



AMSA

ADELAIDE 2018

CANYONS TO COAST

Australian Marine Sciences Association
55th Annual Conference
Adelaide | 1–5 July 2018

PROGRAM BOOK & ABSTRACTS



www.amsa18.amsa.asn.au

#AMSA18 @AMSACnf



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Photography by: Greg Adams

WELCOME FROM AMSA PRESIDENT

It gives me great pleasure to welcome all delegates, sponsors and exhibitors to the 55th Annual AMSA Conference, Adelaide 2018 – Canyons to Coast. AMSA was last in Adelaide in 2009 and I think we can expect another excellent conference. The setting couldn't be better, taking place in the brand new Adelaide Convention Centre. The Scientific Committee has put together a cracker of a program including keynote addresses from some of Australia's leading scientific minds, Prof. Matthew England, Prof. Gretta Pecl and we welcome Dr Gary Greene and Dr. Ashley Rowden as international keynote speakers. You should also find yourself swimming (pun intended!) in options for talks with four concurrent sessions featuring over 230 presentations from amongst the 20 thematic and special symposia. This year also showcases the Joe Baker poster session which will feature 37 contributions which you can peruse as we reflect on the incredible life of Joe, AMSA's inaugural Patron. As you move from talk to talk or poster to poster, be sure to spread the word on all the interesting things you see using our twitter feed [@amsa_marine](#) [#AMSAConf](#) 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 AMSA's 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 his or her career. This year's recipient, Distinguished Prof. David Bellwood from College of Science and Engineering and the ARC Centre of Excellence for Coral Reef Studies at James Cook University, is well deserving and you'll hear about his pioneering work on coral reef ecosystem function. We also showcase the next generation of marine scientists by giving the Allen Award, supporting an outstanding postgraduate student to attend the AMSA conference, this year the award will go to Francesca Gissi from the University of Wollongong.

And of course no AMSA conference would be complete without the bevy of opportunities to catch up with colleagues over a refreshing beverage or develop new skills and contacts as part of a workshop. AMSA 2018 does not disappoint in this regard. In addition to a full line-up of social activities in the evenings, including a public forum on July 4th, the Local Organising Committee has worked with the science community to offer a host of workshops on topics such as indigenous engagement, marine biosecurity, citizen science, 3D modelling, seabed mapping and classification, marine reserve connectivity, application writing, communication, IMOS data use and recreational fishing research.

I hope you take advantage of all these opportunities and that you have an excellent meeting!

Regards,

Dr Will Figueira

President, AMSA

WELCOME FROM ORGANISING CHAIR

On behalf of the organising committee, welcome to AMSA 2018 Canyons to Coasts! After nine years, the AMSA South Australian branch is thrilled to host this year's conference at the stunning Adelaide Convention Centre. We thank all delegates for attending the conference and being right in the heart of the city of Adelaide, we can assure you there will be plenty of things to do in and around the conference.

The conference this year brings a long-standing tradition of covering vast themes with many presentations and posters being presented. We also have multiple workshops to choose from, a public event on the Southern Ocean and multiple social engagements on the agenda. This year, we are also progressing our social responsibilities with environmental sustainability by going paperless for the abstract book. We will also be using sustainable materials for lanyards and satchels that can be re-used at next year's conference or we will have some ideas on re-use available for those items. The Adelaide Convention Centre is also EarthCheck Gold certified for natural resource preservation and commits to Fair Trade Principles. On top of all that, we will be catering across the conference with > 90 % produce from local suppliers, so you will be able to delight in some of the great food and beverages that South Australia has to offer.

AMSA conferences have always been rich with a passion for all things marine science, which has fostered a great sense of camaraderie over the years. We are sure that the AMSA 2018 conference will be no exception and hope you are all inspired by the showcase of marine science on offer. Lastly, be sure to get the most out of the many networking opportunities available throughout the week and remember to enjoy yourself, you are among friends.



Dr Ryan Baring
Organising Chair

AMSA 2018 Conference Organising Committee

Ryan Baring
Organising Chair, Flinders University

Kathryn Wiltshire
Conference Co-Chair, SARDI

Maylene Loo
Treasurer, CSIRO

Jessica Buss
Sponsorship, Flinders University

Rene Campbell
Graphic Design and Marketing, Social Events, Flinders University

Ember Corpuz
Chair, Marketing and Sponsorship, Environmental Scientist

Bill Goh
Workshops, University of Adelaide

Shannon Lauchlan
Marketing, University of Adelaide

Lauren Meyer
Social Events, Flinders University

Sue Murray-Jones
Indigenous Workshop, Environmental Consultant

Nicole Patten
Student Awards, SARDI

Eleanor Pratt
Marketing, Flinders University

Sarah-Lena Reinhold
Indigenous Workshop, University of Adelaide

Shirley Sorokin
Sponsorship, Joe Baker Tribute, Student Awards, Flinders University

Jackson Stockbridge
Workshops, University of Adelaide

Sam Taylor
Sponsorship and Marketing, Gläshaus

Georgia Walden
Workshops, University of Adelaide

Sasha Whitmarsh
Social Events, Flinders University

Nikki Zanardo
Social Events, DEW

WELCOME FROM THE SCIENTIFIC COMMITTEE

After years of preparation the conference is now about to commence, and you can look forward to an exciting scientific program! On behalf of the Scientific Committee, I warmly welcome you at "Canyons to Coast".

We have been ambitious with the conference theme to develop a new perspective on the interconnectedness between the deep sea, offshore and coastal ecosystems. The diverse and full scientific program will look at this perspective from various angles, and deepen our understanding of patterns, processes and connectivity. The program is also integrating current issues arising from global warming, biosecurity and marine debris. Additional workshops held before, during and after the conference will enhance the practicality of novel approaches. The exhibition hub will give insight into latest technological advances. Together, the overall conference program can progress marine research as well as ocean and coastal management into the future.

The appeal of the conference theme had overwhelmed us, with an outstanding reply by the marine science community putting forward symposia and submitting abstracts. We have 15 symposia and five general thematic sessions, and >230 oral and 37 poster presentations. There has been real momentum in the planning stages and I sensed that the Scientific Committee and the symposium leaders were seeking a program with real potential for synergies and scientific advancement.

The symposium leaders have been heavily engaged in shaping the program, reviewing abstracts and attracting participation, and we thank them for all their commitment to an exciting scientific content. I also wholeheartedly thank all members of the Scientific Committee for their many ideas, hard work with symposia proposal and abstract reviews, program revisions, and coping with the flurry of conference emails.

This conference has attracted a diverse range of participants, and we welcome in particular the international participants from seven overseas countries. Thank you all for coming and contributing. There is a lot of content to explore at this conference, and plenty of opportunity to mingle and network. Enjoy!

Sabine Dittmann
 Scientific Program Chair



Scientific Committee

Prof Sabine Dittmann
 Chair, Flinders University

Dr Malcolm Clark
 NIWA, NZ

Dr Kathy Conlan
 Canadian Museum of Nature

Prof Martina Doblin
 University of Technology, Sydney

A/Prof Jochen Kämpf
 Flinders University

Dr Rachel Przeslawski
 Geoscience Australia

Dr Paul van Ruth
 SARDI Aquatic Sciences

Prof Thomas Schlacher
 University of Sunshine Coast

A/Prof Jody Webster
 University of Sydney

Dr Ryan Baring
 Chair Organising Committee,
 Flinders University

ABOUT AMSA



The Australian Marine Science Association Inc. (AMSA; www.amsa.asn.au) is Australia's peak professional body for marine science with near 1000 members from diverse disciplines and workplaces throughout all states and territories. For over 50 years AMSA has promoted all aspects of marine science in Australia as a membership network of professionals and corporate affiliates as a not-for-profit organisation. The 2018 organising committee and the SA State Branch are thrilled to be your hosts for the 55th AMSA Conference and we are pleased to invite you to Adelaide for what will be a showcase of a new era in Australian marine science.

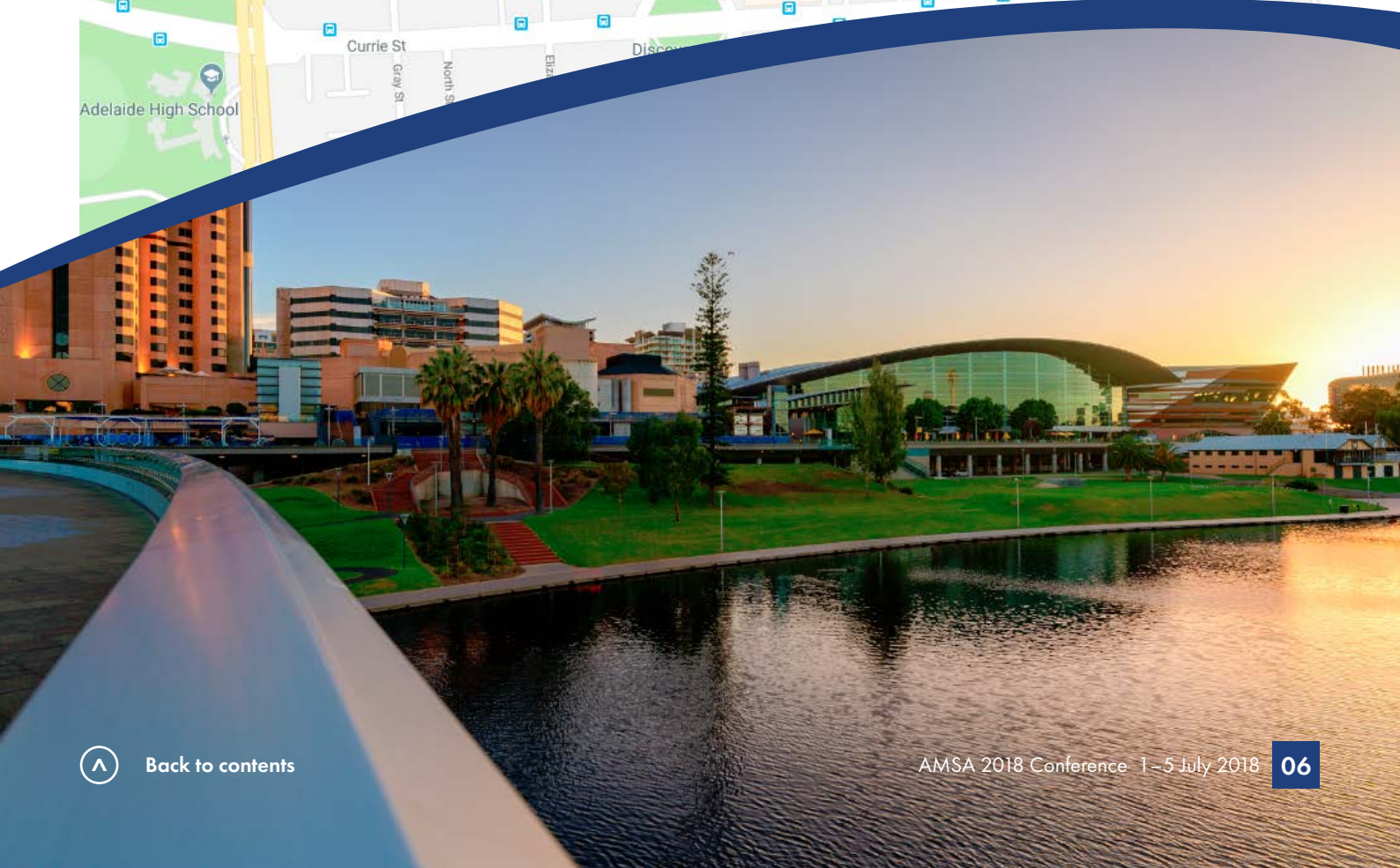
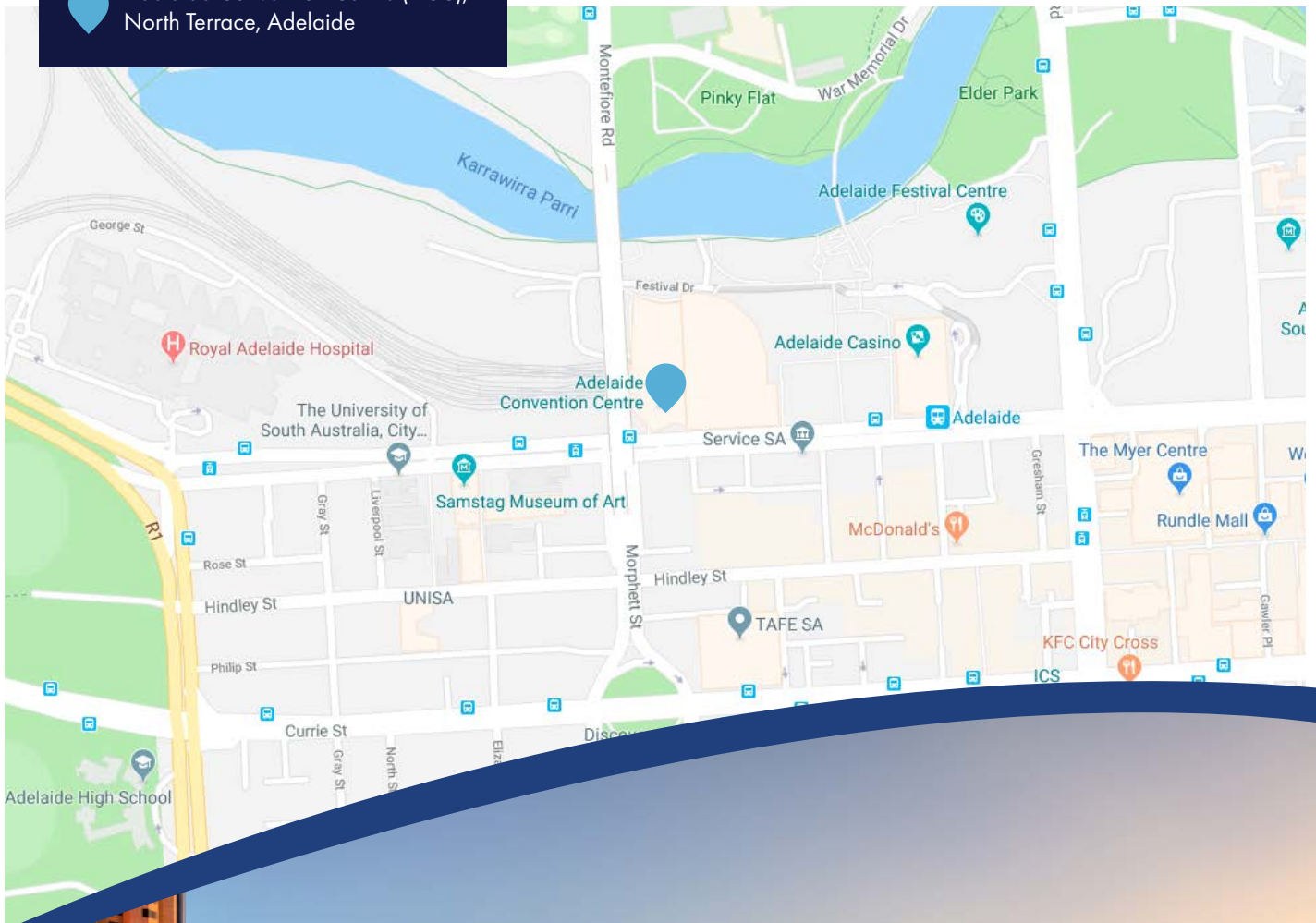
AMSA membership is open to those working and studying in all disciplines of marine science. Supporting AMSA through membership provides direct support for efforts in marine science research.

Membership Benefits

- 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

VENUE

Adelaide Convention Centre (ACC),
North Terrace, Adelaide



Venue floor plan

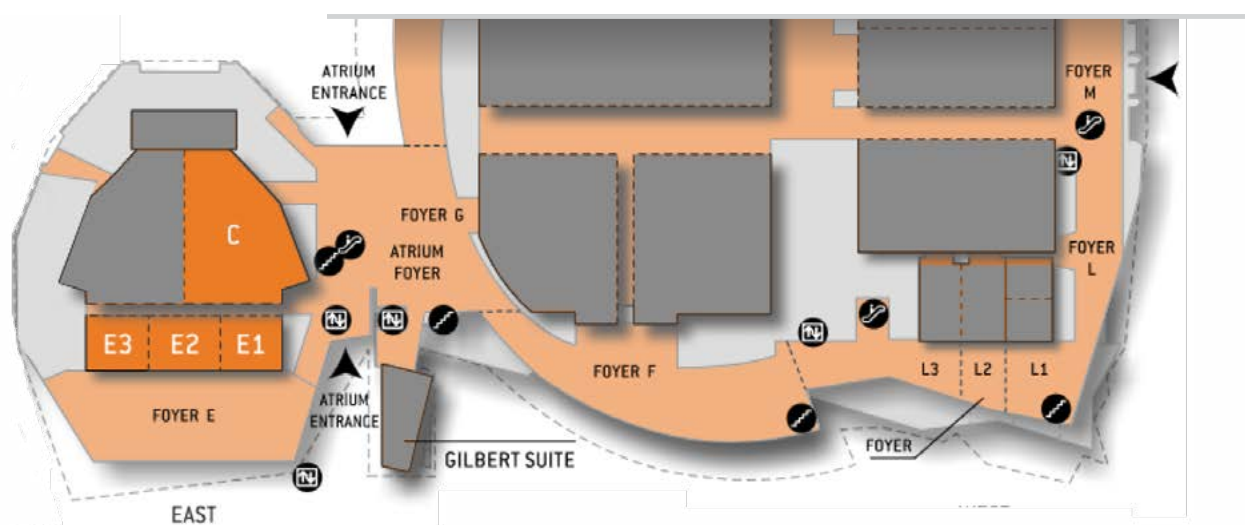
Upper level

Speaker preparation room	S1
Skyway breakout	S2
Gala dinner	Panorama Ballroom

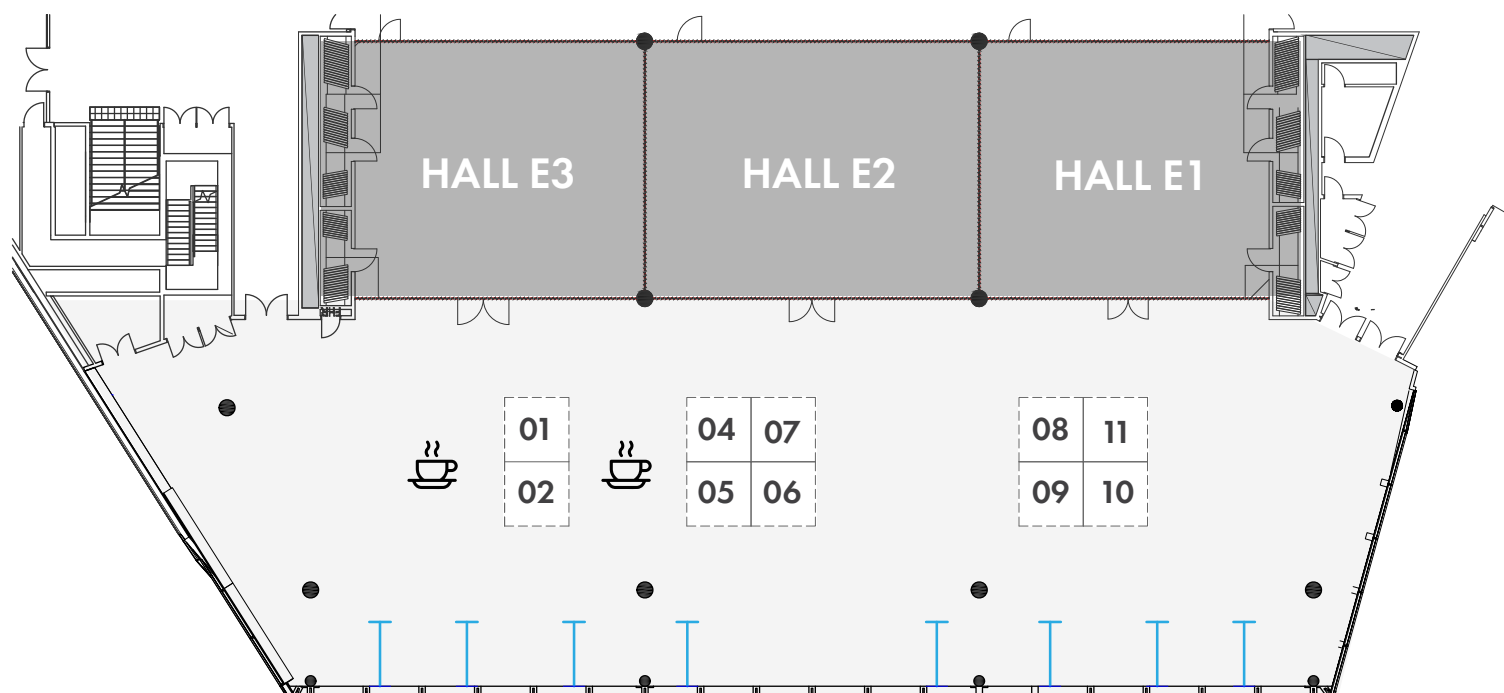


Ground level

Breakout rooms	E1, E2, E3
Exhibition and posters	Foyer E
Plenary	Hall C



Exhibition floor plan



01 TriOS environmental monitoring

02 CAPSTAN & MQMarine

04 IMBROS

05 CSIRO Publishing

06 MARINE NATIONAL FACILITY (MNF)

07 CSIRO Oceans and Atmosphere

08 Geoscience Australia

09 ONETEMP - HOBO DATA LOGGING SOLUTIONS

10 SA Marine Parks

11 Metocean Services Int. / RBR Ltd

SOCIAL AND SPECIAL PROGRAM ACTIVITIES

Welcome Function

Date: Sunday 1 July 2018
Time: 1800 – 1930
Dress: Smart casual
Inclusions: Food and beverages will be provided
Venue: Adelaide Convention Centre, exhibition hub

Thank you to SARDI, our official Welcome Reception sponsor



Joe Baker poster session

Date: Monday 2 July 2018
Time: 1830 – 2030
Dress: Smart casual
Inclusions: Limited canapes and beverages will be provided
Venue: Adelaide Convention Centre, poster display area

Thank you to AIMS, our sponsor for the Joe Baker poster session



Student and ECR Mentoring Night

Date: Tuesday 3 July 2018
Time: 1830 – 2100 - after 9pm anyone is welcome
Dress: Smart casual
Inclusions: Food and 1 drink provided on entry.
Venue: The Elephant British Pub, 1 Cinema Pl, Adelaide
Transfers: Will not be provided, please make your own way to the venue.

Thank you to Flinders University, our official sponsor for the Student and ECR Mentoring Night.



Coastal Conflicts

Date: Wednesday 4 July 2018
Time: 1830 – 2000
Inclusions: Food will not be provided, a cash bar will be available
Venue: The Science Exchange
55 Exchange Place, Adelaide
Cost: Free, but bookings are required. [Book here.](#)

Gala Dinner

Date: Thursday 5 July 2018
Time: 1830 – 2400
Dress: Cocktail
Inclusions: Dinner and drinks are provided. There will be a live band and award ceremony throughout the evening
Venue: The Panorama Ballroom, Adelaide Convention Centre

Thank you to NESP Marine biodiversity hub, our official gala dinner sponsor



CONFERENCE WORKSHOPS

Registration for workshops is required and can be booked through the conference [registration portal](#). The Marine science and meeting indigenous research priorities workshop on Monday is open to all delegates.

Sunday 1 July

Marine Biosecurity

Organisers: Dr Richard Stafford-Bell and Dr Craig Sherman

Time: 0830 – 1700

Location: The University of Adelaide

Description:

Responsibility for marine biosecurity is shared across government, industry, researchers and the community. Up to date knowledge and efficient information flow between sectors is essential to permit response if required and effective management or assessment of impacts. The aim of this workshop will be to identify key knowledge gaps in marine pest research that need to be addressed to provide a more coordinated approach to marine pest management.

The workshop will incorporate an overview session followed by smaller break out group discussions where participants will identify knowledge gaps and science priority needs. The output of these discussions will be incorporated into a submission to a peer-reviewed journal.

Marine Citizen Science: sharing successes and lessons for improved outcomes

Organiser: Jacqui Pocklington

Time: 1000 – 1600

Location: The University of Adelaide

Description:

Citizen science has taken off as a way for scientists to increase sampling effort while increasing science literacy and engagement of the public. There are however challenges to making it work for everyone. Practitioners and participants of marine citizen science projects/programs are invited to discuss successes, limitations, and lessons learned in order to: 1. learn from one another to work towards best practice models for different types of marine citizen science projects; and 2. develop guidance/frameworks for marine researchers interested in utilizing citizen science to answer research questions. Representation from a variety of projects/programs would be ideal.

3D Modelling for ecology: getting photogrammetry right in difficult environments

Organisers: Gus Porter, Marine Lechene and Tom Taylor

Time: 1400 – 1700

Location: The University of Adelaide

Description:

This workshop aims to:

- Introduce Photogrammetry (strengths and constraints)
- Develop hands-on experience with building 3D models, including the use of:
 - Software
 - Image capture
 - Building models
 - Trouble-shooting
- Tips and tricks to optimize the process for different environments
- Help participants brainstorm and refine application to their work

Workshop structure:

Introduction

Concepts behind photogrammetry. How to “think like an image-set”, what to expect of a model, and some common pitfalls to avoid. Model-building steps, explaining what happens in each. Guidance on image capture.

Hands-on model building

Participants capture their own images of provided objects (smart phone cameras will do). Build models as per instructions provided. Trouble-shoot! Resulting models will certainly not be perfect. Provide insight on what went wrong, and how to fix it. Participants can re-run models with updated photo-sets to look for improvement.

Optimizing for different environments

Photogrammetry is flexible, but needs to be optimized for different applications. Cover camera, lighting, and software settings for each of: Small objects (eg. Corals), large transects (eg. 1,000 m²), terrestrial, drones, micro-scale.

Open discussion

Specific questions, brainstorm, pointers, experiences.

Monday 2 July

Marine science and meeting indigenous research priorities workshop

Time: 1330 – 1800

Location: Adelaide Convention Centre, E3

Catering: Conference catering

Open to all conference participants

Description:

For the past two years a workshop focused on Indigenous Engagement has been held at the annual Australian Marine Sciences Association Conference. These workshops are aimed at promoting indigenous engagement in marine science by sharing information on successes and identifying what can be done to advance meaningful collaboration. This is the third workshop of the series and will focus on indigenous knowledge systems and nation research priorities. The key objective of the workshop is to provide information that will help form better relationships between researchers and Indigenous communities and facilitate bi-cultural research development. Focussing on temperate Australia, this workshop also aims to raise awareness among researchers, funding agencies and policy makers about the value and importance of including Indigenous knowledge and communities in marine science.

Time	Speaker	Presentations
1330-1340	Rodney O'Brien	Kaurna Welcome to Country
	Sarah-Lena Reinhold/ Paul Hedge	Workshop Introduction
1340-1350	Phil Duncan	Gomerioi Nation
1350-1405	Chelsea Marshall	Gumma Indigenous Protected Area and Australian National University
1405-1420	Emma Lee	University of Tasmania and Swinburne University
1420-1435	Emma Richards	Barngarla Aboriginal Corporation
1435-1450	Denis Rose	Gunditj Mirring Traditional Owner Aboriginal Corporation
1450-1515	Afternoon tea	
1515-1530	David Collard	Nyoongar Nation
1530-1545	Doc Reynolds	Tjaltjraak Native Title Aboriginal Corporation
1545-1600	Garry Goldsmith and Klynton Wanganeen	Narungga Nation Aboriginal Corporation
1600-1615	Daryle Rigney	Ngarrindjeri Regional Authority and Flinders University
1615-1630	Libby Evans-Illidge	Australian Institute of Marine Science
1630-1645	Traceylee Forester	Australian Institute of Marine Science
1645-1700	Short break	
1700-1800	Panel discussion	

Tuesday 3 July

National seabed mapping coordination workshop

Organisers: Kim Picard, Nathan Quadros and Daniel Ierodiaconou

Time: 1830 – 2200

Location: The University of Adelaide

Description:

The National Seabed Mapping Coordination working group is an open group of governments, universities and industry representatives (experts and non-experts) seeking to better coordinate seabed mapping data acquisition and submission (initially focusing on bathymetry, backscatter), in Australian waters. Since 2016, multiple initiatives have been identified that will help coordinate data acquisitions to encourage collaborations, data sharing and reuse of data. These include the development of a government priority map, a National Multibeam Acquisition Guideline, a dedicated website hosting various resources, planning and data management tools and a data portal. This workshop will introduce the initiatives and provide a progress update. We will work actively on initiatives, such as website content, a new in-development tool “QA4Bathy” which aim to simplify, standardise and automate the QA process for multibeam data, and we will discuss how Australia might best contribute to international initiatives such as Seabed 2030. We welcome to this workshop (and working group) all types of users of seabed mapping data as we seek active feedback and define future actions for the working group.

Wednesday 4 July

Challenges and solutions to measuring and demonstrating connectivity in Marine Protected Area (MPA) networks

Organisers: Dr Alice Jones, Alison Wright, Dr Simon Bryars and Dr Thomas Prowse

Time: 1800 – 2230

Location: The University of Adelaide

Description:

MPA networks are a widely used tool for protecting marine biodiversity. These networks are expected to support spatial and functional connectivity within and between individual MPAs - making networks more effective than single MPAs. The connectivity of an MPA network is critical to its ability to effectively protect the marine species, communities and ecosystems within it. However, the level of connectivity across an MPA network can be hard to measure, and the associated ecological benefits are difficult to demonstrate. We invite relevant experts, including scientists; researchers; stakeholders; policy makers; and, marine managers to join us in this workshop, where we will:

- Identify the main challenges and barriers to measuring connectivity across MPA networks.
- Highlight existing comprehensive and successful methods for understanding and quantifying connectivity within MPA networks.
- Generate a set of recommendations for solutions to the challenges of measuring and demonstrating connectivity for the purposes of assessing MPA network effectiveness.

This workshop is related to the panel discussions coming out of a symposium (S11) being chaired by Alison Wright and Simon Bryars titled 'Marine biodiversity conservation – what's effective?' We aim to produce a collaborative review/perspectives paper from the outputs of this workshop.

CBiCS – road-testing a new marine ecological classification scheme

Organisers: Dr Adrian Flynn and Dr Matt Edmunds

Time: 1830 – 2130

Location: The University of Adelaide

Description:

Marine ecological classification and 'habitat mapping' is required to enter a new phase of sophistication and standardisation to provide adequate metrics for decision support and to deal with the volumes of data generated by new sensing technologies. This workshop will introduce CBiCS, a new marine ecological classification scheme developed for the state of Victoria and rolling out across several Australian and International jurisdictions. The workshop will seek to 'road-test' the classification scheme. We will actively seek feedback by prospective end-users in the areas of research, natural resource management, NGOs and community. We will establish an objective testing and feedback-capture process to report on workshop results. For the \$10.00 entry fee, each participant will receive a USB drive with instructional training materials.

Friday 6 July

Marine National Facility data management policy - consultation workshop

Organisers: Ben Rae and Carolyn Seelen

Time: 0830 – 1230

Location: The University of Adelaide

Description:

The new research vessel Investigator has brought with it an enhanced suite of fixed and modular equipment and an improved capacity to integrate user supplied equipment. As a result, the diversity and volume of data being collected on-board has increased substantially. The MNF has identified the opportunity to review the current MNF Data Policy to better reflect the new operating paradigm, and this consultation workshop will seek input and identify opportunities to improve the relevance and applicability of this policy for our key stakeholders. A Draft Revised MNF Data Policy will be released for comment prior to the conference.

Paper accepted! Now what? Find your way to real impact using animation video and graphics

Organiser: Dr Tullio Rossi
Time: 0900 – 1300
Location: The University of Adelaide

Description:

After attending this workshops, you'll possess all the theoretical and practical knowledge necessary to turn your research into a simple and beautiful animation video. In addition to learning how to use animation software, you'll also benefit by learning the key principles of storytelling and communication through graphics. This workshop is sure to inspire and empower you to positively impact the world with your science

- This workshop is built around the case study of the three-time award-winning video "Lost at Sea."
- Learn how to turn your science into a simple story that connects with your audience.
- Learn an easy-to-use and affordable animation software.
- No graphic design skills? No problem! You'll create your masterpiece with a user-friendly and affordable animation software.

Recreational fishing in Commonwealth waters

Organisers: Dr Tim Lynch and Carlie Devine
Time: 1030 – 1630
Location: The University of Adelaide

Description:

Australia's recreational fishing sector is moving further offshore in pursuit of fishing opportunities, which places them in areas managed by the Australian Government. As recreational fishers are key stakeholders in marine management a better understanding of their motivations and values are required to effectively inform administration of the EPBC Act – such as effects on Matters of National Environmental Significance – use of Australian Marine Parks and Commonwealth managed commercial fisheries. Most recreational fisheries research is state based and we will both assess and contrast the general utility of existing state datasets from WA and NSW for quantifying recreational fishing in adjacent Commonwealth waters. At two case study sites – the Hunter and Ningaloo AMP – we will also test if state data can be downscaled to example areas of interest.

How to access and use IMOS data for your research

Organiser: Craig Steinberg
Time: 1000 – 1700
Location: The University of Adelaide

Description:

Since 2006, IMOS has been routinely operating a wide range of observing equipment throughout Australia's coastal and open oceans, making all of its data accessible to the marine and climate science community, other stakeholders and users, and international collaborators. This workshop is to assist the scientific community to discover, access, download, use and understand the potential of the data. Presentations will be made by key leaders responsible for the collection and dissemination of the data with examples of how they have used the data sets to further their research. Hands on guided tutorials will show how the AODN portal can be used and a summary of tools that are available to analyse the data.

For more information [click here](#).

Prepare high quality applications for sea time on the Marine National Facility Research Vessel Investigator

Organisers: Ben Rae and Carolyn Seelen
Time: 1330-1530
Location: The University of Adelaide

Description:

The introduction of the multidisciplinary research vessel Investigator has attracted an increase in demand for the limited time available on the ship. Applications for sea time are assessed by the National Benefit Assessment Panel (NBAP) and the Scientific Advisory Committee (SAC) against specific criteria. This workshop will provide the scientific community the opportunity to hear from a panel of members of the SAC, NBAP, MNF Steering Committee members and previously successful Chief Scientists who will convey what constitutes a high quality application; provide a greater understanding of the evaluation criteria; describe how applications are assessed; and, share examples of successful proposals.

KEYNOTE SPEAKERS



Dr Gary Greene

Director
Tombolo

Dr Gary Greene is a marine geologist/geophysicist specializing in seafloor mapping, geohazards assessment, and marine benthic habitat characterization. Gary obtained his undergraduate degree in paleontology at Long Beach State University, a Master of Science degree in geophysics at San Jose State University, and a PhD in marine geology at Stanford University. He was a research geologist at the U.S. Geological Survey for 28 years after which he retired to become the Director of Moss Landing Marine Labs where he established the Center for Habitat Studies and taught geological oceanography and marine benthic habitat mapping techniques for over 12 years. Presently, Gary is Director of a small research institute on Orcas Island called Tombolo that is partially supported by the SeaDoc Society and private donors, and is a Research Scientist at Friday Harbor Labs of the University of Washington. For the past 30 years Gary has been mapping the seafloor of Alaska, California and the San Juan Archipelago including British Columbia, Canada for the purpose of characterizing benthic habitats, extending land and island geology to the offshore, and assessing marine geohazards such as identifying and mapping submarine landslides, tsunami generation sites, and active faults.

Abstract

Geology makes a difference – canyons, faults, and glaciers as main components in marine benthic habitat characterization

Oceanographic processes are one of many factors that control marine ecological environments. These processes are complex and on the seafloor are dependent upon circulation pathways controlled by geomorphology. However, other natural factors such as depth, nutrient sources, temperature, current strength, predator-prey relationships, refugia, recruitment areas, to mention a few, are all critical in the formation and maintenance of healthy marine benthic habitats. But the one major deterministic component of these habitats is geology. Geology and geologic processes “set-the-stage” for habitats and their ecological associations. For example, submarine canyons, gullies, and faults are features that play a major role in sourcing and transferring nutrients, providing hard and soft substrates for biological attachment and burrowing, and for concentrating the food web from plankton to the largest marine mammals. Glacial moraines, eskers, dead-ice banks and fiords also influence these processes and provide good benthic habitats. The role that canyons, faults, and glaciers play in habitat characterization will be discussed from a west coast North American (NE Pacific) perspective using Monterey Canyon, the San Juan Archipelago, and the Queen Charlotte-Fairweather transform fault system as examples. In addition, as Australia generally lacks glacial features, emphases will be placed on submarine canyons, which predominate on the shelf and slope of the continent, and the critical benthic habitats they provide will be examined in light of canyons along the west coast of North America.



Professor Gretta Pecl

Professor

IMAS and Director
of Centre for Marine
Socioecology

Gretta Pecl is a Professor of marine ecology with broad interdisciplinary research interests and a passion for science engagement and communication with the public. Much of her current research centres around understanding climate change impacts in marine systems, and how our marine industries and communities may best adapt to these changes. She developed and leads the very successful national citizen science project Redmap Australia, the Range Extension Database and mapping project, which invites fishers and divers around our coastline to help monitor changes in our seas. Gretta is also currently working with international colleagues on a Global Network of Marine Hotspots to facilitate learning and communication among the world's most rapidly warming ocean regions. Professor Pecl is a Fulbright Fellow, an ARC future fellow, a University of Tasmania 'Rising Star' and the Editor-in-Chief of the international journal *Reviews in Fish Biology and Fisheries*.

Abstract

Addressing key questions for climate-driven species redistribution requires integration of ecology, conservation and social science

Climate change is driving a pervasive global redistribution of the planet's species, with manifest implications from genes to ecosystems across multiple temporal and spatial scales. Species redistribution defies conservation paradigms that focus on restoring systems to a baseline and challenges management strategies, which are often static and based on human-dictated boundaries drawn in the past. Likewise, changes in distribution of marine resources create difficulties, particularly when species cross jurisdictional boundaries and where historical catch rates and assessment processes may no longer be appropriate. Moreover, we are still a long way from understanding the suite of mechanisms and processes underlying the high variation in rate and magnitude of shifts. Building on that uncertainty, we have even less understanding of how species redistribution will drive changes in ecological communities and further complicate aspirations of ecosystem-based management. Climate-driven species redistribution therefore presents intriguing ecological challenges to unravel, as well as fundamental philosophical questions and urgent issues related to conservation, food security, Indigenous and local livelihoods, and many other aspects of human well-being. This presentation will highlight some of the key questions for climate-driven species redistribution in marine systems in the context of ecology, conservation, natural resource management and social science. Understanding range shifts from ecological, physiological, genetic and biogeographical perspectives is essential for informing and designing conservation and natural resource management strategies for a changing future. However, for species redistribution research to support development of relevant adaptive strategies and policy decisions adequately, studies need to take an interdisciplinary approach and must recognise and value stakeholders.



Professor Matthew England

Deputy Director
UNSW Climate Change
Research Centre

Matthew England is an Australian Research Council Laureate Fellow and Deputy Director of the UNSW Climate Change Research Centre (CCRC) as well as being a Chief Investigator in the ARC Centre of Excellence for Climate System Science. In 2014 England was elected a Fellow of the Australian Academy of Science. In 2016 he was elected a Fellow of the American Geophysical Union. England is a former Fulbright Scholar and CSIRO Flagship Fellow, and winner of the Royal Society of Victoria Research Medal, 2007; two Eureka Prizes (Environmental Research, 2006; Land and Water, 2008); the 2005 AMOS Priestley Medal and the Australian Academy of Science Frederick White Prize, 2004. He was recently awarded with the Tinker-Muse Prize for Science and Policy in Antarctica (www.scar.org/2017/1149-england-2017-muse-prize). England coordinated and led the 2007 “Bali Climate Declaration by Scientists”; a major international statement by the scientific community that specifies the reductions in greenhouse gas emissions required to minimise the risk of dangerous human-induced climate change. England was the convening lead author of the 2009 Copenhagen Diagnosis. He is currently co-chair of the CLIVAR Southern Ocean panel, and was a contributing author and reviewer of the Intergovernmental Panel on Climate Change (IPCC) Second and Third Assessment Reports. England’s expertise covers the physics of the oceans and their role in climate variability and climate change.

Abstract

Drivers of recent oceanic trends around Antarctica from the surface to the abyss

Despite unequivocal global warming, Southern Ocean surface waters have largely cooled over the past ~40 years and Antarctic sea ice has expanded, in stark contrast to almost all historical climate model simulations. The Southern Ocean surface cooling is nearly circumpolar, except notably in the Amundsen-Bellingshausen Sea, where rapid warming and sea-ice retreat has been observed. In contrast to the overall surface cooling around Antarctica, subsurface ocean warming has been observed, both over the Antarctic shelf and in the abyssal ocean layers ventilated by Antarctic Bottom Water. The shelf water warming threatens to drive catastrophic retreat of Antarctica’s marine-terminating ice sheets, resulting in accelerated global sea-level rise. The bottom water warming likely indicates a slowdown of the overturning of dense water around Antarctica, with implications for the global cycling of heat and nutrients by the oceans. This talk will present an overview of the processes that have led to these oceanic temperature trends around Antarctica, and give an outlook of expected changes over the coming decades.



**Dr Ashley
Rowden**

Principal Scientist
NIWA

Ashley's research interests are focused on the question – What drivers or processes control and maintain biodiversity in the marine environment? Specifically, he is interested in examining the relationship between the biodiversity of seafloor fauna and habitat heterogeneity, productivity and disturbance. To address such questions Ashley has been involved in research in a number of marine habitats from the intertidal to the deepest depths in the oceans. Some of his research has concerned applied aspects of marine science. Such as determining the effects of fishing, aquaculture and seabed mining on seafloor fauna, and the production of environmental classifications, habitat suitability maps, and ecological risk assessments for conservation and management purposes.

Abstract

Disturbances to deep-sea communities: comparing earthquake triggered mass sediment transport to deep-seabed mining

Earthquakes have the potential to trigger submarine mass transport processes that transfer substantial amounts of sediment and organic carbon from the continental margin to deep-sea environments. This presentation will review the evidence that such events have had a significant and persistent impact on deep-sea community structure and function across the world's oceans. While long-recognised, a detailed understanding of these impacts has been thwarted by the rare opportunity to study benthic communities soon after the occurrence of large mass transport events. An earthquake in New Zealand in November 2016 provided for such an opportunity. The earthquake caused significant local and regional ground-shaking that resulted in submarine mass slope failure in the Kaikōura Canyon and the devastation of one of the world's most productive benthic ecosystems. This event also led to the initiation of a turbidity current and the deposition of sediment >600 km from source at abyssal depths. A series of cores, grabs and camera transects were collected in Kaikōura Canyon itself, and along the path of the turbidity current in the Hikurangi Channel. Data from this sampling were compared to data collected from previous samples in Kaikōura Canyon, which allowed for the quantification of the initial physical and chemical effects on the seafloor environment, including carbon sequestration, as well as changes in benthic community structure. The impacts of earthquake-triggered mass transport events are likely to be similar to those caused by the activities of proposed deep-seabed mining. The last part of the presentation will draw parallels between the two types of disturbances, and based on what we know about the effects of earthquake-initiated events, consider with what confidence we can predict the extent of the local and regional impact on biodiversity from any future seabed mining.

AWARD WINNERS



Professor David Bellwood

Distinguished Professor of
Marine Biology
College of Science and
Engineering
ARC Centre of Excellence
for Coral Reef Studies at
James Cook University

2018 Jubilee Award winner

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

Distinguished Professor David Bellwood is the world's foremost expert on the evolution and functional ecology of coral reef fishes. He received his PhD from James Cook University and is currently a Distinguished Professor of Marine Biology in the College of Science and Engineering and the ARC Centre of Excellence for Coral Reef Studies at James Cook University. Bellwood's pioneering work on coral reef ecosystem function has firmly established him as the preeminent researcher in this expanding research field, not just in Australia, but globally. His findings have revolutionized our understanding of the evolution of coral reefs, the global ecology of reef systems, and their capacity to withstand human impacts. He has contributed a host of now standard methodologies to the field including fish capture and swimming performance assessment techniques and has defined novel functional groups with his work linking feeding morphology to functional roles of coral reef fishes. His work spans paleontology, molecular biology, and social-ecological systems. It would not be an understatement to suggest that Distinguished Professor Bellwood has led the charge in working out how coral reef ecosystems function and what we have to do to maintain them.

Abstract

Fishes, Functions and the Future of Coral Reefs.

Coral reefs are one of the world's most iconic marine systems characterized by spectacular taxonomic and functional diversity. Today, coral reefs are changing fast as anthropogenic pressures reconfigure reef ecosystems. In this new world, fishes will play a central role. It is now widely accepted that it is the ecology of fishes, and more specifically, their functional roles that are important for the survival of aquatic ecosystems. As primary targets for fisheries, fishes represent one of the critical services that reefs provide for people. At the same time, fishes are a key component of reef ecosystems mediating critical benthic interactions. In my talk, I will first explore the roles of fishes and how they have shaped marine ecosystems, especially coral reefs, over the last 300 million years. I will then explore how fishes came to dominate modern coral reefs. Their greatest contribution, however, is still to come. That is, the role they will play in determining the future of coral reefs. The global loss of corals has resulted in coral reef ecosystems that are fundamentally different to anything we have encountered before. Our studies suggest that it will be the fishes not the corals that will drive many of the critical processes on coral reefs in the future. If we are going to steer reefs through the Anthropocene, fishes are going to be our most important guides and allies.



Francesca Gissi

PhD Candidate
University of Wollongong

2018 Allen Award winner

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.

Francesca Gissi is a PhD student in her final year at the University of Wollongong. Francesca is studying the effects of metals on scleractinian corals which are keystone species forming vital structural habitats that support other biota. The paper "Alterations in the coral microbiome following exposure to metals", which she will present at the AMSA 2018 Conference describes a study that investigated the effects of dissolved nickel and copper on the coral *Acropora muricata*.

Abstract

Alterations in the coral microbiome following exposure to metals

The potential impacts of mining activities on tropical coastal ecosystems are poorly understood. There is limited information available on the effects of metals to scleractinian corals which are keystone species forming vital structural habitats that support other biota.

This study investigated the effects of dissolved nickel and copper on the coral *Acropora muricata* and its associated microbiota at the National Sea Simulator. Four replicate flow-through chambers were established including controls, 50 -10000 µgNi/L and 5-100 µgCu/L. Each chamber contained 3 coral fragments (5-8 cm in length) collected from the GBR. After 96-h metal exposure, corals were air-blasted to remove tissues and flash frozen. Tissues microbiota were DNA sequenced (16S and 18S) to observe changes in the structure of the microbiome.

Control treatments remained healthy throughout the exposures. After 36 h, bleaching was observed in corals exposed to 50 and 100 µgCu/L and 10000 µgNi/L. At 96 h significant discolouration of corals was observed in 500 and 1000 µgNi/L treatments. Copper caused significant changes to both the eukaryotic and bacterial communities, while Ni appeared to have no significant effect on the microbiome. Effects were only observed at very high Ni and Cu concentrations, well above those likely to be encountered in marine systems.

AMSA AND EXTERNAL STUDENT PRIZES

Each year at the annual AMSA conference, student prizes are awarded to the most outstanding oral and poster presentations in a number of categories.

AMSA prizes



The Ron Kenny Prize (talk & poster)

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 (talk)

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 AMSA 2004 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.



Ernest Hodgkin Estuary Research Award (talk or poster)

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.

External prizes



Sea World Research & Rescue Foundation Prize (talk & poster)

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 Talk and Best Student Poster in the area of Science and Conservation of Marine Vertebrates. The winning student for oral presentation must provide a brief summary (<300 words) of the presentation/project suitable for general public audiences and the winning student for poster presentation must agree to their poster being included 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 (talk & poster)

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. 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.



Diversity Journal Award for Coral Reef Research (talk & poster)

Diversity is an international and interdisciplinary open access journal published quarterly online by MDPI. Focused on diversity; concept, assessment and preservation from the molecular through to the organismic. The journal encourages scientists to publish experimental and theoretical results with extensive detail and no restriction on length of papers. The journal also has a focus on marine diversity, with recent highlights in the theme of Coral Reef Research. For the first time at an AMSA conference, Diversity will be awarding student prizes for the best talk and poster on Coral Reef Research.



RBR Award for Innovative Marine Science (poster)

RBR are a global company that design and produce innovative instruments for measuring the blue planet. Their products are widely used from the deepest depths of the ocean through to coastal and polar research. With a range of sensors and loggers for measuring many water parameters, RBR instruments are built on a modular platform for rapid customisation to scientists needs. For the first time at an AMSA conference, RBR will be awarding a student prize for the poster which best highlights the use of Innovation in Marine Science.

Eligibility

- Must be a current financial student member of AMSA during the conference
- 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
- 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, 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 photographs provided by institutions or external agencies will not be a major consideration;

Award rules

- The presentation and poster 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
- 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*.

AMSA 2018 SYMPOSIA AND GENERAL SESSION THEMES AND INFORMATION

S1 Cross-shelf exchange processes

Symposium led by: Ana Redondo Rodriguez (SARDI Aquatic Sciences) & Jochen Kämpf (College of Science & Engineering, Flinders University)

On continental shelves, cross-shelf circulations influence the distributions and transport of heat, salt, phytoplankton, nutrients, and pollutants and can have a profound impact on coastal ecosystems. The mechanisms for such exchange can involve that driven by winds, flow across canyons, bottom boundary layer transport and cooling and evaporation. We invite abstracts focussed on cross-shelf circulation, how this relates to continental shelf properties and ecosystem responses including connectivity and larval transport. We invite contributions focusing on interdisciplinary techniques, comparisons of models with observations, and specific case-studies.

S2 Extremes: causes, symptoms, and impacts

Symposium led by: Jochen Kämpf (College of Science & Engineering, Flinders University) & Andrew Marshall (Bureau of Meteorology)

This symposium, partnered with the Australian Meteorological and Oceanographic Society (AMOS), features extreme events and their impacts on marine ecosystems via a sudden and intermittent change of physical and/or biogeochemical environmental conditions. Extreme events are traditionally defined as rare, intense and severe weather phenomena such as heat waves, droughts or tropical storms. While those events can directly affect marine ecosystems, recent research reveals that the sea has its own extreme events. An example are oceanic heat waves that can be triggered without their atmospheric counterpart. Alternatively, we may define an extreme event indirectly via its symptoms, such as an unexpected ecological catastrophe or regime shift, as a basis to investigate and identify possible causes. For this symposium, we welcome any presentation shedding light on extreme events – their causes, symptoms, and impacts.

S3 Seafloor mapping in Australia - progress, discoveries, applications

Symposium led by: Kim Picard (Geoscience Australia) & Daniel Ierodiaconou (Deakin University)

Australia's seabed is largely unexplored, with less than 30% of the entire seafloor mapped at high resolution. The need for improved mapping coverage of the seafloor to deliver integrated products that describe bathymetry, geology and habitat, is essential to identify marine resources, assess geologic hazards, characterise biodiverse and vulnerable environments, create baselines for monitoring change, and generate knowledge to inform policy. Recent seafloor mapping progress has been achieved through new initiatives for collaboration and co-ordination, and the development of standards for acquisition. This session invites contributions on all aspects of seabed mapping that report on (i) recent co-ordination and collaboration initiatives, (ii) recent mapping efforts to support marine science, (iii) new insights into seabed habitat types and distributions, and (iv) new knowledge on seabed processes and geohazards.

S4 Advances in marine ecological classification

Symposium led by: Matt Edmunds (Australian Marine Ecology); Adrian Flynn (Fathom Pacific) & Lawrance Ferns (Department of Environment, Land, Water and Planning, Victoria)

A new era of marine biotope mapping and monitoring is required to deal with the biodiversity management and research objectives of the 21st Century and the high volumes of imagery and data generated by modern methods. The requirements for spatial management, monitoring of biodiversity, community states and health, ecosystem services and application of environmental accounting have evolved in recent years. To meet these needs, classification schema are required that unify the processes of setting ecological information needs, data collection, processing pipelines and mapping. Concurrent developments in the area of underwater robotics, that have facilitated increased efficiency of data collection at higher resolution and over larger areas, need to dovetail into such schema if those efficiencies in data collection are to translate to efficient ecological interpretation and decision-making. One scheme recently developed is the Combined Biotope Classification Scheme designed to provide such unification and be applicable to all marine habitats. This symposium aims to bring workers in marine classification systems together to present recent advances and explore the implications and benefits of various classification schema and biotope assessment approaches.

S5 Structure and function of coral reefs in a changing world

Symposium led by: Morgan Pratchett, Tory Chase & Andrew Hoey (ARC Centre of Excellence for Coral Reef Studies, James Cook University, Townsville)

Coral reefs are one of the world's most biodiverse and productive ecosystems, yet they are also one of the most threatened. Local anthropogenic stressors are being greatly compounded by climate change, and leading to changes in the structure and function of coral reefs in Australia and globally. Understanding how reef populations and communities are responding to current stressors, and how these vary spatially will be critical in predicting future trajectories for coral reefs. We invite presentations that focus on any aspect of coral reefs ecology, but particularly encourage presentations that consider the impacts of various disturbances and threats to the biodiversity, productivity or function of coral reef ecosystems.

S6 Linking disciplines to advance mechanistic insights of species responses to climate change

Symposium led by: Asta Audzijonyte, Michael Oellermann & Greta Pecl (Institute for Marine and Antarctic Studies, University of Tasmania)

Marine species from shallow to deep waters, are facing warmer, more acidified and oxygen depleted oceans, already causing rapid changes in species distributions, interactions and ecosystem function. Yet, species responses to environmental change and the likely ecosystem changes remain challenging to predict due to an insufficient mechanistic understanding of the underlying processes. Will oxygen limitation in warming water affect the energy budgets, growth and reproduction of marine species? How can we integrate acclimation, genetic adaptation, biotic interactions and multi-level species traits into future predictions? Which species traits and environmental factors matter? How do we account for temperature variability and extremes in experiments and models? What are the likely implications for population productivity, community resilience and fisheries management? To make reliable predictions of climate change on marine ecosystems and to devise best management practices it is imperative to improve the mechanistic understanding through active interdisciplinary dialogue. This session aims to bring researchers from disciplines of physiology, ecology, genetics and modelling to discuss mechanisms that determine marine organism responses to climate change from individual to community level.

S7 Micro- to Macro-: connecting multi-scale climate change research in marine systems

Symposium led by: Karlie McDonald, Alistair Hobday, Peter Thompson & Beth Fulton (CSIRO Oceans and Atmosphere, Hobart)

The effects of anthropogenic global environmental change on biotic and abiotic processes have been reported in marine 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 temporal scales. The multi-scale study of climate change in marine systems is further complicated by the connectivity in space, time and levels of biological organisation inherent in marine systems. For example, understanding climate induced shifts in: species range distributions (e.g., movement of tropical species into warm temperate regions), migration behaviour of anadromous, catadromous and amphidromous species between coastal environments and the ocean, or the dispersal range of plankton with altered currents all require scientists to conduct research and integrate knowledge across multiple scales and between different disciplines. The objective of this session is to integrate scientific knowledge of climate induced change on marine systems through the presentation of innovative research and technologies covering multiple spatial, temporal and biological scales from laboratory to global analysis and biological scales including individual cells and species to ecosystems. In addition to showcasing the state of marine climate research across multiple scales and disciplines, the session will discuss the possible future development of interdisciplinary climate change science in marine systems.

S8 Marine microbes as mediators of ocean processes

Symposium led by: Gustaaf M. Hallegraeff (Institute for Marine and Antarctic Studies, University of Tasmania), Alison Turnbull (SARDI-PIRSA) & Martina A. Doblin (University of Technology, Sydney)

Marine microbes underpin all of the production-based ocean ecosystem services, and impact on human health and wellbeing through their regulation of climate, formation of harmful algal blooms (HABs) and support of biodiversity at multiple dimensions and trophic levels. Changes at the base of the foodweb will therefore have far-reaching consequences on the delivery of ocean ecosystem services, worth over \$42 billion dollars in Australian waters annually. This symposium invites presentations on microbial diversity and function across marine ecosystems, highlighting new experimental, observational, and modeling approaches to understand the ecological and biogeochemical roles of these critical organisms.

S9 Genomics of marine organisms: contributions to ecology and evolution

Symposium led by: Luciano Beheregaray (Flinders University) & Joey DiBattista (Curtin University)

Recent technological advances in genomics now allow the collection of powerful data for ecologically and commercially important species. Genomic studies (i.e. the study of hereditary information based on 1000s of DNA markers or full genomes) provide fundamental and general insights into the complex biology of living organisms. As such, they have advanced biotechnology and also informed on the ecology, conservation management and evolution of both model and non-model organisms. Genomic information provides unprecedented resolution for a range of needs and applications in marine ecology, fisheries management, aquaculture, biogeography and taxonomy. Integrative genomic approaches can also be used to clarify how aquatic organisms adapt to their environment and how they might respond to localized or global changes triggered by human activities. This symposium will provide a forum for discussions about the application and integration of genomic information in ecological and evolutionary studies of marine organisms.

S10 Marine biosecurity in an increasingly-connected world: protecting Australia from marine pests and diseases

Symposium led by: James Lavender & Brett Herbert (Department of Agriculture and Water Resources, Canberra), Richard Stafford-Bell (Department of Economic Development, Jobs, Transport and Resources, Victoria) & Craig Sherman (Deakin University)

Rapid globalisation and increasing maritime trade has led to a significant increase in the rate of introductions of marine pests globally. These species do not recognise national and international borders requiring a collaborative approach to their management. Responsibility for marine biosecurity, which aims to minimise the risks posed by marine pests, as well as aquatic diseases, is shared across government, industry, researchers and the community. Information flow between sectors is essential to permit response if required and effective management or assessment of impacts. Australia's marine biosecurity is underpinned by a strong foundation of scientific research, but the risks posed by marine pests and disease are dynamic. This symposium seeks to derive shared understanding of the current direction, ecological and economic impacts, and future considerations for marine biosecurity in Australia. It will provide an exciting opportunity for scientists to demonstrate the real world applicability of their research, with a focus on practical and novel means of minimising the risk of pest and disease introduction, establishment, spread and impact. National co-operation in scientific research, that improves our understanding of marine pests and diseases, is at the core of Australia's efforts to effectively and efficiently reduce marine biosecurity challenges.

S11 Marine biodiversity conservation – what's effective?

Symposium led by: Alison Wright & Simon Bryars (Department for Environment, Water and Natural Resources, South Australia)

Ever since marine protected areas (MPAs) were first introduced, a debate has been held on the most effective tool for marine conservation. Demonstrating that MPAs are still considered an effective approach for marine conservation, an international target of 30% of habitats protected in IUCN category II Zones (high protection zones) was set in 2015 and supported by marine scientists and the IUCN. However, there is still debate amongst marine experts and managers on the merits of marine protected areas and on what management tools are effective for biodiversity conservation. Are marine protected areas the most effective tool? What is limiting them from being effective? Do we just need good fisheries management? Is integrated spatial planning and management the tool of the future? What do we know about best practice to conserve our marine biodiversity? We invite relevant experts, including: scientists; researchers; stakeholders; policy makers; and, marine managers to submit abstracts on their experiences in managing marine biodiversity conservation within and beyond national jurisdiction. The talks will be followed by a panel discussion on the outcomes from the day; the roles played; and the tools used to deliver effective marine biodiversity conservation.

S13 From sea to coast – marine mammals in a connected world

Symposium led by: Rebecca McIntosh (Philip Island Nature Parks); Simon Goldsworthy (SARDI Aquatic Sciences) & Jan-Olaf Meynecke (Griffith Centre for Coastal Management)

Marine mammals are connecting land and sea and occupy a wide range of habitats. Their migratory behaviour often poses great challenges to study these animals and albeit their often iconic character, knowledge about their whereabouts is still limited. They are exposed to a range of challenges including impacts from anthropogenic activities such as shipping, fishing, exploration, pollution and climate change but have also found ways of adapting to impacts. New techniques are being used to shed light on the migration, adaptation and behaviour of marine mammals such as seals, sea lions, orcas, southern right and humpback whales in Australian waters setting worldwide standards. Contributions that discuss emerging scientific information, novel methodologies and cross-disciplinary threat abatement for marine mammals will be welcomed.

S14 Assessing and mitigating ecosystem effects of fishing and aquaculture

Symposium led by: Simon Goldsworthy & Alice Mackay (SARDI Aquatic Sciences)

Ecosystem based fisheries management (EBFM) considers the effects of fishing on the whole marine ecosystem. To inform this approach, techniques are required to identify and monitor impacts and develop measures to mitigate both direct and indirect effects of fishing. Wild fisheries can directly impact habitats, interact with non-target species and affect the function of the broader marine ecosystem. Information on bycatch of threatened, endangered and protected species are required to develop measures to mitigate interactions and impacts on their populations. Aquaculture can impact benthic habitats and species assemblages, and the nutrient load in the environment. Ecosystem models can be used to assess the impact of fisheries on ecosystem productivity and simulate ecosystem responses to different fisheries management strategies. These models also provide a means of assessing indirect effects of fishing such as competition with marine predators. Presentations relating to the assessment, mitigation or modelling of the ecosystem effects of fishing and aquaculture are welcome.

S15 Aquaculture blue economy

Symposium led by: Xiaoxu Li, Steven Clarke, (SARDI Aquatic Sciences) & Kate Rodda (PIRSA Fisheries & Aquaculture)

In 2014, for the first time the aquaculture contribution to the supply of fish for human consumption overtook that of wild caught fish in the world. Aquaculture has also been the fastest growing animal-food-producing sector over the last few decades. Therefore, it has been considered as the key sector to address one of the greatest challenges in the world - how to feed more than 9 billion people by 2050. In Australia, the new national aquaculture strategy aims to double the value of the aquaculture industry to \$2 billion per annum by 2027, meaning that the annual production will have to grow by 7% over the next ten years. This expansion will need to occur in an environmentally sustainable and socially responsible manner. The Aquaculture Blue Economy symposium will address the latest aquaculture developments in Australia, including policy and natural resource management, cutting-edge innovations to diversify and improve production and productivity, nutrition and sustainable feeds, disease and pest management, genetics and molecular technologies, environment assessment and monitoring, environmental modelling and forecasting, and social and economic impacts.

S16 Marine Debris: the world-wide pollution crisis acting on local to global scales

Symposium led by: Peter Davies, Edwina Foulsham (NSW Office of Environment and Heritage) & Stephen Smith (National Marine Science Centre, SCU Coffs Harbour)

Marine debris is fast emerging as one of the most ubiquitous pollutants in the marine environment. Currently, over 7 million tonnes of plastic litter enter the ocean every year and this amount is increasing every day. Plastics can now be found in almost all types of marine environments from coastal wetlands to the deep ocean floor. Consequently, there is a growing body of work dealing with the incidence and impacts of marine debris. This symposium aims to bring together researchers across a wide range of disciplines to share our understanding of the marine plastics issue both in Australasia and internationally. Papers are invited on all aspects of marine plastic pollution. Topics may include analytical methods, distribution and transport of marine plastics, as well as impacts on populations, biodiversity, ecosystems, human health, and socio-economic values of the marine environment. Papers exploring community engagement and management solutions are also welcome.

General session themes:

G1 Deep sea and canyon ecology

In this session we invite presentations on the biology and ecology of the deep sea, seamounts and canyons. While knowledge has grown on deep sea biodiversity, faunal distribution and links to key habitat features, fundamental discoveries are still being made with every expedition. How much have we learned about ecological structure and processes in deep sea communities, under both taxonomic and functional perspectives? Are biodiversity patterns with depth modulated by habitat features and by offshore gradients? This session will also welcome presentations on technological advances to investigate deep sea ecology.

G2 Life-history and connectivity in the ocean

This session will have a biological perspective on the life history of marine organisms and their connectivity between habitats and across oceanic spheres. Presentations on population dynamics of marine species, in both near and offshore regions, and on migrations of marine species in the course of their life cycle are welcome. This includes how connectivity can improve the management and conservation of marine organisms. Presentations on functional connectivity, such as benthic-pelagic coupling, fit into this session as well.

G4 Carbonate shelves: geology, oceanography and biota

The Great Australian Bight has the largest temperate latitude carbonate shelf on Earth. This session invites presentations on the geological characteristics of carbonate shelves and the biota contributing to carbonate sediments, in both tropical and temperate latitudes. We seek to explore the similarities and idiosyncrasies of tropical and temperate carbonate shelves, and the extent to which they may be impacted by ocean acidification.

G5 Estuaries and coasts





Estuaries are gateways linking oceanic and freshwater spheres. Connectivity through estuarine waters is a key driver of exchange processes for sediment, nutrients and organisms such as diadromous fish. This session is seeking presentations on the geology, oceanography and ecology of coast and estuarine ecosystems. We also invite presentations addressing the outwelling from estuaries, and other aspects of the physical and biological oceanography of various types of estuaries. How the coastal zone is affected by anthropogenic impacts and remediation or restoration efforts are also topics that are welcome.

G6 Open theme

The open theme session will accommodate other presentations falling into the conference theme but not specifically fitting into any of the symposia or other general sessions. This could for example include presentations on bioluminescence, symbiosis, marine ecological processes not otherwise specified, and aspects of the blue economy.

AMSA CONFERENCE PROGRAM



Sunday 1 July

Workshops				
	Workshop 3	Workshop 8	Workshop 9	
Location	The University of Adelaide	The University of Adelaide	The University of Adelaide	ACC - foyer E
0830	Marine Biosecurity Organiser: Richard Stafford-Bell, Craig Sherman			
0900				
1000				
1100				
1200				
1300				
1400		3D Modelling for Ecology: getting photogrammetry right in difficult environments Organiser: Gus Porter, Marine Lechene and Tom Taylor	Marine Citizen Science: sharing successes and lessons for improved outcomes Organiser: Jacqui Pocklington	Registration
1500				
1600				
1700				
1800-1930	Welcome reception (exhibition and poster hub, foyer E)			
	Sponsored by SARDI <div></div>			

Monday 2 July

0800-0900	Registration				
Plenary					
Room	Hall C				
0900-0930	Welcome to country & official opening				
0930-1015	Keynote - Gary Greene : Geology Makes a Difference – Canyons, Faults, and Glaciers as Main Components in Marine Benthic Habitat Characterization				
1015-1100	Morning tea (foyer E)				
Short talks chairs symposia					
Room	Hall C				
Chair	Ryan Baring				
1100-1115	S3 - Whiteway : Collaborating to maximise Australian seabed mapping efforts				
1115-1130	S13 - McCauley : Blue whales across southern Australia				
1130-1145	S1 - Kämpf : Interaction of oceanic flows with submarine canyons				
1145-1210	Exhibitor & sponsor presentations, book launch				
1210-1330	Lunch (exhibition and poster hub)				
Concurrent sessions					
Room	Hall C	E1	E2	E3	Skyway
	S3 Seafloor Mapping in Australia – Progress, Discoveries, Applications	S13 From sea to coast – marine mammals in a connected world	S1 Cross-shelf exchange processes	Indigenous Research Priorities Workshop	G5 Estuaries and coasts
Chair	Kim Picard	Rachael Gray	Ana Redondo-Rodriguez	Sarah-Lena Reinhold and Melissa Nursey-Bray	Peter Fairweather
1330-1345	Mackay : 100% of the World Ocean floor mapped by 2030 - Contribution of the South and West Pacific Regional Data Assembly and Coordination Centre to the Seabed 2030 initiative	Sequeira : Convergence of marine megafauna movement patterns in coastal and open oceans	Gale : Variable Across-Shelf Nutrient Fluxes in the Albany Group of Canyons	1340-1350: Duncan : Indigenous Engagement at its Innovative Best (NSW)	Borland : Habitat type and beach exposure shape fish assemblages in the surf zones of ocean beaches
1345-1400	Parnum : Innovations in using acoustic backscatter in seafloor habitat mapping	Meynecke : The influence of environmental drivers on marine mammal strandings on the east coast of Australia	Steinberg : Seasonal Cross-shelf Exchanges along the Great Barrier Reef	1350-1405: Marshall : Transferring from the Past to Repair the Future – Gumma Indigenous Protected Area Research Frameworks (NSW)	Brennan : Thermal Performance of Seagrass-Associated Estuarine Fishes
1400-1415	Ierodiaconou : Regional seabed mapping with crowd-sourced bathymetry	Möller : Behaviour, Movements and Occupancy Patterns of Blue Whales Satellite Tagged in Southern Australian Waters	Liu* : Eddy-current interaction in the Leeuwin Current off the lower west coast of Australia	1405-1420: Lee : ‘Love is in the air’: Cultural Fisheries and Tasmania’s new Indigenous Politic (TAS)	Rasheed : The Critical Role of Mega-Herbivores in Structuring Great Barrier Reef Seagrass Communities and their Services
1415-1430	Nanson : A new genetic classification and mapping approach for seafloor features on the Australian continental margin	Torre-Williams : Newborn humpback whale (<i>Megaptera novaeangliae</i>) observations in the Gold Coast Bay, Queensland, Australia	Middleton : Upwelling along the shelves of the Greater Australian Bight. Part I: the role of submarine headlands and valleys	1420-1435: Richards : Barngarla Sea Country (SA)	Clarke : Overlap in Fish Assemblages Observed Using Pelagic and Benthic BRUVS

1430-1445	Bergersen: Simultaneous Surface and Subsurface Mapping: Benefits for Better Understanding Biological and Geological Processes	Genoves: Social network analyses of common bottlenose dolphins (<i>Tursiops truncatus</i>) reveal social units with sifferential habitat use in the Patos Lagoon estuary and adjacent coastal waters in Southern Brazil	van Ruth: Seasonal- and event-scale variations in the influence of upwelling on enrichment and primary productivity in the eastern Great Australian Bight	1435-1450: Rose: Koonang Mirring; Managing Sea Country in south-west Victoria (VIC)	Williams: Taking a deeper look: Quantifying the differences in fish assemblages between shallow and mesophotic temperate rocky reefs
1445-1515	Afternoon tea (foyer E)				
Concurrent sessions					
Room	Hall C	E1	E2	E3	Skyway
	S3 Seafloor Mapping in Australia – Progress, Discoveries, Applications	S13 From sea to coast – marine mammals in a connected world	S1 Cross-shelf exchange processes	Indigenous Research Priorities Workshop	G5 Estuaries and coasts
Chair	Gary Greene	Jan-Olaf Meynecke	Jochen Kämpf		Craig Sherman
1515-1530	Johnstone: Amphibious Coastal and Nearshore Mapping Following a Massive Earthquake in Kaikoura, New Zealand	Bailleul: Biologically important areas for iconic species and apex predators in the Great Australian Bight	Woo: Observing the Oceans with Gliders: Tools for Data Visualisation and Analysis	Collard: Nyoongar Sea Country (WA)	McGarvey: Longer food chains in pelagic ecosystems: trophic energetics of animal body size and metabolic efficiency
1530-1545	Beaman: Project 3D-GBR: Bathymetry grid development and geological science outputs	Sorrell: Remotely piloted aircrafts improve the precision of monitoring for fur seals	Ribó: Environmental and morphological controls on the particle fluxes in the Gulf of Valencia, NW Mediterranean	Reynolds: Cultural Leadership in Coastal and Marine Management Research: A multi-disciplinary approach (WA)	McEnnulty: Estimates of Zooplankton Biomass in Australian Waters
1545-1600	McNeil: Lidar and multibeam data reveals the complex morphology of Halimeda algal bioherm inter-reef habitat in the northern GBR	Pirotta: Thar she blows: An economical custom-built drone for assessing whale health	Redondo-Rodriguez: Hydrodynamics of Coffin Bay	Goldsmith/Wanganeen: Narungga Sea Country priorities (SA)	Meyer: Assessing the dietary effects of white shark cage-diving on target and non-target species using fatty acid profiling
1600-1615	Cowdery: Uses and Applications of Airborne LiDAR Bathymetry for Coastal Zone Management in Western Australia and Victoria		Rocha: Biogeochemical Modeling of the East Australian Current System	Rigney: Ngarrindjeri Sea Country Plan (SA)	Dunn: The occurrence and distribution of a stalked barnacle on blue swimmer crabs in South Australian Gulfs
1615-1630	Johnson: Seemap Australia - National release of a benthic habitat mapping service for the Australian continental shelf.		Hodgson-Johnston: Australia’s Integrated Marine Observing System in 2018: Planning for Impact	Evans-Illidge: AIMS Aboriginal and Torres Strait Islander Aboriginal Engagement Strategy (QLD)	O’Brien: The diversification of eDNA studies on a global scale and a novel application: estuaries and citizen scientists
1630-1645	Short break			Forester: Lama Lama Sea Country (QLD)	

Concurrent sessions					
Room	Hall C	E1	E2	E3	Skyway
	S3 Seafloor Mapping in Australia – Progress, Discoveries, Applications	S13 From sea to coast – marine mammals in a connected world	S2 Extremes: causes, symptoms, and impacts	Indigenous Research Priorities Workshop	G5 Estuaries and coasts
Chair	<i>Robin Beaman</i>	<i>Jason Earl</i>	<i>Andrew Marshall</i>	<i>Lachlan Sutherland</i>	<i>Jacqui Pocklington</i>
1645-1700	Ingleton: SeaBed NSW State-wide Mapping Program: Prioritisation and Recent Discoveries in the Illawarra	McIntosh: Australian Fur Seal Pup Numbers Remain Depressed: Results of the 2017-18 Census	Smith: Sub-seasonal to Seasonal Sea Surface Temperature Forecasts for applications in the Australasian Region	1645-1700: short break 1700-1800: panel discussion	Fairweather: Are Associations of Intertidal Scavengers like Guilds of Predators or Assemblages of Herbivores?
1700-1715	Siwabessy: Marine acoustic mapping of turbid, macro-tidal coastal environments – a large-scale example from tropical northern Australia	Goldsworthy: Assessing the impacts of seal populations on the seafood industry in South Australia	Feng: MJO induced diurnal sea surface temperature variations off northwest shelf of Australia observed from Himawari geostationary satellite		Bingham: Functional plasticity in vertebrate scavenger assemblages in the presence of introduced carnivores
1715-1730	Pygas: Review and Meta-analysis of the Importance of Remotely Sensed Habitat Structural Complexity in Marine Ecology	Charlton*: Life histories of Southern right whales in South Australia based on three decades of research	Kavi: Cracking the Indian Ocean Dipole Code		Frid: Take a dump: Ecological functioning of the benthos during two decades of sewage sludge disposal.
1730-1745	Boutros: Integrated Image-Based Surveys of Reef Fish and Their Habitat	Meyer: Otlet – an online platform for sourcing biological samples	de Burgh-Day: An assessment of ACCESS-S1 ocean forecast skill around New Zealand for marine industry applications		Dissanayake: Ecosystem functioning: Global conservation in mudflats
1745-1800			Marshall: Sub-seasonal to seasonal climate driver impacts on the Australasian marine environment		Kaber: Assessment of Coral Reef Ecosystem for Determination of Carrying Capacity in Marine Ecotourism Management within Dampier Strait Marine Protected Area of Raja Ampat (TBC)
1810-1830	Tribute to Joe Baker (Hall C)				
1830-2030	Joe Baker poster session (exhibition and poster hub, foyer E) Sponsored by AIMS				
	  <p>Australian Government AUSTRALIAN INSTITUTE OF MARINE SCIENCE</p>				

Tuesday 3 July

0830-0900	Registration				
Plenary					
Room	Hall C				
Chair	Sabine Dittmann				
0900-0905	Introduction, Housekeeping				
0905-0915	Technical Award (2017) presentation				
0915-1000	Keynote - Gretta Pecl : Addressing key questions for climate-driven species redistribution requires integration of ecology, conservation and social science				
1000-1045	Keynote - Matt England : Drivers of recent oceanic trends around Antarctica from the surface to the abyss				
1045-1115	Morning tea (foyer E)				
Concurrent sessions					
Room	Hall C	E1	E2	E3	Skyway
	S6 Marine Climate Change from Shelves to Deep Seas	S13 From sea to coast – marine mammals in a connected world	S3 Seafloor Mapping in Australia – Progress, Discoveries, Applications	G5 Estuaries and coasts	S15 Aquaculture Blue Economy
Chair	Gretta Pecl	Rebecca McIntosh	Daniel Ierodiaconou	Milena Fernandes	Steven Clarke
1115-1130	Audzijonyte : Size matters to fish: trends, drivers and implications of fish body sizes in temperate Australia	Fulham : Comparative ecology of human-associated <i>Escherichia coli</i> in endangered Australian sea lion (<i>Neophoca cinerea</i>) pups	Young : Temporal dynamics of subtidal reef communities across a seascape and the impact of marine protected areas	Kelleway : Variability in the response of blue carbon to tidal restoration: a 20-year record from the lower Hunter estuary	Li : Effects of temperature, substrate type and water current on the performances of <i>Donax deltooides</i> and <i>Katelysia rhytiphora</i>
1130-1145	Kingsbury : Changes in Trophic Niche Use as Tropical Fish Move Poleward	Batley : Genome-wide association study of an unusual dolphin mortality event reveals candidate genes for susceptibility and resistance to cetacean morbillivirus	Wines : Predicting Species Richness and Biomass using Multibeam Sonar and Baited Cameras in Victoria’s Largest Marine Protected Area	Mosley : Restoring tidal connections and geochemical conditions to achieve coastal ecosystem restoration and carbon sequestration at the Dry Creek salt field	Bansemer : Reducing wild derived dietary fish meal inclusion levels in production diets for large Yellowtail Kingfish (<i>Seriola lalandi</i>).
1145-1200	Holland : Latitudinal patterns in the distribution of low-trophic-level fish biomass shaped by oceanographic variables	Taylor : Novel, less invasive sampling for anthropogenic pollutant investigations in pinnipeds	Daniell : Improving Fishing Mortality Rate Estimates for Management of the Queensland Saucer Scallop Fishery	Jones : Estimating Mangrove Biomass and Carbon Content Using Unmanned Aerial Vehicles	Legrand : Mucosal microbiomes of the commercially important aquaculture species Yellowtail Kingfish (<i>Seriola lalandi</i>) and markers of changing health status
1200-1215	Baudron : Impact of Life History Traits on the Warming-Induced Changes in Distribution of the Northeast Atlantic Fish Species Assemblage	Lindsay : Management of endemic hookworm disease in an endangered pinniped, <i>Neophoca cinerea</i>	Munroe : Biogeochemical maps reveal distinct land and marine–based influences in an urbanised coastal embayment	O’Mara : Response of Estuarine Food Webs to Sediment Delivery from Catchments during Flooding	Danckert : Diversity and plasticity: the intestinal microbiome of aquacultured abalone
1215-1230	Twinn : Mechanistic understanding of climate driven range shifts: using thermal tolerances of rock lobster to predict future range shifts	Reinhold : Exploring the use of hard part analysis in conjunction with DNA methods to describe Long-Nosed Fur Seal dietary profiles.		Tsang : Sediment Arsenic in Darwin Harbour	
1230-1400	Lunch (exhibition and poster hub)				

Concurrent sessions					
Room	Hall C	E1	E2	E3	Skyway
	S6 Marine Climate Change from Shelves to Deep Seas	G2 Life history and connectivity in the ocean	S4 Advances in marine ecological classification	G5 Estuaries and coasts	S15 Aquaculture Blue Economy
Chair	<i>Asta Audzijonyte</i>	<i>Iain Suthers</i>	<i>Lawrance Ferns</i>	<i>Arnold Dekker</i>	<i>Matt Hoare</i>
1400-1415	Ikpewe: The impact of temperature on growth rates of demersal fish species in the West of Scotland	Galauduk: Characterizing Ontogenetic Habitat Shifts In Marine Fishes: Advancing Nascent Methods For Marine Spatial Management	Flynn: Combined Biotope Classification Scheme (CBiCS): A new marine ecological classification scheme to meet new challenges, Part I: Components and hierarchies	Middleton: Coastal Observations using Airborne Lidar	Nayar*: Industrial scale harvesting of cultivated marine microalgae using polyelectrolyte flocculants for food and feed applications
1415-1430	Nay: Do Fish Prefer Friends? Trade-offs Between the Presence of Conspecifics, Heterospecifics, or Predators and Thermal Preference.	Oxley: Identifying the unidentifiable: a novel approach for discriminating and estimating biomass of cryptic fish species.	Edmunds: Combined Biotope Classification Scheme (CBiCS): A new marine ecological classification scheme to meet new challenges, Part II: Case studies, morphospecies and image scoring	Sagar*: Change detection and coastal characterisation using tidal composite imagery from Digital Earth Australia	Skordas: The effect of dietary inclusions of dried <i>Gracilaria cliftonii</i> meal and high water temperatures on feeding and behaviour of juvenile greenlip abalone (<i>Haliotis laevis</i>).
1430-1445	Porter: Changes to habitat structure drive fish assemblages... Tell me more! Tell me in 3D.	Hawes: Modelling the connectivity of the black cod (<i>Epinephelus daemeli</i>): where do the larvae go?	Porskamp: Benthic Habitat Mapping: Multiscale Hierarchical Classification in Victoria, Australia	Murray: Mapping the distribution and trajectory of the global intertidal zone	Thomson: Impacts of vitamin K1 on tissue vitamin K levels, immunity, oxidative status and survival of greenlip abalone (<i>Haliotis laevis</i>) at high summer water temperatures.
1445-1500	Nagelkerken: Species Interactions Drive Fish Biodiversity Loss in a High-CO ₂ World	Schilling: Evaluating estuarine nursery use and life history patterns of tailor (<i>Pomatomus saltatrix</i>) in eastern Australia	Parsons: Soundscape Monitoring and Metrics in the Marine Environment	Auricht: Have droughts and increased water extraction from the Murray River (Australia) reduced coastal ocean productivity?	Fontanini: Juvenile Roe's abalone (<i>Haliotis roei</i>) ability to survive a marine heatwave is greatly compromised under global warming scenarios.
1500-1515	Wootton: Novel methods to assess long-term trends in size and age at maturity in fish: a story of harvest and warming	Cecino: Dispersal and Metapopulation Persistence: a Network Approach		Fellowes: Classifying the Geomorphic Planforms of Embayed Beaches	Currie: Colour Change Kinetics of Greenlip Abalone, <i>Haliotis laevis</i> Donovan, Fed Dried Macroalgae Meals
1515-1545	Afternoon tea (foyer E)				

Concurrent sessions					
Room	Hall C	E1	E2		Skyway
	S6 Marine Climate Change from Shelves to Deep Seas	G2 Life history and connectivity in the ocean	G4 Carbonate shelves		S15 Aquaculture Blue Economy
Chair	<i>Ivan Nagelkerken</i>	<i>Paul van Ruth</i>	<i>Scott Nichol</i>		<i>Xiaoxu Li</i>
1545-1600	Machovsky-Capuska: The effects of Sea Surface Temperature on Prey Quality and Nutritional Niche, In a Generalist Marine Predator	Schlaefer: Limited Connectivity Between Local Jellyfish (<i>Copula sivickisi</i> , Class Cubozoa) Populations	James: Stranded quarternary aeolianites, SE Australia, a conceptual link between marine source and terrestrial deposition		Davison: South Australian Aquaculture: Zoning in on Aquaculture Zone Policies
1600-1615	Oellermann: Mechanistic Insights to Limits of Thermal Performance in Australian Spiny Lobsters	Murphy: Resolving Cephalopod Trophic Ecology in Relation to Body-Size in the Tasman Sea Mesopelagic Environment.	Picard: Origin of high density pockmark fields and their use in inferring near-seabed current: A case study from Oceanic Shoals Marine Park, northern Australia		Hoare: Ecological sustainable development of South Australian aquaculture blue economy
1615-1630	Hariato: respR: A new R package for efficient and unbiased analysis of aquatic respirometry data - with marine environmental stress case studies	Rogers: Environmental and ecological drivers of habitat use of white sharks (<i>Carcharodon carcharias</i>) in Spencer Gulf and the Great Australian Bight	Brooke: The Lord Howe seamount chain and the development of atolls		Zhang: Sustainable utilisation of South Australian marine biodiversity towards a blue bio-economy
1630-1645	Black: Free Ocean Carbon Dioxide Enrichment (FOCE) investigation on Southern Ocean benthic marine communities: Primary producer behavioural, physiological and community composition responses.	Bradshaw: Predicting sustainable shark harvests when stock assessments are lacking			
1700-1800	AMSA state branch meeting				
Workshops					
Location	The University of Adelaide	The Elephant			
	Workshop 13				
1830	National seabed mapping coordination workshop Organiser: Kim Picard, Nathan Quadros, Daniel Ierodiaconou	<div>Student and ECR mentoring night</div> <div>Sponsored by Flinders University</div> <div></div>			
1930					
2030					
2130					
2230					

Wednesday 4 July

0830-0900	Registration				
Plenary					
Room	Hall C				
Chair	Rachel Przeslawski				
0900-0905	Introduction, Housekeeping				
0905-0950	Keynote - Ashley Rowden : Disturbances to deep-sea communities: comparing earthquake triggered mass sediment transport to deep-seabed mining				
Short talks chairs symposia					
Room	Hall C				
0950-1005	S5 - Pratchett : Changing Structure and Function of Coral Reef Assemblages in the Anthropocene				
1005-1020	S11 -Bryars : 5-years in: Is South Australia’s marine parks network being effective at biodiversity conservation?				
1020-1022	Geoscience Australia – Scott Nichol				
1022-1037	S8 - Doblin : Functional Traits of Phytoplankton along Environmental Gradients				
1037-1115	Morning tea (foyer E)				
Concurrent sessions					
Room	Hall C	E1	E2	E3	Skyway
	S5 Structure and function of coral reefs in a changing world	G1 Deep sea and canyon ecology	S11 Marine biodiversity conservation – what’s effective?	S10 Marine biosecurity in an increasingly-connected world	S8 Marine microbes as mediators of ocean processes
Chair	Tory Chase	Kathy Conlan	Simon Bryars	Brett Herbert	Gustaaf Haellegraeff
1115-1130	Lechene : The application of large-area mosaic imaging to coral reef community assessment	Schlacher : Environmental heterogeneity promotes fauna diversity in submarine canyons	Brock : The importance of remote offshore Island Sanctuary Zones in South Australia’s marine parks network	McDonald : Towards a national collaborative approach to marine biosecurity science	Catalano : Microbiomics from the deep: exploring the microbial diversity of deep sea sponges from the Great Australian Bight
1130-1145	Brown : The dynamics of coral-algal interactions in space and time on the southern Great Barrier Reef	Rowden : Quantifying the transfer of terrestrial organic matter to the deep ocean in submarine canyons using the compound-specific stable isotope (CSSI) technique	Ortodossi : Seascape connectivity shapes reserve performance on exposed coastlines		McLaughlin : Photo-physiological response of phytoplankton to tidal mixing in coastal waters of north-western Australia.
1145-1200	Hoey* : Differential Resilience of Macroalgal- and Coral-Dominated Habitats to Disturbance	Cook : 40 years of surveying deepwater benthic continental slope and canyon habitats in the western North Atlantic.	Przeslawski : Applying geoscience to biodiversity monitoring: Case studies from an Australian Marine Park	Sherman : Range expansion and the impacts of an invasive sea star on the behaviour and morphology of a native bivalve	Dafforn : Assessing the impacts of stormwater discharges on sediment microbes and biogeochemical cycling in urban waterways
1200-1215	Sommer : Community Assembly Along the Tropical-to-temperate Transition: Mechanistic Insights From Eastern Australia	Kloser : Micronekton assemblages and bioregional setting of the Great Australian Bight: a temperate northern boundary current system	Parra : Ecogeographic and anthropogenic drivers of dolphin distribution: Informing future spatial conservation planning in a Marine Park in South Australia	Lee : A gelatinous pest: Settlement preferences of the invasive ascidian <i>Ciona intestinalis</i> in South Australia	Davies : Ecology of the Dinoflagellate Genus <i>Tripos</i> in Australian Waters
1215-1230	Ferrari : 3D models reveal trade-offs between coral growth and thermo-tolerance		McLeay : Southern Rock Lobster population responses inside a Marine Protected Area following three summers of protection	Carter : Using science to inform biosecurity management in a complex regulatory environment	
1230-1330	Lunch (exhibition and poster hub)				

Concurrent sessions					
Room	Hall C	E1	E2	E3	Skyway
	S5 Structure and function of coral reefs in a changing world	G1 Deep sea and canyon ecology	S11 Marine biodiversity conservation – what's effective?	S10 Marine biosecurity in an increasingly-connected world	S8 Marine microbes as mediators of ocean processes
Chair	<i>Morgan Pratchett</i>	<i>Thomas Schlacher</i>	<i>Danny Brock</i>	<i>James Lavender</i>	<i>Martina Doblin</i>
1330-1345	Wilmes: Specific Timing Of Ontogenetic Shifts In The Diet And Habitat Of Newly Settled Juvenile <i>A. cf. solaris</i> And Consequences For Individual Growth	Scanes: Mine Waste and Acute Warming Induce Energetic Stress in Key Deep-sea Fauna	Whitmarsh: Varying effects of anthropogenic stressors on fish assemblages: a comparison of four case studies	Howe: An expanded monitoring and management program for marine invasive species in Victoria's marine protected areas.	Hallegraeff: Unprecedented <i>Alexandrium</i> blooms in a previously low biotoxin risk area of Tasmania, Australia
1345-1400	Chase: Spatial prevalence of coral-fish interactions and the benefits of aggregative fish for coral populations	Williams*: Canyon habitats of the commercial pink ling: structure, distribution and management	Jordan: Evaluation and prioritisation of threats to marine environmental assets in order to achieve effective biodiversity management	Pocklington: Utilizing citizen science for marine pest detection in marine protected areas	Turnbull: Paralytic Shellfish Toxins in Tasmanian Southern Rock Lobster
1400-1415	Dawson: Reef Islands Dominated by Foraminiferan Sands Will be Most Sensitive to Climate Change Impacts and Ecosystem Shifts	Wiltshire: Predicting Environmental Suitability for Key Benthic Taxa in an Ecologically and Economically Important Deep-sea Environment	Niner: No net loss as a policy approach for marine biodiversity protection	Herbert: Aquatic animal disease and marine pest surveillance in Australia	Farrell: Seasonal Variations in Blooms of <i>Dinophysis</i> spp. and Diarrhetic Shellfish Toxins on Wild Harvest Beaches Along the New South Wales Coast
1415-1430	Radice: Stable isotopes indicate role of upwelling and coral heterotrophic feeding following mass bleaching in remote coral reefs of Maldives, Indian Ocean	Gunton: Polychaetes from Australia's Eastern Abyss	Haberstroh: Baited video, but not diver video, detects a greater abundance of legal size target species within no-take areas at Ningaloo	Deveney: Environmental detection of biosecurity relevant organisms using molecular methods: practical implementation	Seeger: Adsorption of Fish-Killing Algal Toxins to Clay Particles as a Mitigation Strategy for Harmful Algal Blooms
1430-1445		Dittmann: Depth related changes of benthic assemblages from canyons to intertidal coasts	Reis: Assessing the relative vulnerability of Chondrichthyan species as bycatch using spatially reported catch data series	Buss: Rapid transmission and pathogenesis of <i>Bonamia</i> infection in <i>Ostrea angasi</i>	
1445-1515	Afternoon tea (foyer E)				

Concurrent sessions					
Room	Hall C	E1	E2	E3	
	S6 Marine Climate Change from Shelves to Deep Seas	G1 Deep sea and canyon ecology	S11 Marine biodiversity conservation – what's effective?	S10 Marine biosecurity in an increasingly-connected world	
Chair	<i>Michael Oellermann</i>	<i>Penny Berents</i>	<i>Alison Wright</i>	<i>Richard Stafford-Bell</i>	
1515-1530	Rodriguez-Dominguez: Effects of global warming and ocean acidification on fish fitness traits	Li: Spatial distribution of sponge species richness: lessons learned from spatial predictive modelling and pattern predictions	Baring: Functional classifications add value to faunal count data for marine park performance assessments	Roberts: PIRSA's aquatic animal disease prevention and response management: Pacific oyster mortality syndrome as a recent case example	
1530-1545	Doubleday: Marine life breaking rules by building shells in acidic extremes	King: Diversity in the Deep: deep sea amphipods and isopods (Crustacea) of the Great Australian Bight	Huveneers: Regional benefits of shark-diving tourism in developed economies	Carew: Recreational Boat Operators' Self-management of Biofouling in Australia	

1545-1600	Coni: Ocean Acidification May Buffer the Negative Impacts of Tropical Sea Urchins at Temperate Latitudes	Crowther: First comprehensive study of sea anemones (Cnidaria: Actiniaria) from the deep sea of the Great Australian Bight: 2015 & 2017 surveys	Simpson: Exploring seahorse habitat choice: Will seahorses choose artificial habitat over natural habitat?	Lavender: MarinePestPlan 2018-2023: Australia’s national strategic plan for marine pest biosecurity
1600-1615	Falkenberg: Approaches to project physiological effects of environmental change: examples from ocean acidification		Hein: Investigating long-term responses of coral assemblages to coral restoration: Case studies from around the world	
1615-1630	Short break			
Room	Hall C	E1	E2	
	S6 Marine Climate Change from Shelves to Deep Seas	G6 Open theme	S11 Marine biodiversity conservation – what’s effective?	
Chair/s	<i>Zoe Doubleday</i>	<i>Ian Poiner</i>	<i>Simon Bryars & Alison Wright</i>	
1630-1645	Giraldo-Ospina: Looking for Evidence of Deep Reef Refugia: Can a Single Extreme Marine Heatwave Cause Change in Marine Benthic Communities in Offshore Reefs?	Hodgson-Johnston: The National Marine Science Plan in 2018	S11 panel discussion	
1645-1700	Ferreira: Functional Loss of Grazing Drives Runaway Expansion of Weedy Species in a Near-Future Ocean	Lara-Lopez* : How the Integrated Marine Observing System can play a role in education		
1700-1715	Hayes: The role of Glycine betaine in range expansions; protecting mangroves against extreme freeze events.	Arthur: The Role of CSIRO’s Marine National Facility in Training Australia’s Future Marine Experts		
1715-1730	Pereira: Responses of the flat oyster <i>Ostrea angasi</i> to climate change	Abbott: CAPSTAN: interdisciplinary training for next generation of marine scientists		
Workshops				
Location	RIAUS Science Exchange	The University of Adelaide	ACC - room E3	The University of Adelaide
		Workshop 4	Workshop 6	Workshop 12
1800	Public Forum with Q&A at RIAUS Science Exchange “Coastal Conflicts”	Challenges & solutions to measuring & demonstrating connectivity in Marine Protected Area (MPA) networks Organiser: Alice Jones, Alison Wright, Simon Bryars, Thomas Prowse		CBiCS – Road-testing a new marine ecological classification scheme Organiser: Adrian Flynn, Matt Edmunds
1900			Prepare high quality applications for sea time on the MNF RV Investigator Organiser: Ben Rae, Carolyn Seelan	
2000				
2100				
2200				
2230				

Thursday 5 July

0830-0900	Registration			
Plenary				
Room	Hall C			
Chair	Will Figueira			
0900-0905	Introduction, Housekeeping			
0905-1000	Award ceremony and Jubilee Award presentation			
	Jubilee Award winner - Bellwood : Fishes, Functions and the Future of Coral Reefs			
1000-1015	Allen Award winner - Gissi : Alterations in the coral microbiome following exposure to metals			
1015-1017	Short address by CSIRO Oceans & Atmosphere (Hobday)			
Short talks chairs symposia				
Room	Hall C			
1017-1032	S7 - Thompson: Scaling the Oceans			
1032-1047	S9 - Beheregaray: Genomics of marine organisms: contributions to ecology and evolution			
1047-1115	Morning tea (foyer E)			
Concurrent sessions				
Room	Hall C	E1	E2	E3
	S9 Genomics of marine organisms: contributions to ecology and evolution	S7 Micro- to Macro-: connecting multi-scale climate change research in marine systems	S16 Marine Debris: the world-wide pollution crisis acting on local to global scales	S14 Assessing and mitigating ecosystem effects of fishing and aquaculture
Chair	Luciano Beheregaray	Peter Thompson	Edwina Foulsham	Simon Goldsworthy
1115-1130	Evans: Dispersal patterns for taxa with differing reproductive characteristics along the Western Australia coastline	Hobday: Climate change adaptation efforts for species may be antagonistic to natural evolutionary responses	Wilcox: Finding the Missing Plastic – Resolving the Global Mass (Im)Balance for Plastic Pollution in the Ocean	Earl: Assessing the effectiveness of underwater seal crackers for reducing the impacts of fur seals on South Australia’s Lakes and Coorong Fishery.
1130-1145	DiBattista: Genomics Reveals Patterns of Dispersal, Cryptic Lineages, and Vagrant Reef Fish Along the Coast of Western Australia	McDonald: Anomalous chlorophyll a events under global environmental change	Richardson: Understanding causes of gear loss provides a sound basis for fisheries management	Hamilton: Technical mitigation measures to reduce marine mammal bycatch in commercial trawl fisheries: lessons learnt and future directions.
1145-1200	Iacchei: Genomically-informed Fisheries Management of White Seabass (<i>Atractoscion nobilis</i>)	Ullah: The Cumulative Effects of Global Climate Change and Local Ecosystem Drivers on a Temperate Coastal Ecosystem	Smith: Tracing the Source of Plastic Bottles on Beaches in Northern New South Wales, Australia	Davey: Presence or Function: Which is most important in environmental impact assessment? (Considerations from Aquaculture EIAs)
1200-1215	Villacorta-Rath: Can dispersal history drive spatio-temporal phenotypic differences between Southern rock lobster (<i>Jasus edwardsii</i>) post-larvae?	Figueira: Characterising range expansion potential of tropical vagrant fishes	Peters: Plastic plight on our shores: An insight into marine debris in the Gulf St Vincent bioregion, South Australia.	Morgan: Genetic structure found among Australian east coast populations of snapper, <i>Chrysophrys auratus</i> (Sparidae) using microsatellites
1215-1230	Silva: Drivers of diversification in rock lobsters	Champion: Changing windows of opportunity: Past and future climate-driven shifts in temporal persistence of kingfish (<i>Seriola lalandi</i>) oceanographic habitat within southeast Australian bioregions	Schuyler: Economic Incentives Reduce Plastic Inputs to the Ocean	Priess: A comparison of blue swimmer crab catch composition and abundance across varying pot types
1230-1330	Lunch (foyer E)			
Room	Hall C			
1330-1335	AMSA 2019 announcement			
1335-1340	Indigenous engagement at conference			
1340-1410	AMSA AGM (all members welcome)			

Concurrent sessions				
Room	Hall C	E1	E2	E3
	S9 Genomics of marine organisms: contributions to ecology and evolution	S7 Micro- to Macro-: connecting multi-scale climate change research in marine systems	S16 Marine Debris: the world-wide pollution crisis acting on local to global scales	G5 Estuaries and coasts
Chair	Joey diBattista	Karlie McDonald	Stephen Smith	Chris Frid
1415-1430	Miller: Seascape genomic analysis of a commercially important mollusc- integrating population genetics, genomics and marine LiDAR data	Taylor: Investigating the role of Competitive Processes in Mediating Range Expansions of Tropical Vagrant Fish	Tetu: Plastic Leachate Exposure Affects Photosynthesis Of Marine Prochlorococcus	Nedossyko: Oysters are the Future: Shellfish Reef Restoration Strengthening Australia’s Blue Economy
1430-1445	Sandoval-Castillo: Seascape genomics reveals adaptive divergence in a connected and commercially important mollusc, the greenlip abalone (<i>Haliotis laevis</i>), along a longitudinal environmental gradient	Cetina-Heredia: Predicted Climate Driven Change to Eastern Rock Lobster Larval Flow across the Tasman Sea	Lawson: Why, how and where to monitor plastic pollution	McAfee: Oyster optimism – restoring the past to conserve the future
1445-1500	Attard: From conservation genetics to conservation genomics: A genome-wide assessment of blue whales (<i>Balaenoptera musculus</i>) in Australia	Discussion: Developments in GOOS	Willis: How successful are waste abatement campaigns and government policies at reducing plastic waste into the marine environment?	Suthers: FAD or Function? The importance of towers, planktivory and connectivity for sustainable fishing on designed artificial reefs - tentatively added
1500-1515	Barcelo: Population genomic structure of Australian Common dolphins (<i>Delphinus delphis</i>)			Ribbat*: Source Waters of an Offshore Artificial Reef off Sydney, Australia.
1515-1530	Pratt: The genomic basis of ecotype formation in bottlenose dolphins (genus <i>Tursiops</i>)			
1530-1600	Afternoon tea (foyer E)			
Room		E1	E2	E3
		G6 Open theme	S16 Marine Debris: the world-wide pollution crisis acting on local to global scales	S9 Genomics of marine organisms: contributions to ecology and evolution
Chair/s		Allyson O’Brien	Tony Flaherty	Luciano Beheregaray & Joey diBattista
1600-1615		Fernandes: Nitrogen Tipping Points for Seagrass Conservation	Wilson: Putting the Science into Marine Debris Citizen Science Monitoring	S9 discussion
1615-1630		Nayar: Nitrogen acquisition and resource allocation strategies in temperate seagrass <i>Zostera nigricaulis</i> : Uptake, assimilation and translocation processes	Foulsham: Scientific monitoring of marine debris in coastal environments to inform and assess litter reduction policy in NSW	
1630-1645		Lockyer: Use of Single Sperm Densities in Fertilisation Assays May Significantly Underestimate Toxicity	Hardesty: A useful framework for addressing mismanaged waste that can end up as marine debris	
1830-0000	Gala dinner (ACC, Panorama Ballroom)			
Sponsored by NESP Marine biodiversity hub				
 National Environmental Science Programme				

Friday 6 July

Workshops				
Location	The University of Adelaide	The University of Adelaide	The University of Adelaide	The University of Adelaide
	Workshop 2	Workshop 5	Workshops 6 & 7	Workshops 11
0830	How to access and use IMOS data for your research Organiser: Craig Steinberg	Recreational fishing in Commonwealth waters Organiser: Tim Lynch, Carlie Devine	Marine National Facility data management policy – consultation workshop Organiser: Ben Rae, Carolyn Seelan	Paper accepted! Now what? Find your way to real impact using animation video and graphics Organiser: Tullio Rossi
0900				
1000			Prepare high quality applications for sea time on the MNF RV Investigator Organiser: Ben Rae, Carolyn Seelan	
1100				
1200				
1300				
1400				
1500				
1600				
1700				

AMSA POSTER PROGRAM

Poster	First name	Last name	Paper title	Organisation	Topic
1	Thomas	Clarke	Identifying Spawning Behaviour and Important Areas of Yellowtail Kingfish (<i>Seriola lalandi</i>) in South Australia	Flinders University	G2 Life-history and connectivity in the ocean
2	Hayden	Schilling	Age, growth and mortality of tailor (<i>Pomatomus saltatrix</i>) in eastern Australia	UNSW	S14 Assessing and mitigating ecosystem effects of fishing and aquaculture
3	Mardi	McNeil	Epiphytic carbonate production, sediment dynamics, and export from a sub-tropical seagrass carbonate factory: Moreton Bay, Queensland	Queensland University of Technology	G4 Carbonate shelves: geology, oceanography and biota
4	Adrian	Flynn	Unique bryozoan reefs in Western Port, a southern temperate embayment	Fathom Pacific Pty Ltd	
5	James	Daniell	Siliciclastic Foundations of Shelf-Edge Reefs on the Central Great Barrier Reef	James Cook University	
6	Thomas	Fellowes	Monthly to Decadal Morphologic Evolution of Sheltered Beaches within an Urbanized Estuary	University of Sydney	G5 Estuaries and coasts
7	Richard	Grainger	Prey Composition, Diet and Nutritional Niche of White Sharks (<i>Carcharodon carcharias</i>) in New South Wales, Australia	The University of Sydney	S6 Linking disciplines to advance mechanistic insights of species responses to climate change
8	Richard	Grainger	Long-term Acclimation of Feeding Energetics to Ocean Acidification in an Ecologically Important Sea Urchin, <i>Heliocidaris erythrogramma</i> , From Southeast Australia	The University of Sydney	
9	Rachel	Kelly*	Social licence and citizen science: Potential and progress	Institute for Marine and Antarctic Studies	G5 Estuaries and coasts
10	Traceylee	Forester	Working together on sea country	AIMS	Indigenous Workshop
11	Lauren	Meyer	Otlet – an online platform for sourcing biological samples	Flinders University	G6 Open theme
12	Rachel	Przeslawski	Marine Sampling Field Manuals for Benthic Monitoring	Geoscience Australia	S11 Marine biodiversity conservation – what's effective?
13	Paul	Rigby*	Low-power, Low-cost Oceanographic Drifters	AIMS	S1 Cross-shelf Exchange Processes
14	Kim	Picard	The geodiversity of the southeast Indian Ocean seafloor revealed by Malaysia Airlines flight MH370 search data	Geoscience Australia	S3 Seafloor Mapping in Australia – Progress, Discoveries, Applications
15	Rachel	Nanson	Application of a new genetic classification and semi-automated geomorphic mapping approach in the Perth submarine canyon, Australia	Geoscience Australia	S4 Advances in Marine Ecological Classification
16	Tory	Chase	Species-specific behaviors dictate intensity of fish-coral interactions	James Cook University & ARC Center of Excellence for Coral Reef Studies	S5 Structure and function of coral reefs in a changing world
17	Januar	Harianto	Quantifying multistressor impacts of ocean warming and acidification on the sea urchin, <i>Heliocidaris erythrogramma</i>	The University of Sydney	S6 Linking disciplines to advance mechanistic insights of species responses to climate change
18	Almendra	Rodriguez-Dominguez	Irreversible behavioural impairment of fish starts early: embryonic exposure to ocean acidification	The University of Adelaide	
19	Nathan	Janetzki	Snails know how to beat the heat: Using thermal imagery to investigate associations between intertidal ectotherms and substratum temperature	Flinders University	S7 Micro- to Macro-: Connecting multi-scale climate change research in marine systems
20	Karlie	McDonald	Anomalous chlorophyll a events	CSIRO	
21	Claire	Rowe	The role of temperature and macronutrient selection on metabolic and swimming performance of the Indo-Pacific Damselfish	University of Sydney	

Poster	First name	Last name	Paper title	Organisation	Topic
22	Claire	Rowe	The invasive upside-down jellyfish <i>Cassiopea</i> in New South Wales Coastal Lakes: identification and distribution	University of Sydney	S10 Marine biosecurity in an increasingly-connected world: protecting Australia from marine
23	Ruth	Eriksen *	Taxonomy of the Dinoflagellate genus <i>Tripos</i> in Australian waters	CSIRO Oceans and Atmosphere	S8 Marine microbes as mediators of ocean processes
24	Kazuhide	Dan	Sustainable seawater purification system for the depth to the shallows built in piles and quays using the purifying functions of microorganisms and the tidal energy	National Institute of Technology, Akashi College	G6 Open theme
25	Catarina	Silva	Impact of tissue type and sex in the discovery of single nucleotide polymorphisms (SNPs) in rock lobsters	James Cook University	S9 Genomics of marine organisms: contributions to ecology and evolution
26	René	Campbell	Sizing up the crab invaders! Morphometrics for <i>Carcinus</i> spp. can assess population variability and assist with species identification	Flinders University	S10 Marine biosecurity in an increasingly-connected world: protecting Australia from marine
27	Ryan	Baring	Persistence of the Invasive European Shore Crab in Multiple Coastal Habitats	Flinders University	
28	Kathryn	Wiltshire	Comparing the performance of traditional and DNA methods to detect marine pests	SARDI Aquatic Sciences	
29	Kirin	Apps *	Turning wildlife experiences into conservation action: Can white shark cage-dive tourism influence conservation behaviour?	Southern Cross University	S11 Marine biodiversity conservation – what's effective?
30	Alexandra	Jones	Earth observation for monitoring cetacean species	The University of Sydney	S13 From sea to coast – marine mammals in a connected world
31	Nikki	Zanardo	Social cohesion and intrapopulation community structure in southern Australian bottlenose dolphins (<i>Tursiops</i> sp.)	Flinders University	
32	Krishna-Lee	Currie	Growth and Nutrient Utilisation of Greenlip Abalone (<i>Haliotis laevis</i>) Fed <i>Ulva</i> sp. Protein Extract	Flinders University	S15 Aquaculture Blue Economy
33	Lucas	Kas	From production to predation in the western Tasman Sea - assessing the trophic status of the size-structured ecosystem using stable isotope analysis	UNSW	
34	Kurniawan	Kurniawan	Factors Affecting purging success in Pipis (<i>Donax deltoides</i>)	Flinders University	
35	Rebecca	McIntosh	Looking Without Landing – Using Remote Piloted Aircraft (RPAs) and Citizen Science to Monitor the Prevalence of Marine Debris Entanglements in Fur Seals	Phillip Island Nature Parks	S16 Marine Debris: The world-wide pollution crisis acting on local to global scales
36	Scott	Wilson	Is there something Fishy with Microplastics?	Macquarie University	

ABSTRACTS

Turning wildlife experiences into conservation action: Can white shark cage-dive tourism influence conservation behaviour?

Kirin Apps¹, Charlie Huveneers², Kay Dimmock¹

1. Southern Cross University, Lismore, Australia
2. Flinders University, Adelaide, SA, Australia

Abstract

Wildlife tourism is often promoted as an activity which supports conservation by enhancing environmental knowledge, attitudes, and behaviour through interpretative messaging and personal experiences with wildlife. Despite these potential linkages, evidence to support such claims is limited. In order for wildlife tourism operators to build a motivated constituency supporting conservation, elements of the tour which contribute to positive attitudes and environmental behaviour must be identified. This study investigated the attitudes and environmental behaviour of 136 wildlife tourists following a white shark cage-dive experience in South Australia. Responses to an online survey revealed a significant increase in participation for seven of the eight conservation-related behaviours explored, and a positive shift in participants' understanding, awareness, attitudes, and concern for sharks following the tour. Results suggest that emotional engagement during the tour is associated with enhancing participants' knowledge, attitudes, and behaviour. Recommendations for complementing the emotional response to viewing wildlife, with interpretative communication, are discussed.

Keywords: conservation; wildlife tourism; marine tourism; white shark; cage-diving.

Poster presentation

S11

CAPSTAN: interdisciplinary training for next generation of marine scientists

Dr April N Abbott^{1,2,3}

1. CAPSTAN, Macquarie University, NSW, Australia
2. Macquarie University Marine Research Centre, NSW, Australia
3. Department of Earth & Planetary Sciences, Macquarie University, NSW, Australia

Abstract

The impacts of climate change on Earth's marine systems will continue to be one of our major societal challenges. In order to understand these impacts, and to best mitigate the ecological and economic effects, we need scientists able to integrate multi-disciplinary approaches. CAPSTAN (Collaborative Australian Postgraduate Sea Training Alliance Network) is rising to meet this need through hands on training of the next generation of marine scientists. Postgraduate students spend approximately 2 weeks on board Australia's RV Investigator working with experts from across disciplines to understand first hand the interconnectedness of biology, chemistry, geology, physics, climate, and economics within the marine science realm. The first CAPSTAN voyage sailed in November 2017 with 20 students and 9 expert trainers representing 12 universities. Students gained hands-on experience coring, collecting water samples, identifying sea birds and mammals, and synthesizing their observations across disciplines to better understand the interplay of shelf break canyons, sedimentation, food webs, and water chemistry in the Bremer region. Here, I will discuss the first voyage in terms of learning outcomes directly related to equipping the next generation to effectively integrate climate change in marine science and support a resilient blue economy.

G6[Open theme](#)**Wednesday 4 July, 1715 - 1730**

The role of CSIRO's Marine National Facility in training Australia's future marine experts

Ben Arthur¹ and Ben Rae¹

1. CSIRO Marine National Facility, Castray Esplanade, Hobart, TAS, 7004

Abstract

The Australian Government funds the CSIRO Marine National Facility to provide landmark scientific infrastructure for dedicated blue-water research to benefit the nation. The literal flagship of the Facility is the advanced multidisciplinary research vessel *Investigator*, which now has three years of demonstrated experience in delivering research across Australia's marine jurisdiction and beyond. But is just delivering research enough? With Australia's growing blue economy, what is the Marine National Facility doing to help deliver the marine scientists, policy makers and industry advisors who will ensure we successfully manage the future conservation and prosperity of our marine environment? The Facility has launched a suite of unique collaborative education and training opportunities where teachers and students from primary to tertiary education can get hands-on with the real world application of STEM related to Australia's marine and coastal environments, both when the ship is in port and at sea. From floating classrooms around the nation, to teachers on board research voyages in Antarctica and Australia's tropical north, to undergraduate students sampling the Bremer Canyon in the Great Australian Bight, here we provide an overview of these education and training activities and discuss the future of the Marine National Facility as a unique training platform.

G6 [Open theme](#)
Wednesday 4 July, 1700 - 1715

From conservation genetics to conservation genomics: a genome-wide assessment of blue whales (*Balaenoptera musculus*) in Australia

Catherine R. M. Attard^{1,2}, Luciano B. Beheregaray¹, Jonathan Sandoval-Castillo¹, K. Curt S. Jenner³, Peter C. Gill^{4,5}, Micheline-Nicole M. Jenner³, Margaret G. Morrice⁵, Luciana M. Möller^{1,2}

1. Molecular Ecology Lab, College of Science and Engineering, Flinders University, GPO Box 2100, Adelaide, SA 5001, Australia
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3. Centre for Whale Research, PO Box 1622, Fremantle, WA 6959, Australia
4. Blue Whale Study, C/- Post Office, Narrawong, VIC 3285, Australia
5. School of Life and Environmental Sciences, Deakin University, PO Box 423, Warrnambool, VIC 3280, Australia

Abstract

Genomic datasets of thousands of markers improve our power to detect low population structure and identify adaptive divergence compared with traditional genetic datasets of tens of markers. Low population structure yet adaptive divergence may be the case for many marine fauna, and so genomic datasets could inform their management and conservation. In Australia there are endangered pygmy blue whales (*Balaenoptera musculus brevicauda*) that feed at the Perth Canyon off WA and the Bonney Upwelling off SA/VIC. Our previous genetic dataset of 10 microsatellites and mtDNA showed no evidence of genetic structure for these feeding aggregations. Here we used a genomic dataset of 8,294 filtered SNPs from ddRAD to re-assess whether the Australian feeding aggregations constitute one population and to test, for the first time, whether there is adaptive divergence between the aggregations. We found no evidence of neutral population structure, but the greater power of the dataset allowed us to reliably detect related individuals, and we found negligible evidence of adaptive divergence. We propose that individuals travel widely, leading to high gene flow and adaptive variation suited to a range of environmental conditions. This means the same blue whale population is vulnerable to anthropogenic activities across a wide geographic range.

S9**Genomics of marine organisms: contributions to ecology and evolution****Thursday 5 July, 1445 - 1500**

Size matters to fish: trends, drivers and implications of fish body sizes in temperate Australia

Asta Audzijonyte^{1,2}, Rick D. Stuart-Smith¹, Greta Pecl^{1,2}, Graham J. Edgar¹, Neville S. Barrett¹, John R. Morrongiello³ and Julia Blanchard^{1,2}

1. Institute for Marine and Antarctic Studies, University of Tasmania
2. Centre for Marine Socioecology
3. University of Melbourne

Abstract

Decreasing ectotherm body sizes is considered as a universal response to global warming. However, despite the accumulating evidence that such changes are indeed happening, there has been little concerted effort to assess magnitude underlying drivers. Using an extensive dataset from the University of Tasmania Long-Term Temperate MPA Monitoring program and Reef Life Survey citizen science surveys, we demonstrate a significant trend towards decreasing average body sizes in temperate coastal Australian fish species. The trend is not explained by species' exploitation status and appears strongest in Tasmania. The observations are consistent with published otolith biochronology data suggesting increased juvenile growth rates of shallow water species and the hypothesis that warming will lead to "faster" ectotherm life-histories with earlier maturation and smaller adult body sizes, although the mechanisms are still unclear. Changes in marine organism body sizes have large impacts on ecological and population dynamics through energy transfer efficiency, feeding and natural mortality. For example, ecosystem models suggest that even small decrease in fish body length can be comparable to the introduction of moderate fishing. Our findings call for urgent cross-disciplinary research to understand the pervasiveness and implications of life-history changes in marine ectotherms.

S6***Marine Climate Change from Shelves to Deep Seas*****Tuesday 3 July, 1115 - 1130**

Have droughts and increased water extraction from the Murray River (Australia) reduced coastal ocean productivity?

Hannah Auricht¹, Ken Clarke¹, Megan Lewis¹, Luke Mosley¹

1. School of Biological Sciences, University of Adelaide, North Terrace, Adelaide, 5001

Abstract

River discharges are decreasing in many regions of the world but the consequences of this on water quality and primary productivity of receiving coastal oceans are largely unclear. In this presentation we describe our research using satellite remote sensing data (MODIS) of the coastal ocean zone which receives outflows from the Murray River, from 2002 to late 2016. This system has experienced historical flow reductions and a recent extreme hydrological "Millennium" drought. Remotely sensed Chlorophyll *a* and Particulate Organic Carbon in the coastal ocean were strongly correlated with river outflows ($R^2 > 0.6$) in an 8km radial buffer zone from the Murray Mouth, and the river influence extended up to approximately 60 km from the Murray Mouth during high flow periods. This distance was greater than the freshwater plume extent during maximum flows in 2011 suggesting new primary productivity was created. In contrast, there was no additional coastal ocean productivity above background levels from 2007 to 2010 when river outflows ceased. Hindcast calculations based on historical flows suggest that declining River Murray flows have greatly reduced primary productivity in adjacent coastal waters. This has potential consequences for higher trophic levels and thus should be considered in future management planning.

G5*Estuaries and coasts*

Tuesday 3 July, 1445 - 1500

Biologically important areas for iconic species and apex predators in the Great Australian Bight

F. Bailleu¹, S.D. Goldsworthy¹, P.J. Rogers¹, A.I. Mackay¹, I. Jonsen², M. Hindell³, T. Patterson⁴

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4. CSIRO, Oceans and Atmosphere, Hobart, TAS, Australia

Abstract

A total of 4,924 tracks, and 15,698 observations collected from 11 species (pinnipeds, cetaceans, seabirds, pelagic fish) over the last 20 years in the Great Australian Bight (GAB) have been analysed. Spatial distribution models show differences in use of the region by species that are annual resident versus those that are migratory, using the region periodically and seasonally for feeding or breeding. However, a combination of inter-species overlap models identified two main regions highly used by marine predators, one in the eastern GAB and the other in the western GAB. While these two regions have common features like narrow shelves and steep slopes, they are influenced by different oceanographic features. A coastal upwelling in the east and the Leeuwin Current in the west seasonally affect local nutrient supply and production, which ultimately attract foraging predators. This work was part of the Great Australian Bight Research Program. The Great Australian Bight Research Program is 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 environment, economic and social values of the region; providing an information source for all to use.

S13 *From sea to coast – marine mammals in a connected world*
Monday July 2, 1515 - 1530

Reducing wild derived dietary fish meal inclusion levels in production diets for large Yellowtail Kingfish (*Seriola lalandi*).

Matthew S. Bansemer¹, David A.J. Stone^{1,2,3,4}, Paul Skordas¹, Leo Nankervis⁵, Michael Salini⁶

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2. Flinders University, School of Biological Sciences, GPO Box 2100, Adelaide, SA 5001, Australia
3. University of Adelaide, School of Animal and Veterinary Sciences, Roseworthy, SA 5371, Australia
4. Marine Innovation Southern Australia
5. Skretting Australia, Cambridge, TAS 7170, Australia
6. Ridley Agriproducts, Narangba, QLD 4504, Australia

Abstract

Further research to understand dietary wild derived fish meal (FM) substitution with commercially relevant alternative ingredients for large Yellowtail Kingfish (*Seriola lalandi*) is needed. This 252 day study was designed to replace FM, with FM by-product, poultry meal (PM) or soy protein concentrate (SPC) in a series of six diets for Yellowtail Kingfish (2.52 kg). Fish were fed to apparent satiation once daily. Growth, feed utilisation or blood hematology and biochemistry indices measured were not significantly influenced by fish meal replacement. We recommend that when using SPC, diets contain no less than 20% wild derived FM. We recommend that when using PM, diets contain no less than 20% FM (derived from either wild stocks or seafood by-products). When using FM by-product, we recommend that diets contain a total of 30% FM, where at least 10% is derived from wild stocks, and no more than 20% is derived from seafood by-products. The available information points toward flexibility in formulation but some caution is advised pending further understanding of nutrient deposition, histology and bile acid metabolism. We recommend that trends with some of the diets be followed up with further pilot scale commercial trials before the full formulation flexibility is realised.

S15 **Aquaculture blue economy**

Tuesday 3 July, 1130 - 1145

Population genomic structure of Australian common dolphins (*Delphinus delphis*)

Andrea Barceló^{1,2}, Luciano B. Beheregaray^{1,2}, Kerstin Bilgmann^{1,2,3} and Luciana Möller^{1,2}

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2. Molecular Ecology Lab at Flinders University (MELFU), College of Science and Engineering, Flinders University, GPO Box 2100, Adelaide SA 5001, Australia
3. Department of Biological Sciences, Faculty of Science and Engineering, Macquarie University, Sydney NSW 2109, Australia

Abstract

Assessing population connectivity in oceanic environments can be challenging due to their vast spatial scales and poor knowledge about environmental barriers for dispersal. Population genomic datasets provide great power for clarifying population structure and allow detection of genomic regions under environmental selection. Common dolphins (*Delphinus delphis*) are highly mobile and gregarious, presenting high potential for connectivity. Their populations, however, may prefer particular oceanographic conditions, and follow the distribution of their prey, which in turn make them vulnerable to fisheries interactions. We analysed 313 biopsy samples of common dolphins from seven regions covering most of their distribution in Australia. Using ddRAD-seq, we generated 24,140 single nucleotide polymorphisms for assessing the population genomic structure at both neutral and putatively adaptive regions of the genome. Preliminary results indicate two divergent populations along the eastern and southern Australia, respectively, with evidence of occasional long-distance migration in both directions. Further subdivisions were detected within these populations, but these do not correspond to those previously suggested based on other molecular markers. These findings will help clarify dolphin management units and informing conservation management of the species in Australia in the context of fisheries interactions.

S9

**Genomics of marine organisms: contributions to ecology and evolution,
Thursday 5 July, 1500 - 1515**

Functional classifications add value to faunal count data for marine park performance assessments

Ryan Baring¹, Orlando Lam¹, Sasha Whitmarsh¹, Sabine Dittmann¹, Peter Fairweather¹ and Charlie Huveneers¹

1. Flinders University, Sturt Road, Bedford Park, SA, 5042

Abstract

Estimates of faunal communities are crucial for assessment of Marine Parks performance to establish ecological baselines and ensure that management zones are performing as they were initially intended. Counts of fauna (e.g., fish and macroinvertebrates) are common practice in ecological assessments of marine habitats. The collection of faunal count data is often costly (in time and resources) and limited to providing information on the composition and relative abundance of particular fauna in time and space. What if count data could be used to assess the biological function of communities in particular habitats or zones with little extra cost? Based on fish monitoring from BRUVS and subtidal benthic macroinvertebrate surveys in Coffin Bay, South Australia, we provide an updated method to apply biological trait analyses to estimate ecosystem functions in marine park zones. While detailed understanding of the functional roles of marine organisms in Australian waters is still growing, assigning classifications based on movement, life histories or feeding mode can usually be done, and will be further refined as more species-specific knowledge becomes available. This innovative tool aims to progress and improve the functional understanding of communities in marine habitats by adding value to marine-parks performance programs.

S11 *Marine biodiversity conservation – what's effective?*
Wednesday 4 July, 1515 - 1530

Persistence of the Invasive European Shore Crab in Multiple Coastal Habitats

Ryan Baring¹, Hayley Jessup-Case^{*1}, Sabine Dittmann¹, René T. Campbell¹ and Orlando Lam Gordillo¹

1. College of Science & Engineering, Flinders University, Sturt Road, Bedford Park, SA 5042

Abstract

The European shore crab *Carcinus maenas* is an invasive crab species which has established populations along Adelaide's coastline, in low energy soft-sediment, and sometimes marginal habitats. Seasonal monitoring of *C. maenas* occurred in mangroves, a shipping port, and rocky shore habitats using a combination of baited traps and timed searches to identify the distribution, abundance, and size-frequency of populations. Over the five year study, *C. maenas* has extended its range along the coast, particularly in the southern metropolitan region. Monitoring has shown an increase in numbers at times, where the crabs are most abundant during cooler months. Size distributions of *C. maenas* have varied between the three study regions with larger, more mature crabs being found in the mangroves (northern region), medium sized crabs in the port, and mostly smaller juvenile crabs on the rocky shores (southern region), indicating that *C. maenas* may use various habitats depending on their life-cycle. This study demonstrates the persistence of the European shore crab in South Australian coastal environments.

Poster presentation

S10

Genome-wide association study of an unusual dolphin mortality event reveals candidate genes for susceptibility and resistance to cetacean morbillivirus

Kimberley Batley¹, Jonathan Sandoval-Castillo¹, Catherine Kemper², Catherine Attard¹, Nikki Zanardo¹, Ikuko Tomo², Luciano, Beheregaray¹ and Luciana Möller¹

1. Flinders University, Bedford Park, SA, Australia
2. South Australian Museum, Adelaide, SA, Australia

Abstract

Infectious diseases are significant demographic and evolutionary drivers of populations, but studies about the genetic basis of disease resistance and susceptibility are scarce for wildlife populations. Cetacean morbillivirus (CeMV) is a highly contagious disease that is increasing in both geographic distribution and incidence, killing tens of thousands of cetaceans worldwide. The largest CeMV outbreak in the Southern Hemisphere occurred in Australia in 2013, where it was a major factor in an unusual dolphin mortality event, killing mainly young Indo-Pacific bottlenose dolphins (*Tursiops aduncus*). Using cases and controls of the most affected dolphin population, we carried out a genome-wide association study to identify candidate genes for resistance and susceptibility to CeMV. The ddRAD dataset consisted of 262,892,901 filtered-sequence reads, and 35,493 high quality SNPs. Association analyses found significant differences in allele and genotype frequencies amongst cases and controls at 74 SNPs overall, and Random Forests identified eight as candidates. Annotation of these SNPs resulted in five candidate genes with functions putatively associated with stress, pain and immune responses. Biomarkers can now be developed to assess potential genetic risk factors in other cetacean populations, and possibly aid in the advancement of vaccines against morbilliviruses.

S13**From sea to coast – marine mammals in a connected world****Tuesday 3 July, 1130 - 1145**

Impact of Life History Traits on the Warming-Induced Changes in Distribution of the Northeast Atlantic Fish Species Assemblage

Alan R. Baudron¹, Niall G. Fallon¹ and Paul G. Fernandes¹

1. University of Aberdeen, Tillydrone Avenue, AB24 2TZ, Scotland, U.K.

Abstract

Climate change causes marine fish distribution to shift polewards. Bergmann's rule states that large species are found in colder environments, thus large fish should be more sensitive to warming. The impact of body size and other life history traits on temperature-induced changes in distribution has yet to be established. We assessed distribution changes over 30 years and investigated links with life history traits of 51 species across the northeast Atlantic region, including the North Sea (NS) and the western shelf (WS). Species' centres of gravity, and latitudinal and longitudinal movements over time, were estimated. Links between distribution changes and life history traits were explored statistically. Large species showed great increases in latitude whilst decreases in latitude were small, suggesting they are more likely to move north and less likely to move south than small species. On the WS, large species exhibited greater decreases in longitude indicating westward movements off the shelf towards cooler waters. In the NS, species with higher caudal fin aspect ratios showed greater increases in latitude. These results suggest that larger, more active fish species are more likely to relocate under rising temperatures, possibly in order to avoid temperature-induced oxygen limitations. The potential ecological implications are discussed.

S6***Marine Climate Change from Shelves to Deep Seas*****Tuesday 3 July, 1200 - 1215**

Project 3D-GBR: Bathymetry grid development and geological science outputs

Robin J. Beaman¹, Jody M. Webster², Ángel Puga-Bernabéu³, Gustavo Hinestrosa², Mardi A. McNeil⁴, Luke Nothdurft⁴, Thomas C. L. Bridge^{5,6} and James Daniell⁷

1. College of Science & Engineering, James Cook University, Cairns, Qld, 4870, Australia
2. School of Geosciences, The University of Sydney, Sydney, NSW, 2006, Australia
3. Departamento de Estratigrafía y Paleontología, Universidad de Granada, Granada, 18002, Spain
4. School of Earth, Environmental & Biological Sciences, Queensland University of Technology, Brisbane, Qld, 4001, Australia
5. Biodiversity & Geosciences Program, Museum of Tropical Queensland, Queensland Museum Network, Townsville, Qld, 4810, Australia
6. Australian Research Council Centre of Excellence for Coral Reef Studies, James Cook University, Townsville, Qld, 4811, Australia
7. College of Science & Engineering, James Cook University, Townsville, Qld, 4870, Australia

Abstract

Project 3D-GBR is a long-term bathymetry data aggregation project to improve the accuracy of the underwater seascape for Australia's Great Barrier Reef (GBR) and Coral Sea. In a collaboration with the Australian Hydrographic Service, Geoscience Australia and James Cook University, the source bathymetry data for the project includes all the available multibeam and singlebeam surveys, airborne lidar bathymetry, satellite derived bathymetry, ENC spot depths and GA-developed Intertidal Elevation Model DEM data. All source data are edited as 3D point clouds to remove noise, apply a consistent WGS84 horizontal datum, and wherever possible, a mean sea level vertical datum. The resulting 100/30 m-resolution grids are now widely used by marine managers, scientists and the public. We show the steps taken to generate these grids and provide examples of the dramatic improvement in the revealed seabed geomorphology. Importantly, these bathymetry grids have provided the critical data for regional-scale geological interpretations of the GBR, including the character of submarine canyons and undersea landslides along the margin, the distribution of extensive submerged reefs, and the remarkable morphology of *Halimeda* (green algae) bioherms on the northern GBR shelf. Here we show some of the science outputs from these seafloor environments and outline future planned research.

S3**Seafloor Mapping in Australia – Progress, Discoveries, Applications****Monday 2 July, 1530 - 1545**

Genomics of marine organisms: contributions to ecology and evolution

Luciano B. Beheregaray¹ and Joseph DiBattista²

1. Flinders University, Adelaide, SA, 5042

2. Curtin University, Perth, WA, 6102

Abstract

Recent technological advances in genomics now allow the collection of powerful data for ecologically and commercially important species. Genomic studies (i.e. the study of hereditary information based on 1000s of DNA markers or full genomes) provide fundamental and general insights into the complex biology of organisms. As such, they have advanced biotechnology and also informed on the ecology, conservation management and evolution of both model and non-model organisms. Genomic information provides unprecedented resolution for a range of needs and applications in marine ecology, fisheries management, aquaculture, biogeography and taxonomy. Integrative genomic approaches can also be used to clarify how aquatic organisms adapt to their environment and how they might respond to localized or global changes triggered by human activities. In this talk, we introduce basic concepts in ecological and conservation genomics and use case studies from our own work on temperate and tropical ecosystems to illustrate the power of genomic information for addressing questions in marine ecology and evolution. We also introduce the scope and structure of the AMSA 2018 symposium 'Genomics of Marine Organisms'.

S9***Genomics of marine organisms: contributions to ecology and evolution*****Thursday 5 July, 1030 - 1045**

Simultaneous Surface and Subsurface Mapping: Benefits for Better Understanding Biological and Geological Processes

Douglas Bergersen¹

1. Acoustic Imaging, Cooroy, QLD 4563

Abstract

Swath mapping of the seabed has become a more standard technique in recent years for geologists, biologists, and hydrographers to understand the spatial distributions of features ranging from sand wave fields to gas escape structures to seagrass meadows. Most modern multibeam echo sounders (MBES) generate bathymetry and backscatter data, which provide useful information on the surficial characteristics of the surveyed area. More recently, water column data is being logged, extending analyses to areas above the seabed.

Subbottom profilers (SBP) are another acoustic mapping tool. These systems image subsurface slices through the seabed. Although SBPs have existed at least as long as multibeam echo sounders, the two instruments are rarely used simultaneously during most shallow mapping programs.

This presentation provides an overview of a project where both instruments were deployed to map a mobile layer of weed wrack in Jurien Bay, WA through 2 time periods. Although the MBES data provided some clues to weed wrack distribution, a more thorough understanding of the biological and sedimentological dynamics affecting the bay were achieved by incorporating the subsurface data.

S3

Seafloor Mapping in Australia – Progress, Discoveries, Applications
Monday 2 July, 1430 - 1445

Functional plasticity in vertebrate scavenger assemblages in the presence of introduced carnivores

Ellen Bingham¹, Ben Gilby¹, Andrew Olds¹, Michael Weston², Rod Connolly³, Brooke Maslo⁴, Christopher Henderson¹, Charles Peterson⁵, Christine Voss⁵, Thomas Schlacher¹

1. University Of The Sunshine Coast, Alexandra Headlands, Queensland, Australia
2. Deakin University, Melbourne, Victoria, Australia
3. Griffith University, Gold Coast, Queensland, Australia
4. The State University of New Jersey, Ecology, Evolution and Resources, New Jersey, New York, USA
5. University of North Carolina, Chapel Hill, North Carolina, USA

Abstract

Introduced species may suppress or enhance ecological functions, or they may have neutral effects in ecosystems where they replace or complement native species. Few studies, however, have explicitly tested for these trajectories, and for the effect these might have for native species. In this study, we experimentally test the trajectory and scale of change in the function of 'carriion removal' at different carrion loads along ocean beaches in Eastern Australia that have different numbers of introduced red foxes (*Vulpes vulpes*) and several species of native raptors. We hypothesised that the 'positive' effect of foxes on carrion removal would be greatest at high carrion loads because competition for resources between native and introduced species is lower. Scavenger abundance, fox occurrences and carrion consumption by these species differed widely between locations and times. Despite distinct spatial differences in the structure of vertebrate scavenger assemblages, total carrion consumption was not significantly different between locations at any carrion load. This lack of variation in functional rates indicates potential functional plasticity in the scavenger assemblage and possible functional accommodation of red foxes. Neutral fox effects on ecological functions or the ecosystem more broadly are, however, very unlikely to extend beyond carrion consumption.

G5**Estuaries and coasts****Monday 2 July, 1700 - 1715**

Free Ocean Carbon Dioxide Enrichment (FOCE) investigation on Southern Ocean benthic marine communities: Primary producer behavioural, physiological and community composition responses.

James Black¹, Jonathan S Stark², Glenn Johnstone², Phillip Boyd¹, Andrew McMinn¹, John McKinlay², Imojen Pearce²

1. Institute for Marine and Antarctic Studies (IMAS), Hobart

2. Australia Antarctic Division (AAD), Kingston

Abstract

Ocean acidification is predicted to simultaneously disadvantage some organisms (calcifying heterotrophs) while benefiting others groups (autotrophs), likely altering marine community dynamics. The oceans capacity for atmospheric CO₂ absorption will result in a change in carbonate chemistry expected to decrease pH, calcium carbonate (Ω) and increase oceanic pCO₂ by the year 2100. Laboratory research is insufficient to determine how in-situ marine communities will respond to ocean acidification. Free Ocean Carbon Dioxide Enrichment (FOCE) experiments are a recent technological advance enabling in-situ community assemblage experiments. We conducted the first benthic polar FOCE experiment (antFOCE) and have analysed the effects on benthic primary producer behaviour, photo physiology, net production and community composition. This was done using novel, custom made sensors and automated underwater systems in both long term community (2 months) and short term physiological (<144 hours) experiments. Decreased seawater pH (7.7) was found to significantly alter the behaviour of benthic primary producers (diatoms) and enhance photosynthetic yield in the short term. This had flow on effects, increasing the relative primary production compared to controls in long term FOCE experiments. We expect these positive responses of primary producers to ocean acidification will result in higher primary producer biomass in Antarctic benthic communities.

S6

Linking disciplines to advance mechanistic insights of species responses to climate change

Tuesday 3 July, 1630 - 1645

Habitat Type and Beach Exposure Shape Fish Assemblages in the Surf Zones of Ocean Beaches

Hayden P. Borland¹, Thomas A. Schlacher¹, Ben L. Gilby¹, Rod M. Connolly², Nicholas A. Yabsley¹, Andrew D. Olds¹.

1. School of Science and Engineering, University of the Sunshine Coast, Maroochydore, QLD 4558, Australia
2. Australian Rivers Institute—Coasts & Estuaries, and School of Environment, Griffith University, Gold Coast, QLD 4222, Australia

Abstract

The surf zones of ocean beaches are prime fishing sites and provide habitat for a diversity of fish species. The spatial composition of seascapes shapes fish abundance and diversity in most coastal ecosystems, but it remains untested whether seascape effects operate on ocean beaches. This study used the surf zones of sandy beaches in eastern Australia as a model system to contrast fish assemblages between the 2 main surf habitats (nearshore troughs and offshore bars), and test how habitat partitioning changes with beach exposure, wave conditions, seascape connectivity (i.e. proximity to estuaries and rocky headlands) and tide. Fish were sampled with baited remote underwater video stations from the surf zones of 18 sandy beaches in southern Queensland and northern New South Wales. Fish assemblages always differed between nearshore trough and offshore bar habitats; beach exposure was also important to surf fishes but did not alter the priority effects of habitat partitioning. Our results show that surf zones are composed of topographically and hydrodynamically distinct habitats that support correspondingly distinct fish assemblages. Because fishing effort also differs between surf habitats, fisheries management and spatial conservation planning need to reflect these spatial nuances in the surf zones of ocean beaches.

G5 *Estuaries and coasts*
Monday 2 July, 1330 - 1345

Integrated Image-Based Surveys of Reef Fish and Their Habitat

Nader Boutros¹, Oscar Pizarro¹ and Stefan Williams¹

1. Australian Centre for Field Robotics, The University of Sydney, Sydney

Abstract

Novel imaging techniques and improvements in computational resources allow high resolution image-based 3D reconstructions of entire reefs to be created. These reconstructions can be used to estimate the physical structure (e.g. Friedman et al. 2012) and biological makeup of the reef, while preserving information on the spatial distribution of habitat features (Gonzalez-Rivero et al. 2017).

Stereo-imaging fish surveys are widespread. They allow researchers to estimate size distributions and biomass of fish assemblages and can be used to estimate the 3D positions of observed fish relative to the imaging system (Shortis et al. 2009).

The proposed approach uses image-based habitat reconstructions and stereo fish survey techniques to observe the distribution of fish within the mapped area. A stationary stereo rig is used to observe fish swimming in a region in which a 3D habitat map has been created. The position of the stationary rig is determined by matching features between the fish survey and habitat reconstruction images. The locations of observed fish can then be estimated, allowing the habitat features (e.g. rugosity) at those locations to be scrutinised directly from the reconstruction. This may allow for a better understanding of how habitat can impact the distribution of fish.

S3

Seafloor Mapping in Australia – Progress, Discoveries, Applications

Monday 2 July, 1730 - 1745

Predicting sustainable shark harvests when stock assessments are lacking

Corey J. A. Bradshaw¹, Thomas A. A. Prowse², Michael Drew³, Bronwyn M. Gillanders⁴, Steven C. Donnellan^{5,6}, and Charlie Huveneers⁷

1. Global Ecology, College of Science and Engineering, Flinders University, GPO Box 2100, Adelaide, South Australia 5137, Australia
2. School of Mathematical Sciences, University of Adelaide, Adelaide, South Australia 5005, Australia
3. South Australian Research and Development Institute – Aquatic Sciences, West Beach, Adelaide, South Australia 5024, Australia
4. Southern Seas Ecology Laboratories, School of Biological Sciences, University of Adelaide, Adelaide, South Australia 5005, Australia
5. Centre for Evolutionary Biology and Biodiversity, University of Adelaide, Adelaide, South Australia 5005, Australia
6. South Australian Museum, Adelaide, South Australia 5000, Australia
7. Southern Shark Ecology Group, College of Science and Engineering, Flinders University, GPO Box 2100, Adelaide, South Australia 5137, Australia

Abstract

Effective fisheries management generally requires reliable data describing the target species' life-history characteristics, the size of its harvested populations, and overall catch estimates, to set sustainable quotas and management regulations. However, stock assessments are often not available for long-lived marine species such as sharks. Stage- or age-structured population models can assist if sufficient information exists to estimate survival and fertility. Using data collected from the bronze whaler (*Carcharhinus brachyurus*) fishery in South Australia, we estimated survival probabilities from life tables of harvested individuals, as well as calculated natural mortalities based on allometric predictions. Deterministic matrices built using estimates of life-table data or natural mortality produced instantaneous rates of change of 0.006, and 0.025, respectively. Stochastic simulations suggest the relative rate of population decline starts to become precipitous around 25% beyond current harvest rates. If the catch is assumed to be proportional, the relative r declines approximately linearly with incrementing harvest beyond the current rate. Variation in the survival estimates derived from the life tables was by far the dominant determinant of model performance. Our models provide a framework for assessing the relative susceptibility of long-lived fishes to harvest pressure when detailed stock data are missing.

G2 *Life history and connectivity in the ocean*
Tuesday 3 July, 1630 - 1645

Thermal Performance of Seagrass-Associated Estuarine Fishes

Mitchell D Brennan¹ and David J Booth¹

1. Fish Ecology Lab, University of Technology, Sydney, 15 Broadway, Ultimo, NSW, 2007

Abstract

Anthropogenic activities have driven a global increase in sea surface temperatures (SST), with possible increases of 4 °C predicted by the end of the 21st century. As obligate ectotherms, fish are affected by ambient water temperatures, so increasing SST can be expected to alter life-history and survival of fishes. This project has combined in situ fish sampling, monitoring ambient temperatures, and controlled laboratory experiments to measure the thermal performance of seagrass-associated estuarine fishes.

The study links ambient water temperature to growth, metabolic activity and fish behaviours including boldness and foraging. For instance, we have found that, within a given estuary, fish species differ in their thermal performances, and we aim to compare species responses across a latitudinal gradient (from Port Stephens to Merimbula, NSW).

Collectively, this sampling and experimentation will be used to determine likely long-term impacts of increased SST, such as potential differences in individual success, competition effects and range distributions, and the subsequent impacts on estuarine fish assemblages.

G5*Estuaries and coasts***Monday 2 July, 1345 -1400**

The importance of remote offshore Island Sanctuary Zones in South Australia's marine parks network

Danny Brock¹, Simon Bryars¹, Daniel Easton¹, David Miller¹, Yvette Eglinton¹, Jamie Hicks¹, Craig Meakin¹ and Alison Wright¹

1. Department of Environment, Water and Natural Resources

Abstract

A common issue in marine conservation is the lack of relatively un-impacted locations that can act as reference sites. These sites are important as they can serve as a baseline for scientific research and for design and evaluation of management actions. Proximity to human population centres can act as a proxy for a number of stressors to marine ecosystems, including fishing, coastal development and pollution. In general, negative impacts on marine systems correlate with increases in proximity to and size of human population centres.

South Australia's marine parks network contains several remote, offshore Island Sanctuary Zones. These locations were included in the network in part because they contain high levels of biodiversity and their remoteness has meant impacts to these systems are relatively low. Ecological monitoring conducted at offshore islands since marine park implementation in 2014 have confirmed the importance of these locations as biodiversity hotspots for fish and macro-invertebrates. In addition, other measures such as biomass of large fish and the size and abundance of focal species are the highest in the network, demonstrating the important role these areas play as reference sites and in biodiversity conservation.

S11 *Marine biodiversity conservation – what's effective?*
Wednesday 4 July, 1115 - 1130

The Lord Howe Seamount Chain and the Development of Atolls

Brendan Brooke¹, Colin Woodroffe², Scott Nichol¹ and Zhi Huang¹

1. Geoscience Australia
2. University of Wollongong

Abstract

The Lord Howe Seamount Chain provides a unique opportunity to investigate a major marine geological process – the evolution of mid-ocean volcanoes into carbonate platforms and coral atolls. Charles Darwin hypothesised that an atoll can form as a result of the subsidence of the volcano underlying a reef. Initially, a fringing reef encircles the cone of the volcano, growing vertically as the volcano subsides, leaving only a ring-shaped coral reef around a central lagoon. In contrast, marine erosion has truncated the Lord Howe Island and Balls Pyramid volcanoes, and each remnant sits in the centre of a several-kilometre wide shelf, which supports a diverse mesophotic reef. Elizabeth and Middleton reefs, two atoll-like reefs 100-150 km to the north that sit on much older seamounts, may not be atolls in the Darwinian sense if they also formed on a truncated volcanic shelf. We present a compilation of a range of bathymetric data (LADS and acoustic) for Elizabeth and Middleton reefs that provides the first glimpses of shelves that extend seawards from the reef margins, similar to Lord Howe Island and Balls Pyramid. The data suggest a similar mode of formation and indicate the presence of extensive mesophotic reef.

G4 *Carbonate shelves: geology, oceanography and biota*
Tuesday 3 July, 1615 - 1630

The dynamics of coral-algal interactions in space and time on the southern Great Barrier Reef

Kristen T. Brown^{1,2,3}, Dorothea Bender-Champ^{1,3}, Andreas Kubicek^{1,3}, Rene van der Zande^{1,2,3}, Michelle Achlatis^{1,2,3}, Ove Hoegh-Guldberg^{1,2,3} and Sophie Dove^{1,2,3}

1. Coral Reef Ecosystems Lab, School of Biological Sciences, University of Queensland, 4072 St. Lucia QLD
2. Global Change Institute, University of Queensland, 4072 St. Lucia QLD
3. ARC Centre for Excellence for Coral Reef Studies, University of Queensland, 4072 St. Lucia QLD

Abstract

Globally, tropical coral reefs are being degraded by human activities, and as a result, reef-building corals have declined while macroalgae have increased. Recent work has focused on measuring macroalgal abundance in response to anthropogenic stressors. To accurately evaluate the effects of human impacts, however, it is necessary to understand the effects of natural processes on reef condition. To better understand how coral reef communities are influenced by natural processes, we investigated how spatial and seasonal changes in environmental conditions influence benthic community structure, and the composition and frequency of coral-algal interactions over a 23-month period at Heron reef on the southern Great Barrier Reef. Hard coral cover and macroalgal density showed distinct spatio-temporal variations, both within and between reef habitats, revealing the importance of spatial variability in the dynamics of coral reef composition. The composition and biomass of macroalgae increased in spring and declined in summer, tracking closely with changes in temperature and light availability, which further influenced the composition and frequency of coral-algal interactions. The results of this long-term experiment improve our understanding of how environmental conditions control spatio-temporal changes in macroalgal communities, and how changes in benthic cover influence the frequency and composition of coral-algal interactions.

S5

Structure and function of coral reefs in a changing world
Wednesday 4 July, 1130 - 1145

5-years in: Is South Australia's marine parks network being effective at biodiversity conservation?

Simon Bryars¹, Alison Wright¹, Danny Brock¹, Yvette Eglinton¹, Jamie Hicks¹, Vera Hughes¹, Sarah Laurence¹, Craig Meakin¹ and David Miller¹

1. Department of Environment, Water and Natural Resources

Abstract

South Australia's network of 19 marine parks was finalised in 2012 and fully implemented in 2014. The marine parks are 'multiple-use' with different zones providing for varying levels of protection and permissible activities. The strategies of the accompanying 19 management plans are delivered through four sub-programs of protection, stewardship, compliance, and performance, which are collectively designed to provide for biodiversity conservation and public appreciation but also allow ecologically sustainable development and use of marine resources.

In 2018 a status report was released that documents the management activities undertaken, and early ecological and socio-economic outcomes observed, after the first five years. The findings of the report highlight that the marine parks program is on track to meet its statutory obligations through the implementation of activities aligned with the strategies of the management plans. The program is currently observing the predicted outcomes expected from effective implementation of these strategies. The report has been used to develop recommendations that guide the direction of the marine parks program over the next five years leading up to the legislated 10-year review of the management plans by 2022.

S11 *Marine biodiversity conservation – what's effective?*
Wednesday 4 July, 1005 - 1020

Rapid transmission and pathogenesis of *Bonamia* infection in *Ostrea angasi*

Jessica J. Buss^{1,2}, James O. Harris¹ and Marty Deveney²

1. Flinders University, Sturt Road, Bedford Park, SA, 5042.

2. SARDI, Aquatic Sciences, 2 Hamra Avenue, West Beach, SA, 5024.

Abstract

Bonamia, a pathogenic haplosporidian parasite was detected in Australian shellfish in 1990. *Bonamia* infection remains a challenge to *Ostrea angasi* aquaculture. Northern hemisphere field data has indicated that *Bonamia* infections build slowly, but we observed rapid infection in field-deployed *O. angasi*. To investigate infection of *Bonamia* in *O. angasi*, we exposed uninfected juvenile *O. angasi* (<36 mm SL) to infected adults (<83 mm SL). Oysters were sampled at 10, 21 and 40 days post exposure, and *Bonamia* prevalence and intensity were assessed. Mortalities began >15 days exposure, with >50% mortality by day 25 and >75% mortality by day 40. All mortalities suitable for sampling were examined with majority having signs of clinical *Bonamia* infection. No mortalities occurred in unexposed tanks. We found *Bonamia* is not a pathogen with slow infection rate for which high intensity reflects long exposure, and host death is not required for transmission. Patterns of infection observed in field studies overseas are likely to reflect infection dynamics driven by a range of factors. Dynamics of *Bonamia* infection in *O. angasi* are unknown, but understanding *Bonamia* transmission and infection dynamics can inform interpretation of field studies and aid development of management strategies for oyster aquaculture industries worldwide.

S10 **Marine biosecurity in an increasingly-connected world: protecting Australia from marine pests and diseases**

Wednesday 4 July, 1430 - 1445

Sizing up the crab invaders! Morphometrics for *Carcinus* spp. can assess population variability and assist with species identification

René T. Campbell¹, Sabine Dittmann¹, Michael Gardner¹, Marty Deveney²

1. College of Science & Engineering, Flinders University, Sturt Road, Bedford Park, SA 5042
2. South Australian Research and Development Institute, West Beach, SA 5024

Abstract

European shore crabs are highly invasive and consist of two species, *Carcinus maenas* from the North Atlantic, and *C. aestuarii* from the Mediterranean Sea. Introduced *Carcinus* in South Australia have currently not been confirmed at the species level, and we observe morphological differences in crabs from different habitats. Morphometric analysis can assist with taxonomic classification of the genus and identify morphological variation among local populations. Crabs were collected from three intertidal habitats (mangrove, port and rocky shore) along Adelaide's metropolitan coastline over five years. Twelve morphological traits and two carapace size ratios have been measured for over 800 crabs to date. Morphometric relationships display isometric growth overall, with multivariate analyses supporting morphological variation by both sex, size and habitat. Carapace size ratios for identification suggest that most specimens are *C. maenas*, however evidence for the presence of *C. aestuarii* or hybridisation has occurred, particularly in rocky shores. Taxonomic classification through morphometrics can be variable and inconclusive, therefore DNA barcoding techniques will be used to later confirm the species present. Additional morphometric analysis indicated variation in the population structure across habitats, which could be attributed to life history strategies or potential plasticity to different environment conditions.

Poster presentation

S10

Recreational Boat Operators' Self-management of Biofouling in Australia

Timothy Carew¹, Nyree Stenekes² and Robert Kancans²

1. Australian Department of Agriculture and Water Resources, (speaker)
2. Australian Bureau of Agricultural and Resource Economics and Sciences, (authors)

Abstract

Movements of vessels within Australia pose a risk for the spread of marine pests. Marine pests can readily attach as biofouling to hulls, internal seawater systems or to boating gear. There are more than 75,000 recreational boats greater than 7 metres in length in Australia, creating opportunity for pests to be inadvertently spread as boats move from one place to another.

In 2015, a national review of Australia's marine pest biosecurity arrangements identified national education and awareness activities as key to minimising domestic spread of marine pests.

In 2015, a nationwide project was commissioned through the Australian Bureau of Agricultural and Resources Economics and Sciences to:

1. Gather information on the behaviours of domestic vessel operators as it relates to biofouling management, vessel movement patterns and anti-fouling practices; and
2. Determine the level of understanding of marine pest risks by domestic recreational boaters in Australia.

Participation in the online survey was voluntary with 1585 responses received. This presentation will discuss the key findings of the project including the drivers and barriers to behaviour change, information and policy gaps, anecdotal learnings and suggestions for a way forward to encourage increased uptake of biofouling management practices by recreational boaters.

S10 *Marine biosecurity in an increasingly-connected world: protecting Australia from marine pests and diseases*

Wednesday 4 July, 1545 - 1600

Using science to inform biosecurity management in a complex regulatory environment

Raquel Carter¹, Christine Lamont¹

1. Nopsema, Perth, WA, Australia

Abstract

In Australia the regulatory requirements for marine biosecurity management are complex. Off the WA coast and out to 200nM alone there are four regulators and four sets of relevant legislation covering state and Commonwealth waters, in addition to numerous policies and guidelines that are relevant to marine biosecurity management. As the oil and gas industry in Australia pushes into remote locations in deeper water further from the mainland coast, very large offshore processing facilities have been built in foreign ports and transported to remote locations in Australian waters where they will remain for decades. To service these facilities, a variety of support vessels are utilised with conveyances between offshore facilities and Australian ports. These projects represent a challenging and novel biosecurity management situation, particularly in relation to environmental impact assessment, ongoing management, regulation and the science necessary to underpin sound decision making and management. There are opportunities for industry, government and the scientific research community to learn more about the potential invasive marine species (IMS) risk to the Australian marine environment from large and remote offshore facilities and to gain further insight into the key information that should be considered when planning for and selecting effective IMS risk mitigation measures.

S10 *Marine biosecurity in an increasingly-connected world: protecting Australia from marine pests and diseases*

Wednesday 4 July, 1215 - 1230

Microbiomics from the deep: exploring the microbial diversity of deep sea sponges from the Great Australian Bight

Sarah R Catalano¹, Qi Yang², Melissa Wos-Oxley^{2,3}, Shirley Sorokin², Jason Tanner^{1,2,4}, Andrew PA Oxley¹

1. South Australian Research and Development Institute Aquatic Sciences Centre, Hamra Avenue, West Beach, SA, 5024
2. Flinders University, Sturt Road, Bedford Park, SA, 5042
3. South Australian Museum, North Terrace, Adelaide, SA, 5000
4. University of Adelaide, North Terrace, SA, 5000

Abstract

As holobionts, sponges are known to have intimate physiological relationships with their associated microbial assemblages. They enrich for and harbour unique, rare components of the microbial biosphere, which provide a wealth of services important for both the host and the marine ecosystem. However, very little is known of deep-water sponge-microbe associations, especially in the Great Australian Bight (GAB), which forms a large proportion of South Australia's ecologically valuable marine frontier. The focus of this study was to elucidate the diversity of sponge-microbe associations that are key for coupling the benthic-pelagic deep-water marine ecosystems. The species level diversity and phylogenetic endemism of sponges collected from different depths in the GAB was inferred from specific marker genes, and was evaluated alongside the microbial community diversity of the tissues using a deep-sequencing approach. From this work, distinct sponge-microbiome associations were revealed in relation to sponge phylogeny and distribution. The Great Australian Bight Research Program is 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 environment, economic and social values of the region; providing an information source for all to use.

S8 *Marine microbes as mediators of ocean processes*
Wednesday 4 July, 1115 - 1130

Dispersal and Metapopulation Persistence: a Network Approach

Giorgia Cecino¹ and Eric A. Trembl²

1. School of BioSciences, The University of Melbourne, Parkville VIC 3010
2. Deakin University, Waurn Ponds, VIC 3216

Abstract

Connectivity among populations, largely determined by the early life history characteristics, is essential in ensuring metapopulation persistence for marine species. Using the network approach for visualising and analysing population connectivity, we investigated its relationship with metapopulation persistence. Including dispersal in the analysis of metapopulation dynamics can be more realistic than traditional demographic approaches. Also, to quantify the patch-level source-sink contribution of subpopulations, we calculated patch growth parameters, λ_c (Figueira & Crowder, 2006); reflecting losses occurring within a patch, and credits for gains on others. Here, we focus on marine species living in the South-East Marine Region of Australia and we used a dispersal model to develop habitat networks, where habitat patches are represented by nodes and dispersal connections are represented by linkages. We quantified the influence of life history characteristics and dispersal structure on metapopulation persistence. Specifically, we calculated the heterogeneity in the dispersal networks, in the form of closed dispersal loops, in-out degree centrality (number of links leading to-from a subpopulation node), and symmetry (extent to which the probability of dispersal to-from a node is the same). These network-based metrics can be indicative of metapopulation persistence. Our results demonstrate the power of a network approach to understand metapopulation persistence.

G2 *Life history and connectivity in the ocean*
Tuesday 3 July, 1500 - 1515

Predicted Climate Driven Change to Eastern Rock Lobster Larval Flow across the Tasman Sea

Paulina Cetina-Heredia¹, Moninya Roughan¹, Melinda A. Coleman², Andrew Jeffs³ and Geoffrey Liggins⁴

1. Regional and Coastal Oceanography Laboratory, School of Mathematics and Statistics, UNSW Australia, Sydney, Australia
2. Department of Primary Industries, NSW Fisheries and National Marine Science Centre, Coffs Harbour, New South Wales, Australia
3. Department of Primary Industries, NSW Fisheries, Sydney, New South Wales, Australia
4. Institute of Marine Science and School of Biological Sciences, University of Auckland, Auckland, New Zealand

Abstract

Climate change has affected ocean circulation and dispersal patterns, particularly along strengthening western boundary currents where a poleward shift in species distribution has already been observed. We examine predicted future climate driven changes in the flow of Eastern Rock Lobster (ERL) larvae within the Subtropical Pacific Gyre, focusing on the export of larvae across the Tasman Sea between mainland Australia, New Zealand and Tasmania. We use outputs of an eddy-resolving configuration of the Ocean Forecast Australian Model that downscales future climate scenarios from 2006-2101. We use a Lagrangian model to simulate the dispersal of ERL over its 12-month pelagic phase under climate scenarios. We find that in future climate the export of ERL larvae from Australia to the New Zealand's continental shelf will decrease considerably despite its long pelagic stage; in contrast, export from mainland Australia to Tasmania is shown to increase. In addition, larvae spawned along the Australian coastline will take approximately 2 months longer to reach New Zealand, and 6 months shorter to reach Tasmania. Our results imply that future climate has the potential to exacerbate range shifts such as those observed in the last decade, and that connectivity across the Tasman Sea is likely to diminish significantly.

S7**Micro- to Macro-: connecting multi-scale climate change research in marine systems****Thursday 5 July - 1430 -1445**

Changing windows of opportunity: Past and future climate-driven shifts in temporal persistence of kingfish (*Seriola lalandi*) oceanographic habitat within southeast Australian bioregions

Curtis Champion^{1,2}, Alistair J. Hobday^{2,3}, Xuebin Zhang², Gretta T. Pecl^{1,3}, Sean R. Tracey¹

1. Institute for Marine and Antarctic Studies, Hobart, Tasmania 7001, Australia.
2. CSIRO Oceans and Atmosphere, Hobart, Tasmania 7000, Australia.
3. Centre for Marine Socioecology, Hobart, Tasmania 7001, Australia.

Abstract

Climate-driven shifts in species distributions are occurring rapidly within marine systems and are predicted to continue under climate change. To effectively adapt, marine resource users require information relevant to their activities at decision making timescales. We model oceanographic habitat suitability for kingfish (*Seriola lalandi*) from southeast Australia using multiple environmental variables at monthly time steps over the period 1996 – 2040. Habitat predictions were used to quantify the temporal persistence (months per year) of suitable oceanographic habitat within six coastal bioregions. A decline in temporal habitat persistence is predicted for the northernmost (equatorward) bioregion, while increases are predicted for the three southernmost (poleward) bioregions. We suggest that temporal habitat persistence is an important metric for climate change adaption because it provides fishery-relevant information. Our methods demonstrate how novel metrics relevant to climate adaption can be derived from predictions of species' environmental habitats, and are appropriate for the management of fisheries resources and protection of high conservation value species under future climate change.

S7

Micro- to Macro-: connecting multi-scale climate change research in marine systems
Thursday 5 July, 1215 - 1230

Life histories of Southern right whales in South Australia based on three decades of research

Claire Charlton^{*1}, Robert McCauley¹, Rhianne Ward¹, John Bannister², Robert Brownell Jr.³, Chandra Salgado Kent¹, Stephen Burnell⁴.

1. Centre for Marine Science and Technology, Curtin University Western Australia
2. Western Australian Museum, Western Australia
3. NOAA Fisheries, Southwest Fisheries Science Center, California
4. Eubalaena Pty. Ltd. Adelaide, South Australia

Abstract

Life histories of Southern right whales (SRWs), *Eubalaena australis*, were assessed using 26 years of count and photo identification data. Data were collected annually between 1991 and 2016 at a major aggregation ground at Head of Bight in the Great Australian Bight Commonwealth Marine Reserve. Maximum abundance of SRW was recorded between late-July and early-August. The mean residence period was 65 days (range 1-99) for calving females and 15 days (range 1-51) for unaccompanied adults. A daily maximum of 172 individuals was recorded in 2016, with female and calf pairs ranging from 18-81. The estimated mean rate of increase in total SRWs sighted at Head of Bight was 5.5% (SD=2.5, 95%CI=0.03) per annum, and for females accompanied by a calf was 4.9% (SD=1.9, 95%CI=0.03). The photo-ID database includes 1,186 non-calf individuals including 459 reproductive females and 471 inter-annual calving intervals. The estimated mean calving interval was 3.3 years (SD=0.8, 95%CI=0.01). The mean age at first parturition was 9.3 years (SD=2.1 95%CI=0.03, N=22). These population demographics and life history parameters provide key information for recovery assessments, species conservation planning and global comparative studies with other right whale populations.

S13

From sea to coast – marine mammals in a connected world

Monday 2 July, 1715 - 1730

Spatial prevalence of coral-fish interactions and the benefits of aggregative fish for coral populations

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2. ARC Centre of Excellence for Coral Reef Studies, James Cook University, Townsville QLD 4814 Australia

Abstract

Specific fish-coral associations produce discernable benefits to host corals through fish services, however, the spatial extent and relative frequencies of these interactions remains unquantified, thus preventing a measurable link between fish services and coral populations. *In situ* surveys of the most prominent aggregative damselfish-coral associations were conducted at 45 sites spanning >1700 km along the Great Barrier Reef, during and after the 2016 bleaching event. The proportion of corals occupied by each fish species varied among habitat zones and exposure level, ranging from <1% to 94% (average coral occupancy prevalence of ~34%). Biomass of fish associating with coral colonies was two-fold greater on sheltered sites than exposed sites, with reef slope and shallow sandy patch habitats hosting >80% of all observed aggregative damselfish-coral associations. Although seemingly ubiquitous, aggregative fish-coral associations are strongly habitat dependent, occupancy is lower, and spatially more heterogeneous, than previously thought. Analyses of coral colony attributes (i.e. microstructure, bleaching status) reveal coral colony position and branch attributes dictate colony usage by fish, governing fine-scale prevalence of fish-derived services, whereas bleaching status has less impact on occupancy. Further multiscale analysis of variation and abundance before and after disturbances provide insights into the spatial processes associated with fish-coral interactions.

S5**Structure and function of coral reefs in a changing world****Wednesday 4 July, 1345 - 1400**

Species-specific behaviors dictate intensity of fish-coral interactions

TJ Chase^{1,2}, MS Pratchett^{1,2}, MO Hoogenboom^{1,2}

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Abstract

Coral reef fish often engage in obligate and symbiotic interactions with branching corals, providing beneficial services to host corals. However, mechanisms underlying these benefits likely depend on fish behavioral traits, which differ within and among species. This study examines variation in intensity of damselfish-coral interactions over temporal scales by assessing key behavioral traits that determine strengths of fish-coral associations, and therefore, influence fish-derived services (i.e. associational defense or nutrient provision). *In situ* behavioral observations revealed variation in diurnal and nocturnal behaviors among five damselfish species. Three species (*Chromis viridis*, *Dascyllus aruanus*, and *D. reticulatus*), consistently displayed high interaction strengths with corals (i.e. frequent colony visits and high heterospecific aggressiveness), whereas *Pomacentrus amboinensis*, and *P. moluccensis* displayed low interaction strengths. This research identifies which fish behaviors are consistent with beneficial effects on their host colonies (i.e. coral tissue aeration, nutrient subsidy, and enhanced coral photosynthesis), as well as an estimate of when they are most effective in their service production, leading to impacts on coral colony and reef community scale. Determining how these prevalent fish-coral species respond to future stresses require an understanding of interspecific variations that currently exists, playing critical roles in determining overall interaction persistence.

Poster presentation

S5

Overlap in Fish Assemblages Observed Using Pelagic and Benthic BRUVS

Thomas M. Clarke¹, Sasha K. Whitmarsh¹, Peter G. Fairweather¹, Charlie Huveneers¹

1. College of Science & Engineering, Flinders University, Sturt Road, Bedford Park, SA, 5042

Abstract

Baited Remote Underwater Video Stations (BRUVS) are increasing in popularity as non-invasive and fishery-independent tools for assessing fish assemblages. Although most BRUVS studies have focused on demersal fish communities, few recent studies also use BRUVS to examine the comparatively under-sampled pelagic communities. The propensities of benthic-positioned BRUVS to detect pelagic fishes and, likewise, pelagic-positioned BRUVS to detect demersal fishes are, however, unknown. For the first time, this study used benthic and pelagic BRUVS simultaneously deployed either separately (single) or in combination to assess assemblages of demersal and pelagic species at three contrasting sites within temperate Gulf St Vincent, South Australia. Assemblages observed via benthic and pelagic BRUVS were significantly different at all sites, including sites as shallow as 7 m depth, but there were no significant differences in assemblages observed when a type of BRUVS were deployed as single units or in combination. This study reveals the limitations of using only benthic or pelagic BRUVS, and highlights the necessity for both BRUVS positions to be applied together to ensure that a comprehensive representation of entire fish assemblages throughout the water column can be obtained.

G5*Estuaries and coasts***Monday 2 July, 1415 - 1430**

Identifying Spawning Behaviour and Important Areas of Yellowtail Kingfish (*Seriola lalandi*) in South Australia

Thomas M. Clarke¹, Sasha K. Whitmarsh¹, Peter G. Fairweather¹, Charlie Huveneers¹

1. College of Science & Engineering, Flinders University, Sturt Road, Bedford Park, SA, 5042

Abstract

Yellowtail kingfish (*Seriola lalandi*, YTK) is a circumglobal, pelagic species of carangid which is capable of migrating vast distances. Their large size, fighting ability, and desirable flesh, has led to heavy targeting from recreational and commercial fisheries, as well as supporting an expanding aquaculture industry. In 2014, a community-suggested sanctuary zone was implemented inside Coffin Bay to protect the large schools of YTK observed annually in shallow waters during spring. While it has been assumed that these aggregations are related to spawning events because of observations of tight groups and behaviours expected to be linked with spawning, definitive evidence is seemingly lacking. This project will use a range of biologging and tracking technology to identify and describe typical spawning behaviours and determine whether such behaviour occurs in Coffin Bay. Kingfish will then be tracked using archival satellite tags to examine their wider movements within southern Australia and assess the level of connectivity between YTK from Coffin Bay and other aggregation sites. Findings of this study will aim to identify natural areas and environmental conditions vital to the spawning and recruitment of YTK and contribute to effective management through the continual protection of these critical aggregation areas for YTK.

Poster presentation

G2

Ocean Acidification May Buffer the Negative Impacts of Tropical Sea Urchins at Temperate Latitudes

Ericka Coni¹, Ivan Nagelkerken¹, Camilo Ferreira¹, Sean Connell¹, David Booth²

1. University of Adelaide, North Terrance, SA 5005

2. University of Technology Sydney, Broadway, NSW 2007

Abstract

Range shifting of tropical species has brought novel interactions to temperate ecosystems. The historical range of the sea urchin, *Centrostephanus rodgersii*, along the southeast coast of Australia has resulted in novel resource-consumer interactions driving many temperate reefs into alternative states. Besides direct detrimental effects, the development of barrens as a result of sea urchin overgrazing may be positive to vagrant tropical fishes that can be regularly found in similar habitats in tropical regions. However, as ocean acidification is predicted to intensify along with ocean temperature, its effects on sea urchin performance and creation of barrens, and consequently on the fish communities remain unclear. By performing surveys at natural CO₂ vents and tropicalisation hotspots, we evaluate the buffering effect of ocean acidification on sea urchin-induced habitat degradation, and their cascading effects on tropical and temperate fish communities. Although we found that in temperate reefs most tropical vagrant fishes preferred barrens, we discovered that the abundance of sea urchins and the development of barrens at the vents were reduced. Our findings highlight the important role played by ocean acidification in buffering the creation of barrens, and consequently the shifting of native fish communities under the establishment of climate-induced tropical fishes.

S6 **Marine Climate Change from Shelves to Deep Seas**

Wednesday 4 July, 1545 - 1600

40 years of surveying deepwater benthic continental slope and canyon habitats in the western North Atlantic.

Heath Cook^{1,2}, Laura Shulman¹ and William Bemis²

1. Integrated Statistics, 16 Sumner Street, Woods Hole MA, USA
2. Department of Ecology and Evolutionary Biology and Cornell University Museum of Vertebrates, Cornell University, 215 Tower Road, Ithaca NY, USA

Abstract

The NOAA Fisheries Service bi-annual bottom trawl survey has monitored deepwater benthic continental slope and canyon habitats since the 1970s. It is a random stratified survey that is conducted between Cape Hatteras, USA and the Scotian Shelf, Canada using a 4-seam trawl, towed at an annual average of 120 stations by the FSV *Henry B. Bigelow*. The survey covers depths from 200m to 370m, 1340km of continental slope, and 31 major canyons. More than 600 species of fishes and invertebrates have been recovered. The long time series and sheer volume of biological, oceanographic, and bathymetric data collected is a goldmine for scientists studying these deepwater environments. However, there are many challenges to maintaining a continuous survey over such a considerable period, including logistical difficulties related to bottom trawling at depth and in complex bathymetry. Further significant challenges include: balancing stakeholder demands; the relative lack of valuable commercial species in these habitats; reluctance of management agencies to invest in biodiversity research; and a recent uptick in the declaration of marine protected areas, especially those associated with deepwater corals. Challenges are detailed coupled with the insights that have been gained overcoming them, particularly over the past decade.

G1 *Deep sea and canyon ecology*
Wednesday 4 July, 1145 - 1200

Uses and Applications of Airborne LiDAR Bathymetry for Coastal Zone Management in Western Australia and Victoria

Alex Cowdery¹, Hugh Parker¹, Nathan Quadros²

1. Fugro Australia Marine Pty Ltd,
2. FrontierSI (formerly Cooperative Research Centre for Spatial Information)

Abstract

Using technology to define the general shape of the seabed, determine broad classification seabed materials whilst also allowing realistic modelling of floods, surface water, tsunamis, storms and oil spills is possible. Through collaboration with multiple stakeholders and independent experts such as CRCSI, governments can drive policy to allow investment in comprehensive accurate datasets whilst leveraging more sophisticated analysis techniques to deliver better decisions and business intelligence for the coastal zone.

This presentation will review the use of Airborne LiDAR Bathymetry (ALB) in helping the Western Australian Government and their stakeholders to understand the coastline and nearshore environment, to update charts and better analyse the risks and exposure of the coastline to climate change events. The outcomes of this project have enabled more informed government decisions in planning and managing coastal infrastructure and natural environments. This presentation will also review the success of a collaborative project trialling ALB in sections of Port Philip, Victoria. This pilot project will review existing information and aims to design an approach for enhancing the success of complete coverage of Port Phillip for CZM, hydrodynamic modelling and nautical charting.

S3 *Seafloor Mapping in Australia – Progress, Discoveries, Applications*
Monday 2 July, 1600 - 1615

First comprehensive study of sea anemones (Cnidaria: Actiniaria) from the deep sea of the Great Australian Bight: 2015 & 2017 surveys

Andrea L. Crowther¹ and Michela Mitchell²

1. South Australian Museum, North Terrace, Adelaide, SA, 5000
2. Museums Victoria, Melbourne, VIC, 3001

Abstract

Actiniaria are exclusively soft-bodied hexacorallian cnidarians occurring in shallow and deep sea environments. Actiniaria from deep sea regions of Australia are relatively unknown; however, specimens were collected during surveys of the Great Australian Bight, undertaken primarily from RV *Investigator*, in 2015 and 2017. These surveys comprise the first comprehensive review of Actiniaria from the deep sea of the Great Australian Bight. Current records show that three families of Actiniaria dominate the deep sea environment: Hormathiidae, Actinostolidae and Actinoscyphiidae. Representatives of all of these families were found during these surveys, with hormathiids dominating the catch. In total, over 20 operational taxonomic units (putative species) were identified, including new records for Australia and likely new species.

Two research programs supported this collection: the Great Australian Bight Deepwater Marine Program (GABDMP), a CSIRO led research program sponsored by Chevron Australia, with data generated to be made publicly available, and the Great Australian Bight Research Program (GABRP) - 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.

G1 **Deep sea and canyon ecology**
Wednesday 4 July, 1545 - 1600

Growth and Nutrient Utilisation of Greenlip Abalone (*Haliotis laevis*) Fed *Ulva* sp. Protein Extract

Krishna-Lee Currie^{2,3} Amy L. Bates¹ Gordon S. Howarth¹, Mark Purvis³, Matthew Bansemer² and David A.J. Stone^{1,2,3,4}

1. University of Adelaide, School of Animal and Veterinary Sciences, Roseworthy, South Australia, Australia
2. South Australian Research and Development Institute (SARDI) of Aquatic Sciences, West Beach, South Australia, Australia
3. College of Science & Engineering, Flinders University, Bedford Park, South Australia, Australia
4. Marine Innovation Southern Australia, Australia

Abstract

In Australia, cultured greenlip abalone (*Haliotis laevis*) are fed formulated diets that typically do not contain macroalgae. In this 90-day study, the growth and nutrient utilisation of juvenile greenlip abalone (1.82 g) fed diets containing *Ulva* sp. protein extract (UPE), a by-product of the macroalgae industry produced and supplied by Venus Shell Systems (Bomaderry, NSW), were investigated. Animals were fed one of the four practically formulated test diets containing graded levels of UPE (0% basal diet, 5%, 10%, and 20%) or a commercial diet that served as a control for the 0% basal diet. Diets were formulated to contain 37% crude protein, 5% lipid, and 17.5 MJ/kg gross energy. Growth performance and feed utilisation of greenlip abalone fed the four experimental diets were similar. Dietary inclusions of UPE supported the growth of juvenile greenlip abalone and may be used to reduce dietary inclusions of other dietary protein sources including solvent extracted soybean meal, dehulled lupins, and wheat flour. Currently, UPE is cost prohibitive for commercial use in greenlip abalone diets. However, under the provision that UPE becomes economically viable in the future, we recommend dietary inclusion levels of up to 20% for greenlip abalone diets.

Poster presentation

S15

Colour Change Kinetics of Greenlip Abalone, *Haliotis laevis* Donovan, Fed Dried Macroalgae Meals

Krishna-Lee Currie¹, Mark Purvis¹, Amy Bates², Matthew Bansemer^{3,4}, James O. Harris¹, David AJ Stone^{1,2,3,4}

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2. The University of Adelaide, School of Animal and Veterinary Sciences, Roseworthy Campus, South Australia, Australia 5371;
3. SARDI Aquatic Sciences, PO Box 120, Henley Beach, South Australia, Australia. 5022;
4. Marine Innovation Southern Australia,

Abstract

In Australia, cultured greenlip abalone are fed formulated diets that lack macroalgae, the natural diet of abalone. This has resulted in a pale lip colour in contrast to the vivid green lip colour of wild abalone. The aim of this three month study was to evaluate the effects of dried macroalgae meal inclusion on the kinetics of colour change of greenlip abalone (*Haliotis laevis*). Three diets were used: 1) a commercial control diet; 2) a diet containing 15% dried mixed species macroalgae meal (MSM); and 3) a diet containing 15 % dried *Gracilaria cliftonii* meal. Colour change was measured monthly using digital photography and image analysis. The 15% *G. cliftonii* meal resulted in significant change in lip hue and lip colour saturation resulting in a visually greener lip, shell colour also changed from green/blue to a red/brown. In contrast, the inclusion of 15% MSM into the formulated abalone diet had no effect on lip, foot or shell colour, compared to the commercial diet. The addition of 15% *G. cliftonii* meal to formulated diets can be used to manipulate greenlip abalone lip and shell colour. further investigation is required to optimise *G. cliftonii* meal dietary inclusion to manipulate colour.

S15 **Aquaculture blue economy**
Tuesday 3 July, 1500 - 1515

Assessing the impacts of stormwater discharges on sediment microbes and biogeochemical cycling in urban waterways.

Katherine A Dafforn^{1,2}, Peter Steinberg^{2,3}, Stuart L Simpson⁴, Jaimie Potts⁵, Peter Scanes⁵, Simone C Birrer^{2,3}, Michael Sutherland⁵, Vivian Sim^{2,3}, Tim Lachnit⁶, Sanjay Swarup⁷, Staffan Kjelleberg⁷, Martina Doblin⁸, Gavin Birch⁹, Paul Gribben^{2,3}, Peter Freewater¹⁰ and Emma L Johnston^{2,3}

1. Department of Environmental Sciences, Macquarie University, North Ryde, NSW 2109
2. Sydney Institute of Marine Science, Mosman, NSW 2088
3. School of Biological, Earth and Environmental Sciences, University of New South Wales, Sydney, NSW 2052
4. Aquatic Contaminants, CSIRO Land and Water, Locked Bag 2007, Kirrawee, NSW 2232
5. NSW Office of Environment and Heritage, Lidcombe, NSW 1232
6. University of Kiel, Kiel, Germany
7. Singapore Centre for Environmental Life Sciences Engineering, Nanyang Technological University, 60 Nanyang Drive, Singapore 637551
8. University of Technology, Sydney, PO Box 123, Broadway, NSW 2007
9. University of Sydney, NSW 2006
10. Greater Sydney Local Land Services, PO Box 4514, Westfield Penrith, NSW 2750

Abstract

Estuaries are productive ecosystems that are subject to significant 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. 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.

S8 *Marine microbes as mediators of ocean processes*
Wednesday 4 July, 1145 - 1200

Diversity and plasticity: the intestinal microbiome of aquacultured abalone

Nathan Danckert¹, Kim-Yen Phan-Thien¹, Neil Wilson¹, Brian Jones¹, David Stone^{2,3,4,5}

1. Sydney Institute of Agriculture, the University of Sydney, Camperdown, NSW, 2006
2. South Australian Research and Development Institute Aquatic Sciences Centre, West Beach, SA 5024, Australia
3. Flinders University, School of Biological Sciences, GPO Box 2100, Adelaide, SA 5001, Australia
4. University of Adelaide, School of Animal and Veterinary Sciences, Roseworthy, SA 5371, Australia
5. Marine Innovation Southern Australia

Abstract

The digestive tract microbiome has a significant role in health, digestion and development. In healthy organisms, the microbiome is considered to improve health by promoting the uptake of essential nutrients for development, regulating the immune system, and thereby helping to prevent pathogenic infection. On the other hand, shifts in the microbiome that lead to imbalance, known as a state of dysbiosis, are associated with a number of diseases and adverse health conditions. The importance of the digestive tract microbiome in abalone, a commercially important aquaculture species, has not been well established. The aim of this research was to identifying the core microbiome, in terms of diversity and plasticity, of Australian abalone throughout the aquaculture grow-out cycle. Metagenomic approaches were used to sequence the intestinal microbiome of commercially cultured green lip (*Haliotis laevis*) and hybrid abalone (*Haliotis laevis* x *H. rubra*). The community composition and plasticity of the microbiome were examined throughout development during periods of optimal growth and temperature stress. The intestinal microbiome appears to be dominated by the phyla Proteobacteria and Fusobacteria, with *Psychrilyobacter* being the dominant genus. This research provides novel and practical information for researchers and farmers.

S15 **Aquaculture blue economy**
Tuesday 3 July, 1200 - 1215

Improving Fishing Mortality Rate Estimates for Management of the Queensland Saucer Scallop Fishery

James J. Daniell¹, Rebecca Formanek¹, Tony, J. Courtney², Wen-His Yang³, Matthew J. Campbell²

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2. Department of Agriculture and Fisheries, Dutton Park, QLD, 4102
3. University of Queensland, St Lucia, QLD, 4072

Abstract

Scallop fisheries are known for large fluctuations in abundance and subsequent variability in catch. Queensland Saucer scallops (*Ylistrum balloti*) are no exception with commercial catches varying dramatically over time. Based on historically low catch rates in 2015, the scallop stock was concluded to be overfished. It is hypothesized that the modelling of scallop stock can be improved through generating more reliable estimates of fishing mortality (F). This is based on the assumption that fishing mortality is not uniformly distributed, but rather a single unit of effort in the scallop's highly-preferred habitat removes a higher proportion of the stock than the same level of effort in a less-preferred habitat. Incorporating substrate information has also previously shown to improve the assessment of the Atlantic scallop (*Placopecten magellanicus*). The relationship between Saucer scallops and seabed substrate/structure is poorly understood, however, research utilising sediment samples and historic catch data indicates a moderate positive correlation between adult scallops and concentrations of mud. Multibeam echosounder and vessel monitoring data also reveal strong associations between scallops and the Mary River palaeochannel. Ongoing research will investigate the variability of seabed substrate throughout the fishery and how this information can improve modelling and management of stock.

S3

Seafloor Mapping in Australia – Progress, Discoveries, Applications
Tuesday 3 July, 1145 - 1200

Siliciclastic Foundations of Shelf-Edge Reefs on the Central Great Barrier Reef

James Daniell¹, Robin J. Beaman², Jody M. Webster³, Tiffany L. Sih¹, Scott G. Smithers¹

1. James Cook University, Townsville, Qld, 4870
2. James Cook University, Cairns, Qld, 4870
3. The University of Sydney, Sydney, NSW, 2006

Abstract

Widespread reef growth on the Great Barrier Reef initiated approximately 452-365 ka. These initial phases of early reef growth are commonly buried under more recent reef growth. As a result, direct observations of the substrates on which barrier reefs have developed and how these substrates influence modern reef morphology remain poorly understood. We present acoustic and sedimentary evidence of a shelf-edge delta system between Myrmidon Reef and the shelf break that can be attributed to the lowstand Burdekin River. Multibeam bathymetry shows that this shelf-edge delta underlies at least four drowned patch reefs and broad areas of highly rugose 'hardground'. These drowned reefs represent the initial establishment of early deglacial reefal limestone on top of flooded coastal siliciclastic accumulations and, as a result, are an analogy for the roots of modern barrier reef growth. Adjacent shelf-edge reef systems also show evidence of initiation on top of deltaic substrates.

Poster presentation

G4

Presence or Function: Which is most important in environmental impact assessment? (Considerations from Aquaculture EIAs)

Adam Davey¹, Jeff Ross¹ and Catriona Macleod¹

1. Institute for Marine and Antarctic Sciences, University of Tasmania, Hobart, Tasmania

Abstract

Even though we would probably all advocate that it is the functional role that species play that is most important in determining the ecology and environmental condition of any given situation, environmental impact assessments and management decisions are still often reliant on relatively simple metrics derived from either overall abundance, species richness or some indexed combination of these.

We draw on data from 3 case studies associated with aquaculture monitoring in Tasmania (Macquarie Harbour, Storm Bay and the D'Entrecasteaux Channel) to reflect on this, and assess the value of these different approaches. We consider just what can be ascertained from simple measures of abundance in systems that are variously impacted, and discuss how, where and why these simple measures can still be a valuable and cost effective assessment tool. We also explore where and why a deeper understanding of the community ecology might be important. We will provide some recommendations as to how to integrate these different approaches to benthic assessment; allowing for both relatively rapid assessments but also more context where appropriate, and hence improve management decisions.

S14 *Assessing and mitigating ecosystem effects of fishing and aquaculture*
Thursday 5 July, 1145 - 1200

Ecology of the Dinoflagellate Genus *Tripos* in Australian Waters

Claire H. Davies¹, Frank E. Coman², Ruth S. Eriksen¹, Felicity McEnnulty¹, Mark Tonks², Anthony J. Richardson^{2,3}, Anita S. Slotwinski², Julian Uribe-Palomino, Gustaaf Hallegraeff⁴

1. CSIRO Oceans and Atmosphere, Castray Esplanade, Hobart, TAS 7000, Australia
2. CSIRO Oceans and Atmosphere, EcoSciences Precinct, GPO Box 2583, Dutton Park, QLD 4102, Australia
3. Centre for Applications in Natural Resource Mathematics (CARM), School of Mathematics and Physics, The University of Queensland, St Lucia, Queensland 4072, Australia
4. Institute for Marine and Antarctic Studies, University of Tasmania, Private Bag 129, TAS 7001, Australia

Abstract

Australian researchers and policy makers have access to two significant phyto- and zooplankton datasets, through the IMOS-funded National Reference Stations (NRS) and the Continuous Plankton Recorder (AusCPR) surveys. With over 10 years of consistently sampled and measured species-level data, it is now possible to address issues ranging from taxonomic rigour to the ecology and phenology of plankton on an Australia-wide scale. Using the morphologically distinct dinoflagellate genus *Tripos* (previously *Ceratium*) as an example, we reviewed IMOS observations of >45 *Tripos* species against the historical observations during the period 1940 to 1990s by Taylor, Wood, Huisman and Hallegraeff, clarifying the important diagnostic features and spatial and temporal distributions. Using these confirmed distribution data we then used a statistical modelling approach to understand drivers of distributions of each species. This tests the concepts of warm water (*T. biceps*, *T. dens*, *T. falcatus*, etc), cosmopolitan (*T. fusus*, *T. muelleri*, *T. furca*), cold water (*T. lineatus*) or putative deep "shade flora" (*T. gravidus*, *T. cephalotus*, *T. praelongus*, *T. ranipes*) species against real environment data and can be used as a tool to project the likely effects of climate change on distribution.

S8 *Marine microbes as mediators of ocean processes*
Wednesday 4 July, 1200 - 1215

South Australian Aquaculture: Zoning in on Aquaculture Zone Policies

Jade Davison¹

1. Primary Industries and Regions South Australia, Fisheries and Aquaculture, Level 14/25 Grenfell Street, Adelaide, SA, 5000

Abstract

The *Aquaculture Act 2001* provides the state government regulatory agency, Primary Industries and Regional Development SA, with the capacity to regulate aquaculture development in South Australia. A fundamental feature of this legislative framework is the capacity to establish dedicated aquaculture zones. These zones represent a unique spatial planning approach; one that provides certainty to all users, including competing industries and social groups, and maintains environmental needs such as conservation.

Twelve aquaculture zone policies are prescribed in South Australia. These zone policies occupy approximately 7% of state waters. More than half (52%) of this area is allocated to aquaculture exclusion zones, where no aquaculture activity is permitted. The remaining 48% is set aside to allow aquaculture to occur, with generally 5-10% allocated at any one time.

South Australia's aquaculture industry generates nearly 50% of the state's seafood economic output. The aquaculture zone process illustrates how dedicated legislation and management can provide an efficient, effective and ecologically sustainable platform for aquaculture. The recent review of the *Aquaculture (Zones—Eastern Spencer Gulf) Policy 2016* will be detailed as a case study, to describe the process undertaken to design and implement a zone policy and demonstrate the reasons for the effectiveness of this approach.

S15 *Aquaculture blue economy*
Tuesday 3 July, 1545 - 1600

Reef Islands Dominated by Foraminiferan Sands Will be Most Sensitive to Climate Change Impacts and Ecosystem Shifts

John L. Dawson¹ and Scott G. Smithers¹

1. James Cook University, Townsville, QLD, 4811

Abstract

Reef islands are low-lying accumulations of wave-driven sediments derived from the surrounding reef. Higher sea levels and more frequent high-intensity storms are predicted to accelerate shoreline erosion and compromise island geomorphological stability and habitability. While the geological record demonstrates some capacity for reef islands to adjust to such threats, little is known about the impacts of reef ecosystem changes on the supply of sediment necessary for these adjustments. Using a stochastic model of sediment availability, we predict a high probability (81%) that reef islands now dominated by a supply of sands derived from foraminifera (calcareous single-celled protists) will not be supplied with sufficient sediment to remain geomorphologically stable under climate changes projected under a business-as-usual scenario (RCP8.5), with some reef islands shifting to a negative sediment budget (losses>gains) as early as 2060. A two-fold increase in percentage coral cover and three-fold decrease in percentage cover of turf-algae resulted in a 65% reduction in the likelihood of net island erosion this century. Importantly, these results demonstrate that reef islands dominated by foraminiferan sand supply will be most sensitive to climate change impacts while those dominated by coral sands will be more robust.

S5***Structure and function of coral reefs in a changing world*****Wednesday 4 July, 1400 - 1415**

An assessment of ACCESS-S1 ocean forecast skill around New Zealand for marine industry applications

C.O. de Burgh-Day¹, C.M. Spillman¹, C. Stevens^{2,3}, A Alves¹ and G. Rickard²

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2. National Institute of Water and Atmospheric Research, Auckland, New Zealand
3. The University of Auckland, Auckland, New Zealand

Abstract

Fisheries and aquaculture are significant industries in New Zealand (worth ~NZ\$1.4B). It has been shown in similar industries in Australia that it is economically beneficial to be able to predict conditions relevant to the industry such as Sea Surface Temperature (SST) and Heat Content (HC) months in advance.

We describe an assessment of the SST and 300 m HC forecast skill of the Australian Bureau of Meteorology's new seasonal prediction system ACCESS-S1 on multi-week to seasonal timescales, using a set of retrospective ensemble forecasts for the period 1990-2012. This hindcast set is verified against Reynolds AVHRR satellite data analysis and the Bluelink ReANalysis 3.5 (BRAN3.5) dataset. We find that the model has generally good skill for predicting SST and 300m HC, with the Pearson correlation coefficient score predominantly above 0.7 in all seasons to a lead time of 3 months inshore (depth < 300m) and largely above 0.6 to a lead time of 1 month ahead elsewhere. We attribute regions of lower skill to the complex nature of the currents in the region being difficult for the model to simulate, and an overly-strong response to La Niña conditions due to the influence of the Southern Ocean bias (a known warm bias in ACCESS-S1).

The good skill of ACCESS-S1 around New Zealand demonstrates the potential for developing useful forecasting tools for fisheries and aquaculture industry applications in the region.

S2 *Extremes: causes, symptoms, and impacts*
Monday 2 July, 1730 - 1745

Environmental detection of biosecurity relevant organisms using molecular methods: practical implementation

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Abstract

Biosecurity risks are rising with increased trade, passenger movement and global change. Diseases and pests decrease production, influence trade opportunities, pose risks to health, amenity and the environment. Australian marine environments are at high risk from incursions; industries are geographically concentrated, environments have high endemism and sensitivity to perturbations and risks are difficult to assess. Detection of pests and pathogens is central to implementing biosecurity principles. Environmental detection of pests and pathogens using molecular approaches is rapid and inexpensive, and provides confidence in identification. Validation of methods, however, is mostly lacking, decreasing confidence in emerging approaches. To validate detection systems for pests and pathogens, analytical performance, temporal and spatial sampling design, sample handling, extraction efficiency, assay inhibition and diagnostic sensitivity need to be understood. These are substantially greater requirements than designing an assay, and validation often test the limits of knowledge and technology. We present data from a range of validation activities and discuss approaches to achieving validation for environmental molecular detection systems.

S10 *Marine biosecurity in an increasingly-connected world: protecting Australia from marine pests and diseases*

Wednesday 4 July, 1415 - 1430

Genomics Reveals Patterns of Dispersal, Cryptic Lineages, and Vagrant Reef Fish Along the Coast of Western Australia

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10. Australian Institute of Marine Science, UWA Oceans Institute, (M096) 35 Stirling Highway, Crawley, WA 6009

Abstract

An important ecological driver underpinning coastal marine management is dispersal, but it has proven difficult to directly measure in this setting. The coastal waters of Western Australia (WA) provides an emerging frontier for implementing new genomic tools and the testing of dispersal under a range of management frameworks. This talk will highlight case studies that apply seascape genomic methods to a recreationally important coastal fish species (Stripey Snapper, *Lutjanus carponotatus*), a commercially important deepwater grouper species (Eightbar Grouper, *Hyporthodus octofasciatus*), and a herbivorous rabbitfish species (Mottled Spinefoot, *Siganus fuscescens*) that has been implicated in poleward range shifts along the extensive coastlines of both western and eastern Australia. Each of these case studies uses genotype-by-sequencing approaches to estimate realised connectivity via larval dispersal. We present complimentary data based on traditional genetic markers, hydrodynamic simulations, demographic analyses, as well as diet and microbiome metabarcoding that we argue provides a much needed context for the interpretation of these genomic data sets.

S9

Genomics of marine organisms: contributions to ecology and evolution

Thursday 5 July, 1130 - 1145

Ecosystem functioning: Global conservation in mudflats

Navodha Dissanayake^{1,2}, Bryony Caswell¹ and Chris Frid²

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Abstract

Understanding variations to taxonomic composition along latitudinal and biogeographic gradients is a central theme in ecology. We present a global analysis of the taxonomic and functional (trait) composition of mudflat macrobenthic assemblages with a view to understanding the global ecological functioning of mudflats. Benthic macrofaunal compositional data were extracted from 163 datasets (spanning 1975-2016) representing 4 climatic zones and 10 biogeographic regions. A biological trait database was developed including 10 biological traits with 41 trait modalities for 448 taxa, to address core functions of a mudflat ecosystem e.g. secondary production, nutrient cycling, organic matter decomposition and bioturbation. As expected species richness increased from temperate to tropics while the taxonomic composition differed significantly between climatic zones and biogeographic regions. However, biological trait composition was much more consistent between climatic zones (20-30% pairwise similarity) and between biogeographic regions (20-40% similarity). ANOSIM analysis indicated the only significant difference in biological traits between regions was Tropical Atlantic vs Central-Indo Pacific. The lack of differences in the trait composition between the remaining biogeographic regions suggest that across most of the globe the ecological functioning and ecosystem services delivered by mudflats is conserved in the face of the massive changes in species composition.

G5
Estuaries and coasts
Monday 2 July, 1730 - 1745

Depth related changes of benthic assemblages from canyons to intertidal coasts

Sabine Dittmann¹, Orlando Lam Gordillo¹, Ryan Baring¹, Kathy Conlan²

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2. Canadian Museum of Nature, Ottawa, Canada

Abstract

Depth related patterns of benthic diversity are still controversial, especially for infauna, which are less well known in the deep sea. Here, we compare benthic assemblages along a depth gradient from intertidal mudflats, over recent surveys in shallow shelf sediments (~10-25 m), to previously published infauna assemblages from deeper shelf (~100-200 m) and canyon environments (>1000 m) (Conlan et al. 2015). All depths sampled were located off the coast of South Australia. Samples were obtained by hand-held corer, box corer or Smith-McIntyre grab and expressed as individual m⁻². The number of operational taxonomic units was highest at 100-200 m depth compared to the inshore and deeper sites, indicating higher diversity in the vicinity of the shelf break. Individual densities were highest in intertidal sediments and also high at the shelf break, but overall, abundances decreased with depth. The assemblage composition changed along the depth gradient as abundances of different taxa varied with depth, and was most unique at the shelf break. The benthic assemblages will be further assessed using functional classifications to explore depth related changes in ecosystem functions.

G1 *Deep sea and canyon ecology*
Wednesday 4 July, 1430 - 1445

Functional Traits of Phytoplankton along Environmental Gradients

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Abstract

Photosynthetic marine microbes are key members of ocean foodwebs, not only as major contributors to biodiversity, but also because of their influence on ecosystem function. Their nonlinear biological responses to changes in the physicochemical environment make phytoplankton sensitive indicators of environmental degradation or change. While impacts are often manifest as a rapid change in species composition, there is increasing evidence that eukaryotes can adjust their functioning in response to changes in their external environment. Here we report on the traits of photosynthetic marine microbes along gradients of temperature and nutrient availability, and in response to differing modes of environmental variation. Combining flow cytometric investigation of live cells and knowledge of their environmental exposure (e.g. through particle trajectory analyses within ocean circulation simulations), we show that microbial populations in adjacent water masses have different thermal performance. Picoeukaryote populations in the East Australian Current have ~45% greater survivorship during upwards shifts in temperature (+10 °C above ambient) compared to picoeukaryotes in the Tasman Sea. Microbial populations sampled across broader environmental gradients diverge in their nutrient utilisation patterns, suggesting their biogeochemical role could shift in different regions. Understanding traits that are linked to fitness or performance will provide key insights into population responses to ocean change.

S8 *Marine microbes as mediators of ocean processes*

Wednesday 4 July, 1022 - 1037

Marine life breaking rules by building shells in acidic extremes

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Abstract

We describe the discovery of marine snails living at a shallow-water CO₂ vent in New Zealand, an environment 30 times more acidic (pH 6.6) than normal seawater. This calcifying species was not only present in these extreme conditions, but also five times more abundant at the vent compared to neighbouring control habitats. By measuring the chemical fingerprints locked within the shell material, we show that these snails have a restricted range of movement, which suggests that they live under these conditions for their entire lives. Using techniques and concepts drawn from materials science, we also unravel the micro- and nano-structural characteristics of the shells developed under such extreme conditions. The existence of these snails demonstrates that calcifying animals can build their shells under the corrosive conditions caused by extreme CO₂ enrichment. This discovery opens opportunities to explore new perspectives on species' resistance to ocean acidification and the ecological and evolutionary processes that confer that resistance.

S6 *Marine Climate Change from Shelves to Deep Seas*

Wednesday 4 July, 1530 - 1545

The occurrence and distribution of a stalked barnacle on blue swimmer crabs in South Australian Gulfs

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Abstract

A stalked barnacle, *Octolasmis* spp., has been identified on the external surfaces and internal gill chambers of blue swimmer crabs (*Portunus armatus*) in South Australia. *Portunus armatus* support an important commercial and recreational fishery in South Australia and while *Octolasmis* spp. infestation has affected blue crabs in Northern America, there is limited information about its influence in South Australia. A total of 840 *P. armatus* were sampled to assess annual and monthly variations in *Octolasmis* spp. loading. The proportion of *P. armatus* infected with *Octolasmis* spp. between 2015–2017 was ~90%. The loading of *Octolasmis* spp. accumulated with the size of *P. armatus*, however, loading was low with most *P. armatus* exhibiting 1–14 *Octolasmis* spp. Infestation was highly variable between months and did not follow the typical increase in infestation with temperature observed in tropical locations. Overall, 63% of *Octolasmis* spp. were gravid, with male *P. armatus* exhibiting a higher proportion of internal gravid *Octolasmis* spp. than females. Currently, the infestation in South Australia is considered low compared to tropical locations where parasitic infection has negatively affected the health and catches of portunids, but the level at which parasitic loading starts affecting *P. armatus* health is unknown.

G5

Estuaries and coasts

Monday 2 July, 1600 - 1615

Assessing the effectiveness of underwater crackers for reducing the impacts of fur seals on South Australia's Lakes and Coorong Fishery

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2. Department of Environment, Water and Natural Resources, Waymouth Street, Adelaide, SA, 5000

Abstract

In recent years, interactions between long-nosed fur seals (*Arctocephalus forsteri*) and gillnet fishers in South Australia's Lakes and Coorong Fishery have increased, and impacts to the fishery through the depredation of catches and gear damage have been reported. A potential solution to this issue involves the use of deterrent methods to scare seals away from fishing gear. A trial was done in the Coorong estuary to investigate: (1) the deterrent effect of underwater crackers on seals interacting with commercial gillnets; and (2) the effectiveness of crackers for reducing seal impacts on the fishery. It involved two commercial vessels that fished using gillnets in the same standardised way. One vessel was equipped with crackers (treatment) that could be used on problem seals, and the other was not (control). Crackers were most effective when used on seals that were approaching gillnets, and least effective on seals that were depredating fish caught in gillnets. Net damage was significantly higher for the control than for the treatment. While the deterrent effect of crackers is expected to reduce over time if they are used repeatedly on the same animals, our results suggest that they might be a useful tool in the management of seal-fisher conflicts.

S14 *Assessing and mitigating ecosystem effects of fishing and aquaculture*
Thursday 5 July, 1115 - 1130

Combined Biotope Classification Scheme (CBiCS): A new marine ecological classification scheme to meet new challenges, Part II: Database, morphospecies and image scoring

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2. Australian Marine Ecology Pty Ltd, Melbourne, Australia
3. Nordinson Studios, Hobart, Australia

Abstract

The Combined Biotope Classification Scheme (CBiCS) was developed to meet the requirements of environmental decision support and to deal with the volumes of data generated by new sensing technologies. CBiCS integrates the classification of settings and components associated with habitats, biotopes and morphospecies. Part II of this series of presentations describes the Morphospecies Component. This component provides a hierarchical system, language and tools to describe visual biodiversity at near-species level, especially where the taxon cannot be determined. The morphospecies hierarchy integrates with the biotic classification component, with larger structural features corresponding to biotope complex descriptors and smaller visually distinct forms comprising indicators for biotopes and sub-biotopes. The system is unique in that it combines both visual morphospecies and taxonomic species, over 5700 categories catalogued. The new scheme has yielded many benefits for ecological monitoring and assessment in Victoria. Results are presented for its application to the description and mapping of high diversity deep reef biotopes in Victorian waters. The hierarchical relationship between morphospecies provided more accurate and responsive multivariate distance measures for monitoring community successions over long periods. The scheme, and its fine resolution, has lead to a machine AI system for scoring large image sets, as obtained from robotic benthic surveys.

S4 *Advances in marine ecological classification*
Tuesday 3 July, 1415 - 1430

Taxonomy of the Dinoflagellate genus *Tripos* in Australian waters

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Abstract

The marine dinoflagellate genus *Tripos* Bory de Saint-Vincent, 1823 (previously *Ceratium*) is very diverse, with over 150 species documented globally. In Australia and the Southern Ocean, more than 50 species have been reported, with occasional high biomass blooms of *Tripos fusus*, *T. furca*, and *T. muelleri* a feature of estuaries and in-shore waters. Off-shore, *Tripos* rarely contribute significantly to biomass, yet they are widely reported to be useful indicators of the movement of water masses.

There is considerable plasticity in the morphology of many species, which may or may not be of taxonomic significance, resulting in confusion and uncertainty around spatial distribution and abundances. We reviewed over 100 years of species-level data, primarily collated in the Australian Phytoplankton Database, to identify a sub-set of species with unambiguous records that may serve as indicators of water masses, and therefore potentially show decadal changes in distribution linked to environmental drivers. In the course of the review, we developed a Lucid key (dichotomous and matrix) to clarify identification of this important genus for new and experienced microscopists.

Poster presentation

S8

Dispersal patterns for taxa with differing reproductive characteristics along the Western Australia coastline

Richard D. Evans^{1,2}, Oliver Berry³, Rachel Binks¹, Margaret Byrne¹, Joseph D. DiBattista⁴, Kor-jent van Dijk⁵, Ming Feng⁶, Udhi Hernawan^{7,8}, Yvette Hitchen⁹, W. Jason Kennington⁹, Glenn I. Moore¹⁰, Samuel D. Moyle¹¹, Kathryn McMahon^{12,13}, Kathy Murray¹, Stephen J. Newman¹¹, Georgina Pitt¹, Nicole Ryan¹, Thor Saunders¹⁴, Michael J. Travers¹¹

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13. Western Australian Marine Science Institution, Crawley, WA, Australia,
14. Northern Territory Department of Primary Industry and Fisheries, PO Box 3000, Darwin, NT 0801, Australia.

Abstract

Optimal management of marine biodiversity relies on an overarching understanding of community level spatial connectivity. However, few community-level assessments are made and single-taxon studies are potentially limited in their transferability to taxa with differing reproductive and dispersal strategies. This study compares the genetic diversity, population structure and distribution of adaptive genetic variation of six taxa including a mangrove (*Avicennia marina*), two seagrass (*Halophila ovalis* and *Halodule uninervis*), a coral (*Cyphastrea microphthalma*) and two coral reef fish (*Lutjanus carponotatus* and *Pomacentrus milleri*) species with different life history characteristics, from the Northern Territory to south of Perth (spanning 3,500 km), Western Australia. We demonstrate, using microsatellite and SNP genotyping, that there are common barriers to dispersal between some bioregions for most taxa, but within bioregions genetic connectivity is strongly dictated by life history. Bioregions south of Ningaloo were consistently distinct from all five northern bioregions for all species. For the northern bioregions, there were differences between the species in the scale of population subdivision, genetic diversity and adaptive genetic variation. These results will be discussed in the context of long term conservation management initiatives.

S9

Genomics of marine organisms: contributions to ecology and evolution

Thursday 5 July, 1115 - 1130

Are Associations of Intertidal Scavengers like Guilds of Predators or Assemblages of Herbivores?

Peter Fairweather¹

1. Flinders University, Adelaide, SA, Australia

Abstract

Ecological studies of seashores over the past century have characterised traits of coexisting predators or herbivores within communities in a thorough fashion. Such understanding has contributed to community concepts like keystone predators, trophic cascades, scramble competition and diffuse consumption. But far less attention has been paid to another feeding mode that animals can exhibit, that of scavenging upon recently-dead carrion. Southern Australia has a suite of such invertebrate scavengers that is near ubiquitous (when sampled correctly), features quite a few taxa beyond 'specialised' nassariid gastropods and peracarid crustaceans, and extends along a gradient from rocky seashores to calmer mudflats. Examination of these scavengers in terms of community ecology gives a first point of comparison to the more familiar grazers consuming algae or predators consuming invertebrates: I shall describe their taxonomy, relative abundances, response times to carrion, interactions at carrion, and other aspects of behaviour. In contrast to many herbivore and some predator assemblages, these scavengers tend to be cryptic, only becoming apparent when carrion becomes locally available, and show a number of adaptations to this lifestyle. Thus they conform to classic theoretical formulations of donor-controlled communities but also should reward further study by revealing extra intricacies of this foraging mode.

G5**Estuaries and coasts****Monday 2 July, 1645 - 1700**

Approaches to project physiological effects of environmental change: examples from ocean acidification

Laura J Falkenberg¹, Sam Dupont², Brooks A Kaiser³, Wenting Chen¹, Philip J Wallhead¹, Camilla W Fagerli¹, Magnus D Norling¹, Kumiko Azetsu-Scott⁴, Ann-Dorte Burmeister⁵, Lars Ravn-Jensen³, Richard GJ Bellerby^{1,6}

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Abstract

Understanding the links between the abiotic environment and organism fitness and function is a central challenge of biology, and an issue of growing relevance due to anthropogenic environmental changes. Our command of these links may be enhanced by synthesising existing literature. Here I will discuss approaches that have been, and could be, used to bring together literature regarding organism responses to ocean acidification. Specifically, I will detail methods used to project organism responses in two case studies of the upcoming Arctic Monitoring and Assessment Programme's 2018 report on Arctic Ocean Acidification (AMAP AOA): 1) sea urchins and kelp that support an urchin harvesting industry in northern Norway, and, 2) shrimp that support a fishery in Greenland. I will then focus on methods that could be used in the future, highlighting benefits to be gained from moving toward more mechanistically-based frameworks (e.g. those based on oxygen- and capacity-limited thermal tolerance, adverse outcome pathways). Exploring approaches to re-consider existing scientific literature represents a potentially powerful method to enhance mechanistic understanding of the influence of the abiotic environment on whole organism function and fitness.

S6 *Marine Climate Change from Shelves to Deep Seas*
Wednesday 4 July, 1600 - 1615

Seasonal Variations in Blooms of *Dinophysis* spp. and Diarrhetic Shellfish Toxins on Wild Harvest Beaches Along the New South Wales Coast

Hazel Farrell¹, Phil Baker¹, Grant Webster¹ and Anthony Zammit¹

1. NSW Food Authority, PO Box 6682, Silverwater, NSW, 1811

Abstract

Commercial wild shellfish harvest from selected beaches along the NSW coast comprise part of the shellfish quality assurance program (SQAP) regulated by the NSW Food Authority. The annual harvest season, predominately focused on pipis (*Donax (Plebidonax) deltoides*), occurs between June and December. One component of the SQAP is management of potential risk from algal biotoxins for shellfish consumers. This involves routine phytoplankton monitoring, which escalates to shellfish biotoxin sampling and/or harvest area closures if potentially harmful species are detected above specified levels. Historical monitoring data suggested that diarrhetic shellfish toxins (DSTs) produced by *Dinophysis* spp. were a possible risk to the pipi harvest industry. This was investigated further through a retail level survey. Wild harvest shellfish samples were collected from the Sydney Fish Market during the 2015, 2016 and 2017 harvest seasons and tested for the three main algal toxin groups (DSTs, paralytic shellfish toxins and amnesic shellfish toxin). DSTs were the predominant toxin group reported in the survey. Coupled with routine phytoplankton and biotoxin monitoring data at wild harvest beaches, our data identify seasonal hot spots for DST events on NSW beaches.

S8 *Marine microbes as mediators of ocean processes*
Wednesday 4 July, 1400 - 1415

Classifying the Geomorphic Planforms of Embayed Beaches

Thomas E. Fellowes^{1,2}, Ana Vila-Concejo², Shari L. Gallop¹

1. Department of Environmental Sciences, Macquarie University, NSW, 2109

2. Geocoastal Research Group, School of Geoscience, University of Sydney, NSW, 2006

Abstract

Globally, more than 50% of beaches are embayed between headlands, and their beach processes are heavily influenced by their geomorphic planform. To date, no planform classification exists, which has limited the morphological understanding of embayed beach systems. Here we propose a new embayment parameter that quantifies the degree of embayment. Using satellite imagery, we measured multiple embayment features (e.g., area, depth, headlands and beach length) at 183 swell-dominated embayed beaches, to describe their planform shape and create a new planform parameter (γ_e). γ_e categorises planforms from 'non-embayed' ($\gamma_e < 0.1$) through to 'very-embayed' ($\gamma_e > 1.5$). More than 50% of planforms were characterised by two outward angled headlands, and lower γ_e than similar size planforms with inward angled headlands. Wide and deep embayments are significantly less embayed and can be classified as 'semi-embayed' ($\gamma_e < 0.2$) or 'non-embayed' ($\gamma_e < 0.1$) systems with limited or no headland influence. Small-area embayments ($> 1 \times 10^6 \text{ m}^2$) present the most variable feature measurements and sensitivity to γ_e suggesting our parameter is more valuable than the individual feature measures when classifying planforms. This new classification system can be used to quantify the degree to which beach processes are influenced by headlands and beach planform, which is important for determining beach responses for coastal management.

G5 *Estuaries and coasts*
Tuesday 3 July, 1500 - 1515

Monthly to Decadal Morphologic Evolution of Sheltered Beaches within an Urbanized Estuary

Thomas E. Fellowes^{1,2}, Ryan Schosberg^{*1}, Ana Vila-Concejo¹, and, Shari L. Gallop²

1. Geocoastal Research Group, School of Geoscience, University of Sydney, NSW, 2006

2. Department of Environmental Sciences, Macquarie University, NSW, 2109

Abstract

This study investigates how sheltered beach morphology varies over seasonal and decadal timescales with shifts in energy exposure and development pressures. We focus on Botany Bay, NSW, an estuary heavily modified by urbanization, land reclamation and dredging. Shoreline position, beach volume and beach profile shape were surveyed monthly from May 2016-October 2017 and long-term shoreline position was calculated using aerial imagery from 1943-2017 (mean resolution=4.4 years). Results showed that segments of beach up to 1.5 kilometers long underwent periods of shoreline recession over a period of decades. This is due to frequent, large-scale dredging of bay bathymetry, the effects of which are twofold: sediments that typically nourish the beaches are instead redirected to dredging hotspots; and the wave energy climate is augmented as less wave energy is dissipated and waves penetrate deeper into the estuary. Although high-energy events rarely impacted beaches within the bay, such events created erosion features that persisted for over a year in the lowest energy beaches, as was the case following a series of storms in 1974. These results highlight the need for more inclusive management plans for low-energy beach systems that emphasize sustainable management of sediment sources and account for prolonged beach recovery rates.

Poster presentation

G5

Eddy-current interaction in the Leeuwin Current off the lower west coast of Western Australia

Ming Feng², Qin-Yan Liu^{*1}, Dongxiao Wang¹, Andreas Schiller²

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The Leeuwin Current (LC) region is featured by active eddy activities with prominent seasonal and interannual variability. In this study, we use long-term mooring observations of current velocity and temperature off Two Rocks (near Fremantle, around 32°S), combined with numerical model simulations, to provide new insight to the LC eddy energetics on the continental shelf. Mooring results show that the maximum surface velocity of the LC on the continental shelf occurs in austral winter-spring, reaching >35 cm s⁻¹ in July and September, in contrast to the austral autumn-winter peak velocity of the overall volume transport of the LC. An unseasonable strengthening of the LC occurred in February-April 2011 (42 cm.s⁻¹ at 200 m isobath), during an extreme marine heatwave event. Inferred by the eddy momentum flux, eddies act to maintain the mean shear of the LC. Eddy-mean flow interaction shows cross-stream variations, with significant positive eddy Reynolds- $\overline{(u'v')}$ $\partial v/\partial x$ on offshore side, and negative $-\overline{(u'v')}$ $\partial v/\partial x$ on inshore side of the Leeuwin Current core. The eddy barotropic conversion rate depicts striking along-stream variations: mean flow to eddy conversion on the offshore side upstream from the mooring locations where large eddy kinetic energy is observed; and eddy to mean flow conversion downstream from the mooring locations where the mean flow of the Leeuwin Current re-emerges from the active eddy field.

S1

Cross-shelf exchange processes

Monday 2 July, 1400-1415

MJO induced diurnal sea surface temperature variations off northwest shelf of Australia observed from Himawari geostationary satellite

Ming Feng^{1,2}, Zhi Huang³

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2. CSIRO, Centre of Southern Hemisphere Oceanography Research, Hobart, TAS
3. Geoscience Australia, Canberra, Australia

Abstract

High frequency coupling between the tropical upper ocean and atmosphere at diurnal time scales is being recognised as important for the behaviour of large scale climate modes such as Madden Julian Oscillation (MJO). The Indonesian-Australian Basin region off the northwest shelf of Australia has been identified to host some of the strongest diurnal sea surface temperature (SST) variations in the tropical Indo-Pacific oceans. In this study, we use the hourly Himawari geostationary satellite SST observations in the region to understand the modulation of the amplitude of SST diurnal variations with the MJO evolution during the two austral summer seasons of 2015-16 and 2016-17. A composite analysis based on different MJO phases shows that the diurnal variations of SST typically peaked during phases 2 and 3 off the northwest shelf, prior to the onset of the active phases of MJO (Phase 4). During the El Nino event of 2015-16 when the MJO activities are suppressed, the MJO modulated diurnal SST amplitude variations are less pronounced. In addition, we also observe notable spatial variability of diurnal variations of SST in the region. The relationship of diurnal variations of SST with cloud cover, solar radiation, and surface wind anomalies are being assessed.

S2 *Extremes: causes, symptoms, and impacts*
Monday 2 July, 1700 - 1715

Nitrogen Tipping Points for Seagrass Conservation

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Abstract

The demise of coastal seagrasses is often linked to nutrient inputs from land, with sudden die-off sometimes occurring as a result of small increases in loads. The associated thresholds are poorly understood and natural resource managers lack the evidence to apply numerical load limits. This study provides a novel methodological approach to determine tipping points for loss, using as a case study the coastal region of Adelaide, South Australia. Nitrogen inputs from rivers, domestic and industrial wastewater are used to simulate the spatial and temporal variability of loads leading to historical losses of *Posidonia* and *Amphibolis* spp. The identified thresholds varied between 0.8 and 1.1 t N km⁻² sustained over at least 6 months, and explained up to 95% of losses. These values highlight the relatively low tolerance of these two temperate species to nitrogen pressure. *Posidonia* spp. appears more resilient, with losses occurring predominantly nearshore where loads are higher, whereas the greater susceptibility of *Amphibolis* spp. is demonstrated by the onset of fragmented loss at lower loads further offshore. Threshold values are expected to vary locally not only with species, but also time of exposure, return period, and the frequency and intensity of pulsed events.

G6[Open theme](#)

Thursday 5 July, 1600 - 1615

3D models reveal trade-offs between coral growth and thermo-tolerance

Renata Ferrari¹, Adriana Humanes², Will Figueira³, Katharina Fabricius¹, Daniel Pygas³, Helios Martinez², James Guest²

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3. The University of Sydney, Coastal and Marine Ecosystems Group, School of Environmental and Life Sciences, Science Rd, Camperdown, NSW, 2006, Australia

Abstract

Growth and contraction of ecosystem engineers influence ecosystem structure and function. Dramatic changes in biodiversity are inevitable in the face of global change. Although ecosystems can potentially adapt, it is unclear whether adaptation rates are sufficient to cope with the current rate of climate change. While corals have the potential to adapt there are also risks, such as costs to recipient population fitness due to resource trade-offs between traits. For instance, are there resource trade-offs between increased thermo-tolerance and coral growth? To accurately assess this requires long-term measurements of coral growth, however, traditional techniques for estimating growth are usually destructive or involve removing corals from the reef (alizerin staining, buoyant weighing). This talk will show case how 3D models are being used to measure coral growth over time *in situ*, of corals of three morphologies (corymbose, foliose and massive). We followed 100 colonies per morphology, identified their thermo-tolerance and measured their growth after six months. This talk will focus on the implications and advantages of using 3D models to quantify coral growth. Our results will provide support for predictive models of trade-offs between coral fitness and thermo-tolerance, producing crucial data for assessing the feasibility of restoration and conservation programs.

S5 *Structure and function of coral reefs in a changing world*
Wednesday 4 July, 1215 - 1230

Functional Loss of Grazing Drives Runaway Expansion of Weedy Species in a Near-Future Ocean

Camilo M. Ferreira¹, Ivan Nagelkerken¹, Silvan U. Goldenberg¹, Georgia Walden, Jonathan Y. S. Leung¹ and Sean D. Connell¹

1. Southern Seas Ecology Laboratories, School of Biological Sciences and The Environment Institute, DX 650 418, The University of Adelaide, Adelaide, SA 5005, Australia.

Abstract

The ability of a community to absorb environmental change without undergoing structural modification is a hallmark of ecological resistance. The recognition that species interactions can stabilize community processes, has led to the idea that the effects of climate change may be less than what most considerations currently allow. Here we tested whether herbivory can compensate for the expansion of weedy algae triggered by CO₂ enrichment and warming. Using a long-term (six months) macrocosm experiment harbouring a benthic grazer community, we show that increasing per capita herbivory absorbs the boosted effects of CO₂ enrichment on algal production. However, under the combined effects of acidification and warming this compensatory effect was eroded by reducing herbivore biodiversity and biomass. This loss of compensation combined with boosted primary productivity drove a fourfold expansion of weedy algae species. Our results demonstrate compensatory capacity to buffer ecosystems against CO₂ enrichment, but loss of this capacity through ocean warming, driving significant algal turf expansion. Identifying compensatory processes and the circumstances under which they prevail could potentially help manage the impacts of ocean warming and acidification, which are further amplified by local disturbances such as habitat loss and herbivore overexploitation.

S6***Marine Climate Change from Shelves to Deep Seas*****Wednesday 4 July, 1645 - 1700**

Characterising range expansion potential of tropical vagrant fishes

Will Figueira¹, David Booth², Riccardo Cannas¹, Giglia Beretta², Luke Brown²

1. University of Sydney
2. University of Technology Sydney

Abstract

As oceans warm due to climate change, it is becoming increasingly common to find tropical fish species occurring in temperate habitats. These vagrant fishes have the potential to greatly impact local communities and represent the early phase of range shifts. Here we combine data from an 18 year monitoring program of tropical vagrant fishes in SE Australia with lab based analyses of thermal metabolic and swimming performance to evaluate the relative establishment potential for different vagrant species. Metrics of thermal tolerance established by evaluating the rate of decline in abundance with temperature for individual species were generally well related to propensity for individual species to occur as overwinters. We found thermal tolerance patterns tended to vary most strongly within families rather than amongst them. There was correspondence between the level of cold tolerance of a species with its metabolic performance though patterns were generally better explained by swim speed performance. This results suggests swim speed may be of more direct relevance than metabolic scope to the loss of individuals as temperature drops. These results highlight the utility of integrating abundance series, temperature data and lab-based analysis to gain a better understanding of the range expansion potential of tropical fishes.

S7

Micro- to Macro-: connecting multi-scale climate change research in marine systems
Thursday 5 July, 1200 - 1215

Combined Biotope Classification Scheme (CBiCS): A new marine ecological classification scheme to meet new challenges, Part I: Components and hierarchies

Flynn, A.J.¹, Edmunds, M.² and Abdul-Rahman, A.³

1. Fathom Pacific Pty Ltd, Melbourne, Australia
2. Australian Marine Ecology Pty Ltd, Melbourne, Australia
3. Nordinson Studios, Hobart, Australia

Abstract

A new scheme for marine ecological classification, the Combined Biotope Classification Scheme (CBiCS), was developed to meet the requirements of environmental decision support and to deal with the volumes of data generated by new sensing technologies. We identify the key requirements for the deployment of a successful ecological classification system on the basis of the results of a review of existing schema. CBiCS has been designed on the basis of existing international schema and Australian classification schema that have enjoyed successful uptake and standardisation. The scheme has been adopted by the Victorian Department of Environment, Land, Water and Planning in a program to unify the state's marine data. In Part I of this series of presentations, we describe the structure of CBiCS and profile the biotic component specifically. We introduce a new temperate reef geform terminology that aligns with well-established terminology used for tropical reef structures. We characterise the functionality of the scheme as a unifying framework by applying it to a long-term monitoring and habitat mapping program in Victoria, Australia. We demonstrate a variety of benefits, including for aspects of raw data capture, remote sensing, reporting against trigger values, citizen science and stakeholder communication.

S4 *Advances in marine ecological classification*

Tuesday 3 July, 1400 - 1415

Unique bryozoan reefs in Western Port, a southern temperate embayment

Flynn, A.J.¹, Edmunds, M.², Bock, P.³, Gowlett-Holmes, K.⁴, Gordon, D.⁵

1. Fathom Pacific Pty Ltd, Frankston, Australia
2. Australian Marine Ecology Pty Ltd, Melbourne, Australia
3. National Museum of Victoria, Melbourne, Australia
4. CSIRO Marine and Atmospheric Research, Hobart, Australia
5. National Institute of Water and Atmospheric Research, Wellington, New Zealand

Abstract

New information is presented for a unique bryozoan biogenic reef system in Western Port, Victoria, Australia. A multispecies assemblage of bryozoans form biogenic mounds on unconsolidated sediment in 5–8 m water depth in an area with strong tidal currents and high turbidity. The dominant bryozoan growth form on the Western Port reefs is a rigid, foliose, densely convoluted colony forming mounds with 1–2 m of vertical relief. Compound ascidians, hydroids and branching sponges are associated with the bryozoan colonies. The Western Port bryozoan biotope is not known from other nearshore environments off the southern Australian mainland and is unlike those occurring on the continental shelves off southern Australian and southeastern New Zealand. The Western Port bryozoan biotope has some similarities to those recorded from the Huon Estuary and Bathurst Channel, Tasmania and to bryozoan faunal crusts described from UK waters. We estimate that there is potentially some 3 km² of bryozoan reef in Western Port. The Western Port bryozoan reefs feature in recreational fisher lore and support populations of targeted fish species. Potential anchor damage and sedimentation are key risks and we call for protection of this unique biotope, particularly in light of projected increases in recreational fishing pressure.

Poster presentation

G4

Juvenile Roe's abalone (*Haliotis roei*) ability to survive a marine heatwave is greatly compromised under global warming scenarios.

Aisling Fontanini¹, Lachlan Strain², Anthony Hart², Euan Harvey¹.

1. Curtin University, Kent St, Bentley, WA, 6102

2. Department of Primary Industries & Regional Development, Northside Dr, Hillarys, WA, 6025

Abstract

Roe's abalone (*Haliotis roei*) are a popular recreational fishing species that inhabit shallow rock platforms in hostile, high energy environments in Western Australia. During 2011, a heat wave devastated northern populations and to date there has been little evidence of recovery or newly recruited juveniles. To determine how growth and mortality of juveniles differs with temperature, laboratory reared 2+ *H. roei* were raised under one of four stable temperature treatments at 14°C, 18°C, 22°C, or 26°C for six months. In an attempt to further understand their resilience to a sustained warming event, a three-week, 4°C 'heatwave' was simulated in all treatments. No mortality was experienced in response to the heatwave at lower temperatures (warmed to 18°C & 22°C), however there was 100% mortality in the 26°C treatment within a week of the onset of the heatwave (at 30°C). Juvenile *H. roei* experienced the greatest growth rates and survival at 18°C & 22°C, but mortality in the 22°C treatment increased when heated by 4°C. Not surprisingly, juveniles living in cooler conditions are more likely to survive a warming event, however growth was slower in the 14°C treatment. Juveniles living in warmer environments are more vulnerable to heatwaves as temperatures exceed 22°C.

S15 **Aquaculture blue economy**
Tuesday 3 July, 1445 - 1500

Working together on sea country

Traceylee Forester¹ and Libby Evans-Illidge¹

1. Australian Institute of Marine Science
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Abstract

The Australian Institute of Marine Science (AIMS) has recently taken steps to embed into its research operations the rights, interests and aspirations of the Traditional Owners of sea country where AIMS works. An AIMS-wide Aboriginal and Torres Strait Islander Engagement Strategy has been developed to build on existing project-based partnerships and experience and establish an organisational approach for the future. With the guidance of a full-time Indigenous Engagement Coordinator who is a northern Australian Traditional Owner, the strategy provides a road map with over 30 specific practical actions around the following 5 goals:

1. Incorporate Indigenous perspectives into corporate governance and management;
2. Improve the cultural competency of AIMS staff;
3. Establish and foster strong mutually beneficial working relationships with Traditional Owners of sea country where AIMS has an interest;
4. Improve marine science outcomes for AIMS and Traditional Owners through building reciprocal capacity
5. Increase the employment of Aboriginal and Torres Strait Islander people in marine science related careers at AIMS and elsewhere.

AIMS is now well positioned to deliver better science with greater real-world impact in the tropical north.

Poster presentation

Indigenous Workshop

Scientific monitoring of marine debris in coastal environments to inform and assess litter reduction policy in NSW

Edwina L. Foulsham¹, Peter L. Davies¹, Stephen D. A. Smith² and Robert J. Edgar²

1. Coastal and Marine Unit, NSW Office of Environment and Heritage, Sydney, NSW 2000
2. National Marine Science Centre, Southern Cross University, Bay Drive, Coffs Harbour, NSW, 2450

Abstract

Reduction of litter is one of the NSW Government's highest environmental priorities. In December 2017, the government introduced a Container Deposit Scheme (CDS) to provide a refund for the return of drink container items regularly identified in litter. This paper reports on a large marine debris monitoring program in NSW coastal environments. The results will be used to monitor the effectiveness of government policy interventions aimed at reducing litter and marine debris. Regular surveys are being conducted in mangrove and remote beach sites, before and after the implementation of the CDS. These specific environments are known accumulation zones for marine debris and are not frequently visited by the public. As the litter found at these sites has mostly arrived there via water, either from creeks and stormwaters or from the sea, they are good sentinels of marine litter. The surveys involve a collaboration between government, universities, and the public collecting highly valuable data. Initial results yield some very interesting data on the types of litter which is reaching our marine environment. The program is also collecting baseline data on standing stocks and the accumulation rates, of a range of litter types, to inform future marine debris policy.

S16 *Marine Debris: the world-wide pollution crisis acting on local to global scales*
Thursday 5 July, 1615 - 1630

Take a dump: Ecological functioning of the benthos during two decades of sewage sludge disposal.

Christopher L. J. Frid¹ and Bryony A. Caswell¹

1. School of Environment & Science, Griffith University, Gold Coast Campus, Parklands Drive, Qld 4222, Australia.

Abstract

Human bodily wastes have been disposed of to the marine environment for as long as humans have lived or visited the coasts. Treatment of raw sewage in traditional sewage treatment plants yields large quantities of sewage sludge which requires disposal or further, costly, treatment. Up until 1998 the UK disposed of around 9 million tonnes (wet weight) of sewage sludge a year to marine disposal sites. Statutory monitoring of the various sites showed varying degrees of change in benthic assemblages driven by the organic enrichment, intermittent hypoxia and smothering. We seek to understand how such changes in the benthos at one of the most impacted sites impacted on seafloor functioning. Results from 26 years of monitoring data from the Firth of Clyde (UK) sewage disposal site showed substantial changes in macrobenthic nutrient cycling and the provision of food for predators occurred. Levels of ecological functioning were elevated on the margins, 1–2 km from the centre, of the disposal grounds. Changes in food-web dynamics are expected, that weaken benthic pelagic coupling and lower secondary production (such as fisheries). Functioning was generally conserved as species composition changed, but declined precipitously below a ~6% total organic carbon threshold.

G5*Estuaries and coasts***Monday 2 July, 1715 - 1730**

Comparative ecology of human-associated *Escherichia coli* in endangered Australian sea lion (*Neophoca cinerea*) pups

Mariel Fulham¹, Michelle Power², Rachael Gray¹

1. Sydney School of Veterinary Science, The University of Sydney, Camperdown, NSW, Australia
2. Department of Biological Sciences, Macquarie University, North Ryde, NSW, Australia

Abstract

The dissemination of human-derived bacteria into the marine environment has the potential to expose wildlife populations to atypical microbes that may alter the composition of the gut microbiome or act as pathogens. Our aim was to determine whether endangered Australian sea lion (*Neophoca cinerea*) pups from two South Australian colonies had been colonised by human-associated *Escherichia coli*. We collected faecal samples ($n = 111$) to isolate *E. coli* and used molecular screening to assign isolates to phylotypes and detect integrons. *E. coli* phylotype frequency differed between colonies with group B2 and D being the most abundant at Seal Bay, Kangaroo Island (55% and 7%) and Dangerous Reef, Spencer Gulf (36% and 49%), respectively. Phylotypes B2 and D are frequently associated with humans and strains within these types have a propensity to cause disease. The difference in phylotype distribution and presence of human-associated *E. coli* suggests that proximity to human populations can influence gut microbiota. We report the first case of antimicrobial resistance in a free-ranging Australian sea lion population. The identification of antimicrobial resistance can provide crucial information concerning anthropogenic pollution in the marine environment, inform conservation management strategies and facilitate further monitoring of bacterial dissemination to vulnerable pinniped populations.

S13 *From sea to coast – marine mammals in a connected world*
Tuesday 3 July, 1115 - 1130

Characterizing Ontogenetic Habitat Shifts In Marine Fishes: Advancing Nascent Methods For Marine Spatial Management

Ronen Galaiduk^{1,2}, Ben Radford^{1,3,4}, Benjamin Saunders², Stephen Newman⁵, Euan Harvey²

1. Australian Institute of Marine Science, The University of Western Australia, 35 Stirling Highway, Crawley 6009, WA
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3. The UWA Oceans Institute, The University of Western Australia, 35 Stirling Highway, Crawley 6009, WA
4. School of Earth and Environment, The University of Western Australia, 35 Stirling Highway, Crawley 6009, WA
5. Western Australian Fisheries and Marine Research Laboratories, Department of Fisheries, Government of Western Australia, P.O. Box 20, North Beach 6920, WA

Abstract

Niche requirements and habitat resource partitioning by conspecific fishes of different sizes are significant knowledge gaps in the species distribution modelling domain. Management actions and operations are typically concentrated on static habitats, or specific areas of interest, without considering movement patterns of species associated with ontogenetic shifts in habitat usage. Generalized Additive Models were used to model the body length-habitat relationships of six fish species. These models were used to identify subsets of environmental parameters that drive and explain the continuous length-habitat relationships for each of the study species. Continuous predictive maps of the length distributions for each of the six study species across approx. 200 km² of the study area were created from these models. This highlights the importance of considering ontogenetic processes for marine spatial management. Importantly, predictive hotspot maps were created that identify potential areas that accumulate individuals of similar life stages of multiple species (e.g. multispecies nursery areas). Predictive modelling provides crucial information that elucidates spatial patterns in community composition across mosaics of benthic habitats. This novel technique can contribute to the spatial management of coastal fish and fisheries by identifying areas that are important for different life history stages of multiple fish species.

G2*Life history and connectivity in the ocean*

Tuesday 3 July, 1400 - 1415

Variable Across-Shelf Nutrient Fluxes in the Albany Group of Canyons

Emma J Gale¹ and Jochen Käempf²

1. Charles Darwin University, School of Environment, Ellengowan Drive, Darwin 0909, NT
2. Flinders University, College of Science & Engineering, Sturt Rd, Bedford Park 5042, SA

Abstract

In nutrient-poor waters, biological production hinges on across shelf transport of nutrients from deeper waters to surface waters. Submarine canyons can provide that conduit for transport; depending on favourable bathymetry and oceanographic conditions. Within the Albany Group of Canyons, located off South Western Australia, seasonal upwelling at Bremer Canyon is believed to produce a biological hotspot for marine life, including killer whales, which congregate in the summer months. However, little is known of the other 31 canyons in the group. In November 2017, the Marine National Facility's Research Vessel, the Investigator, was utilised for an inaugural postgraduate training voyage called CAPSTAN which collected multidisciplinary data, from the shelf and slope surrounding four of the Albany Group canyons. New seafloor mapping identified Whale Canyon as shelf incising, like Bremer Canyon, indicating favourable bathymetry for upwelling. Yet, physical, chemical and biological measurements of the upper water column (0-1000 m) showed the thermocline and chlorophyll maxima, were elevated at the head of Whale Canyon but not at the head of Bremer Canyon, whilst the upwelling index was favourable at Bremer but not at Whale. These analyses provide valuable information to feed into marine management plans, which currently include Bremer but not Whale Canyon.

S1 *Cross-shelf exchange processes*
Monday 2 July, 1330 - 1345

Social Network Analyses of Common Bottlenose Dolphins (*Tursiops truncatus*) Reveal Social Units With Differential Habitat Use in the Patos Lagoon Estuary and Adjacent Coastal Waters in Southern Brazil

Rodrigo C. Genoves^{1,2,3}, Pedro F. Fruet³, Juliana C. Di Tullio³, Eduardo R. Secchi³, & Luciana M. Möller^{1,2,3}.

1. Cetacean Ecology, Behaviour and Evolution Lab (CEBEL), College of Science and Engineering, Flinders University, GPO Box 2100, Adelaide SA 5001, Australia
2. Molecular Ecology Lab at Flinders University (MELFU), College of Science and Engineering, Flinders University, GPO Box 2100, Adelaide SA 5001, Australia
3. Ecology and Conservation of Marine Megafauna Lab (ECOMEGA), Oceanographic Institute (IO), Federal University of Rio Grande (FURG), Rio Grande RS, Brazil.

Abstract

The aim of this research is to identify predictor variables that play a role in the social structure of a population of common bottlenose dolphins, *Tursiops truncatus*, inhabiting the Patos Lagoon estuary (PLE) and adjacent coastal waters in southern Brazil. For this we conducted 339 photo-identification surveys in the area over a period of 10 years (2006-2015), and identified 217 individuals, 102 of which were highly sighted and used for social analyses. Multiple regression quadratic assignment procedures indicated that spatial overlap, temporal overlap and gregariousness significantly affected patterns of associations in this population. Using these variables, we calculated generalized affiliation indices (GAI), and compared results with those from an analysis which only considered an association index and gregariousness (HWIG). The GAI's social network disclosed greater social structure compared to the HWIG's social network, but both captured social units that either inhabited estuarine and coastal waters or only coastal waters. These results suggest that spatio-temporal variables play an important role in delineating the social structure of this population. We recommend that the presence of social units with differential habitat use patterns should be considered in future conservation management strategies.

S13 *From sea to coast – marine mammals in a connected world*
Mondy 2 July, 1430 - 1445

Looking for Evidence of Deep Reef Refugia: Can a Single Extreme Marine Heatwave Cause Change in Marine Benthic Communities in Offshore Reefs?

Ana Giraldo-Ospina¹, Renae Hovey¹, and Gary Kendrick¹

1. University of Western Australia, Stirling Highway, Crawley, WA, 6009

Abstract

Temperate Western Australia experienced an unprecedented marine heatwave during the summer of 2010/2011. In consequence, mass mortalities of fish, invertebrates and important foundation species such as seagrass and kelp were reported in shallow, inshore reefs (< 15 m). We analysed a data set from shallow (15 m) and deep (25 and 40 m) sites in offshore reefs (Houtman Abrolhos Islands, Jurien Bay, and Rottnest Island) to investigate if offshore habitats showed the same signs of community change after the extreme event. Multivariate analyses of benthic community composition indicate that while shallow sub-tropical regions showed a response to the marine heatwave, the change in deeper communities was minor or negligible. Offshore reefs in the most temperate zone also show a trend of benthic community change not driven the marine heatwave but most likely to a decadal process. The main environmental factors associated with the change in community composition will be discussed in relation to the main processes driving change in these communities. The results of this study indicate that deeper habitats may be refugia from extreme events, however, these habitats are not spared from chronic disturbances and long-term environmental pressures.

S6 *Marine Climate Change from Shelves to Deep Seas*

Wednesday 4 July, 1630 - 1645

Alterations in the coral microbiome following exposure to metals

Francesca Gissi^{1,6}, Amanda Reichelt-Brushett², Anthony Chariton³, Jenny Stauber⁴, Paul Greenfield⁵, Sarah Stephenson¹ and Dianne Jolley⁶

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2. School of Environment, Science and Engineering, Southern Cross University, Lismore, NSW.
3. Macquarie University, NSW.
4. CSIRO Land and Water, NSW.
5. Data61, CSIRO, NSW, Australia.
6. School of Chemistry, University of Wollongong, NSW.

Abstract

The potential impacts of mining activities on tropical coastal ecosystems are poorly understood. There is limited information available on the effects of metals to scleractinian corals which are keystone species forming vital structural habitats that support other biota.

This study investigated the effects of dissolved nickel and copper on the coral *Acropora muricata* and its associated microbiota at the National Sea Simulator. Four replicate flow-through chambers were established including controls, 50 -10000 µgNi/L and 5-100 µgCu/L. Each chamber contained 3 coral fragments (5-8 cm in length) collected from the GBR. After 96-h metal exposure, corals were air-blasted to remove tissues and flash frozen. Tissues microbiota were DNA sequenced (16S and 18S) to observe changes in the structure of the microbiome.

Control treatments remained healthy throughout the exposures. After 36 h, bleaching was observed in corals exposed to 50 and 100 µgCu/L and 10000 µgNi/L. At 96 h significant discolouration of corals was observed in 500 and 1000 µgNi/L treatments. Copper caused significant changes to both the eukaryotic and bacterial communities, while Ni appeared to have no significant effect on the microbiome. Effects were only observed at very high Ni and Cu concentrations, well above those likely to be encountered in marine systems.

S5**Structure and function of coral reefs in a changing world****Thursday 5 July, 1000 - 1015**

Assessing the impacts of seal populations on the seafood industry in South Australia

Simon Goldsworthy¹, Alice Mackay¹, Fred Bailleul¹, Andrew Oxley¹, Sarah-Lena Reinhold^{1,2,3}, Peter Shaughnessy^{1,4}, Melissa Nursey-Bray³

1. South Australian Research & Development Institute, 2 Hamra Ave, West Beach, SA, 5024
2. Flinders University, Sturt Road, Bedford Park, SA, 5042
3. The University of Adelaide, North Terrace, Adelaide, SA, 5005
4. South Australian Museum, North Terrace, Adelaide, SA, 5000

Abstract

The last 30 years have seen at least a 3.6-fold increase in the population size of Long-nosed fur seals in South Australia, which now number around 100,000 individuals. Over this period, new haul-out sites and breeding colonies have established across the State, some in close proximity to finfish aquaculture and major commercial and recreational fishing areas. There is growing concern from the seafood and some ecotourism industries and the broader community that fur seals are overabundant and that their populations and impacts need to be managed. Most of the seals that interact with fisheries, aquaculture and ecotourism are juvenile and sub-adult males, which are common in coastal waters, especially in winter months. We present results from major study that integrates: 1) new and existing data on seal diet to assess the importance of commercial fish and finfish aquaculture species in their diet; 2) satellite telemetry and spatial modelling to assess spatial overlap and interactions between seals and the seafood sector; 3) trophodynamic modelling to assess the impact of consumption on current and future seafood production; and 4) socio-economic surveys to assess industry perceptions of the economic impact of seals on the seafood sector and the broader marine ecosystem.

S13 *From sea to coast – marine mammals in a connected world*
Monday 2 July, 1700 - 1715

Long-term Acclimation of Feeding Energetics to Ocean Acidification in an Ecologically Important Sea Urchin, *Heliocidaris erythrogramma*, From Southeast Australia

Richard Grainger¹, Maria Byrne¹, Sergio Torres Gabarda¹

1. Schools of Medical and Life and Environmental Sciences, The University of Sydney, Sydney, NSW, 2006, Australia

Abstract

Predicted anthropogenic-induced ocean acidification (OA) may present significant energetic challenges for calcifying marine invertebrates including sea urchins. Subsequently, shifts in energy budgets could have flow-on ecosystem impacts. While physiological responses to climate stressors are often assessed over relatively short exposures (1-2 months or less), long-term studies are required to better assess acclimation capacities and help validate shorter studies. Therefore, we investigated the energetic responses of adult sea urchins (*Heliocidaris erythrogramma*, a dominant herbivore on reefs in southeast Australia) after acclimation in control (pH_{total} 8.0) and near-future OA conditions (pH_{total} 7.9, 7.7) for 9 months. Respiration rates were measured at 8 and 9 months. Feeding rates and assimilation efficiency were measured at 9 months and used to calculate the energy budget (scope for growth) of *H. erythrogramma*. Acidification had no significant effect on respiration at both 8 and 9 months, suggesting that urchins had reached physiological homeostasis. Moreover, acidification did not affect any of the other measured parameters, with urchins maintaining positive energy budgets in all treatments. This indicates good potential for acclimation and a resilience of feeding energetics to long-term OA in adult *H. erythrogramma* and suggests that herbivory pressure by individual urchins may not be altered by acidification.

Poster presentation

S6

Prey Composition, Diet and Nutritional Niche of White Sharks (*Carcharodon carcharias*) in New South Wales, Australia

Richard Grainger^{1,2*}, Victor Peddemors³, David Raubenheimer^{1,2}, Gabriel E. Machovsky-Capuska^{1,2}

1. Charles Perkins Centre, The University of Sydney, Sydney, NSW, 2006, Australia.
2. School of Life and Environmental Sciences, The University of Sydney, Sydney, NSW, 2006, Australia.
3. NSW Department of Primary Industries, Sydney Institute of Marine Science, Mosman, NSW, 2088, Australia.

Abstract

Disentangling the factors governing prey selection and dietary breadth in wild predators can be extremely challenging, yet it is important for understanding their ecological roles. Nutritional ecology provides an effective framework to address such questions, linking nutrition with food choice and broader predator ecology. White sharks (*Carcharodon carcharias*) are marine apex predators distributed globally in temperate and sub-tropical coastal and open-ocean regions including Australia, where they often inhabit shallow coastal environments. The mobile, elusive and potentially dangerous nature of this species poses significant challenges in studying its foraging ecology. Here we provide the first dietary assessment of white sharks in New South Wales (NSW) and combine this with prey proximate composition and multidimensional nutritional niche analyses to better understand the nutritional ecology of white sharks on the NSW coast. Stomach contents of sharks (n = 30) obtained from the NSW Shark Meshing Program were analysed. We examine relationships of sex, ontogeny and geographic location with the amount, species composition and nutritional content of prey, to better understand the nutritional niche of white sharks. These data will provide valuable information on the diet and nutritional ecology of white sharks in NSW, with a view to enhancing conservation and management of this species.

Poster presentation

G5

Polychaetes from Australia's Eastern Abyss

Laetiitia Gunton¹, Elena Kupriyanova¹, Pat Hutchings¹, Robin Wilson², Anna Murray¹, Hannelore Paxton¹, Tim O'Hara²

1. Australian Museum Research Institute, Australian Museum, 1 William Street, Sydney, NSW 2010, Australia.
2. Museum Victoria, GPO Box 666, Melbourne, VIC 3001, Australia.

Abstract

The deep-sea floor constitutes 91 % of the oceans' area, however, due to its remote location in comparison with littoral and sublittoral areas very few faunal samples have been collected. The 31-day expedition '*Sampling the Abyss*' on board the Marine National Facility research vessel *Investigator*, led by Museums Victoria and supported by CSIRO and NESP Marine Biodiversity Hub in 2017, was the first Australian research cruise focused on investigating the abyssal environment from Tasmania to southern Queensland. Forty-nine beam trawl samples were collected from 13 sites. These trawl samples were conducted at both lower bathyal (~ 2500 m) and abyssal depths (~ 4000 m). A total of about 600 polychaetes from 24 families were recorded, with Ampharetidae, Maldanidae and Onuphidae being the most abundant polychaete families. Further investigation into these families revealed new species and interesting patterns in species abundance and distribution between sample sites and sample depths. This project will contribute to the understanding of polychaete abundance and diversity in the poorly-sampled deep-sea environment off the coast of Australia.

G1**Deep sea and canyon ecology****Wednesday 4 July - 1415- 1430**

Baited video, but not diver video, detects a greater abundance of legal size target species within no-take areas at Ningaloo

Julia Haberstroh¹, Dianne McLean¹, Thomas Holmes², Tim Langlois¹

1. The University of Western Australia, Perth, WA, Australia
2. Department of Biodiversity, Conservation and Attractions, Kensington, WA, Australia

Abstract

The inherent differences in baited video versus diver video survey methodologies may influence their ability to detect effects of fishing. Here the ability of no-take areas to provide sufficient protection for legal sized individuals from targeted species within the Ningaloo Marine Park (NMP) was studied using both baited remote underwater stereo-video (stereo-BRUV) and diver operated stereo-video (stereo-DOV). The relative abundance of four recreationally targeted fish species, *Carangoides fulvoguttatus*, *Epinephelus rivulatus*, *Gnathanodon speciosus* and *Lethrinus nebulosus*, were examined using both methodologies inside and outside no-take areas across the NMP. Additionally, the length-frequency distribution of the most targeted species, *L. nebulosus*, was investigated. Stereo-BRUVs found positive effects of protection from fishing on the relative abundance of *C. fulvoguttatus*, *G. speciosus* and *L. nebulosus* and larger sized *L. nebulosus* in no-take areas. Stereo-DOVs however did not detect any differences in relative abundance and size between areas open and closed to fishing. These contrasting results suggest that choice of sampling methodology can influence interpretations of the ability of no-take areas to provide adequate levels of protection for target species.

S11 **Marine biodiversity conservation – what's effective?**
Wednesday 4 July, 1415 - 1430

Unprecedented *Alexandrium* blooms in a previously low biotoxin risk area of Tasmania, Australia

Gustaaf Hallegraeff¹, Christopher Bolch¹, Juan José Dorantes-Aranda², Shauna Murray³, Alison Turnbull⁴, Sarah Ugalde¹

1. Institute for Marine and Antarctic Studies, University of Tasmania, Private Bag 129, Hobart, Tasmania 7001, Australia
2. Institute of Ocean Sciences and Limnology, Universidad Nacional Autónoma de México, Mexico City, Mexico
3. Plant Functional Biology and Climate Change Cluster, University of Technology Sydney and Sydney Institute of Marine Sciences, Mosman, NSW, Australia
4. South Australian Research and Development Institute, GPO Box 397 Adelaide SA 5001, Australia

Abstract

During Oct 2012 a shipment of blue mussels from the poorly monitored east coast of Tasmania was tested by Japanese import authorities and found to be contaminated with unacceptable levels of Paralytic Shellfish Toxins (10 mg/kg). This led to a global product recall and loss to the local economy of AUD 23M. Following low toxicity during 2013 and 2014 and minimal shellfish farm closures implemented, more severe bloom events occurred during July-Nov 2015, 2016 and 2017 (up to 300,000 *Alexandrium* cells/L; 150 mg/kg PST in mussels, 22 in oysters; 11 in rock lobster viscera; 1.3 in abalone viscera), also causing 4 human hospitalisations after consumption of wild shellfish. While *Alexandrium tamarense* had been previously detected in low concentrations in south-eastern Australia, cultured strains mostly belonged to the mostly non-toxic group 5 (now *australiense*; detected since 1987) and toxic group 4 (*pacificum*; since 1997). Instead, the 2012 and 2015 outbreaks were dominated by group 1 (*catenella=fundyense*) never seen in bloom proportions previously in the Australian region. Preliminary microsatellite evidence suggests that the latter may have been a previously cryptic genotype in the Tasmanian area, but newly stimulated by climate-driven increased water column stratification during winter months.

S8 *Marine microbes as mediators of ocean processes*

Wednesday 4 July, 1330 - 1345

Technical mitigation measures to reduce marine mammal bycatch in commercial trawl fisheries: lessons learnt and future directions

Sheryl Hamilton^{1,2} and G. Barry Baker^{1,2}

1. Institute for Marine and Antarctic Studies, University of Tasmania, Hobart, Tas, 7004

2. Latitude 42 Environmental Consultants Pty Ltd., Kettering, Tas, 7155

Abstract

Marine mammals are incidentally killed in a range of fisheries throughout the world. Interactions with fishing operations occur when marine mammals feed on the same target species or associated non-target species of a fishery, are attracted to fishing operation discards, and/or passively encounter fishing gear in the water column. This may result in the mortality of individuals caught in active fishing components or supporting gear. This review assessed technical measures developed to reduce marine mammal bycatch in commercial trawl operations. Substantial development and research of mitigation options is still needed to address the bycatch of a range of species in many fisheries. In particular, there are no reliably effective technical solutions to reduce small cetacean bycatch in trawl nets, although loud acoustic pingers have shown some potential. Appropriately designed, fishery-specific exclusion devices have reduced pinniped bycatch in some trawl fisheries. However, despite reductions in observed bycatch, there remains concern about exclusion device efficacy and the post-escape survival of the bycatch species in some fisheries. Future development of mitigation measures requires rigorous experimental testing to determine the efficacy of the measure in reducing mortality, and a clear target to assess whether meaningful bycatch reduction has been achieved following mitigation implementation.

S14 *Assessing and mitigating ecosystem effects of fishing and aquaculture*
Thursday 5 July, 1130 - 1145

A useful framework for addressing mismanaged waste that can end up as marine debris

Britta Denise Hardesty¹ and Chris Wilcox¹

1. CSIRO Oceans and Atmosphere, Hobart, Tasmania, Australia.

Abstract

A useful framework for addressing mismanaged waste that can end up as marine debris

Applying a systems perspective to understanding the marine debris issue requires a means of conceptualizing the sources, distribution and dynamics of debris in the environment. It is also useful to identify and quantify impacts on wildlife, humans and other assets; and to identify and evaluate the suite of potential management responses. Whilst we tackle this thorny issue, it is worth considering the uncertainty and gaps in our knowledge. Resolving this uncertainty can be challenging, given that we are confined to working with observational data because experiments at scale are difficult or impossible. To advance this area of research, we suggest applying a conceptual framework that allows us to break the components into smaller parts that can integrate uncertainty and connect variables of interest to outcomes of interest. We identify four specific questions inherent to a risk framework: the first three focus on risk analysis, and the fourth on risk management or mitigation. In this talk, we discuss the value of integrating a systems perspective, connecting sources and drivers to dynamics and distribution to impacts and management responses. We also discuss the precautionary principle and its application to risk management in the plastics pollution issue, considering the topic in light of the revised Federal Threat Abatement Plan on marine debris.

S16 *Marine Debris: the world-wide pollution crisis acting on local to global scales*
Thursday 5 July, 1630 - 1645

Quantifying multistressor impacts of ocean warming and acidification on the sea urchin, *Heliocidaris erythrogramma*

Januar Harianto¹, Hong D Nguyen¹, Sergio T Gabarda¹, Richard J Grainger² and Maria Byrne^{1|2}

1. University of Sydney, School of Medical Science, NSW, 2006, Australia

2. University of Sydney, School of Life and Environmental Sciences, NSW, 2006, Australia

Abstract

The warming and acidification of the world's oceans affect nearly all aspects of physiology in marine organisms, and it is important to consider both stressors when predicting biological responses to near-future oceanic change. Here we present a long-term study on the effects of these stressors on the physiological responses of the sea urchin *Heliocidaris erythrogramma*, a species that resides in the south-east Australian ocean warming hotspot. Urchins collected in winter were slowly-adjusted over 7 weeks to conditions of elevated temperature (ambient +0, +2, +3°C) and decreased pH_{total} (ambient -0, -0.4 pH units) conditions, before they were maintained and the baseline temperature was adjusted weekly to mimic the seasonal change expected over time. Metabolic rate was measured at weeks 4 and 12, ammonia excretion rate at week 12, feeding rate at week 13, and survival for up to 20 weeks. Results showed that at +3°C, urchins were very stressed, with low survival (37 – 45%), significantly increased metabolic rate from both stressors, and decreased feeding. However, acclimation time significantly influenced metabolic rate data with contrasting results when collected at 4 or 12 weeks of acclimation, emphasising the importance of continuous, long-term studies when predicting the consequences of climate change on study organisms.

Poster presentation

S6

respR: A new R package for efficient and unbiased analysis of aquatic respirometry data – with marine environmental stress case studies

Januar Harianto¹, Nicholas Carey² and Maria Byrne^{1,3}

1. University of Sydney, School of Medical Science, NSW, 2006, Australia
2. Hopkins Marine Station, Stanford University, CA 93950, USA
3. University of Sydney, School of Life and Environmental Sciences, NSW, 2006, Australia

Abstract

Using respirometry to estimate the impacts of environmental stressors on animal physiology is an increasingly common practice in experimental marine biology. As respirometry datasets become larger and analytical approaches more complex, manipulating the data remains a challenge with existing software tools, with limits to transparency and reproducibility. Here we describe the open-source “respR” R package, a collection of functions that implement a workflow-based approach to simplify (and in some cases, automate) the analysis and visualisation of respirometry data. The package can be used for closed, intermittent flow, flow-through and open respirometry and uses well-defined sets of rules to reliably and rapidly generate reproducible results. Unique to “respR” is the use of novel rolling regression and kernel density estimation techniques to automatically detect common metrics such as (i) maximum metabolic rates (MMR, or $MO_{2, \max}$); (ii) minimum metabolic rates ($MO_{2, \min}$) which may be termed standard (SMR), basal (BMR) or resting metabolic rates; (iii) critical oxygen tension (P_{crit}); and (iv) linear sections of a non-linear dataset. Although designed specifically with aquatic respirometry in mind, the package can easily be repurposed to estimate linear relationships from a range of applications in other research disciplines.

S6 *Marine Climate Change from Shelves to Deep Seas*
Tuesday 3 July, 1615 - 1630

Modelling the connectivity of the black cod (*Epinephelus daemeli*): Where do the larvae go?

Steven Hawes¹ and Will Figueira¹

1. University of Sydney, Sydney, NSW, 2008

Abstract

The black cod *Epinephelus daemeli* is a large, long-lived reef fish of the family Serranidae, found mostly along the NSW coastline. Listed as a protected species since 1983, due to population declines from fishing pressure throughout the 20th century. However, this protection has not resulted in population recovery. The aims of this study was to investigate the connectivity of *E. daemeli* along its known distribution, identifying strong areas of potential settlement. Using a biophysical dispersal model, larvae were released during April-May (2004-2011) from known areas of aggregation and tracked to settlement sites (both reefs and intertidal rocky shores). The results predicted high local retention and self-recruitment for Solitary Islands, Nambucca and Port Stephens, suggesting sustaining these populations are critical to persistence of juveniles in these regions. Connectivity was predicted to occur between the offshore populations and the NSW coast, suggesting genetic, if not demographic, connectivity exists. Further research is required to determine if juvenile populations can be predicted by the model, noting that post-settlement processes were not considered. This study provides insights into the connectivity of black cod along NSW, which can be utilised by conservation managers to aid in the recovery of this vulnerable population.

G2**Life history and connectivity in the ocean****Tuesday 3 July, 1430 - 1445**

The role of Glycine betaine in range expansions; protecting mangroves against extreme freeze events.

Matthew Hayes¹, Audrey Shaw³, Amber Jesse², Chris Miller³, John Kennedy², Ilka Feller².

1. Villanova University, Villanova, PA, USA
2. Smithsonian Environmental Research Center, Edgewater, MD, USA
3. St Leo University, St Leo, FL, USA

Abstract

Glycine betaine (GB) is an organic osmolyte that plays a key role in osmoregulation, allowing a variety of plant species to tolerate environmental stresses such as salinity and extreme temperatures. GB improves enzyme and membrane integrity within the cytosol and chloroplasts, and helps mediate osmotic adjustment in plants grown under stress conditions. A few mangrove species, including the common mangrove *Avicennia germinans*, accumulate relatively high concentrations of GB in response to increased salinity, allowing these plants to survive across the intertidal zone, suggesting an additional tolerance to hypersaline conditions. However, the role GB plays in allowing mangroves to survive extreme weather events such as impact freezes is unknown.

Due to a warming climate mangroves are expanding their range poleward. Their current range limit now includes locations that experience freezing temperatures suggesting mangroves do have a mechanism to survive freezing conditions. Here, through a combination of common garden experiments grown in various locations across southern USA, we test if freezing temperatures correspond with increased GB concentrations in *A. germinans*, and if increased GB synthesis corresponds with increased survivability. The results of our experiment will help our understanding of how mangroves expand their ranges and adapt to survive extreme freeze events.

S6**Marine Climate Change from Shelves to Deep Seas****Wednesday 4 July, 1700 - 1715**

Investigating long-term responses of coral assemblages to coral restoration: Case studies from around the world

Hein MY^{1,2}, Gardiner N¹, Beeden R³, Willis BL^{1,2}

1. College of Science and Engineering, James Cook University, Townsville QLD 4811 Australia
2. ARC Centre of Excellence for Coral Reef Studies, James Cook University, Townsville QLD 4814 Australia
3. Great Barrier Reef Marine Authority, Townsville QLD 4810 Australia

Abstract

Coral restoration is gaining increasing attention as a reef management strategy to address dramatic declines in coral cover worldwide. However, there is often a mismatch between the objectives of coral restoration programs and measures used to assess their effectiveness. Here, we use five indicators to characterise and compare coral assemblages among restored sites, non-restored (degraded) sites, and nearby (non-degraded) control sites: hard coral cover, structural complexity, coral generic diversity, density of coral juveniles, and coral health. Surveys were conducted at four well-established coral restoration programs in Thailand, the Maldives, Florida Keys, and US Virgin Islands. Restored sites in all four regions were associated with increased structural complexity (>25%) in comparison to disturbed, unrestored sites. Moreover, hard coral cover at restored sites was double that at non-restored sites at three out of four locations. In contrast, the three other indicators varied inconsistently among locations, highlighting differences in methodologies among restoration programs (generic diversity metric) or in the overall health state of local reefs (density of coral juveniles, coral health). We suggest that long-term objectives for coral restoration and measures of their effectiveness be better integrated into the design of restoration programs in order to maximise the resilience potential of restored reefs.

S11 *Marine biodiversity conservation – what's effective?*
Wednesday 4 July, 1600 - 1615

Aquatic animal disease and marine pest surveillance in Australia

Brett Herbert¹ and Sarah Graham¹

1. Department of Agriculture and Water Resources, Canberra.

Abstract

Surveillance is a core element of biosecurity systems including for aquatic animal health and marine pest management. Surveillance for aquatic animal diseases in Australia is relatively well advanced due to international reporting obligations, trade certification requirements and management of endemic and emerging diseases within Australia. Marine pest surveillance is less mature; however, a national surveillance strategy is under development to define marine pest surveillance objectives. Lists of reportable diseases of aquatic animals and priority marine pests are maintained by national government committees for aquatic animal health and marine pests respectively. The Australian government has supported research into identified surveillance priority areas. Projects that will be discussed include development and validation of early detection methods to manage or control aquatic animal diseases and marine pests, as they are often only 'discovered' when they emerge and start to cause problems. Also under investigation are methods to engage stakeholders (including researchers) in passive surveillance. Additionally, there are surveillance activities that are funded through the Australian Government Agricultural Competitiveness White Paper program in Australia and its offshore territories. The role researchers can play in surveillance to improve biosecurity in aquatic environments will be discussed.

S10 *Marine biosecurity in an increasingly-connected world: protecting Australia from marine pests and diseases*

Wednesday 4 July, 1400 - 1415

Ecological Sustainable Development of South Australian Aquaculture Blue Economy

Matthew Hoare¹

1. Primary Industries and Regions South Australia, Fisheries and Aquaculture, Level 14/25 Grenfell Street, Adelaide, SA, 5000

Abstract

South Australia's aquaculture production has more than doubled since 2000. To manage this level of production in an environmentally sustainable and socially responsible manner, a robust regulatory framework is required. Primary Industries and Regional Development South Australia (PIRSA) regulates aquaculture pursuant to unique dedicated aquaculture legislation, the *Aquaculture Act 2001*, which employs the principles of ecologically sustainable development (ESD) to promote marine and inland aquaculture for the benefit of the community and industry.

To achieve ESD of aquaculture, a single point of contact "one-stop-shop" approach is utilised by PIRSA to case manage the legislative formal referral and approvals processes for aquaculture applications. PIRSA also undertakes ESD risk assessments of aquaculture applications, based on a national ESD framework. Furthermore, aquaculture licence holders are required to submit annual environmental monitoring program (EMP) reports specific to the type of aquaculture operation and the associated environmental risks, to monitor their environmental performance. Additional periodic EMP requirements may also be required to collect evidence on the condition of the environment. Environmental performance is also monitored through regulated inspections of aquaculture sites. This regulatory framework ensures the delivery of a wholly social and environmental approach to maximise the benefits of the state's aquaculture blue economy.

S15 **Aquaculture blue economy**
Tuesday 3 July, 1600 - 1615

Climate change adaptation efforts for species may be antagonistic to natural evolutionary responses

Alistair J. Hobday¹, Juan-Diego Gaitán-Espitia¹

1. CSIRO Oceans and Atmosphere, Hobart, Australia

Abstract

In response to climate change impacts on natural systems, scientists, managers and policy makers are developing a range of intervention strategies to maintain biodiversity. These strategies focus on two aspects that theoretically enhance species persistence – population connectivity and population size – and have been successful approaches for species conservation in the past. However, they are based on an “equilibrium” view of the environment. In contrast, climate change represents a relatively fast directional selection pressure, producing conditions outside the historically-experienced range. Novel genotypes might need to evolve, and so interventions that facilitate large, connected populations may interfere with the direction of selection pressure and slow down evolutionary responses to climate change. Here we take an evolutionary systems approach to shed insight onto the risks and opportunities with climate adaptation interventions that seek to improve species outcomes. Successful interventions will require consideration of effects at genetic, individual, population and community levels. We provide a conceptual framework to guide thinking about the risks with species interventions, and show that in some cases enhancing population size and increasing connectivity may not be the most appropriate options for species threatened by climate change, and may even reduce the success of their natural evolutionary responses.

S7

Micro- to Macro-: connecting multi-scale climate change research in marine systems
Thursday 5 July, 1115 - 1130

Australia's Integrated Marine Observing System in 2018 – Planning for Impact

Indi Hodgson-Johnston¹, Tim Moltmann¹, and Ana Lara-Lopez¹

1. Integrated Marine Observing System, Battery Point, Tasmania, 7004

Abstract

This presentation will update the Australian marine science community on the Integrated Marine Observing System (IMOS). IMOS is a national collaborative research infrastructure, supported by Australian Government.

This presentation will include updates from the IMOS Nodes on regional science planning and implementation, the progress of IMOS task teams, the Australian Ocean Data Network, an overview of partnerships, and highlighted research achievements from IMOS derived data.

The presentation will also inform the community of new initiatives for planning for uptake and impact of IMOS data and the development of a systematic and dynamic analysis of the socio-economic, policy and legal drivers for sustained ocean observing in Australia.

This analysis includes planning for strategic responses to emerging priorities and societal pressures in Australian marine policy. One example is the implementation and development of value-added products relevant to end-user needs (e.g. IMOS OceanCurrent). From these products, policy relevant analyses are being developed, such as the Plankton 2015 Report. These analyses can then contribute to formal, periodic assessments such as the national State of the Environment and State of Climate reports.

S1

Cross-shelf exchange processes
Monday 2 July, 1615 - 1630

The National Marine Science Plan in 2018

Indi Hodgson-Johnston² and Tim Moltmann^{1,2}

1. Chair, National Marine Science Committee
2. Integrated Marine Observing System, Battery Point, Tasmania, 7004

Abstract

This presentation will update the Australian marine science community on the progress of the objectives contained in the National Marine Science Plan: 2015-2025. It will provide updates on the implementation and progress of the National Marine Science Plan's priorities, including: the funding of national research vessels for full use; sustaining and expanding IMOS; marine science research training; marine baselines and long term monitoring; science programs to support decision-making; national ocean modelling systems; marine ecosystems processes and resilience; and how marine science can contribute to a sustainable blue economy. The National Marine Science Committee also provides oversight of the Australian Ocean Data Network (AODN) to assist in realising the vision of the AODN as an interoperable online network of marine and climate data resources for Australia.

The presentation will also discuss the National Marine Science Committee's future priorities and strategies for furthering the objectives of the Plan, including initiatives to increase engagement with the Plan throughout the Australian marine science community.

G6 [Open theme](#)
Wednesday 4 July, 1630 - 1645

Differential Resilience of Macroalgal- and Coral-Dominated Habitats to Disturbance

Andrew Hoey^{*1}, Zoe Loffler¹, Alexia Graba-Landry¹, Joel Kidgell², Jessica Hoey³, Morgan Pratchett¹

1. ARC Centre of Excellence for Coral Reef Studies, James Cook University, Townsville, QLD, 4811
2. College of Science and Engineering, James Cook University, Townsville, QLD, 4811
3. Great Barrier Reef Marine Park Authority, Townsville, QLD 4810

Abstract

Many of the world's ecosystems are in decline. The effects of local anthropogenic disturbances being greatly compounded by climate change, leading to shifts in the dominant habitat-forming organisms in many locations. Given predicted increases in the frequency and intensity of disturbances under ongoing climate change, understanding the effects of such disturbances on habitat-forming organisms is critical. Within shallow tropical reef ecosystems shifts from coral- to macroalgal-dominance have been triggered by acute disturbances, such as cyclones or coral bleaching events, however the responses on macroalgal-dominated habitats to disturbances are largely unknown. Using long-term monitoring of inshore reefs on the northern Great Barrier Reef we investigate the response of both coral- and macroalgal-dominated habitats to multiple disturbances; two severe cyclones (2014 and 2015) and the back-to-back marine heatwaves (2016 and 2017). This presentation will describe the impacts these disturbances had on these shallow water benthic communities, namely the homogenisation of benthic habitats that shifted toward a novel habitat configuration, and the subsequent reassembly and differential resilience of macroalgal- and coral-dominated habitats on these inshore reefs.

S5

Structure and function of coral reefs in a changing world
Wednesday 4 July, 1145 - 1200

Latitudinal patterns in the biomass of herbivorous and planktivorous fish of the Great Southern Reef

Matthew M. Holland¹, James A. Smith¹, Jason D. Everett¹, Adriana Vergés and Iain M. Suthers¹

1. Evolution & Ecology Research Centre, The University of New South Wales, Sydney, NSW, 2052

Abstract

Often under-appreciated for its economic and social importance, 'the Great Southern Reef' ecosystem sits adjacent to ~70% of Australia's population. Here, bottom-up ecosystem processes influenced by the East Australian Current (EAC) may be important drivers of marine food webs. We examined latitudinal distribution in biomass of planktivorous and herbivorous fish along the temperate east coast of Australia. We used the Reef Life Survey database, oceanographic variables (satellite-derived temperature and chlorophyll), and IMOS Continuous Plankton Recorder data to develop Generalised Additive Models. Results suggest that biomass of planktivorous fish peaked in the mid-latitudes of NSW, consistent with similar peaks in zooplankton abundance, and possibly related to the separation of the EAC from the coast. Herbivorous fish biomass peaked at the northern extent of our analysis (southern Queensland) and declined towards the south. The final models explained ~62% of the variability in fish biomass. We showed that differences in the dominance of trophic groups can be explained by variation in zooplankton availability and oceanographic variables such as temperature. Observations that temperature could affect the distribution of biomass for the lowest fish trophic levels has potential implications for food security and environmental management, particularly as this region is a hotspot for climate change.

S6 *Marine Climate Change from Shelves to Deep Seas*
Tuesday 3 July, 1145 - 1200

An expanded monitoring and management program for marine invasive species in Victoria's marine protected areas.

Howe, Steffan¹, Jonathon Stevenson¹, Mark Rodrigue² and Roellen Gillmore²

1. Science and Management Effectiveness Branch, Parks Victoria, Level 9 / 535 Bourke St, Melbourne, Victoria 3000
2. Environment and Conservation Branch, Parks Victoria, Level 9 / 535 Bourke St, Melbourne, Victoria 3000

Abstract

Parks Victoria manages a range of marine protected areas, as well as local ports and recreational activities in both Port Phillip and Western Port. The introduction of marine pests threatens the integrity of marine biodiversity and may reduce the social and economic benefits derived from the marine environment. Parks Victoria has implemented a range of programs for management of marine pests, disease and overabundant native animals in the marine national parks and sanctuaries since their declaration in 2002. An extensive research and monitoring program underpins these management programs which have a clear focus on protecting natural and cultural values. In mid-2017 Parks Victoria received additional resources to develop an expanded marine pest program for the parks including two main streams: 1) Monitoring and Response, and 2) Awareness and Communications. This presentation will focus on the Monitoring and Response stream and will outline various applied marine pest research and monitoring programs and initial results from these programs, as well as outlining several tools and approaches being developed to help inform and improve marine pest management.

S10

Marine biosecurity in an increasingly-connected world: protecting Australia from marine pests and diseases

Wednesday 4 July, 1330 - 1345

Regional benefits of shark-diving tourism in developed economies

Charlie Huveneers¹, Mark G. Meekan², Kirin Apps³, Luciana C. Ferreira^{2,4}, David Pannell⁵, Gabriel M. S. Vianna^{2,4}

1. College of Science and Engineering, Flinders University, Sturt Road, Bedford Park, SA, Australia
2. Australian Institute of Marine Science, Perth, WA, Australia
3. School of Environment, Science and Engineering, Southern Cross University, Lismore, NSW
4. Oceans Institute and School of Biological Sciences, University of Western Australia, Perth, WA, Australia
5. Oceans Institute and Centre for Environmental Economics and Policy, University of Western Australia, Perth, WA, Australia

Abstract

Shark-diving is part of a rapidly growing industry focused on marine wildlife tourism. Our study provides an estimate of the economic value of shark-diving tourism across Australia by comprehensively surveying the whale shark, white shark, grey nurse shark, and reef shark diving industries using a standardised approach. A socio-economic survey targeted tourist divers and collected information on expenditures related to diving, accommodation, transport, living costs, and other related activities during divers' trips. A total of 711 tourist surveys were completed, with the total annual direct expenditure by shark-divers in Australia estimated conservatively at \$25.5 M. Additional expenditure provided by the white-shark and whale shark-diving industries totalled \$8.1 and \$12.5 M for the Port Lincoln and Ningaloo Reef regions respectively. These additional revenues show that the economic value of this type of tourism do not flow solely to the industry, but are also spread across the region where it is hosted. This highlights the need to ensure a sustainable dive-tourism industry through adequate management of shark-diver interactions and the species on which it is based. Our study also provides standardised estimates which allow for future comparison of the scale of other wildlife tourism industries within or among countries.

S11 *Marine biodiversity conservation – what's effective?*
Wednesday 4 July, 1530 - 1545

Genomically-informed Fisheries Management of White Seabass (*Atractoscion nobilis*)

Matthew Iacchei¹, Jonathan Whitney², Kimberly Selkoe^{3,4}, Scott Aalbers⁵, Chukey Sepulveda⁵, Alfonsina E. Romo-Curiel⁶, Robert J. Toonen³, Hunter Lenihan⁷

1. Department of Natural Sciences, Hawai'i Pacific University, Kāne'ohe, HI, USA
2. Department of Oceanography, School of Ocean and Earth Science and Technology, University of Hawai'i at Mānoa, Honolulu, USA
3. Hawai'i Institute of Marine Biology, University of Hawai'i at Mānoa, Kāne'ohe, HI, USA
4. National Center for Ecological Analysis and Synthesis (NCEAS), Santa Barbara, CA, USA
5. Pflieger Institute of Environmental Research, Oceanside, CA, USA
6. Departamento de Oceanografía Biológica, Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE), Ensenada, BCS, Mexico
7. Bren School of Environmental Science and Management, University of California Santa Barbara, Santa Barbara, CA, USA

Abstract

Coastal habitats contain some of the most valuable but challenging-to-manage fisheries species. Paramount to the effectiveness of any of these management approaches is knowledge of individual species' life history, ecology, and for spatially-explicit approaches, the size and spacing of populations maintained by genetic connectivity. Here we present a genome-level survey of a valuable fisheries species, the White Seabass (*Atractoscion nobilis*) across the majority of the species' distribution along the Pacific coast of California and Baja California Mexico to understand the scale of White Seabass populations. We characterized eight unique samples plus multiple replicates using a pooled RAD-seq technique that produced a final dataset of 1561 SNPs on 261 contigs of 300bp each distributed across the genome. Each SNP had 40x coverage and was scored across all pools. We found no indication of genetic structure across the species' distribution across putatively neutral genomic regions, and few outlier loci across the natural population samples. However, we found differences between hatchery broodstock samples and wild samples at both neutral and outlier loci. We discuss the implications of these results both for the management of wild populations across the United States–Mexico border, and explore the potential impact of stock-enhancement of this fishery.

S9

Genomics of marine organisms: contributions to ecology and evolution

Thursday 5 July, 1145 - 1200

The impact of temperature on growth rates of demersal fish species in the West of Scotland

Idongesit E.Ikpewe¹, Alan R.Baudron¹, C. Tara Marshall¹ and Paul G.Fernandes¹

1. University of Aberdeen, Aberdeen, United Kingdom.

Abstract

The temperature-size rule (TSR) predicts that increased temperature would result in faster growth but a smaller asymptotic length. Sea temperatures in the West of Scotland has risen by approximately 1 °C over the past three decades. The present study investigated whether changes in the growth rates of haddock (*Melanogrammus aeglefinus*), cod (*Gadus morhua*), saithe (*Pollachius virens*), whiting (*Merlangius merlangus*) and Norway pout (*Trisopterus esmarkii*) were consistent with the TSR. Data for age-length-keys (ALKs) used in this analysis were obtained from Marine Scotland laboratory, while temperature data were obtained from ICES Report on Ocean Climate. For each species, the Von Bertalanffy growth function (VBGF) was fit on a cohort-by-cohort basis beginning in 1986, excepting Norway pout for which data began in 1990. For haddock asymptotic length (L_{∞}) was significantly, negatively correlated with temperature while the growth rate (K) was positively correlated. Over the study period a 28% decrease in the L_{∞} of haddock was associated with a temperature increase of 1 °C. The correlations between temperature and the VBGF parameters were not significant for saithe, whiting, Norway pout or cod. The significant result for haddock is consistent with the TSR which was also previously detected in North Sea haddock.

S6 **Marine Climate Change from Shelves to Deep Seas**
Tuesday 3 July, 1400 - 1415

Regional seabed mapping with crowd-sourced bathymetry

Emilie Novaczek^{*1}, Elaine Hynick², Mary Young³, Daniel Ierodiaconou³, and Rodolphe Devillers¹

1. Memorial University of Newfoundland (MUN), St. John's, NL, Canada
2. Fisheries and Oceans Canada (DFO), St. John's, NL, Canada
3. Deakin University, Warrnambool, Vic, 3280

Abstract

Increased pressure on marine ecosystems and prioritization of spatial planning have created an urgent need to better understand marine resources and associated habitats. We will present a low-cost method for improving accuracy and resolution of regional seabed maps using crowd-sourced single-beam bathymetry and explore the potential of this approach for data poor regions of Australia.

Olex bathymetry is collected globally from thousands of commercial fishing vessels using on-board single-beam echosounders. These data are compiled, quality-checked, and corrected for predicted tides. Olex bathymetry represent decades of survey effort with significant value to ecological research. Previous work by the MAREANO program has demonstrated the utility of these data for mapping marine biotopes. Olex XYZ points for Newfoundland and Labrador, Canada, were interpolated using Empirical Bayesian Kriging to generate a continuous surface covering 690,725 km² (i.e. 10 times the size of Tasmania). The resulting 75m bathymetric grid has 100+ times finer spatial resolution than was previously available for most of the study area. Correlation between the interpolated Olex surface and independent bathymetry data collected by Fisheries and Oceans Canada is >95%.

S3

Seafloor Mapping in Australia – Progress, Discoveries, Applications
Monday 2 July, 1400 - 1415

SeaBed NSW State-wide Mapping Program: Prioritisation and Recent Discoveries in the Illawarra

Tim Ingleton¹, Michelle Linklater¹, Michael Kinsela¹, Brad Morris¹, Katie Allen¹, Peter Davies¹, Edwina Foulsham¹, Michael Sutherland¹, and David Hanslow¹.

1. New South Wales Office of Environment and Heritage, 59-61 Goulburn Street, Sydney, Australia 2001

Abstract

MBES and Marine LiDAR are important technologies used for high-resolution mapping of nearshore marine environments. The data they acquire provide fundamental baseline information for mapping sediment-habitat distributions, deriving terrain variables and supporting the development of hydrodynamic, inundation, wave and sediment transport models for improved management of coastal hazards and risk. The NSW Office of Environment and Heritage is mapping secondary sediment compartments (<50m water depth) to build upon high-resolution coverage as part of the state's Coastal Reforms program.

Pilot surveys focused around Wollongong have provided a new perspective of the seabed for this part of the inner- to mid-shelf. While the sediment compartment off Wollongong is reef-dominated (~57%), Illawarra North is sediment-dominated and Illawarra South features a large sand-basin. Geomorphometry of the seabed was explored, and classifications for seabed landforms, substrate and geomorphology were produced. Expansive low profile guttered reefs are characteristic for the region. Structural faults and volcanic craters (200-600m) are also apparent and contiguous with the terrestrial geology. Backscatter identified 4-5 broad sediment classes that are to be validated with sediment sampling and towed video. A coastal-hazard focused ranking process, applied across the state's compartments to plan and prioritise data collection, is discussed.

S3**Seafloor Mapping in Australia – Progress, Discoveries, Applications****Monday 2 July, 1645 - 1700**

Stranded quaternary aeolianites, SE Australia; A conceptual link between marine sources and terrestrial deposition

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Abstract

Calcareous aeolianites (beach-dune complexes) are an integral part of carbonate depositional systems and it is postulated that they contain a sensitive record of their offshore marine source. This hypothesis is tested herein by documenting and interpreting part of the most extensive and temporally longest such system in the modern world, Pleistocene stranded sea beaches and aeolianites in southeastern Australia that stretch back ~790 k.y. The deposits do reflect their source, a heterozoan carbonate factory composed of abundant coralline algal, echinoderm, benthic foraminifer, mollusc and bryozoan biofragments. The aeolianites differ in composition from open shelf sediments because they contain numerous mollusc fragments, which are not abundant offshore. This difference is due to two factors: 1) inboard, shallow water aragonitic molluscs are swept onshore before they can be diagenetically altered in the shallow subsurface marine environment, as they would be if their particles remained offshore, and 2) there are numerous infaunal aragonitic bivalves in the beach environment whose fragments could be added to the sediment milieu before it is swept into the adjacent beach dunes. Thus, these carbonate aeolianites do not specifically reflect most of the offshore open marine environment but instead record the composition of the inner neritic and beach settings.

G4***Carbonate shelves: geology, oceanography and biota*****Tuesday 3 July, 1545 - 1600**

Snails know how to beat the heat: Using thermal imagery to investigate associations between intertidal ectotherms and substratum temperature

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2. Marine Ecology Research Centre, School of Environment, Science and Engineering, Southern Cross University, Lismore, New South Wales 2480, Australia

Abstract

Intertidal ectotherms often live near their upper limits of thermal tolerance when emersed on rocky seashores. With predictions of warming temperatures associated with climate change, the survival and persistence of some intertidal species may be challenged. To predict the potential effects of climate change a baseline of rock temperature, and biotic associations with rock temperature, must be established. A common-garden experiment was established to measure the temperature of intertidal boulders for six rock types using thermal imagery. All six rocks had mosaics of surface temperature. The maximum temperature of these mosaics differed consistently between rocks, with purple siltstone and grey siltstone the hottest, and quartzite and white limestone the coolest. Seashore sampling was then completed to investigate the biological relevance of baseline temperature data. Sampling investigated the associations between organism location and temperature mosaics for three snail species on one hotter rock (grey siltstone) and one cooler rock (quartzite). All three snail species occupied cooler parts of temperature mosaics, avoiding the hottest areas. Stronger associations were detected on grey siltstone and for the more-thermally sensitive snail species. These results allow us to better understand substrate temperature, and some biotic interactions with substrate temperature, in the rocky intertidal.

Poster presentation

S7

Seamap Australia - National release of a benthic habitat mapping service for the Australian continental shelf.

Craig Johnson¹, Vanessa Lucieer¹, Peter Walsh¹, Claire Butler, Emma Flukes¹, Mark Hepburn².

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2. Condense. Level 3, 13-17 Castray Esplanade, Battery Point, TAS 7004

Abstract

In many ways, Australia is defined by the oceans that surround us. We have the third largest marine estate in the world comprising 8.2 million square kilometres of which < 15% is mapped. Understanding the distribution of marine habitats within this marine estate requires national collaboration and a multidisciplinary approach from a network of scientists. The Australian National Data Service (ANDS) has invested in this network by funding *Seamap Australia*.

Seamap Australia collated available benthic mapping data for the Australian continental shelf and made these accessible from one location. The project then synthesised these datasets into one spatial data product using a newly proposed national benthic marine classification scheme developed specifically for the Australian continental shelf. The individual data sets and the *Seamap Australia* product can be both visualised and downloaded via www.seamapaustralia.org.

Seamap Australia is a nationally significant resource highlighting the diversity of benthic habitats in one seamless data product. The *Seamap Australia* website demonstrates how national benthic data can be enhanced with existing data, including imagery, biodiversity, environmental pressures, commercial fishing, and physical data, to become a truly useful multidisciplinary resource.

Seamap Australia can be constantly developed and updated as future research continues to improve knowledge of our vast marine estate.

S3

Seafloor Mapping in Australia – Progress, Discoveries, Applications
Monday 2 July, 1615 - 1630

Amphibious Coastal and Nearshore Mapping Following a Massive Earthquake in Kaikoura, New Zealand

Elizabeth Johnstone¹, Owen Friedlieb¹, Rhys Davies¹, Rebecca McAtamney², Annette Hadler², Geoffrey Gearheart³, Daniel Ierodiaconou⁴

1. iXblue Australia, Wynnum West, Queensland 4178
2. LINZ, Wellington, New Zealand, 6145
3. Tellus4d Geoimaging, Shelly Beach, Queensland 4551
4. Deakin University, Warrnambool, Victoria 3280

Abstract

A 7.8-magnitude earthquake struck Kaikoura, New Zealand in November 2016, causing widespread landslides and significant horizontal movement and uplift along the coast. Following the quake, Land Information New Zealand (LINZ), funded a hydrographic mapping project in the nearshore waters surrounding Kaikoura peninsula to re-map 35,000 Hectares of seafloor. iXblue was contracted to conduct hydrographic charting (IHO-44 standard) of the area, including marine protected areas designated for production of additional science bi-products. From November 2017 through February 2018, these areas were sonified using high-resolution multibeam technology. In addition, we performed backscatter analysis, laser scanning, acquired sediment samples, and used drone-based photogrammetry to map the coast in specific sites. Using this suite of technologies, we have discovered several previously undocumented faults. The complex fault regime controls the alluvial river systems sculpting the land and the offshore canyon morphology. In addition, our data suggests the faults also play an important role in the seafloor habitats and resulting biological communities. The recent uplift, up to six metres in some areas, has formed new reef structure while other pre-existing reef platforms have become subaerial, causing massive die-offs in important nearshore habitat. Quantifying these shifts is vital for local fisheries and coastal management.

S3

Seafloor Mapping in Australia – Progress, Discoveries, Applications
Monday 2 July, 1515 - 1530

Earth observation for monitoring cetacean species

Alexandra Jones¹, Eleanor Bruce¹, Doug Cato¹, Michelle Blewitt²

1. School of Geosciences, University of Sydney, Madsen Building F09, NSW, 2006

2. Marine Studies Institute, University of Sydney, NSW, 2006

Abstract

Each year, about 30,000 humpback whales migrate along the east Australian coast between their summer feeding grounds in the Antarctic and the winter breeding and calving grounds within the Great Barrier Reef. During the southern migration, females and their newly born calves are thought to rest in sheltered coastal waters or embayments for protection from rough seas, predators, conspecifics and to conserve energy. This resting behaviour has been well documented in Hervey Bay, Queensland, and more recently in Jervis Bay, on the south coast of New South Wales. Humpback whale habitat usage patterns in this area are poorly understood. Here we review the suitability of existing survey methods to determine the most appropriate method(s) for examining humpback whale habitat usage patterns within Jervis Bay. In addition, we present the effectiveness of images collected onboard a local whale watching vessel and from citizen scientists in understanding residency time of mother-calf groups within the bay. Understanding the residency time and habitat usage patterns of mother-calf groups within Jervis Bay has direct implications for the conservation significance and environmental management of the Jervis Bay Marine Park area.

Poster presentation

S13

Estimating Mangrove Biomass and Carbon Content Using Unmanned Aerial Vehicles

Alice R. Jones¹, Ramesh Raja Segaran¹, Michelle Waycott¹, Adam Kilpatrick¹, Lian Pin Koh¹, William Seow Goh¹, Bronwyn M. Gillanders¹

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Abstract

Unmanned Aerial Vehicles (UAVs) are increasingly being used as tools for the collection of biological data, including ecosystem mapping and development of three-dimensional models of vegetation structure. We developed a model of biomass and carbon storage for the grey mangrove (*Avicennia marina*) based on imagery collected with a UAV. With support from the South Australian Department of Planning, Transport and Infrastructure (DPTI) and Lendlease (a large construction company), we collected imagery of mangroves that were subsequently felled as part of a major road building project. The imagery was processed to generate a three-dimensional canopy model of the mangroves, from which we extracted measurements of tree height and canopy area. We also weighed and measured the felled trees and took subsamples for elemental analyses, enabling us to calculate the biomass and carbon content of each tree, based on empirical data. Using these biomass and carbon content estimates, we were able to calibrate and validate a predictive model of mangrove biomass based on the height and canopy area measurements from the aerial imagery. This proof-of-concept model has the potential to be further developed for use in carbon accounting and could support the establishment and monitoring of mangrove-based carbon offsetting projects.

G5**Estuaries and coasts****Tuesday 3 July, 1145 - 1200**

Evaluation and Prioritisation of Threats to Marine Environmental Assets in Order to Achieve Effective Biodiversity Management

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2. NSW Office of Environment and Heritage, Sydney, NSW 2001
3. NSW Department of Primary Industries, Coffs Harbour, NSW, 2450
4. NSW Department of Primary Industries, Mosman, Sydney, NSW 2088

Abstract

An important step in identifying the most appropriate management actions to achieve marine conservation outcomes, and to gain acceptance by stakeholders, it is important to describe a regions environmental assets and evaluate the threats to these assets from the specific activities. In NSW, these threats and resulting risk have recently been assessed by defining a set of common stressors that may result in impacts on specific environmental assets, including seabed habitats and associated assemblages, the water column, and threatened and protected species. The assessment of risks has allowed an identification of priority threats, key stressors, spatial scale of risk and key activities that result in cumulative impacts. Spatial management has been recognised as one tool that can help manage a range of specific threats, and this complements other initiatives that target water quality, habitat management and restoration, impacts on wildlife, climate change, boating impacts and harvest strategies. Important initiatives also target improved governance, community education and engagement, and industry training that all aim to achieve improved marine biodiversity outcomes. These initiatives are incorporated into a new NSW Marine Estate Management Strategy that includes an integrated monitoring program that will evaluate the effectiveness of management actions.

S11 *Marine biodiversity conservation – what's effective?*
Wednesday 4 July, 1345 - 1400

Assessment of Coral Reef Ecosystem for Determination of Carrying Capacity in Marine Ecotourism Management within Dampier Strait Marine Protected Area of Raja Ampat TBC

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2. Marine Science Department, Faculty of Fisheries and Marine Science, University of Papua, Jl. Gunung Salju Amban, Manokwari 98314, West Papua, Indonesia
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5. Professor of Coastal and Marine Resources Management, Faculty of Fisheries and Marine Science, Graduate School Bogor Agricultural University, IPB Campus, Jl. Agatis, Bogor, 16680, West Java, Indonesia

Abstract

Assesment of carrying capacity in marine ecotourism management has been done in April and November 2016 on diving spots within Dampier Strait Marine Protected Raja Ampat. The data LIT (*Line Intercept Transect*) collected from 0-10 m, 30-40 m, and 60-70 m. The morphometric code of benthic component used as a reference was published by Australian Institute of Marine Science (AIMS). The data of hard coral biodiversity was collected in the range 0.5-20 m depth. The The percentage of coral coverages done with excel method, biodiversity index and similarity index with Biodiversity Pro 4 application. The condition of hard coral are in good to very good conditions. There are many kinds of coral reefs species in 10 dive spots. We found 141 spesies included in 16 families. Beauty and megabiodiversity of coral reefs are very important for ecotourism management. The management of marine ecotourism must be implemented with conservation and preservation of the coral reefs ecosystem. Implementation of management should be supported by sufficient assessment of carrying capacity for sustainable marine ecotourism which promotes prosperity of local people.

Key Words: coral reef ecosystem, carrying capacity, marine ecotourism management, marine protected area, Dampier Strait Raja Ampat

G5 *Estuaries and coasts*
Monday 2 July, 1745 - 1800 TBC

Interaction of Oceanic Flows with Submarine Canyons

Jochen Kämpf¹

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Abstract

This presentation gives an overview of the interaction of oceanic flows with submarine canyons with a focus on those processes that trigger localized onshore nutrient fluxes and upwelling. First, I discuss the general dynamics inherent with upwelling in an isolated submarine canyon which is only initiated under certain flow conditions. This is followed by a discussion of possible cross-shelf water exchanges and upwelling at vast distances (>100 km) in the lee of a shelf-break canyon. Then, I briefly review what we know about canyon-upwelling processes on the continental shelf around Australia, from the western Arafura Sea to the southern shelves, highlighting the Murray Canyon group, and Australia's south-western shelf which features the Perth Canyon. Surprisingly, we recently discovered shelf-break canyons in the Bremer Bay region of the far western Great Australian Bight, but whether they trigger upwelling is not known yet.

S1 *Cross-shelf exchange processes*
Monday 2 July, 1130 - 1145

From production to predation in the western Tasman Sea - assessing the trophic status of the size-structured ecosystem using stable isotope analysis

Lucas Kas¹

1. UNSW, 84 Ferguson St, Maroubra, NSW, Australia

Abstract

Ocean fisheries are increasingly managed by satellite imagery of sea level and sea surface temperature, but the ecosystem basis to these oceanic habitats is unknown. My research will link size-based ecosystems of the western Tasman Sea, with trophic level estimates based on nitrogen stable isotopes composition of the major functional groups, to determine the trophic ecology of each oceanic environment. Trophic ecology and function can be revealed by quantifying a set of numerical food web parameters established from the relationship between body size and trophic level, such as: food chain length, trophic efficiency, and predator-prey mass ratios. Therefore, the effect of coastal ocean warming off eastern Australia can be understood, and information on the biomass, productivity, and resilience of each ecosystem used to improve fisheries management.

Poster presentation

S15

Cracking the Indian Ocean Dipole Code

Ankit Kavi¹ and Jochen Kämpf¹

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Abstract

The Indian Ocean Dipole (IOD) is a prominent mode of coupled atmosphere-ocean variability that affects the lives of millions of people in surrounding countries. It is well known that El-Niño events in the Pacific Ocean are triggered via Westerly Wind Bursts (WWBs) that create equatorial Kelvin waves suppressing upwelling that normally develops in the eastern equatorial Pacific in support of the world's most productive fisheries off Peru. Here we show that WWBs occur regularly in the Indian Ocean and their suppression of coastal upwelling off Sumatra constitutes the norm. Consequently positive IOD events are triggered in years of significantly fewer WWBs, such that the Sumatran upwelling can fully develop in austral spring without counter effects from downwelling Kelvin waves. The resulting cold surface water anomaly is reinforced by the formation of a geostrophic upwelling jet that moves colder Timor Sea water equatorward along the Sumatran coast and displaces warmer equatorial water that normally occupies this region. We expect this identification of WWBs as the anti-trigger of positive IOD events to be the starting point for further advances in the understanding of equatorial modes of climate variability, their teleconnection, and their changes under the global warming scenario.

S2 *Extremes: causes, symptoms, and impacts*
Monday 2 July, 1715 - 1730

Sustainable seawater purification system from the depth to the shallows built in piles and quays using the purifying functions of microorganisms and the tidal energy

Kazuhide Dan¹

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Abstract

In closed sea areas in the world the eutrophication is being progressed. Nowadays in closed sea areas in Japan it is hard to control the seawater quality in deep areas because of the poor oxygen seawater or the anoxic seawater. It is necessary to maintain that the seawater is clean and rich in nature for the sustainable development. One of methods is this sustainable seawater purification system built in piles and quays using the purifying functions of microorganisms and the tidal energy.

It is shown that this system can decrease Chemical Oxygen Demand (CODMn) in the seawater experimentally and can be utilized in order to purify the seawater for the depth to the shallows using this system built in quays and partially using this system built in piles.

This system has following advantages.

1. Using the tidal energy → ecosystem
2. Using the purifying functions of microorganisms, decomposing organic materials → ecological and natural without chemicals,
3. Capable of purifying the seawater in the shallow area, especially also in the deep area → useful
4. This system built in quays or piles is simple. It is easier to construct this system additionally → economical

Poster presentation

G6

Variability in the response of blue carbon to tidal restoration: a >20-year record from the lower Hunter estuary.

Jeffrey Kelleway¹, Christopher Owers², Kerrylee Rogers², Patricia Gadd³, Atun Zawadski³, Grant Edwards¹, Karita Negandhi¹, Doug Beckers⁴ and Neil Saintilan¹

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2. School of Earth and Environmental Science, University of Wollongong, NSW 2522
3. Australian Nuclear Science and Technology Organisation, NSW 2232
4. Hunter Central Coast Branch, NSW National Parks and Wildlife Service, NSW 2250

Abstract

The reintroduction of tides is a method of restoring degraded coastal habitats, historically driven by benefits to fisheries habitat and/or acid sulfate soil management. There has been an increasing focus on the 'blue carbon' potential of wetland restoration, with the reintroduction of tidal connection thought to have benefits of enhancing carbon sequestration and avoiding future emissions. Despite broad quantification of carbon cycling in undisturbed ecosystems, there remains little empirical data regarding the response of blue carbon to management intervention in Australia.

We assessed responses in carbon stocks and accumulation at three sites of the lower Hunter estuary which were impounded in the 1950s-70s, and have since experienced tidal reconnection (Kooragang, 1995; Hexham, 2008; Tomago, 2015). We found substantial within-site variability in the structure and size of biomass growth and the development of soil carbon stocks within 9 years of tidal reconnection commencing at Hexham. Spatial and temporal variability in atmospheric flux of CO₂ and CH₄ was evident in EC tower data collected before and after tidal reconnection at Tomago. This flux was strongly correlated with wetland elevation and influx of freshwater following rainfall in the wetland. Our results demonstrate some of the subtleties of blue carbon response to hydrological intervention and highlight the need for robust quantification in blue carbon projects.

G5*Estuaries and coasts*

Tuesday 3 July, 1115 - 1130

Social licence and citizen science: Potential and progress

Rachel Kelly^{1,2}

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2. Centre for Marine Socioecology, University of Tasmania, Hobart, Tasmania 7005, Australia

Abstract

Social licence is an emergent concept in the marine sector and an important theme for development in marine industry and resource use. Meaningful public engagement with science and research is particularly recognised as necessary to advance public knowledge about the marine environment and to promote stewardship of ocean spaces. Citizen science is expanding in marine spaces and may create communication pathways between social groups, to promote collaborative decision-making that can enhance outcomes for science and management. Our research is among the first attempts to link social licence theory with citizen science, aiming to produce practical outcomes that can be applied in ocean management. Here, we examine the role citizen science can play in promoting social licence in the marine realm. Firstly, investigating European marine citizen science projects and their potential to enhance social licence for marine conservation. Secondly, describing an Australian case-study to determine whether and how diverse user groups (i.e. divers, fishers) communicate via citizen science and whether social licence is promoted through this exchange. We highlight social licence as a potential tool to foster positive engagement between ocean users, and identify how citizen science can influence perceptions to promote social licence in the marine realm.

Poster presentation

G5

Diversity in the Deep: deep sea amphipods and isopods (Crustacea) of the Great Australian Bight

Rachael A King^{1,2}, Amelia Lewis², Michelle T Guzik², Andy D Austin², Jason Tanner³

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3. South Australia Research and Development Institute, West Beach, South Australia, Australia

Abstract

The deep-sea is a largely unexplored, complex environment where benthic invertebrate diversity is poorly known and mostly undescribed. New material from recent surveys including those by the RV Investigator, have provided fresh material for analyses, and have indicated high levels of diversity present in the Great Australian Bight (GAB) especially within the crustacean groups Isopoda and Amphipoda. These groups are well-known as dominant members of benthic deep-sea habitats world-wide, yet Australian deep-sea assemblages of these groups often lack modern evolutionary and taxonomic treatments. Here we present preliminary molecular phylogenies for amphipods and isopods based on COI sequence data that include the available GAB specimens, and additional Southern Ocean/Antarctic material from the National Institute of Water and Atmosphere (NIWA). The resultant phylogenies will be discussed in terms of placing the GAB taxa in context within the larger region, and will form the basis for on-going taxonomic research that will describe this unique fauna. This research was part of The Great Australian Bight Research Program (GABRP), which was a collaboration between BP, CSIRO, the South Australian Research and Development Institution (SARDI), the University of Adelaide and Flinders University.

G1***Deep sea and canyon ecology*****Wednesday 4 July, 1530 - 1545**

Changes in Trophic Niche Use as Tropical Fish Move Poleward

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2. School of the Environment, University of Technology Sydney, Broadway, NSW 2007, Australia

Abstract

As tropical fish species shift poleward in response to warming temperatures, the use of trophic niche space within recipient temperate ecosystems may be altered. The aim of this study is two-fold; firstly, to determine if local temperate species react adaptively to ocean warming by shifting trophic niches or increasing/decreasing their diet breadth, and secondly, to evaluate the trophic response of the tropical vagrants. To identify the extent to which these tropical vagrants modify existing food webs, a combination of stable isotope analysis (SIA) and gut content analysis (GCA) was performed on temperate and tropical species. SIA is used to quantitatively evaluate trophic position whilst GCA can determine if variations in isotope composition are a result of adjustment in diet or changes in the chemical composition of habitual food sources. We conducted multi-seasonal sampling along a latitudinal gradient in eastern Australia to ensure a broader range of arrival stages within tropical, temperate, and mixed communities. We found that as tropical omnivores shift southwards, carbon is depleted and nitrogen is enriched within the fish tissue, indicating that these fish are feeding at higher trophic levels as they move poleward.

S6***Marine Climate Change from Shelves to Deep Seas*****Tuesday 3 July, 1130 - 1145**

Micronekton assemblages and bioregional setting of the Great Australian Bight: a temperate northern boundary current system

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Abstract

Micronekton communities and pelagic bioregionalisation of the Great Australian Bight (GAB), a regionally significant northern boundary current system, were studied as part of a multi-disciplinary pelagic ecosystem study. Micronekton community structure, biomass and phenylalanine $d^{15}N$ isotopes differed between the eastern and central GAB. The results are supportive of a hypothesis that the east GAB is an upwelling-dominated system. Using lanternfishes (family Myctophidae) as a model group, a supervised cluster analysis indicated bioregional affinities between GAB pelagic fauna and the subtropical Indian Ocean region. However, over the continental slope, the east GAB appears to have biogeographic affinities with the Subtropical Convergence and South Tasman Sea, concordant with oceanographic regimes on the GAB continental slope. Lanternfish assemblage distribution was compared with existing bioregional schema based on physicochemical variables and the Delphic Method. Lanternfish assemblage distributions support a regionalisation placing the GAB within a Subtropical Indian Ocean province, as opposed to a Subtropical Convergence province. No single existing biogeographic schema adequately reflected lanternfish distributions, but boundaries from multiple physicochemical schema were able to be selected to erect data-driven hypothesised pelagic biogeography. The data presented here will be useful for the management and monitoring of oil-and-gas developments and Marine Parks.

G1 *Deep sea and canyon ecology*
Wednesday 4 July, 1200 - 1215

Factors Affecting purging success in Pipis (*Donax deltoides*)

Kurniawan Kurniawan¹, Graham Mair¹, Poppy Stivahtaris¹ and Alistair Scott-Young²

1. Flinders University, Bedford Park, South Australia, Australia
2. Goolwa PipiCO, Goolwa, SA, Australia

Abstract

Sand content in is a determinant factor of product in cockle industry. Goolwa Pipico has implemented process recirculating purging system for 16 hours o improve quality of cockle product This research aim to develop a method to quantify the amount of sand in pre- and post-purged product, to investigate factors impacting purging and to evaluate a method to improve de-sanding process.

methods including chemical, heat, enzymes & bacteria to find the best digestion process to separate sand from organic component of the cockles.

To better understanding of the problem, quantification of sand was conducted in pre and post purging related to purging timeline, tray position, and distances of harvest location. A pulse feeding method using microalgae were conducted to improve de-sanding success.

Poster presentation

S15

How the Integrated Marine Observing System can play a role in education

Ana Lara-Lopez^{*1}, Peter Strutton², Tom Trull³, Paula Conde Pardo³, Roger Proctor¹, Eduardo Klein² and Tim Moltmann¹

1. Integrated Marine Observing System, University of Tasmania
2. University of Tasmania
3. Commonwealth Scientific and Industrial Research Organisation

Abstract

The need to attract, train and retain the next generation of marine scientists was highlighted in the National Marine Science Plan. Australia has one of the largest marine jurisdictions on earth and marine industries that are estimated will contribute ~\$100 billion per annum by 2025. In addition, the steep increase in available marine data, and rapid development of eResearch, have created the need to train future marine scientists capable of understanding, using and interpreting these vast observational datasets and thus ensure that new graduates have the necessary skills in current and emerging marine science fields. Indeed the ability for students to be able to access and query Australian and international databases is a key skill to answer important science questions. The University of Tasmania in collaboration with the Integrated Marine Observing System are developing a pilot for on-line teaching and learning modules that include tools for the use and interpretation of its marine observations. These modules are focused on marine biogeochemistry and will be openly available through the University's Open2U system.

G6[Open theme](#)**Wednesday 4 July, 1645 - 1700**

MarinePestPlan 2018-2023: Australia's national strategic plan for marine pest biosecurity

James Lavender¹, Cian Foster-Thorpe¹ and Brett Herbert¹

¹ Department of Agriculture and Water Resources, Canberra.

Abstract

In 2015 a Review of National Marine Pest Biosecurity recommended implementation of a national marine pest biosecurity strategy. *MarinePestPlan 2018-2023*, Australia's national strategic plan for marine pest biosecurity, was finalised in early 2018. *MarinePestPlan 2018-2023* outlines five key objectives for national marine pest biosecurity, including improved marine pest prevention, strengthened surveillance, enhanced emergency response capability, support for research and development, and greater stakeholder engagement. Marine pest biosecurity is a shared responsibility of marine environment stakeholders and *MarinePestPlan 2018-2023* reflects this in the nature of its development, objectives, and implementation approach. I will present an overview of Australia's national biosecurity framework, discuss the objectives and activities of *MarinePestPlan 2018-2023* and the progress towards its implementation. The role of Australian marine science research in contributing to national marine pest biosecurity will be discussed such as providing expertise to policy development, reporting suspected marine pests, and implementing sound biosecurity practices in laboratories and in the field.

S10 *Marine biosecurity in an increasingly-connected world: protecting Australia from marine pests and diseases*

Wednesday 4 July, 1600 - 1615

Why, how and where to monitor plastic pollution

TJ Lawson¹, Britta Denise Hardesty¹, Qamar Schuyler¹ and Chris Wilcox¹

1. CSIRO Oceans and Atmosphere

Abstract

Plastic volume in the ocean is increasing rapidly. It has detrimental consequences for wildlife, economies and potentially human health. Understanding why and where mismanaged waste enters the environment and how it moves in the environment is critical. This knowledge can help us to stop the leakage into the environment and provide useful information to governments about hotspots and intervention options that will likely be successful.

We have been involved in a series of projects to tackle this issue. We are working from local grass-roots levels to international scales. In this talk, we will discuss the value of harmonizing approaches to monitor plastic pollution, how to sample simply and effectively, and where we may want to focus our efforts. Together, with a robust, comparable baseline data collection approach, we can provide the information needed to underpin policy and enact change via on-ground activities at local, national and international scales.

S16 *Marine Debris: the world-wide pollution crisis acting on local to global scales*
Thursday 5 July, 1430 - 1445

The application of large-area mosaic imaging to coral reef community assessment

Marine Lechene¹, Julia Haberstroh¹, Renata Ferrari^{1,2}, Maria Byrne¹, Will Figueira¹

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Abstract

Adequately sampling the percentage of coral cover and species composition on coral reefs is a challenge with most methods covering only 5-10% of the reef area. Recent advances in photogrammetry-based techniques have made image-based surveys more efficient and cost effective, providing the opportunity to estimate benthic cover for expansive areas of reef. In this study, we explore the use of large-area (~300m²) high resolution (0.81-1.18mm/pixel) photomosaic habitat maps to accurately characterise coral reef assemblages. We established the areal coverage of coral communities from eight reef areas around Heron Island, Great Barrier Reef. We then compared these estimates to those derived from quadrat sampling strategies (various size and number of quadrats; done virtually on the maps) as well as those derived from rapid visual estimation. Our results indicated that the use of 2x2m quadrats was most efficient as it consistently delivered the highest precision estimates with the lowest sampling effort although higher effort is needed for rare classes. The rapid visual estimation technique was efficient and delivered accurate results. However, accuracy was strongly dependent upon the observer's knowledge of the local biota rather than their experience with coral reef classification per se.

S5

Structure and function of coral reefs in a changing world

Wednesday 4 July, 1115 - 1130

A gelatinous pest: Settlement preferences of the invasive ascidian *Ciona intestinalis* in South Australia.

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Abstract

Invasive species can cause serious impacts on the ecology and economy of novel regions. Their successful establishment in new areas has been linked to many factors, one of which is facilitation by anthropogenic structures. A prolific invader, the solitary ascidian *Ciona intestinalis* appears in high abundance on coastal structures around Australia. As a fast growing, dominant colonizer, sessile community composition can be shaped by the presence of this ascidian. Settlement preferences of larval *C. intestinalis* were investigated by deploying submerged recruitment tiles at two marinas in South Australia. Tiles were made of turpentine timber, fibre cement or acrylic, and were orientated vertically and horizontally face-down, to mimic the surfaces artificial structures. To investigate temporal patterns in settlement, groups of tiles were deployed over 12 months. We found that *C. intestinalis* settlement occurred year-round, and was the most abundant species recorded. *C. intestinalis* recruited in higher abundance to horizontal face-down orientations throughout the duration of the study, and recruitment to vertical substrates was highly variable. This study can inform for the management of coastal areas with high coverage of anthropogenic structures. The design of future constructions can also benefit by being informed of surfaces that minimise the impact of pest species.

S10 *Marine biosecurity in an increasingly-connected world*
Wednesday 4 July, 1200 - 1215

Mucosal microbiomes of the commercially important aquaculture species Yellowtail Kingfish (*Seriola lalandi*) and markers of changing health status

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2. SARDI Aquatic Sciences, West Beach, SA, Australia
3. Helmholtz Centre for Infection Research, Braunschweig, Germany

Abstract

The mucosal surfaces and associated microbiota of fish play an important role in the overall health and fitness of the host and provide the first line of defence against potential pathogens. Active bacterial assemblages (in the gut, skin and gills) of healthy Yellowtail Kingfish and fish with early and late stages of enteritis were surveyed by constructing Illumina 16S rRNA (cDNA) amplicon libraries. Body sites clustered independently to one another, indicating that each mucosal surface supports distinct bacterial assemblages. Health status also significantly influenced the global bacterial composition across all body regions, with the gut of diseased fish dominated by certain potentially opportunistic species. Most noteworthy, however, was the marked variation in the outer-surface (skin and gill) communities at the very early stages of the disease, where an overall loss of diversity was apparent. In contrast, the skin and gill microbiota of fish with late stage disease were generally similar to those of healthy individuals. Gut health status thus appears to be an important factor which defines the outer surface bacterial assemblages of fish and likely reflects changes in immune states during the early onset of disease. This study revealed potential non-invasive biomarkers for early detection in commercial aquaculture systems.

S15 **Aquaculture blue economy**
Tuesday 3 July, 1145 - 1200

Spatial distribution of sponge species richness: lessons learned from spatial predictive modelling and pattern predictions

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Abstract

The broad continental shelf offshore northern Australia is characterised by extensive carbonate banks, terraces and pinnacles that provide potential habitats for sponge communities. Previous research in the region has established a baseline environmental inventory of these communities for these seabed features at the local scale and explored multivariate ecological relationships. Here we adopt a predictive modelling approach to advance our understanding of the spatial patterns of sponge communities and potential associations with a range of environmental variables. The dataset comprises 77 samples from the Oceanic Shoals Marine Park, for which sponge species richness (SSR) and 49 seabed biophysical variables are derived. We model SSR using random forests, generalised linear models, and their hybrid methods with geostatistical techniques. The predictive models were selected using various variable selection methods and validated using 10-fold cross-validation. We discuss modelling results focusing on: spatial patterns of SSR in relation to predictive environmental variables and seabed features and; goodness-of-fit and predictive accuracy. We also offer guidelines for selecting predictors based on predictive accuracy instead of parsimoniousness. This study builds on baseline environmental information for monitoring of ecosystem health, and insights into areas where the management and conservation of sponge gardens could be focused.

G1 *Deep sea and canyon ecology*
Wednesday 4 July, 1515 - 1530

Effects of Temperature, Substrate Type and Water Current on the Performances of *Donax deltoids* and *Katelsysia rhytiphora*

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3. Liaoning Ocean and Fisheries Science Research Institute, Dalian, 116023, China

Abstract

To select a clam species that could be further pursued for aquaculture development in SA, key environmental factors (temperature, substrate type and water current) that might affect performances were evaluated in this study in pipis, *Donax deltoides* and mud cockles, *Katelsysia rhytiphora*. Both species had been treated at different temperatures (18°C, 23°C and 28°C), substrate types (with or without sands) and water currents (2 cm/s, 10 cm/s and 18 cm/s) for a period of 80 days. Their shell length, wet weight, dry weight and survival rate collected at day 40 and day 80, respectively. Analyses have showed that in pipis, the growth rate was significantly affected by the temperature, being significantly higher at 23°C than at other temperatures. Similar trend was also revealed in shell length, wet weight and dry weight. The survival rate, on the other hand, decreased significantly when temperature increased from 18 °C to 23 °C. At day 80, the highest survival rate was achieved in those that was cultured in the sand substrate at 18 cm/s water current. Furthermore, all values in the sand substrate group were significantly higher than those in the without sand substrate group.

Performances of mud cockles, on the other hand, decreased with the increase in water temperature, with the highest being at the 18°C. In other parameters (substrate type and water current), there were no significant difference in the shell length between different treatments.

S15 **Aquaculture blue economy**
Tuesday 3 July, 1115 - 1130

Management of endemic hookworm disease in an endangered pinniped, *Neophoca cinerea*

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Abstract

Endemic intestinal hookworm infection with *Uncinaria stenocephala* occurs with 100% prevalence in neonates of the endangered Australian sea lion, *Neophoca cinerea*, contributing to significant pup disease and mortality. It is considered a factor in the decreased recruitment of animals into the reproductive cohort, negatively impacting population recovery. To determine the efficacy, safety and impact of treating pups with an anti-parasiticide, Ivermectin was administered subcutaneously or topically in a randomised prospective and placebo-controlled study. Both methods of administration were 100% effective in eliminating hookworm, with statistically significant ($p < 0.05$) improvements in weight, standard length and blood parameters (anaemia) in treated compared with control pups. Interestingly, there was greater improvement in these health parameters with injectable versus topical application, with no adverse effects seen in either Ivermectin-treated group.

This study highlights the efficacy and safety of two Ivermectin formulations for treatment of neonatal hookworm infection in *N. cinerea*, including the novel topical application. The significance and applicability of these findings will be discussed, with consideration of the implications for treatment of a co-evolved endemic parasite in a free-ranging pinniped population. Additionally, this study demonstrates the application of an intervention to quantify disease impacts and population resilience to inform disease risk assessment.

S13***From sea to coast – marine mammals in a connected world*****Tuesday 3 July, 1200 - 1215**

Use of Single Sperm Densities in Fertilisation Assays May Significantly Underestimate Toxicity

Antony Lockyer¹, Craig Styan¹

1. University College London, Australia

Abstract

Fertilisation assays are commonly used to investigate the effect of trace metals to marine invertebrates. Multiple sperm densities are required to accurately determine the nature and magnitude of the effect of a toxicant to fertilisation. However, many studies on the effects of trace metals to fertilisation in marine invertebrates use only a single sperm density which can result in an underestimation of toxicity. We established fertilisation curves and associated metrics to derive dose response curves and effect concentrations (EC50) for the polychaete *Galeolaria caespitosa* for Copper, Zinc, Lead and Cadmium. We observed a three-fold difference in toxicity of Copper, Zinc and Lead between sperm densities that elicit over 80% fertilisation in controls. The risks of underestimating toxicity at this magnitude include the development of inappropriate water quality standards and decreased reproduction of sensitive marine species. The results from this study stress the need for the use of metrics that are independent of sperm density for determining toxicity data in routine testing.

G6

[Open theme](#)

Thursday 5 July, 1630 - 1645

The effects of Sea Surface Temperature on Prey Quality and Nutritional Niche, In a Generalist Marine Predator

Gabriel E. Machovsky-Capuska^{1,2}, Mark G. R. Miller³, Fabiola R. O. Silva², Christophe Amiot⁴, Karen A. Stockin⁴, Alistair M. Senior^{1,5}, Rob Schuckard⁶, David Melville⁶ and David Raubenheimer^{1,2}

1. The University of Sydney, Charles Perkins Centre, Sydney, Australia.
2. The University of Sydney, School of Life and Environmental Sciences, Sydney, Australia.
3. James Cook University, College of Science and Engineering and Centre for Tropical Environmental and Sustainability Science, Cairns, QLD, 4878, Australia.
4. Institute of Natural and Mathematical Sciences, Massey University, Auckland, New Zealand.
5. The University of Sydney, School of Mathematics and Statistics, Sydney, Australia.
6. Ornithological Society of New Zealand, Nelson, New Zealand.

Abstract

Nutrition, physiology and behaviour are critical to predict the extent to which a species is a dietary generalist, and how they respond to environmental fluctuations. Here we propose a novel integrative approach, combining a multidimensional nutrient niche framework, satellite tracking, prey quality and multivariate ellipse-based Bayesian approach to explore the influence of Sea Surface Temperature anomalies (SSTa) in the nutritional niches of Australasian gannets. The study was conducted between 2012 and 2016 breeding seasons at Farewell Spit colony on the South Island, New Zealand (40° 33'S 173° 01'E). We observed broad nutritional niches that varied seasonally, suggesting gannets are generalists at macronutrient levels, prey composition and prey exploitation abilities. During warm water events (strong positive SSTa), gannets expanded their foraging habitat, increased their foraging trip duration and consumed prey and diets low in nutritional quality (energy proportions of protein and lipid). These factors combined led to the smallest nutritional niche breadth over the seasons studied. Incorporating the proposed multidimensional nutritional framework in future studies will enable to assess how the nutritional goals in wild marine predators drive ecological interactions.

S6 *Marine Climate Change from Shelves to Deep Seas*
Tuesday 3 July, 1545 - 1600

100% of the World Ocean floor mapped by 2030 - Contribution of the South and West Pacific Regional Data Assembly and Coordination Centre to the Seabed 2030 initiative

Kevin Mackay¹, Geoffroy Lamarche¹, Helen Neil¹, Vaughan Staggs², Jenny Black², Adam Greenland³

1. National Institute of Water and Atmospheric Research (NIWA), Wellington, New Zealand
2. GNS Science, Wellington, New Zealand
3. Land Information New Zealand (LINZ), Wellington, New Zealand

Abstract

The Seabed 2030 South and West Pacific Ocean Regional Data Assembly and Coordination Centre (SaWPaC) has been formed to generate new high-resolution ocean floor maps of the western and southern Pacific Ocean. The centre is part of the joint Nippon Foundation and the General Bathymetric Chart of the Oceans (GEBCO) initiative to produce a definitive map of the World Ocean floor by 2030 to empower the world to make policy decisions, use the ocean sustainability and undertake scientific research based on detailed bathymetric information of the Earth's seabed. It is responsible for the region from South America to Australia, north of latitude 50°S to 10° north of the Equator and the western part of the Northern Pacific Ocean to Russia. The region includes the world's deepest trenches and covers some of the remotest oceans where bathymetric data from existing ship tracks is spaced up to 100 km apart. The challenge for the SaWPaC will be to collate and combine all the available bathymetric data from the numerous nations that have surveyed in the region. The centre will also promote efforts to collect new data and contribute to map products generated by the Seabed 2030 global mapping project.

S3 *Seafloor Mapping in Australia – Progress, Discoveries, Applications*
Monday 2 July, 1330- 1345

Sub-seasonal to seasonal climate driver impacts on the Australasian marine environment

Andrew G Marshall¹, Harry H Hendon¹, Mark A Hemer², Kathleen L McInnes², Ming Feng², Andreas Schiller² and Tom H Durrant³

1. Bureau of Meteorology, Australia
2. CSIRO Oceans and Atmosphere, Australia
3. MetOcean Solutions, New Zealand

Abstract

Our recent work has aimed to elucidate key drivers of sub-seasonal to seasonal scale variability in the Australasian marine environment, especially their role for promoting extreme events. This talk will highlight the influences of (i) the Madden-Julian Oscillation (MJO) on sea level and surface temperature variability and extremes along the Western Australian coast, (ii) the El Niño – Southern Oscillation (ENSO) on initiation and amplification of the Ningaloo Niño, and (iii) the MJO and Southern Annular Mode (SAM) on ocean surface wave variability and extremes. Our work focuses on the prominent role in forcing both the local and remote signals in the ocean by the large-scale atmospheric circulation anomalies associated with these drivers, emphasizing that the MJO, SAM and ENSO may all be valuable sources of predictable variability for the Australasian marine environment on sub-seasonal to seasonal timescales.

S2 *Extremes: causes, symptoms, and impacts*
Monday 2 July, 1745 - 1800

Oyster optimism – restoring the past to conserve the future

Dominic McAfee^{1,2}, Melanie Bishop¹, and Sean Connell²

1. Macquarie University, Sydney, New South Wales
2. University of Adelaide, Adelaide, South Australia

Abstract

Oyster reefs have encrusted the Australian coastline for millions of years, enduring glacial cycles and rapid sea level change. However, they were no match for the 19th century appetite of colonial Australia, with thousands of kilometres of oyster reef decimated within a century of European settlement. The ecological benefits of these ecosystem engineers have only recently been appreciated, and there is growing optimism for their restoration to increase the resilience of ecosystems to change. Field experiments manipulating temperature and predation over broad latitudinal gradients demonstrate that oyster habitat can ameliorate biotic and abiotic stress experienced by invertebrate communities, and the intensity of this amelioration increases with stress. On thermally manipulated rocky shores, oysters can endure stressful future climates, while maintaining climate refugia for inhabiting organisms. Furthermore, oysters increase fish abundance because their structures provide nursery habitat, and their filter-feeding improves water quality. Restoring some of these ecological traits is the ambition of Australia's largest oyster reef restoration project, restoring 20 hectares of native oyster in Gulf St. Vincent. The optimism surrounding this project has fuelled productive collaboration between researchers, industry, community, and multiple tiers of government. The future looks bright for oyster restoration, but we still have much to learn.

G5**Estuaries and coasts****Thursday 5 July, 1430 - 1445**

Blue whales across southern Australia

McCauley, R. D.¹, Joliffe C.¹

1. Curtin University, Perth, WA, Australia

Abstract

Calls from New Zealand pygmy blue whales (NZPB), Eastern Indian Ocean (EIOBP) pygmy blue whales and Antarctic blue whales (AB) are detected across southern Australia. NZPB calls occur eastward of Bass Strait, EIOBP calls occur west of Bass Strait, while AB calls occur along the entire southern Australian coast. Bass Strait is the only location where all calls have been detected within a short space of time. Along the southern Australian coast EIOBP whales are preferably detected towards the east, favouring the Bonney coast. Receivers off Portland showed 10-181 times greater EIOBP whale calling when integrated over their season than at sites located around the GAB. Within a season the Portland site did not show consistency of EIOBP whale presence or call rates, but when call rates were integrated across a season and correlated with an upwelling index of seasonally integrated seabed water temperature across seven seasons, the upwelling index predicted 83% of the variance in whale presence. By correcting EIOBP whale call rates for variable population growth rates we found a 4.3% growth rate gave the maximum correlation coefficient of 90%. The song of EIOBP has changed across time and is constantly evolving.

S13

From sea to coast – marine mammals in a connected world

Monday 2 July, 1115 - 1130

Anomalous chlorophyll a events under global environmental change

Karlie S. McDonald¹, Alistair J. Hobday¹, Elizabeth A. Fulton¹ and Peter A. Thompson¹

1. CSIRO Oceans and Atmosphere, Hobart, Australia

Abstract

Marine phytoplankton have an important role in the global carbon cycle and in the bottom up regulation of trophic interactions in marine systems. Climate change is expected to affect phytoplankton biomass by altering the physical and chemical regulators of primary productivity, such as temperature, salinity and mixed layer depth (MLD). However, the impact of changes in the complex and dynamic interactions between the seasonal and climate drivers of primary productivity on the structure and function of marine systems under climate change remain poorly understood. We used satellite derived chlorophyll a (chl. a) data to investigate changes in the frequency, duration and timing of anomalous high and low biomass events in 26 marine climate hotspots. The regulators of primary productivity, such as MLD, salinity and sea surface height, were assessed for anomalous high and low biomass events. Our results indicate that mixing of the water column, for example MLD and wind speed, and climate cycles, such as El Niño–Southern Oscillation (ENSO), are important drivers of anomalous high and low chl. a events in the marine climate hotspots. This analysis of the drivers of anomalous high and low chl. a events in the marine climate hotspots can reveal possible shifts in primary productivity under global environmental change.

Poster presentation

S7

Anomalous chlorophyll *a* events in a marine climate hotspot

Karlie S. McDonald¹, Alistair J. Hobday¹, Elizabeth A. Fulton¹ and Peter A. Thompson¹

1. CSIRO Oceans and Atmosphere, Hobart, Australia

Abstract

The impacts of global environmental change, such as thermal stratification, strengthened currents and acidification, on ocean productivity have significant consequences on the structure and function of these systems through altered global biogeochemical cycles and marine food webs. However, potential ecological shifts in marine primary productivity from a climate change remain poorly understood and difficult for scientists to quantify.

We utilize chlorophyll *a* (chl. *a*) biomass from MODIS satellite derived data in the Southern California marine climate hotspot, a region where the temperature increase is within the fastest 10% globally, to investigate ocean productivity in the changing global environment. Anomalous high and low chl. *a* events were assessed in the Southern California marine climate hotspot. A principal components analysis indicates that MLD and climate cycles, such as ENSO, are important drivers of anomalous high and low chl. *a* events in the Southern California marine climate hotspot. The information presented provides insights into the shifts in marine primary productivity under global climate change, such as changes in the intensity of the bloom events in Southern California hotspot.

S7

Micro- to Macro-: connecting multi-scale climate change research in marine systems

Thursday 5 July, 1130 - 1145

Towards a national collaborative approach to marine biosecurity science

Justin McDonald¹

1. Department of Primary Industries and Regional Development

Abstract

Increasing global demand for maritime resources, ever rising vessel movements and large-scale factors including climate change, all affect the likelihood of introduced marine pests entering Australian waters.

To protect our marine environment from introduced marine pests a strategic, consistent, scientific approach is essential and should be a priority for Australia's biosecurity agencies. Limited resources are available nationally so only by working strategically, and with a collaborative approach can we deliver an effective programme that will ensure Australia's marine biosecurity futures.

Research is central to marine biosecurity and should underpin our risk analysis, decision-making capability. Research should be adaptive for immediate rapid response and to unforeseen threats as they emerge. Long-term strategic research is vital to anticipating emerging and future biosecurity challenges. Fundamental to all this must be coordination among the various marine biosecurity bodies (government, university and industry alike), with complementary research that is efficiently managed for efficient and economical use of the limited resources. This talk will discuss the ups and downs of marine biosecurity science in Australia and the development of a national body to help coordinate and direct future marine biosecurity science.

S10 *Marine biosecurity in an increasingly-connected world: protecting Australia from marine pests and diseases*

Wednesday 4 July, 1115 - 1145

Estimates of Zooplankton Biomass in Australian Waters

Felicity R. McEnnulty¹, Frank E. Coman², Claire H. Davies¹, Ruth S. Eriksen¹, Mark Tonks², Anthony J. Richardson^{2,3}, Anita S. Slotwinski², Julian Uribe-Palomino

1. CSIRO Oceans and Atmosphere, Castray Esplanade, Hobart, TAS 7000, Australia
2. CSIRO Oceans and Atmosphere, EcoSciences Precinct, GPO Box 2583, Dutton Park, QLD 4102, Australia
3. Centre for Applications in Natural Resource Mathematics (CARM), School of Mathematics and Physics, The University of Queensland, St Lucia, Queensland 4072, Australia

Abstract

There is currently no map or national product of zooplankton biomass around Australia. Zooplankton estimates are needed for validating nutrient-phytoplankton-zooplankton models and ecosystem models, and for understanding energy transfer from phytoplankton to fish. Here we compile 13,951 zooplankton observations from nets, Continuous Plankton Recorder (CPR) and Laser Optical Plankton Counter (LOPC) data to generate the first zooplankton biomass maps around Australia. We used generalised additive models based on a suite of environmental variables including sea surface temperature, chlorophyll-a, salinity, time of day and season. We adjusted for biases associated with different sampling types (nets, CPR or LOPC) and tow types (vertical, horizontal, oblique). To assess confidence in the data, we compared zooplankton biomass maps generated independently from nets, CPR and LOPC. We found that zooplankton biomass was strongly related to environmental variables. We also built regional models for each marine management bioregion in Australia. This work will provide Australia-wide and regional nutrient-phytoplankton-zooplankton models and ecosystem models with a product useful for assessing zooplankton biomass.

G5

Estuaries and coasts

Monday 2 July, 1530 - 1545

Longer food chains in pelagic ecosystems: trophic energetics of animal body size and metabolic efficiency

Richard McGarvey¹, Natalie Dowling² and Joel E. Cohen³

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3. Laboratory of Populations, Rockefeller and Columbia Universities, New York, New York 10065

Abstract

We show that pelagic ecosystems, those based on one-celled primary producers, have longer food chains than terrestrial ecosystems. Yet pelagic ecosystems have 5-fold lower primary productivity. This challenges the hypothesis that greater energy flows permit higher trophic levels. We hypothesize that longer food chain length in pelagic than terrestrial ecosystems is associated with smaller pelagic animal body size, permitting more rapid trophic energy transfer. Assuming widely confirmed negative quarter-exponent allometric dependence of biomass production rate on body mass at each trophic level, the lowest three pelagic animal trophic levels are estimated to add biomass more rapidly than their terrestrial counterparts by factors of 12, 4.8, and 2.6. Pelagic animals consequently transport primary production to a fifth trophic level 50-190 times more rapidly than animals in terrestrial webs, overcoming the approximately 5-fold slower pelagic primary productivity, energetically explaining longer pelagic food chains. In addition, invertebrates, dominant at lower pelagic animal trophic levels, produce more biomass per unit of energy consumed, so transferring more food energy upward in pelagic food webs. These two mechanisms for higher animal trophic transfer rates imply longer pelagic food chains, reestablishing an important role for energetics in explaining food web structure. Ref: American Naturalist (2016) 188:76-86.

G5*Estuaries and coasts***Monday 2 July, 1515 - 1530**

Australian Fur Seal Pup Numbers Remain Depressed: Results of the 2017-18 Census

Rebecca McIntosh¹, Karina Sorrell², Tony Mitchell³, Peter Dann¹ and Roger Kirkwood⁴

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2. School of Biological Sciences, Monash University, Clayton, Vic 3800
3. Department of Environment, Land, Water and Planning, Orbost, Vic 3888.
4. Phillip Island, Cape Woolamai, Vic 3922.

Abstract

Four range-wide censuses of Australian fur seal (*Arctocephalus pusillus doriferus*) pups have been performed every five years between 2002 and 2017. From 2007 to 2013, we identified the first overall reduction in pup numbers of -4.2% per annum (p.a.) since protection in 1975. We hypothesised that this was an anomaly related to food shortages. However, 2017 census results show that pup numbers, particularly at the larger colonies in Victoria, remain depressed.

Pup numbers (\pm s.e.) from 21 colonies in 2013 were estimated to be $16,516 \pm 84$, with the majority being in Victoria. Between 2013 and 2017, pup numbers in Victoria reduced from an estimated 11,800 pups to 10,700 pups, or -2.4% p.a. This includes a change of -1.4% p.a. at Seal Rocks and -8.1% p.a. at The Skerries, two of the larger colonies. Elevated levels of persistent organic pollutants have been detected in Australian fur seals, and they suffer from high rates of entanglement in marine debris; such threats may be having demographic impacts.

In comparison, numbers of Long-nosed fur seal pups (*Arctocephalus forsteri*) continue to increase at some sites as this species recolonises Bass Strait. Trends for both species in Victoria and future research priorities will be discussed.

S13

From sea to coast – marine mammals in a connected world
Monday 2 July, 1645 - 1700

Looking Without Landing – Using Remote Piloted Aircraft (RPAs) and Citizen Science to Monitor the Prevalence of Marine Debris Entanglements in Fur Seals

Rebecca R. McIntosh¹, Ross Holmberg¹ and Peter Dann¹

1. Research Department, Phillip Island Nature Parks, Cowes Victoria 3922

Abstract

Marine debris is causing large-scale ecosystem impacts across global oceans and has triggered significant mitigation measures. Macro-debris entangles wildlife and alters habitats, breaking down into ever smaller particles that enter the food chain with potentially devastating follow-on effects. Fur seals provide an excellent species for research of marine debris, because they breed and rest on land where they can be observed.

Reliable data are vital to understanding the impacts of marine debris. At Seal Rocks, Victoria, we have identified 441 individual entanglements of Australian fur seals (*Arctocephalus pusillus doriferus*), from Dec 1997-Sept 2017 and removed 50% of those entanglements. However, these data underestimate the scale of the problem because landing at Seal Rocks causes the fur seals to flee into the water, preventing accurate estimates of prevalence and reliable trend analyses.

Using Remote Piloted Aircraft (RPA), we can obtain data with greater precision and accuracy, and less disturbance than ground-based methods to determine the prevalence of marine debris entanglements in fur seals. We also describe the self-designed web-based portal through which citizen scientists have been recruited to count fur seals, providing replicate counts as well as an opportunity to inspire and educate global citizens.

Poster presentation

S16

Photo-physiological response of phytoplankton to tidal mixing in coastal waters of north-western Australia.

M.J. McLaughlin¹, J. Greenwood¹, M.J. Lourey², C.E. Hanson³

1. CSIRO Oceans & Atmosphere, Crawley, Western Australia, Australia
2. BMTOceanica, Osborne Park, Western Australia, Australia
3. Department of Education WA, Morley, WA, Australia

Abstract

The continental shelf of the South Kimberley region of Western Australia is wide (~300 km) and interactions with the Indian Ocean result in some of the largest tropical tides in the world measured in King Sound, a large embayment which opens to the Indian Ocean. These large tidal ranges, combined with complex bathymetry, generate very strong coastal currents (up to 4 knots) that can break-down water column stratification. Investigation of the photosynthesis vs. irradiance (P vs I) relationships from incubations of phytoplankton in this area showed that despite high concentrations of suspended particulate matter [SPM] and low nutrient concentrations, photosynthetic rates were high in King Sound compared to shelf and offshore stations. In King Sound the mixed layer (calculated from density structure) extended to the seabed (~30 m), while the euphotic zone (defined as 1% of surface irradiance) was shallower. As a result it seems that rather than adapting to low-light conditions at the bottom of the water-column, phytoplankton in King Sound have adapted their physiology to maximize photosynthesis under high intensity light conditions at the surface, a growth strategy viable only in well-mixed conditions where excursions to the surface are frequent.

S8 *Marine microbes as mediators of ocean processes*
Wednesday 4 July, 1130 - 1145

Southern Rock Lobster population responses inside a Marine Protected Area following three summers of protection

Lachlan McLeay¹, Richard McGarvey¹, Adrian Linnane¹, John Feenstra¹ and Peter Hawthorne¹

1. SARDI Aquatic Sciences, 2 Hamra Ave, West Beach, SA, 5024.

Abstract

Marine Protected Areas (MPAs) are internationally recognised spatial management tools to protect and conserve marine and coastal habitats, species biodiversity and abundance. On 1 October 2014, a network of MPAs was fully implemented in South Australia and fishing restrictions inside no-take sanctuary zones came into effect. In collaboration with DEWNR and the Northern Zone Rock Lobster Fishermen's Association (NZRLFA), SARDI (Aquatic Sciences) undertook a research project to assess changes in the relative biomass, abundance and size of Southern Rock Lobster (*Jasus edwardsii*) and abundance of key bycatch species, inside and outside Sanctuary Zone 3 (SZ-3) of the Western Kangaroo Island Marine since 1994. A survey was undertaken inside and outside the Sanctuary Zone in 2017. Survey estimates of relative biomass and abundance of legal-size lobsters were 4.4 and 3.5 times higher, respectively, inside the Sanctuary Zone compared to outside. Male and female lobsters sampled during the survey were also significantly larger inside the Sanctuary Zone compared to outside. The biomass and abundance of lobsters inside the sanctuary zone increased 81.1% and 44.2%, respectively, over three summers of protection. Key bycatch species identified in the 2017 survey were similar to those reported historically.

S11 *Marine biodiversity conservation – what's effective?*
Wednesday 4 July, 1215 - 1230

Epiphytic carbonate production, sediment dynamics, and export from a sub-tropical seagrass carbonate factory: Moreton Bay, Queensland

Mardi A. McNeil¹, Luke D. Nothdurft¹, Linda Nothdurft²

1. Queensland University of Technology, Brisbane, Qld, 4001
2. The University of Queensland, Brisbane, Qld 4067

Abstract

In tropical reef-related settings and cool-temperate shelves, carbonate production rates from seagrass calcareous epiphytes are often high, resulting in the development of a carbonate mud-rich facies within seagrass beds. However, the heterogeneity of seagrass systems suggests that these results may not apply in more marginal environments. In this study, we quantified an annual rate of carbonate production from calcareous epiphytes on two seagrass species not previously documented, *Zostera muelleri* and *Halophila spinulosa*, from a sub-tropical semi-enclosed embayment in eastern Australia. Results show that Moreton Bay seagrass habitat is an active and productive carbonate factory, producing approximately 24,665 tonnes of epiphytic CaCO_3 per annum, primarily from crustose coralline red algae, bryozoans, and foraminifera. The mean annual rate of epiphytic carbonate production is $130.5 \pm 8 \text{ g CaCO}_3 \text{ m}^{-2} \text{ year}^{-1}$, with sub-tidal depths producing significantly more CaCO_3 than in the inter-tidal zone ($p < 0.05$). These rates are comparable with tropical lagoons (e.g. Florida Bay) and cool temperate settings (e.g. South Australia). In Moreton Bay, abundant epiphytic carbonate is produced, but not retained in seagrass meadows, but rather is exported by two processes: resuspension and winnowing by tidal flushing; and export whilst still attached to shed leaf blades via rafting on wind and tide entrained detrital wrack.

Poster presentation

G4

Lidar and multibeam data reveals the complex morphology of *Halimeda* algal bioherm inter-reef habitat in the northern GBR

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2. The University of Sydney, Sydney, NSW, 2006
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Abstract

The *Halimeda* algal bioherms are the second largest living structures in the Great Barrier Reef (GBR) after coral reefs. Built up over millennia by calcium carbonate algal sediments, they provide physical structure and complex seafloor topography, and are an important inter-reef benthic habitat. Despite their importance, the bioherms have received very little scientific attention since early geological/biological work in the 1980s. New high-resolution airborne lidar bathymetry and multibeam data from Project 3D-GBR, have allowed us to re-map the distribution of *Halimeda* bioherms on the northern GBR with greater detail and accuracy than previously possible. The gbr30 DEM for the northern GBR was used as the basis to digitise new GIS polygons of bioherm spatial distribution. The resulting map showed that bioherms cover an area of >6000 km², three times larger than previously known and rivalling the area of coral reef in the northern GBR. Truly remarkable was the visualisation of their complex reticulate and ring-shaped morphology, revealed in 3D for the first time and overturning the long-standing morphological interpretation. Here we present the latest spatial mapping and 3D bathymetry visualisation of the *Halimeda* algal bioherm inter-reef habitat, and outline current and future research stemming from this initial seafloor mapping.

S3

Seafloor Mapping in Australia – Progress, Discoveries, Applications
Monday 2 July, 1545 - 1600

Assessing the dietary effects of white shark cage-diving on target and non-target species using fatty acid profiling

Lauren Meyer^{1,2}, Heidi Pethybridge², Peter D. Nichols², Crystal Beckmann³, Barry D. Bruce² and Charlie Huveneers¹

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2. CSIRO Oceans and Atmosphere, Hobart, TAS, Australia
3. SARDI Aquatic Sciences, South Australian Research and Development Institute, West Beach, SA Australia

Abstract

The Neptune Islands Group Marine Park is home to Australia's largest aggregation of adult white sharks (*Carcharodon carcharias*) and the nation's only white shark cage-diving industry. Here, tourism practices use tuna bait and minced fish (berley) to attract white sharks to within view of the diving cages. However the dietary effects of interacting with the cage-diving remain unexplored. Employing fatty acid (FA) profiling of muscle biopsies, commonly used to reveal the trophic interactions between marine organisms, we determined the relative diet profiles for 96 white sharks across periods of residency at the Neptune Islands. The resulting FA profiles showed large variability, and no discernable difference with time spent at the islands. Conversely, FA profiles of silver trevally (*Pseudocaranx georgianus*), which are observed often feeding on the bait and berley, revealed significant differences between individuals caught at the Neptune Islands (n=70) and where cage-diving does not occur (n=35). Despite a lack of diet shift in the target white sharks, the industry's effect may be most pronounced on non-target species. These results indicate that the effects of marine wildlife tourism extend beyond the focal species of interest, which is critical information for management regimes that aim to minimise anthropogenic changes from wildlife tourism.

G5 **Estuaries and coasts**
Monday 2 July, 1545 - 1600

Otlet – an online platform for sourcing biological samples

Lauren Meyer¹, Madeline Green¹

1. Otlet, Sydney, NSW, Australia

Abstract

Research teams collect >94 million biological samples annually, the majority of which are subsampled for targeted analysis. The remaining sample, often including a number of unused organs, is then able to be repurposed for additional studies by collaborators around the world. However, the absence of a systematic way to source these unused samples results in wasted tissues, organisms and opportunities for research as scientists undertake redundant sampling regimes. As such, 'Otlet', a global online database, was set up to overcome the challenges of sourcing scientific research samples from colleagues. The platform allows the users to 1) upload a record of their unused samples, 2) search the database of existing samples from other users and request them directly from the contributor and, 3) post a request for samples onto a searchable community board. The platform facilitates communication between research teams across different locations, taxa and expertise to foster novel collaborations while accelerating scientific output.

Otlet's newly constructed platform is an important tool for biological scientists of all disciplines to efficiently communicate and source research material. Membership is freely available for scientific use by researchers from universities, government agencies, museums, private consulting and NGOs.

Poster presentation

G6

The Influence of Environmental Drivers on Marine Mammal Strandings on the East Coast of Australia

Jan-Olaf Meynecke¹, Gabrielle Keating², Justin Meager³, Geoffrey Ross⁴, Darrell Strauss⁵, Anthony Carroll²

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4. NSW National Parks & Wildlife Service Office of the Environment & Heritage, Australia
5. Griffith Centre for Coastal Management, Gold Coast, Australia

Abstract

Stranding and other incidents of cetaceans are a well-known phenomena in all parts of the world. Incidents have been associated with changes in magnetic fields, diseases, boat strikes, pollution, fishing and environmental factors. Quantitative analyses of stranding data over large spatial and time scales can provide insights into causes of strandings. Here we collated available information on cetacean incidents that occurred on the east coast of Australia between 1985 and 2015. Incidents included reports of carcasses, boat strikes, injured animals found stranded, entrapped in shallow water, entangled or floating. Over 630 entries were analysed for location, timing and types of incidents and compared with environmental drivers with a focus on humpback whales (*Megaptera novaeangliae*). Correlations were identified between the sea surface temperature of the East Australian Current and relatively calm sea state and swell when cetaceans stranded. Stranding events also had a stronger association with the La Nina phase than El Nino. Understanding the influence of environmental drivers of cetacean stranding is critical for conservation management in particular when considering impacts of climate change. Maintaining stranding data is therefore an important conservation and monitoring tool to investigate long-term trends and population dynamics and quantify key threats to protected cetaceans.

S13

From sea to coast – marine mammals in a connected world
Monday 2 July, 1345 - 1400

Coastal Observations using Airborne Lidar

Jason Middleton¹ and Peter Mumford¹

1. School of Aviation, University of New South Wales, Sydney, NSW 2052

Abstract

The School of Aviation at UNSW has been monitoring coastal beaches and inlets of New South Wales since 2015 using airborne lidar. Coastal beach observations have included survey flights pre-and post the June 2016 East Coast Low event which caused substantial erosion, and the data allow estimates not only of sand loss during events, but also the rebuilding of beaches after such events. The entrances of coastal Inlets vary substantially in time, as they are affected by run-off flows, as well as beach sediment movement caused by winds and waves at various stages of the tide. In this presentation, we show time series of beach erosion and deposition at selected beaches, and at selected entrances. Such data can provide an important foundation for improving understanding of the impacts of such changes, both on the physical environment and on the ecology, and for coastal management.

G5

Estuaries and coasts

Tuesday 3 July, 1400 - 1415

Upwelling along the shelves of the Greater Australian Bight. Part I: the role of submarine headlands and valleys

John Middleton¹

1. SARDI Aquatic Sciences, South Brighton, South Australia, Australia

Abstract

An idealised numerical model is used for the analysis of the summer-time circulation along Australia's southern shelves. An impulsively started, constant alongshore wind stress and horizontally uniform stratification is used to study the two main upwelling areas - the Bonney Coast and the Kangaroo Island/Eyre Peninsula. For the Bonney Coast, the coastline is reasonably uniform but 7 pairs of submarine headlands and valleys characterize the shelf topography to depths of 150 m. In agreement with studies of other regions, upwelling is found within the valleys and downwelling over the headlands. Here, the upwelling (downwelling) are shown to be qualitatively consistent with barotropic vorticity dynamics where the bottom vertical velocity w_b is inferred from the acquisition of anti-cyclonic (cyclonic) vorticity as a fluid column moves equatorward across the headlands and valleys. Additionally, upwelling is most intense on the equatorward side of the submarine headlands: a feature long known for the Californian/Oregon shelves. A new explanation for this preferential upwelling is given and results from the alongshore baroclinic pressure gradient set up by the up- and downwelled density field that in turn drives an onshore geostrophic flow. These dynamics are used to explain upwelling for the Kangaroo Island/Eyre Peninsula regions.

S1 *Cross-shelf exchange processes*
Monday 2 July, 1415- 1430

Seascape genomic analysis of a commercially important mollusc- integrating population genetics, genomics and marine LiDAR data

Adam Miller¹, Craig Sherman¹, Daniel Ierodiaconou¹, Mary Young¹, Ary Hoffmann², Collin Ahrens³, Eric Trembl^{1,2}, Steve Swearer²

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2. School of BioSciences, The University of Melbourne, Parkville, Victoria, Australia
3. Western Sydney University, Sydney, New South Wales, Australia

Abstract

Advances in the field of landscape genetics/-omics over the last decade now provide exciting opportunities for assessing spatial patterns of genetic structure, and physical environmental factors influencing patterns of genetic differentiation. However, the transferability of these approaches to the marine realm is often challenging and impeded by limited knowledge of marine habitats. We demonstrate how LiDAR and SONAR technologies, which are being used increasingly for imaging seabeds around the world, can help overcome current day limitations of seascape genetic/-omic research by guiding spatial sampling efforts across marine habitats and environmental gradients. We explored patterns of genetic structure in an abalone species (*Haliotis rubra*) from south-eastern Australia. Using a panel of genome wide SNP markers, we assessed patterns of genetic structure across a replicated hierarchical sampling area guided by bathymetric LiDAR imagery. Our results indicate high levels of gene flow and a lack of neutral genetic structure between fishing stocks spanning 1400 km of the coastline. However, significant genotype by environment associations were identified, indicating that selection is responding to habitat heterogeneity and both local and regional scales. We discuss the implications of these findings in the context of fisheries management and future seascape genetic/-omic research.

S9

Genomics of marine organisms: contributions to ecology and evolution

Thursday 5 July, 1415 - 1430

Behaviour, Movements and Occupancy Patterns of Blue Whales Satellite Tagged in Southern Australian Waters

Luciana Möller^{1,2}, Catherine Attard^{1,2}, Kerstin Bilgmann³, David Paton⁴, Ian Jonsen³, Virginia Andrews-Goff⁵ and Michael Double⁵

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4. Blue Planet Marine, PO Box 919, Jamison Centre, Canberra, Australian Capital Territory 2614, Australia
5. Australian Marine Mammal Centre, Australian Antarctic Division, 203 Channel Highway, Kingston, Tasmania 7050, Australia

Abstract

Blue whales are endangered due to past whaling, and are currently impacted by other anthropogenic activities. It is important to determine their behaviour, movements and occupancy in Australian waters for identifying biologically important areas, and when and where they may be impacted by anthropogenic activities. There is little knowledge about occupancy patterns and movements of pygmy blue whales in the feeding region of the Bonney Upwelling in southern Australia. During summer 2015 we satellite tagged 13 whales in this region. Data collected with the Argos system showed tag transmission of up to ~200 days, and whale travelling distances of up to ~17,000 km. Movements ranged from the Bass Strait to Timor East and Indonesia. Whales utilised the Bonney Upwelling region from at least January to June, exhibiting mostly area restricted search behaviour and performing square-shaped dives shallow in depth and short in duration. Transiting behaviour was typical after whales left the feeding region, moving westward and then northward along the Australian coast until they reached tropical waters in the Indo-Pacific in June-August. This novel information is useful for understanding blue whale diving behaviour, movements and migratory routes, and for management decision-making under Australia's Environment Protection and Biodiversity Conservation Act.

S13 *From sea to coast – marine mammals in a connected world*
Monday 2 July, 1400 - 1415

Genetic structure found among Australian east coast populations of snapper, *Chrysophrys auratus* (Sparidae) using microsatellites

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3. New South Wales Department of Primary Industries, Mosman, NSW, Australia
4. Fisheries Victoria, Department of Economic Development Jobs Transport and Resources, Queenscliff, VIC, Australia

Abstract

Snapper, *Chrysophrys auratus*, is a high value food fish in Australia that is targeted by both commercial and recreational fisheries. East coast fisheries are currently managed under 4 different state jurisdictions (Queensland, New South Wales, Victoria and Tasmania) following different regulation limits, although it is believed that the fisheries target the same biological stock. An allozyme-based study in the mid 1990's of east coast populations identified a weak genetic break north of Sydney. A cross-jurisdictional stock assessment of the east coast is currently underway to better inform spatial management of this important fishery. This study used 9 microsatellite markers to assess the validity, strength and location of the allozyme break to better inform the stock assessment model. Nine populations were sampled spanning four states and over 2,000 km, including sites north and south of the allozyme break. Analyses confirmed the presence of two distinct biological stocks along the east coast with a region of overlap around Eden in southern New South Wales, roughly 400 km south of the allozyme break. In terms of the east coast stock assessment model, Queensland and New South Wales fisheries should be included in the same model while Victorian fisheries are distinct.

S14**Assessing and mitigating ecosystem effects of fishing and aquaculture****Thursday 5 July, 1200 - 1215**

Restoring tidal connections and geochemical conditions to achieve coastal ecosystem restoration and carbon sequestration at the Dry Creek salt field

Luke Mosley¹, Jason Quinn², Tan Dang¹, Courtney Cummings³, and Sabine Dittmann⁴

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2. Coastal Management Branch, Department of Environment, Water and Natural Resources, Adelaide, South Australia 5001
3. Environment Protection Authority, South Australia 5001
4. College of Science & Engineering, Flinders University, Adelaide, South Australia 5001

Abstract

Degraded coastal ecosystems are ubiquitous globally and increasingly there is a focus on restoring these systems. One of the most challenging environments to restore are salt fields where hypersaline and sulfide-rich sediments have typically built up over large areas. These conditions pose an environmental hazard and barrier to ecological recovery. The approach and initial findings of a tidal restoration trial in a 38 ha pond at the Dry Creek salt field (4000 ha) are described. The aim of the trial was to restore geochemical conditions and enable recovery of coastal ecosystems and coastal ("blue") carbon sequestration. Installation of four tidal pipes and gates reconnected the pond to the tidal creek in July 2017. Controlled release of water and introduction of tidal circulation rapidly restored the water quality in the pond to near-coastal conditions. Less saline and more oxidising conditions also resulted in the upper soil layer. The ecological response has been rapid with vegetation, fish and invertebrates recolonising the pond. Carbon accounting (changes in soil, water, above and below ground biomass C) is being undertaken using the Verified Carbon Standard to assess if generation of carbon credits could be used to fund a wider restoration project at the site.

G5*Estuaries and coasts,***Tuesday 3 July, 1130 - 1145**

Biogeochemical maps reveal distinct land and marine–based influences in an urbanised coastal embayment

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Abstract

Biogeochemical maps can be used to identify important influences and inputs in coastal environments. Biogeochemical tracers can also be used to study animal movement and diet, monitor coastal development, and evaluate the condition of habitats and species. However, the beneficial applications of spatial biogeochemical analysis are hindered by a limited understanding of how tracer distribution correlates with different land and ocean–based influences. To help address these knowledge gaps, we developed biochemical maps, or “tracerscapes” of three stable isotopes and 13 major and trace elements in an urbanised coastal embayment (Moreton Bay, Australia) using a benthic penaeid prawn. Discriminant analysis identified seven biochemical regions distinguished by variation in catchment, urban, and offshore input, habitat type, and local conditions. ¹⁵N and ¹³C identified areas influenced by wastewater input and nearshore sediment resuspension. High lead and copper concentrations identified areas that received distinct urban inputs. Arsenic and cadmium increased offshore, implying marine influences were a significant control over As and Cd bioavailability. Cobalt and rare earth elements also helped differentiate some areas. Overall, ¹⁵N, ¹³C, Cd, Cu, and Pb were the most reliable tracers that differentiated offshore and catchment–based effects. We encourage others to consider these tracers in coastal analysis.

S3***Seafloor Mapping in Australia – Progress, Discoveries, Applications*****Tuesday 3 July, 1200 - 1215**

Resolving Cephalopod Trophic Ecology in Relation to Body-size in the Tasman Sea Mesopelagic Environment.

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3. CSIRO Oceans & Atmosphere, Hobart, TAS 7001, Australia

Abstract

Cephalopods are a critical component of marine ecosystems, globally abundant in coastal, oceanic and deep-sea ecosystems. Many aspects of their biology and ecology, such as voracious predation, rapid growth, and short life spans, suggest they are influential in the transfer of energy through marine food webs. However, we lack a detailed understanding of cephalopod food web dynamics, and it is vital to resolve cephalopod trophic connections in order to understand how this key group influences the structure and function of marine ecosystems. We used nitrogen stable isotope analysis of a mesopelagic cephalopod community, sampled in the southern Tasman Sea using pelagic trawls from 0 - 1000m depth, to assess their trophic ecology. We found a wide diversity of trophic positions held by the different cephalopod species, with the relationship between trophic position and body-size variable between species, particularly those with distinct morphological differences. These results will provide the first steps to including a trait-based cephalopod community in trait and size-structured ecosystem models. These models are increasing in complexity and power, offering a powerful means to predict abundance and biomass, which will enable us to better understand the role of cephalopods in the structure and function of marine ecosystems.

G2 *Life history and connectivity in the ocean*
Tuesday 3 July, 1600 - 1615

Mapping the distribution and trajectory of the global intertidal zone

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5. Australian Institute of Marine Science, Townsville, 4810, Australia.

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Abstract

Increasing human populations around the world's coastline have caused extensive loss, degradation and fragmentation of coastal ecosystems. Yet a lack of high-resolution spatial data on the distribution of tidal flats—one of the world's most extensive coastal ecosystem types—has hindered our ability to monitor and respond to this challenge at the global scale. Here we present the first global maps of the intertidal zone and its changing distribution over the past three decades. We used every available Landsat satellite images acquired within 1-km of the coastline (N = 707,528 images) and an advanced machine learning classifier to map the global extent of the intertidal zone for the period from 1984 to 2016. Our analysis was implemented in parallel on 22,000 computers, requiring nearly 100 years of computing time to complete. The global intertidal time-series maps reveal that at least 128,000 km² of the earth's surface is intertidal, concentrated in Asia, North America and South America. Furthermore, our map time-series illuminates the dynamic processes of intertidal change at a global-scale and reveals remarkable patterns of intertidal change driven by both natural and anthropogenic processes. Our datasets and remote sensing analysis pipeline will provide means to measure and analyse critical processes affecting the state of the global coastal environment.

G5 *Estuaries and coasts*
Tuesday 3 July, 1430 - 1445

Species Interactions Drive Fish Biodiversity Loss in a High-CO₂ World

Ivan Nagelkerken¹, Silvan Goldenberg¹, Camilo Ferreira¹, Bayden D. Russell², and Sean D. Connell¹

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2. The Swire Institute of Marine Science & School of Biological Sciences, The University of Hong Kong, Pokfulam Road, Hong Kong SAR, China

Abstract

Accelerating climate change is eroding the function and stability of ecosystems by weakening the interactions among species that stabilise biological communities against change. A key challenge to forecasting the future of ecosystems centres on how to extrapolate results from short-term, single-species studies to community-level responses that are mediated by key mechanisms such as competition, resource availability and predation. We used CO₂ vents as potential analogues of ocean acidification combined with *in situ* experiments, to test current predictions of fish biodiversity loss and community change due to elevated CO₂, and to elucidate the potential mechanisms that drive such change. We show that high risk-taking behaviour and competitive strength, combined with resource enrichment and collapse of predator populations, fostered already common species enabling them to double their populations under acidified conditions. However, the release of these competitive dominants from predator control led to suppression of less common and subordinate competitors that did not benefit from resource enrichment and reduced predation. As a result, local biodiversity was lost and novel fish community compositions were created under elevated CO₂. Reduced overfishing of predators could act as a key action to stall diversity loss and ecosystem change in a high CO₂ world.

S6 **Marine Climate Change from Shelves to Deep Seas**
Tuesday 3 July, 1445 - 1500

Application of a new genetic classification and semi-automated geomorphic mapping approach in the Perth submarine canyon, Australia

Rachel Nanson¹, Zhi Huang¹, Kim Picard¹, Malcolm McCulloch², Scott Nichol¹

1. National Earth and Marine Observations, Geoscience Australia
2. University of Western Australia's Ocean's Institute

Abstract

Acquisition of a range of high resolution marine geophysical and remote sensing data types has intensified in recent years, providing opportunities to reclassify the Australian seafloor in greater detail than ever before. Geoscience Australia has developed a new genetic classification approach that utilises established classification schemes and feature descriptors defined by Harris et al. (2014), Dove et al. (2016), the International Hydrographic Organization, and the Coastal Marine and Ecological Classification Standard.

We have initiated the scheme in the ecologically significant Perth Canyon which extends across >1500 km² and plunges from the south-western Australian shelf break (~170 m) to 4700 m. The canyon sits within a Marine Protected Area, incorporating a Marine National Park and Habitat Protection Zone in recognition of its benthic and pelagic biodiversity values. However, detailed information of the spatial patterns of the seabed habitats that influence this biodiversity is lacking. We have utilised 20 m resolution bathymetry and acoustic backscatter data (2015) acquired by the Schmidt Ocean Institute, plus sub-bottom datasets. Our mapping results demonstrate both the potentially dynamic and energetic nature of the canyon, and the excellent habitat potential provided by the predominantly steep surfaces that dominate the Marine Park.

Poster presentation

S4

A new genetic classification and mapping approach for seafloor features on the Australian continental margin

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1. National Earth and Marine Observations, Geoscience Australia

Abstract

Since Geoscience Australia's first complete geomorphic map of the Australian seafloor was published in 2008, acquisition of a range of marine geophysical and remote sensing data types with improved resolution has intensified. Such progress provides an opportunity to classify the Australian seafloor in greater detail, using methods that preserve links between processes and morphology for the purpose of improved resource, environmental and risk management.

Our new genetic classification scheme uses shallow coastal, shelf and deep marine datasets and particularly draws on Harris et al. (2014) geomorphic map of the world's oceans, and a draft European system for classifying seafloor morphology into semi-hierarchically arranged components (Dove et al., 2016). This flexible approach enables morphological mapping of the seafloor where project resources may limit interpretations, with extension of the approach to mapping seafloor geomorphology where and when data is sufficient for more detailed geomorphic interpretation.

Here we present initial mapping of Perth Canyon and Gifford Guyot demonstrate that the two-part, semi-hierarchical characteristics of the new scheme are suited to a broad range of settings with varying data resolution. Geoscience Australia is currently collaborating with the European Mareano-Infomar-Maremap (MIM) group to finalise the approach and extend its application to other marine settings.

S3***Seafloor Mapping in Australia – Progress, Discoveries, Applications*****Monday 2 July, 1415 - 1430**

Do Fish Prefer Friends? Trade-offs Between the Presence of Conspecifics, Heterospecifics, or Predators and Thermal Preference.

Tiffany Nay¹

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3. Marine Biological Section, Department of Biology, University of Copenhagen, Strandpromenaden 5, DK-3000 Helsingør, Denmark

Abstract

Increasing water temperatures and the poleward shifts in marine fishes has raised concerns regarding species persistence in their current habitats. Determining preferred temperatures of individual species and the relative influence of biotic and abiotic factors in their environment is critical to predict future impacts on individual species and therefore, more broadly, marine ecosystems. We investigated whether the presence of conspecifics, heterospecifics, or predators influences the thermal preference of a coral reef fish, the black-axil chromis, *Chromis atripectoralis*. An automated shuttlebox system was used to establish the preferred temperature of individual *C. atripectoralis*, either in the absence of other fish, or with 'treatment' fish placed in either the hot or cold side of the system. In the absence of other fishes, *C. atripectoralis* preferred $24.0 \pm 1.6^\circ\text{C}$; however, *C. atripectoralis* preferred warmer temperatures when either conspecifics ($28.9 \pm 1.2^\circ\text{C}$) or heterospecifics ($29.7 \pm 1.1^\circ\text{C}$) were present in the warm chamber. Conversely, *C. atripectoralis* preferred cooler temperatures when either conspecifics ($21.2 \pm 1.4^\circ\text{C}$) or heterospecifics ($21.1 \pm 1.1^\circ\text{C}$) were present in the cold chamber. When predators were present in either chamber, *C. atripectoralis* actively avoided that chamber. Indeed, species interactions can drive relationships with temperature in some species; therefore, it is imperative this information be considered when evaluating future species distribution ranges.

S6 **Marine Climate Change from Shelves to Deep Seas**

Tuesday 3 July, 1415 - 1430

Industrial scale harvesting of cultivated marine microalgae using polyelectrolyte flocculants for food and feed applications

Sasi Nayar^{*1}, Lucie Van Haver², Kriston Bott¹

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2. Ecole Supérieure de Chimie Organique et Minérale (ESCOM), Allée du Réseau J-M Buckmaster, Compiègne, France

Abstract

Harvesting microalgae is a techno-economic bottleneck in the algal biomass industry, compounded by the small cell size and dilute biomass concentrations in culture. Harvesting involves handling large volumes of the culture to recover biomass, amounting to 30% of the operating cost. Among various commercial harvesting techniques adopted, flocculation is convenient, energy efficient and cost effective. Polyelectrolyte flocculants are non-toxic polymers effective at very low concentrations. They carry ionic charge and facilitate flocculation in microalgae by neutralising surface charges on cells and binding particles by physical or chemical forces. Flocculation efficiencies of 20 commercial polyelectrolyte flocculants were evaluated in jar tests for *Nannochloropsis oceanica* and *Isochrysis galbana*, two marine microalgal taxa commonly used in aquaculture. Among the flocculants tested, the flocculation efficiency for tannin based PolySepar[®] CFL-40 was ~99% at concentrations of 50 - 100mg L⁻¹ within 5 minutes. When trialled in larger pilot scale raceways with *N. oceanica*, this flocculent recorded efficiencies of up to 83% at 80 mg L⁻¹. Parameters such as calorific value, crude protein, amino acids, crude lipid, fatty acids, total carbohydrates and pigments showed no differences for biomass harvested with the flocculent when compared to centrifugation. However, higher ash content was observed in flocculent harvested biomass.

S15 **Aquaculture blue economy**
Tuesday 3 July, 1400 - 1415

Nitrogen acquisition and resource allocation strategies in temperate seagrass *Zostera nigricaulis*: Uptake, assimilation and translocation processes

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2. Centre for Aquatic Pollution Identification and Management, University of Melbourne, Melbourne, VIC, Australia
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4. School of Life and Environmental Science, Deakin University, Melbourne, VIC, Australia

Abstract

The dominant seagrass in Port Phillip Bay (PPB), Australia, *Zostera nigricaulis*, declined between 2000 and 2011, coinciding with the 'Millennium drought' that ended in 2009. These seagrasses are nitrogen-limited, underpinning the need to develop nitrogen budgets for better ecosystem management. Environmentally realistic measurements of specific uptake rates and resource allocation were undertaken to develop nitrogen budgets and test the hypothesis that the above-ground and below-ground compartments are able to re-mobilise ammonium and nitrate through uptake, translocation and assimilation to adapt to varying levels of nitrogen in the ecosystem. Uptake of ¹⁵N labelled ammonium and nitrate by above- and below-ground seagrass biomass, epiphytes and phytoplankton was quantified in chambers *in situ*. Preferential uptake of ammonium over nitrate was observed, where the uptake rate for nitrate was about one sixth of that for ammonium. Epiphytes and phytoplankton also registered an increased affinity for ammonium over nitrate. Translocation experiments demonstrated the uptake by both the above-ground and below-ground biomass, respectively from the water column and pore water, and subsequent translocation to the opposite compartment. Acropetal translocation (below- to above-ground biomass) was more prevalent than basipetal translocation. This is a unique outcome given basipetal translocation has been widely reported for *Zostera* by other researchers.

G6[Open theme](#)

Thursday 5 July, 1615 - 1630

Oysters are the Future: Shellfish Reef Restoration Strengthening Australia's Blue Economy

Anita Nedosyko¹, Chris Gillies¹, Simon Branigan¹, Simon Reeves¹, Danny Brock², Heidi Alleway³, Abbie Rogers⁴

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3. Primary Industries and Regions South Australia, Grenfell Street, Adelaide, SA, 5000
4. University of Western Australia, Stirling Hwy, Crawley WA 6009

Abstract

Shellfish reefs were once a prominent ecological feature of southern Australian coasts and estuaries. However, unsustainable fishing by early European settlers resulted in the collapse of these reefs, removing a vital ecosystem and its many associated benefits. Restoration of shellfish reefs is a key component of The Nature Conservancy's Great Southern Seascapes program and since its inception in 2014 restoration projects have been established in Port Phillip Bay, Victoria; Gulf St Vincent, South Australia; Oyster Harbour, Western Australia; Noosa and Pumicestone Passage in Queensland. In 2016 construction of Windara Reef, a 20-hectare reef in Gulf St Vincent commenced, and once complete will be the largest attempt to restore shellfish reefs in Australia. Restoration at this scale has been made possible through funding under the Australian Government's National Stronger Regions Fund program. A key aspect of the Windara reef project is the development of a socio-economic model to demonstrate how restoration activities can support the Government's environmental and infrastructure investments. This presentation describes the objectives of Windara Reef and the data we are collecting to enable alternative funding sources that can stimulate a new blue economy in Australia through a prosperous shellfish reef restoration industry.

G5

Estuaries and coasts

Thursday 5 July, 1415 - 1430

No net loss as a policy approach for marine biodiversity protection

Holly J. Niner¹, Craig A. Styan¹, Ben Milligan², Peter J.S. Jones²

1. University College London, Adelaide, South Australia, Australia

2. University College London, London, UK

Abstract

Biodiversity offsetting seeks to improve the ecological link between impact and compensation, commonly under an aim of no net loss (NNL). Australia has offsetting policies at a federal and state level and is an ideal case study to explore the complexities and practicalities of applying the mitigation hierarchy and biodiversity offsetting in marine environments. Using a mixed method approach I have explored how offsets have been used in marine development consenting processes. This analysis presents a range views and experiences across jurisdictions and sectors, and suggests that current practice in Australia is unlikely to realise an aim of NNL. Factors influencing this outcome relate to issues common to terrestrial offsets but also those specific to marine environments. These include the challenges posed by quantifying impact and offset outcomes to manageable levels of certainty in highly variable and dynamic marine environments and the frequently complex governance systems in place to support the implementation of offset activity. I discuss how the marine environment requires special consideration and what is required to ensure that the rigour of impact assessment is not reduced by the use of offsets and the approach is used for improved outcomes for marine biodiversity.

S11 *Marine biodiversity conservation – what's effective?*
Wednesday 4 July, 1400 -1415

The diversification of eDNA studies on a global scale and a novel application: estuaries and citizen scientists

Allyson O'Brien¹ and Alexander Coutts¹

1. School of Biosciences, University of Melbourne, Victoria, Parkville, VIC, 3031

Abstract

Technological advances have facilitated the accessibility of environmental DNA (eDNA) approaches so they can now be used by scientists that do not have genetics or molecular science backgrounds. Examples of how citizen scientists are adopting eDNA approaches are also emerging in the literature on a global scale. To quantify this diversification and application of eDNA science we conducted a quantitative systematic literature review. We focused the review on studies that used the terms 'eDNA', 'metabarcoding', and 'ecogenomics', a term occasionally used in the literature. We collected information about the temporal and geographic distribution of studies, the study system (marine, estuarine, freshwater or terrestrial) and taxonomic groups. We found most studies focused on vertebrates or microbial communities and the majority of aquatic studies (253 studies) were from freshwater (160) and marine systems (87) with only 6 in estuaries. Although the application of eDNA approaches in a citizen science context was recognized we found only one study that explicitly involved citizen scientists. This information gap provided the premise for further research, which will also be presented, developing an eDNA water sampling approach specifically for estuarine environments with an emphasis on making it easy-to-implement for citizen scientists.

G5***Estuaries and coasts*****Monday 2 July, 1615 - 1630**

Mechanistic Insights to Limits of Thermal Performance in Australian Spiny Lobsters

Michael Oellermann¹, Anthony Jr. Hickey², Quinn Fitzgibbon¹, Greg Smith¹

1. Fisheries and Aquaculture Centre, Institute for Marine and Antarctic Studies (IMAS), University of Tasmania, Hobart, Tasmania, 7001, Australia
2. School of Biological Sciences, University of Auckland, Auckland, New Zealand

Abstract

Despite significant progress in understanding mechanisms driving thermal limitation in marine ectotherms, agreement lacks about general concepts due to conflicting, incomplete or incoherent data. This study aims to link cellular metabolism with cardiac and whole animal performance in response to increasing temperatures, in an ecological and economical key organism, the Australian spiny lobster. We monitored oxygen consumption and heart rate of adult lobsters simultaneously, followed by assessments of cellular heart function during increasing temperatures. Results showed marked links between declining cellular metabolism and whole animal critical temperatures in southern- and eastern rock lobsters. This was marked by decreasing ATP production, increasing energy “leakage” of mitochondrial membranes and partly decreasing oxygen efficiency towards higher temperatures. However, in tropical rock lobsters, mitochondrial metabolism appeared to decline before critical temperatures, paralleled by a pronounced shift of metabolic substrate. Interestingly, heart rate proved to be a good predictor of aerobic metabolism in spiny lobsters, underlining its usefulness as metabolic proxy in field- or behavioral experiments. This study reveals links between cellular failure and thermal limitation of Australian spiny lobsters and added important mechanistic insights to assess and predict the response and sensitivity of a key predator to progressing ocean warming and concomitant oxygen declines.

S6***Marine Climate Change from Shelves to Deep Seas*****Tuesday 3 July, 1600 - 1615**

Response of Estuarine Food Webs to Sediment Delivery from Catchments during Flooding

O'Mara, Kaitlyn¹, Burford, Michele¹, Fry, Brian¹, Olley, Jon¹

1. Australian Rivers Institute, Griffith University, Nathan, Queensland, 4111

Abstract

Floods in subtropical areas are more episodic and less frequent than those in the tropics, but can be high disturbance events. Flooding can supply terrigenous material, nutrients and trace metals to the coastal zone. Coastal bays, such as Moreton Bay, Queensland, support a diverse array of estuarine and marine organisms in seagrass, mangroves and coral reef habitats. Fisheries, including eastern king and brown tiger prawns, rely on these habitats to replenish stocks. In Moreton Bay, clearing of the catchments surrounding the rivers has accelerated the rate of sediment infilling by up to nine times over the last 100 years, changing the dynamics of the ecosystem. Cyclone Debbie created major flooding and freshwater discharge into southern Moreton Bay in 2016. The floods had sustained impacts on productivity. We sampled brown tiger prawns and small fish, i.e. flathead and flounder, throughout the bay once before and twice after the flood. Stable isotopes and trace metals were analysed to examine the effect of the disturbance on these species. This talk will examine the flood response and the impacts on the food web. Results from this study highlight the importance of understanding how catchments impacted by humans influence estuarine processes and implications for fisheries.

G5*Estuaries and coasts***Tuesday 3 July, 1200 - 1215**

Seascape connectivity shapes reserve performance on exposed coastlines

Nicholas Ortodossi¹, Ben Gilby¹, Thomas Schlacher¹, Rod Connolly², Nick Yabsley¹, Andrew Olds¹

1. University Of The Sunshine Coast, Sunshine Coast, QLD, Australia
2. Griffith University, Gold Coast, QLD, Australia

Abstract

The spatial properties of landscapes influence numerous ecological attributes on land and in the sea, including the efficacy of nature reserves. In this context, connectivity has been shown to modify reserve performance in low-energy marine ecosystems (e.g. coral reefs, mangroves, seagrass), but it is not clear whether seascape linkages also shape reserve effectiveness on high-energy, exposed coastlines. We used the surf zones of ocean beaches in eastern Australia as a model system to test how seascape connectivity and reserve attributes combine to shape conservation outcomes. Spatial patterns in fish assemblages were measured in 12 reserves and 15 reference sites distributed over 2,000 km of coastline. Effective reserves had three key attributes. They i) encompassed a sizeable area of surf-zone habitat (> 1.5km of coastline); ii) were located close (< 100m) to rocky headlands; and iii) included pocket beaches in a heterogeneous seascape. We suggest that conservation outcomes for exposed coastlines will be enhanced by prioritizing sufficiently large areas of seascapes, with strong ecological linkages to abutting complementary habitats. Our findings have broader implications for coastal conservation planning, by demonstrating that similar effects of connectivity on reserve performance can be applied to reserve design in both sheltered and exposed seascapes.

S11 *Marine biodiversity conservation – what's effective?*
Wednesday 4 July - 1130 - 1145

Identifying the unidentifiable: a novel approach for discriminating and estimating biomass of cryptic fish species.

Andrew PA Oxley¹, Sarah R Catalano¹, Melissa L Wos-Oxley^{2,3}, Emma L Westlake¹, Gretchen L Grammer¹ and Mike A Steer¹

1. South Australian Research and Development Institute Aquatic Sciences Centre, Hamra Avenue, West Beach, SA, 5024
2. Flinders University, Sturt Road, Bedford Park, SA, 5042
3. South Australian Museum, North Terrace, Adelaide, SA, 5000

Abstract

The capacity to reliably identify the early life stages of marine species is important for providing insights into their biology and our understanding of community ecology. This is particularly important for the implementation of fisheries assessment tools like the daily egg production method (DEPM), which are frequently used to obtain fishery-independent estimates of spawning biomass to support sustainable resource management. Using mixed species ichthyoplankton samples, this method essentially derives biomass by quantifying egg density within a spawning area and determining how many fish were required to produce those eggs. However, while this method is readily applicable to fish that have clearly identifiable eggs, for many it remains challenging, particularly for those (like Snapper or King George Whiting) whose eggs are hard to distinguish from the other species that spawn at the same time. Here we have developed a new DNA-based (*in situ* hybridisation) approach which overcomes this constraint by turning the eggs of the target species blue. This approach represents a major advance from current molecular-based strategies as it is relatively non-destructive and allows for the simultaneous identification and staging of fish eggs (and larvae).

G2 *Life history and connectivity in the ocean*
Tuesday 3 July, 1415 - 1430

Innovations in using acoustic backscatter in seafloor habitat mapping

Iain M. Parnum¹, John Arnould², Marcela M. L. Figueroa¹, Daniel Ierodiaconou², Xinh Le Sy¹, Alaa Mufti¹, and Andrew Thomas¹

1. Centre for Marine Science and Technology, Curtin University, Perth, Western Australia
2. School of Life and Environmental Sciences, Deakin University, Victoria

Abstract

Until recently, water column and multi-frequency acoustic data had been restricted to single beam echo-sounders. However, these data types are now becoming more readily available for multibeam echo-sounders, which opens up new applications and improvements to current ones. This talk will present examples of how multibeam water column, and multi-frequency backscatter data can be utilised for seafloor mapping studies, but also highlighting their challenges. For instance, multibeam water column backscatter data does require increased storage requirements and computation considerations, but does offer great potential such as improvements 3D models from subsea structure and used to survey for marine fauna. Multi-frequency backscatter data offers the potential to increase discrimination ability in seafloor classification, but possibly at the sacrifice of spatial resolution, which will be discussed.

S3***Seafloor Mapping in Australia – Progress, Discoveries, Applications*****Monday 2 July, 1345 - 1400**

Ecogeographic and Anthropogenic Drivers of Dolphin Distribution: Informing Future Spatial Conservation Planning in a Marine Park in South Australia

Guido J. Parra¹, Cecilia Passadore^{1,*}, Luciana Möller^{1,2}, Fernando Diaz-Aguirre^{1,2}

1. Cetacean Ecology, Behaviour and Evolution Lab, Flinders University, Sturt Road, Bedford Park, SA, 5042.

2. Molecular Ecology Lab, Flinders University, Sturt Road, Bedford Park, SA, 5042.

Abstract

As marine predators experience increasing anthropogenic pressures, there is an urgent need to understand their distribution and their drivers to inform spatial conservation planning. We used an ensemble modelling approach to investigate the spatio-temporal distribution of southern Australian bottlenose dolphins (*Tursiops cf. australis*) in relation to a variety of ecogeographical and anthropogenic variables in Coffin Bay, Thorny Passage Marine Park, South Australia. Further, we evaluated the relevance of current sanctuary zones for their protection. Dolphins showed no distinct seasonal shifts in distribution patterns. Dolphin presence was highly influenced by distance to sanctuary zones and water depth, with areas of high probability of dolphin occurrence located mainly within the inner area of Coffin Bay. Areas of high probability of dolphin occurrence in the inner area were associated with shallow waters (2 – 10 m), and located within 1,000 m from land and 2,500 m from oyster farms. The majority of areas of high (>0.6) probability of dolphin occurrence are outside sanctuary zones where multiple human activities are allowed. The inner area of Coffin Bay is an important area of year-round habitat suitability for dolphins. Our results can inform future spatial conservation decisions and improve protection of important dolphin habitat.

S11 **Marine biodiversity conservation – what's effective?**
Wednesday 4 July, 1200 - 1215

Soundscape Monitoring and Metrics in the Marine Environment

Miles Parsons^{1,2}

1. Australian Institute of Marine Science, Fairway, Crawley, Western Australia
2. Centre for Marine Sciences and Technology, Curtin University

Abstract

Biodiversity is a primary parameter likely affected by habitat degradation, and its on-going assessment is one of the most difficult challenges faced by biologists, particularly in remote environments. Autonomous methods of recording long-term biodiversity data are key to detecting, identifying and quantifying change. In the ocean, sound is the primary sensory modality and acoustic cues are used for multiple life functions, thus monitoring biological sounds and soundscapes holds great potential. Acquisition of long-term recordings has become more accessible and commercial, cost-effective systems more readily available. The development and application of sophisticated acoustic metrics, can provide a way of analyzing soundscape structure and relating it to local biodiversity, in essence a remote sensing method, thus the use of soundscape metrics is a rapidly developing area. Marine monitoring plans on national scales are under development and multiple international working groups have come together to better understand the implications such metrics may have. NOAA and the International Quiet Ocean Project's Working Group on Acoustic Measurement of Ocean Biodiversity Hotspots recently held soundscape metric workshops focussed on marine and freshwater environments. This talk will present an introduction into soundscape monitoring, and a synopsis of recent meetings on their use in monitoring biodiversity hotspots.

S4***Advances in marine ecological classification*****Tuesday 3 July, 1445 - 1500**

Response of the flat oyster *Ostrea angasi* to climate change

Roberta Pereira¹, Pauline Ross¹ and Maria Byrne¹

1. The University of Sydney, School of Life and Environmental Sciences, NSW, Australia

Abstract

Oysters are among the most vulnerable groups predicted to be affected by ocean warming and acidification, a key component in coastal ecosystems, providing important ecological services and supporting an extensive global aquaculture industry. We evaluated the physiological responses of the native flat oyster species *Ostrea angasi* to elevated CO_2 and temperature in an outdoor mesocosm experiment. *O. angasi* was exposed to two $p\text{CO}_2$ concentrations (400 μatm and 1000 μatm) and two temperatures (ambient and elevated $+3^\circ\text{C}$) in an orthogonal design. Shell size, condition index, standard metabolic rate, extracellular pH (pHe) and survival were measured at the end of a 10 week exposure. Elevated $p\text{CO}_2$ increased the standard metabolic rate of *O. angasi* and lowered the pHe which suggests that oyster's response to ocean acidification may be an energetically costly process. An effect of temperature was observed on the condition index, potentially indicating that less energy was invested in somatic growth during the experimental period and also on survival rate. The results suggest that *Ostrea angasi*, may have limited capacity with ocean acidification and is extremely sensitive to warming.

S6**Marine Climate Change from Shelves to Deep Seas****Wednesday 4 July, 1715 - 1730**

Plastic plight on our shores: An insight into marine debris in the Gulf St Vincent bioregion, South Australia.

Kristian J. Peters¹ and Tony Flaherty¹

1. Natural Resources Adelaide and Mount Lofty Ranges. Department of Environment, Water and Natural Resources.

Abstract

The complexity and extent of worldwide sources of marine debris suggests that information at local scales is a critical component of global management and highlights the value of developing local-level mitigation and intervention strategies. The goal of most marine debris projects – to define contributing sources spatially and over time is often challenged by logistics and costs, therefore seeking community-based support coalesced with scientific guidance presents a viable alternative to obtain quantifiable information. The Gulf St Vincent (GSV) marine bioregion in southeast, South Australia, is an area considered of ecological and economic importance. Like other marine regions, the GSV bioregion is subject to a variety of pressures including anthropogenic debris. Established in 2010, the GSV marine debris program is a successful example of how volunteer-based sampling can facilitate collection and deliver broad spatio-temporal information aimed at identifying the key sources of marine debris. Results from biennial surveys conducted at 38 sites (~35km of coastline) have shown remarkable consistency highlighting the dominance of plastic products. Central to these are fragments and items associated with food packaging and fishing both of urban and oceanic origin. The key findings have provided a platform to develop local-scale mitigation that includes planning, product mitigation and community education.

S16 *Marine Debris: the world-wide pollution crisis acting on local to global scales*
Thursday 5 July, 1200 -1215

The geodiversity of the southeast Indian Ocean seafloor revealed by Malaysia Airlines flight MH370 search data

Kim Picard¹, Brendan Brooke¹, Peter T. Harris², P. Justy. W. Siwabessy¹, Millard F. Coffin^{3,4}, Maggie Tran¹, Michele Spinoccia¹, Jonathan Weales¹, Miles Macmillan-Lawler² and Jonah Sullivan¹

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3. Institute for Marine and Antarctic Studies, University of Tasmania, Private Bag 129, Hobart, Tasmania 7001,
4. Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, 02543, USA

Abstract

A large multibeam dataset was acquired in the SE Indian Ocean to assist the search for Malaysia Airlines flight MH370. We present the results of a geomorphic analysis of this new data and compare with the Global Seafloor Geomorphic Features Map (GSFM), which was based on coarser resolution satellite-derived bathymetry data. The analysis shows that compared to the GSFM:

- Abyssal plains and basins are significantly more rugged;
- Four times more seamounts are present, indicating a greater number of these ecologically significant features than previously estimated for the broader region and perhaps globally.

This high-resolution mapping also provides insights into the geological evolution of the region, in terms of structural, tectonic, and sedimentary processes. For example,

- Sub-parallel ridges extend over 20% of the area mapped and their characteristics provide valuable insight into seafloor spreading processes;
- Rifting is recorded along the Broken Ridge – Diamantina Escarpment, with rift blocks and well-bedded sedimentary bedrock exposures;
- Sediment mass transport is a dominant ocean floor sedimentary process.

The new MBES data highlight the complexity of the search area and serve to demonstrate how little we know about the 85-90% of the ocean floor that has not been mapped with this technology.

Poster presentation

S3

Origin of high density pockmark fields and their use in inferring near-seabed current: A case study from Oceanic Shoals Marine Park, northern Australia

Kim Picard¹, David K Williams², Lynda Radke¹, Rachel Przeslawski¹, Justy Siwabessy¹ and Scott Nichol¹

1. Geoscience Australia, GPO Box 378, Canberra, ACT, Australia,
2. Australian Institute of Marine Science, PO Box 41775, Darwin, NT, Australia

Abstract

Pockmarks are seabed depressions that have been observed around the world's ocean and lake floors for decades. They typically indicate shallow and/or deep sub-surface fluid seepage. Dense fields of pockmarks were identified on the silty plains that surround carbonate banks in the Oceanic Shoals Marine Park, Timor Sea. Many of the pockmarks are characterised by a scour mark aligned with the dominant near-seabed tidal flow. Here we present the automated method used to map and characterise pockmarks, draw on geochemical datasets to provide information on how the pockmarks developed and investigate their relationship with hydrodynamic conditions and infauna distribution. Results suggest that:

- Pockmark scours are a good indicator of near-seabed currents as they record bi-directionality and correlate with the modelled tidal regime. Spatial patterns in pockmark scour also suggest that currents are redirected by the banks, leading to locally varied flow directions.
- Labile organic matter shed from carbonate banks primes the mineralisation of abundant particle-bound Total Organic Carbon, thus enhancing pore water TCO_2 concentrations and causing gaseous efflux from the sediments. This provides a potential shallow mechanism for pockmark formation.
- Pockmark density influences local polychaete biodiversity, but may also be related to sediment grain-size and TCO_2 values.

G4***Carbonate shelves: geology, oceanography and biota*****Tuesday 3 July, 1600 - 1615**

Thar she blows: An economical custom-built drone for assessing whale health

Vanessa Pirotta¹, Alastair Smith², Martin Ostrowski³, Dylan Russell³, Ian Jonsen¹, Alana Grech⁴, Robert Harcourt¹

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2. Heliguy Pty. Ltd., Sydney, NSW, 2204, Australia
3. Macquarie Marine Research Centre/Chemistry and Biomolecular Sciences, Macquarie University, Sydney, NSW, 2109, Australia
4. ARC Centre of Excellence for Coral Reef Studies, James Cook University, Townsville, Queensland, 4811, Australia

Abstract

Drones or Unmanned Aerial Vehicles (UAVs) have huge potential to improve the safety and efficiency of sample collection from wild animals under logistically challenging circumstances. We present a method for surveying population health that uses UAVs to sample respiratory vapour, 'whale blow', exhaled by free-swimming humpback whales (*Megaptera novaeangliae*), coupled with molecular diagnostics based on the amplification and sequencing of respiratory tract microbiota. We developed a low-cost multirotor UAV incorporating a sterile petri dish with a remotely operated 'flip lid' to sample whale blow with minimal disturbance to the whales. This design addressed a number of sampling challenges: accessibility; safety; cost and, critically, minimized the collection of atmospheric and seawater microbiota and other sources of DNA contamination. We collected 59 samples of blow from northward migrating humpback whales off Sydney, Australia and used high throughput sequencing of bacterial ribosomal gene markers to identify putative respiratory tract microbiota. Model-based comparisons with seawater and drone-captured air demonstrated that our system minimized external sources of contamination and was effective in capturing sufficient material to identify whale blow-specific microbial taxa. This successful application indicates that using customized UAVs is a practical and cost-effective approach for monitoring health parameters in whale populations.

S13

From sea to coast – marine mammals in a connected world

Monday 2 July, 1545 - 1600

Utilizing Citizen Science for Marine Pest Detection in Marine Protected Areas.

Jacqueline B Pocklington¹, Steffan Howe², Mark Rodrigue¹, Jonathon Stevenson³, Emily Verey⁴, Roellen Gillmore², Darren Baldyga²

1. Parks Victoria, Wharf Street East, Queenscliff, VIC, 3225
2. Parks Victoria, Bourke Street, Melbourne VIC 3000
3. Parks Victoria, Foster VIC 3960
4. Parks Victoria, Nelson Place, Williamstown VIC 3016

Abstract

Marine Pests are a significant threat to Marine Protected Areas. To complement organisation efforts, the citizen science program Sea Search encourages participants to monitor for new incursions of marine pests and overabundant natives. With an engaged community and regular monitoring of MPAs, early alert can lead to timely management intervention and possibly successful eradication. Parks Victoria have worked with CSIRO and ALA to allow community monitoring records and observations to be uploaded into an App and online database to improve reporting, which incorporates automatic alert to staff for possible new incursions. This database also allows records to be available through ALA increasing data security and transparency.

S10

Marine biosecurity in an increasingly-connected world: protecting Australia from marine pests and diseases

Wednesday 4 July, 1345 - 1400

Benthic Habitat Mapping: Multiscale Hierarchical Classification in Victoria, Australia

Peter HJ Porskamp¹, Alex Rattray¹, Mary A Young¹ and Daniel Ierodiaconou¹

1. Deakin University, School of Life and Environmental Sciences, Faculty of Science and Technology, P.O. Box 423, Warrnambool, Victoria 3280, Australia

Abstract

Coastal zones are often under threat due to their proximity to anthropogenic disturbances and as a result benthic habitat maps are increasingly recognised as a key component for marine spatial planning. Developing quantitative and objective approaches to integrate multibeam sonar (MBES) data with ground observations for predictive modelling is essential for ensuring repeatability and providing confidence measures for mapping products. The aim of this study is to investigate a multi-scalar approach to improve the accuracy of benthic habitat maps.

The study site encompasses 700 square kilometres surrounding Cape Otway in southeast Australia with full MBES data coverage and over 600 linear kilometres of towed video data classified using Combined Biotope Classification Scheme (CBiCS). An ensemble learning approach combining bathymetry, backscatter, towed video and wave exposure from oceanographic models was used to model the distribution of biotope classes at different hierarchical levels. Results indicated the more biotopes predicted within the model the lower the overall model accuracy. For all CBiCS hierarchies larger scale predictors were favoured and the most important predictor was wave exposure. This research suggests that multiscale and inclusion of oceanographic predictors are favoured by machine learning techniques for benthic habitat mapping on wave dominated coastal waters.

S4***Advances in marine ecological classification*****Tuesday 3 July, 1430 - 1445**

Changes to habitat structure drive fish assemblages... Tell me more! Tell me in 3D.

A. Porter¹, M. Bryson², R.A. Coleman¹, R. Ferrari³, W. Figueira^{1,4}

1. School of Life and Environmental Sciences, University of Sydney
2. Australian Centre for Field Robotics, University of Sydney
3. Australian Institute of Marine Science, Townsville
4. Sydney Institute of Marine Science, Sydney

Abstract

Climate change is reshaping the seabed. From coral bleaching to erosion and resulting shoreline armouring, the physical shape of the ocean is changing. How can we expect the organisms that rely on benthic habitats to respond? Ultra-high-res 3D capture of benthos, and collaboration with software engineers yielded previously impossible analysis of habitat shape. By comparing these data with fish assemblages, the role of habitat structural complexity is examined from temperate to tropical east Australia. There were clear effects of overall complexity, as well as several novel metrics of complexity derived from 3D data. The size of features in a landscape (not just the overall complexity) drove different groups of fishes. Additionally, beta diversity is shown to be an important consideration. With expanding computational and mapping abilities, predicting mechanistic responses of mobile organisms to structural changes is increasingly within reach.

S6***Marine Climate Change from Shelves to Deep Seas*****Tuesday 3 July, 1430 - 1445**

Changing Structure and Function of Coral Reef Assemblages in the Anthropocene

Morgan Pratchett¹ and Andrew Hoey¹

1. ARC Centre of Excellence for Coral Reef Studies, James Cook University, Townsville, QLD, 4811

Abstract

Coral reefs are subject to increasing disturbances and pressures caused by land clearing and agricultural runoff, coastal development, pollution, and above all, increasing global greenhouse emissions. Ongoing climate change, and specifically ocean warming, has resulted in unprecedented successive years of pan-tropical mass coral bleaching. Importantly, climate change now represents the foremost threat to the integrity, functioning and biodiversity of many reef systems. While the full impacts of the recent mass bleaching will take several years to manifest, this presentation outlines projected changes in the structure and function of coral reef ecosystems that have been subject to severe coral bleaching and coral loss. Projections are based on meta-analyses of changes in fish and coral assemblages following major mass-bleaching events across a broad range of geographical locations. Learnings from prior mass-bleaching events will not only inform anticipated impacts, but also guide ongoing research to explicitly document the effects of the recent mass-bleaching on Australia's Great Barrier Reef and at other key locations throughout the Indo-Pacific.

S5***Structure and function of coral reefs in a changing world*****Wednesday 4 July, 0950 - 1005**

The genomic basis of ecotype formation in bottlenose dolphins (genus *Tursiops*)

Eleanor A.L. Pratt^{1,2}, Luciano B. Beheregaray¹, Pedro Fruet³, Gaby de Tezanos Pinto⁴, Kerstin Bilgmann⁵, Nikki Zanardo^{1,2,6}, Fernando Diaz Aguirre^{1,2} and Luciana M. Möller^{1,2}

1. Molecular Ecology Laboratory, College of Science and Engineering, Flinders University, Bedford Park 5042, South Australia
2. Cetacean Ecology, Behaviour and Evolution Laboratory, College of Science and Engineering, Flinders University, Bedford Park 5042, South Australia
3. Institute of Oceanography, Federal University of Rio Grande, Rio Grande, Brazil
4. Institute of Natural Sciences and Mathematics, Massey University, Palmerston North 4442, New Zealand
5. Department of Biological Sciences, Macquarie University, North Ryde 2113, NSW, Australia
6. Department of Environment, Water and Natural Resources, Adelaide 5000, South Australia

Abstract

Advances in the field of genomics have allowed an increase in the number of genomic studies on non-model species. The cetacean lineage provides an ideal system to investigate molecular signatures of evolutionary transitions due to their dramatic adaptation to and within the aquatic environment. This is evident in bottlenose dolphins (genus *Tursiops*) with distinct inshore/nearshore and offshore ecotypes repeatedly observed around the world. This study investigates the genomic basis of ecotype formation in bottlenose dolphins of the southern hemisphere across three ocean basins. Using a dataset of over 24,000 single nucleotide polymorphisms (SNPs), we found genomic diversity levels on average lower in inshore than offshore populations. Genomic differentiation between species, and further subdivision within *T. truncatus* corresponding to different ecotypes was also revealed. A number of SNPs were identified as potentially under divergent selection between ecotypes, their functions largely relate to regulation of various cellular processes. We hypothesise that these regions of the genome underpin behavioural and physiological adaptations of dolphins to contrasting inshore and offshore environments. By understanding past adaptations of bottlenose dolphins to differing habitats, we may be in a better position to predict their responses to ongoing and future environmental change and habitat modification.

S9

Genomics of marine organisms: contributions to ecology and evolution

Thursday 5 July, 1515 - 1530

A comparison of blue swimmer crab catch composition and abundance across varying pot types

Jessica Priess¹, Charlie Huveneers¹, and Crystal Beckmann²

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2. South Australian Research Development Institute

Abstract

Annual surveys of blue swimmer crabs (*Portunus armatus*) are undertaken in the South Australian gulfs to inform management of the state's Blue Crab Fishery. Frequent changes in the diameter and mesh size of commercial pots has complicated our ability to understand the discrepancy in *P. armatus* catch per unit effort (CPUE) between commercial and survey pots. Ninety pots (15 deployments of 6 pot types) were deployed in both Spencer Gulf and Gulf St Vincent to compare catch composition of survey and various commercial pots to facilitate CPUE comparison between these pots. The CPUE of legal-sized *P. armatus* in large diameter pots was highest compared to medium and small diameter commercial pots. Mesh size influenced size frequency distribution of *P. armatus*, which contributed to the differences in legal-sized and pre-recruit CPUE. The research pot had the highest CPUE of pre-recruits, caught the most bycatch, and had the highest mortality rate. Standardisation of historic survey CPUE was successfully used to correct for differences between commercial and survey pots. This study increased our understanding of relative pot efficiency and how it influences legal-sized and pre-recruit CPUE, which are key parameters used to set the Blue Crab Fishery total allowable commercial catch.

S14 *Assessing and mitigating ecosystem effects of fishing and aquaculture*
Thursday 5 July, 1215 - 1230

Applying Geoscience to Biodiversity Monitoring: Case Studies From an Australian Marine Park

Rachel Przeslawski¹, Kim Picard, Scott Nichol, Ben Radford², Phil Bouchet³

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4. Australian Institute of Marine Science, Crawley WA, 6009
5. University of Western Australia, Crawley WA, 6009

Abstract

Following the establishment of the world's largest network of marine protected areas, Australia is now tasked with implementing national plans to manage a huge range of marine environments, from tropical to sub-Antarctic climates and shallow reef to abyssal depths. Monitoring (i.e. condition assessment and trend detection) is one of the key objectives of management plans for the MPA network. As part of a national effort to acquire baseline data for future monitoring purposes between 2009 and 2012, we collected geoscientific (bathymetry, backscatter, sub-bottom profiles, sediment grain-size) and biological data (assemblages and richness of infauna, sponges and pelagic fish) using a variety of gear (grab, sled, pelagic baited video, multibeam sonar, sparker) from the Oceanic Shoals Australian Marine Park in northern Australia. In this presentation, we describe how the integration of such data (including derived geoscientific products) helped to inform sampling design, map habitats, predict the distribution of benthic and pelagic communities at varying spatial scales, and better understand ecosystem processes. We hope to encourage ecologists and marine managers to incorporate geoscientific methods into their research and policy in order to further improve sampling design, data collection, robust modelling, and informed decision-making.

S11 *Marine biodiversity conservation – what's effective?*
Wednesday 4 July, 1145 - 1200

Marine Sampling Field Manuals for Benthic Monitoring

Rachel Przeslawski¹, Scott Foster², Jacquomo Monk³, Neville Barrett³, Phil Bouchet⁴, Andrew Carroll¹, Tim Langlois⁴, Vanessa Lucieer³, Joel Williams⁵

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2. CSIRO, GPO Box 1538, Hobart TAS, 7001
3. Institute for Marine and Antarctic Studies, University of Tasmania, Private Bag 49, Hobart TAS, 7001
4. University of Western Australia, 35 Stirling Hwy, Crawley WA, 6009
5. NSW Department of Primary Industries, Port Stephens Fisheries Institute, Taylors Beach NSW, 2316

Abstract

Australia is uniquely placed to develop standardised national approaches to monitor the marine environment, and we have therefore released a suite of field manuals for the acquisition of marine benthic data so that data are directly comparable in time and through space. The manuals include selected frequently-used sampling platforms: Multibeam sonar, autonomous underwater vehicles, baited remote underwater video, towed cameras, grabs and box corers, and sleds and trawls. The main challenge in the development of these manuals was to find a balance between being overly prescriptive (such that people follow their own protocol, ignoring the manuals) and overly flexible (such that data is not consistent and comparable). A collaborative approach was paramount, and ultimately, over 65 individuals from 30 organisations contributed to the field manuals. This not only improved the content but also increased the potential for adoption across multiple agencies and programs. Future work is based on the understanding that sampling protocols should be periodically updated, lest they become superseded or obsolete. Version 2 of the field manual package is due for completion in late 2018, including potential new manuals and a long-term plan for their management and integration into a national Australian monitoring program.

Poster presentation

S11

Review and Meta-analysis of the Importance of Remotely Sensed Habitat Structural Complexity in Marine Ecology

Daniel Pygas¹, Renata Ferrari Legorreta¹, Will Figueira¹

1. University of Sydney, Sydney, NSW, Australia

Abstract

Habitat structural complexity is a key determinant of the distribution of marine biota, mediating several abiotic and biotic processes. Recent remote sensing studies examined the role of various measures of complexity over various locations, ecosystems and biota, though until now there has been limited attempt to review and synthesise the findings. This review and meta-analysis developed a standardised rank-based scoring metric (Rs_{1-10}) that enabled quantitative comparisons of the efficacy of various measures of complexity and associated predictors across these disparate studies. While measures of complexity were important, other predictors that do not, at least directly, measure complexity were often more so. Of note, Rs_{1-10} identified surface rugosity, one of the most utilised measures of complexity, as the poorest performing predictor. Explanations for this and the relatively poor performance of measures of complexity overall included their specificity and often narrow ecological relevance, the ability of other predictors to capture important structuring environmental gradients and the potentially confounding effect of spatial extent and resolution. Such considerations provide opportunities to improve the design and implementation of remote sensing studies and enhance marine conservation and resource management efforts.

S3***Seafloor Mapping in Australia – Progress, Discoveries, Applications*****Monday 2 July, 1715 - 1730**

Stable isotopes indicate role of upwelling and coral heterotrophic feeding following mass bleaching in remote coral reefs of Maldives, Indian Ocean

Veronica Z. Radice,¹ Ove Hoegh-Guldberg,¹ Brian Fry,² Michael D. Fox,³ Sophie G. Dove¹

1. The University of Queensland, St. Lucia, Queensland, Australia
2. Griffith University, Nathan, Queensland, Australia
3. University of California San Diego, La Jolla, California, United States of America

Abstract

Oceanographic processes such as upwelling redistribute nutrients and particulate resources, serving an important role in the nutrient dynamics and function of coral reef ecosystems. Since corals are both autotrophic and heterotrophic, the extent of upwelling in shallow versus deep reefs could affect coral trophic strategies, especially under conditions of increased seawater temperatures. Using stable isotope ratios of corals, their symbionts, and particulate organic matter, we investigated the trophic strategies of three common coral species across shallow and deep reefs (10-30 m) one year before and after the 2016 mass bleaching in the Maldives, Indian Ocean. Overall, upwelling appeared to be the primary nitrogen source for corals, with nitrogen isotope ratios (^{15}N) of coral hosts and symbionts consistent with the isotopic signature of deep-water nitrogen. In contrast, trophic strategy and metabolism controlled carbon isotope ratios (^{13}C) among species, with significantly different ^{13}C values of *Galaxea fascicularis* between depths. One year after the bleaching event, there were significant increases in ^{15}N values of all coral host species and significant decreases in host ^{13}C values of shallow *G. fascicularis* colonies and *Pocillopora verrucosa* colonies from both depths. These results suggest coral heterotrophic feeding increased following the mass bleaching event in the Maldives.

S5 *Structure and function of coral reefs in a changing world*
Wednesday 4 July, 1415 - 1430

The Critical Role of Mega-Herbivores in Structuring Great Barrier Reef Seagrass Communities and their Services

Michael A. Rasheed¹, Abigail L. Scott¹, Paul H. York¹, Samantha J. Tol¹, Rob G. Coles¹,

1. Centre for Tropical Water & Aquatic Ecosystem Research, James Cook University, Cairns QLD 4870

Abstract

Seagrasses provide important habitat that deliver ecosystem services and food to a diversity of herbivores. In the tropics we have a spectrum of herbivores; from small mesograzers such as amphipods, to macrograzers such as fish, and the large megagrazers including turtles and dugongs. Through large-scale herbivory exclusion experiments examining the range of herbivores and their interactions in the Great Barrier Reef (GBR) we demonstrate that plant-herbivore interactions can substantially modify seagrass characteristics that impact the delivery of important ecosystem services such as fisheries nursery habitat, carbon sequestration and sediment stabilisation. We have also recently demonstrated that dugong and turtles can influence seagrass meadows by dispersing propagules and seeds up to hundreds of kilometres, providing a mechanism for meadow expansion and recovery. Currently, monitoring programs and management of both seagrass and megaherbivores on the GBR are conducted independently of each other and a greater integration such as that planned in the Reef Integrated Monitoring and Reporting Program could lead to a much better understanding of this important plant-animal interaction and also lead to greater conservation outcomes for both seagrass habitats and their fauna.

G5*Estuaries and coasts***Monday 2 July, 1400 - 1415**

Hydrodynamics of Coffin Bay

Ana Redondo Rodriguez¹ and John Middleton¹

1. South Australian Research and Development Institute, West Beach, SA, 5024

Abstract

Coffin Bay, South Australia, is a very important centre for oyster farming. The region is characterized by several interconnected sub bays and a narrow mouth that leads to a number of sand banks, where the majority of the oyster farms are located. Here we present the results of an idealised hydrodynamic model of Coffin Bay based on the Regional Ocean MOdeling Suite (ROMS). The importance of tides, wind forcing and thermohaline forcing are investigated, including the cross-shelf exchange process between the inner bays and the adjacent shelf.

S1***Cross-shelf exchange processes*****Monday 2 July, 1545 - 1600**

Exploring the use of hard part analysis in conjunction with DNA methods to describe Long-Nosed Fur Seal dietary profiles.

Sarah-Lena Reinhold¹, Andrew Oxley¹, Simon Goldsworthy¹, Alice Mackay¹, Diane Colombelli-Negrel²

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2. Flinders University, Sturt Road, Bedford Park, SA, 5042

Abstract

Recovering long-nosed fur seal populations have more than trebled within South Australia since the 1980's, leading to increased concerns about their impact on prey species and potential competition for marine natural resources. To date, dietary studies have only focused on breeding colonies, with little investigation of non-breeding animals, which are most likely to interact with fisheries and key prey species in coastal waters. This study examined the diet of long-nosed fur seals (*Arctocephalus forsteri*) at 12 haulout sites and two breeding colonies across four regions (Coorong, Gulf St. Vincent, Spencer Gulf and South coast Kangaroo Island) in South Australia. For the first time hard part analysis (n=422) was used in conjunction with DNA methods (sub-sample n=37) to investigate long-nosed fur seal diet. Combined these methods detected 82 prey species of which 57 were only described using DNA analysis (n=37), however hard part analysis provided a means for assessing diet composition quantitatively. Key prey species varied regionally but leatherjackets made up 41.1% of overall diet in biomass. In addition, this study identified marked variation in the importance of little penguins in fur seal diet across the regions.

S13***From sea to coast – marine mammals in a connected world*****Tuesday 3 July, 1215 - 1230**

Assessing the relative vulnerability of Chondrichthyan species as bycatch using spatially reported catch data series

Marcelo Reis¹ and William Figueira¹

1. University of Sydney, Coastal and Marine Ecosystems Group, School of Life and Environmental Sciences, NSW, 2006.

Abstract

Fishery impacts are recognized as a threat not only to target species populations, but also to bycatch species. Unfortunately, the choice of priorities for conservation or research in fisheries is usually related to the economic value and most retained bycatch species such as sharks and rays have been historically of low income. Stock assessments, when performed in a traditional way, require large quantities of quality data, financial support and foremost, to be feasible. Issues such as multi-species catches, low cost-benefit appeal and low sample availability have typically limited the ability to carefully assess Chondrichthyan bycatch in a conventional manner. In this study we develop a technique to quantify the relative vulnerability of Chondrichthyans taken as bycatch in the SESSF Fishery of Australia based on the spatial interaction between species distributions and fishing activity. We related this metric to estimates of resilience for 20 bycaught and several target species. The interaction-resilience combinations obtained showed considerable agreement with IUCN status of assessed species however there were exceptions reflecting particular cases where local assessments pointed Australia as differ from the general global assessment. Moreover results overall pointed to small benthopelagic dogfishes as the bycatch species with highest interaction paired alongside threatened pelagic sharks.

S11 *Marine biodiversity conservation – what's effective?*
Wednesday 4 July, 1430 - 1445

Source Waters of an Offshore Artificial Reef off Sydney, Australia.

Nina Ribbat*¹, Moninya Roughan¹, Iain Suthers¹, Brian Powell²

1. University of New South Wales (UNSW), Sydney, NSW 2052 Australia
2. University of Hawaii at Manoa (UH), Honolulu, 96822

Abstract

Artificial reefs are used worldwide to enhance the richness of the local marine life, improve ecological connectivity and enhance fish production. This study investigates the source of water delivered to the continental platform of southeast Australia and to an offshore artificial reef off Sydney, Australia. Using the results from a high resolution hydrodynamic model, a series of Lagrangian particle trajectory experiments are conducted from 2012-2013 to investigate the effect of circulation variability on the distribution of source waters reaching the reef. The main features defining the origin of particles reaching the continental platform and reef is the poleward flowing EAC, its separation from the coast and the EAC eddy field. Water reaching the OAR within the zooplankton generational lifespan of 21 days, is advected alongshore by the EAC over a distance of ~133-222 km, confined inside the 100 m isobath. 7-14 days prior to washing the reef, the water resides in more inshore regions (<50 km from the coast). Seasonality has a minimal impact on the distribution of the source waters. Our study identifies circulation regimes and sites of major water exchange across the shelf. Also, our findings provide a useful guide for the strategic placement of future artificial reefs.

G5 *Estuaries and coasts*
Thursday 5 July, 1500 - 1515

Environmental and morphological controls on the particle fluxes in the Gulf of Valencia, NW Mediterranean

Marta Ribó^{1,2}, Enrique Isla² and Pere Puig²

1. Macquarie University, Sydney, NSW 2109, Australia
2. Institut de Ciències del Mar (ICM-CSIC), Barcelona, 08003, Spain

Abstract

The transfer of matter and energy from the continent to the ocean is controlled by circulation and is affected by the action of storms, increasing the particle flux magnitude and depth extent.

Submarine canyons are identified as preferential conduits transferring sediments from the shelf to the continental slope. However, in certain areas shelf-to-canyon sediment transport is poorly understood. Off-shelf transport of particles and organic matter has been analysed in the Gulf of Valencia (GoV) margin. Three instrumented moorings were deployed, including sediment traps and current meters at similar depths within a canyon and on the open slope (Fig. 1).

In this area, sediment is mainly transported southwards along the shelf. However, particle fluxes within the submarine canyon (incising the northern GoV slope where the slope drastically narrows) doubled the ones registered on the open slope after major NNE storm events, due to the off-shelf suspended sediment advection (Fig. 2).

Biogenic constituent concentrations in the total mass flux (e.g., organic matter and biogenic silica) indicated that the degraded organic matter is observable after storm events, and fresher material is collected during the late winter and early spring, coincident with the seasonal phytoplankton bloom typical of the NW Mediterranean.

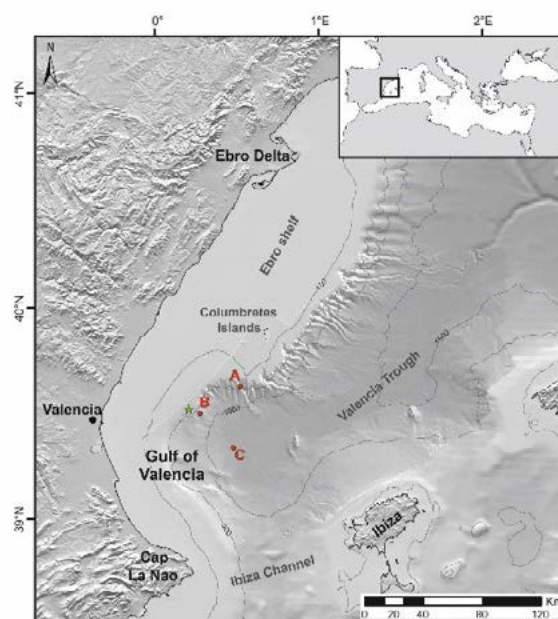


Fig. 1 Study area indicating mooring sites (red dots) and wave buoy location (green star).

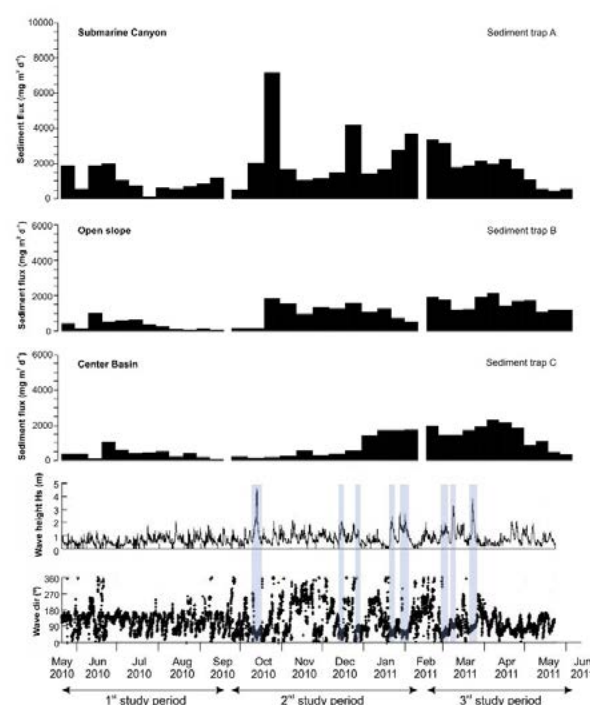


Fig. 2 Total mass fluxes and wave height and direction. Blue bar indicates major NNE storm event.

S1 *Cross-shelf exchange processes*
Monday 2 July, 1530 - 1545

Understanding causes of gear loss provides a sound basis for fisheries management

Kelsey Richardson^{1,2}, Riki Gunn³, Chris Wilcox¹ and Britta Denise Hardesty¹

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2. College of Arts, Law and Education, University of Tasmania
3. Ravenshoe, Australia

Abstract

Derelict fishing nets comprise a significant amount of the marine debris in the world's oceans and on its shorelines. These 'ghost nets' result in economic losses for the fishing industry, pose hazards to navigation at sea, and can entangle marine and terrestrial wildlife. Ghost nets are an acute problem along Australia's northern coastline, with most nets originating from South-east Asian fishing vessels outside Australia's Exclusive Economic Zone (EEZ). To understand the causes of gear loss and identify tractable solutions to this transboundary problem, Australian and Indonesian fishers (N=54) were asked why, when and in what circumstances and conditions they are likely to lose gear. Fishers identified snagging of nets (78%) and gear conflicts (19%) as the main causes of gear loss. These interviews informed the development of a fault tree, as a tool to identify the chain of events which result in gear loss or abandonment. The fault tree analysis is used to underpin recommendations for interventions and improvements in regional fisheries management. The ultimate goal is to reduce fishing gear loss resulting from overcrowding, overcapacity and illegal, unreported and unregulated Fishing (IUU).

S16 *Marine Debris: the world-wide pollution crisis acting on local to global scales*
Thursday 5 July, 1130 - 1145

PIRSA's Aquatic Animal Disease Prevention and Response Management: Pacific Oyster Mortality Syndrome as a Recent Case Example

Shane Roberts¹, Alex Chalupa³, Marty Deveney², Judd Evans⁴, Lauren Holmes¹, Elise Matthews¹, Trudy McGowan⁴, Roger Paskin³, Evan Rees¹ and Sean Sloan¹

1. Primary Industries and Regions SA (PIRSA), Fisheries and Aquaculture Division, Adelaide, SA 5000
2. PIRSA South Australian Research & Development Institute (SARDI), Aquatic Sciences, West Beach, SA 5024
3. PIRSA, Biosecurity SA Division, Glenside, SA 5065
4. South Australian Oyster Growers Association

Abstract

PIRSA has a dedicated aquatic animal health program which includes: veterinary medicine regulation, health certification requirements for livestock, fish kill investigations, disease surveillance and management, including emergency response.

POMS is a disease caused by Ostreid Herpesvirus (OsHV-1) microvariant and presents as rapid high mortalities (up to 100%) in Pacific oysters. POMS is known to occur in Europe, New Zealand and NSW. On 1 February 2016 Tasmania reported their first detection of POMS in oyster farms experiencing high mortalities. South Australia's oyster growing industry were heavily reliant on Tasmanian hatcheries.

In July 2016 a barge from Sydney, NSW, arrived in Port Adelaide with Pacific Oysters on its hull. The barge was immediately removed from the water and quarantined. One oyster tested positive. Tracing and surveillance since then had not detected infection in feral or farmed oysters in SA. This case demonstrated that biofouling on vessels can translocate OsHV-1 across borders.

On 28 February 2018 South Australia confirmed its first detection of POMS, in Port Adelaide River. Extensive surveillance and testing across the State has only detected the virus in Port Adelaide feral oysters.

The emergency responses, disease prevention measures and impact on industry from the above incursions will be discussed.

S10

Marine biosecurity in an increasingly-connected world: protecting Australia from marine pests and diseases

Wednesday 4 July, 1515 - 1530

Biogeochemical Modeling of the East Australian Current System

Carlos Rocha¹, Christopher A Edwards², Moninya Roughan¹, Paulina Cetina-Heredia¹, Colette Kerry¹

1. UNSW Sydney, NSW, Australia

2. University of California – Santa Cruz, CAL, U.S.A.

Abstract

Phytoplankton is the first link in the marine food chain and plays an integral role in marine biogeochemical cycling. Understanding phytoplankton dynamics is then critical in a range of topics spanning from fisheries management to climate change mitigation. It is also especially interesting in the East Australian Current System as its eddy field strongly conditions nutrient availability and therefore phytoplankton biomass. Numerical models provide unparalleled insight into these dynamics, yet modelling efforts off East Australia have been limited to case studies that did not attempt to analyse the biogeochemical dynamics at a regional scale, or lacked the resolution to realistically solve finer scale features. We have coupled a model of the pelagic nitrogen cycle to a high-resolution (2.5 - 5 km horizontal) three-dimensional ocean model to address this gap and solve both regional and finer scales of the biogeochemical processes occurring in the East Australian Current System. We use statistical techniques to compare the simulated surface chlorophyll to an ocean colour dataset for the 2003-2011 period and show that the model can solve the observed phytoplankton surface patterns. We then use the model to describe some of the biogeochemical processes occurring in mesoscale eddies and infer their impact on productivity.

S1**Cross-shelf exchange processes****Monday 2 July, 1600 - 1615**

Effects of Global Warming and Ocean Acidification on Fish Fitness Traits

Almendra Rodriguez-Dominguez¹, Sean Connell¹, Jonathan Y.S. Leung¹, Ivan Nagelkerken¹

1. Southern Seas Ecology Laboratories, School of Biological Sciences and The Environment Institute, DX 650 418, The University of Adelaide, Adelaide, SA 5005, Australia.

Abstract

Increasing ocean acidification and global warming can alter important physiological processes in marine organisms. However, some species have a higher capacity to acclimate to these future conditions. Here we evaluated several traits indicative of fitness in two fish species, temperate hardy heads and gobies. Fish total antioxidant capacity (TAC), oxidative stress (MDA), RNA: DNA ratio, body weight, and length were tested under elevated CO₂ and temperature in a factorial design, with an exposure of five months. Hardy heads showed greater oxidative stress under the combination of elevated CO₂ and elevated temperature, but this was not reflected in their growth as RNA: DNA ratio did not differ among treatments. In contrast, gobies showed no significant difference in oxidative stress, and showed a higher RNA: DNA ratio under elevated CO₂ conditions. Our results showed that some species are negatively affected by future climate change conditions, whereas others such as gobies are more resistant and might benefit from elevated CO₂. Differences in acclimation capacity across species could impact future community and species interaction dynamics. Understanding the effect of environmental stressor on fish fitness will aid in better predicting climate change impacts on fish populations' persistence.

S6**Marine Climate Change from Shelves to Deep Seas****Wednesday 4 July, 1515 - 1530**

Irreversible Behavioural Impairment of Fish Starts Early: Embryonic Exposure to Ocean Acidification

Almendra Rodriguez-Dominguez¹, Sean Connell¹, Clement Baziret², Ivan Nagelkerken¹

1. Southern Seas Ecology Laboratories, School of Biological Sciences and The Environment Institute, DX 650 418, The University of Adelaide, Adelaide, SA 5005, Australia.
2. Aix Marseille Université / Mediterranean Institute of Oceanography (MIO) UM 110 13288 Marseille France.

Abstract

Long-term species responses to ocean acidification depend on their sensitivity during different life stages. We tested for the greater sensitivity of fish eggs than juveniles to ocean acidification by exposing eggs to control and elevated CO₂ levels, and translocating offspring between treatments in a reciprocal design. After 8 weeks of exposure, activity levels of juveniles from control eggs were similar, whether juveniles had experienced elevated CO₂ conditions or not, and this pattern was consistent over time. However, juveniles raised as eggs under elevated CO₂ showed reduced activity levels compared to those from control eggs. This response was not reversed when CO₂-exposed juveniles were translocated to control conditions. Our findings highlight the value of evaluating fish sensitivities to global change pollutants among different life stages, and indicate that sensitivity during the often-overlooked egg stage can be critical with long-lasting impairment of behaviours that are coupled to individual fitness and population persistence.

Poster presentation

S6

Environmental and ecological drivers of habitat use of white sharks (*Carcharodon carcharias*) in Spencer Gulf and the Great Australian Bight

P. Rogers¹ and M. Drew¹

1. Sardi Aquatic Sciences, West Beach, South Australia

Abstract

Telemetry and modelling approaches were used to investigate the movements of 55 white sharks (*Carcharodon carcharias*), their relationships with key habitat types, environmental variables, areas used by marine industries and tourism in Spencer Gulf and the eastern Great Australian Bight (EGAB). Models explaining daily presence-absence of white sharks in Spencer Gulf, included water temperature, season, and the two site type factors of snapper habitat, and proximity to Australian sea lion (ASL) (*Neophoca cinerea*) habitats. The best model explaining daily presence-absence in the Neptune Islands Group Marine Park Sanctuary Zone, included bottom water temperature, season, and daily presence-absence of cage-diving operators. Spatial overlap and residency of white sharks were assessed in several State managed marine protected areas and fishery management areas. Outcomes represent several useful advice points for policy-makers, and address information gaps that have existed for the southern Australian white shark population for decades.

G2 *Life history and connectivity in the ocean*
Tuesday 3 July, 1615 - 1630

Quantifying the transfer of terrestrial organic matter to the deep ocean in submarine canyons using the compound-specific stable isotope (CSSI) technique

Ashley Rowden², Daniel Leduc¹, Andrew Kingston¹, Max Gibbs², Andrew Swales², Brittany Graham¹, Scott Nodder¹,

1. Niwa, Wellington, New Zealand

2. Niwa, Hamilton, New Zealand

Abstract

Deep-sea canyons that incise the continental shelf can facilitate the transfer of terrestrially and coastally-derived organic matter to the deep ocean, thus potentially providing important food resources to deep-sea benthic communities. Accordingly, some canyons are recognised as hot-spots of benthic biomass and activity; none more so than the Kaikōura Canyon, which hosts among the highest biomass yet recorded at the deep seabed globally. In this study, we compare the contribution of land and coastal-derived plant material to the sediment of the high productivity Kaikōura Canyon and the low productivity Hokitika Canyon using the compound-specific stable isotope (CSSI) technique and multivariate mixing models. This method, which is based on the analysis of fatty acid compounds, is used here for the study of connectivity between nearshore and deep ocean ecosystems for the first time. Our results provide new insights into the mechanisms responsible for the exceptionally high productivity of Kaikōura Canyon seabed communities, which may be driven by food inputs from outside the canyon. The application of this and other tracer methods will help clarify the fate of the vast quantities of fine, land-derived organic matter entering the oceans.

G1 *Deep sea and canyon ecology*
Wednesday 4 July 1130 - 1145

The invasive upside-down jellyfish *Cassiopea* in New South Wales Coastal Lakes: identification and distribution

Claire Rowe^{1,2}, Shane T. Ah Yong¹, William Figueira², Stephen J. Keable¹

1. Marine Invertebrates, Australian Museum Research Institute, Australia
2. School of Life and Environmental Sciences, University of Sydney, Australia

Abstract

Scyphozoans of the genus *Cassiopea* (Cassiopeidae) are notable for their unusual benthic habit of lying upside-down with their oral (feeding) arms facing upwards, resulting in their common name, “upside-down jellyfish”. In Australia, there are five named species of *Cassiopea*, which have all been recorded in northern tropical waters. *Cassiopea* are frequently noted worldwide as an invasive species, and have recently been reported in the temperate waters of Wallis Lake and Lake Illawarra. The specimens were assigned to *C. cf. marenzelleri* and *C. ndorsia*, which showed a southern range expansions of the genus by approximately 600km and 900km respectively.

This project will examine *Cassiopea* blooms, what triggers them, and what is driving their success in different coastal lakes along the coast of New South Wales. In particular it will identify which species of *Cassiopea* is present within Lake Macquarie, where they were first reported in 2017, and their current spatial and temporal distribution there. Methodologies utilised will include video survey, analysis of variance and genetic comparisons based on the DNA barcoding region of the cytochrome oxidase subunit I gene (COI). The results will assist with identifying any negative influences caused by blooms of *Cassiopea* and help create appropriate management strategies.

Poster presentation

S10

The role of temperature and macronutrient selection on metabolic and swimming performance of the Indo-Pacific Damsel fish

Claire Rowe¹, William Figueira¹, David Raubenheimer^{1,2}, Samantha M. Solon-Biet^{1,2}, Gabriel E. Machovsky-Capuska^{1,2, #}

1. School of Life and Environmental Sciences, The University of Sydney, Australia.

2. Charles Perkins Centre, The University of Sydney, Sydney, Australia. Corresponding authors: *

Abstract

Increases in temperatures have led to considerable influx of tropical “vagrant” marine species into cooler temperate waters in a phenomenon called ‘tropicalisation’. Here we combine metabolic performance metrics, feeding manipulations and nutritional geometry models to study the influence of temperature on vagrant Indo-Pacific damselfish (*Abudefduf vaigiensis*) macronutrient selection (energy amounts of protein, lipid and carbohydrates) and the role of temperature and macronutrient intake in individual performance (burst swim speed, active and resting metabolic rate, and metabolic scope). *A. vaigiensis* fed non-randomly, showing selection for their macronutrient intake. We observed an increase in the intake of protein and lipid with high temperatures. When exposed to low temperatures, they had a higher active metabolic rate, metabolic scope and burst swimming speed). Our findings provide evidence that *A. vaigiensis* can select specific macronutrients in their diets reducing the effects on performance when thermally stressed. These findings suggest acclimation to or selection for colder water temperatures. Further studies should benefit from the approach proposed here, to better understand the ecological and evolutionary drivers that influence the survival of tropical species in marginal thermal habitats.

Poster presentation

S7

Change detection and coastal characterisation using tidal composite imagery from Digital Earth Australia.

Stephen Sagar^{*1}, Claire Phillips¹, Leo Lymburner¹ and Robbi Bishop-Taylor¹

1. Geoscience Australia, Cnr Jerrabomberra Avenue and Hindmarsh Drive, Symonston, ACT, 2609

Abstract

Change detection and characterisation of dynamic coastal regions utilising earth observation imagery can be easily confounded by tidal influences and environmental noise such as white caps and sun glint. We describe a methodology for producing composite imagery from the Landsat archive managed within Digital Earth Australia (DEA); constraining the tidal domain using a tidal modelling framework.

The compositing process significantly reduces pixel-to-pixel noise in the data, whilst removing cloud, haze, sunglint and breaking water, enhancing the utility and visual aesthetics of the imagery. The nature of the compositing process maintains the band relationships of the data, enabling traditional image analysis such as band ratios and classification to be performed on a clean, noise free data set. Case studies are presented which include continental-scale mosaics of the Australian coastline, providing snapshots of coastal and estuarine regions at high and low tide, and tailored examples demonstrating the potential of tidally constrained composites to address coastal change detection and monitoring applications.

We demonstrate web based services which increase the usability of these image products for non-technical users, and detail ongoing work to enable coastal scientists and managers to tailor their own composite imagery from the DEA to meet specific research or monitoring requirements.

G5***Estuaries and coasts*****Tuesday 3 July, 1415 - 1430**

Seascape genomics reveals adaptive divergence in a connected and commercially important mollusc, the greenlip abalone (*Haliotis laevis*), along a longitudinal environmental gradient

Jonathan Sandoval-Castillo¹, Nicholas Robinson², Lachlan Strain³, Anthony Hart³, Luciano B. Beheregaray¹

1. Molecular Ecology Lab, Flinders University, Adelaide, SA 5042.
2. Nofima, PO Box 5010, N-1432 Ås, Norway
3. Molluscs Lab, Western Australian Fisheries and Marine Research Laboratories, Hillarys, WA 6025.

Abstract

Broadcast spawning marine organisms often have large population sizes and are exposed to reduced stochastic effects. Under such scenarios, strong natural selection associated with spatial environmental heterogeneity is expected to drive adaptive divergence, even in the face of connectivity. We tested this hypothesis using a seascape genomics approach in the commercially important greenlip abalone (*Haliotis laevis*). We assessed how its population structure has been influenced by environmental heterogeneity along a zonal coastal boundary with strong oceanographic connectivity in southern Australia. Using 9,109 SNPs for 371 abalones from 13 localities and environmental mapping across ~800 km, we identify 8,786 putatively neutral and 323 candidate adaptive loci. From a neutral perspective, the species represents a metapopulation with very low differentiation ($F_{ST}=0.0081$) and weak isolation by distance. Candidate adaptive loci, however, indicated five divergent population clusters. The distribution of adaptive variation was correlated to minimum sea surface temperature and oxygen concentration. Around 80 candidates were annotated to genes with functions related to high temperature and low oxygen tolerance. Our study includes a documented example about the uptake of genomic information in fisheries management and supports the hypothesis of adaptive divergence due to coastal environmental heterogeneity in a connected metapopulation of a broadcast spawner.

S9**Genomics of marine organisms: contributions to ecology and evolution****Thursday 5 July, 1430 - 1445**

Mine Waste and Acute Warming Induce Energetic Stress in Key Deep-sea Fauna

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4. Ecology Research Centre, School of Biological and Environmental Sciences, The University of New South Wales, Kensington, NSW, 2052, Australia.

Abstract

Climate change could interact with pollution in all of the Earth's oceans. In the fjords of Norway, mines discharge suspended sediment that pollutes deep-sea ecosystems. Furthermore, climate change will cause more frequent down-welling of warm water in fjords. It remains unknown how these stressors may interact to affect deep-sea biota and ecosystems. Here, we exposed two deep-sea foundation species; the gorgonian coral *Primnoa resedaeformis* and the demosponge *Geodia atlantica* to suspended sediment (10 mg L⁻¹) and warming (+ 5 °C) in a factorial mesocosm experiment for 40 days. Physiology (respiration, nutrient flux) and cellular responses (cell stability) were measured for both species. Exposure to suspended sediment reduced respiration and suppressed silicate uptake of *G. atlantica*. However, combining sediment with warming caused *G. atlantica* to respire and excrete nitrogen at a greater rate. For *P. resedaeformis*, suspended sediments reduced O:N ratios however, when combined with warming, respiration, nitrogen excretion, and cellular instability all increased significantly resulting in lower O:N ratios. We show that suspended sediment and warming can act alone and also interact to cause harm to deep-sea biota. Warming and pollution could interact in the deep-sea to cause declines in these two species, and possibly other deep-sea organisms.

G1 *Deep sea and canyon ecology*
Wednesday 4 July, 1330 - 1345

Age, growth and mortality of tailor (*Pomatomus saltatrix*) in eastern Australia

Hayden T. Schilling^{1,2}, John Stewart³, Lenore Litherland⁴, James A. Smith^{1,2}, Jason D. Everett^{1,2}, Julian M. Hughes³, Iain M. Suthers^{1,2}

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3. New South Wales Department of Primary Industries, Chowder Bay Road, Mosman, NSW 2088, Australia
4. Fisheries Queensland, Brisbane, QLD, Australia

Abstract

Pomatomus saltatrix is a globally distributed pelagic mesopredator with previously identified differences in life history patterns. Despite being a key recreational species and subject to high fishing pressure in eastern Australia, many characteristics of *P. saltatrix*'s life history remain undefined. Over 3 years, Over 3,500 fish were sampled from recreational and commercial fishers across two jurisdictions. Annual formation of rings within otoliths was validated and whole otoliths were shown to be equivalent to sectioned otoliths. Growth was determined to be fast yet the oldest collected fish was 6 years old, suggesting possible age truncation of this stock as other populations of the same species are commonly caught at older ages. Continued sampling of length frequencies has shown a decline in total annual mortality due to the introduction of harvest restrictions by management authorities.

Poster presentation

S14

Evaluating estuarine nursery use and life history patterns of tailor (*Pomatomus saltatrix*) in eastern Australia

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5. New South Wales Department of Primary Industries, Chowder Bay Road, Mosman, NSW 2088, Australia

Abstract

Estuaries provide important nursery habitats for juvenile fish, but many species move between estuarine and coastal habitats throughout their life. We used otolith chemistry to evaluate the use of estuaries and the coastal marine environment by juvenile *Pomatomus saltatrix* in eastern Australia. Otolith chemical signatures of juveniles from 12 estuaries, spanning 10° of latitude, were characterised using LA-ICP-MS. Based upon multivariate elemental signatures, fish collected from most estuaries could not be successfully discriminated. This was attributed to the varying influence of marine water on otolith elemental composition in fish from all estuaries. Using a reduced number of estuarine groups, the multivariate juvenile otolith elemental signatures and univariate Sr:Ca ratio suggests that 24-52% of adult *P. saltatrix* had a juvenile period influenced by the marine environment. Elemental profiles across adult otoliths highlighted a variety of life history patterns, rather than a consistent juvenile estuarine phase. The presence of juveniles in coastal waters was confirmed from historical coastal trawls. Combining multiple lines of evidence suggests considerable plasticity in juvenile life history for *P. saltatrix* in eastern Australia, utilising both estuarine and coastal nurseries. Knowledge of juvenile life history is important for the management of coastal species of commercial and recreational importance.

G2

Life history and connectivity in the ocean

Tuesday 3 July, 1445 - 1500

Environmental heterogeneity promotes fauna diversity in submarine canyons

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Abstract

Submarine canyons may support high diversity and abundance of benthic megafauna relative to other seabed areas, and are frequently regarded as priority features for marine conservation planning. However, not all canyons or parts of canyons provide high-quality habitats for megabenthos, and knowledge of how diversity of benthic megafauna is related to attributes of canyon environments is surprisingly poorly tested. Here we test whether there is enhancement of faunal diversity by habitat heterogeneity in canyons, focusing primarily at local scales. We analysed data from 63 video transects taken in 21 canyons off Australia over depths from 70 to 1300 m. Images were scored for properties of fauna, substratum type and seabed geomorphology, and analysed with metrics for seabed slope and hardness. Patterns in fauna diversity were driven by the combined effect of depth range (primarily) and variance in seabed properties (mostly substrate type); there was a strong effect of local seabed heterogeneity matched at the same scale. These local effects are, hypothetically, modified and re-shaped by a) processes acting at the scale of whole canyons (e.g. size, upwelling intensity), b) seascape effects (e.g. connectivity) and c) fishing disturbance. The relative role of these drivers and their interactions remain to be further examined.

G1 *Deep sea and canyon ecology*
Wednesday 4 July, 1115 - 1130

Limited Connectivity Between Local Jellyfish (*Copula sivickisi*, Class Cubozoa) Populations

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Abstract

The abundance of cubozoan jellyfishes can vary greatly spatially and temporally, making it difficult to study species population dynamics. We investigated the population structure and habitat preference of *Copula sivickisi*, a harmless cubozoan, by mapping its distribution at multiple spatial scales. 'Jelly Cams', underwater cameras paired with a light attractant, were deployed at increasing spatial scales, from a 300 by 400 m grid within a single bay, to across multiple bays and reefs spanning 12 km. *C. sivickisi* were largely restricted to habitats with sargassum algae and, relatedly, to depths less than 9 m. The abundance of *C. sivickisi* peaked in the middle of algal bands and dropped off to zero where the bands ended. *C. sivickisi* were found in all bays and reefs sampled except the southernmost reef, which was the most exposed. Medusae showed no preference for water seeded with sargassum algae or with conspecifics in flume tank experiments, suggesting that their ability to navigate to algae via chemotaxis may be limited. The strong association between *C. sivickisi* and sargassum algae, the restriction of *C. sivickisi* to sheltered habitats and the limited navigation ability of medusae, may restrict the connectivity between populations.

G2 *Life history and connectivity in the ocean*
Tuesday 3 July, 1545 - 1600

Economic Incentives Reduce Plastic Inputs to the Ocean

Qamar A. Schuyler¹, Britta Denise Hardesty¹, TJ Lawson¹, Kimberley Opie² and Chris Wilcox¹

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2. CSIRO Land and Water, Clayton, South Victoria, Australia

Abstract

Marine debris has significant detrimental effects on wildlife, public health, and the economy. Container deposit legislation (CDL) is one of the many legislative actions aimed at curbing the amount of debris entering the ocean. Beverage containers are consistently among the most commonly littered items, so effective legislation could prove a significant lever to reduce debris inputs to the marine environment. The effectiveness of CDL at reducing the amount of beverage container litter on the coasts of two countries, Australia and the United States, was evaluated by comparing results of debris surveys in states with and without cash incentives for returned beverage containers. The proportion of containers found in coastal debris surveys in states with CDL was approximately 40% lower than in states without CDL. Additionally, CDL states had a higher ratio of lids to bottles, further demonstrating the effectiveness of the incentives in removing bottles from the waste stream. The reduction in beverage containers in the presence of CDL was greater in areas with low socio-economic status, where debris loads are highest. These results provide strong evidence that fewer beverage containers end up as mismanaged coastal waste in states that provide a cash refund for returned beverage containers.

S16 *Marine Debris: the world-wide pollution crisis acting on local to global scales*
Thursday 5 July, 1215 - 1230

Adsorption of Fish-Killing Algal Toxins to Clay Particles as a Mitigation Strategy for Harmful Algal Blooms

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Abstract

Fish-killing algal blooms pose a significant risk to a globally expanding aquaculture industry and effective management strategies are urgently required. The only approach currently practised in the field (South Korea), is the application of clay rich soil to flocculate harmful algal cells. In 2015, we worked closely with Korean scientists on routine clay dispersal operations targeting *Cochlodinium polykrikoides* blooms off Namhae Island (\$1.5M of fish lost). Clay dispersal effectively reduced algal cell concentrations to below levels considered dangerous to finfish aquaculture (<300 cells mL⁻¹), but exacerbated toxicity towards the gill cell line RTgill-W1 by up to 32% when compared to control sites. Subsequent laboratory studies revealed *Cochlodinium* cell lysis after clay treatment as the principal cause of increased toxicity. However, applying a finely ground version of the identical clay completely eliminated toxicity towards the gill cell line. Further screening of 14 different clay types for removal of gill cell damaging toxins produced by ten different algal species proved bentonite type clays to be best suited for this purpose (100% removal of toxicity in all cases). These findings highlight the potential of clay for the adsorption of fish-killing algal toxins and point towards fine-tuning current practices for improved treatment efficacy.

S8 *Marine microbes as mediators of ocean processes*
Wednesday 4 July, 1415 - 1430

Convergence of marine megafauna movement patterns in coastal and open oceans

Ana Sequeira¹

1. University of Western Australia, Perth, WA, Australia

Abstract

Effective conservation of highly migratory marine species requires identification of the intrinsic and extrinsic drivers of their movement at large scales. We collated and analysed a global dataset of ~ 2.8 million locations from > 2,600 tracked individuals across 50 marine vertebrates, including sharks, whales, seals, penguins, flying birds, sirenians and polar bears, using different locomotion modes (fly, swim, walk/paddle) and evolutionarily separated by millions of years. We found that movement patterns of marine vertebrates are mostly independent of their evolutionary histories, differing significantly from the patterns known for terrestrial animals (i.e. scaling with body size). We detected a remarkable convergence in the distribution of speed and turning angles across marine vertebrates, ranging from whales to turtles. Results show a prevalence of movement patterns dominated by search behaviour on coastal habitats compared to more directed, ballistic movement patterns when the animals move across the open ocean. Efforts to develop understanding of how movement patterns of marine vertebrates will alter with forecasted severe ocean changes (e.g., reduced Arctic sea ice cover, sea level rise or declining oxygen content), should specifically consider the habitat(s) through which they move.

S13

From sea to coast – marine mammals in a connected world

Monday 2 July, 1330 - 1345

Range expansion and the impacts of an invasive sea star on the behavioural and morphology of a native bivalve

Craig Sherman¹, Lucy Klein¹, Peter Biro¹, Mark Richardson¹, Simeon Lisovski¹, Andrea West¹, Nathan Bott², Randall Lee³, Alastair Hirst³

1. Deakin University, Waurn Ponds, VIC, Australia
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3. Environmental Protection Authority, Melbourne, VIC, Australia

Abstract

The establishment and subsequent spread of invasive species is widely recognized as one of the most threatening processes contributing to global biodiversity loss. Understanding the mechanisms of range expansion is therefore of significant interest to ecologists and conservation managers alike. Invasive species can also cause evolutionary shifts in a range of life history and behavioural traits of native species. Here we report on the range expansion of the Northern Pacific sea star (*Asterias amurensis*) and explore the anti-predatory behaviour of the native scallop (*Pecten fumatus*) to this introduced predatory sea star. Hydrodynamic modelling combined with eDNA plankton sampling demonstrated that the establishment of range expansion populations is consistent with natural larval dispersal and recruitment. We also carried out escape response trials using scallops from populations with more than 20 years of exposure to the sea star and with scallops with no history of exposure. We found a significant difference in the anti-predatory response of exposed and non-exposed populations, suggesting that exposed populations may have evolved novel anti-predatory responses over a relatively short time period.

S10 **Marine biosecurity in an increasingly-connected world: protecting Australia from marine pests and diseases**

Wednesday 4 July, 1145 - 1200

Drivers of diversification in rock lobsters

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4. Institute for Marine and Antarctic Studies, University of Tasmania, Hobart, TAS 7001, Australia

Abstract

It is commonly accepted that speciation can occur without spatial separation. However, these processes are not well understood as they are usually multi-genic and multiple mechanisms can contribute to reproductive barriers. With a pelagic larval duration of up to two years, lobsters from the genus *Jasus* are ideal for investigating diversification with gene flow. The genus *Jasus* is distributed in a tight latitudinal band (-25° to -47°) and consists of six species: *Jasus edwardsii*, *J. paulensis*, *J. caveorum*, *J. frontalis*, *J. tristani* and *J. lalandii*. However, phylogenetic relationships within the group are yet to be fully resolved. We used nuclear (single nucleotide polymorphisms - SNPs - and sequences) and mitochondrial data to investigate diversification within this genus. Well-resolved phylogenetic trees were recovered when using both nuclear sequences and SNPs, placing *J. frontalis* as the sister taxon to a clade containing all remaining *Jasus* species. Mito-nuclear discordance was evident and may be the result of historical mitochondrial introgression during past glacial cycles. Genomewide SNPs suggests possible admixture events between *Jasus* species. The results highlight the importance of using independent genome-wide sources of evidence for inferring robust phylogenetic relationships.

S9

Genomics of marine organisms: contributions to ecology and evolution

Thursday 5 July, 1215 - 1230

Impact of tissue type and sex in the discovery of single nucleotide polymorphisms (SNPs) in rock lobsters

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4. Institute for Marine and Antarctic Studies, University of Tasmania, Hobart, TAS 7001, Australia

Abstract

Recent advances in massively parallel sequencing technologies have facilitated genome wide studies in non-model organisms, with thousands of markers being genotyped in hundreds of individuals. In studies employing such methods, random sampling of individuals and markers across the genome are expected to avoid potential bias. However, opportunistic sampling designs are frequent and bias can occur for example with sex-linked markers. Here we explore the potential impacts of tissue type and sex in the discovery of single nucleotide polymorphisms (SNPs) using genome complexity reduction (DArTseq™). We use a total of 450 adult lobster samples from the genus *Jasus* to test the effects of tissue type (287 from legs and 163 from pleopods). We also use 135 of these samples to test the effects of sex ratio and for identification of sex-linked markers (50 females and 85 males). Results from this study emphasise the importance of controlling for sex ratio and tissue type for accurate studies using genome wide markers. The markers developed here are being used to investigate the genomic basis of adaptation in the genus *Jasus* and to assess levels of neutral genetic variability between populations.

Poster presentation

S9

Exploring seahorse habitat choice: Will seahorses choose artificial habitat over natural habitat?

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Abstract

Artificial structures, including specifically designed artificial habitats, have long been considered a potential tool in the conservation of threatened species, though this idea often requires further exploration.

As a result of declining natural habitat availability, seahorses have been observed inhabiting artificial structures such as swimming nets. While research has explored whether seahorses disproportionately inhabit some natural habitat over others, or swimming net panels with varying amounts of epibiotic growth, it has not yet been explored whether seahorses choose to inhabit swimming nets when natural habitat is also present.

Adult *Hippocampus whitei* individuals were offered a choice between different habitats in a series of choice experiments conducted with the aim of determining a ranking of habitats and exploring whether seahorses would choose swimming nets over other natural habitats. It was found that seahorses displayed a consistent choice for swimming nets over other available habitats, which were selected according to the following rankings: 1: Net, 2: *Sargassum* sp., 3: *Posidonia australis*, 4: *Zostera muelleri*.

Thus, artificial structures and habitat units may be a powerful conservation tool in as far as they may be selected and inhabited by seahorses, though further research needs to explore their ability to house a healthy seahorse population.

S11 **Marine biodiversity conservation – what's effective?**
Wednesday 4 July, 1545 - 1600

Marine acoustic mapping of turbid, macro-tidal coastal environments – a large-scale example from tropical northern Australia

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Abstract

Northern Australia's highly turbid coastal waters present challenges for seabed habitat and bathymetric mapping. In these environmental conditions multibeam sonar systems rather than LIDAR are required technologies. By integrating seabed sonar data with sub-bottom profiles and sediment sample data, critical environmental baseline information is obtained, improving our understanding of coastal processes. Integrated seabed mapping is a core part of a four year collaborative program between the Northern Territory Government, Geoscience Australia and Australian Institute of Marine Science, which is funded by the INPEX-operated Ichthys LNG Project and collaborator co-investment. Here, we outline key insights gained from mapping the seafloor of the greater Darwin Harbour area using this integrated multibeam and sub-bottom approach. These new data reveal both terrestrial and marine palaeo- and recent environments. Geomorphic features identified include reefs, sediment bedforms and erosional surfaces, indicating a range of contemporary processes. These features produce a diversity of benthic habitats that support sessile and infaunal communities that are adapted to this turbid and dynamic environment. These data will be used to inform management of the benthic habitats of Darwin Harbour and help guide monitoring of biological communities.

S3

Seafloor Mapping in Australia – Progress, Discoveries, Applications
Monday 2 July, 1700 - 1715

The effect of dietary inclusions of dried *Gracilaria cliftonii* meal and high water temperatures on feeding and behaviour of juvenile greenlip abalone (*Haliotis laevis*).

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2. Flinders University, College of Science and Engineering, Adelaide, SA 5001, Australia
3. University of Adelaide, School of Animal and Veterinary Sciences, Roseworthy, SA 5371, Australia
4. Marine Innovation Southern Australia.

Abstract

Greenlip abalone (*Haliotis laevis*) cultured in Australian land-based systems are subjected to acute high summer water temperatures, which leads to decreased feed intake and survival. There is interest in incorporating dried macroalgae meals in formulated diets for greenlip abalone to improve feed intake during periods of high water temperatures. This multifactorial study used a ventral videography technique to monitor the feeding behaviour of juvenile greenlip abalone fed a 0% basal diet or a diet containing 10% protein enriched *Gracilaria cliftonii* meal at optimal (22°C) and high water temperatures (26°C). Abalone were acclimated at 22°C for two weeks, and then water temperature was raised 1°C day⁻¹ until 26°C was achieved, and then abalone feeding and homing behaviour was subsequently videoed monitored and scored. Abalone fed the 10% dried *G. cliftonii* diet had a higher feed intake and commenced feeding earlier during daylight compared to those fed the 0% basal diet. The homing behaviour of abalone decreased as water temperature increased. This study demonstrated the potential of using *G. cliftonii* meal dietary inclusion to stimulate feeding in greenlip abalone during periods of both optimal and high water temperatures, and the effect high water temperature has on homing behaviour.

S15 **Aquaculture blue economy**
Tuesday 3 July, 1415 - 1430

Sub-seasonal to Seasonal Sea Surface Temperature Forecasts for applications in the Australasian Region

Grant A Smith¹, Claire Spillman¹

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Abstract

Marine park managers and members of the aquaculture & fisheries industries rely on sea surface temperature (SST) seasonal forecasts to better inform their decision-making. 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 around the Australian coastline. The skill of the ACCESS-S1 SST forecasts were assessed against satellite observations 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 made available as both spatial maps and indices plots for regions of interest around Australia.

S2***Extremes: causes, symptoms, and impacts*****Monday 2 July, 1645 - 1700**

Tracing the Source of Plastic Bottles on Beaches in Northern New South Wales, Australia

Stephen D. A. Smith¹, Kelsey Banister¹, Nicola Fraser¹ and Robert J. Edgar¹

1. National Marine Science Centre, Southern Cross University, Bay Drive, Coffs Harbour, NSW, 2450

Abstract

Beach-stranded marine debris is often dominated by fragments of plastic, making it difficult to identify its likely origin: this limits our capacity for targeted mitigation measures. In this study, in collaboration with volunteers, we surveyed plastic bottles as a relatively identifiable subset of plastics at sites along a 200-km section of the north coast of New South Wales, from Coffs Harbour north to Byron Bay. Source and product type were determined using barcodes, inscriptions/embossing, or bottle shape and characteristics. We were able to identify the country of origin and product type for 505 of the 694 bottles collected. Just over half (51%) of these were of domestic origin with the remainder dominated by bottles from China (24%) and south-east Asian countries (21%). As most of the foreign bottles lacked marine growth, and are unavailable for purchase in the region, passing ships are the most likely source. Densities on remote beaches were significantly greater than those recorded from accessible beaches and this is likely due to removal of items by beach goers. Monitoring of bottles on remote beaches has now been incorporated into a statewide program to evaluate the impact of the Container Deposit Scheme in NSW.

S16 *Marine Debris: the world-wide pollution crisis acting on local to global scales*
Thursday 5 July 1145 - 1200

Community Assembly Along the Subtropical-to-temperate Transition: Mechanistic Insights From Eastern Australia

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Abstract

Biogeographic transition zones, where tropical, subtropical and temperate species overlap, are being transformed by changes in species distributions and interactions and provide a unique 'window' into how climate change might influence complex biological systems. Here, we examine these dynamics in the subtropical-to-temperate transition zone in eastern Australia, where corals occur at their high-latitude range limits. We combine fine-scale field data with functional and phylogenetic data to investigate the mechanisms that shape ecological dynamics in this region. For corals, results are consistent with the hierarchical filtering model of community assembly, whereby species pass through a regional climatic filter based on their tolerances for marginal conditions and subsequently segregate into local assemblages according to the relative strength of habitat filtering and species interactions. Moreover, patterns of algae, sea urchin and fish abundance point to the important role of these taxa on high-latitude reefs. For example, coral cover is negatively associated with algae cover, and sea urchins are more abundant at higher latitudes, where they likely release corals from algal competition. Understanding the links between community composition, species interactions and environmental conditions for multiple taxa leads to an ecosystem understanding of transition zones and of how complex ecosystems may respond to climate change.

S5

Structure and function of coral reefs in a changing world

Wednesday 4 July 1200 - 1215

Remotely piloted aircrafts improve the precision of monitoring for fur seals

Karina Sorrell^{1,2}, Rohan Clarke¹, Ross Holmberg², and Rebecca McIntosh².

1. School of Biological Sciences, Monash University, Clayton, Vic 3800.
2. Conservation Department, Phillip Is Nature Parks, Vic 3922.

Abstract

Remotely piloted aircrafts (RPAs) have revolutionised the field of spatial and temporal ecology. Major benefits for environmental management, including population monitoring, have followed for many animal taxa. Prior to this study, RPAs had not been used to monitor fur seals, although the potential advantages of this technology were apparent. We used fur seals as a model system to assess how counts derived from RPA surveys compared with traditional ground count and mark-recapture techniques to derive abundance estimates. All major Victorian fur seal colonies were counted from RPA-imagery using a recently developed citizen science portal, 'Seal Spotter'. For some sites, RPA-imagery provided measurable improvement when compared with traditional methods, including reductions in disturbance to fur seals, and more precise counts. However, the use of RPAs was not possible at some sites given terrain or the potential for negative interactions with other wildlife. Our findings have the potential to improve wildlife monitoring techniques for both fur seals, and a broader range of animal taxa. In particular, our comparative approach that incorporates multiple census methods presents an objective case for transitioning to the monitoring technique with the highest efficacy.

S13 *From sea to coast – marine mammals in a connected world*
Monday 2 July, 1530 - 1545

Low-power, Low-cost Oceanographic Drifters

Craig Steinberg¹, Damien Jorgensen¹, Andreas Klein-Miloslavich¹, Paul Rigby¹, Robby McKilliam², David Haley² and Alex Grant²

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2. Myriota Pty Ltd, 25 Chesser St, Adelaide, SA, 5000

Abstract

Oceanographic drifters have a critical role to play in measuring the fine details of ocean dynamics—from the direction and speed of currents and eddies to the physical characteristics of parcels of water within the wider ocean. Here we present details of a drifter which is particularly suited for shallow deployments in remote coastal and coral reef environments, and which takes full advantage of the latest low-power, low-cost sensors and ‘Internet of Things’ (IoT) communications technology. Applications delivered by the IoT have the potential to increase operational efficiency, reliability and safety. However, a challenge exists to deliver connectivity with remote marine science platforms at a cost, battery life and form factor that makes the deployments viable. This is especially true in cases where the system must scale to support large numbers of devices. The AIMS drifter is built upon the Myriota communications module, which securely delivers high-value small-data direct to a constellation of low Earth orbit satellites. Recent results from pilot deployments within the Great Barrier Reef are presented, where the drifter GPS track, sea-surface temperature and barometric pressure are successfully transmitted multiple times per day.

Poster presentation

S1

Seasonal Cross-shelf Exchanges along the Great Barrier Reef

Craig Steinberg¹, Hemerson Tonin¹, Felicity McAllister, Jessica Benthuisen¹, Mike Herzfeld² and Richard Brinkman¹

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2. CSIRO Oceans and Atmosphere, Castray Esplanade, Hobart, Tas, 7004.

Abstract

A wide variety of processes have been observed and modelled that provide evidence of cross-shelf exchanges that affect the ecology of the Great Barrier Reef. Whilst at first it may seem that the along-shelf flows generated by the prevailing SE trades and boundary currents would dominate the circulation, cross-shelf flows are of fundamental importance and account for a significant proportion of the flushing and the introduction of nutrients. From spring to summer when the trades ease and the East Australian Current accelerates sub-surface intrusions of deeper Coral Sea waters make their way across the shelf. The complex reef matrices can channel these flows and mix them alleviating surface warming on the outer shelf.

During a successful monsoon season or wet season river plumes can extend hundreds of kilometres along the shelf but also extend across the shelf into the Coral Sea. In one extreme case a freshwater plume from the Burdekin can be seen to deflect the East Australian Current. In autumn as coastal waters cool Dense Shelf Water Cascades have also been observed to move across the seafloor across the shelf. The presentation will provide an overview of the processes from a mix of IMOS observations and eReefs modelling.

S1 *Cross-shelf exchange processes*
Monday 2 July, 1345 - 1400

FAD or Function? The importance of towers, planktivory and connectivity for sustainable fishing on designed artificial reefs.

Iain M Suthers, Michael B Lowry, Alistair Becker, Matthew D Taylor and James Smith

I.M.Suthers@unsw.edu.au

Abstract

Designed offshore artificial reefs with structure - such as pillars and towers - which occupy a significant proportion of the water column, can support a biomass of fish five times greater than adjacent natural reefs, and similar to that found on decommissioned oil platforms. Compared to natural reefs, designed reefs extend up into the plankton-rich coastal waters providing habitat for planktivorous and predatory fish. The key to this ecosystem is the delivery of plankton by coastal currents to a "wall of mouths" of forage fish and to the benthic assemblage attached to the reef. The artificial reef ecosystem enables an extension of the high degree of planktivory now recognised for the temperate rocky reef community off eastern Australia, and possibly elsewhere. This review compares fish assemblage and the vertical relief of Australia's first designed, offshore artificial reef - deployed in 2011 off Sydney - with other artificial reef studies. Two groups of planktivorous rocky reef fish are identified: pelagic schooling species and those that are site attached. The Sydney offshore artificial reef has a distinctive fish assemblage compared to natural reefs, dominated by planktivorous site attached fish (*Atypichthyes strigatus*), and shoals of a planktivorous scad (*Trachurus novaezelandiae*). The amount of recreational fishing on the reef in terms of boat-effort was approximately 1,500-2,500 boat hours per year, resulting in an estimated catch of 700 kg pa, from a structure only 12 m by 15 m. Approximately a third of this harvest can be attributed to planktivory around the 12 m high towers, with remainder attributed to a process of fish attraction and connectivity with other reefs. The trophic ecology of fish movements between natural and artificial reefs and the adjacent estuary is a key unknown in our understanding of sustainable recreational harvests from these increasingly popular deployments.

G5 *Estuaries and coasts*
Thursday 5 July, 1445-1500

Novel, less invasive sampling for anthropogenic pollutant investigations in pinnipeds

Shannon Taylor¹, Michael Lynch², Alan Yates³, Michael Terkildsen¹, Gavin Stevenson³, Nino Piro³, Jesuina de Araujo³, Rachael Gray¹

1. Sydney School of Veterinary Science, The University of Sydney, Camperdown, NSW, Australia
2. Melbourne Zoo, Parkville, Victoria, Australia
3. Australian Ultra Trace Laboratory, National Measurement Institute, North Ryde, NSW, Australia

Abstract

Persistent Organic Pollutants (POPs) cause toxicity in a range of species with those dominating the upper trophic level particularly vulnerable to their bioaccumulative toxic effects. As long-lived, upper trophic predators, marine mammals are considered to be sentinels of marine ecosystem health. Blubber is the 'gold standard' sample matrix for determining POPs concentrations in marine mammals, largely limiting sampling to dead individuals. This study evaluates the utility of fur as a less invasive biomarker to assess pollutant exposure in the Australian fur seal, *Arctocephalus pusillus doriferus*.

The concentration of selected POPs including dioxin/furans (PCDD/Fs), dioxin-like polychlorinated biphenyls (dl-PCBs), and polybrominated diphenyl ethers (PBDEs) was determined in blubber and fur using high resolution mass spectrometry (HRMS) or liquid chromatography mass spectrometry (LCMS). Elevated levels of several compounds, including the most toxic dioxins, were detected in juvenile Australian fur seals with alopecia (hair loss) at Lady Julia Percy Island, in fur seals stranded along the Victorian coast and also in neonatal pups at Seal Rocks. The latter indicates the risk of POPs mediated toxicity in-utero, a particularly susceptible developmental stage.

We discuss the significance of POPs in relation to pinniped health and evaluate the utility of fur as a biomarker for anthropogenic pollutants in the marine environment.

S13***From sea to coast – marine mammals in a connected world*****Tuesday 3 July, 1145 - 1200**

Investigating the role of Competitive Processes in Mediating Range Expansions of Tropical Vagrant Fish.

Thomas Taylor¹, Will Figueira¹,

1. University of Sydney, Camperdown NSW 2006

Abstract

Climate change is promoting fast poleward expansion in many tropical marine fish species. With projected increases in sea surface temperatures, there is significant scope for increased range expansions in the future. However, the strength and consequences of competitive interactions between vagrant and resident fishes are largely unknown. We investigate how ecologically similar vagrant and resident species affect the patterns of habitat use and behaviour of one another using 3D photogrammetry and time budget analysis. Two territorial species; the vagrant *Stegastes gascoynei* and resident *Parma microlepis* were compared along with two schooling species; vagrant *Abudefduf vaigiensis* and resident *Atypichthys strigatus*. There was a shift in the type and structural complexity of habitat occupied, with individuals found in seemingly less preferred habitats in the presence of their pair than without it. However, behavioural effects were only apparent for the territorial species, which had altered feeding and vigilance patterns. This demonstrates that competition is likely playing a role in limiting the range expansion capacity of the vagrant species evaluated here and mitigating their impact on resident fish assemblages. While similar research on additional species would be required to determine how broad these relationships are, these results serve to highlight the role of competition in regulating range expansions.

S7

Micro- to Macro-: connecting multi-scale climate change research in marine systems
Thursday 5 July, 1415 - 1430

Plastic Leachate Exposure Affects Photosynthesis Of Marine *Prochlorococcus*

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1. Department of Molecular Sciences, Macquarie University, North Ryde, 2109, NSW, Australia.
2. Marinebiologisk Lab, University of Copenhagen, Denmark.

Abstract

Marine microorganisms are crucial in maintaining the earth's climate and sustaining biogeochemical processes. Photosynthetic marine microorganisms are particularly important, contributing significantly to global oxygen production and providing food for higher trophic levels. One of the most abundant marine photosynthetic bacteria, *Prochlorococcus* spp. are important contributors to oceanic primary production. Marine plastic pollution is a growing, globally recognized problem. However, the potential for plastics to impact key marine bacteria through leaching of toxicants has not been explored previously. Our work has determined the impact of exposure to leachates from plastic bags (HDPE) and plastic matting (PVC) on *in vitro* growth and primary productivity of *Prochlorococcus marinus* NATL2A and MIT9312 (model low light and high light adapted ecotypes). Growth of *Prochlorococcus* NATL2A and MIT9312 was significantly impacted ($p < 0.001$) by all tested concentrations of HDPE and PVC leachate within 72 hours of exposure. Photosynthetic effective quantum yield (Φ) of PSII and oxygen production was also significantly impaired by leachate exposure, with strain specific differences in sensitivity observed. Understanding how plastic leachates impact key marine primary producers will help us better understand the risks of plastic pollution to marine ecosystems.

S16 *Marine Debris: the world-wide pollution crisis acting on local to global scales*
Thursday 5 July, 1415 - 1430

Impacts of vitamin K1 on tissue vitamin K levels, immunity, oxidative status and survival of greenlip abalone (*Haliotis laevis*) at high summer water temperatures.

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1. School of Animal and Veterinary Sciences, The University of Adelaide, Roseworthy, SA 5371, Australia
2. Centre for Paediatric and Adolescent Gastroenterology, Children, Youth and Women's Health Service, North Adelaide, SA 5006, Australia
3. College of Science and Engineering, Flinders University, Adelaide, SA 5001, Australia
4. South Australian Research and Development Institute, Aquatic Sciences Centre, Marine Innovation South Australia, West Beach, SA 5024, Australia
5. Marine Innovation Southern Australia

Abstract

Summer mortality, associated with high temperature (>23°C), low dissolved oxygen levels, increased bacterial loads and immune suppression, affects land-based production of greenlip abalone (*Haliotis laevis*) in Southern Australia. This 39 day study aimed to reduce mortality of greenlip abalone (72 g) by dietary intervention using vitamin K1 (levels of 0.0, 0.5, 1.0 and 5.0 mg kg⁻¹ diet) to support the innate immune system and oxidative status. Diets were fed at 22 and 25°C. No mortalities occurred at 22°C, however, high mortalities occurred in all treatments at 25°C. Compared to the negative control diet (0.0 mg kg⁻¹ K1 at 25°C), the inclusion of vitamin K1 did not improve survival, oxidative status or immune function ($P>0.05$). Vitamin K1 inclusion significantly increased vitamin K1 concentrations of visceral organ and muscle tissues; however, steady-state levels were not reached. In contrast, when fed vitamin K1, steady-state levels of vitamin K2-MK-4 were achieved in visceral organ and muscle tissues, and for vitamin K2-MK-7 in visceral organ tissue. This indicates efficient interconversion. In conclusion, vitamin K1, at levels of up to 5.0 mg kg⁻¹, resulted in significant increases in visceral organ and muscle tissues vitamin K1 concentrations, but failed to improve immune function, oxidative status or survival at 25°C.

S15 **Aquaculture blue economy**
Tuesday 3 July, 1445 - 1500

Scaling the Oceans

Peter Thompson¹

1. CSIRO Oceans and Atmosphere, 3-4 Castray Esplanade, Hobart, Tasmania, 7001.
AMSA 2018

Abstract

Oceanic phytoplankton captures some 55 gigatonnes of CO₂ per year; or about 40% of global primary production (PP). About 0.2% is harvested as fish (~100 megatonnes) and something between 1 and 3% reaches the ocean floor. PP, fisheries and carbon sedimentation are increasingly important to humans but they all have enormous spatial and temporal variability that is, in part, dependent upon the type and size of phytoplankton. With > 5000 species that vary in volume over 9 orders of magnitude and abundance that varies from ~ 0 to 100,000,000 cells L⁻¹ it is a challenge to estimate the current status. Improving the oceanic carbon budget and predicting carbon fluxes in a changing ocean remains a greater challenge. Remote sensing provides a more precise estimated phytoplankton biomass but models PP and trophic transfer have low precision. In this presentation I review the trends observed at > 300 global, long-term time-series of phytoplankton abundance, composition and the environment. For example, 97% of the North Atlantic Ocean has warmed but, contrary to models, a significant majority of sites showed increases in dinoflagellates and zooplankton. Where sufficient data are available the time series stations may provide the best predictors of future ecology.

S7

Micro- to Macro-: connecting multi-scale climate change research in marine systems

Thursday 5 July, 1015 - 1030

Global Ocean Observing System (GOOS)

Peter Thompson¹

1. CSIRO Oceans and Atmosphere, 3-4 Castray Esplanade, Hobart, Tasmania, 7001

Abstract

GOOS coordinates observations around the global ocean for three critical themes: climate, ocean health, and real-time services. These themes correspond to the GOOS mandate to contribute to the UNFCCC Convention on climate change, the UN convention on biodiversity and the IOC/WMO mandates to provide operational ocean services, respectively. Currently there are 3 very active GOOS panels for climate, biogeochemistry and biological+ecosystem panels, seeking global consensus on the 'essential ocean variables'. The challenges are substantial and the potential rewards are significant. The status of these efforts will be reviewed, Australia's current involvement and opportunities to shape the future of global ocean observing discussed following the presentation.

S7

Micro- to Macro-: connecting multi-scale climate change research in marine systems

Thursday 5 July, 1445 - 1530

Newborn humpback whale (*Megaptera novaeangliae*) observations in the Gold Coast Bay, Queensland, Australia

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1. Coastal-Marine Research Group, Institute of Natural and Mathematical Sciences, Massey University, Private Bag 102 904, North Shore MSC, Auckland 0745, New Zealand
2. Griffith Centre for Coastal Management, Griffith University, Queensland 4222, Australia
3. Humpbacks and High-rises, Gold Coast, Queensland, Australia
4. NorthTech, Whangarei, New Zealand

Abstract

Humpback whales (*Megaptera novaeangliae*) undertake an annual migration and suitable calving habitat includes warm (19 to 24°C), shallow, sheltered tropical waters. East Australian humpback whales are believed to breed in the Great Barrier Reef Region. Here we investigated calving occurring outside the primary breeding grounds by examining (1) spatial location at which newborn calves were observed (2) depth and SST associated with newborn observations and (3) relative age classification of observed newborns. Using citizen science and platforms of opportunity, we investigated the occurrence of newborn calves being found in Gold Coast Bay between 2013 and 2016. A total of 75 newborn calves were observed during June (n = 3), July (n = 38), August (n = 31), September (n = 2), and October (n = 1). Newborns were categorized as Class 1 (n = 30) or Class 2 (n = 45) based on diagnostic morphological features. Our investigation indicated that parturition occurs regularly along the northern migration, 1000 km outside the known calving grounds. We conclude that some humpback whales are utilising warm and shallow waters in south-east Queensland to birth their calves whilst still on migration. These findings may signify that this population is expanding its calving range into unknown and unprotected areas.

S13 *From sea to coast – marine mammals in a connected world*
Monday 2 July, 1415 - 1430

Sediment Arsenic in Darwin Harbour

Tsang, Jeffrey^{*1}, Claire Phillips², Lynda Radke^{2,3}, Bill Maher⁴, Frank Krikowa⁴, Will Bennett⁵, Niels Munksgaard⁶ and Edward Butler¹

1. Australian Institute of Marine Science, PO Box 41775, Casuarina NT 0811
2. Geoscience Australia, GPO Box 378 Canberra ACT 2601
3. Current: Department of Environment and Natural Resources, Northern Territory Government, Goyder Centre, 25 Chung Wah Terrace, Palmerston NT 0830
4. Institute for Applied Ecology, University of Canberra, Locked Bag 1, Canberra ACT 2601
5. Environmental Futures Research Institute, Griffith University, Southport QLD 4215
6. Research Institute for the Environment and Livelihoods, Charles Darwin University, Darwin NT 0909

Abstract

During a seabed mapping survey of outer Darwin Harbour, 93 sediment samples were collected in 2015 from random waypoints that were stratified spatially and by water depth. The average sediment arsenic (As) concentration was 33 mg/kg, but ranged from 6–134 mg/kg. Two thirds of sediment As concentrations measured exceeded the national sediment quality guideline (SQG) value of 20 mg/kg. Moreover, 10% of samples exceeded the 70 mg/kg SQG-high value, and therefore toxicity effects are possible. With no known anthropogenic sources, the elevated sediment As concentration in Darwin Harbour was attributed to the occurrence of lateritic rocks, which dominate the coastal geology around Darwin. In 2016, some outer Darwin Harbour sediments were recollected, and analyses confirmed conglomeratic laterites are sources of As. Geochemical data indicate As is associated with coarse sediment grains (sand and gravel fractions), and is not readily bioaccessible (based on dilute-acid extraction). Concentrations of As species in porewater adjacent to pisoliths (measured with diffusive gradients in thin films in aerated sediment reactors) were typically below national (low reliability) trigger values for marine water. Although sediment As concentration can be elevated in outer Darwin Harbour, it is bound tightly by laterites and not readily bioaccessible.

G5*Estuaries and coasts*

Tuesday 3 July, 1215 - 1230

Paralytic Shellfish Toxins in Tasmanian Southern Rock Lobster

Alison Turnbull¹, Catherine McLeod², Navreet Malhi¹, Jessica Tan¹, Ian Stewart³, Tim Harwood⁴, Andreas Kiermeier⁵, Gustaaf Hallegraeff⁶, Quinn Fitzgibbon⁶ & Thomas Madigan¹

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2. Seafood Safety Assessment Ltd., Hillcrest, Kilmore, Isle of Skye IV44 8RG, Scotland.
3. Queensland Alliance for Environmental Health Sciences, The University of Queensland, 39 Kessels Road, Coopers Plains, Queensland 4108, Australia
4. Cawthron Institute, 98 Halifax St East, Nelson 7010, New Zealand
5. Statistical Process Improvement Consulting and Training Pty Ltd, PO Box 301, Gumeracha, South Australia 5233, Australia
6. Institute for Marine and Antarctic Studies, University of Tasmania, Private Bag 129, Hobart, Tasmania 7001, Australia

Abstract

The paralytic shellfish toxin (PST) producing algae, *Alexandrium tamarense* Group 1, bloomed on the east coast of Tasmania in 2012, causing large scale closures of the Southern Rock Lobster fishery. Public health and market access risks are now being managed conservatively with Tasmanian lobster routinely monitored for PST. Monitoring has demonstrated that PST do not accumulate in the tail meat; however, PST have been found in the hepatopancreas of lobsters sourced from the entire east coast of Tasmania.

Field data from 2012 -2016 was combined with surveys of recreational harvesters and a cooking study in a 2-D Monte Carlo model to assess exposure of recreational harvesters to PST during bloom periods. The assessment estimated the number of hepatopancreas meals potentially causing illness could be reduced from 4% to 1% if the bivalve regulatory level was imposed. Harvest closures have occurred in 2013, 2015, 2016 and 2017 following winter blooms of *A. tamarense*. The maximum value of 10.4 mg STX.2HCl equiv/kg was found at Maria Island during the extensive 2017/2018 bloom. Research currently underway focuses on rapid test kits for PST detection, methods of non-destructive sampling, confirmation of geographic closure zones and examining the impact of PST on lobster physiology.

S8 *Marine microbes as mediators of ocean processes*

Wednesday 4 July, 1345 - 1400

Mechanistic understanding of climate driven range shifts: using thermal tolerances of rock lobster to predict future range shifts

Samantha Twiname¹, Quinn Fitzgibbon¹, Alistair Hobday², Chris Carter¹, Gretta Pecl¹

1. Institute for Marine and Antarctic Studies, University of Tasmania, Private Bag 49, Hobart, TAS 7001

2. CSIRO Oceans and Atmosphere, Castray Esplanade, Hobart, TAS 7001

Abstract

Ocean warming is affecting marine species worldwide, with one of the most observed changes being alterations to species geographical distributions. Understanding what drives these range shifts is key to predicting what may happen with future warming. We examined the aerobic and escape performance of the puerulus and juvenile stages of *Jasus edwardsii*, a common Tasmanian species of spiny rock lobster, and *Sagmariasus verreauxi*, a species of spiny rock lobster extending its range into and further south in Tasmania, Australia. *Jasus edwardsii* individuals of both life stages were tested at 16, 18, 20, 22, 24 and 26°C, and *S. verreauxi* individuals were tested at 22, 24, 26, 28 and 30°C. Intermittent flow respirometry was used to determine aerobic scope (AS), excess post-exercise oxygen consumption (EPOC) and recovery times. Escape velocities were determined from high speed stereo-video footage. The comparison between the performance measures of the two species indicates that *S. verreauxi* have higher thermal tolerances than *J. edwardsii*, and this may facilitate further expansion of this range-shifting species into Tasmanian waters with future ocean warming.

S6

Linking disciplines to advance mechanistic insights of species responses to climate change

Tuesday 3 July, 1215 - 1230

The Cumulative Effects of Global Climate Change and Local Ecosystem Drivers on a Temperate Coastal Ecosystem

Hadayet Ullah¹, Ivan Nagelkerken^{1,2}, Silvan U. Goldenberg¹, Damien A. Fordham²

1. Southern Seas Ecology Laboratories, School of Biological Sciences, University of Adelaide, Adelaide, Australia,
2. The Environment Institute, School of Biological Sciences, The University of Adelaide, Adelaide, Australia

Abstract

Global warming, in combination with the intensive exploitation of commercial marine species, has caused large-scale reorganizations of biological communities in many of the world's marine ecosystems. Accurate prediction of the potential effect of these global and local stressors on an ecosystem-level requires a comprehensive understanding of how entire species communities and their interactions respond. We used a time dynamic integrated ecosystem modeling approach (Ecosim) to investigate the independent and cumulative effects of ocean acidification and warming in conjunction with fishing on a coastal ecosystem. To quantify the effects of ocean acidification and increasing temperature at the community level, we used physiological and behavioral data of species obtained from two large-scale mesocosm experiments which include primary producers to top predators such as sharks. The ecosystem model was built on Port Philip Bay of southern Australia since our experimental approach likely mimics shallow temperate coastal ecosystems. We built ecosystem models that accounted for complex species interactions such as predation and competition, and represents the likely future productivity of the fishery under different fishing regimes at a "business-as-usual" scenario. The results of this study highlight the importance of including species interactions in future climate models to support sustainable fisheries management.

S7***Micro- to Macro-: connecting multi-scale climate change research in marine systems*****Thursday 5 July, 1145 - 1200**

Seasonal- and event-scale variations in the influence of upwelling on enrichment and primary productivity in the eastern Great Australian Bight

Paul D. van Ruth¹, Nicole L. Patten¹, Mark J. Doubell¹, Piers Chapman², Ana Redondo Rodriguez¹ and John F. Middleton¹

1. South Australian Research and Development Institute - Aquatic Sciences

2. Texas A&M University

Abstract

We used physical, chemical and biological datasets to assess the influence of upwelling on enrichment and primary productivity in the eastern Great Australian Bight at seasonal- and event-scales. The length of an upwelling season did not dictate its intensity or productivity; indeed, long, intense seasons were not necessarily the most productive. At the event-scale, temperature and salinity were better indicators of enrichment than wind stress, with temperatures $<15^{\circ}\text{C}$ and salinities <35.6 psu associated with elevated concentrations of NO_x ($>2\ \mu\text{m}$) and bursts of primary productivity ($\sim 700\ \text{mg C m}^{-2}\ \text{d}^{-1}$). We used this information to develop a conceptual model outlining 5 meteorological/oceanographic scenarios that occur in the eastern GAB, and their potential influence on enrichment and primary productivity, and hypothesise that total ecosystem productivity depends on the combination of these scenarios that occurs in the region in a given season/year. This work was conducted as part of 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 environment, economic and social values of the region; providing an information source for all to use.

S1 *Cross-shelf exchange processes*
Monday 2 July, 1430 - 1445

Can dispersal history drive spatio-temporal phenotypic differences between Southern rock lobster (*Jasus edwardsii*) post-larvae?

Cecilia Villacorta-Rath¹, Bridget S. Green¹, Caleb Gardner¹, Nick P. Murphy², Carla A. Souza², Jan M. Strugnell^{2,3}

1. Institute for Marine and Antarctic Studies, University of Tasmania, Hobart, TAS 7001, Australia
2. Department of Ecology, Environment & Evolution, La Trobe University, Melbourne, Vic 3086, Australia
3. Centre of Sustainable Tropical Fisheries and Aquaculture, James Cook University, Townsville, Qld 4810, Australia

Abstract

Recruitment of marine organisms with bi-partite life is the result of processes taking place from embryogenesis to settlement. Moreover, environmental conditions experienced during larval dispersal can determine size-at-settlement. Therefore phenotypic variability can arise in recruits due to the different dispersal histories. Here we investigated morphological differences in recently settled southern rock lobsters (*Jasus edwardsii*) recruits along a latitudinal and temporal gradient in Tasmania, Australia. We tested whether morphological variation was due to natural selection or to dispersal history. We used double digest restriction-site associated DNA sequencing (ddRADseq) to assess differences in genetic structure of recently settled recruits on the east coast of Tasmania over three months of peak settlement during 2012. Phenotypic differences in pueruli between sites and months of settlement were observed, with smaller individuals found at the northernmost site. There was a lack of overall genetic divergence, but significant differences in pairwise F_{ST} between settlement months at the southernmost study site suggested chaotic genetic patchiness. Individuals settling into that site earlier in the season were genetically different from those settling later, providing evidence for isolation by time at this site. These results suggest that larval cohesiveness during larval dispersal of *J. edwardsii* could drive phenotypic differences at settlement.

S9**Genomics of marine organisms: contributions to ecology and evolution****Thursday 5 July, 1200 - 1215**

Collaborating to maximise Australian seabed mapping efforts

Tanya Whiteway¹, Kim Picard¹, Rachel Nanson¹, Rachel Przeslawski¹, Scott Nichol¹, Stephanie McLennan¹, Aero Leplastrier¹

1. Geoscience Australia, Canberra, ACT, 2600

Abstract

In Australia and its Antarctic Territory, high-resolution seabed mapping is primarily driven by safety of navigation and environmental management requirements. Data acquisition relies on relatively few players from government agencies, universities and industry, but with considerably more end-users. Until recently, there has been limited coordination of the mapping activity which has resulted in duplication of effort, lack of consistency, loss of efficiency and limited use of the data. To address this situation, Geoscience Australia is facilitating a National Seabed Mapping Coordination Working Group which is a collaboration of Australian and New Zealand representatives from federal and state government, universities and industry. Driven by the principle of “collect once, use many times”, the group is developing a government priority plan for data acquisition in Australia, a national multibeam echosounder guideline and common seabed mapping tools, such as a survey register, that will be available on the web. GA is also collaborating nationally and internationally to develop a common geomorphic mapping approach for the interpretation of seabed data, and field manuals to standardise marine monitoring practices. This presentation highlights the progress of these initiatives and demonstrates how collaboration is crucial to the development of standards and coordination of mapping efforts.

S3

Seafloor mapping in Australia - progress, discoveries, applications
Monday 2 July, 1100 - 1115

Varying effects of anthropogenic stressors on fish assemblages: a comparison of four case studies

Sasha K. Whitmarsh¹, Charlie Huveneers¹, Peter G. Fairweather¹

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Abstract

Determining the effects of anthropogenic stressors on fish assemblages (e.g. fishing, tourism, effluent disposal, shipping, and urbanisation) is a growing area of research due to increasing concerns about the state of marine ecosystems. We used a contemporary method for assessing fish assemblages, baited underwater video, to assess the effects of such stressors through the comparison of four case studies in South Australia. These case studies include investigating: new marine park zones in upper Gulf St Vincent (GSV); effluent output from desalination and artificial structures in lower GSV; bait and berley input from shark-cage tourism at the Neptune Islands; and multiple stressors (e.g. fishing, oyster leases and effluent output) in Coffin Bay. We found mixed results from these anthropogenic stressors with evidence of assemblage change due to artificial structures in the lower GSV, but limited effects (so far) from protection in the upper GSV and no strong effect from bait and berley input at the Neptune Islands. Overall, it is unwise to assume such different stressors lead to similar impacts on fishes and these sorts of studies are needed to overturn that default mindset and assist with informing management decisions.

S11

Marine biodiversity conservation – what's effective?

Wednesday 4 July, 1330 - 1345

Finding the Missing Plastic – Resolving the Global Mass (Im)Balance for Plastic Pollution in the Ocean

Chris Wilcox¹, Erik van Sebille², Laurent Lebreton³, Britta Denise Hardesty¹,

1. CSIRO Oceans and Atmosphere Flagship, Hobart, Tasmania, Australia
2. Institute for Marine and Atmospheric Research, Department of Physics, Utrecht University
3. The Modelling House, 66b Upper Wainui Road, Raglan 3297, New Zealand

Abstract

Several global studies have attempted to estimate the standing stock of plastic debris in the oceans at the global scale. However, recent work estimating the amount lost from land on an annual basis suggests that the standing stock should be several orders of magnitude larger than the global estimates. We investigate the role of coastal deposition within the first few weeks after plastic enters the ocean and very near its sources, one of the hypothesized sinks for the missing plastic in this mass balance. We utilize a continental scale dataset of plastics collected along Australia's coast and in the offshore regions together with models of plastic release and transport based on Lagrangian tracking to investigate the role of local deposition in the coastal environment. Our models predict that the vast majority of positively buoyant plastic is deposited within a very short distance from its release point, with only a small fraction escaping into the open ocean. These predictions match our coastal and offshore observations, providing clear evidence that this mechanism of immediate coastal deposition is, at least in part, driving the apparent mismatch between coastal emissions and the standing stock in the ocean.

S16 *Marine Debris: the world-wide pollution crisis acting on local to global scales*
Thursday 5 July, 1115 - 1130

Canyon habitats of the commercial pink ling: structure, distribution and management

Alan Williams^{*1}, Franziska Althaus¹, Thomas A. Schlacher²

1. CSIRO Oceans and Atmosphere Flagship, Castray Esplanade, Hobart, Tas 7001, Australia
2. The Animal Research Centre, University of the Sunshine Coast, Q-4558 Maroochydore

Abstract

Photographic and acoustic survey of the Big Horseshoe submarine canyon off Victoria, a prime fishing ground, showed it is mostly a large terrace of calcareous muddy sands interspersed with mosaics of rubble patches supporting a sparse benthic epifauna. However, low-relief rocky ridges of sedimentary claystones outcrop at the canyon rim and support communities of erect epibenthic megafauna dominated by sponges. These rocky microhabitats support relatively high densities of adult pink ling, an important commercial species. Ling are part of a distinct assemblage restricted to the upper continental slope (~300-700 m depths) – a narrow (~7 km wide) escarpment. Although small in the regional context (11,250 sq km), the upper slope has a key ecological role by providing habitat in the depth zone where the oceanic mesopelagic prey of fishes such as ling intersect the continental margin. We classify ling's upper slope habitats at multiple scales using a hierarchical framework to illustrate the scales relevant to understanding ecological and anthropogenic habitat use, and the varying goals of spatial management. Protection of structured, hard bottom habitat on the upper slope is important because it is very limited in areal extent and composed of friable claystones vulnerable to degradation or removal by bottom trawling.

G1**Deep sea and canyon ecology****Wednesday 4 July, 1345 - 1400**

Taking a deeper look: Quantifying the differences in fish assemblages between shallow and mesophotic temperate rocky reefs

Joel Williams¹, Alan Jordan¹, David Harasti¹, Peter Davies, Tim Ingleton², Neville Barrett³

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2. NSW Office of Environment and Heritage, Sydney, New South Wales, Australia
3. University of Tasmania, Hobart, Tasmania, Australia

Abstract

The spatial distribution of a species assemblage is often determined by habitat and climate. In the marine environment, depth can become an important factor as degrading light leads to changes in the biological habitat structure. To date, much of the focus of ecological fish research has been based on reefs in less than 40 m. The aims of this study were to 1) quantify the differences in the fish assemblages between shallow and mesophotic reefs, and 2) model the effects of environmental conditions and habitat structure on the spatial distribution of fishery targeted species. To do this, we deployed stereo-BRUVS on temperate rocky reefs in two depth categories: shallow (20-40m) and mesophotic (80-120m), off Port Stephens in NSW. We used generalized linear models to investigate what factors best described the spatial distribution of key fishery species including *Chrysophrys auratus*, *Nemodactylus douglassii*, *Psuedocaranx georgianus* and *Meuschenia scaber* as well as all targeted species pooled together. Redundancy analysis was used to determine what factors best describe patterns in the species assemblage. These results demonstrate the importance of mesophotic reefs to fishery targeted species and therefore have implications for informing the management of these fishery resources on shelf rocky reefs.

G5**Estuaries and coasts****Monday 2 July, 1430 - 1445**

How successful are waste abatement campaigns and government policies at reducing plastic waste into the marine environment?

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Abstract

Plastic production is increasing globally and in turn there is a rise of plastic waste lost into the coastal and marine environment. To combat this issue, there is an increase in policies that target specific types of plastic waste (such as microbeads and plastic shopping bags). Given that such anthropogenic waste have environmental and human health impacts, identifying effective abatement policies is imperative to reducing waste before it enters the ocean. Within Australia, state and local governments employ a plethora of policies and campaigns to reduce waste inputs to the environment. Waste managers were interviewed from 40 local councils around Australia on waste abatement strategies and investments implemented in their council. Generalised linear models were used to compare outreach programs (such as 'Don't be a Tosser' and Clean Up Australia) and state-enacted policies (e.g. Plastic Shopping Bag Ban and Zero Waste Strategy) aimed at targeting human behaviour to reduce waste. Investments in outreach programs led to larger reductions of waste than investments in policies. Illegal dumping, litter prevention and recycling all significantly reduced waste along a council's coastline. Additionally, councils that invested in a coastal waste management budget had less waste on the coastline within their jurisdictions.

S16 *Marine debris: the world-wide pollution crisis acting on local to global scales*
Thursday 5 July, 1445 - 1500

Specific Timing Of Ontogenetic Shifts In The Diet And Habitat Of Newly Settled Juvenile *A. cf. solaris* And Consequences For Individual Growth

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Abstract

The crown-of-thorns starfish (CoTS) is a coral eating Indo-Pacific starfish species, which can initiate coral-algal phase shifts. For over thirty years, it has been debated whether marked fluctuations in adult starfish numbers are fundamentally caused by anthropogenic activities that affect larval survival or by characteristic life history traits; a debate that hinders the development of urgently needed conservation measures. Using empirical data of newly settled CoTS (< 1 year old, n=3432) sampled across 64 reefs of the GBR, we will demonstrate that the dietary shift from coralline algae to hard coral maximises growth rates of juvenile starfish. We will then show that the proportion of coralline algae eating starfish gradually declined in samples over time, indicating that coralline algae eating starfish either shifted their diet or died. We suggest that the timing of this dietary shift is strongly affected by the availability of suitable coral prey near settlement areas, which in turn may greatly constrain population growth and in extreme cases lead to the extinction of single starfish cohorts, at least during the early post-settlement phase. Taken together our results provide additional strong evidence in support of a natural phenomenon hypothesis.

S5***Structure and function of coral reefs in a changing world*****Wednesday 4 July, 1330 - 1345**

Is there something Fishy with Microplastics?

Scott P. Wilson¹ and Kathryn Hassell²

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Abstract

Marine debris and microplastics are significant issues across the globe and have been shown to be also prevalent around Australia. While there is evidence of ingestion and impacts to seabirds and turtles locally there is little information on potential harm to other marine species, particularly fish. Hence, a baseline study of coastal fish species around Port Phillip and Westernport Bays, Victoria was conducted to determine firstly whether microplastic was present in common fish species of the region and whether there were any differences either taxonomically or spatially in these levels and then finally were there potential health condition related factors associated with microplastic ingestion.

Preliminary data indicates that there were species differences with all sandy flathead (*Platycephalus bassensis*) ingesting microplastics compared to limited ingestion in the smooth toadfish (*Tetractenos glaber*). Spatial differences were also evident with over 80% of samples at some sites having ingested microplastics. The majority of microplastic ingested were fibres of various colours, but predominantly blue. The findings will be described in full and highlight any potential condition related affects. Comparisons to data from other studies overseas and the broader implications for both Australian and regional level management will be discussed.

Poster presentation

S16

Putting the Science into Marine Debris Citizen Science Monitoring

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Abstract

With growing awareness of the issues of marine debris and microplastics within our community there has been growing engagement in both formal and informal debris and litter clean-ups. This has led to the recruitment of individuals and groups into programs to assist with monitoring and reporting on marine debris. However, this community based data is often criticised for lacking scientific credibility. The value of citizen science therefore lies in the design, collection methods, analysis and reporting of this data following standardised approaches. This paper will highlight examples of local and national scale programs that engage the community while maintaining the necessary scientific data capabilities. Programs that involve social media such as the Take 3 for the Sea 'Pick it up, Snap it, Share it' or the education focused Australian Microplastics Action Project (AUSMAP) are two such examples that will be discussed from a quality assurance/quality control and data analysis and reporting perspective. Overall, the benefits of novel data collection and analysis from the community will be outlined and implications for enabling future citizen science outcomes discussed.

S16 *Marine Debris: The world-wide pollution crisis acting on local to global scale*
Thursday 5 July, 1600 - 1615

Comparing the performance of traditional and DNA methods to detect marine pests

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Abstract

Ballast water transport is an important mechanism for marine pest introductions, and with the global increase in shipping, ballast water introductions are accelerating. To manage the risk of marine pest transfer in ballast water, knowledge of the occurrence of pests within port areas is needed. Few Australian ports, however, have been adequately surveyed for marine pests, because traditional survey methods are time-consuming, expensive and sometimes infeasible. DNA-based methods for pest detection have been developed which are faster and cheaper, and provide high confidence in pest species identification. The feasibility of implementing these methods has been demonstrated, but further data were needed to optimise sampling for DNA detection. The methods had also not been rigorously compared to traditional survey techniques. DNA-based and traditional surveys were carried out at the ports of Gladstone, Brisbane, Melbourne, and Hobart. Plankton tows were collected seasonally and analysed using DNA-based methods, while each port was surveyed by traditional dredge, trap and visual sampling in summer and winter. We compared the ability of both methods to detect six pests of concern for ballast water transport, the feasibility and relative cost of each method, and determined the best season for sampling for each detected pest.

Poster presentation

S10

Predicting Environmental Suitability for Key Benthic Taxa in an Ecologically and Economically Important Deep-sea Environment

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Abstract

Species distribution modelling is increasingly being applied to poorly-studied deep-sea environments to predict habitat suitability, patterns of species richness, and environmental drivers. We compared several modelling options and used Maxent to run species distribution models for 96 representative species of the deep-sea benthos of southern Australia. We obtained occurrence data from recent Great Australian Bight Research Program (GABRP) surveys, Australian museum collections, and online databases, and applied a target group background approach to overcome spatial biases. As many of the environmental variables were correlated, we selected variables to use in final models based on the importance of each variable assessed across a subset of species. Final models were aggregated to identify regions of potential high diversity and explore patterns in suitability across longitudinal bands and depth zones for each Phyla. Upper mid-slope depths were found to have high suitability throughout southern Australia, with depth zonation being much more pronounced than longitudinal differences.

This work was undertaken through the GABRP - a collaboration between BP, CSIRO, 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.

G1 *Deep sea and canyon ecology*
Wednesday 4 July, 1400 - 1415

Predicting Species Richness and Biomass using Multibeam Sonar and Baited Cameras in Victoria's Largest Marine Protected Area

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Abstract

Establishing detailed baseline data is crucial for making effective management plans of marine protected areas (MPAs), as well as assessing their performance over time. One of the most efficient and cost-effective means of gathering fish assemblage data is using Baited Remote Underwater Videos (BRUVs). This method becomes even more powerful when combined with high-resolution multibeam echo sounder (MBES) surveys, allowing the opportunity to observe fish assemblage dynamics in context with habitat characteristics. We aimed to test various methods and highlight the importance of thorough baseline habitat mapping of MPAs to enhance future management. BRUVs were deployed at 52 sites within Wilsons Promontory Marine National Park, Australia, and 3501 individuals, from 42 families were recorded. Generalised Additive Models revealed hotspots of diversity and biomass and Distance Based Linear Models found complexity of the seafloor to explain 24.7% of the variance in fish assemblages, followed by depth (7.1%) and distance to reef (3.3%). This can be used to inform park management focussing on complexity, depth and distance to reef gradients to detect the largest range of fish while reducing survey effort and costs. Using an initial high-resolution MBES survey, monitoring can be designed with superior precision, allowing maximum detection with reduced sampling.

S3 *Seafloor Mapping in Australia – Progress, Discoveries, Applications*
Tuesday 3 July, 1130 - 1145

Observing the Oceans with Gliders: Tools for Data Visualisation and Analysis

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Abstract

Thirty years ago in an article in *Oceanography*, Henry Stommel (1989) imagined the establishment of a futuristic fleet of undersea gliders. This has now come to pass. With a wealth of ocean glider data continually being produced and available for public download internationally, emphasis now must turn to data uptake. This paper introduces the suite of tools developed at the Australian National Facility for Ocean Gliders (ANFOG) to equip users to do this, as part of the Integrated Marine Observing System (IMOS). The software includes *NetCDF Ninja*, an interactive graphical user interface that allows users to explore all the metadata and data contained in NetCDF files. Furthermore, we also present *Gliderscope*, an elegant visualisation and analysis software developed specifically for glider data. *Gliderscope* is supported by a series of engaging video tutorials and hands-on, computer based workshop exercises which familiarise users with the data collected by ocean gliders, the ways data can be analysed and interpreted, as well as help them explore key principles of physical and biological oceanography. Here, we demonstrate the software using peer reviewed exercises that will educate the next generation of oceanographers and aid researchers in understanding the wealth of glider data that is available worldwide.

S1 **Cross-shelf exchange processes**
Monday 2 July, 1515 - 1530

Novel methods to assess long-term trends in size and age at maturity in fish: a story of harvest and warming

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Abstract

Age and size at maturation play key roles in determining the fitness of individuals and underpin population demography. Evidence is growing that fishing and climate change can cause rapid change in life histories by increasing overall mortality and imposing size selectivity on populations. Declines in size and age at maturity can in turn impact on stock productivity as well as result in the loss of valuable phenotypic variation that could buffer populations against further environmental perturbations. Yet, despite the importance of understanding change in maturity schedules, such studies have largely been restricted to northern-hemisphere, high-value stocks where large observational datasets are recorded. Change in age and size at maturity is currently unassessed in Australian fished stocks. We will demonstrate a recently developed ontogenetic growth-modelling technique that can allow us to model age and size at maturity from length-at-age datasets commonly collected by fisheries agencies. Additionally, we will present time-series estimates of maturity in a number of key fish species. This approach could facilitate the recreation of life history schedules over many decades, help understand drivers of potential maturity changes, and improve sustainable fisheries management in rapidly changing future environments.

S6 *Marine Climate Change from Shelves to Deep Seas*
Tuesday 3 July, 1500 - 1515

Temporal dynamics of subtidal reef communities across a seascape and the impact of marine protected areas

Mary Young¹ and Daniel Ierodiaconou¹

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Abstract

Marine protected areas (MPAs) have become a necessary component for managing marine environments with the recognition that ecological interactions between species and availability of suitable habitat are imperative for long-term ecological persistence. Along the 2000 km coast of Victoria, Australia, 5% of the coastal waters were designated as no-take MPAs. These MPAs were declared to be a comprehensive, adequate and representative sample of its marine habitats based on the best available knowledge at the time. However, since their designation, more information on seafloor habitat, biological and environmental data have been acquired. In this study, we use available biological data (Subtidal Reef Monitoring Program and Reef Life Survey) to assess the temporal trends in reef communities inside and outside MPAs and associate those observations with environmental characteristics including multiple derivations of seafloor habitat, wave climate, temperature trends, and biogenic habitat. Additionally, we use the environmental data to determine how representative the MPAs are of the habitat available in Victorian waters.

S3

Seafloor Mapping in Australia – Progress, Discoveries, Applications
Tuesday 3 July, 1115 - 1130

Social cohesion and intrapopulation community structure in southern Australian bottlenose dolphins (*Tursiops* sp.)

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Abstract

Defining intra-population community variation among group living mammals provides an understanding of population responses to environmental, social, and anthropogenic factors. Here, we use generalized affiliation indices and social network analysis to investigate social cohesion and intra-population community structure of southern Australian bottlenose dolphins (*Tursiops* sp.) inhabiting Adelaide's metropolitan coast, South Australia. Data on sex, relatedness and residency of known individuals were also included to investigate potential influences on associations and community structure. Dolphins were clustered into two social communities that had little spatial overlap and were associated with different habitats; a northern, shallow-water community, and a southern, deep-water community. Preferred associations were more prevalent within than between these two communities, and analysis on genetic relatedness indicated that dolphins, particularly females, were on average more related within than between communities. Social network metrics were mostly similar between communities, and the temporal stability of associations for both communities was characterised by rapid disassociations and casual acquaintances. We suggest that these two dolphin communities likely arose due to a combination of ecological and social factors. This study enhances our understanding of the factors shaping mammalian groups, and our ability to manage human activities that can impact upon their behaviour and social structure.

Poster presentation

S13

Sustainable utilisation of South Australian marine biodiversity towards a blue bio-economy

Wei Zhang¹

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Abstract

The South Australian marine environment is resource rich and provides a source of flora and fauna that contain compounds of potential use for nutraceutical, cosmeceutical, agricultural and pharmaceutical bioproducts. Along with macro-organisms the microbiome of organisms provides increasing opportunities to study new marine bacteria and bacteria-sourced compounds. Recent work will be presented from the Centre for Marine Bioproducts Development at Flinders University, who along with partners in China are researching bioproducts from SA marine organisms from the depths (bacteria of deep-sea sponges) to the shallows (beachcast algae). The future of marine biotechnology research in Australia will also be addressed. Research on the biodiversity of marine organisms, the ecological interactions between them, and the long-term preservation of both, are integral to the production of bioproducts from these resources. International partnerships may also be advantageous. Bringing together taxonomists, ecologists, biotechnologists, policy makers and industry, including international partners, for an Australian marine bio-economy will ensure sustainable use of our marine resources.

S15 *Aquaculture blue economy*
Tuesday 3 July, 1615 - 1630

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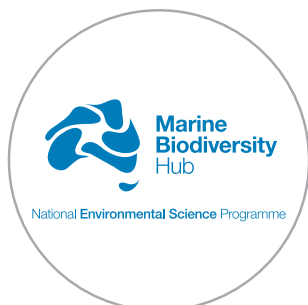
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