Wonnerup wetland system is recognised by RAMSAR as one of the most important waterbird habitat in Western Australia, and is visited by more than 30,000 waterbirds each year. Its catchment is mostly cleared for use by agriculture and dairy farms, having a highly modified drainage and diversions of freshwater flow. The water flow through the estuaries was first altered in 1908 and is now controlled by surge barriers installed at their mouths, which provide options for fish-passage and storm surge and flood protection for the township of Busselton. Eutrophic symptoms, such as cyanobacterial blooms and occasional significant fish kills, occur most frequently in the exit channel of the Vasse estuary and near the barriers. Recent investment by the state government on the *Revitalising Geographe Waterways* program has allowed substantial scientific investigation of the environmental issues in this region. These data were implemented in a 3D hydrodynamic model (TUFLOW FV) to explore the effect of different operations of the gates on the water quality in the estuary. This talk will focus on the integration of the science undertaken to support management decisions during a significant cyanobacterial bloom (up to 400,000 cells/mL) dominated by *Anaebanopsis arnoldii* which persisted for more than 2 months. Water quality was monitored tri-weekly at several sites. LANDSAT imagery showed the bloom double in area between 17th December 2016 and 9th January 2017, to cover approximately half of the Vasse estuary. Scenarios explored with the hydrodynamic model showed different regimes in vertical salinity stratification and bed shear stress in the estuary depending on operation of the gates and tidal inflow, which can potentially affect the biota and biogeochemical fluxes. Successful science integration is crucial for the effective management of the complex Vasse-Wonnerup estuarine system.

Drivers of kilometre-scale coral reef benthic composition in Timor-Leste

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The Coral Triangle includes at least 29% of the world's coral reefs and provides habitat to an unprecedented concentration of biodiversity which is important to ecosystems and people. This plus increasing threats led to the establishment of Coral Triangle Initiative by six southeast Asian nations, including the newly formed nation of Timor-Leste. The understanding of Timorese coral reefs relatively limited by comparison to the other more established Coral Triangle Initiative nations. Improving the knowledge of the Timor-Leste's reefs is critically important for the sustainable use and management of these resources. Our study aims to increase understanding of Timorese marine resources by rapidly acquiring and analysing coral reef benthic imagery at multi-kilometre-scales with centimetre-scale precision. The objective of this work is to: 1) provide estimates of coral abundance and other key benthic groups; 2) incorporate broad morphological characters of hard corals (i.e. massive, branching, foliose etc.) to increase the ecological relevancy of the coral cover metric, and 3) analyse potential drivers of large-scale coral reef benthic variability. Over 28,000, 1 m^2 quadrats were collected and analysed using machine-learning techniques. The coral cover is variable ranging from 5-75% which is comparable to small number of conventional surveys done previously on the north coast. Additionally, the community composition of corals based on coarse morphological categories varies significantly. Although Timor-Leste is seeking to develop, its reefs are not 'pristine' – likely from heavy levels of subsistence fishing, gleaning, and watershed-based pollution. This reinforces the need for Timor-Leste to develop appropriate management strategies that will promote the long-term sustainable use of its coastal marine resources.

Biodiversity of coral reef cryptofauna in relation to coral habitat and reef fish communities in Timor-Leste

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Coral reefs are among the most biodiverse ecosystems globally with the Coral Triangle (CT) known as the global centre for many marine groups such as reef-building corals, fish, and cryptofauna. While there is considerable information about coral and fish diversity on CT reefs, relatively less is understood about cryptofauna. Much of this is due to the difficulty of sampling and identifying these cryptic species. Autonomous Reef Monitoring Structures (ARMS) in conjunction with DNA barcoding techniques have been developed to systematically quantify cryptofauna in a variety of marine habitats including coral reefs. In our study, ARMS were used to assess the diversity of brachyuran crabs across the north coast of Timor-Leste and to relate it the condition of associated coral reefs. Brachyuran crabs sampled from 25 ARMS deployed in Timor-Leste were DNA barcoded in addition to metabarcoding of the 500 µm, 100 µm, and sessile samples from ARMS. Thirty percent of the barcoded crabs were unique to Timor-Leste which is comparable to ARMS biodiversity assessments in the Indo-Pacific. Results were considered in the context of other ecological variables such as coral abundance and reef fish abundance data measured from stationary point count surveys.

Australia has no marine spatial planning

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Ocean and coastal resources are limited in space and abundance in Australian waters and the pressure on the marine environment, resulting from an expansion of existing use and the rise of new ones, has been devastating in many places. Management of Australia's coast and ocean through marine spatial planning (MSP) coupled with ecosystem based management (EBM) is needed. It requires integration and multi-level governance. Trade-offs on resources lost for remediation, recovery and the values of goods and services are discussed. Uses that must be integrated include fisheries, marine protected areas and aquaculture. Good MSP requires coordination, understanding and goodwill of all stakeholders. Management requires monitoring, evaluation and recording. Transboundary cooperation is well advanced in some places yet Australia and its states have no MSP. Some states are considering MSP and Western Australia has brought stakeholders together in a 'blueprint for 2050. Marine protected areas are an important part of MSP and have come into consideration as more and more of the oceans' waters and substrates are exploited. Examples are given of where MSP would be needed in Australian coastal and Commonwealth waters. Efforts to conserve marine biological diversity using conventions, international agreements and "soft law" are discussed. Conflicts arise when uses are not compatible with one another and are competing for ocean space or have adverse effects on each other (user vs. user conflicts), or when uses are not compatible with the needs of a healthy and sustainable environment and cause conflicts between users and the environment (user vs. environment conflicts).States do not have compatible policies with each other or the Commonwealth waters from 3 nautical miles to the EEZ at 200 NM.

Exploring the slope/offshore Great Australian Bight (GAB) pelagic habitat paradox.

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The central offshore/slope Great Australian Bight (GAB) is a pelagic habitat paradox with apparent high micronekton (small fish, crustaceans, squid and gelatinous organisms) biomass in a predicted low productivity region. This anomaly is manifest in the comparison of the central and eastern GAB, where the predicted Flinders Current System (FCS) is unique globally, being at the northern margin of a major ocean, associated with upwelling off Kangaroo Island in the east and predicted downwelling in the centre. To investigate this apparent paradox we undertook a voyage on the RV Investigator in December 2015 to understand the microbial, plankton and micronekton communities over the slope and deep-ocean and explore the fundamental knowledge gaps between the two regions. New observing tools were used to elucidate fine scale ocean mixing and production as well as describe the micronekton including gelatinous community with a new profiling acoustic and optical probe to 1000 m. We provide an overview of the voyage placed in context with the oceanographic setting and historical biological sampling to compare the structure and function of the region. Historical biological sampling focused on a program of bio-acoustics and a continuous plankton recorder for broad scale spatial and temporal context. We outline the key findings and the remaining uncertainties and how this could affect the distribution and abundance of key species. This work was undertaken through the Great Australian Bight Research Program - a collaboration between BP, CSIRO, the South Australian Research and Development Institute (SARDI), the University of Adelaide, and Flinders University. The Program aims to provide a whole-of-system understanding of the environmental, economic and social values of the region; providing an information source for all to use.

Evaluating conflict potential in the marine and coastal areas of the Kimberley region through public participation GIS

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Marine spatial planning (MSP) is an approach to manage different human uses and conservation goals. Most conservation planning, including MSP, suffers from the lack of social data, hence the aim of this study was to evaluate, through the well established method of public participation GIS (PPGIS), areas of conflict potential using human values associated with marine and coastal areas of the Kimberley. The remote Kimberley region is renowned for its rich Aboriginal culture and heritage, biodiversity and wilderness. The region has a low population and dispersed economic development including agriculture, mining, fishing, and more recently oil and gas exploration. Almost 170 interviews involving participatory mapping were held with stakeholders who either visited or lived in the Kimberley. Seventeen values were elucidated from the interviews, spanning consumptive, non-consumptive, direct and indirect uses. Biodiversity, the physical landscape and Aboriginal culture were most valued. Our results show that, the entire study area was valued for one or more values. Results included maps of higher than average intensity of each particular value. We developed conflict matrices, with values categorized as consumptive and non-consumptive, and the degree of conflict potential based on the extent of social norm violation and goal interference. At least a third of existing marine protected areas were mapped as having medium to high conflict potential. These were all near-shore, with large, remote offshore marine protected areas showing very little evidence of conflict potential. As Aboriginal culture, biodiversity and physical landscape values were most marked by the respondents, careful consideration of the social impacts of future developments associated with access is essential. Our work also highlights that there is an important base for societal support for marine protected areas in the region. PPGIS based on interviews provides social data for the 'missing layer' in MSP. Such data are needed if the social concerns of stakeholders are to be recognized and included in spatial planning. PPGIS complemented by extensive field interviews is a powerful method of evaluating existing human values over large marine spaces and provides quantitative inputs into modeling of conflict potential in marine spatial planning.

Importance of habitat selection to successfully develop Blue Carbon projects.

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Over the last few years blue carbon initiatives have been developed aiming to enhance the CO_2 sequestration capacity of coastal vegetated ecosystems (tidal marsh, mangrove and seagrass) and/or avoid greenhouse gas emissions resulting from their disturbance. Although a few previous studies demonstrate that conservation and restoration activities in seagrass meadows could result in 'additionality' (enhanced sequestration or avoided emission through management), here we show that this may not always be the case. Seagrass soil cores were collected in the Upper Spencer Gulf, South Australia to estimate organic carbon (C_{org}) stocks and sequestration rates of bare sediments, resilient (*Posidonia australis* and *Posidonia sinuosa*) and naturally recovered (*P. australis*) meadows, following their die-off in the early 2000s. The average C_{org} stocks in 1 m-thick deposits were 6.1 ± 0.26 kg/m^2 in resilient meadows, 4.8 ± 0.19 kg m^{-2} in naturally recovered meadows and 3.2 ± 0.05 kg m^{-2} in bare sediment. The dating of the soils with ^{210}Pb radioisotope showed that most habitats (resilient and naturally recovered meadows, and bare sediments) were probably mixed and/or eroded, making it impossible to reconstruct the chronology of the upper part of the cores, corresponding to the last century. The area where vegetation occurred is highly exposed and thus likely affected by resuspension of sediments. Radiocarbon dating revealed that mixing may also have occurred in the older sediment in most of the cores. The difficulties in establishing baseline C_{org} stock and accumulation rates prevents determining the extent of enhanced accumulation or avoided emissions at this study site and precludes its hypothetical eligibility for crediting. The results obtained in this study demonstrate that not all blue carbon habitats have the same crediting potential, and that careful selection of sites for restoration and techniques for monitoring additionally are crucial to successfully develop a blue carbon project.

Clams benefit mobile fauna by creating algal beds with low predation pressure

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The role of negative trophic interactions in structuring communities and food webs is well established. However, there is growing interest in how communities are structured through positive (commonly, non-consumptive) interactions. Facilitation of a habitat-forming species by another habitat-former promotes diverse assemblages through increased structural complexity and resource provision. A key mechanism by which habitat-formers often promote biodiversity is by reducing predation pressure. Thus both trophic and non-trophic processes should be important components of facilitation. However, facilitation theory has been slow to incorporate the role of trophic processes, and how the strength of these interactions may change across ecological contexts. Here, we test whether the macroalga *Sirophysalis trinodis* provides a functionally distinct habitat when occurring on the bivalve *Anadara trapezia*, within a soft sediment matrix, in contrast to where it occurs on an adjacent rocky reef, and whether differences in community structure are the result of morphological changes in the alga or predation pressure across the ecological contexts. Interestingly, the alga was less complex but supported a more abundant and diverse community of epifauna when settled on the bivalve in contrast to the reef. Algal transplant experiments, remote underwater video, and deploying 'Squidpops' demonstrated a higher predator abundance and consumption on the reef, suggesting that bivalves are indirectly providing a refuge for epifaunal species. These results indicate that both trophic and non-trophic interactions are important for organisms but their relative strengths vary across ecological contexts.

After a decade, what is new in IMOS?

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Australia's Integrated Marine Observing System (IMOS) was established in 2006–2007 by the Australian government to monitor its marine jurisdiction and address the requirements of the Australian marine and climate science community. As a marine observing system, IMOS has focused on building long-term time series data streams to meet the knowledge needs, and has ensured that by making all of the data openly available, its observations are used by many stakeholders. After a decade of operation, a series of new initiatives, programs and task teams have started in IMOS, these include:

• Australian Marine Microbial Biodiversity Initiative (AMMBI), which started in 2012 at IMOS National Reference Stations (NRS) with the aim to build a marine microbial biodiversity map of Australia that could be integrated with environmental data.

• Bioplatforms Australia marine microbes project to establish how Australia's marine microbial communities change over time in various locations and environments, by investigating the microbial communities of seawater, sediment, sponges and sea grass utilising IMOS capability.

• Zooplankton Ocean Observations and Modelling (ZOOM) Task Team which is beginning the process of systematically integrating zooplankton observations into biological models (biogeochemical models, size-based ecosystem models and food web based ecosystem models).

• IMOS Radiometry Task Team (IRTT) whose rationale is to perform activities that can improve the usability of IMOS radiometric data sets for research purposes, as well as for validation of satellite ocean colour products, and develop a plan for the evolution of radiometry measurements in IMOS for the next decade.

• National Ichthyoplankton Monitoring and Observing' (NIMO) initiative which evaluates the value of long-term monitoring of ichthyoplankton at selected IMOS NRS. This monitoring began in late 2014, and is now ongoing at five NRS around Australia.

• Harmful Algal Blooms forecasting, which is exploring the potential for IMOS for underpin research into HAB forecasting and enabling the combined power of in situ observations, remote sensing and modelling/forecasting to come together and deliver impact that can help the aquaculture and fishing industries.

This talk is an overview of these new initiatives currently happening in IMOS.

Diet and temperature interact to affect survival and fecundity of a marine herbivore

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Increases in sea surface temperatures are predicted to alter marine plant-herbivore interactions and thus the structure and function of macroalgal and seagrass communities. Predicting the effects of increased temperatures requires an understanding of how temperature interacts with other stressors. We used a marine amphipod, *Peramphithoe parmerong*, to test how increased temperatures and diet quality interact to determine herbivore growth, survival and fecundity. *P. parmerong* was grown in laboratory conditions under 9 combinations of altered temperature (ambient, +2 °C and +4 °C) and diet (two high and one low quality) for two generations. Temperature and diet interacted to determine to the total number of the surviving F1 generation and the total potential F2 population (based on brooding eggs and hatched juveniles). This indicates that changes to diet will complicate predicting the effects of increasing temperature, and that effects will continue beyond the current generation. The size of the first generation of amphipods was altered by diet, but not temperature, with the poor quality macroalga, *Colpomenia peregrina*, producing significantly smaller individuals than treatments with the higher quality *Sargassum* spp. Given that available diet quality changes with the seasons, and increased sea surface temperatures may alter the availability of preferred macroalgae, global climate change is likely to impact communities of marine herbivores due to compounded impacts from temperature and diet quality, rather than just thermal stresses on the population.

Exotic polychaete species identified using integrative methods.

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Tube-dwelling polychaetes are among the most invasive fouling taxa with many having a near worldwide distribution. Their success as invaders is partly due to plasticity, and this feature also makes it difficult identify their incursions based on morphology alone. Along the coast of Adelaide, South Australia, we identified two species of Sabellidae from the genera *Branchiomma* and *Parasabella* that were previously unknown in this region. Sabellid worms are known to exhibit high intraspecific morphological plasticity and therefore use of diagnostic features alone can be a poor indicator of species. We combined molecular techniques with morphological characters to delineate and identify species collected from Adelaide. Nuclear (internal transcribed spacer) DNA sequences of 21 samples showed two distinct lineages. Comparison of the sequences with the NCBI Nucleotide BLAST database match species previous identified as *Branchiomma sp B* (Capa et al., 2013), and *Parasabella sp 2* (Capa and Murray, 2015). Though these species have a cryptic distribution, they have thus far only been recorded in tropical regions, include Darwin, Australia and this is the first report of these Sabellids in temperate waters. Our research highlights the usefulness of molecular approaches combined with traditional taxonomy to identify and manage newly arrived exotic species.

Assessment of human-induced change & biological risk posed by contaminants in estuarine sediments: a scheme for assessing global harbour estuaries

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A comprehensive assessment of the condition of marine sediments requires a full range of chemical analyses, toxicological testing, assessment of benthic community structure plus bioavailability and bioaccumulation. These are expensive, time consuming and require a high level of professional skill. This is generally beyond the resources of most jurisdictions and unnecessary for initial screening. An inexpensive, rapid and simple scheme is presented, providing two important types of information to assess the status of estuarine bottom sediments. The mean enrichment quotient (MEQ) for Cu, Pb and Zn provides the magnitude of human-induced change, i.e. deviated from pristine condition. Sediment quality guidelines (SQGs) are used to assess the risk posed by sedimentary contaminants in supporting healthy benthic communities. The most commonly used SQGs determine two values for each contaminant; a concentration below which adverse effects are seldom observed and the concentration above which adverse effects are common, with concentrations between exhibiting inconsistent biological effects. Sediments mantling Sydney estuary, Australia are well characterised after 30 years of research and suited for assessment using this approach. Maximum enrichment for bottom sediment in this estuary exceeds 100 times for some metals and the MEQ is >10 times for the majority of the estuary. This level of metal enrichment gives a clear impression of the magnitude of anthropogenic change. Areas of the harbour where single metal concentrations are expected to have an adverse effect on benthic populations vary between 2% and 50% of the waterway, whereas organochlorine compounds are expected to have adverse effects over extensive parts of the estuary. The risk of adverse effects for combined mixtures of contaminants is highest for ~2% of the estuary, while 25% of the waterway has an intermediate risk of being adversely affected. SQGs identify the chemicals of most concern, as well as the locations of greatest risk. The scheme is well suited to initial assessments of estuarine sedimentary health for harbour estuaries, which are highly influenced by urban and industrial development worldwide. This screening approach underpins management decisions and provides essential information on which future research may be designed. This approach will be applied to ten important harbours in the world as part of the 'World Harbour Project'.

Early detection of MIS from biofouling assemblages in South Australia using next generation sequencing

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Biofouling on commercial and recreational vessels allows the introduction of marine invasive species (MIS) that can have negative impacts on the endemic biodiversity. The on-going surveillance of MIS has been improved by the advent of DNA-based techniques. Our study investigated the use of high throughput DNA sequencing to assess biodiversity as a method to identify MIS from biofouling samples. A field trial was conducted in South Australia at three locations used by recreational and commercial vessels: North Haven, Wirrina Cove and at two sites in the relatively disturbed region of Kangaroo Island. Larval settlement plates were installed for a period of 12 months, with the samples collected after one, three, six, nine and 12 months. DNA was amplified for the 18S rRNA gene and sequenced on an Illumina Miseq. The putative findings indicated that several MIS was detected at one month sampling time point. The presence of key MIS (e.g. *Ciona intestinalis*) identified at North Haven and Wirrina sites also showed high potential to reduce the diversity of molecular operational taxonomic units (MOTUs). Our findings further indicated the diversity of the biofouling community was greatest at less disturbed sites such as Kangaroo Island, where highly invasive species such as *C. intestinalis* are not present or less dominant.

Dynamics and connectivity of the Bonney Coast Upwelling on a daily scale using the Himawari-8 dataset

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The Bonney Coast Upwelling (BCU) is a key ecological feature in the Australian marine regime; it helps contribute to the largest fin fish based fishery in Australian waters and is a feeding ground for endangered blue whales. The BCU is a seasonal wind-driven feature that operates intermittently throughout the Austral summer (on the time scale of between a few days to a couple of weeks). Since its discovery in the late seventies, the region has been investigated using a range of physical oceanographic techniques, from shipboard sampling to modelling and remote sensing. The latter of which has, until recently, been limited by the temporal frequency of the MODIS and AVHRR satellite passes over the Australasian region (twice a day), making the data susceptible to cloud contamination. The geostationary Himawari-8 satellite, which became operational in late 2015, is an ideal platform to provide adequate temporal resolution to minimise the cloud contamination problem. This study generates sea surface temperature (SST) daily composites from hourly Himawari-8 images, during the period from November 2016 – March 2017. A topographical position index method is used to isolate the upwelling signatures in the Bonney Coast region from these daily images. With the BCU mapped on a daily basis, we are able for the first time to quantitatively investigate the spatial and temporal development of the BCU, from onset to termination, during an entire upwelling season. The Initial analysis from the 1st of November 2016 – 20th of February 2017 identified three distinct upwelling events (5-17th of January, 19th of January – 2nd of February, and 6-20th of February). At maximum development, these three events covered areas ranging between 9460 and 12923 km^2. The upwelling events showed rapid development during the first couple of days with the spatial extent of the surface plume increasing by up to 10-fold within the first 48 hours. In addition, the study will also be able to investigate the connectivity between the BCU and other local upwelling features off Kangaroo Island and the Eyre Peninsula.

A multi-technique investigation of population structure of tunas in Indonesian archipelagic waters.

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Indonesia's pelagic fisheries resources are of high importance to the nation's economy and as a domestic food resource, with two species of high importance being yellowfin tuna, *Thunnus albacares* (YFT) and bigeye tuna, *T. obesus* (BET). Current stock assessments suggest both species are fully exploited and possibly overfished in some areas. However, the assessments are weakened by uncertainties, including possibly erroneous assumptions that both species are broadly distributed and well-mixed. Two key questions needed addressing for sustainable management of these resources: (i) Is there sufficient evidence of meta-population structure in YFT and BET across the Indonesian archipelago that would justify assessments and management by region? (ii) What is the level of connectivity between tunas in eastern and western Indonesian waters, and between Indonesian waters and adjacent oceanic regions? Over the past 4 years, an Australian – Indonesian collaboration (ACIAR Project FIS/2009/059) has addressed the population structures via a multi-technique approach – genetics, otolith chemistry and parasite loads. This approach followed recognition that each technique has strengths and limitations in defining population structure, and used together have a high likelihood of providing a clearer 'picture'. Samples were collected from juvenile (0+) YFT and BET in two years (2013 and 2014) from 9 sites across the Indonesian archipelago and from two outlier sites in the Indian and Western Pacific Oceans (Maldives and Solomon Islands). The genetics characterisations were based on mitochondrial DNA and Diversity Arrays Technology (DArT) analyses; those for otolith chemistry were based on stable isotope ratios ($\delta^{18}O$ and $\delta^{13}C$) measured by mass spectrometry and microelements (including Li, Mg, Mn, Cu, Sr, Ba and Fe) measured by laser ablation; and parasite loads characterised in terms of species and abundance. Preliminary analyses (which will be updated in reporting for this conference) of the results of the three techniques showed similar pictures emerging, with some significant regional (i.e. inter-sample location) differences; between samples of the Indonesian sampling locations and those of the outlier sites, but also among groupings of sites across the Indonesian archipelago. The results of this study will be an important contribution to the current Harvest Strategy development for Indonesia's tuna fisheries.

Uncovering the diversity of deep sea crustaceans (Isopoda and Amphipoda) from the Great Australian Bight

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The deep-sea is a largely unexplored, complex environment where benthic invertebrate diversity is poorly known and mostly undescribed. Australian deep-sea benthic faunal surveys have previously concentrated on the western and eastern mainland coasts and northern Tasmania, leaving the deep-sea benthos of the Great Australian Bight (GAB) virtually unstudied. Recent collections made through the Great Australian Bight Research Program (GABRP) have provided fresh material for analyses, indicating high levels of diversity present in the GAB including large numbers of Isopoda and Amphipoda (Crustacea). These two groups are well known as dominant members of benthic deep-sea habits world-wide, yet the Australian deep-sea assemblages of these groups lack a modern phylogenetic and taxonomic framework. This project aims to provide a comprehensive taxonomic checklist to deep-sea species of amphipods and isopods in the GAB and robust multigene phylogenies for both groups, with targeted taxonomic evaluation of the Serolidae. This isopod family is cosmopolitan with both shallow and deep-sea representatives. Australian deep-sea serolids have been documented previously but only employing traditional morphology-based approaches. Two genera (*Brucerolis* and *Acutiserolis*) are recorded from areas around Tasmania, New Zealand, south-eastern Australia and now, based on recent surveys, the GAB. The present study is employing *CO1*, *16S* and *18S* sequence data to define relationships for these two genera including additional Southern Ocean and Antarctic material from the National Institute of Water and Atmosphere (NIWA). This will enable us to place the GAB taxa within a broader Southern Ocean serolid phylogeny. New species will be described based on molecular and morphological criteria. Preliminary results indicate the possibility of morphologically cryptic species within existing morphospecies (e.g. *Brucerolis victoriensis*).

No evidence of alternative stable states in the dynamic between the habitat-forming seaweed *Hormosira banksii* and coralline turf

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Coastal marine ecosystems are among the most ecologically and socio-economically important on the planet. The ecosystem engineer *Hormosira banksii* is often the dominant species in the temperate intertidal zones of southern Australia, where it is commonly associated with an understory of *Corallina officinalis* turf. *H. banksii* forms a dense canopy which facilitates other species by ameliorating the harsh effects of abiotic factors such as temperature and desiccation. Disturbances are common in intertidal areas and climate-driven increases in storm intensity and temperature are exerting increased pressure on these important ecosystems. Published studies have shown that removal of canopy-forming macroalgae can lead to replacement by turf-forming algae, suggesting the possibility of alternative stable states and hysteresis in the dynamic. On an intertidal rocky reef on the northern coast of Tasmania we manipulated cover of the *H. banksii* canopy and understory coralline turf in a pulse perturbation within $1m^2$ plots. The manipulated plots contained eight treatments ranging from 100% removal of *H. banksii* to 100% removal of the understory *C. officinalis*. Recovery in these plots was followed over two years from 2014 to 2016. The aim of the experiment was to determine whether a threshold density exists between the two species where a discontinuous phase shift occurs, and to document the recovery of this ecosystem post-disturbance. The results indicate that rather than a shift between the dominant species indicating alternative stable states, both species appear to be slowly returning to equilibrium within the plots irrespective of the manipulation treatment.

A hidden oasis for corals? Exploring past and present-day coral distribution in a subtropical setting

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The adage that an understanding of the past can help guide our expectations of the future is being challenged under the current climate, where changes in ecological processes are occurring at an unprecedented rate. Coral reefs will likely persist as geomorphic structures, but the ecological communities that form the modern reef will experience significant changes to their structure and function. During past periods of climatic warming, coral reefs have been known to shift their geographical ranges into higher latitudes and survive in protected environments termed 'refugia'. Subtropical areas and deeper, mesophotic waters (30-150 m) have been hypothesised as potential refugia for corals under continued ocean warming. This research explores potential refugia along the eastern margin of Australia, looking to the remote, subtropical islands of Lord Howe Island and Balls Pyramid which occur at the latitudinal limit of reef development in the Pacific Ocean. These islands are protected by World Heritage listing and with State and Commonwealth government marine reserves. We synthesise a diverse range of broad-scale and fine-scale datasets to explore the distribution of corals in this setting through space and time. Bathymetry data, drill cores, sediment cores and sub-seabed acoustic profiles collected around the shelves of these islands were integrated to map the extent of past reef accretion. Towed underwater video imagery was collected to describe modern benthic communities and quantify coral cover in the mesophotic zone. Results show substantial fossil coral reef development around the Balls Pyramid shelf, with an extensive submerged fossil reef mapped on the mid-shelf in 30-50 m depth, comparable to the previously documented fossil reef around Lord Howe Island. Abundant live coral communities were revealed on the fossil reef surfaces on both shelves, with corals commonly occurring in 30-40 m depth and extending to a depth of 94 m. The discovery of abundant live coral on the deep shelf demonstrates that subtropical, mesophotic settings can provide important habitat for coral growth. Also, the record of extensive fossil reef accretion suggests this region may provide benthic habitat suitable for coral refugia, as well as substrate for coral range expansion, under continued ocean warming.

Oceanic drivers of reef heat budgets in northwestern Australia: the role of tides on regional and reef-scales

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The thermal conditions in which coral reefs live are governed by ocean and atmospheric processes that occur over a vast range of scales, ranging from large-scale processes at the scale of ocean basins (order thousands to tens of thousands of km), to regional scale ocean dynamics (order 100 km), to smaller-scale (order km or less) processes occurring at the scale of individual reefs. This presentation will focus on the role that tides in particular play in regulating temperature variability and thermal extremes that reef systems experience, focusing on recent research activities in northwestern Australia as a case study of these dynamics. At the scale of individual reefs, we demonstrate how temperature variability within tide-dominated reef habitats (such as those found throughout northern Australia) often differ substantially from the surrounding ocean and how thermal extremes can be accurately predicted (now and in the future) by assessing the mechanisms that control reef heat budgets. Using data from field observations in Kimberley region of northwestern Australia, we show how a simple heat budget model can be used to investigate how tidal and solar heating cycles interact with reef morphologies to control diurnal temperature extremes within shallow tidally-forced reefs. This model is then extended to show how reefs globally with tidal amplitudes comparable to their depth relative to mean sea level tend to experience the largest temperature extremes. As a consequence, this analysis reveals how even a modest sea level rise can substantially reduce temperature extremes within tide-dominated habitats, more generally. Finally, on larger (regional scales) we will discuss research related assessing the ocean drivers of coral bleaching across northwestern Australia during 2016, and the notable role that tidal mixing in particular played in controlling temperature variability and thermal stress across the region.

Integrated land-sea modelling of the Kimberley

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While the body of scientific knowledge on the Kimberley marine environment is still small compared with what is known of other areas of Australia (e.g. tropical waters of the east coast), recent ecological studies from Kimberley Marine Research Program have produced a large body of new information that is relevant to the protection and management of the Kimberley marine environment. In this study, we collected a large amount of information on land, coastal and marine ecosystems as well as natural and socio-economic processes, including both existing data sets and recent data produced by the KMRP program. This information is integrated via two ecosystem models, Ecopath with Ecosim (EwE) and ALCES, to model the marine and land ecosystems, respectively. This information has also allowed us to clarify the range of future scenarios of climate change and socio-economic development the region may undergo in the coming 2-3 decades. Our implementation of EwE and ALCES models combine our best understanding of the natural world and the human parts of the Kimberley and provide our current "best guess" of the general types of future the Kimberley could face under different climate change and increasing human use scenarios and the likely impact of options available to manage these stressors. In addition, EwE and ALCES can help identify gaps and assist in directing further research needs. In this talk, we first show projections of land-based stressors on the coastal and marine environment as obtained by the ALCES model, and then show an initial set of results from the EwE model, describing the impact of these projections on the marine environment. Understanding the process and interactions within the marine Kimberley ecosystem, including the role of terrestrial inputs, can promote and support plans for conservation and management.

Metrics, parameters and results from fisheries and wildlife studies with the CSIRO Ruggedized Autonomous Gigapixel Systems (CRAGS)

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Wildlife populations, fisheries and recreational space are under pressure across the globe due to various anthropogenic drivers. To both detect trends and assess mitigation strategies, long-term monitoring is required. Traditionally, visual monitoring through spotting scopes or high powered binoculars was undertaken by researchers interested in populations, behaviours, uses and ecology. However, development of time-series datasets from visual monitoring is logistically difficult- especially in remote locations - and various camera traps systems have been developed to autonomously collect data. These systems, while able to collect long time-series, tend to have two major drawbacks in that they don't replicate either the high resolution or field of view available to on-ground observers with scopes. To solve this dilemma CSIRO have developed 'CRAGS', (CSIRO Ruggedized Autonomous Gigapixel Systems). CRAGS are a form of camera trap that can scan a wide area (1-4km) with much higher resolution than standard cameras, can be deployed remotely in harsh environmental conditions and programmed to collect time-series data. Similar to a person on a vantage point with high powered binoculars, they allow for high definition (gigapixel) images where any point in the image can be zoomed into without losing clarity. Originally designed for work on Shy Albatross on remote offshore islands, CRAGS have also been successfully deployed onto a lighthouse to monitor fishing use of an artificial reef, on cliff tops to view offshore pelagic fisheries and in coastal bays for patterns of human use. The most recent collaborative project for CRAGS is between CSIRO and the Korean Polar Research Institute (KOPRI), who deployed four units in Antarctica over Austral summer (2016/17) to monitor penguin and Skua colonies as well as sea-ice movement, and are planning to redeploy to Korea in Austral winter to monitor migratory shorebirds. We provide examples of the different metrics and parameters which have been developed across these fishery and wildlife applications to address various research questions.

Incorporating community concerns into decision-support tools for environmental management of finfish aquaculture. How can social science better guide environmental decision makers?

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Recent media coverage would suggest that the broader community is becoming increasingly concerned about the environmental management and regulation of finfish aquaculture operations in Australia. Regulation, certification and industry best practice guidelines all include provisions for evaluation of environmental conditions which are based on science, but the community is still not convinced. How can we ensure that monitoring and management practices address community concerns?
The "Your Marine Values" study sought to clarify community values associated with the marine and coastal environment of the Huon Estuary and D'Entrecasteaux Channel, SE Tasmania. We will use this study as a test case to discuss how the values relate to the monitoring, regulatory and certification requirements for salmon aquaculture in this region and more broadly. We will compare the implications of the different approaches and how they relate to the key "marine values", with a view to identifying gaps in our understanding or opportunities for improvement. The "Your Marine Values" study was used to develop a decision support tool for aquaculture planning and development that incorporates social parameters for environmental management. We will discuss the difficulties in doing this and further consider how aligning environmental management with community values can help to address community expectations and improve social acceptability of alternative management and operational strategies.

Broadscale Environmental Monitoring – What is it? Who does it? How does it fit in to Marine and Coastal Management? and Can we do better?

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Monitoring is defined as "the process by which you observe and check the progress or quality of (something) over a period of time". For monitoring to be actionable (have practical value) it needs to be referenced to particular objectives or performance targets; which implies that there needs to be an "action" associated with the monitoring results. In the marine context this is often relatively easy to achieve in relation to point source inputs or impacts that can be directly associated with a particular activity, but is more difficult in the "broadscale" context where there may be multiple stressors and complex interactions to consider. Establishing causality and responsibility under these circumstances is often extremely difficult, and therefore both engagement and management needs to be based on a different premise. This presentation will review **broadscale monitoring** in the marine environment from a range of different perspectives (science and management) – looking at different applications/ management objectives and how the approach might necessarily need to change depending on the purpose i.e. impact assessment, remediation or just for understanding (natural variability/ climate change). Using examples from broadscale monitoring programs in Australia and overseas we will examine similarities and differences in approach, and highlight some potential pitfalls. We will consider the role of research in monitoring, and how that might relate to adaptive management processes. Concluding with a checklist of considerations for monitoring, some insights into how monitoring and management processes might be improved, and some suggestions as to where science can best fit in.

Recent sediment investigations in an enclosed tropical harbour

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A sediment vibra-coring campaign and an acoustic survey of Gove Harbour were conducted in September-October 2016. The campaign and the survey covered an area of around 2 km^2. The aim of the field studies was to determine the composition, thickness and possible layering of the seabed sediments. The cores were taken using a Specialty Devices Inc. (SDI), VibeCore-D that utilises a high frequency vibration to acquire near undisturbed cores. A boat mounted instrument (Tritech SeaKing Parametric Sub Bottom Profiler) was using high and low acoustic frequencies to determine layering in the sediments. Positioning was obtained via GPS (Hemisphere Crescent L1 and MGL-3) input to the instrument. The collected sediment cores were sub-sampled and analysed for particle size distributions. An analysis of the samples suggested that there was a significant both vertical and horizontal variability of the collected sediment material between the sites: there were sites with only 20% of fine material and sites with up to 100% fine material in the top sediment layer. The collected acoustic transect profile data were post-processed and the transect lines closest to the sediment coring sites were extracted. A comparative analysis of the core composition/particle size distribution and the sub-bottom profiler images supported the understanding of the sediment layering. The collected information provided a valuable contribution to and means for validating the sub-bottom profiles with core samples. The developed understanding of the sediment layer properties will be further used in suspended sediment and bed load transport modelling.

Using acoustic current profilers and drifting buoys for current measurements in estuarine environments

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It is generally accepted in the scientific, oceanographic community that acoustic instruments, such as acoustic Doppler current profilers, are reliable tools, which can be used in variable, frequently adverse conditions without any extra calibration or basic ground truthing. This notion has been tested in two phases of the present study. In June 2016, the phase one of the study was carried out. Two bottom mounted instruments from Nortek AS, Aquadopp 2 MHz Profilers, were deployed in Darwin Harbour at two different locations: one ADCP in the middle of East Arm, between the INPEX jetty at Blaydin Point and Myrmidon Creek, and another in the channel of Sadgroves Creek, near Stokes Hill Wharf. Both profilers were collecting current velocity data through the water column at each of the locations over a 24-hour period. While the Aqaudopp instruments were logging data, a set of drifting buoys was released over each of the locations for a duration of a few hours. The drifters were logging positions via two different types of devices: satellite trackers and on-board GPSes. In February 2017, the phase two of the study was completed. A boat mounted 1200 kHz RDI Workhorse ADCP in a downward looking mode was used to resolve currents vertically when following a cluster of GPS tracked drifters released within Middle Arm of Darwin Harbour. After successful retrieval of all the instruments, the current velocity and positioning data were downloaded and processed. The deployments revealed that both Eulerian and Lagrangian types of measurements produced similar results in terms of the calculated statistics from both types of data. A valuable conclusion was made that acoustic instruments may be used to assess vertical structure of currents in conjunction with drifting trackers for understanding temporal and spatial variability of estuarine currents. As a result of the study, current parameters were estimated within three different areas of Darwin Harbour. These data will further feed into studies of the harbour water quality and pollutant (e.g. such as spilled hydrocarbons, wastewater, etc.) diffusion and transport.

Photosynthetic acclimation to desiccation stress in *Zostera muelleri*

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Seagrass meadows are high-value ecosystems known for their ecological and economic importance. Due to their immobility, the distribution and productivity of seagrasses is largely impacted by environmental factors. For species living in the intertidal zone, desiccation stress (higher irradiances, increased temperatures and dehydration) during exposure is thought to control vertical distribution. In temperate and subtropical Australia, *Zostera muelleri* is capable of inhabiting all areas of the intertidal zone, highlighting its importance as a key restoration species. However, to date, little is known about the effects of desiccation stress on *Z. muelleri*, its impact on vertical distribution, and/or differences between latitudinal locations. To explore this, we examined *Z. muelleri* plants collected from three areas within the intertidal zone (high, medium, low), exposing them to desiccating atmospheric conditions for up to 8hrs (maximum tidal exposure). In plants collected from a temperate intertidal habitat, initial reductions in photosynthetic activity were observed across all zones, with further reductions zone specific. But, what about plants that grow in subtropical habitats where they are exposed to higher levels of stress, through increases in irradiance and temperature. Are the photosynthetic responses of these similar? Is desiccation stress controlling vertical distribution? We answer these question and provide valuable information on the photosynthetic acclimation abilities of *Z. muelleri*. Likewise, knowledge gained allows for identification of appropriate areas for restoration trials, with the overall hope of preventing further decline and assisting in recovery.

Assessing states of health and disease in stranded green sea turtles (*Chelonia mydas*)

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There are current knowledge gaps in the pathophysiological processes occurring in green sea turtles (Chelonia mydas) in Australia. To investigate this, we retrospectively examined the hematologic and biochemical blood parameters of 127 green turtles that were admitted to rehabilitation clinics between 2002 and 2016. Significant differences were found between animal size and between animals that survived compared with those that died. Univariate analysis of analytes showed that large animals had significantly higher levels of monocytes ($p < 0.05$) and protein ($p < 0.01$). Animals that died had significantly lower heterophils ($p < 0.01$) and higher levels of aspartate aminotransferase (AST) ($p < 0.01$) and protein ($p < 0.01$) compared with animals that survived. During rehabilitation, there was a significant increase in protein ($p < 0.01$) and decrease in uric acid ($p < 0.05$) in small immature animals. χ^2 contingency tests showed that reference intervals used to define healthy green turtles in Australia were not prognostically significant for any analyte in small immature animals. The observed results reflect nonspecific, multisystemic pathology that is likely to be secondary to a primary, unidentified noninfectious disease process. These results suggest that the current techniques may be inadequate to accurately assess green turtle health and the development of more accurate biomarkers would be beneficial in the management of this species.

Intra-annual variability of the North West Shelf of Australia and its impact on the Holloway Current

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Shelf circulation off the northwest coast of Australia is dominated by the seasonal variations of the Holloway current, driven by the monsoonal winds. Strong interannual and intra-annual variations of sea levels, ocean temperatures, and alongshore current are observed along the shelves off the northwest coast of Australia. A combination of modelled outputs and 2-years IMOS mooring time series were used to analyse the intra-annual variability of the North-West shelf and the Holloway current. Whereas the interannual variability in the region is mostly forced remotely by tropical Pacific and Indian Ocean processes, the intra-seasonal and semiannual signals are mostly driven by variations of regional winds at the northern coast of Australia. The Holloway current, with a mean annual transport of ~1 Sv, is stronger during austral autumn but is less consistent in the rest of the year. The dominant modes of intra-annual variability of the Holloway current were located at the intra-seasonal and semi-annual frequencies. Sea-level composites revealed the existence of a strong coastal sea-level oscillation signature at both frequencies over the NW shelf. Moreover, the phase analysis of sea level anomalies indicated the excitation and propagation of coastally trapped Kelvin waves, forced by MJO (intra-seasonal) and semi-annual wind anomalies. Although intra-seasonal waves are excited over the eastern parts of the Kimberley shelf, semi-annual waves are generated further to the East, over the Northern Australian coast. In both cases, strong alongshore wind anomalies drive cross-shelf Ekman flows, inducing upwelling and downwelling near the coast, and exciting the propagation of coastally trapped Kelvin waves toward the south-west. The Kelvin waves have a phase speed of ~ 1.9 $m.s^{-1}$ for both frequencies, characteristic of the first baroclinic Kelvin wave mode. In addition to sea-level anomalies, Kelvin waves also force velocity anomalies, as south-westward/north-eastward anomalies are associated with positive/negative anomalies in sea level. The fluctuations in the velocity field over the NW shelf translates into significant transport anomalies, ranging on average from ~0.3 Sv to ~0.4 Sv, for intra-seasonal and semiannual frequency, respectively.

Marine 'holobionts': seaweed-microbe interactions in a changing environment

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Emerging evidence from a wide diversity of systems increasingly shows that host-associated microorganisms are critically important for the normal development and functioning of eukaryotic hosts. Understanding the relationship between hosts and microbes is particularly crucial for habitat-forming holobionts that form the biogenic structure of ecosystems – e.g., trees and corals – because impacts on the interaction between these hosts and their associated microbiome can cascade throughout an entire ecosystem. Critically, such habitat-forming "foundation" species are in global decline. On temperate rocky coasts, seaweeds are the dominant biogenic habitat, forming dense underwater forests that underpin coastal biodiversity and functioning. Disruptions to host-microbiome interactions via environmental change can lead to higher incidence and severity of disease, affecting the resilience of seaweed populations. We have identified putative disease phenotypes of two key Australian seaweeds: the dominant kelp *Ecklonia radiata* and the fucoid *Phyllospora comosa*. Putative disease phenotypes were common and widespread, and in some cases greater in summer or on urbanised shorelines. Host-associated microbial communities characterised using 16S rRNA gene sequencing and metagenomics differed markedly between "diseased" vs "healthy" algae, even at a continental scale. Inoculation experiments have identified bacterial and fungal pathogens, which affected seaweed performance and survival, suggesting that microbial diseases may be an important process contributing to declines of seaweed forests. In the holobiont context, these results reinforce the idea that host-microbiome associations form a coherent biological entity, or holobiont, that must be studied together if we are to have an understanding of biological systems.

Restoration of underwater forests: "Operation Crayweed"

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Seaweeds are important habitat-forming organisms that support diverse communities and underpin a wide range of ecosystem functions and services in temperate coastlines around the world. Key species of seaweeds are, however, declining in many places around the world. While conservation in a preventative sense is a partial solution to the challenge of habitat degradation, the status of many of the world's ecosystems clearly demonstrates that it is not sufficient by itself. We use the seaweed *Phyllospora comosa*, or "crayweed", which disappeared from the Sydney coastline in the early 1980's, as an example of the potential of marine habitat restoration. We have been doing research on the ecological restoration of this species for the past 5 years and we have shown that the conditions in Sydney are now suitable for the re-establishment of crayweed populations and its associated biodiversity. Restored sites resemble reference sites with regards to multiple components of biodiversity. We have now scaled-up and initiated restoration of this crucial habitat at the scale of the degradation – which is rarely done in marine systems. Most importantly, we believe that this is a great project to involve the general public and enhance people awareness of important issues affecting their "backyard".

Can we increase services provided by coastal infrastructure with eco-engineering?

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Urbanisation in terrestrial systems has driven architects, planners, ecologists and engineers to collaborate on the design and creation of more sustainable structures. Examples include the development of 'green' buildings and the introduction of wildlife corridors that mitigate urban stressors and provide positive ecological outcomes. In contrast, efforts to minimise the impacts of urban developments on the marine environment have been restricted in both extent and scope, usually limited to the assessment of structural changes, e.g. number and abundance of species, rather than functional ones, e.g. productivity. New eco-engineering approaches are emerging that seek to mitigate environmental impacts and recover neglected ecosystem services by integrating knowledge of ecosystem process and function into urban design practices. In Sydney Harbour, Australia, intertidal seawalls were eco-engineered by adding concrete tiles with 5cm deep crevices and seeded with a native local habitat-former oyster or coralline algae or both. Structural and functional aspects, e.g. filtration rates of oysters and primary productivity, of enhanced and control tiles were measured to assess whether eco-engineering efforts were successful in increasing diversity and functioning of seawalls, therefore potentially increasing important services, such as local water quality.

Trawl exposure and protection of Australia's seabed fauna

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Sustaining seabed fauna is critically important for marine ecosystem processes. Here we provide the most extensive assessment of the current trawl fishing exposure of benthic invertebrates across Australia's waters. This work responds to the global need to quantify and address the broad scale impacts of trawl fishing on the seabed. Such information is greatly in demand by a range of stakeholders, such as fishery managers and industries aiming to adhere to sustainable certification commitments, conservation planners designing protected areas and decision makers setting national environmental agenda and policy. We aimed to quantify trawl exposure and protection of benthic invertebrates at large-scales, including developing a method that integrates data from disparate seabed surveys to spatially expand predicted distributions. We incorporate data from 18 seabed surveys to map the abundance distribution of benthic invertebrates in 9 regions within the Australian Exclusive Economic Zone. Our approach combines disparate benthic survey data, groups taxa having similar distributions within taxonomic class, and uses Random Forests to predict group distributions from environmental variables. Exposure and protection are quantified by overlapping predicted abundance distributions of benthic invertebrate groups with maps of trawl-footprint, marine reserves and fishery closures. We found that more of Australia's EEZ is currently protected from trawling (58%) than is exposed (<5%). Across all regions, 96% of benthic invertebrate groups had greater abundance protected than exposed to trawling. The mean exposure of benthic invertebrate abundance to trawling was 7%, compared to mean protection of 38% — further, 55% was neither exposed nor protected. Fishery closures, covering 19% less area than marine reserves, overlapped with a higher mean proportion of predicted benthic abundance; thus, highlighting the contribution of fishery closures to marine conservation. Furthermore our study demonstrates how disparate seabed surveys can be combined equitably to support regional assessments of benthic invertebrates. This study is widely applicable elsewhere and for a range of other taxa, helping decision makers: identify taxa and regions that are at higher risk of disturbance, determine the effectiveness of current protection measures, and guide the placement of future protection measures. Such analyses can help managers achieve more sustainable industries and marine ecosystems.

Great whale presence in northern Australia based on passive acoustics

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During 2005-2015 seventy nine sea noise logger deployments across northern Australia from 21° S on the Western Australian (WA) coast to north of Darwin have revealed regular and consistent patterns of Antarctic blue (AB), pygmy blue (PB), dwarf minke (DM), humpback (HB), Bryde's (BY) and sperm whales (SW). AB were infrequently recorded as far north as 19° S and against expectations, in summer as well as winter. Eastern Indian Ocean PB show regular migrations from their northern terminus in the Banda Sea, south over October to December down the WA coast, to return north over July-September. Long range detections along the northern WA coast show PB spread well westward into the Indian Ocean, suggesting they utilise upwelling systems along the southern Indonesian coast. DM migrate north-south along the WA coast, with most detected over 19-21° S but reaching as far north as 14° S in lower numbers over May to September, usually occurring as one or a few individuals but on rare occasions in schools of possibly hundreds. AB, PB and DM all predominated near or seaward of the shelf break. HB have a seasonal migration to the Kimberley coast although they were also relatively common at the shelf edge. A location sampled for three years in the Joseph Bonaparte Gulf (JBG, 2010-2013) detected increasing numbers of HB each year over July to October, with usually one singer detected at any time but calling duration increasing each year. Calls of BY were common on the shelf from Exmouth (21° S) north, with highest calling rates in the JBG during the monsoon where on average 3-5 animals were calling at any time, compared with 1-2 in the dry season. Individual BY sang continually for typically, 14-20 hours but on occasions several days non-stop. Sperm whale (SW) clicking from individual animals or large pods appeared in the offshore Exmouth and JBG each monsoon season. Bouts of SW clicking at JBG lasted 2.8 hours and occurred every 2.3 days (medians). SW clicking at JBG often correlated with intense evening fish choruses. A diverse and dynamic great whale fauna occurs in our north.

Influence of oceanographic conditions on coastal zooplankton assemblages at three IMOS National Reference Stations in Western Australia

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Zooplankton can provide important information about ocean-climate processes at various spatial and temporal scales. Despite this importance, the zooplankton of the southeast Indian Ocean waters off Western Australia (WA) are vastly understudied compared to other coastal ocean environments. This study examined the spatial and temporal variation in the abundance, distribution and diversity of the mesozooplankton, with a focus on copepods, in coastal ocean waters off WA, a region that extends across thirteen latitudes and is strongly influenced by the anomalously poleward flowing Leeuwin Current. The study used data from observational monitoring conducted by Australia's Integrated Marine Observing System (IMOS) at three WA National Reference Sites located at Ningaloo (21°S), Rottnest Island (32°S) and Esperance (34°S). Analyses of mesozooplankton abundance and composition confirmed that there were clear dissimilarities in copepod assemblage structures among the three sites, with differences in the key taxa observed. Exploration of the relationships between copepod assemblages, oceanographic and biogeochemical variables through distance-based linear modelling, revealed that the north to south alongshore gradient in seawater density explained a significant amount of the variation in copepod assemblage structures. The results of the study suggested that both broad scale latitudinal gradients, and seasonality in, oceanographic conditions are influential in shaping the copepod assemblage structures in Western Australian coastal waters. This study is the first to use IMOS data to relate differences in oceanographic conditions to dissimilarities in mesozooplankton assemblages in Western Australian coastal waters, and provides support for the value of maintaining continuous long-term monitoring of marine systems.

Interdisciplinary knowledge exchange across scales in a globally changing environment.

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The effects of anthropogenic global environmental change on biotic and abiotic processes have been reported in aquatic systems across the world. An interdisciplinary approach that facilitates the exchange of knowledge and the development of new methods across spatial and biological scales is required to effectively understand, quantify and predict climate impacts on marine systems. Through the presentation of innovative research findings across multiple spatial and biological scales we integrate scientific knowledge of climate induced changes and their impacts on the functioning of marine systems that sustain our environmental services We assess the limitations and assumptions of current interdisciplinary knowledge, their exchange pathways and the transferability of research findings across spatial and biological scales relating to the advancement of scientific understanding of global environmental change in marine systems. In addition, to showcase the state of marine climate research across spatial and biological scales, our paper outlines the possible forward trajectory and future development of climate change science in marine systems required to sustain environmental services.

Marine climate hotspots as indicators of primary productivity in a changing global environment.

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Ecological shifts in ocean productivity have significant consequences on the structure and functioning of marine ecosystems through altered global biogeochemical cycles and marine food webs. However, temperature thresholds and potential shifts in marine primary productivity from a changing global environment remain poorly understood and difficult for scientists to quantify. Marine climate hotspots, regions where the temperature increases are ≥90th percentile globally, have been recently identified for the potential to pre-emptively investigate impacts of climate induced temperature increases. We assess ocean productivity in the changing global environment through the utilization of chlorophyll *a* (chl. *a*) and sea surface temperature (SST) from MODIS satellite data in these marine climate hotspots. The inter-annual and seasonal trends chl. *a* and SST since 2002 are discussed across the 26 polar, temperate and tropical marine climate hotspots. Importantly, changes in the duration, intensity, seasonal timing, rate of onset and rate of decline of high chl. *a* events (>90% percentile) are quantified. Understanding these changes at the base of the marine food web are essential to predict and manage the effects of global change on marine ecosystems and their resources.

Seven pearls of wisdom for working in partnership with Traditional Owners towards shellfish restoration in Australia

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Indigenous Australians have been sustainably managing and enjoying shellfish resources for thousands of years. However, since the late eighteenth century over 99% of Australia's shellfish reefs have been lost through overfishing, destructive fishing practices, sedimentation, pollution and disease. Shellfish restoration with the goals of boosting fishery production, protecting shorelines from erosion, improving water quality and increasing coastal employment is already a major industry overseas. Interest in shellfish restoration is growing in Australia with restoration trials underway in most states. Working in partnership with Traditional Owners is important for the sustainable management of our coastal resources and with shellfish restoration being a new initiative in Australia we have a significant opportunity for fresh relationships impacting local outcomes. A workshop with 21 Traditional Owners from Australia and New Zealand developed seven pearls of wisdom for shellfish reef restoration activities: - (1) recognising and acknowledging Country and Traditional Owner rights, (2) co-designing and co-managing restoration projects, (3) focussing on local outcomes and employment opportunities, (4) the importance of historical and current-day mapping of coastal resources and the role of Traditional Owner knowledge in this, (5) generating a shared vision of restoration and the potential benefits, (6) the importance of early Traditional Owner engagement and long-term partnerships and, (7) the importance of recognising the connections between land and sea and improving coastal water quality. Our presentation will elaborate on how these 7 wisdoms can be put into practice for shellfish restoration projects and more broadly into the sustainable management and restoration of Australia's coasts. Leadership and recommendations were provided by representatives from the Bunya Bunya (southeast Queensland), Joondoburri (southeast Queensland), Kabi Kabi (southeast Queensland), Mamu (north Queensland), Narungga (South Australia, Ngati Whatua (Aotearoa), Ngati Tahinga, Ngati Paoa and Ngati Whanaunga (Aotearoa), Quandamooka (southeast Queensland), Woppaburra (southeast Queensland) and Yawaalaraay (southeast Queensland) peoples.

Patterns in diversity of seagrasses in the tropical Indian Ocean

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The Indo-Pacific is a biodiversity hotspot for seagrasses with meadows threatened by human activities and global change. Resilience of these meadows is dependent in part, on the genetic diversity of populations to resist pressures and the connectivity among populations to enable recovery following loss. We assessed the clonal richness and genetic diversity of three seagrass species with differing dispersal potential (*Thalassia hemprichii, Halodule uninervis, Halophila ovalis*), across a range of spatial scales (m's – 1000's km) from Indonesia to NW Australia using a combination of microsatellite markers and SNP's. There was a large variation in the genotypic diversity among populations, and also among species. For *T. hemprichii* the average clonal richness (R) was 0.67 (range 0.09-1.00), the average for *H. uninervis* 0.32 (range 0.00-0.79) and 0.44 for *H. ovalis* (range 0.05-0.96). Low genotypic diversity was more commonly observed in species with lower dispersal potential. No obvious spatial patterns in genotypic diversity were observed for *T. hemprichii* over the large spatial scale it was sampled (Indonesia – Australia). Allelic diversity also varied among populations within species, and the western Kimberley had the lowest diversity. For *T. hemprichii* average allelic diversity was 1.6 in the Kimberley compared to 3.0 in Indonesia and other areas of NW Australia, and *H. ovalis* was on average 3.0 in the Kimberley vs. 4.1 in other areas. A large-scale spatial pattern in allelic richness was evident in *T. hemprichii* with reductions away from the centre of diversity in the Coral Triangle towards the edge of the range, but the western Kimberley was an outlier due to its much lower allelic diversity. This lower diversity in the Kimberley is potentially driven by historical or oceanographic isolation. Based on this genetic information, we propose spatial management units at different spatial scales, across the Indo-Australian archipelago and at more local scales e.g. the western Kimberley. In addition, we propose an index of genetic resilience taking into account the potential to resist and recover from disturbance and adapt to pressures over generational times.

Photo-id studies using spot patterns of whale sharks – are they pointless?

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Photo-identification studies of whale sharks that enlist citizen-scientists to generate data sets have been promoted as an inexpensive means to monitor both migration patterns and population demography of these marine megafauna. We utilized a continuously expanding photo-identification database assess connectivity and residency patterns of five whale shark aggregation sites across the entire Indian Ocean at timescales of up to a decade. We also examined patterns in demography at one of these localities, Ningaloo Reef WA, over the same period. We found no evidence of connectivity of aggregations at ocean-basin scales, and evidence for only limited connectivity at regional (100s-1000s km) scales. A male whale shark sampled in January 2010 at Mozambique was resighted eight months later in the Seychelles and was the only one of 1,724 individuals to be photographed at more than one site. On average, 35% of individuals were re-sighted at the same site in more than one year. The Monte Carlo simulation study showed that the power of this photo-identification approach was strongly dependent on both the number of individuals identified in aggregations each year and the size of resident populations. Our demographic study found that aggregation size at Ningaloo displayed large fluctuations from 2007-2014, with estimates of the numbers of sharks ranging by almost an order of magnitude. Short-term photo-id studies could generate a modelled increase or decrease in population size depending on the timing of the study. Our results suggest that it will be difficult to extract accurate and robust information about population trajectories from aggregation sites where only a small part of the population (typically mostly juvenile males) are present. Better results may be obtained by combining the photo-identification libraries from a number of regional localities to increase both spatial coverage and broaden the range of life history stages included in long-term data bases.

Marine debris: sources, distribution and management implications for an urbanised estuary

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Marine debris is a ubiquitous contaminant in the marine environment, and yet there exists a paucity of data on the distribution of debris in the world's urbanized estuaries. In Sydney Harbour 47 % of surveyed residents rank marine debris as the most important threat to the marine estate. Using novel photogrammetry techniques unique to this field, this project investigated the spatial distribution and abundance of different debris types. We photographed debris continuously along multiple georeferenced transects at 38 beaches in Sydney Harbour. Our research will describe the distribution of marine debris through space and time in Sydney Harbour's beaches and will assist with the development of debris reduction strategies.

The ocean circulation and dynamics of the Great Australian Bight: model results and validation

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The Regional Ocean Modelling System (ROMS) is adapted to provide hind-cast solutions (2011-2014) for the ocean circulation of the Great Australian Bight (GAB). Thirty (sigma) levels are adopted in the vertical and the horizontal grid is ~ 4 km. Along open boundaries, the model is forced with a global tidal model TPXO-8.1 and the BRAN2015 global assimilating model output. ECMWF meteorological forcing is applied at the surface. The inherently unpredictable deep water eddies are not well represented by the model suggesting data assimilation is needed. However, the modelled circulation and thermohaline properties of the shelf and shelf break waters are in good to excellent agreement with data. For the shelf, comparisons are made of model results with IMOS and other data that demonstrate very good skill with squared correlations of a) 0.8-0.9 for monthly averaged currents, b) 0.7 - 0.8 for weather-band currents, and c) > 0.5 for the tidal band. During winter, the generally eastward winds drive eastward currents of order 20-30 cm over the shelf and shelf break (the Leeuwin and S.A. Currents). Downwelling is also found along the shelf break. During summer, and typically during four to five 10 day events, winds reverse to the west. At these times, currents can exhibit an anticlockwise circulation over the GAB shelf with westward coastal currents, an eastward shelf break S.A. Current, downwelling within the mid-GAB and coastal upwelling in the east. In order to determine the dynamics and robustness of these results, analyses are presented that isolate the components of the circulation that arise from wind forcing, Sverdrup transports, thermohaline fields and inflows at the western boundary (e.g., Leeuwin Current).

Identifying biological and ecological Essential Ocean Variables (EOVs) for global sustained observations

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We present the process developed by the Biology and Ecosystems Panel of the Global Ocean Observing System (GOOS) to identify biological and ecological EOVs for implementation in a sustained, global observing system. Given the complexity of marine ecosystems and the challenge of selecting key variables that may properly address its changes, the process was based on a Driver-Pressure-State-Impact-Response (DPSIR) model. This process consisted on (1) identifying the scientific and societal needs that require sustained biological and ecological oceanographic observations, and (2) evaluating the existing time series of observations, and (3) studying the impact vs feasibility of the variables being currently measured and how their monitoring would address societal needs. Societal drivers and pressures were extracted from the mission of 24 relevant international bodies and conventions. Drivers were clustered around four major groups: (1) sustainable use of biodiversity, biodiversity conservation, and knowledge, (2) environmental quality and threat prevention and mitigation, (3) capacity building, sustainable economic growth, and ecosystem based management, and (4) food security. Major pressures identified were habitat loss, climate change, pollution and eutrophication, coastal development, invasive species, solid wastes, ocean acidification, extreme weather events, noise, and mining. The feasibility, given by the current state of large-scale ocean biological observations was evaluated through an on-line survey which informed on the temporal and spatial scale of observations of different biological variables being carried out for all marine taxonomic groups and marine ecosystems by 100+ observing programs. The impact of the variables was inferred through a literature search using the SCOPUS database determining how many publications address each of the pressures for each of the variables in the marine environment. Based on this analysis, candidate proposed biological EOVs are: Phytoplankton biomass and diversity, Zooplankton biomass and diversity, Fish abundance and distribution, Marine turtles, birds, and mammal abundance and distribution, Live coral, Seagrass cover, Macroalgal cover, and Mangrove cover.

Sources of Variation in Cetacean Blubber Hormone Levels:

Implications for Management of Post-mortem Sampling

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Advances in non-invasive and remote sampling techniques have greatly assisted cetacean sampling efforts. However, numerous cetacean species remain impractical to sample and therefore opportunistic post-mortem (PM) sampling can be useful. These samples (e.g. blubber) contain important information (e.g. steroid hormones) useful for monitoring key physiological processes, such as reproduction. However, relatively limited work has been done to examine how factors such as tissue depth, freeze-thaw cycles and storage conditions affect blubber steroid hormone concentrations. Between 2010-2016 blubber samples were collected from free-ranging humpback whales (HWs) (n = 283) to develop hormone analysis techniques; PM samples (n = 41), from 10 cetacean species, were sourced from various Australian archives to conduct blubber experimental trials. All samples were extracted for steroid hormones using a solvent-extraction protocol modified from Trego et al. (2013). Progesterone (P4), testosterone (T), oestradiol (E2) and cortisol levels were measured using competitive enzyme immunoassays. The effect of delayed freezing was examined by sub-sampling 5 fresh HW samples after various storage periods at room temperature. Blubber hormone levels typically increased with the duration of delay in freezing. E2 levels were significantly elevated following a 48-hour delay; increases in P4, T and cortisol concentrations were significant after 72 hours. A series of 3 freeze-thaw cycles appeared to have no effect on the concentration of pooled blubber steroid extracts. However, storage of extracts at -20°C for between 4 and 10 weeks resulted in significant declines in T, E2 and cortisol concentrations. PM blubber samples were dissected vertically into two layers (outer: < 10mm from the skin; inner: <10mm from the muscle) to examine how sampling depth affects steroid concentrations. P4, E2 and cortisol levels did not vary consistently with tissue depth; conversely, T levels were typically highest in the inner blubber layer. Our results suggest that storage of blubber steroid extracts at -20°C is inadvisable. We have also shown that it is preferable to collect and examine blubber of consistent depths when comparing T levels over time and between animals. These results highlight the need to establish consistent blubber sampling protocols, particularly in places like Australia, which lack national stranding networks.

From grey to green: efficacy of eco-engineering solutions for nature-based coastal defence

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Humans and associated infrastructure in the coastal zone are threatened by hazards, such as erosion and flooding. The severity of coastal hazards is predicted to increase with future climate change, causing sea level rise and more frequent and extreme storm events. Armouring with 'hard' engineered structures is the current solution for coastal defence. However, costs of maintaining these structures under future climate change scenarios are significant. In parallel, this has prompted research investigating the value of natural ecosystems to provide protection against erosion and waves, with the benefit that these systems can adapt to changes in climate. Recently, the restoration or creation of habitats through 'soft ecological engineering' techniques has been advocated as a tool for natural shoreline stabilisation, with additional ecosystem benefits, such as biodiversity provision. Despite the significant limitations of hard coastal defence in a changing climate, these structures are continuing to be built, with little changes in practices or management. One barrier to the wider use of eco-engineering approaches for coastal defence is evidence that restored or created habitats function in an equivalent way to firstly, the natural habitat and secondly, hard engineered structures. Here we present a systematic review and meta-analysis to determine the current evidence base for the effectiveness of coastal defence using soft engineering versus hard solutions. In comparison to the coastal defence service provided by natural habitats, there were few studies that quantified nature-based coastal defence. Further, we found no studies that experimentally compared the defence value of created or restored habitats with a hard engineered feature. Thus, this represents a large gap for the case of soft eco-engineering techniques to replace artificial defences. Nevertheless, where studies were available, there was evidence that created oyster reefs, saltmarshes and mangroves could provide comparable shoreline stabilisation and wave attenuation as submerged breakwaters. We discuss future research directions to support the use of nature-based coastal defence in place of hardened shorelines.

Assessing catch composition and fishing grounds of Indonesian dropliners and longliners targeting deepwater snappers and groupers in the Timor and Arafura Seas

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The deepwater fishery for snappers and groupers in the Indonesian parts of the Timor and Arafura Seas is species-diverse and data-poor: There are no time series on catch and effort, and official statistics group various species into one or a few categories. We developed an integrated data collection, storage, and reporting system, which involves captains of 80 dropline and longline vessels. We equipped each participating boat with a vessel tracking device, and we asked captains to take pictures of each fish caught. Through the pictures' time stamps we derived information on fishing grouds and catch composition with a much higher spatial resolution than would have been possible with port sampling. The pictures also provided a means to verify species identification, which has been a major challenge in assessment of this fishery. This data collection system does away with the necessity to sub-sample catches during offloading, and it resulted in a high number of observations (over 400,000 fish measured so far). The high number of observations improved sensitivity to detect very large individuals of a species, and for various species we found fish with a maximum length larger than published values. We contend that the advantages of this voluntary data collection system (e.g. high number of verifiable observations), far outweigh the disadvantages (e.g., lack of control on data collection practices). Results of vessel tracking showed that Indonesian fishers operate on the slope of the Sahul Shelf just North of the water column boundary between Australia and Indonesia in the Timor Sea. Since seabed habitats North and South of the water column boundary are similar, it is likely that Indonesian fishers use snapper and grouper stocks that are shared with Australia.

Assessing catch of juvenile tuna around Fish Aggregating Devices deployed in Indonesia's Exclusive Economic Zone

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Though deployment of anchored Fish Aggregating Devices (FAD) in Indonesia's EEZ is subject to a licensing system, the number of active FADs has increased unchecked over the past two decades. Most fishers operating on these FADs target juvenile yellowfin tuna *Thunnus albacares* and bigeye tuna *Thunnus obesus*, along with juvenile and adult skipjack tuna *Katsowunis pelamis.* These three species from the basis of one of Indonesia's most important fisheries. Whereas purse seiners are often blamed for excessive take of juvenile tuna, we found that juvenile tuna, often traded as "baby tuna", also dominates catches of small- and mid-scale boats operating on FADs using hook-and-line gears (handlining, trolling, and pole-and-lining). Coastal small-scale fishers perceived a decrease in tuna catch rates along with increased use of FADs, which to them suggested that FADs keep tuna from reaching nearshore fishing grounds. The Indonesia Ministry of Marine Affairs and Fisheries addressed these concerns with a regulation on minimum distance between FADs and a probition to deploy FADs in a fence-like pattern. More recently, the Ministy has been contemplating a complete ban on the use of FADs. We propose to conduct research that disentangles the effects of over-exploitation, targeted fishing on baby tuna, and the effects of FADs on migration along with piloting measures to control deployment and use of FADs. Since research as well as development of regulatory mechanisms will take time, we propose to implement these workstreams parallel to each other.

Metal and metalloid concentrations in Darwin Harbour sediment: influence of urban development

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Darwin Harbour is a large macro-tidal drowned river valley on the coast of the Northern Territory. To assist with the development of sediment quality guidelines we sampled surface sediments (0-5 cm depth) from ≈300 sites on intertidal mudflats and in mangrove lined creeks. The samples were analysed for grainsize distribution and selected metals, metalloids and nutrients. Major element compositions show that clays and iron-oxy-hydroxides are the predominant metal-bearing minerals. Sulfides and organic phases constitute additional metal bearing phases at some sites. A strong positive correlation between the abundance of fine grains (<63 µm) and Aluminium (Al) concentration was used to calculate Al-normalised metal and metalloid concentrations and map their distribution across Darwin Harbour. The use of Al-normalised concentrations allowed us to account for the confounding effect of grainsize variation on metal levels in order to reveal the influence of urban sources of metals along the developed eastern side of the harbour. Elevated metal levels in this area contrasts with lower, near-pristine metal levels in most other parts of the harbour. Data analysis revealed that the average estimated contributions of Copper, Zinc and Lead to sediment from the urban catchments were 20-29 % above those in the remaining areas of the harbour. Temporal trends in a finely sliced 23 cm long sediment core recovered from an urban sub-catchment and dated by the ^{210}Pb method revealed a sharp increase in metal concentrations and lead isotope ratios (^{208}Pb/^{206}Pb and ^{207}Pb/^{206}Pb) approximately 77 +/- 9 years ago corresponding to the accelerated development of Darwin during WW2. Comparison with sediment quality guidelines for seven metals and metalloids with defined guideline levels, show that metal levels in Darwin Harbour sediment currently are well below levels at which toxicity effects are likely. However, at four sites naturally occurring Arsenic concentrations exceeded the guideline level.

Applications of unmanned aerial vehicles in intertidal reef monitoring

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Monitoring of intertidal reef platforms has traditionally been undertaken by on-ground survey methods which have assisted in understanding these complex habitats. Knowledge gained is often detailed; however, often only captures a small spatial footprint of the platform. Increased coverage can be achieved through conventional remote sensing techniques, such as satellites or manned aircraft, but is limited by the spatial resolution required to capture the heterogeneity of intertidal reefs, and inherently high costs that impede repeatability. Recent developments in low-cost unmanned aerial vehicles (UAVs) provide new opportunities for monitoring these coastal ecosystems through the ability to capture centimetre resolution imagery and topographic structure data not readily possible with conventional approaches. However, there has been a lack of quantitative studies comparing on ground measurements to those that can be achieved with UAVs. This study compares UAV remote sensing of intertidal reef platforms to traditional on-ground monitoring surveys, and investigates the role of UAV derived geomorphological variables in explaining observed intertidal algal and invertebrate assemblages. A multi-rotor UAV was used to capture < 1 cm resolution data from intertidal reef platforms, with precisely positioned on-ground quadrat surveys of intertidal biotic data for comparison. UAV surveys provided reliable estimates of dominant canopy-forming fucoid alga such as *Hormosira banksii*, however understorey species were obscured and often underestimated. UAV derived geomorphic variables showed elevation and distance to seaward platform edge explained 19.7% and 15.9% of the variation in algal and invertebrate assemblage structure. The findings of this study demonstrate benefits of low-cost UAVs for intertidal monitoring though rapid data collection, full coverage census, identification of dominant canopy habitat and generation of UAV geomorphic derivatives for explaining biological variation

Integrated seabed mapping and geoscience in support of marine park management

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Information describing the form and composition of the seabed is required to characterise habitats and assess the spatial patterns of biodiversity of benthic marine ecosystems. Seabed mapping that integrates a range of biophysical datasets provides a robust approach to delivering this information in ways that can be effectively used to support the management of marine parks at the network and local (Marine Protected Area) scales. Key observational datasets include high-resolution bathymetry, acoustic backscatter, seabed sediment samples (mud, sand, gravel), sub-seabed acoustic profiles and imagery of seabed sediment, morphology and biological communities (video, still photos). Bathymetry data and derived products (seabed slope, aspect, relief, rugosity), backscatter data and sub-seabed data provide the basis for classifying seabed geomorphic features and the production of full coverage feature maps of target areas. Seabed samples and imagery provide the essential data to ground-truth these interpretations and develop habitat maps that fully integrate these environmental parameters. This talk will use case studies of integrated seabed mapping at a range of spatial scales to demonstrate the value of this information for marine park management, including: mapping of submarine canyons at the national scale to inform habitat assessments within and between marine park networks; seabed mapping at the local scale and in high spatial resolution to build the baseline data for a single marine park, and; predictive modelling of seabed sediment and substrate types to extend beyond point observations to adjacent unsampled areas. Central to the application of these integrated data and models for marine park management is the design of prioritised monitoring programs, particularly stratified sampling approaches to more effectively and efficiently target key benthic habitats, such as reefs and banks. An example of this will be presented for the Oceanic Shoals CMR in northern Australia, incorporating a standardised reef geomorphology classification scheme. The presentation will also include examples of data visualisation products (seabed flythroughs; online maps and images) as valuable tools for managers that help raise awareness and understanding of the natural assets and values within Australia's marine park network.

Nearshore marine Aquatic Ecosystem Condition Reports, AECR's or just another headache?

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Since 2010, the South Australian Environment Protection Authority has monitored the nearshore marine environment of South Australia with a view to assess and report on ambient ecosystem condition. Named as, Aquatic Ecosystem Condition Reports (AECR), the program has assessed most of the coastal waters of South Australia. Results are provided in a report card format for the general public and non-technical users, a detailed technical report, as well as making the raw data accessible to anyone. The approach is intended to provide information on nearshore ecosystem condition to all interested stakeholders in a useful format. The range of reporting formats is in recognition that anyone can contribute to environmental decision making if they have relevant information. The presentation will discuss the challenges and successes of the SA EPA, Aquatic Ecosystem Condition Reports (AECR) in guiding environmental decision makers.

The tropical rock oyster Indigenous economic development project: challenges, success and opportunities

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The Northern Territory Government's Department of Primary Industry and Resources (DPIR) current research and development program for tropical rock oysters originated from a request from senior Aboriginal Traditional Owners to reintroduce the commercial sales experience in the past by developing an aquaculture industry. This would require the development of hatchery, grow-out and shellfish safety protocols for a species new to aquaculture; black-lip rock oysters (*Saccostrea mytiloides*). Furthermore, a raft of governance and socio-economic factors are critical to consider when undertaking such a development. This potential development is additionally challenged considering the remoteness of Indigenous communities across the top end of Australia. This presentation will discuss the challenges, successes and opportunities when balancing the competing demands for the creation of a new industry for Indigenous economic development, from the perspective of a government agency. Pilot scale oyster farming by the Warruwi community of South Goulburn Island in the Northern Territory, will be used as a case study. We hope to highlight the complexities and challenges of these trials, alongside key learning and the importance of long-term commitment and adoption of a co-operative research model.

Going back to basics: population dynamics and ecotoxicology

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Understanding how pollution affects populations is critical for targeted environmental risk assessments and adequate protection of the environment. However, the vast majority of ecotoxicology studies still have a traditional focus of identifying effects on individual organisms and do not measure the effects at the population-level. Population modelling tools to measure the effects of pollution are available and would add value to current ecotoxicology studies by aligning outcomes more closely to what needs to be protected. I will briefly outline possible reasons why this knowledge gap still exists and explain why these are not fundamental reasons why they should not be more broadly adopted. There are clear ways in which this problem can be addressed without an increase in cost including better considerations at the initial study design phase about what endpoints should be measured. The purpose of highlighting this knowledge gap is to assist in facilitating the integration of population-level endpoints into routine pollution monitoring programs and progress of ecologically relevant ecotoxicology research.

Using metabarcoding and metabolomics to measure marine community structure and function

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Environmental 'omics' is revolutionizing the way we obtain ecological data. As these technologies develop, the cost per sample is decreasing and we are now able to use these approaches to routinely explore and assess the condition of biological communities and their environment. Metabarcoding and metabolomics are quite different approaches that have been used separately to measure the condition of biological communities. Metabarcoding measures the structure and composition of organisms in a community using genetic techniques, while metabolomics provides information on the functional capabilities of a community by measuring a suite of key metabolites. Collectively, we believe that these two approaches have the potential to provide informative and novel insights into the structure and function of communities, in particular, how communities respond to environmental stressors such as pollution. We tested this idea with a field experiment that used different pesticides to manipulate intertidal soft sediment communities. Small plots of sediment in mesocosms were dosed with two pesticides known to occur in coastal sediments in southern Australia; diuron or boscalid. Two concentrations of each pesticide were applied so there were four treatments plus control mescosms, as well as ambient plots (i.e. 6 x 5 replicates each = 30 plots). The mesocosms were deployed in Little River estuary, Victoria, Australia, for four weeks and samples were collected at two and four weeks for chemical analysis, metabarcoding and metabolomics. We were interested in broad patterns of community change and so applied metabarcoding, targeting 18s rRNA for eukaryotic community structure. We used a targeted approach for profiling polar metabolites, including sugars, amino acids and organic acids. Here we present the key results from both approaches and discuss how they represent changes in the community's structure and function created by the different pesticide treatments. The concentration of pesticides treatment mesocosms was low one day after application, so we will also discuss the implications of this and future improvements to our sediment dosing approach. Our results provide insight into these new ways to measure communities and how they can be combined to provide meaningful information on the state of marine environments and key stressors.

Multiple approaches to assess artisanal food safety

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Shellfish are abundant in the mangrove-fringed coastlines of northern Australia and are still collected and eaten by Indigenous people. Darwin Harbour is faced with increased industrialisation, land clearing and population growth, and there is concern that development is compromising the quality and safety of wild harvest shellfish for consumption. Shellfish ingest and accumulate metals and bacteria, including those that may be adverse to human health. In an earlier study, microbial communities were assessed in shellfish at different locations in Darwin Harbour, including sites impacted by sewage effluent discharge. Bacterial community composition in shellfish was species specific regardless of location, and different to the surrounding water and sediment. Some bacterial taxa differed between sites in the snails *Telescopium telescopium, Terebralia palustris* and *Nerita balteata*, but not in oysters *Saccostrea cucullata*. The abundance of potential human pathogens was very low and pathogen abundance or diversity was not associated with site classification i.e. sewage impact, industry impact and control. To further assess shellfish safety, specific detection of *E. coli*, norovirus, salmonella, *Bacteroides* and indigenous vibrios (*V. parahaemolyticus* and *V. vulnificus*) was performed on shellfish (*T. telescopium*, *N. balteata*, *S. cucullata* and *Scylla serrata*) over two dry seasons and a wet season, as part of an Aquatic Foods Monitoring Program. *E. coli* concentrations were low or below detection in the dry seasons, but significantly higher concentrations were measure in shellfish in the wet season. The sewage-associated pathogens norovirus and salmonella, and faecal marker *Bacteroides*, were rarely detected in biota, even close to sewage discharge sites. Vibrios were significantly more prevalent in samples during the wet season. *V. parahaemolyticus* presence did not vary between sites, however, *V. vulnificus* was more prevalent at control sites. The data did not implicate human effluent in vibrio occurrences. However, the occurrence of virulent vibrio strains suggests any future aquaculture involving shellfish should take into account these data when developing appropriate shellfish quality assurance protocols.

A Preliminary Study of the Movement Patterns of False Killer Whales *Pseudorca crassidens* in Waters of the Northern Territory, Australia.

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The false killer whale *Pseudorca crassidens* is regarded as Data Deficient globally and in Australia. In most parts of its range, there is little information on its social behaviour, dispersal or ecology. This study presents the first assessment of its movement patterns in Australian waters, based on satellite tracking of four individuals, in the Arafura and Timor Seas from March to July 2014. When initially tagged, the four individuals occurred in a single group, and showed generally similar movement patterns and regularly re-associated. Total distance travelled by tagged individuals ranged from 5,161 km (over a 54 day period) to 7,577 km (104 days). Distance from land varied from 100 m to 188 km (median distance 24 km). Individual minimum convex polygons covered an area of 72,368 to 86,252 km2 with a total overlap of 64,038 km2. Water depths varied from 0.3 m to 118 m (median 36 m). 15% of records were in waters shallower than 10 m, and 26% of records were within 10 km of land. In the coastal waters of northern Australia, policies and conservation planning for management of marine biodiversity are limited. Marine conservation planning has focused largely on species with typically small home ranges (Australian snubfin Australian humpback dolphins) and conservation planning for these species may be reasonably straightforward. However, for highly mobile species such as the false killer whale with extensive dispersal is much more difficult. The observed movement patterns in this study indicate that this species 1) is unlikely to be well protected by a single small reserve or a network of discrete and small protected areas, and 2) may be exposed to some threats across the broad range used by individuals from anthropogenic activities within the Australian Economic Zone and coastal waters (e.g. interaction with fisheries, coastal development and oil and gas industries). With respect to interactions with and impacts of potential threats, the current evidence base is very sparse. This study indicates that false killer whales appear to regularly use coastal and pelagic waters in this region and hence should be afforded more conservation attention.

Integrating science and management needs

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Commonwealth Marine Reserves are generally offshore, deep and largely unexplored. They make up over a third of Australia's Exclusive Economic Zone. How much science has been done in this vast estate? Why is research and monitoring in these reserves important? This presentation provides a brief overview of what we know about our reserves based on what is available to us as managers. It also considers some of the key gaps in our knowledge. Using and improving our knowledge and understanding of the natural, cultural, social and economic values of the reserves and the pressures on those values is key to managing our reserves effectively. Reserves can offer an excellent opportunity to explore our oceans and test hypothesis about values in the marine environment and interactions with pressures. Comparatively little is known about the biodiversity contained in the offshore marine environment compared to coastal and terrestrial areas. Most voyages of discovery to new destinations in deeper waters result in new species being discovered and a better understanding of how marine ecosystems function. The discovery, identification and refinement of values and pressures on those values are key research questions for both managers and scientists. Where we do have information about our reserves, it is important to have comparable and systematic collection and analysis of data over time using standardised methods to develop information about spatial and temporal trends. This isn't always easy with finite resources, different approaches to sampling design, and management questions that are high level, however there are ways forward to overcome these obstacles. Finally, working in partnership with other agencies across multiple disciplines is challenging but needed to fully realise the benefits of research and monitoring in marine reserves. This presentation provides some examples of successful partnerships for both scientists and mangers alike.

Shallow water shark detection with sonar

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Non-interactive, shallow water (<20 m) detection of large marine fauna is beneficial for numerous behavioural studies and hazard mitigation. This study examined the ability of sonar systems to detect sharks in such depths. Various systems, operating at a range of frequencies, were deployed in 3-10 m deep waters. The acoustic beams were directed horizontally across the water for lateral ensonification of various sharks. Maximum acoustic target strength of 2-2.7 m length sharks ranged between -12 and -16 dB, comparable to that of dolphins and similar sized marine mammals. On average, shark backscatter increased with target size, was greater when broadside (compared with end-fire orientation) and reduced, as expected, with range. In shallow water, sonar performance is inhibited by reverberation from the seafloor and water surface. Hence, in this study, systems with thinner vertical beamwidths extended ranges at which targets could be discerned in the backscatter, but reduced the vertical volume of water ensonifed at closer ranges. As a result, a sonar system with a 3° vertical beamwidth 'imaged' sharks at ranges >100 m, but at <60 m targets appeared and disappeared in background noise, as they changed range or height, in or out of the acoustic beam. Additionally, sonar tilt angle significantly affected height of ensonified water, thus increased tilt angles reduced the ranges at which targets could be observed. When sharks were present in the acoustic beam, however, their behaviour was evident. Speed (<1 ms-1) and approach angle (typically up current) could be observed and coarse position in the water column inferred. A combination of frequencies and beam patterns is therefore recommended to extend the detection range and performance in shallow water. This facilitates the observation of fine-scale (m) movements and behaviours of not only sharks, but a number of marine species, and has significant benefits for ecological research without using extractive sampling methods. However, environmental impacts of operating frequency (and bandwidth) must be considered when implementing sonar systems. Reducing the operating frequency increases detection range, but also increases the amount of sound energy that may be 'heard' by many species of marine fauna (particularly <100 kHz).

Marine soundscape ecology: Throwing a snapper in the works

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For many marine fauna, acoustic cues are part of their primary sensory modality and it is clear that many species respond directly to various types of sound whether biological, anthropogenic or geophysical in origin. Ecoacoustics, the study of how an ecosystem's acoustic diversity and complexity relate to its physical characteristics, is becoming more prominent in the marine environment as technologies associated with data acquisition rapidly advance. As more varieties of environments and their associated 'soundscapes' are recorded, more information can be teased out on the relationship between the two. This is of particular interest when attempting to monitor long-term trends in remote or inaccessible areas, as passive acoustic recording systems can be a cost-efficient and easy-to-deploy method of gathering information. Yet there are a plethora of natural or induced patterns exhibited by vocal marine fauna that need to be understood and accounted for before inferences should be drawn on how the soundscape relates to the physical condition. There are a vast number of soniferous fish species that soliloquise, chit-chat and gather in numbers to produce calming lullabies or machine gun choruses, but they don't all sing the same tune. The spectral content, source level, duration and structure of a call all affect its acoustic complexity. At the same time, spatial and temporal (diel, lunar, seasonal, annual) patterns of choruses can increase variance in acoustic complexity over time and are often species-, environment- and site-specific. Temporal and frequency partitioning is shown to be prevalent, random or non-existent, with one chorus of fish completely masked by another and while some fish choruses return after dramatic environmental events, others disappear with the saltiness of the sea. This talk will provide example patterns of fish vocalisations in shallow waters from northern Australia to highlight some of the potential challenges in using ecoacoustic assessment that can arise from the different types of vocalisation. The consistency of acoustic indices can be significantly impacted by contributors of the soundscapes they aim to evaluate.

Shifts in plankton community composition in the Great Australian Bight: new insights into food web

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The Great Australian Bight (GAB) is a region of great economic and ecological importance to southern Australia. The area supports fisheries of national and international importance, and large populations of small pelagic fish and iconic apex predators. There is, however, limited information available on the lower food web dynamics supporting these higher trophic levels in the GAB. Studies to date have focused on discrete plankton groups, with limited understanding of community level responses to changes in environmental conditions. Here, we investigated the abundances and biomass of planktonic communities from viruses through to mesozooplankton in shelf and offshore waters of the central and eastern GAB. Shelf planktonic communities exhibited marked differences between the central and eastern GAB. In the central GAB on the shelf, highest bacterial abundances co-occurred with highest phytoplankton biomass, dominated by large phytoplankton (> 5 µm). In contrast, in the east on the shelf, phytoplankton biomass was low and dominated by small (< 5 µm cells), and co-occurred with highest zooplankton (< 150 µm) abundances and biomass. Slope and offshore planktonic communities showed high variability with distance from the shelf and between the central and eastern GAB. Foir example, highest phytoplankton biomass occurred in the east, but zooplankton biomass (< 150 µm) was similar between the central and eastern GAB. Differences in the size structure and planktonic community composition in the central and eastern GAB were linked to different oceanographic conditions (upwelling in the east, the occurrence of eddies, other convective processes on the slope) occurring prior to, and at the time of the study. Implications for the flow of carbon through the different food webs in the central and eastern GAB will be addressed.

Cyclical migration dynamics in juvenile southern bluefin tuna

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Large scale migrations are a key component in the life history strategy of many marine species. Using electronic tagging data spanning more than a decade with statistical models of movement behavior, we quantified the annual migration cycle of juvenile southern bluefin tuna (Thunnus maccoyii) and identify important habitats for this species. We used behavior-switching models to map areas where southern bluefin tuna (SBT) were either migrating westwards, migrating eastwards, or resident. These results highlight cohesive areas of residency in the open ocean utilized by many individuals and document the temporal sequence of movements within a migration cycle from austral summer foraging grounds in the Great Australian Bight (GAB) to winter foraging grounds in the Indian Ocean and Tasman Sea. Although SBT showed increased residency in defined regions of the Indian Ocean, specific individuals did not use the same area each year. SBT typically took longer on their outward migration into the Indian Ocean than on their eastward migration back to the GAB. This suggests that arrival at a particular time in the GAB is more cohesive across individuals and may be driven by seasonal cycles of particular food sources/prey availability, whereas departure dates from the GAB may be subject to the intrinsic physiological state condition of SBT.

World Harbour Project: Conflict and the Future in the World's Harbours

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As a result of residential and industrial development, harbours are often subject to elevated loads of pollutants from various shipping activities, industrial spills and leaks, sewage outfall and agricultural waste (amongst other sources). Managing conflict in harbours, the most intensely altered part of the littoral zone, has been a successful focus of an international collaboration. This paper will share key findings from the 2016 paper Conflicts in some of the World Harbours: what needs to happen next? Conflicts appear clearly in rapid developing harbours when values or uses of harbours are changing (Jakarta Bay, Jiaozhou Bay) and can become latent in other situations (Sydney, Plymouth). Yet we suspect there is remarkable agreement if the timeframes were extended out into the future – say 10 years. Likewise looking back from 20 years hence gets users engaged in avoiding undesirable futures and making decisions now to increase the chance of achieving plausible and desirable future states. Decisions, valuations and risk are framed by views of the future and so it is prudent to examine how these are developed in harbour users. Futures are important and useful discussions in conflictual environments because they help lift people into more creative solution spaces. In the World Harbour Project Working Group 3 the future was seen as a useful place to make a contribution for discovering shared and sharable insights into the ways harbour conflicts could be discussed and resolved.An initial paper shows that the ways conflicts are managed is sometimes framed by a deep embodiment of cultural and biophysical constraints. The future is a discussion that relaxes some of those constraints while imposing a long-term and collaborative perspective. Our research is currently mapping the activity in futures thinking in Ports and Harbours.

Jakarta Bay as an opportunity for collaborative and integrative research and the need for knowledge brokering

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The research relationships that develop between Australian researchers and Indonesian researchers are significant. This paper reflects on the experience of a PhD student (Putri *et al.*, 2015), Indonesian and Australian researchers as they seek to address pressing issues in the coast

of Jakarta, through various funding opportunities, in a way that is appropriate and efficacious. A quest for sharing capacity resources, research experience (including but not exclusively based on research outputs) and other knowledge needs over four years offers some insights and is also a call for help. Jakarta Bay's problems are challenging, typical of coastal megacities and the focus of many knowledge investments (research, aid, health, diplomacy, monitoring, regulatory frameworks, spatial planning). So there is a need for interdisciplinary, multi-stakeholder engagements that rarely are solutions as much as messolutions – ongoing programs of long-term adaptation through negotiation between agents. The first part of the paper discusses the experience of an Indonesian Government-funded PhD student working in an interdisciplinary way to discover how water pollution affects the livelihood of traditional fishers as vulnerable stakeholders that rely heavily on the degraded fishery resources. An integrative approach, that combined water quality assessment and participative exercises (group mapping, discussions, and interviews with the fishers, NGO, researchers, and government representatives), was effective in providing deeper insights on the Bay's water conditions and environmental degradations, how these affected the traditional fishers and how they adapt to the environmental stressors. This illuminates the complex socio-environmental problems in Jakarta Bay where comprehensive solutions are required and therefore more inclusive collaboration between multi-stakeholders is crucial if the Bay's environments and the fishers' livelihood are to be sustained. The second part highlights the collaborations between Indonesian and Australian researchers as they progress beyond this research and hopefully contribute to the development of solutions for Jakarta Bay's problems.

Determining light - use efficiency of seagrass and coral reef communities for remote sensing applications

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Remote sensing of shallow, marine communities has helped with assessing reef environments at spatial scales previously not possible. There is potential to develop optical models for use with satellite or airborne imagery to map and monitor reef system function and processes, such as primary production and calcification. Previous studies have assumed a single standard metabolic rate for a benthic group to linearly scale up these processes according to spatial coverage of each group. These existing methods of linearly scaling are unable to incorporate variability due to the environment, and assume rates are constant within a benthic group. This study seeks to use a light – use efficiency (LUE) model for estimating variable rates of primary production and calcification based on light absorption. The LUE model has been successfully applied in terrestrial environments for the past 40 years, and could potentially be used in shallow, marine environments. This project measured absorptance of seagrass and coral reef communities at two sites, Heron Island, southern Great Barrier Reef and Saipan Lagoon, Commonwealth of the Northern Mariana Islands. Spectral data was collected along with Lagrangian measurements of primary production and calcification to determine LUE. Results from both reefs showed that seagrass and coral reef communities were autotrophic with high productivity, and net calcification and production were positively correlated. Absorptance spectra differed for each site that was highly dependent on benthic composition. Light – use efficiency for both seagrass and coral reef communities will be presented in context of potential remote sensing applications for monitoring primary production and calcification.

'Barrens of gold': sea urchin farming as a driver of ecological restoration

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Overgrazing by overabundant sea urchins is causing kelp-dominated reefs to shift to urchin barrens throughout southern Australia. These areas are characterised by low kelp abundance, low biodiversity and high urchin densities. Urchin gonads are a delicacy in many countries and commercial urchin harvest has the potential to allow kelp recovery. However, urchins in barrens are considered inedible due to low food availability. We assessed whether urchins from three barren sites could reach commercial quality through gonad conditioning: providing optimal feed and environmental conditions. We collected urchins from three barren and three kelp sites in Port Phillip Bay. Our initial collections indicated that urchins from some barren sites have gonads of higher quality than urchins from kelp sites. This quality was further improved after gonad conditioning with some urchins experiencing a 200% increase in gonad index compared to the baseline sample. Moreover, these urchins had gonads up to 150% larger than urchins from three kelp sites where commercial harvesting occurs. This indicates that gonad conditioning is an effective means of improving the commercial quality of urchins from barrens, making these overabundant invertebrates an untapped resource that could be harnessed for economic and ecological benefit. This project is the initial step in establishing an urchin farming industry in Victoria. Additionally, this study may revolutionise how we manage barrens and existing global urchin fisheries.

Microsatellite DNA analysis of genetic diversity in *Enhalus acoroides* in Indonesia

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Enhalus acoroides is large seagrass widely distributed in Indonesia. Using eight microsatellite DNA loci, the diversity of *E. acoroides* in Indonesia was studied. The study was divided into western and eastern parts of Indonesia. The heterozygosity was highest in eastern Indonesia compared to western Indonesia. In western Indonesia, it was found that the observed and expected heterozygosity ranged from 0.434 to 0.615 and from 0.458 to 0.605, respectively. The analysis revealed high genetic differentiation between sites. In eastern Indonesia, the observed and expected heterozygosity were from 0.671 to 0.801 and from 0.636 to 0.735 respectively, with significant differentiation between sites. High genetic differentiation may indicates low gene flow between populations. In western Indonesia, the *E. acoroides* can be grouped into three groups, while in eastern Indonesia, *E. acoroides* were grouped into 2 groups.

Fine-scale variability of raised geomorphic features on the Sahul Shelf, North-western Australia

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The carbonate banks and terraces of the Sahul Shelf and the pinnacles of the Bonaparte Basin are two Key Ecological Features (KEFs) in the North-west Marine Region that form habitat for tropical sponge and coral communities. Data collected during a 2012 NERP Marine Biodiversity Hub survey to the Oceanic Shoals Commonwealth Marine Reserve revealed that significantly more banks and pinnacles exist than had been previously identified. This data also provided new insights into seabed processes that may influence fine-scale patterns of biodiversity in these features. In this study, we used bathymetry and backscatter data to derive a suite of morphometrics (depth, substrate hardness, seabed slope, surface area and exposure) for each bank or pinnacle. This provided a quantitative basis for exploring the variation among individual raised features, as well as the relationship between these features and the predicted distribution of benthic biological communities as derived from underwater imagery. Here, the exposure of banks to currents is determined by using the direction of pockmark scours surrounding the banks as a proxy, and is validated against a local hydrodynamic model.Cluster analysis of the morphometric data revealed three distinctive types of raised features: 1) large, shallow and steep; 2) Smallest, deep and flattest; and 3) Small, deep and steep. Each type offers different habitat potential, which is also likely influenced by their exposure to tidal currents. Pockmark scour directions indicated bidirectional (WNW to ESE) flow, consistent with local hydrodynamic model results. We estimated that on average 5%, but up to 38%, of the surface area of these raised features are directly exposed to currents that flow along the WNW-ESE vector. Our preliminary analysis of predicted taxonomic assemblages on banks revealed the presence of significantly different communities between study grids. We were, however, unable to establish a relationship between the predicted assemblages and the areas of high current exposures. This study highlights the need to consider heterogeneity among geomorphic features when assessing their conservation values.

Integrating marine acoustic technologies to map the seabed of macro-tidal coastal environments

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Bathymetric LIDAR is becoming the preferred technology to rapidly map coastal environments down to about 40 m water depths. However, in areas of highly turbid waters, such as Darwin Harbour and most of the northern coast of Australia, LIDAR does not provide the required penetration. Therefore, marine acoustic technologies, such as multibeam sonar, are relied upon. This type of data collection is more labour intensive, but also provides higher resolution data (sub-meter in < 100 m water depth). LIDAR also does not provide information on the sub-bottom structure.To highlight how the integration of marine acoustics provide critical environmental baseline information and improves the understanding of marine coastal environments, we present a case study - the Darwin Harbour Seabed Mapping Program. This 4 year program is a collaboration between the Northern Territory Government, Geoscience Australia and Australian Institute of Marine Science and has been made feasible through offset funds provided by INPEX-led Ichthys LNG Project to the Northern Territory Government Department of Environment and Natural Resource and co-investment of the collaborators. For this project, we used a dual-head multibeam sonar to map the seabed down to 5 m water depth (low astronomical tide - LAT) and a sub-bottom profiler to characterise the shallow sub-surface (e.g. 30 m). Integration of these methods revealed a wide diversity of seabed morphologies, such as drowned river valleys, reefs and bedforms, and highlights past and present dynamic processes that have shaped the seafloor of this macro-tidal coastal environment.

Northern Territory Marine Science End User Needs Analysis Project

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The past 25 years has seen unprecedented expansion of the Northern Territory (NT) economy and population. There are now 60% more people living in the NT, and the economy is 2.5 times its size in 1990. Most Northern Territorians live on the mainland coast, on islands or in proximity to catchment areas. Most industry in the NT is dependent on the marine environment, or has an operational intersection with it. Aboriginal peoples comprise 30% of the NT population, and a considerably higher portion of the population outside of the greater Darwin-Palmerston area. This Aboriginal community has significant land holdings across coastal and island areas, controls access to over 85% of the intertidal areas and has extensive cultural, social and commercial interests in the NT marine environment. From a marine science perspective, little is understood about the wider NT marine environment. Yet, every day, government, community and industry organisations make policy, regulatory, strategic and operational decisions relating to this relatively intact tropical marine ecosystem. Decision making that is less that optimally informed by science means that there is considerable risk that environmental values of the NT marine environment are being placed at risk, or that equally, unnecessary restrictions and regulations are being placed on industry and community activity, resulting in lost opportunity or unnecessary productivity penalties. The Northern Territory Marine Science End User Needs Analysis study has been underway for 12 months. This study has consulted with aboriginal groups and decision-makers in government, community and industry organisations that interact with the NT marine environment in order to identify and prioritise the marine science knowledge that decision-makers require to better inform and de-risk the decisions they make pertaining to the NT marine environment. The Northern Territory Marine Science End User Needs Analysis is supported by Charles Darwin University (CDU) and the Australian Institute of Marine Science (AIMS), overseen by an independent expertise based steering group and undertaken collaboratively by Australian Venture Consultants and North Australia Indigenous Land and Sea Management Alliance (NAILSMA). This presentation will provide insight into the study and an overview of its key observations and outcomes.

3D Mapping and Fishes at Breakwalls: Ecoengineering Opportunity?

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Anthropogenic structures are increasingly common in natural environments and present novel habitats. Marine breakwaters function similarly to natural reefs in that they provide habitat for diverse assemblages of mobile animals. However, it is unclear if fish assemblages at these artificial structures are similar to those at natural habitat, or if they differ in important ways. Harbour breakwalls certainly have unique 3D signatures. But only recently have we been able to fully capture these structures and relate them to local fish assemblages. Here we show that A: user-friendly methods of capturing full 3D models of marine habitat are available, B: fish assemblages respond strongly to the complexity of breakwalls, and C: With 3D data, these findings can be used to inform future ecoengineering practices.

fishIDER – An on-line, bilingual resource for improving fish identification capacity of field personnel in tropical fisheries.

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Accurate fish identification is an essential and fundamental requirement of all fisheries monitoring programs. Fisheries assessments routinely rely on fish catch data, as recorded by port-based enumerators and/or on-board observers. The quality of assessments can be significantly impacted by data that is flawed as a result of incorrectly identified fish species. The tuna Regional Fisheries Management Organisations, Indian Ocean Tuna Commission and Western and Central Pacific Fisheries Commission, view the improving of fish identification skills of enumerators and observers as a high priority objective, for Indonesia, but also for other countries in their respective jurisdictions. Training workshops in Indonesia during recent years have revealed an overall, inadequate level of identification skills of government employed enumerators and local fisheries staff, for many of the important pelagic species. Confident identifications are particularly challenging for enumerators for fish in 'less-than-fresh' condition in the markets and other landing places, when external diagnostic features may have diminished or been lost altogether. The Australian Centre for International Agricultural Research (ACIAR) and CSIRO provided support funds for an Australia – Indonesia collaboration to deliver a pilot of a bilingual web-based tool to improve fish identification skills and fisheries monitoring capacity that will benefit Indonesia, but also has a wider regional (South-east Asia and Western Pacific) application. Supplementary information, by species, within the tool will broaden its utility to other lines of fisheries research. The website development is in progress with a launch planned for late July – early August 2017.

Climate-driven disparities among ecological interactions threaten kelp forest persistence

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The combination of acidification and ocean warming presents an uncertain future for kelp forests occupying the warmest parts of their range. These kelp forests are not only subject to the direct negative effects of ocean climate change, but also subject to a combination of unknown indirect effects associated with changing ecological landscapes. Mesocosm experiments were used to test the direct effects of ocean warming and acidification on kelp biomass and photosynthetic health, as well as climate-driven disparities in indirect effects involving key consumers (urchins and rock lobsters) and competitors (algal turf). Elevated water temperature directly reduced kelp biomass, while their turf-forming competitors expanded in response to ocean acidification and a decline in kelp canopy. Elevated temperatures also increased growth of urchins and, concurrently, the rate at which they thinned kelp canopy. Rock lobsters, which predate on urchins thus keeping urchin populations in check, indirectly intensified negative pressures on kelp by reducing their consumption of urchins in response to elevated temperature. Overall, these results suggest that kelp forests situated towards the low-latitude margins of their distribution will have to adapt to ocean warming in order to persist in the future. What is less certain is how such adaptation in kelps can occur in the face of intensifying consumptive (via ocean warming) and competitive (via ocean acidification) pressures that affect key ecological interactions associated with their persistence. If such indirect effects counter adaptation to changing climate, they may erode the stability of kelp forests, increasing the probability of regime shifts from complex habitat-forming species to more simple habitats such as those dominated by algal turfs.

The Gippsland marine environmental monitoring project: An integrated approach to understanding the potential impacts of marine seismic surveys on fish and invertebrates

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The Gippsland Marine Environmental Monitoring (GMEM) project was developed in response to concerns from fisheries groups that a 2010 seismic survey in the Bass Strait caused mass mortalities of scallops, as well as a broader need to add field-based analyses to improve decision making. The GMEM project was an integrated multi-component study that monitored scallop populations and fish behaviour in the Gippsland Basin, Bass Strait, across multiple sites in experimental and control zones. Commercial and doughboy scallops were assessed using dredged samples and underwater imagery from an Autonomous Underwater Vehicle (AUV) before the seismic survey and two and ten months after its completion. Sound pressure was monitored before and during the survey, and particle motion was modelled. To provide environmental context to the 2010 scallop mortality event, sea surface temperatures were also modelled from 2006–2016. Fish behaviour was monitored using tagged tiger flathead, gummy shark, and swellshark released within acoustic arrays in the experimental and control zones; and commercial catch data from 15 species in the region were used to quantify any differences that may have been attributed to the 2015 seismic survey. The highest sound exposure level recorded by the hydrophones was 146 dB re 1 μPa2s at 51 m water depth at a distance of 1.4 km from the airguns. Analysis of AUV images revealed no significant differences in commercial scallop types (live, clapper, dead shell, other) between experimental and control zones. Similarly, analysis of dredged scallops shows no detectable change in shell size, meat size, gonad size and condition, or biochemical indices. Both AUV and dredging data showed strong spatial patterns, with significant differences between sites. There was some evidence of increased swimming speed of flathead, but the range of movement did not cause significant displacement. In addition, modelling showed that a large positive temperature anomaly occurred Feb–March 2010 in conjunction with the 2010 seismic survey overlapping the scallop beds subject to mortality. Our study showed no evidence of adverse effects on scallops, fish, or commercial catch rates due to the 2015 seismic survey, but results must be taken in context with other research.

Development of field manuals for marine benthic monitoring in CMRs

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With the establishment of the world's largest network of marine protected areas, Australia is now uniquely placed to develop standardised national approaches to monitor these Commonwealth Marine Reserves (CMRs). Monitoring at the national scale requires standardisation so that results are comparable and collatable across CMRs through time, while still allowing for differences among equipment, vessels, and environmental conditions. Due to the large geographic area, diverse flora and fauna, and range of environmental conditions represented by the CMRs, a single method of sampling is neither practical nor desirable. As part of the NESP Biodiversity Hub, we will form working groups and leverage off existing networks to develop and promote standard protocols for six key marine benthic sampling platforms (identified based on frequency of use in previous monitoring programs): Multibeam sonar (MBES), Autonomous Underwater Vehicles (AUVs), Baited Remote Underwater Video (BRUVs), towed video, grabs and boxcores, and sleds and trawls. Each of these platforms has particular advantages and limitations that will be described. These field manuals will help guide the standardisation of long-term data acquisition and post-processing (from field to data resource) to appropriately monitor Australia's CMRs.

Small macrofauna in marine management: Polychaetes of the Oceanic Shoals CMR region

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Northern Australia has been the focus of recent marine biodiversity research to support resource management for both industry and conservation, including the management of the Oceanic Shoals Commonwealth Marine Reserve (OS-CMR). Much of this research has targeted habitat-forming sessile invertebrates and charismatic megafauna, but smaller macrofauna and infauna may also be important due to their key roles in ecosystem functions. In this study, sediment samples were collected during four surveys of the OS-CMR region from 2009 to 2012 and then elutriated over a 500-µm sieve, from which the associated polychaetes were identified to species-level and functional group (feeding, habitat, mobility). A total of 2558 individual polychaetes were collected from 271 samples and represented 368 species and 43 families. Polychaete species assemblages and functional groups showed spatiotemporal variation among the surveys, but this was not observed at the family level. Species and family assemblages were weakly related to environmental factors (depth, substrate hardness, grain-size), but functional groups showed stronger relationships. Plain and banks supported distinct polychaete assemblages, although the latter showed temporal variation. These results provide baseline biodiversity and ecological data about the polychaetes and other small macrofauna of the OS-CMR which are discussed in relation to marine management strategies. Notably, spatiotemporal and environmental patterns differed from those of larger sessile fauna (e.g. sponges) collected on the same surveys, highlighting the need to consider small macrofauna in marine sampling regimes.

In which of Australia's north and northwest region CMRs and KEFs are 13 key biotic taxa likely the most widespread?

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Effective management of Australia's Commonwealth Marine Reserves (CMRs) and Key Ecological Features (KEFs) requires knowledge of which key biota exist in each CMR and KEF. Field data to establish this is particularly lacking in the remote and vast N and NW regions, where research and monitoring will always have to be targeted to a small set of key areas. Here, we map all recorded observations of each of 13 key benthic and pelagic taxa (hard coral, soft coral, sponges, brittle stars, polychaetes, molluscs, marine mammals, sea turtles, demersal fish, pelagic fish, demersal sharks and rays, pelagic sharks and rays, and seabirds) from publically available datasets across the N and NW regions within a series of 10 km sized boxes. We then compare the 21 CMRs and 21 KEFs within these regions based on how widespread all recorded observations of each of the 13 taxa have been within each CMR and KEF. This 'gap analysis' provides a first step towards prioritising future field work to establish baseline data in key areas to enable the development of a monitoring program. For the CMRs, we find the following taxa to be relatively widespread: soft corals, sponges, marine mammals and sea turtles in the Kimberly, brittle stars and molluscs in Ashmore Reef, hard corals and sponges in Ningaloo Reef, demersal and pelagic fish in the Gulf of Carpentaria, sponges in the Gascoyne and marine mammals in the Argo-Rowley Terrace. The corresponding KEFs are: sea turtles in the Carbonate banks of the Sahul shelf, demersal and pelagic fish in the Gulf of Carpentaria, pelagic sharks and rays in the Western demersal slope and associated fish communities, hard corals and sponges at Scott Reef and molluscs at Ashmore Reef and Cartier Island.

Women's contribution to food security and fisheries management: new data from the Solomon Islands

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Food security is arguably one of the greatest challenges facing humanity. With rapid globalisation, and the global population forecast to reach 9.7 billion by 2050, this will only intensify. Developing nations disproportionately bear the brunt of food insecurity, and this is particularly evident in the Pacific. Fresh fish is the primary source of animal protein for many nations in the Pacific, and so the general decline in fisheries globally is of concern. As fisheries strain under increasing pressure from climate change, intensifying resource use and changes to land management; their decline and collapse is becoming increasingly common. Given the global threats to fisheries, and their importance to village diets in the Pacific, it is critical that fisheries resources are well managed to ensure food security for future generations. Working in villages in Marovo Lagoon, Western Province in the Solomon Islands, this research investigates the role of women in fisheries, and the relative contribution of male and female fishers to household diets. Preliminary findings indicate that women are more intimately involved in fisheries than previously thought, and make significant contributions to household diets, and thus to food security at village-level. This knowledge broadens our understanding of fishery resource utilization in the Solomon Islands, and provides vital data for improving food security in the region. It is expected that these findings will be broadly transferable to other Pacific Island countries and territories facing similar threats to their food security.

Filling in the gaps in data-poor CMRs: the role of spatial predictive models

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Effective management of Australia's Commonwealth Marine Reserves (CMRs) requires knowledge of the spatial extent and diversity of key habitats they contain. Field data to establish this is particularly lacking in the CMRs located in the remote and vast N and NW regions. Here we construct spatial predictive habitat models for the data-poor Oceanic Shoals CMR using field observations from surrounding areas with comparable depth and geomorphology. We use this as a case study to demonstrate how such predictive models can 'fill in the gaps' where no field data of biota exist, but also to highlight how such models must also be interpreted with caution given inherent uncertainties. We apply an ecological modelling approach with five stages: (1) targeted synthesis of existing data, (2) extensive secondary modelling of primary data, such as bathymetry, to map both physical and biotic drivers of the spatial distribution of habitats, (3) integration of maps of drivers and in situ biological data to develop spatial predictive habitat models, (4) prediction of habitats in areas with no field data using the predictive models, and (5) estimation of map accuracy (total accuracy, kappa, confusion matrices) given the spatial distribution and quantity of validation data. Digital maps of the distribution of key habitats and associated uncertainty estimates provide a valuable starting point for identifying where key habitats may exist, and for targeting field surveys to investigate further.

Research delivered by new research vessel Investigator during the first two years of operation

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The Marine National Facility blue-water research vessel *Investigator* was officially commissioned on 12 December 2014 and represented a step-change for marine and atmospheric research for Australia. Since that time, this advanced and highly flexible research platform has been successfully delivering multidisciplinary voyages across Australia's vast marine estate and beyond to enable a diverse range of oceanographic, atmospheric, geoscience and biological research. This research has involved a wide range of national and international institutions and organisations, and has demonstrated the importance of the Marine National Facility, which is owned and operated by CSIRO, as a key piece of landmark scientific infrastructure for Australia. We outline the milestone achievements and key research delivered by *Investigator* during 2015 and 2016, with a focus on the unique capabilities this vessel has provided for marine and atmospheric research. We provide a breakdown of who has been using the vessel, the intended benefit to the nation from their research and where the data obtained from these voyages is being used. Beyond the scientific research, we highlight some of the additional benefits that Investigator has delivered the marine science and broader community, including its function as a global collaboration hub, and as an important platform for delivering education and training. We also discuss how the vessel has provided a powerful tool for engaging the Australian public in the marine sciences.

Distribution and trophic ecology of Ghost crabs (*Ocypode convexa*)

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Sandy beaches make up approximately three-quarters of the world's shorelines and are important as they contain abundant invertebrate macrofaunal communities, which are an important food resource for vertebrate predators such as shorebirds, seabirds, marine mammals and fish. Despite possessing a terrestrial appearance, food input on sandy beaches is derived predominately from the sea. Input of nutrients and detritus from the sea can increase primary and secondary production and alter food web structures and community dynamics in recipient ecosystems, a process termed "spatial subsidy". Ghost crabs (*Ocypode* spp.) form an important component within beach communities in several places around the world and are part of this trophic complexity. However, little is known of their densities, trophic structure and the role they play as vectors for spatial subsidies through movement of marine derived nutrients inland. The aim of this study was to obtain a snapshot of the trophic ecology of the Golden ghost crab and understand what its role is in terms of marine connectivity along the Mid-West coastline of Western Australia. A baseline survey showed that *Ocypode* spp. particularly *O.convexa*, are abundant and reside along beaches with minimal foot- and four-wheel drive traffic and exist in the upper intertidal zone in comparison to zones within the dune environment. In addition, based on stomach content and stable isotope data, and laboratory assays, the Golden ghost crab consumes material from the marine environment more so than the terrestrial. These results support the importance of marine detritus being washed onto beaches, and the important role ghost crabs are likely to play as consumers within sandy beach ecosystems.

How reliable is structure from motion on coral reefs? Quantifying error rates compared to traditional methods

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The use of structure from motion (SfM) in the marine environment is rapidly increasing due to the many potential benefits of this technique. However, few studies have attempted to compare the results obtained from SfM to those obtained from more traditional methods. We compared the use of SfM to traditional snorkel on a shallow lagoon reef to assess benthic diversity, cover, abundance, and coral health. In addition, since SfM is to be used for monitoring reef structure and health over time, we determined whether measurements extracted from SfM were consistent over time and across different observers. Results indicate that some precautions need to be taken, but overall SfM can reliably be used for a number of ecological applications in coral reefs.

Identifying critical habitat for dolphins in North Western Australia

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The population status and habitat needs for tropical dolphins in north Western Australia are unknown across most of their range. We used broad-scale manned aerial surveys to estimate abundance and distribution of three tropical dolphin species that occur in the Pilbara region of Western Australia. In 2015 the survey design included transects across the region 5km apart and extending offshore to the 20-metre depth contour. We estimated a minimum abundance of 2846 (CI 1549-5230) bottlenose dolphins (*Tursiops aduncus*) over a 18950 km2 survey area uncorrected for availability bias. The best distance sampling model included the factors distance, time of day, observer fatigue, glare angle, dolphin group size and group size/observer fatigue interaction. There were too few sightings of humpback dolphins (*Sousa sahulensis*) in the 2015 survey to estimate abundance using mark-recapture distance sampling (MRDS) modelling and no snubfin dolphins were sighted. In 2016 we adapted the survey design to increase survey effort where humpback dolphins had been sighted previously and increased sampling intensity by reducing the transect spacing to 2.5 km. We also added two new areas (Montebello Islands and Exmouth Gulf) based on reported sightings of humpback and snubfin dolphins at these sites. The 2016 survey recorded adequate sightings to produce a minimum abundance estimate for humpback dolphins of 273 (CI 184-405) over the 9050 km^2 surveyed area, uncorrected for availability bias. The best MRDS model for humpback dolphins included the factors distance, time of day, observer fatigue and dolphin group size. While the few sightings of snubfin dolphins have precluded a population estimate of this species, consistent repeated sightings in Exmouth Gulf suggests this may be the only habitat for snubfins in the Pilbara region supporting a local population. Future research will include targeted boat surveys in Exmouth Gulf to better understand the snubfin population potentially present there, assessment of surface availability of these species to improve confidence around population estimates and modelling species distribution where there are adequate sightings for these tropical dolphin species across the Pilbara region. This information will feed into assessments of their conservation status and help inform the siting of future coastal developments.

The Kimberley –Australia's great unsung coral sanctuary

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Protected by its isolation from urban centres and agricultural influences, the Kimberley is one of the world's least impacted marine ecosystems. This region, which encompasses a wide variety of reef habitats, has long been suspected as a significant repository for coral biodiversity. However, until now, very little information has been publicly available to verify this. Over the last 6 years, coral biodiversity surveys have been undertaken at over 200 sites in the subtidal and intertidal zones of inshore, midshelf and offshore Kimberley sites as part of the WA Museum-Woodside (Kimberley) Collection project. Here I combine this new abundance and distribution data with existing historical information to demonstrate that the level of species richness in the region rivals that of the Great Barrier Reef. Significant findings, such as new species, new Australian distribution records, cross-shelf patterns and regional diversity hotspots will be discussed. Results from this project enhance our understanding of coral biodiversity patterns in Australia and the Indo-Pacific, and the importance of the Kimberley region for the conservation of phylogenetic diversity and evolutionary novelty.

Regional Estuaries Initiative – one year in

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The Regional Estuaries Initiative is a $20 million dollar program by the Western Australian state government to improve the health of WA's regional estuaries. The program focuses on six south-west estuaries, in areas where historic land use and current urban and agricultural expansion combine to place estuaries under significant stress. Unfortunately, hypoxia, algal blooms and fish kills occur relatively frequently in many of these systems. By working along the catchment-to-coast continuum, The Regional Estuaries Initiative will tackle the source of poor water quality. The five key strategies will i) build regional capacity, ii) encourage sustainable agriculture, iii) improve the way water is moved through the landscape, iv) invest in innovative remediation, and v) undertake the science needed informed management. The Initiative also aims to increase public knowledge of estuaries through effective science communication across a variety of media platforms including an engaging and modern website. The integrated approach to estuarine-catchment management will adopt a strongly collaborative framework. While Department of Water is leading the Initiative, strong partnerships have been formed with other agencies, catchment councils, local government, industry groups and informed community to guide and deliver the projects. The 4-year program was launched in April 2016, and this talk will highlight major areas of progress in its first year.

Do Australia's marine protected areas (MPAs) operate as a network? Modelling functional connectivity within the Australian marine environment.

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Marine protected areas (MPAs) play a fundamental role in the protection of biodiversity. While individual MPAs are important for the protection of local populations, the long-term persistence of many species will depend on MPAs functioning collectively as a network. Incorporating connectivity into the spatial planning process is critical to support population dynamics, community structure and genetic diversity because most marine species depend on the exchange of larvae to and from habitat connected by ocean currents. Therefore, it is important to ensure MPAs function collectively to facilitate the dispersal of larvae and juveniles between important habitat patches. The current emphasis on increasing marine protection generally fails to consider whether MPAs do function as a network. The Australian MPA network is touted as one of the best examples of ocean conservation in the world, yet it remains unclear the extent to which functional connections exist among the MPAs to justify the term 'network'. This research developed GIS based models to simulate the dispersal capabilities of three fish and one invertebrate species that are heavily targeted by fisheries or are widespread around Australia. We used data on substrate (i.e. rock or reef), hydrodynamic data (e.g. surface currents), and life history parameters, such as pelagic larval duration and daily larval mortality, to model connectivity between habitat patches. Using a graph theoretic framework, we determined the likely importance of each habitat patch for settlement and recruitment, as well as the 'stepping stones' for dispersal to other areas, to determine the role of MPAs in protecting important habitat and dispersal routes. We present the results for two species and indicate which MPAs, or unprotected areas, are most important for the connectivity of the greater system of MPAs. Our results highlight the importance of incorporating population dynamics and connectivity analyses into the design and evaluation of MPAs to ensure species persistence.

Towards biogeochemical modelling of the East Australian Current system

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The East Australian Current (EAC) is the Western Boundary Current (WBC) of the South Pacific subtropical gyre and dominates the large scale flow of the Tasman Sea. It advects warm oligotrophic waters poleward, displacing cooler, generally more productive waters. It generates mesoscale eddies and induces coastal-upwelling. To better understand how this dynamic oceanographic regime influences the biogeochemical properties of the EAC System, we have developed a coupled physical-BGC (ROMS+N_2PZD_2) model of the region. We strive to achieve a realistic simulation of the basis of the region's marine ecosystem and to assess the spatial and temporal variability of different biogeochemical variables, from synoptic events to seasonal and interannual timescales and encompassing shelf, open ocean, surface and sub-surface. A high demand for this information exists, arising from a range of fields and applications such as scientific research on marine ecosystems, monitoring of seawater quality and decision-making support for marine and coastal management, yet little is still known on how the specific dynamics of the EAC system define the region's BGC processes. We have conducted model performance assessments through comparison of chlorophyll-a model outputs with remote sensing products and verified the model's ability to reproduce the expected latitudinal differences in phytoplankton biomass and mesoscale dynamics (such as higher/lower concentrations in CCEs/WCEs and upwelling filament formation). The use of only one trophic compartment for the phytoplankton group was identified as the main limiting factor to correctly depict some of the phytoplankton dynamics of the region. A brief comparison with the results of an ecosystem model of lesser complexity (NPZD) is also made. These advances form the foundation for future work where we will explore specific scenarios including the BGC dynamics of cyclonic eddies, coastal entrainment and future climate change.

Change in isotopic signatures suggest food web shift off the western Antarctic Peninsula

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The local warming occurring within the Western Antarctic Peninsula (WAP) is causing some of the greatest environmental shifts on the planet. Over the past 140 years there have been profound biological and physical perturbations to the wildlife of the WAP. We examined whether trophic level shifts were evident in the top predators within this system and use stable isotope signatures as a proxy. We examined the bulk δ15N tissue values from 167 leopard seals, sampled from four disparate Antarctic locations between 1880 and 2011, along with values of specialist predators within the system, to account for the uncertainty due to baseline isotopic shifts. Contemporary WAP leopard seals have different nitrogen isotopic values (δ15N) to other leopard seal populations, however historically WAP leopard seals had δ15N values within the range of other Western and Eastern Antarctic populations. From our 140yr record of leopard seal tissues, we show that the δ15N values of WAP leopard seal tissues have dropped significantly, and that this change occurs as a step around the 1980s. The magnitude (2.6‰ δ15N) of change is ecologically significant as it reflects a drop of a trophic level within the contemporary WAP food web. Values suggest that leopard seal have shifted from eating vertebrates to krill. Over this same time period there was no shift in δ15N values of the WAP krill-feeding specialist, the crabeater seal, which supports the idea that the change in leopard seal δ15N values is not due to a baseline shift in nitrogen isotope values.

Defining Important Penguin Areas: localizing feeding hotspots and understanding the role of environmental conditions on foraging success

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Marine predators forage in areas where productivity and food availability are enhanced by complex oceanographic processes. Such areas have been associated with large-scale, well-defined oceanic systems. However, the ways in which local processes and environmental variability influence fine-scale foraging behaviour of marine predators is still poorly understood. Seabirds are especially sensitive to local changes in environmental conditions and food availability during their breeding season, limited by central place foraging. Therefore, understanding how local processes may influence foraging habitat selection on seabirds is critical to better inform conservation and management measures. Here, we investigated the foraging behaviour and success of little penguins *Eudyptula minor* from Phillip Island in relation to local environmental conditions. We tracked the foraging trips and diving performance of breeding birds from two neighbouring (2 km apart) sites during incubation, guard and post-guard stages. Previous GPS tracking had shown a strong spatial segregation between these two sites. We identified the location of feeding hotspots and their variability over time and space by quantifying and localizing birds' foraging success. Then, we studied how bathymetry and dynamic oceanographic features (Chlorophyll-a and sea-surface temperature) influenced little penguins' foraging success in these hotspots. The overlap of GPS and diving behaviour data revealed differences in the three-dimensional use of the habitat between sites. Birds from one site had a smaller foraging range, encountered prey at shallower depths and spent more time pursuing that prey in relation to the total diving time than birds from the other site. This study provides insights on the role of environmental variability in modulating fine-scale foraging behaviour of marine predators and, hence, prey-predator interactions. We will use this information to identify important penguin areas and their persistence over space and time in the northern Bass Strait. Using this approach, we aim to better inform conservation and management decisions, especially in areas where marine wildlife tracking is challenging but environmental data might be available.

Extracting the intertidal extent and topography of the Australian coastline from a 28-year time series of Landsat observations.

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The Australian Geoscience Data Cube (ADGC) provides spatially and spectrally calibrated earth observation data to enable time-series analysis on a per-pixel basis across the Australian Continent. We describe the development of the continental scale Intertidal Extents Model (ITEM v1) from 28 years of the Landsat data archive; processed, managed and delivered from the AGDC. The ITEM utilises continental scale tidal modelling to attribute over 200,000 AGDC Landsat observations for the Australian coastline from 1987–2015. Re-framing these time series observations based on their tidal height can enable us to develop median composite water classification outputs across the tidal range, and create a relative extents and topography of the exposed intertidal zone. This method effectively deals with data quality issues that are often a problem in single scene analysis from satellite observations, enabling a continuous model to be derived for the full Australian coastline at 25-m resolution. Case study examples will be discussed in which we extend the method to examine coastal instability, and produce digital elevation models (DEM) to integrate with terrestrial and bathymetric elevation data. Validated using RTK GPS field observations, these derived DEM models enable significant improvements in the realistic modelling of the Land/Ocean interface for gridded elevation products such as the recently completed Northern Australia 100-m grid.

Impact of eutrophication on carbon storage in seagrass meadows

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Coastal eutrophication is one of the principal factors causing the loss of seagrass meadows worldwide. The loss of seagrass canopy after a disturbance may enhance the loss of sedimentary Organic Carbon (C_{org}) and Nitrogen (N) stocks through resuspension and remineralization, contributing to increased greenhouse gas emissions. This study presents comprehensive estimates of changes to C_{org} and N stocks and accumulation rates in seagrass meadows due to anthropogenic activities (e.g. eutrophication) and determines how habitat characteristics (e.g. bottom shear stress, water depth) influence the degree of nutrient fluxes at Cockburn Sound, WA. A total of 17 soil cores were sampled: 7 cores from living and persistent seagrass meadows, and 10 cores from bare sediments previously vegetated with seagrass. Sediment grain size was analysed to characterize sedimentary conditions and $\delta^{13}C$ of sedimentary organic matter was used to determine the sources of C_{org} stocks at vegetated and un-vegetated sites. Accumulation rates of C_{org} and N were determined by means of ^{210}Pb. On average, seagrass soils contained up to 2.5-fold higher C_{org} and N stores (3.32±0.5 and 0.16±0.15 kg m^{-2}, respectively) than bare but previously vegetated sediments (1.45 and 0.11kg m^{-2}) in 50 cm-thick deposits. Industrialization and land-use change in Cockburn Sound from 1960s onwards had led to the loss of 3,500 ha of seagrass ecosystems, linked to a loss of seagrass C_{org} and N sequestration capacity and the loss of sedimentary C_{org} (1.9 kg m^{-2}) and N (0.05 kg m^{-2}) stores accumulated over the last ~200 years. However, the loss of C_{org} and N stocks at Cockburn Sound was not homogenous. The areas with higher hydrodynamic energy experienced higher erosion and loss of stocks. This information is critical for the implementation of C_{org} storage credit offset policies centred on avoiding the conversion of seagrass ecosystems and contributing to their preservation, and to understand the role of seagrasses as filters and sinks of nutrients in a changing environment.

Phylogenetic relationships of *Panulirus homarus, P. versicolor* and *Thenus orientalis* from Persian Gulf and Oman Sea

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The reconstruction of evolution phylogeny of lobster species are necessary for revealing stock identity that can be used for the management of fisheries industries in Iran. Phylogenetic relationships among lobster species, from Oman Sea, Persian Gulf were examined with nucleotide sequence data from cytochrome oxidase subunit I (COI). The previous works on phylogeny showed that the mitochondrial COI gene in crustacean is a good discriminative marker at both inter- and intra-specific levels. For this purpose, DNA extraction using phenol- chloroform method (HILLIS and MORITZ, 1990) was done. The evolutionary relationships among these species of the lobster were examined using 610 bp of mitochondrial (mt) DNA from the cytochrome oxidase subunit I gene. The result completely agrees with the previously defined species using morphological characters. The resulted phylogenetic trees supported the monophyly of these species. The results imply that Iran's species' origin is Indo-west pacific. Iran's species, which were grouped with the other Lobster taxa seem to always form a sister clade with Indo-west pacific species with bootstrap support of around 80%.

Understanding seagrass resilience in a changing estuary

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Seagrass is a vital primary producer in the Leschenault Estuary and its distribution and condition can inform on the health of the estuary. Seagrass oxygenate sediment and water, acts as nutrient sink, provide shelter areas to recreational fishery species, and reduce sediment resuspension. Unfortunately, seagrass is being lost world-wide at an accelerating rate**.** Effective management of seagrass requires an understanding of seagrass condition, and its potential to resist or recover from disturbance. Estuarine seagrass species generally have colonising traits and sexual reproduction is believed to be an important factor in their ability to recover from disturbance. The Leschenault Estuary or Derbal Elaap in Noongar language, is located north of Bunbury, Western Australia. It is long (approximately 13.5 km), narrow (2.5 km) and shallow (up to 2 m) barrier lagoon permanent open to the ocean by an artificial connection known as "The Cut" in the southern end. The Preston and the Collie rivers also flow into the south of the estuary, and hypersalinity can occur on the northern basin due to evaporation. Early reports from the 1980s suggested that the seagrass was absent from large sections of the estuary. We report here on a multi-scale seagrass monitoring program for the Leschenault Estuary, across four years of study. In 2013-14, *Halophila ovalis* was clearly struggling with further declines in distribution, and reproductive effort was extremely poor, leading to the belief that the seagrass within the estuary was close to a tipping point. Multiple stressors occurred between 2009 and 2014 including substantial and persistent macroalgal blooms from eutrophication and a marine heatwave. Some recovery has been observed since with a substantial increase in reproductive effort. We will also report on distributional changes across the years of study. Given, this estuary is subject to the impacts of a growing population, agricultural and industrial activities and recreational uses, as well as climate change, it is important to monitor seagrass and understand their resilience.

Optimising the management of tropical reef fish

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This project addressed a key knowledge gap on the stock structure of three key tropical reef fish species; Golden Snapper (*Lutjanus johnii*), Black Jewfish (*Protonibea diacanthus*), and Grass Emperor (*Lethrinus laticaudis*). These species are popular targets by both the commercial and recreational fishing sectors and are increasingly becoming the focus in developing Indigenous fisheries. They are also prone to overexploitation because of their vulnerable biological characteristics, aggregative nature and susceptibility to barotrauma related injuries upon release. In the Northern Territory, these issues have resulted in the substantial declines of these species around population centres and managers have been unable to apply appropriate arrangements due to a lack of knowledge on the stock structure of these species. A holistic approach using otolith microchemistry, genetics and parasitology was used to identify the stock structure of these species. All three species were found to have fine-scale stock structure. Black Jewfish stocks had genetic connectivity at the scale of 100's of km which was similar to the scale of juvenile and adult movements determined by the parasite and otolith microchemistry analyses. Golden Snapper and Grass Emperor stocks demonstrated genetic connectivity over 100's to 1000's of km which was much higher than the 10's of km scale stock structure indicated by the other analyses. The fine-scale stock structure for all species needs to be taken into consideration in the management of fisheries that harvest them. The overfishing of these species in the Darwin region highlights they are all vulnerable to serial depletion of localised stocks.

Dynamic ocean management: near real-time spatial ecoinformatics for reducing bycatch in marine fisheries

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Throughout the global ocean, migratory fish are directly exploited in targeted fisheries, many of which use non-selective methods such as pelagic longlines and drift gillnets. Incidental bycatch of other non-target species in these fisheries is a major barrier to ecological and economic sustainability, and a global-scale threat to marine megafauna of conservation concern. Spatial bycatch mitigation solutions, where they exist, often involve large static area closures, yet the inherently dynamic nature of pelagic ecosystems requires a more dynamic approach to fisheries management. Key to developing more effective bycatch mitigation measures at management-relevant scales is an understanding of the conditions under which bycatch events are more likely, including how heterogeneity and variability in the physical environment influence the dynamic distributions of both target and non-target species. This talk will present a dynamic ocean management example from the California Current System, known as EcoCast. Integrating multiple data streams, EcoCast uses dynamic habitat suitability modelling for regional populations of target catch (broadbill swordfish *Xiphius gladius*) and bycatch-sensitive species (leatherback turtle *Dermochelys coriacea*, blue shark *Prionace glauca*, California sea lion *Zalophus californianus*) to generate near-real time predictions of catch likelihood and relative bycatch risk over the domain of the fishery. Prediction maps are served directly to fishers via a web platform to facilitate efforts to maximise catch:bycatch ratios and thereby improve ecological and economic sustainability. This talk will present the technical framework used in the development of EcoCast, and explore the constraints and trade-offs implicit in developing species distribution models that are fit to predict the real-time distributions of mobile species in a highly dynamic marine ecoregion. This multi-species, data-driven approach represents an important step forward in dynamic ocean management, and has generated insights that will be relevant to developing dynamic approaches to managing marine fisheries in other ocean regions, including those targeting migratory fish around Australia.

Threats and Risks to sustainability of NSW estuaries

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NSW has recently completed a comprehensive analysis of threat and risk to sustainability of environmental values and social and economic benefits. The Threat and Risk Analysis (TARA) has prioritised the large scale threats to environmental and societal values for the NSW Marine Estate (beaches, estuaries and marine waters to 3 nm). The 3 primary priority cumulative threats emerging from the TARA are threats from fisheries on marine food webs and ecosystems (as opposed to stocks of harvested species), multiple impacts on estuaries (primarily from land-based activities) and impacts of climate change and how to build resilience. Critical to the assessment of risk was the availability of relevant data that could be used to quantify impacts of stressors on assets. It was clear that data to support assessment of risk to environmental assets, while far from perfect, was vastly better than data to support societal values and this impacted the spatial and temporal scale of assessments and confidence in the outcomes. The NSW Estuary monitoring program, which has assessed pressures on estuaries and impacts on estuarine health for the last decade has allowed a detailed assessment of the degree of impact for almost all of NSW's 184 estuaries. It also allowed analysis of the impacts of major pressures (e.g. agriculture vs sewage vs urban stormwater) and associated stressors (nutrients, sediments) in different types of estuaries. The large database allows analysis of large scale trends by estuary type, rather than extrapolation from "case study" estuaries. This process has underlined the value of data to assessment of risk to environmental and societal values and highlighted the value of the NSW estuarine monitoring and the difficulties of making assessments in the absence of data.

Rocking urban design: how features of natural rock pools can inform ecological engineering

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Rock pools are extremely important habitats, as they provide refuge for intertidal animals and algae during low tide. The high diversity of rock pools compared to surrounding emergent rock is linked to the buffer these microhabitats provide against e.g. thermal stress and desiccation. However, globally rocky reefs are increasingly replaced with seawalls and other infrastructure in urbanised estuaries. Despite their importance in the intertidal zone, water-retaining features are rarely incorporated into marine infrastructure such as seawalls or are included without designs being optimised with respect to characteristics of natural rock pools. Therefore, we surveyed natural rock pools every 6-8 weeks for a year at four intertidal rocky shores in Sydney Harbour to investigate what features of rock pools best support native diversity. Two sites were located in the poorly flushed, relatively sheltered inner Harbour. Two sites were located in the well-flushed, more exposed outer Harbour. Rock pool size parameters width, depth, and volume were measured as well as the abundance and diversity of species. Preliminary results show that the diversity of species was significantly greater in pools at the outer sites than in those at the inner sites of the Harbour. We found that increasing width increased the number of mobile species at both locations, however, it only increased sessile diversity in the outer Harbour. Additionally, we found a strong effect on mobile species richness =at the outer sites of the Harbour=. Although all rock pool size parameters and height on shore influenced the abundance of rock pools, they only explained about 23% of the variation for both sessile and mobile species. This suggests that modifying width and depth in rock pool designs can benefit associated communities.

Sub-surface intensification of marine heat waves: the role of stratification and local winds

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Marine heat waves (MHWs) are becoming more common with record events occurring around the world, and unprecedented biological impacts including mass mortality and habitat shifts. However, little is known about the characteristics of MHWs due to the lack of long term in situ observations. Using two historical datasets spanning 1953 (and 1992) to 2016 we use a seasonally-varying climatology and temperature anomalies to identify and characterize MHW events down to 100 m depth in coastal waters of southeastern Australia. We show that MHWs regularly extend the full depth of the water column, with a maximum intensity below the surface. Extreme temperatures at depth are driven by local downwelling favorable winds that mix the water column and reduce the stratification. These results show the importance of considering sub-surface hydrography, and that sea surface temperature is insufficient to fully understand MHWs which are having disastrous ecological consequences in coastal regions globally.

Will Corals from the naturally extreme Kimberley Region be able to cope with Climate Change?

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Naturally extreme temperature environments such as Australia's Kimberley region provide ideal natural laboratories to understand the drivers of coral thermal tolerance. We will present findings from several lines of research addressing the capacity and limits of Kimberley corals to cope with future ocean warming. In a 2-week heat stress experiment, we showed that nearshore Kimberley corals were not resistant to bleaching despite being adapted to a naturally extreme temperature environment. However, corals from the environmentally more extreme intertidal took longer to bleach and die than corals from the more moderate subtidal. Given that all corals harboured *Symbiodinium* clade C independent of treatment or origin, this highlights the importance of the thermal environment in shaping coral thermal tolerance. A 7-month reciprocal transplant experiment was then conducted to study the capacity and time scales required for subtidal corals to improve their heat tolerance. We found that subtidal corals have only a limited capacity to acclimatise to more extreme temperatures, at least over time scales of a few months. After 4 months, a natural bleaching event occurred which resulted in extensive bleaching and mortality, particularly for subtidal corals transplanted to the intertidal. Intertidal corals overall performed better suggesting the presence of local adaptation. These findings were also confirmed by bleaching surveys that we conducted before, during and after the 2016 bleaching event. Although severe bleaching was widespread in both environments, there were fewer severely bleached corals in the intertidal. Furthermore, many intertidal corals had recovered 6 months later, whereas the majority of subtidal corals had died. Aerial surveys of ~30 reefs in the southern Kimberley conducted as part of a larger survey confirmed the regional scale of this bleaching event. To our knowledge, this is the first documented regional-scale bleaching event in the inshore Kimberley region, demonstrating that even the stress-tolerant Kimberley corals are vulnerable to climate change and marine heatwaves. Future work will identify the physiological and genetic mechanisms underlying the superior heat tolerance of intertidal corals, as well as potential fitness trade-offs. This will significantly improve our understanding of how corals from naturally extreme environments may cope with continued climate change.

How can herbivores modify ecosystem service delivery in seagrass beds?

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Seagrasses provide important habitat that delivers ecosystem services such as the provision of food to a wide diversity of herbivores globally. In the Great Barrier Reef (GBR) we find the full size spectrum of herbivores; from small mesograzers such as amphipods, to macrograzers such as fish and large megagrazers such as turtles and dugongs. These herbivores can structurally alter seagrass beds in either positive or negative ways depending on their size, feeding preferences and methods and grazing intensity. These structural changes can subsequently interact with the delivery of other ecosystem services, or the benefits to humans, provided by the seagrass meadow. Multiple ecosystem services have the potential to interact with each other in non-linear relationships. Interactions between herbivory and the provision of other ecosystem services may be additive, synergistic or antagonistic. For example where seagrass growth is stimulated by mesograzers controlling epiphytic algal loads, or light cropping by fish or turtles there may be an additive or synergistic association with carbon sequestration, sediment stabilisation and habitat provision while heavy grazing by dugong may interact with these services in an antagonistic relationship, but have an additive or synergistic relationship with ecotourism. An understanding of these interactions will be important to ecosystem mangers seeking to maximise delivery of ecosystem services and will help them to understand what trade-offs need to be considered when managing for the conservation of megaherbivores. The GBR not only has one of the highest diversities of herbivores, but also highly diverse seagrass species which cover more than 35 000 km^2. This makes the GBR an ideal place to study seagrass herbivore interactions and their impact on ecosystem service provision across a range of seagrass species and community types. This presentation will outline the current knowledge about herbivore impacts on seagrass ecosystem service provision and provide a conceptual framework to illustrate how herbivory may interact with other ecosystem services. It will also identify how research from temperate seagrass beds may apply to a tropical setting and suggest how the current research gap can be addressed.

Evaluating active-acoustic methods for assessing snapper (*Chrysophrys auratus*) spawning aggregations in Western Australia

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Snapper (*Chrysophrys auratus*) is an important commercial and recreational species, in Australia and New Zealand. From late winter to early summer, adult snapper migrate the broader metropolitan waters of Perth Western Australia into the protected embayment's of Cockburn Sound, Warnbro Sound and Owen Anchorage to form spawning aggregations. In Cockburn Sound, they can be acutely exposed to anthropogenic (e.g. industry, fishing) and environmental factors (e.g. deoxygenation, elevated temperatures) that may affect numbers, spawning success and subsequent recruitment. Monitoring the status of these tightly-managed aggregations is particularly important as impacts of these stressors can be significant and rapid. To facilitate this monitoring, evaluation of commonly used methods for estimating spawning biomass (e.g. daily egg production method), against those that take advantage of developing methods (e.g. hydroacoustic), would be beneficial. To this end, active-acoustic data were collected from spawning aggregations of snapper in Cockburn Sound over two days in November 2016 to determine the packing density, vertical and horizontal distribution and length estimates of individuals (using a BioSonics DT-X single-beam echosounder at 38 and 120 kHz and a BlueView M900-2250 multibeam echosounder at 900 kHz). Length estimates were compared with historic fishery-independent length data. Acoustic data were analysed using Echoview software. Computed tomography scans of individual snapper were used to model the frequency-dependent acoustic backscatter and validate the BioSonics information from single targets. We approximated school shape and packing density using novel model approaches which can deliver estimates of school biomass, with accompanying error estimates. This study forms the first step towards an acoustic assessment of snapper in Cockburn Sound, which could be applied to other aggregations in Western Australia and elsewhere across its distribution.

A review of the use of echosounders for fish-stock assessment in marine and freshwater environments

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Some aquatic animals, most notably cetaceans, have evolved sophisticated echo-detection systems over millions of years for locating and identifying underwater targets such as their fish and squid prey. Perhaps inspired by nature, the first man-made echo-detection instruments (echosounders) were developed in the early 1900s, primarily for submarine detection and to measure water depth. Echosounders were used in commercial marine fisheries in the 1930s and 40s to detect fish, and fisheries scientists quickly realised the potential of echosounding for monitoring important fish stocks. The field of scientific fisheries acoustics was born in the late 1960s, and by the end of the 1980s echosounders had become widely trusted as a tool capable of delivering robust quantitative fish-stock estimates. In marine and freshwater environments around the world, echosounding is one of the primary fish-stock assessment tools employed by many state and federal government agencies, research organisations and private companies. We present a number of case studies to illustrate the range of approaches currently employed and the strengths and limitations of quantitative echosounding.

Patch characteristics of *Ecklonia radiata* influence associated community structure

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Predicted change in kelp habitat structure in response to climate change and other stressors is expected to have broad impacts across temperate reef ecosystems. We determined the effects of reduced density and patch-size of Australasia's most important and widespread habitat forming kelp species, *Ecklonia radiata*, on the community structure of associated species. Across an array of 28 artificial reefs of varying sizes supporting transplanted *E. radiata* at a range of densities, we monitored: i) understorey algae and sessile invertebrates, ii) secondary production, and iii) fish and macro-invertebrates. The abundance and diversity of understorey species increased with reef size, and distinctly different assemblages formed beneath different canopy densities. Larger reefs with *Ecklonia* at low and natural densities best supported the establishment of dense oyster mats (*Ostrea angasi*) and increased recruitment of southern rock lobster (*Jasus edwardsii*). Secondary production associated with standardised rope-fibre habitats was highest on small reefs without a kelp canopy and tended to decrease with increasing reef size and kelp density. On a per unit area basis, larger reefs supported more abundant and diverse fish and macro-invertebrate assemblages, although different species were associated with different kelp densities. While reefs of different sizes and with different kelp densities supported dissimilar assemblages of fish and macro-invertebrates, the nature of these differences was strongly dependent on season. This work has shown clearly that when there is modification of the characteristics of the habitat-forming kelp species, there are 'downstream' effects on other key elements of the kelp bed community.

Applying science and collaboration to enhance environmental impact assessment for sound-generating activities

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Of the range of sound-generating activities in the offshore petroleum sector, seismic surveys typically require the most complex environmental impact assessment (EIA) and management arrangements. Drivers of this complexity include that seismic surveys generate high sound levels, and may be spatially and temporally extensive. Accordingly, these activities have potential to interact with diverse environmental receptors and stakeholders, with impacts to these requiring assessment and management. This complexity is further exacerbated by uncertainty in predictions of impact. The environmental authorisation process for seismic surveys in Australia's commonwealth waters is administered by the National Offshore Petroleum Safety and Environment Management Authority (NOPSEMA). The regulatory regime requires proponents to undertake EIA for their proposed activities. This EIA forms the basis for an environmental management 'case' that is presented to NOPSEMA in an environment plan (EP) for an assessment and decision. NOPSEMA's role is to ensure the EIA and management case is well-reasoned and supported by appropriate evidence, including results of relevant science. NOPSEMA experience in assessing EPs for seismic surveys has highlighted some challenges faced by activity proponents in undertaking a defensible impact assessment, which in turn can result in lengthy approval processes and costly project delays. Among these challenges are limitations in available science and, capacity to keep abreast of new scientific developments and apply these to EIA in appropriate and defendable ways. Limitations in the scientific knowledge base for the impacts of sound on marine life also present challenges for NOPSEMA in making reasonable, well-founded decisions with the right balance of precaution and confidence regarding environmental protection. Using examples from EIA of sound-generating activities, this presentation will highlight some of the more commonly encountered limitations in science, opportunities to improve rigour in EIA and suggestions for targeting future science to management needs.

Modelling the distribution of hard seabed in Darwin Harbour using angular backscatter response

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The effective management of Darwin Harbour in Northern Australia is dependent upon the provision of accurate spatial information of seabed habitats used. To provide this information, a combination of spatially continuous multibeam sonar data, and in-situ video and sediment data were collected from the harbour and used to generate detailed seabed habitat maps. The surveys and subsequent data analysis form part of a collaborative science program between Geoscience Australia (GA), the Northern Territory Department of Environment and Natural Resources (DENR), the Australian Institute of Marine Science (AIMS) and the Darwin Port Corporation aimed at improving knowledge about the marine environments in Darwin Harbour region. The program was made feasible through funding from NTG and co-investment of the collaborators. Here we report the results of using multibeam angular backscatter response curves to model the distribution of hard seabed in subtidal areas of Darwin Harbour. An average angular backscatter response curve which became a reference curve was consolidated from angular backscatter response curves extracted from multibeam sonar data and analysed against backscatter intensity for sites of hard seabed as observed from seabed video. The 'probability of hard seabed' (*p*-hard) variable was then derived by comparing the reference angular backscatter response to all other angular backscatter responses using the Kolmogorov-Smirnov goodness-of-fit. The results agree well with the ground truth data (video observations) with an overall classification accuracy of 75% and an AUC of 0.79. Modelling predicts that 41 km^2 of Darwin Harbour, which represents 23% of the total area mapped, is hard seabed. This presentation focuses on methods used to produce a continuous map of the harbour that shows the distribution of hard seabed. We demonstrate the value of multibeam acoustic data for the characterisation of this ecologically important benthic habitat.

Are seahorse and pipefish losing critical habitat to a problem alga?

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Anthropogenic disturbances may be driving a shift from seagrass-dominated to algal-dominated benthic habitats in Moreton Bay, specifically dominance of the opportunistic macroalga, *Caulerpa taxifolia*. The syngnathidae are a seagrass-dependant fish family, and it is thought that any loss of seagrass may negatively impact upon their populations. Previous research suggests that syngnathids occur in significantly lower densities, or are absent completely, in *C. taxifolia* habitats as compared to seagrass habitats. However, there is currently limited research into the mechanisms driving these differences in distribution between habitats. The objective of this study was to examine potential mechanisms driving changes in syngnathid distribution between seagrass and *C. taxifolia* dominated benthic habitats. Specifically, this study addressed whether syngnathids are able to attach to both *Caulerpa* and seagrasses, and investigated whether habitat selection was driven by either physical or chemical cues. Outcomes of this research may inspire conservation of seagrass habitats, thus leading to flow-on effects benefitting seagrass-associated species such as syngnathids.

"Integrating models into water quality decisions."

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Water quality (WQ) models can benefit policy makers and field scientists in many areas. Models can support decision making frameworks and can be used and improved as a test bed for scientific hypotheses. As examples the eReef 3 dimensional biogeochemical model has been compared against satellite and in-water observations and shown to be fit for purpose for modelling WQ and potential WQ futures on the Great Barrier Reef. In particular the model can be used close to the coast where satellite information is limited or restricted due to cloud and sediment reflectance. Changes to nutrient and sediment footprints of individual river catchments can also be simulated in areas where observations are sparse. The variety and volume of information produced by the model over space and time and the way modellers convey this information to managers and field scientists is complex. In this brief talk we show some different forms of model outputs to extend understanding of their practical use.

Changes in water quality from 2010 to 2016 throughout the Great Barrier Reef

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Water clarity is the main metric by which the health of the GBR is assessed. We use satellite ocean colour, IMOS moorings and Marine Monitoring Program sites and the eReefs 4 km biogeochemical water quality model output to assess water quality between 2010 to 2016. Comparison with observations shows the model is skilful and can fill in the spatial and temporal gaps between observations. The 4 km model simulates spatial variability for all years and shows an increase in Chl *a* from north to south and from outer to inner coastal regions. Primary production and phytoplankton biomass are both higher during La Niña years of 2010-2012. Similarly DIN for the inshore and mid shelf waters is impacted with regional weather events (cyclones) during la Niña years with less change observed in the off shelf regions and during average ENSO years (2013-2015). In all off shelf regions water clarity (secchi depth) was high but decreased from north to south and also from outer to inner coastal regions. We also compare the higher resolution 1 km eReef model with observations in 2015-16.

Sea surface temperature forecasts for evaluating coral bleaching risk in the Great Barrier Reef

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Great Barrier Reef (GBR) Marine Park managers rely on sea surface temperature (SST) seasonal forecasts to better inform their management of coral bleaching events. A new global coupled ocean-atmosphere seasonal prediction system (with land surface and sea ice components) called ACCESS-S will be implemented at the Bureau of Meteorology. This model has higher spatial resolution (approximately 25 km ocean grid in the Australasian region) than the previous Australian seasonal model POAMA2 (approximately 100 km to 200 km ocean grid) and will be run more frequently (daily vs every three days), providing greater detail within the Great Barrier Reef Marine Park. The skill of the SST forecasts were assessed against satellite observations for GBR region for the hindcast period 1990 to 2012. The accuracy of the SST forecasts depends on the location, the forecast lead time, and the time of year the forecast is initialised. Operational SST anomaly forecasts will be available as both spatial maps and regional indices for the GBR, developed in consultation with Great Barrier Reef Marine Park stakeholders.

Climate proofing strategies using seasonal forecasting for Australian marine industries

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Coping with climate variability is business as usual for many Australian marine industries. However anticipating climate variability by using seasonal forecast information, can assist businesses plan ahead to reduce impacts in poor years and maximise opportunities in good years. Additionally the use of seasonal forecasts could extend the period of time in which businesses can operate profitably in a location, where environmental suitability is impacted by climate change. A warming ocean is likely to alter the environmental suitability of current locations for growing or catching particular species, by increasing the number years where upper thermal limits are exceeded for example. Long–term climate projections provide insight into the likely time in the future when current locations will no longer be suitable. These projections, combined with seasonal forecasts, can be used as a risk-based management strategy to help climate-proof industries exposed to both short-term environmental variability and long-term change.

The Darwin National Reference Station: a sentinel for coastal waters in Northern Australia

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Darwin Harbour is the main shipping port for the Arafura Timor Seas region of northern Australia. It provides a major transport hub and has links to Asian markets. Over the past 15 years there have been rapid developments within the Port of Darwin. Nevertheless, the water quality and health of the marine environment is very good. Darwin Harbour still retains over 90% of its mangrove areas and these contain 35 of the 52 species found in Australia. The Northern Territory Government is committed to preserving the environmental and cultural values of the harbour whilst also allowing for non-environmentally degrading economic development. However, monitoring of key processes in the harbour such as tidal currents, waves, water depth, sediment and nutrient transport has not been undertaken continuously; rather collected on a project by project basis. Darwin has one of Australia's national reference network tide gauges with over 50 years of record that is the only existing long term record of tidal behaviour for the area. With the introduction of the Integrated Marine Observing System (IMOS) in 2007, that has now changed. A National Reference Station has been established at the entrance to Darwin Harbour since 2009 and in collaboration with Darwin Port has been set up using an existing channel navigation marker. The NRS measures tidal currents, waves, chlorophyll-a, turbidity, wind, temperature and rainfall in tandem with a comprehensive biogeochemical water sampling programme. The data is made publicly available in near real-time and is being used to provide boundary conditions for a numerical model of the harbour as well as provide data to mariners for ship handling. The system has recently expanded into the Beagle Gulf region with the deployment of a second mooring, also operating in near real-time. This presentation will show results on how these observing platforms are informing multiple research programmes and operational activities of the Harbour as well as how it provides a backbone to other regional mooring arrays through sustained monitoring of macro-tidal coastal waters that dominate vast areas across tropical northern Australia.

Using functional traits to predict biodiversity in subtidal macroalgae systems.

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An important goal of ecology is to understand how the functional traits of organisms affect the identity, abundance and diversity of co-occurring species. To date, trait-based ecology has primarily been concerned with interspecific variability, using mean trait values to describe species. The role of intra-specific variation is less well understood despite many ecosystems, such as temperate reefs, being dominated by few species of habitat-forming macroalgae that can display very high levels of intra-specific variation in morphology. In these ecosystems, intra- not interspecific variation may have stronger effects on biodiversity. To test the relative importance of among and within-species variation in morphology on ecosystem functioning, we quantified morphological traits for six co-occurring habitat-forming algal species across nine months and tested the efficacy of these traits for predicting the abundance of associated epifauna. Algal morphological traits were highly variable among individuals within species for five out of the six species studied, and varied among sampling times. When relating traits to the epifauna, models with algal identity, biomass, surface area per gram and the variance in frond perimeter together were the best predictors of total epifauna abundance. These results suggest that species identity alone cannot predict abundance of associated communities and highlights the need to consider intraspecific variation in habitat-fauna relationships

Eco-engineering built infrastructure for marine and coastal biodiversity: which interventions have the greatest ecological benefit?

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Along urbanised coastlines, built infrastructure is increasingly becoming the dominant habitat. These structures are often poor surrogates for natural habitats, and a diversity of eco-engineering approaches have been trialled to enhance their biodiversity, with varying success. We undertook a quantitative meta-analysis and qualitative review of 103 studies to compare the efficacy of common eco-engineering approaches (e.g. increasing texture, crevices, pits, holes, elevations and habitat-forming taxa) in enhancing the biodiversity of key functional groups of organisms, across a variety of habitat settings and spatial scales. All interventions, with one exception, increased the abundance or number of species of one or more of the functional groups considered. Nevertheless, the magnitude of effect varied markedly among groups and habitat settings. In the intertidal, interventions that provide moisture and shade had the greatest effect on sessile and mobile organisms, while water-retaining features were required to enhance fish. In contrast, in the subtidal, small-scale depressions, which provide refuge to new recruits from predators and other environmental stressors such as waves, had higher abundances of sessile organisms while protruding structures benefited fish. The taxa that responded most positively in the intertidal were those whose body size most closely matched the dimensions of the resulting intervention. This indicates the importance of developing site-specific approaches that match the target taxa and dominant stressors. Furthermore, because different types of intervention are effective at enhancing different groups of organisms, ideally a diversity of approaches should be applied to maximise niche space.

The efficacy of eco-engineered interventions for enhancing the native biodiversity of seawalls in harbours across the globe.

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Seawalls support impoverished ecological communities because their flat, vertical surfaces compress the intertidal zone and limit the available habitat for colonisation and growth of the epibiota. Their communities are often dominated by non-native species. There is growing recognition that eco-engineering interventions, including the addition of microhabitats and seeding with native habitat-forming bivalves may enhance native biodiversity by increasing surface area for attachment and/or increasing habitat diversity. However, the efficacy of these interventions may vary among harbours depending on their local environmental conditions and species pool. Using tiles, we manipulated microhabitats and native habitat-forming bivalves on seawalls in a fully orthogonal design, undertaken at 15 harbours across the globe to test the hypotheses:
1. Adding microhabitats (ridges/crevices) to tiles will enhance native biodiversity and ecosystem functioning over that found on flat tiles. Tiles with high-elevation microhabitats will have a stronger effect than tiles with low-elevation microhabitats.
2. Seeding tiles with native bivalves will support greater native and fewer non-native species than unseeded tiles. The effects will be greater on tiles with microhabitats than flat tiles, due to greater survivorship and habitat formation by the bivalves in crevices where predation and temperature extremes are reduced.
3. The effects of the interventions will be more pronounced in harbours with higher temperatures and growth rates than in harbours with lower temperatures and growth rates.
4. The effects of habitat enhancement will less effective in harbours with low biodiversity and/or higher pollution
Tiles were sampled regularly to monitor growth and survival of seeded bivalves and community development. After 1 month, many of the seeded bivalves had been consumed by predators. The tiles with microhabitats were only effective in protecting the seeded bivalves at sites where the dominant predator was unable to access the crevices (e.g. fish and some seastars). After 6 months, tiles with added microhabitats or seeded bivalves were more biodiverse in some harbours, which could be linked to pollution or other environmental stressors. Further, tiles with microhabitats or seeded bivalves developed a richer community than those that were unseeded or flat. Greater recognition of the harbour-specific pressures is required to enhance the native biodiversity and functioning of seawalls, globally.

Tracking biodiversity values and threats on shallow rocky and coral reefs

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Among many developments in Australian marine science in the last decade, the Reef Life Survey (RLS) program is particularly notable in changing the way marine biodiversity trends are tracked across the continent. Surveys undertaken by trained underwater naturalists voluntarily participating in RLS now cover almost all shallow rocky and coral reef systems found in Commonwealth Marine Reserves (CMRs). This is the only quantitative source of standardised biodiversity data that extends across all major CMR regions, providing a solid baseline to track management plan targets in the recently expanded CMR estate. RLS was formed in collaboration with managers and scientists from State Governments and provides a common currency for shallow marine biodiversity data across Australian MPAs. Ongoing RLS monitoring has highlighted the critical role of Australia's MPAs in buffering against a nationwide decline in the biomass of large reef fishes. RLS has also allowed the first detailed view of marine biodiversity trends related to key human pressures for the State of the Environment report, including spatial comparison of the relative change in reef communities related to fishing and ocean warming over the last decade. This presentation will highlight key findings from the RLS program and how collaborative partnerships with Government management agencies lead to combined management and scientific benefits.

Micronekton community in the Great Australian Bight

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The micronekton community in the Great Australian Bight (GAB) was sampled as part of a whole of ecosystem study to test the hypothesis that the Central GAB has a microbial based food web that results in a less productive ecosystem relative to the Eastern GAB which is considered to operate using the more efficient classic food web. Micronekton describes the taxonomically diverse mid-trophic assemblage that mediates the trophic transfer of primary productively to higher order predators. A total of 12 vertically integrated samples were collected to a depth of 600m using an opening and closing net system at two main cross-shelf transects and some opportunistic sites in the Central and Eastern regions of the GAB. The central and eastern GAB shelf break/upper slope habitats had typical assemblages that were characterised by large schools of euphausiids in the epipelagic zone. Gelatinous zooplankton dominated the micronekton assemblages in offshore habitats of the Central region but only in the oceanic habitat of the East. In the East the upper slope communities were dominated by mesopelagic fish. Average micronketon biomass estimates including all samples were higher for the Eastern region relative to the central region and are comparable to estimates from similar studies in Western Tasmania, Northern Tasman but considerably lower than estimates from the Southern Tasmania and the Southern Ocean. The observed differences in biomass and species composition between Central and East regions and comparisons to other similar datasets in the Australasian region are discussed within the context of the limited sampling replication which precludes robust comparison. This work was undertaken through the Great Australian Bight Research Program - a collaboration between BP, CSIRO, the South Australian Research and Development Institute (SARDI), the University of Adelaide, and Flinders University. The Program aims to provide a whole-of-system understanding of the environmental, economic and social values of the region; providing an information source for all to use.

Assessment of estuarine health in a heavily urbanised and industrialised estuary

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The Port of Newcastle and surrounding heavy industry and the city of Newcastle are major pressures on the Hunter River estuary on the NSW Central Coast. Water and stormwater quality monitoring programmes identified potential stressors in the Hunter River estuary; for example nutrient and metal inputs from industry and shipping activities in the lower estuary, and nutrient inputs from upstream agricultural areas and downstream urban areas. A range of estuarine health indices were assessed in four locations in the lower to mid estuary: Throsby Creek, the South Arm and North Arm of the Hunter River, and Kooragang Island. Ecological processes were examined at a number of levels to capture a range of aspects of ecosystem structure and function. Phytoplankton abundance, benthic microalgae on surface sediments and epiphytic growth on artificial seagrass and pneumatophores were assessed using chlorophyll-a as a proxy measure for algal presence and abundance. The diversity and abundance of fish assemblages, sediment condition (benthic respiration, contaminants, total organic carbon) and leaf condition in mangroves were also investigated. Data collected in the Hunter River estuary were compared to reference estuaries, known standards (ANZECC Guidelines, NSW Trigger Values) or published literature. The lower to middle estuary provides optimum conditions for phytoplankton growth due to the coincidence of better water clarity with increased salinity, and moderate water residence times upstream of the actively flushed lower estuary reach. Algal growth in the lower estuary may also be limited by multiple stressors. Fish assemblages in the Hunter River estuary were as diverse as reference estuaries. Sediments in Throsby Creek and the South Arm were in very poor condition due to high rates of benthic community respiration and to high levels of heavy metals and hydrocarbons. Leaves of mangroves growing in Throsby Creek, South Arm and Kooragang Island appeared to be in poor condition. The northern side of the North Arm was the healthiest of the locations surveyed in this study with ecological processes being in fair condition. Ecological processes are severely impaired in Throsby Creek primarily as a result of legacy contamination of the sediments, and ongoing inputs from the heavily modified catchment.

Integration of multiple techniques to elucidate the population structure of coastal reef fish in northern Australia

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Modeling fisheries populations is one of the many components of management aimed at achieving sustainable exploitation. Definition of the spatial extent of stocks, in particular, is a founding principle of this assessment process. The concept of stocks as natural management units is based on demographically cohesive groups of individuals of a species and is commonly defined in genetic terms. The status of coastal reef fisheries in northern Australia remains undefined for many exploited species. In this study, we aimed to identify the stock structure of three commercial and recreationally important fish species across northern Australia (*Protonibea diacanthus*, *Lutjanus johnii* and *Lethrinus laticaudis*) using a combination of ecological, geochemical and genetic techniques for uptake into fisheries management. All three species were sampled across their Australian distributional range and between 10-13 genetic microsatellite DNA markers were specifically developed for each species. The distribution of the genetic diversity revealed contrasting results between the three species. *Protonibea diacanthus* and *Le. laticaudis* presented distinct populations and major genetic breaks, whereas no pattern of genetic structure was revealed for *Lutjanus johnii*. In this latest species, genomics was used to elucidate the absence of pattern using microsatellite markers. Our multidisciplinary approach to stock discrimination combines and integrates parasites abundances, otolith microchemistry and population genetics. The integration of multiple techniques that operate over different temporal and spatial scales makes it possible to overcome many of the limitations of single technique approaches and greatly strengthens the inference available from stock structure studies.

Infaunal assemblage structure in the deep Great Australian Bight

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Infauna were collected between 200 m and 2800 m depths from the central Great Australian Bight (GAB) during two surveys in 2013 and a further two in 2015, primarily using a multicorer. When analysed at the individual core level, there were no patterns in infaunal assemblage structure with depth, longitude, or any other factor included in the sampling design or environmental variable. For the 2013 data, when data from individual cores in a single multicorer deployment were aggregated, there were clear depth effects, suggesting that a single core is not a sufficiently large sample to be meaningful. These depth effects were not apparent in the combined (across years) data set. At the highest taxonomic resolution achieved (species for many important groups, but genus/family/class/phylum for others), there were differences between 2013 and 2015, which disappeared when all taxa were aggregated at the genus level. While all taxonomy was co-ordinated by the same group at Museum Victoria in attempt to standardise between surveys, there were differences in personnel involved in both sorting and identification between years, so it is unclear if these differences between years are real or an artefact.

Biogeography of southern Australian deep sea fauna

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Specimen data on southern Australian deep sea fauna (>200 m depth) from all major Australian museums were collated and analysed to examine biogeographical patterns. In total, 25837 specimen lots that had been registered and had location information were identified. Location records were then plotted against bathymetric contours, and records where the recorded depth differed substantially from the plotted depth were discarded, leaving 21041 records belonging to 3878 taxa. All taxa were checked against WoRMS, and taxonomy updated where required. 1451 taxa were represented by a single record, although 1 record may have equated to multiple individuals. A total of 3409 taxa (87.9%) were represented by 10 or fewer records. The most abundant taxon was *Sassia kampyla kampyla* (triton), with 205 records. A total of 26 taxa had 50 or more records, although 3 of these were undifferentiated groupings at the order or class level. Data were split into 40 geographic groups with equal numbers of records. Multidimensional scaling and cluster analysis showed strong geographic patterns in taxonomic composition. The GAB region groups out as distinct from the areas east and west of it, and the whole southern region is distinct from the east coast.

Utilizing drone technology to assess leatherback sea turtle (*Dermochelys coriacea*) hatchling fitness, Papua Barat, Indonesia

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Leatherback sea turtles (*Dermochelys coriacea*) are a critically endangered, marine megafauna species that utilize the waters between Australia and Indonesia for feeding and migration, with the primary nesting site of western Pacific leatherbacks located along the northern coast of the Bird's Head Peninsula, Papua Barat, Indonesia. Hatching fitness can significantly affect the survival of sea turtles, and has been shown to be influenced by nest temperatures during the incubation period. During the 2016 nesting season, we monitored fitness of hatchlings in terms of crawl and swimming speeds relative to incubation temperatures from both *in situ* and relocated nests of the leatherback sea turtle at Jamursba Medi (Boreal summer nesting season) and Wermon (Austral summer nesting season), Papua Barat, Indonesia. We used a drone as a video platform for monitoring hatchlings during their movements down the nesting beach and through the surf. Crawl speed was documented for an average of 10m prior to the hatchlings entering the surf. During the current study, the hatchlings had a mean crawl speed of 0.04 ± 0.009 m/s at Jamursba Medi and a mean crawl speed of 0.05 ± 0.07 m/s at Wermon. Swimming speed was documented for 30 – 300m during hatchling movements through the surf. Hatchlings had a mean swimming speed of 0.55 ± 0.13 m/s at Jamursba Medi and a mean swimming speed of 0.57 ± 0.08 m/s at Wermon. We also monitored sand temperatures and nest temperatures throughout the incubation period at both beaches. Mean beach sand and nest temperatures were warmer at Wermon (31.3 ± 0.8°C; 31.7 ± 1.6°C, respectively) than at Jamursba Medi (30.3 ± 0.8°C; 30.9 ± 1.3°C, respectively). The results of this study provide base-line data for utilizing drone technology for evaluating hatchling fitness relative to crawl speed, swimming speed, and sand and nest temperatures. The use of drone technology for monitoring hatchling movements at the natural nesting beaches provides useful metrics for evaluating hatchling fitness relative to factors such as nest incubation temperature and other ecological aspects of the nesting beaches.

Direct and indirect interactions between estuarine habitats and commercially important species of penaeid shrimp

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Two of the most important attributes that estuaries provide for the early life history stages of aquatic animals is food and refuge. Establishing the importance of different areas or habitats within estuaries is a fundamental requirement to understand the structural and functional characteristics of estuarine ecosystems, and also to target management measures at estuarine habitats to achieve fisheries outcomes. Penaeid prawns (= shrimp) represent some of the world's most economically valuable fisheries. The role of subtidal channels and pools in saltmarsh habitats in supporting high densities of juvenile penaeid shrimp is well established, however, the role of saltmarsh as a direct source of nutrition for these species has been the subject of some debate. The advent of stable isotope ecology has seen many studies which attempt to quantitatively establish trophic links between saltmarsh, mangrove and exploited species. This study aimed to assess the importance and contribution of saltmarsh and mangrove habitats in the lower Clarence River estuary as juvenile habitats for Eastern King Prawn (EKP). EKP were the dominant species in the lower estuary, present at densities of 76-499EKP $100m^{-2}$, emigrating from the network of subtidal channels and deltaic islands. This area is primarily shallow, unvegetated, subtidal soft sediment with limited seagrass cover, but has extensive mangrove and saltmarsh habitat adjacent. The saltmarsh grass *Sporobolus virginicus* was the dominant nutritional source for EKP at all areas ranging from 45-97%. The proportion of saltmarsh also varied across time within a location, reflecting changes in availability of alternative food sources. There is a clear link between EKP and mangrove and saltmarsh habitat, both in the direct occupation of subtidal channels by juvenile prawns, and also in support of productivity from marsh-synthesised primary production. This clearly demonstrates the importance of these habitats for Eastern King Prawn, and that rehabilitation and restoration of the extensive habitats lost in the system are likely to have significant benefits for Eastern King Prawn fisheries.

Determining the contribution of estuarine habitats to the diets of commercially important fisheries species in the Hunter River

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Within estuarine systems fish and invertebrates obtain their nutrition from a range of primary producers including mangroves, saltmash and seagrass. Understanding the contribution of primary producers to the diets of fisheries species is important to ensure suitable management of these habitats to maintain sustainable fisheries catches. We used stable isotope analysis to determine the relative contribution of saltmarsh, mangroves, zooplankton and fine benthic organic matter (FBOM) to the diets of commercially important fish and crab species in the Hunter River estuary, New South Wales. The saltmash plant, *Sporobolus virginicus* was the most important nutritional source in the estuary contributing between 22% and 55% of the diets of commercial species, and was particularly important for dusky flathead (*Platycephalus fuscus*), blue swimmer crab (*Portunus pelagicus*) and sea mullet (*Mugil cephalus*). Zooplankton and FBOM were less important, contributing similar proportions of nutrition to the diets of commercial species (20 – 40%) but the remaining sources, including mangroves and other saltmarsh plants, contributed little to the diets of commercial species (<20%). The high contribution of *S. virginicus* to the diets of commercially important fisheries species highlights the importance of saltmarsh to fisheries species in the Hunter River. Given the importance of saltmarsh to commercial fisheries, suitable and effective management processes are needed to protect them and is critical to maintaining sustainable fisheries in the estuary.

Comparative whole membrane proteomics analyses of marine cyanobacteria

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Marine cyanobacteria *Synechococcus* are abundant, globally distributed and genetically diverse. *Synechococcus* strains have developed distinct strategies to cope with a wide range of marine environments, from turbid, estuarine waters to transparent oligotrophic waters and various temperatures across 120° of latitude. We analysed the membrane protein composition of strains isolated from different regimes to gain an understanding of how these bacteria interact with their environment with particular focus on nutrient uptake and its influence on biogeochemical cycles in the ocean. Whole membrane proteins of four *Synechococcus* strains namely *CC9311*(clade I)*, CC9605*(clade II)*, WH8102*(clade III) *and CC9902*(clade IV) have been analysed by shotgun proteomics using Q-Exactive Orbitrap mass spectrometer. *Synechococcus CC9311* and *CC9902* represent temperate strains while *CC9605* and *WH8102* represent strains predominantly found in warm tropical waters. More than 600 proteins have been identified from the membrane extracts for each *Synechococcus sp*. Interestingly, protein phosphatase 2C is one of the highest expressed proteins in *Synechococcus CC9311* and *CC9902.* This protein is suggested to play a role in signal transduction but the exact role in marine cyanobacteria remains elusive. FutA (iron ABC transporter substrate binding protein) unique to *Synechococcus* clade III has been identified as highly expressed in *Synechococcus WH8102*. In contrast, the iron Fe^{3+} ABC substrate binding protein expression level of sync_1545(CC9311), syncc9605_1578 (CC9605) and Syncc9902_2002 (CC9902) is relatively low. In addition, FeoB (ferrous iron transport protein B), unique to *Synechococcus CC9311* and involved in organic iron uptake in coastal waters has also been identified. Overall, the high expression level of FutA suggested the high binding affinity of iron is important for iron scavenging in tropical oligotrophic waters. A large number of expressed membrane proteins have no known function, or only general predictions, which indicates that more work is required to understand the spectrum of chemical compounds that these cells are capable of transporting. Among the top 50 expressed proteins, we also identified some proteins which are unique to *Synechococcus CC9311* suggests there are specific adaptations in *Synechococcus CC9311* for survival in coastal waters.

Measuring the underwater light climate on the North West Shelf of Australia using IMOS Slocum gliders

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The absorption of sunlight stratifies the surface layer of oceans through heat transfer and creates a sunlit photic zone inhabited by most of the world's marine life. Critically, underwater light is one factor that regulates the distribution and abundance of the primary producers that underpin the marine food chain. On Australia's North West Shelf (NWS), these primary producers directly or indirectly sustain coral reefs, commercial and recreational fisheries and the megafauna such as whale sharks and migratory Humpback Whales that support the tourism for which the region is renowned. However, despite its importance, there is a paucity of information on the underwater light climate of the NWS and we are unaware of any studies focusing on the underwater light regime in the region. Here, we present preliminary results on the underwater light climate and factors affecting light penetration on the NWS using underwater Slocum gliders of the Integrated Marine Observing System (IMOS). IMOS Slocum gliders are equipped with a Satlantic OCR-504ICSW Multispectral Radiometer that measures light at 443, 489, 554 and 669 nm, a Wetlabs Eco Puck measuring particle backscatter, chlorophyll and CDOM fluorescence, a Seabird CTD and an Aanderaa Oxygen Optode 3835. On repeat transects of the Kimberly region in 2012 and 2013 we used measurements from the 443 nm wavelength of the Satlantic OCR-504ICSW to calculate light extinction coefficients (K_d) and the 1% light compensation level to delineate the photic zone. Light extinction coefficients typically ranged between 0.08 – 0.25 m^{-1} with the photic zone varying between 30 – 50 m depth. However, during Tropical Cyclone Rusty in February 2013, K_d reached > 0.5 m^{-1}. Factors affecting light penetration included resuspension of sediment due to storm and tidal mixing, internal waves, and, to a lesser extent, chlorophyll biomass. Our results demonstrate that the underwater light climate of North West Shelf is highly dynamic and is routinely affected by sediment resuspension through tidal mixing. Sediment resuspension stimulates phytoplankton blooms that can further affect light penetration. Understanding the underwater light climate of the North West Shelf will help us understand factors influencing primary production of the region.

Modelling the spatial distribution of humpback whales in the Kimberley region of Western Australia

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Off the west coast of Australia, humpback whales migrate annually from summer feeding grounds in Antarctica to breed and calve during winter in the nearshore waters of the Kimberley. Despite extensive aerial and shipboard surveys by industry, tourism, community groups and researchers over the last two decades there have been few attempts to use these data to quantify spatial distributions and critical habitats for the species across the Kimberley region. This information is urgently required to better inform management in an ecosystem that faces challenges of warming environments, industrial development and rapid growth of humpback whale populations. To address this need, we integrated two decades of aerial and shipboard surveys of humpback whales and linked them to environmental covariates obtained from remote sensing in order to build habitat-based models using two different modelling approaches. These included density surface modelling where distance sampling was coupled with generalised additive mixed modelling to produce density maps (individuals km^{-2}) predicted from environmental covariates. The second approach modelled the presence-only sighting data from non-systematic surveys and produced probability of occurrence maps predicted from the same environmental covariates. We also trialled very high resolution satellite imagery (30 cm resolution) to detect and count whales in the Lalang-garram/Camden Sound Marine Park and undertook a cost-benefit analysis to determine the best methods to monitor this important calving area into the future. Humpback whales could be detected in the satellite imagery and the calculated density was comparable to that estimated using traditional survey methods. Our analysis has identified and described the distribution and critical habitat requirements, particularly the core areas for calving and nursing, which were previously poorly defined.

Mass Coral bleaching in the far northern region of the Great Barrier Reef and Torres Strait – a numerical modelling study

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The summer of 2016 was marked by a high rate of coral bleaching on the Great Barrier Reef (GBR). However the coral bleaching did not occur uniformly, taking place with greater severity in the northern region of the GBR. Field campaigns from the Australian Institute of Marine Science, the Great Barrier Reef Marine Park Authority and Torres Strait Regional Authority showed that even in the northern region, coral bleaching did not occur in a uniform spatial distribution. The SHOC numerical model implemented in the region through the eReefs project satisfactorily showed in time-space the thermal fronts of high temperature, which are closely related to coral bleaching. However, the spatial resolution of SHOC model (4km) presents limitations in the representation of both bathymetric features and the possible mechanisms of intrusion of thermal fronts. In this context, a higher resolution model (1km) and with the same vertical layering system was implemented in the northern region of the GBR in order to better infer the mechanisms that explain why some regions of the northern region experienced coral bleaching and why others regions did not. The forcing of the model (hydrodynamic and atmospheric) was obtained from the eReefs project. The results of this study reinforce the regions of occurrence of the thermal fronts presented by the eReefs as well as add more spatial details, facilitating the understanding of the mechanisms of the generation and extinction of the thermal fronts.

Application of a hydrodynamic numerical model towards implementation of desalination plant at Palm Island, Queensland.

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The absence of significant rainfall in the wet seasons until 2016 has raised serious concerns about freshwater supplies to the community of Great Palm Island (Bwgcolman), Queensland as their dams were empty. A long term solution is for the installation of a desalination plant at the site in times of severe drought. Given the urgency of the implementation of this plant, urgent studies were carried out to design the pipeline and the diffuser system as well as to determine the spatial and temporal extent of the hypersaline plume as a result of the operation of this infrastructure. With the recent improvement in pluviometric indexes in the catchment system and the consequent elevation of freshwater storage levels on the island, this has resulted in a temporary relief for the community and so a more considered reassessment of the possible impacts of the hypersaline plume on the receiving environment is being undertaken. Through the use of a spatial high-resolution three-dimensional hydrodynamic model using recently collected bathymetric data, we have sought a better numerical representation of the hiper saline plume from the diffusion system. This work presents this hydrodynamic 3D numerical model of high spatial resolution and its preliminary results. A monitoring array has also been placed in the region, which will provide the data for future calibration and validation of the model presented here. Finally, this comprehensice study is providing the best possible representation of the receiving system in order to better evaluate the temporal and spatial extension of the hypersaline plume.

Fishing in the Torres Strait: success through community participation

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Torres Strait Islanders have a distinctive relationship with the sea. Commercial fishing is one of the most economically important activities in the region and provides a significant opportunity for financial independence. Marine harvest also provides food security and is integral to the traditional way of life and livelihood of all Torres Strait Islanders. Consultation, communication and engagement can be difficult across the scattered islands of the Torres Strait, but is the most important element in the effective management of the region's fisheries and in the protection of its unique cultural and environmental values. Established in 1994, the Torres Strait Regional Authority (TSRA) works to support individuals and communities through the delivery of programmes including in Fisheries, Environmental Management, Economic Development and Native Title. It consists of an elected arm of community representatives and an administrative arm of Australian Public Servants. Traditional Owners' aspirations for 100 per cent Indigenous ownership of access rights in commercial fisheries in the Torres Strait has been supported by the authority charged with managing marine fisheries in the Torres Strait Protected Zone (the PZJA). The PZJA itself includes the TSRA Chairperson, along with the Commonwealth and Queensland Ministers responsible for fisheries. Empowering the community in the management of the regions fishery resources is important in connecting traditional knowledge of resources with modern fisheries management and in leading to improved economic and social outcomes for Torres Strait communities. The PZJA model allows for meaningful engagement of Torres Strait Islanders in the formation of management advice, through representation in key consultative and advisory forums. In the Torres Strait Finfish Fishery, which has been 100 per cent owned by Torres Strait Islanders since 2007, the engagement of the community is not only in the fisheries management actions but also in managing access to the resource. The primary goal is to develop the capacity in the Traditional Inhabitant sector to fully utilise the fishery. However, each season the TSRA Board, with advice from community representatives, leases out unallocated catch on behalf of Traditional Owners to keep markets open for Torres Strait product and to generate revenue to benefit Torres Strait communities.

Protect or repair: insight into shoreline habitat complexity in Australia's urbanized tropical estuaries

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The increasing rate of coastal development in tropical regions calls for effective management strategies to ensure the preservation of local natural resources and the ecological services they provide. Sustainable development and effective ecological engineering both hinge on the integration of knowledge of the ecology of target ecosystems in the planning phase of any development. Currently, however, little is known about the habitat complexity and connectivity of tropical coastal ecosystems, in particular wetlands, when exposed to development. The influence of these characteristics on local biodiversity and habitat functioning, as well as their role in the resilience of coastal ecosystems, such as their potential to withstand/recover from development impacts, is still unclear. Additionally, while habitats altered by human development tend to be considered in need of repair, their composition, status and function has not been investigated. If 'modified' habitats are still able to support local biodiversity and provide ecological services, the need for restoration/rehabilitation efforts should be evaluated on a case-by-case basis. We assessed the habitat composition and mosaic configuration of Ross Creek (Townsville, Queensland) - an estuary exposed to over 150 years of development and urbanization. We used this information to 1) evaluate habitat complexity of a highly modified tropical estuary, 2) determine differences between 'natural' (i.e. without anthropogenic features) and 'modified' habitats, and 3) present a conceptual model for the evaluation of modified habitats and their contribution to the functioning of the ecosystem. Our results indicate a high level of habitat complexity for this developed estuarine system, in part due to the large number of anthropogenic modifications. The distribution and extent of the different habitats along Ross Creek showed how unplanned urban development has contributed to the formation of a complex and varied shoreline mosaic. Both natural and modified habitats showed noticeable variability in species diversity. Further, we highlight the need for inclusion of previously neglected factors, such as sediment type and presence/absence of artificial structures, in future assessments and management plans of developed or under-development systems. These findings highlight the need for new perspectives to improve policies and management strategies for effective marine spatial planning of tropical wetland ecosystems.

Flood 2017 – Impacts on environmental and social values of an urban estuary

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In February 2017, a significant rainfall event caused widespread flooding across the Swan River system and upstream Avon River. The magnitude of flows in this event were similar to that of a flood event in 2000. In that year, freshwater conditions over much of the estuary resulted in a significant blue-green algal bloom that effected the closure of large parts of the Swan River. The impact of these big scale events on the ecological and social values of this urban estuary will be compared and contrasted and the importance of advances in telemetered information and model forecasting as tools for managers will be described.

Using environmental drivers to model blue whale acoustic detection variability

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Blue whales are difficult to study using traditional visual survey methods due to their endangered status and secretive behaviour. Passive acoustic monitoring (PAM) provides an alternative approach to better understand the ecology and behaviour of these rare majestic animals. PAM is cost effective, providing long term sampling that is not affected by adverse weather conditions. We compare two distinct acoustic populations of blue whales living in temperate waters across separate ocean basins. Using the CTBTO's (Comprehensive Nuclear-test Ban Treaty Organisation) hydro-acoustic network, we have access to 15 years of continuous recordings of ocean noise from Cape Leeuwin, off Western Australia and 9 years of recordings from Juan Fernandez Island, off Chile. Hydrophones at each site record ocean noise continuously and whale calls are located using automated detectors. In addition, satellite derived environmental data was obtained which included sea surface temperature, sea surface height and productivity (chlorophyll-a). Using the satellite data, we constructed models to determine which of the environmental variables best predicted whale calls. Our results show that blue whales responded to the inter-annual variability in environmental conditions. This has implications for the management and recovery of the species as we provide some insight to how they may adapt to changing conditions.

Assessment of Arsenic Bioavailability in Darwin Harbour Sediment

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Majority of sediment samples collected from outer Darwin Harbour in 2015 contained elevated arsenic (As); concentrations up to 134 mg As/kg were measured which exceeds the national sediment quality guideline value (SQGV) of 20 mg As/kg, and the SQG-high value of 70 mg As/kg. This is consistent with previous studies that reported high As concentration (up to 222 mg/kg) in sediment scattered throughout inner Darwin Harbour and the intertidal zone. With no known anthropogenic sources, the elevated sediment As in Darwin Harbour is attributable to natural weathering of minerals containing this element. Exceedance of the high-level As sediment guideline indicates toxicity effects are possible. High As concentration has been measured in benthic biota found in Darwin Harbour. In 2016, samples were recollected from outer Darwin Harbour sites; DGT measurements and dilute acid extraction of sediment were performed to assess bioavailable As. Preliminary data indicate As is not readily bioavailable, and associated with coarse sediment grains. Coastal laterites appear to be a source of As in Darwin Harbour sediments.

Mesophotic coral ecosystems: A global perspective and putting Ningaloo in context

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Mesophotic coral ecosystems (MCEs) lie at depths beyond those typically associated with coral reef ecosystems. Significant logistical challenges associated with data collection in deep water has resulted in a limited understanding in the ecological relevance of these deeper coral ecosystems. However, the development and easier access to new technologies, particularly in remote sensing techniques, in recent years has encouraged research effort in deeper waters across the world. A systematic review was carried out to address the current state of MCE knowledge to identify priority research areas. Clear locational biases in research patterns were observed, with studies concentrated in a few discrete areas. The focus of studies, as well as the methods used, is diversifying where we have moved out of the exploratory phase in some locations and are starting to investigate more detailed aspects of the ecology. Ningaloo reef is the largest fringing reef in Australia. Most research to date has targeted the shallower communities, however the parks boundaries encompass a huge area that sits in > 30 m of water. Acoustic data was used to target Autonomous Underwater Vehicle (AUV) transects to collect images of the seafloor as well as accompanying environmental information. We have documented benthic cover across the depth gradient from shallow reefs to beyond the limits of coral growth at Ningaloo and identified the broad communities that are present. The deepest extent of reef building corals is approximately 40 meters, considerably shallower than on mesophotic reefs studied in other areas, where corals are commonly found at depths greater than 100m. Large changes in the communities are observed around the 50-60 m depth where corals are no longer present and macro algae and sponges dominate the hard substratum.

Needles and haystacks: using spatial modelling to find rare sea snakes in the North West Marine Region

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Inexplicable declines in sea snake populations in remote, pristine habitats in North Western Australia, followed by increasing records of two critically endangered species in fisheries bycatch outside of their previously defined ranges, have made them a key management priority. There is limited knowledge about the species composition, abundance, ranges and distribution patterns of sea snake species within and outside Commonwealth Marine Reserves (CMRs) in the North West Marine Region (NWMR). These knowledge gaps underpin a lack of understanding of population status and threats. Understanding distribution patterns and population health of rare marine animals, like sea snakes, over such large spatial scales is logistically difficult and expensive. The use of species distribution and ecological niche modelling can allow researchers and managers to use existing sighting records to predict locations where these species may occur and enable finer scale investigations. Here we use existing sighting records of sea snakes from previously conducted field surveys, baited remote underwater video stations, fisheries interaction data and publically available biodiversity sighting records (e.g. Museum records, Atlas of Living Australia, Reef Life Survey) to understand habitat associations, species assemblages and define distribution patterns of sea snakes within the NWMR. These modelling techniques highlight key habitats within and outside CMRs where sea snakes may be abundant and pinpoint locations where there is a high likelihood of human interaction (i.e. trawl and trap fishing, coastal development, seismic surveying, etc.). This information forms the baseline from which further analyses can be conducted to understand the effectiveness of CMRs and how sea snake populations may react to natural and anthropogenic changes.

Expect the unexpected: remarkable genetic divergence among and within the wild coral reefs of the Kimberley

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The unique and biologically diverse coral reefs of the Kimberley in northwest Australia (NWA) are wild, but despite their remoteness, these ecosystems are experiencing increasing pressures from climate change and anthropogenic development. This study utilised next generation sequencing to inform management strategies aimed at maintaining the health and resilience of these reefs. We assessed genomic variation with thousands of genome-wide SNPS in two species of branching coral; the brooder, *Isopora brueggemanni*, and the broadcast spawner, *Acropora aspera*. These two corals represent the common reproductive modes in hard corals which create the crucial three-dimensional habitats of coral reefs ecosystems. Although we expected the extreme environmental heterogeneity in the Kimberley would lead to unique patterns of genetic diversity, we did not predict that would reveal such strong genetic divergence among allopatric and sympatric populations of these two corals. For the spawner, the morphospecies *A. aspera* comprises at least four discrete lineages in NWA that rarely interbreed, but occur side by side and exhibit genetic cohesion across geographically distant sites. In contrast, no such evidence of cryptic diversity was detected in the brooder, but strong genetic divergence was detected among reefs and reef patches. Focusing on patterns of the main lineage of *A. aspera*, we compared geographic structure and diversity with the brooder. The general patterns of connectivity were surprisingly consistent between the two species; few larvae disperse more than 35 kilometres from their natal reef patch, the Sunday Strait appears to be a semi-permeable barrier in which stepping stone connections exist between the Dampier Peninsula and Buccaneer Archipelago, and the offshore populations at Ashmore Reef are highly distinct from the inshore populations of the Kimberley. If the intention of management agencies is to protect hard corals, they must consider the importance of local recruitment and the distribution of adaptive potential for population maintenance and recovery in a changing environment by ensuring natural connectivity networks are maintained among reefs.

Designing fish-friendly seawalls

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Artificial structures in marine environments are known to reduce the diversity of the fouling assemblage and can also foster more invasive species. This is well documented within Sydney Harbour where half of the foreshore has been modified by seawalls. Recent studies suggest that increasing the complexity of seawalls can mitigate these impacts and increase diversity of the fouling assemblage. What remains unknown is how the increase in complexity affects the associated fish assemblage, either from the effects of the increase in substrate complexity or through its effects on the fouling assemblage. To differentiate these direct and indirect effects, concrete tiles of different complexities were deployed on seawalls within Sydney Harbour and the associated fish assemblage was assessed using remote underwater video (RUV). Preliminary data suggest that adding complex habitat to seawalls modifies the abundance and identity of associated fish. We hypothesise that smaller, residential fish species will benefit most from the addition of complex habitats. This study enhances our understanding of the interactions between fouling and fish assemblages and whether engineering seawalls to increase complexity is a viable management option to better support urban fish communities.

Balancing estuarine and societal health in a changing environment

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This presentation provides a broad overview of a current multidisciplinary research project aimed at supporting sustainable growth in a rapidly-expanding coastal region (Peel-Harvey, south-western Australia) by optimizing tradeoffs between societal goals for catchment development and maintaining the ecological health of the receiving estuary, both now and under future scenarios. It draws together expertise in catchment and estuary hydrological modeling, biogeochemistry, ecology, ecosystem services and socio-economic geography, as well as nine collaborating agencies across the university, government and community sectors. We outline the different project components, their interconnections and provide an overview of progress to date, focusing on the following. (1) Catchment-estuary function and linkages (coupled catchment-estuary model for understanding estuarine water quality in response to catchment inputs, supported by nutrient 'source-to-fate' isotope tracing to disentangle key sources and delivery pathways); (2) Estuarine ecological health response (indices of ecosystem health built from fish and invertebrate community characteristics) and (3) Estuarine ecosystem service (ES) provision (identifying key societal values, selecting quantifiable indicators of relevant ecosystem services, and predicting change in ES delivery under different environmental scenarios). We also outline challenges to date, next steps in project delivery and how this type of approach could be adapted to explore the resilience of other human-natural systems.

Diversity and abundance of microbial hydrocarbon degradation pathways in the offshore environments of the Great Australian Bight

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The deep offshore waters of the Great Australian Bight (GAB) are a potential focus for oil and gas exploration following the release of several lease areas to six major oil companies in 2011. Where naturally occurring oil or methane seeps are a source of hydrocarbons to the deep sea, they are mostly degraded by microorganisms. Additional anthropogenic inputs of oil and gas discharged during routine drilling, or in the case of an oil spill, may exceed the capacity of microbes to degrade the hydrocarbons and could adversely impact ecosystems. The potential for degradation of hydrocarbons by microbes is unknown for the GAB because there are no data on the composition of hydrocarbon degrading communities. In the first analysis of offshore sediment samples from this area, we used next generation sequencing to survey the diversity and community composition of hydrocarbon degrading bacteria using three marker genes (*alkB*, *c23o* and *pmoA*), in surface sediments from depths between 200 and 3000 m. Diverse and unique microbial communities capable of degrading hydrocarbons were documented. The communities differ in structure with depth; the most marked changes being between 400 and 1000 m depth on the continental slope. The observed differences in community structure show a strong correlation with temperature, sediment size structure and organic carbon load. This study provides baseline data on important hydrocarbon degrading microbial communities prior to the start of oil and gas exploratory drilling or production activities. Our data will inform future programs to monitor and assess environmental impacts on the GAB deep sea ecosystem.

Intermediate levels of environmental variability yield faster coral growth at a risk of increasing mortality

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Marine ecosystems often experience strong diurnal and seasonal variability in environmental conditions. This is particularly the case for shallow water communities where factors such as temperature, light and pH can fluctuate drastically with tides or exposure. Organisms living in such dynamic systems must cope with a large range of environmental conditions, affecting their performance in a complex interactive manner. In this long-term study, we assessed the relationship between environmental conditions (temperature, depth, light, pH, pCO_2, O_2, salinity and turbidity) and coral performance (growth, productivity and mortality). As model species we used two abundant coral species (massive *Porites lobata* and branching *Acropora formosa*) on four distinct habitats or sites on a platform reef in the Southern GBR over a 15-month period. Spatial and temporal differences in growth and physiology were observed for both species at each of the different sites. Overall, coral growth (as measured by the alkalinity anomaly technique and buoyant weight increase) for both species was up to 60% higher during winter compared to other seasons. Performance of *A. formosa* was found to be more sensitive to fluctuations in environmental conditions than *P. lobata* performance. Moreover, both species fared better at the two sites with moderate changes in environmental conditions compared to the two sites with either the most stable or the most variable environmental conditions. However, (partial) mortality increased to up to 25% of the colonies at the sites with stronger diurnal and seasonal environmental changes, presumably due to an accumulation of unfavourable conditions affecting coral life-history. Our results suggest that a moderate degree of environmental dynamism or variability could lead to higher payoffs in coral colony growth and physiology, but at a risk of increased mortality.

Variations in productivity in the Great Australian Bight: Uncovering hidden influences on the food web

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The Great Australian Bight (GAB) is an economically and ecologically important part of Australia's marine estate. Contrasting meteorological and oceanographic processes operate across the region, with downwelling dominating year round in the central GAB, and upwelling through the austral summer in the east. These differences are expected to influence enrichment within the euphotic zone and drive shifts in ecosystem productivity. Studies to date have tended to focus on variations in biomass of the lower trophic ecosystem in the region. There have been few examinations of spatial changes in the physiological processes that lead to the accumulation and decay of this biomass, and underpin overall ecosystem productivity. This study investigated variation in primary and secondary production across the GAB during a voyage on the *RV Investigator* in December 2015. We present results outlining changes in phytoplankton photophysiological parameters and daily integral primary productivity, and micro- and meso-zooplankton grazing rates. Clear differences are evident between the eastern and central GAB that can be related to variations in physical forcing and enrichment. We show that changes in the dominant physiological processes between the eastern and central GAB reflect differences in food web dynamics, providing new insights into the factors underpinning overall ecosystem productivity in the region. This work was undertaken through the Great Australian Bight Research Program - a collaboration between BP, CSIRO, the South Australian Research and Development Institute (SARDI), the University of Adelaide, and Flinders University. The Program aims to provide a whole-of-system understanding of the environmental, economic and social values of the region; providing an information source for all to use.

Operation Crayweed: raising awareness about underwater forests in Sydney and beyond

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Seaweeds forests are the biological engines of shallow temperate reefs worldwide. They are among the most productive ecosystems on earth and support important ecosystem services such as fisheries production. In Australia, seaweed forests underpin the Great Southern Reef (GSR), an interconnected system of temperate reefs that span 8,000 km of coastline, from northern New South Wales to mid Western Australia. Although the GSR is valued at $10 billion per year and about 70% of Australians live alongside it, seaweeds and the GSR have been historically undervalued by Australians. This is evidenced by the fact that recent rapid and widespread declines of seaweed forests from many GSR reefs have received much less attention relative to similar declines in tropical or terrestrial habitats. Our 'Operation Crayweed' project combines science, community engagement and art to raise awareness about the importance of seaweeds through the restoration of crayweed (*Phyllospora comosa*), a dominant seaweed. Crayweed disappeared from the Sydney coastline over 30 years ago, probably as a result of urbanisation and sewage pollution. Our research has shown that water quality in Sydney is now suitable for the re-establishment of crayweed, and we have successfully restored crayweed to reefs where they were once dominant. We are now using this good-news restoration success story to engage local communities and boost public awareness about the importance of seaweed forests. After a successful crowdfunding campaign, Operation Crayweed established a citizen-science project whereby recreational divers are driving the restoration and monitoring of an entire crayweed site. Operation Crayweed scientists also collaborated with artists Turpin+Crawford to create a 500 m art installation that was part of Sculpture by the Sea annual art exhibition (2016), which attracted over 450,000 visitors and highlighted the restoration of a crayweed site in south Bondi. This art-meets-science collaboration included a series of workshops and activities with eight local public schools and a childcare centre, with over 100 children participating. By championing outreach and educational activities, our project aims to significantly increase public awareness of marine habitat degradation and the role of science and the community in facilitating recovery.

Latitudinal variation in seagrass herbivory: global patterns and explanatory mechanisms

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Understanding latitudinal patterns in species interactions is becoming increasingly important in the context of climate change. Here, we firstly quantified the influence of latitude and temperature on the strength of herbivore impacts on seagrass meadows by synthesising the global literature on herbivore exclusion experiments in seagrasses to date. Meta-analysis results show that herbivores had a similar net impact on seagrasses across 37 degrees of absolute latitude and across different temperatures. Using a field-experiment, we then examined the role of seagrass traits and latitudinal variation in seagrass production vs. consumption rates as potential explanatory mechanisms of the patterns observed. Seagrass biomass, nutritional traits, leaf production and consumption rates were quantified from nine *Amphibolis antarctica* meadows across 1,700 km, from tropical to temperate latitudes. *In situ* experiments showed that both seagrass production and consumption rates were greatest in the tropics and decreased with latitude. Tropical seagrass leaves had lower levels of total nitrogen and higher phenolic content than temperate seagrass. Despite being lower in nutritional quality, consumption in the tropics was highest, with fish removing ~ 30% of daily primary production. In contrast, consumption of the more nutritious temperate seagrasses was highly variable and dominated by invertebrates. Thus, in lower latitudes, faster *A. antarctica* growth rates compensated for greater consumption by herbivores. This resulted in the net impact of herbivores being similar across latitudes, as higher latitude plants grew more slowly but also suffered less herbivory. This match between consumption and production rates may contribute to explain the observed global patterns in herbivore impacts, which showed comparable effects of consumers on seagrasses worldwide. As ocean temperatures continue to rise and overall herbivory is expected to increase in temperate regions, the survival of seagrass meadows in higher latitudes will depend on the ability of seagrasses to increase growth at compensatory rates.

Wave energy alters biodiversity by shaping intraspecific variation of a habitat-forming species

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Habitat-forming species are utilised in restoration projects because their structure can protect juvenile fish and invertebrates from predators, desiccation and wave exposure thereby increasing local biodiversity. In highly urbanised estuaries such as Sydney Harbour, boat wake is a main source of anthropogenic induced wave energy and high wave energy can dislodge or alter the growth of habitat-forming species. Previously, most research has evaluated how differences in morphology and distribution between habitat-forming species influences community structure. However, intraspecific variation in traits of a single habitat-forming species can also have flow-on effects that influence communities. This is especially true if the capacity by which habitat-forming species ameliorate environmental stressors varies with traits, such as morphology. Observations from Sydney Harbour suggest that the dominant habitat-forming species, the Sydney rock oyster, *Saccostrea glomerata*, grows in different orientations wherein some locations, oysters form complex three-dimensional habitats but in others they only grow in a thin layer on the rock surface. In this study, we investigated whether 1) the growth form of *S. glomerata* varied along a wave gradient, and 2) this variation changed the local biodiversity. At nine sites throughout Sydney Harbour, wave energy, the size and density of oysters, complexity of oyster habitat, and community composition of invertebrates living among oysters and adjacent bare plots was quantified. We found that as wave energy increased, the density and complexity of oysters decreased. However, the richness and abundance of invertebrates was dependent upon oyster habitat, not wave energy. A manipulative field experiment has been designed to tease apart the indirect versus direct effects of wave energy on intraspecific variation in oyster habitat. Results from this study will be useful in guiding site selection and methods to aid oyster restoration projects. Selecting a suitable growth form that will be resistant to local stressors while maximising the local biodiversity is vital for restoration projects within urbanised estuaries to be successful. In the future, we will increasingly rely on successful restoration of habitat-forming species to sustain native marine biodiversity.

Should we monitor the bleeding obvious?

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According to our textbooks, monitoring is generally motivated by a desire to reduce uncertainty in status and trend and underlying causes. Investing scarce resources into monitoring species and ecosystems we more or less already know to be in a state of decline seems frivolous. But conservation managers in marine settings have only indirect or limited influence over a range of threats, including those posed by the oil and gas sector, fisheries and climate change. Often it makes sense to monitor the bleeding obvious to strengthen the argument for policy change among sceptical co-managers. Here we outline how to approach the allocation of monitoring resources where we are interested in (a) reducing uncertainty associated with the subset of threats within our control, *and* (b) persuading others to implement change for those threats beyond our immediate control. Potential applications include monitoring marine reserves and monitoring threatened and migratory species.

Ecosystem engineers in intertidal sediments: microbial responses to macroinvertebrate exclusion along an environmental gradient

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Intertidal sediments are among the most threatened of estuarine habitats, and are exposed to multiple stressors related to land-use practices and anthropogenic activities. As a result, sediment communities have experienced significant shifts, with many larger macroinvertebrates threatened or lost worldwide. Macroinvertebrates, such as bivalves, are often referred to as 'ecosystem engineers' because their activities (such as burrowing and bioturbation) alter their physical and chemical environment. Microbes are also key contributors to coastal ecosystem structure and function, yet, we currently know little about how macroinvertebrate loss will affect co-existing sediment microbial communities. We experimentally excluded the dominant ecosystem engineer (bivalves) from intertidal sediments in Mahurangi Harbour, New Zealand, to investigate microbial community responses with 16S and 18S amplicon sequencing. Experimental plots were established along a gradient of increasing silt content (3.8% - 28.2%). Excluding large macroinvertebrates from intertidal sediments changed microbial diversity, network connectivity and assemblage structure. Microbial diversity was greater in sediments where macroinvertebrates had been excluded, and decreased along a gradient of increasing silt content. Network analysis revealed that macroinvertebrate exclusion resulted in less connected and less 'even' microbial communities. This potentially indicates a breakdown in important microbial interactions, that could result in a loss of function. When considered in the context of increasing development along the world's coasts, and siltation of estuaries, our findings highlight the importance of biotic interactions, as well as the potential consequences for these important sediment ecosystems, including loss of biodiversity and function.

Findings of the Great Australian Bight Collaborative Research Program

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This presentation provides a synthesis of the scientific findings of the Great Australian Bight (GAB) Collaborative Research Program, including an overview of the socio-economic systems and conceptual models of ecosystem function. Outputs from ecosystem models developed to examine the structure and function of the socio-ecological systems of the GAB – a trophodynamic model (Ecopath-with-Ecosim) and a whole-of-system (Atlantis) – are also presented. Models outputs are used to assess the sensitivity of key species, trophic pathways, habitats and assemblages to potential ecosystem stressors, including climate variability and change scenarios, fisheries, aquaculture and oil/gas activities. The potential synergistic and cumulative impacts of multiple stressors, and socio-economic and ecological trade-offs associated with multiple use of the GAB are also examined. Results are used to identify priorities for future monitoring, management and research in the GAB.

Cleaning up the Coral Sea Commonwealth Marine Reserve

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In May, 2016, Parks Australia teamed up with a variety of NGOs and scientists to undertake a marine debris clean-up and bio-discovery voyage on the far flung islands and cays of the Coral Sea Commonwealth Marine Reserve, 400km from the Australian mainland. Marine debris is a global problem and can be found in some of the most pristine ocean environments. It is important that we understand the types, quantity and sources of debris, so that we can respond appropriately. We discovered large amounts of debris and spent 12 days attempting to remove all the debris and return the cays to as pristine condition as possible. We sorted and recorded everything we collected, looking at the origin of manufacture and the vast array of sources of the litter. From thongs to toothbrushes, ships ropes to basketballs, this presentation will show an award winning 10 minute video of the voyage which was created as a tool to help raise the issue of marine debris, discuss the results and analysis of the debris collected, and showcase artworks created from the debris collected at a public art workshop in Cairns.

The application of eDNA metabarcoding for marine biodiversity monitoring at the Cocos-Keeling Islands.

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Environmental DNA (eDNA) metabarcoding, a technique in retrieving multi-species DNA from environmental samples, can detect a diverse array of marine species from filtered seawater samples. Newly developed metabarcoding assays, targeting various regions of the mitochondrial and nuclear genomes, have been applied to seawater samples collected from marine study sites across the Cocos-Keeling Islands. Our assays have successfully detected a wide range of fish, arthropods, cnidarians, sponges, alveolates and algae present in marine water. Our research demonstrates the efficiency, cost-effectiveness and power of using eDNA metabarcoding for comprehensive biodiversity analyses, either alongside or in place of traditional surveying techniques. Building on rapid global and domestic developments in eDNA metabarcoding, it is expected that this genomic approach will soon be integrated into Australian marine resource management and consulting practices.

National bathymetry collaborations and coordination

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Baseline physical mapping of the ocean floor is lacking for most of Australia's Exclusive Economic Zone (EEZ), with only about 25% of the EEZ covered by high resolution multibeam bathymetry data. High resolution bathymetry and its derivative products are high-value datasets that provide essential information for a range of purposes, including: charting, navigation, and safety of life at sea; environmental monitoring and management of Commonwealth Marine Reserves, heritage areas and resource development areas; supporting Australia's territorial claims; Antarctic science and demonstration of Australia's Antarctic presence; operational oceanography in coastal waters; inundation modelling to manage coastal hazards, and; development of renewable energy sources such as wave and tide power. In recent years, the requirement for high resolution bathymetric data has become a priority to meet these and other needs. A consistent high-resolution map of the seafloor for Australia's entire EEZ remains an important long-term national objective, however, there are priority areas where governments have strategic needs for information to inform policy and support management. In 2016, Geoscience Australia, the Australian Hydrographic Service and IMOS collaborated in hosting a workshop to progress an agenda for improved national coordination of bathymetry mapping. The meeting bought together State and Commonwealth agencies to focus on development of a 'National Priority Map for Bathymetry Acquisition' as a first step to improve collaboration, and a way of targeting resources already available. This and a number of other important coordination activities were identified at the workshop and will be summarised in this presentation, along with an overview of priority areas identified for mapping. Geoscience Australia has also collaborated with the Australian Institute of Marine Science to form a National Marine Acoustics Network. This Network will bring together government and non-government marine acoustic specialists and experts to share their skills and equipment to maximise their use and benefit to the nation. These and other activities present a range of opportunities to improve national coordination and collaboration in seabed mapping.

Characteristics of tuna fisheries associated with FADs in Indonesian waters.

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Deepwater anchored Fish Aggregating Devices (FADs), in waters as deep as 2000–5000m, have been a common feature of Indonesia's tuna fisheries since the early 1980s. The numbers of FADs in waters across the Indonesian archipelago have increased significantly during the past decade, from hundreds to thousands. Until present, management measures for the tuna fisheries, including for the FADs, have not been successfully implemented, mainly due to the scale of the fisheries (the large number of fishers and vessels), the large maritime territory of the archipelago, and insufficient resources for enforcement of fisheries regulations. In addressing information gaps to enable improved management, Indonesia and Australia have conducted a joint study as part of a 5 year ACIAR project (FIS/2009/059), including an enumeration program at four key tuna landing ports: Padang (West Sumatera), Palabuhanratu (West Java), Kendari (SE Sulawesi) and Sorong (West Papua). Preliminary findings from 2564 fishing trips surveyed to date include: 1. FADs are of three main types – steel pontoon, bamboo, and polystyrene block, and subsurface attractors are most commonly natural materials (nipa and coconut palm branches); 2. Fishing gears include hand-line/troll-line (HL/TR), pole and line (PL), and purse seine (PS); 3. The proportions of the two main target tunas, skipjack tuna, *Katsuwonus pelamis* (SKJ), yellowfin tuna, *Thunnus albacares*, in the catches vary by gear and fishing depth (shallow surface fishing and targeting of large YFT at 150-200m). SKJ were the dominant species (70-80% by volume) in catches of PL in Kendari and PL and PS in Sorong, but only comprised 30-43% of HL/TL landings of HL/TL vessels in Palabuhanratu and Kendari; 4. Fishing success (as measured by % of FAD visits that yielded catch success) ranged from as low as 35% for HL/TL in Padang to 86% for HL/TL in Palabuhanratu; 5. A large proportion of the SKJ, YFT and bigeye tuna, *T. obesus*, landed by the FAD-based vessels, were juvenile fish, below reported *lengths at maturity* (L_m) for those species, raising obvious concerns for sustainability of the fisheries. Information from this study is assisting the current Harvest Strategy development for Indonesia's tuna fisheries.

The deepest systematic collection of benthic fishes in Australian waters -continental slope and rise of the Great Australian Bight

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The deepest systematic collection of benthic fishes in Australian waters (107 species from 49 families in 200-3000 m depths) was taken by beam trawl during two surveys in the central Great Australian Bight (GAB) in 2015. There had been very limited previous collection of fishes around Australia in depths below 1500 m. This talk will discuss the composition of the benthic ichthyofauna and some of its assemblage level patterns in the GAB. In overview, the fauna is dominated by families that typify the deep ocean: rat-tails (Macrouridae), morid cods (Moridae), cut-throat eels (Synaphobranchidae) and slickheads (Alepocephalidae). Fish abundance (nos. m^{-2}) and biomass (gm^{-2}) peaked at 400 m depth before declining by about an order of magnitude in 3000 m depth. Captures of rare and unusual species included the bizarre tripodfish (*Ipnops agassizii*) and large abyssal giant cusk eel (*Spectrunculus grandis*). Authorative identifications for all taxa were provided by a network of collaborating ichthyologists and a geneticist from CSIRO, NIWA and Australian museums. The two surveys were aboard the Marine National Facility vessel RV *Investigator*: voyage IN2015_C01 funded through the GAB Deepwater Marine Program (GABDMP) and voyage IN2015_C02 funded through the GAB Research Program (GABRP).

Use of Acoustic Techniques for the Determination of Circulation Patterns and Net Sediment Transport, Marine Supply Base, Darwin Harbour.

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The Marine Supply Base channel provides access to berthing and loading at East Arm wharf for vessels that support the offshore energy industry. Sedimentation in the channel due to complex currents in the area is reducing navigational efficiency and safety. A combination of multi-beam echo sounder (MBES) and Acoustic Doppler Current Profiler (ADCP) surveys were conducted over a 12 month period encompassing both dry and wet seasons. The MBES surveys mapped the extent of the MSB channel and the East Arm sandbar adjacent to the channel. Tidal current patterns determined from the ADCP surveys show that tidal currents in the area are highly variable and are stronger in the ebb tide direction except at the entrance to the navigation channel. Tidal current are more variable in the flood tide direction at all remaining sites along the channel. The strength and direction of the tidal currents indicate that sediment movement is along the channel toward the deeper seaward navigation channel. Fine sediments have deposited in the MSB berthing area slightly reducing the volume of the berthing pocket and also depositing toward the end of the channel. An annual sediment deposition rate of 100 mm over the berth area was determined via observations and modelling. Non-cohesive sand transport observations and modelling have indicated slow movement of the sandbar in a dominantly south west direction at between 100 – 200 mm per month. Fine sediment modelling indicates deposition in the MSB berth area of 20 – 50 mm/year under average conditions. Modelling indicates that if the MSB channel was realigned to be straighter the current directions would be more regular assisting navigation. Sediment accumulation would not present a major issue if the majority of the East Arm sandbar was dredged. Navigation simulation using all survey and modelling results has greatly improved the operational efficiency of the base.

Refining methods for detection of marine pests using plankton

tows and qPCR assays

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Knowledge of the distribution of marine pests is important to inform management, ensure compliance with ballast water regulations, and to detect new incursions or range extensions. Traditional surveys for marine pests are time consuming and expensive, and rely on increasingly scarce taxonomic expertise. Detection of marine pests in environmental samples using molecular methods is a rapid, cheaper alternative, and so these methods are garnering increasing attention. In order for molecular approaches to be used as a basis for management, methods for field sampling and processing need to be robust, and application of assays to environmental samples needs to be validated to understand field sensitivity and the potential for false-positives due to cross-reactions with non-target DNA in different geographical regions. We trialled a range of plankton collection, sample preservation, transport and processing methods, with field sampling taking place in six ports around Australia in at least two seasons each. Molecular analysis was performed using 10 qPCR assays for key marine pest species that have been laboratory validated and previously applied to surveys in Port Adelaide. Sample and internal controls were used to assess sample degradation and PCR inhibition respectively. Across the surveys all the assayed pests that are known to be established in each location were detected, with some showing distinct seasonal patterns of detection. Use of a sulphate-based preservative consistently resulted in better sample preservation than when samples were transported cold or filtered and frozen. Inhibition occurred in some samples, and high inhibition was related to reduced detection, but problems with inhibition could be minimised by appropriate processing. Data obtained from this project will help to refine sampling and processing techniques for molecular detection of pests in plankton samples, and the results are the first step in validating these methods for use in management systems.

Assessing environmental suitability of the GAB region for key deep-sea benthic taxa using species distribution modelling

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Deep sea benthic fauna has been relatively poorly studied in southern Australia, including in the Great Australian Bight (GAB) region. Species distribution modelling can be used to predict the relative suitability of habitats for species occurrence, identifying important habitats and potentially also major environmental variables driving distributions. We used Maxent to run species distribution models for several representative species from key benthic taxonomic groups from southern Australia. Maxent was chosen as it has been shown to perform well for presence-only data, even with small numbers of occurrences. We obtained occurrence data on deep–sea benthos from recent survey work in the GAB and the collections of Australian museums, supplemented with data from online databases. To avoid overfitting and aid interpretability of models, we compared a range of modelling options and, based on these comparisons, restricted the feature types used in our final Maxent models. To account for the spatially biased nature of our data set, we applied a target group background approach, using occurrence records of related taxa to characterise the environmental background against which presence points are compared by Maxent. We assessed the importance of the available environmental variables by running models for each species with each variable separately. As many of the environmental variables were found to be correlated, we selected a subset to use in final models, based on the importance across all assessed species. The strong correlation of environmental variables makes identifying major drivers of species distributions difficult, but the important influence of some variable groups was evident. The final models can be used to assess relative suitability of the GAB region for key benthic taxa, and identify regions of potential high diversity based on high suitability for multiple species across the key groups analysed.

Respondent driven sampling (RDS) as a cost-effective method for recreational fisheries: a trial with the Tasmania recreational rock lobster fishery

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Due to the lack of a licencing frame, various open access recreational fisheries can be challenging to gather data from, as standard random selection surveys may be compromised by the need to collect large samples to discover relatively rare participants. We field tested the respondent driven sampling (RDS) technique, a snowball sampling method utilising personal social networks, originally developed for surveying hidden population in the public health sector, to assess potential application in recreational fisheries research. We designed a method comparison study between RDS and a random telephone survey on the well understood and licenced Tasmania recreational rock lobster fishery. In this project, we aimed to 1) test if the RDS method can provide a representative sample through fisher self-referral recruitment, 2) compare the demographic of the surveyed population and 3) gather social-economic data on the recreational rock lobster fishery. To begin the sampling chains, we selected 20 initial respondents (seeds) from rock lobster fishing related industries (e.g. tackle shops, dive stores). Seeds were categorised based on spatial regions (north/south) and gear types (diving/potting) with equal sampling (n=5) for each group. We then conducted the interview in person and provided each seed with 3 recruitment coupons for referring other recreational rock lobster fishers to participate in the survey, which circulate and potentially spread the survey within the fishing community. To increase our potential sample size, we began a second wave of seeding through focus group meetings, targeting groups with strong social links to the fishery such as member from dive/fishing clubs, fish care volunteers and peak fishery body representatives.

Using population genetics to design and assess success of marine restoration

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Worldwide, the decline of habitat-forming species is accelerating. Rehabilitation techniques in terrestrial plant, seagrass and coral habitats are now relatively advanced. Methods often recognise not only short-term conservation goals, but also the influence that genetic diversity has on species' establishment rates, population fitness and adaptive capacity, as well as on associated biodiversity and ecosystem functioning. There is, however, a significant lack of focus on macroalgal habitats, despite similar global declines and ecological importance. In NSW, a dominant habitat-forming seaweed, *Phyllospora comosa*, has become locally extinct from ~70km of urban Sydney reefs for almost 40 years. *P. comosa* is a "foundation" species, and its disappearance has also likely contributed to declines in local biodiversity. Recent developments in relatively low-cost restoration techniques have shown that transplanted *P. comosa* can survive and reproduce in Sydney, stimulating plans for a large-scale program to restore *P. comosa* forests at the scale of the original disappearance. However, these efforts are hampered by a lack of knowledge of underlying genetic patterns that are vital to design restoration programs and measure their success. We are using single nucleotide polymorphisms (SNPs) to characterise the genetic structure and diversity of extant populations of *P. comosa*. 180 plants have been sampled from six suitable donor locations north and south of Sydney, spanning ~160 km, which were chosen based on proximity to restoration sites, algal density and size of bed. For each plant, we collected matching data on 16 traits including morphology, photosynthetic activity and signs of herbivory, disease and bleaching. Associated biodiversity (mobile and sessile understory species) and function (e.g. primary and secondary productivity) will also be surveyed to identify potential links between genetic structure, individual phenotype and ecosystem-level effects. These results will be used to design a restoration program which maximises the survival, condition, reproductive output, associated biodiversity and ecosystem functions of transplanted *P. comosa* patches.

Response of mangrove ecosystems in northern Australian estuaries to environmental change

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Mangrove ecosystems form wetlands of differing extents within macrotidal estuaries of the Top End. Their distribution has adjusted in response to environmental change across a range of timescales. Mangroves occur within a relatively narrow intertidal 'accommodation space' that differs in vertical extent reflecting tidal hydrodynamics within each estuary. This enables mangroves to occupy a restricted series of habitats that have changed as estuaries infilled and coastal plains developed, and that continues to adjust in response to other environmental perturbations. This paper considers the changes in wetland habitats that have occurred at different timescales and the implications for future change. At millennial timescales, stratigraphy, dating and palynology of coastal sedimentary sequences indicate a paleo-environmental history comprising the final stages of postglacial sea-level rise and relative stability of sea level over the past 6000 years. Over historical times, mangrove distribution responds to geomorphological changes in topography and river channel migration, as well as disturbances, such as tropical cyclones. Subtle topographical variation renders sections of low-lying plains particularly vulnerable to saltwater intrusion, and the extension of tidal creeks via paleochannels has resulted in re-introduction of mangroves into freshwater wetlands. Advances in remote sensing, such as higher-resolution imagery and the Australian Geoscience Data Cube provide further insights into short-term changes, including extensive dieback of mangroves that occurred in 2015-6 in the Alligator Rivers region, in a similar manner to that observed around the Gulf of Carpentaria. Understanding these past patterns provides insights into how mangrove forests may change naturally in future and how their sustainability may be affected by sea-level rise. The likely response of these systems to future sea-level rise can be modelled but needs to consider geographical variations between individual systems.

Yard in the marinas – the initiation of WHP in Penang

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The development of marinas and ports have modified the natural coastal ecosystem and often causing habitat degradation. With participation in World Harbour Project we focused on green engineering techniques in restoring natural communities that once lived in the environment. A marina and a port was selected and installed with treatment settlement tiles of different treatments transplanted with a native habitat-forming species of bivalve (tropical oyster, *Crassostrea iredalei)*. Each treatment tile had five replicates and monitoring process will take one year starting from September 2016. Every three months biological variables will be recorded such as survival and growth of seeded oyster, biodiversity of new recruit species, and community complexity. Water quality parameters will also be measured continuously. Several noteworthy obstacles were encountered during installation, among which are failure of aluminium framework used to hold the settlement plates in place; strong wave crushes that resulted in broken plates. As of December 2016, we have recorded a total of 17 species on all tiles namely: algae (3 spp.), barnacle (1 sp.), new bivalve recruits (4 spp.), crabs (2 spp.), fish (1 sp.), molluscs (4 spp.), shrimp (1 sp.), and tubeworm (1 sp.). Among all tiles, treatment tiles made of eco-concrete, seeded with oysters, with 5 cm structural enhancement had recorded both highest species richness and Shannon-Wiener diversity index (12 spp.; H'=0.350) while the least biologically performing treatment tiles were the ones made of seawall material and without oyster seeding and structural enhancement (H'=0.083). Interestingly, the chance of sessile animals found on the reverse sides of all tiles, regardless of the treatment type, was much higher especially the number of new bivalve recruits. The mortality rate currently stands at 47% and is suspected to be due to stormy waves, large flotsam, and predation.

Changes in fish and prawn assemblages following a climate-driven decline in tropical seagrass meadows

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Seagrass meadows provide valuable ecosystem services including provision of nursery and foraging habitat that leads to increased biodiversity and enhanced fisheries production. Global coverage of seagrass ecosystems, however, is declining rapidly and placing these services at risk. Recently, the impact of several years of a La Nińa climate patterns producing high rainfall events and a series of tropical cyclones led to the almost complete disappearance of previously persistent seagrass meadows in Trinity Inlet, Cairns with little recovery over a four year period. Trinity inlet had a fisheries and environmental monitoring program commencing in the 1980's and continuing until the early 2000's making it among the most studied estuaries in northern Australia. The loss of seagrass from 2010 created a valuable opportunity to combine historical research with renewed sampling where seagrass meadows previously existed to determine the ecological change in juvenile fish and prawn assemblages and evaluate the cost of seagrass loss to fisheries production. We replicated the previous sampling methods to target juvenile fish and prawns for comparison with previous data collected when seagrasses were widespread. Fish abundance and species richness were significantly reduced following seagrass declines and the assemblage composition also differed. Abundances of the major commercial prawn species declined markedly since the loss of seagrass with the potential to have a major economic impact to a fishery that was estimated to be worth of over $1 million per year in 1993. This study highlights both the ecological and economic consequences of seagrass loss in tropical estuaries. The results provide a view into the future where the tropical storms and rainfall events are predicted intensify in the region under future climate change scenarios. The findings of this study will allow informed cost-benefit analyses to be made when deciding on the conservation value of seagrass habitats and the implementation of compensatory restoration projects to offset seagrass loss from natural and anthropogenic disturbance.

Regional copernicus data hub: sentinel data access and contributing to marine science

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Copernicus is a European programme that generates and makes use of a multitude of Earth observation data to support a comprehensive environmental monitoring system. The Regional Copernicus Data Hub is established under an EU-Australia agreement to distribute and promote data from the Copernicus Sentinel satellites in the South-East Asia and South Pacific region. The Hub, operated by a consortium of Commonwealth and State Government agencies, is expected to reach full operational capacity in 2018. We will give an update on the status of the Hub and discuss its potential impact on the marine science community. Of most interest to this community, Sentinel-3 data is now available from the Hub and an increasing number of high level products are being released, including measurements of sea surface height, temperature, and water-leaving radiance or reflectance. We will introduce an interactive query interface and an OpenSearch API, to be implemented early 2017. This single portal will be available to access data for all Sentinel missions operated by both the European Space Agency and the European Organisation for the Exploitation of Meteorological Satellites. In addition to easy data access, the Hub will provide training and support for users. We welcome feedback on how the Hub can facilitate collaboration and innovation in the marine domain.

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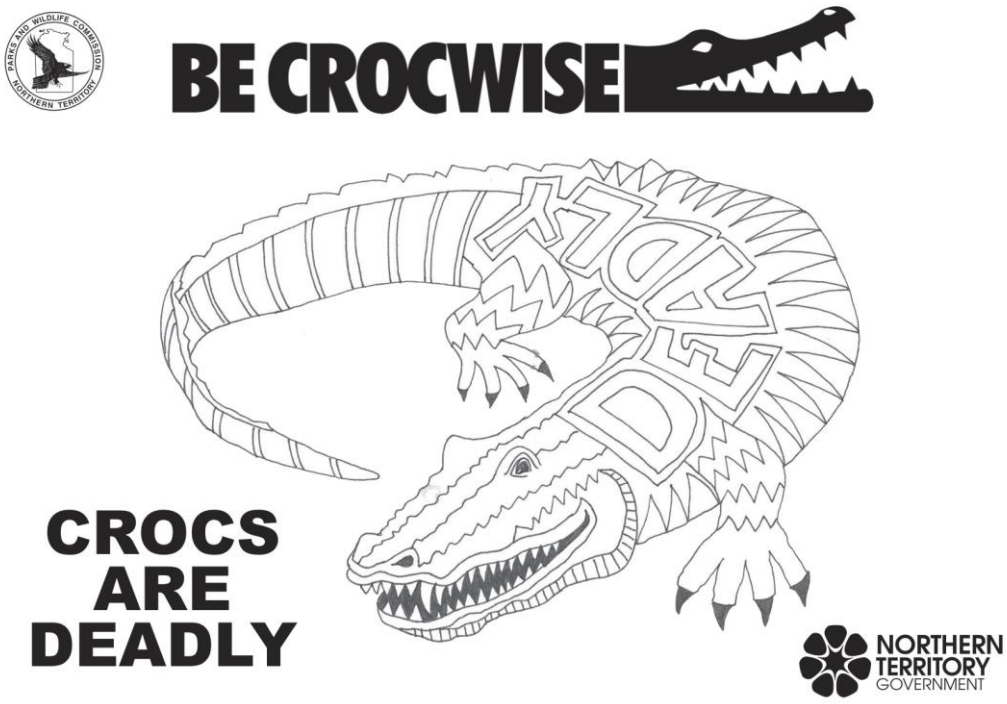

Crocodiles are potentially dangerous to humans. People should never take unnecessary risks in crocodile habitat. Saltwater crocodiles inhabit both saltwater and freshwater habitats.
Some of the ways to stay safe in areas that may have saltwater crocodiles include:

- Never swim in water where crocodiles may live even if there is no warning sign. Only swim in designated safe swimming areas.
- Obey all crocodile warning signs — they are there for your safety and protection.
- Always keep a watch for crocodiles. They will see you before you see them.
- Never provoke, harass or interfere with crocodiles, even small ones.
- Never feed crocodiles — it is illegal and dangerous.
- Be extra vigilant around water at night and during the breeding season from Sept to April.
- Avoid approaching the edge of the water and don't paddle or wade at the edge of the water.
- Stay well back from any crocodile slide marks. Crocodiles may be close by and may approach people and boats.
- The smaller the boat, the greater the risk.
- Always stand a minimum of five metres from the water's edge when fishing.
- Be especially vigilant when launching or retrieving your boat in saltwater crocodile habitat.
- Do not lean over the edge of a boat or stand on logs overhanging water.
- Never dangle your arms or legs over the side of a boat. If you fall out of a boat, get out of the water as quickly as possible.
- Camp at least 2 metres above the high water mark and at least 50 metres from the water's edge. Avoid places where native animals and domestic stock drink.
- Avoid returning regularly to the same spot at the water's edge to fill your bucket.
- Dispose of food scraps, fish offal and other waste properly and away from your campsite.
- Never leave food scraps, fish frames or bait at your campsite. Always check that previous campers have not left these behind.
- Never prepare food, wash dishes or pursue any other activities near the water's edge or adjacent sloping banks. Instead, fill up your bucket and move away from the edge of the water before you start any tasks.

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