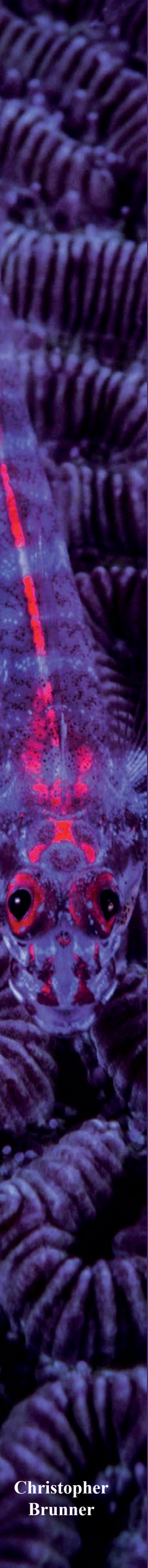
AIMS@JCU

2023 Seminar Day

Abstract Booklet

Townsville Yacht Club



Christopher Brunner

AIMS@JCU

Seminar Day 2023
Friday, 29th September

Townsville Yacht Club

Time	Abstract title	Presenter/Chair
9:30 AM	**Welcome to Country**	**Troy Johnson**
9:45 AM	**Welcome**	**Dr. Cherie Motti**
	Session 1	**Chair - Dr. Leanne Currey-Randall**
10:00 AM	Deciphering the Function of Bacterial Aggregates Within Tissues of the Coral *Acropora loripes*	Cecilie R Gotze
10:15 AM	Evaluating the Toxicity of DEHP and DEHT Leachates from Polystyrene Microplastics on *Artemia franciscana*	Jessica Zacharuk
10:30 AM	Protecting the Invisible Guardians: Establishing Guideline Values for Copper Toxicity to Marine Microbiomes	Marie C Thomas
10:45 AM	**Morning tea**	
	Session 2	**Chair - Alexandra Gulizia**
11:15 AM	Reef Management Measures Project Down to Microbial Scales	Marko Terzin
11:30 AM	Persistance and fitness of bio-engineered coral-Symbiodiniaceae symbioses	Corinne Allen
11:45 AM	Unveiling the Whale Shark Mystery: Threats and Conservation Hotspots in the Coral Sea	Ingo Miller
12:00 PM	**Guidelines for the use of Generative AI tools by HDR candidates at JCU**	**Prof. Ian Atkinson**
12:30 PM	**Lunch**	
	Session 3	**Chair - Josephine Nielsen**
1:15 PM	Using eDNA to track the iconic giant triton snail in the Great Barrier Reef World Heritage Area	Merle Schlawinsky
1:30 PM	Do coral populations harbour genetic variation to adapt to climate change?	Rhys Cornish
1:45 PM	DNA methylation profiling of the Pacific crown-of-thorn seastar (*Acanthaster* cf. *solaris*) using Oxford Nanopore Technology	Sarah Lok Ting Kwong
2:00 PM	**Ocean interventions for socially desirable and just futures**	**Dr. Sarah Lawless**
2:30 PM	**Posters and Afternoon Tea**	
	Session 4	**Chair - Emma Marangon**
3:00 PM	Spatial variation in the size structure of dominant coral morpho-taxa on the Great Barrier Reef	Marine Lechene
3:15 PM	The impact of light on tropical crustose coralline algae growing on artificial substrate in aquaculture	Soren Schipper
3:30 PM	Spatiotemporal trends in pH and dissolved oxygen on inshore fringing reefs, part 1: environmental drivers of mesoscale variability	Stephanie DiPerna
3:45 PM	**Session 5 - Speed Talks**	**Chair - Emma Marangon**
3:50 PM	Survival peaks for seeded *Acropora digitifera* corals living at maximum wave energy limits on Moore Reef	Taylor Whitman
3:55 PM	Beyond heat stress: investigating pre-summer acclimatisation for enhanced coral bleaching prediction	Valerie Cornet
4:00 PM	**Judges deliberation**	
4:30 PM	**Announce awards, closing remarks**	**Dr. Cherie Motti**
5:00 PM	**End of event celebration**	

James Cook University Australia

Australian Government

Australian Institute of Marine Science

10.00am

Deciphering the Function of Bacterial Aggregates Within Tissues of the Coral *Acropora loripes*

Cecilie R Gotze[a,b,c], Ashley M Dungan[a] , Justin Maire[a], Kshitij Tandon[a], Lone Hoj[b], Linda L Blackall[a] & Madeleine JH van Oppen[a, b]

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Bacteria in the genus *Endozoicomonas* are well-known coral symbionts commonly found as cell-associated microbial aggregates (CAMAs) in a wide range of coral species. Despite their prevalence, the functional role within the coral holobiont remains largely unexplored. In this study, we conducted genomic characterization of CAMAs associated with 12 genotypes of the reef-building coral *Acropora loripes* from the central Great Barrier Reef. Metabarcoding analysis of the 16S rRNA gene revealed *Endozoicomonas* as the dominant bacterial symbiont in all coral genotypes. We successfully cultured and fully genome-sequenced the ten most prevalent *Endozoicomonas* strains identified through metabarcoding, revealing their classification into two distinct phylogenetic clades. Employing clade-specific probes for fluorescence in situ hybridization (FISH), we consistently located *Endozoicomonas* CAMAs within the gastro- and epidermal layers of the upper and lower gastric cavity tissue structures. Furthermore, most CAMAs were comprised of strains from a single clade, with a minor proportion containing multiple *Endozoicomonas* phylotypes within a single CAMA. Analysis of near-complete draft genomes of *Endozoicomonas* isolates unveiled their metabolic potential to supply the holobiont with advantageous secondary metabolites, such as B vitamins and antioxidants. Additionally, we identified genomic signatures facilitating host association, including type VI secretion systems and eukaryotic-like repeats. This work contributes to the understanding of the interactions between endosymbiotic bacteria and their coral hosts, which can help guide the selection of prospective probiotic candidates aimed at mitigating coral bleaching. This study underscores the importance of deciphering the role of CAMAs in coral health and resilience, offering valuable information to coral symbiosis research.

I acknowledge the Wulgurukaba and Bindal people as the Traditional Owners of the land and sea country this work was conducted.

10.15am

Evaluating the Toxicity of DEHP and DEHT Leachates from Polystyrene Microplastics on *Artemia franciscana*

Jessica Zacharuk[a,b], George Vamvounis[a]; Mark Cyrus[a] & Cherie Motti[b,c]

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[b]*AIMS@JCU, Division of Research and Innovation, James Cook University, Townsville, QLD 4811, Australia*
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The leaching behaviour of plasticisers and other additives from microplastics is just coming to light as a concern in marine and aquaculture environments. Few studies inquire into the behaviour of leaching effects of plasticisers from the plastic polymer. By investigating the leaching behaviour of DEHP (Di(2-ethylhexyl) phthalate) and DEHT (Di(2-ethylhexyl) terephthalate) from polystyrene microplastics on *Artemia franciscana*, we can assess the mortality, growth, feeding behaviour, and reproductive output effects. By employing distinct treatment groups for both the Nauplii 1 Instar larvae and adult life stages, we aim to understand both the acute and chronic ecotoxicity, and potential ecological consequences that leaching has on plankton. This mode of action between the plastic polymer and plasticiser on plankton is important in understanding how microplastics in the marine environment behave. Our findings not only contribute to the understanding of chemical impacts on aquatic ecosystems but also have broader implications for environmental policy and conservation strategies in aquaculture environments. Further promoting the well-being of both aquatic organisms and humans in society.

Wulgurukaba and Bindal people

10.30am

Protecting the Invisible Guardians: Establishing Guideline Values for Copper Toxicity to Marine Microbiomes

Marie C. Thomas[a,b,c], Gretel Waugh[a,b,c], Inka Vanwonterghem[a], Nicole S. Webster[a,b,d], Christian Rinke[a], Rebecca Fisher[e], Heidi M. Luter[b,c] & Andrew P. Negri[b,c]

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Understanding the responses of marine microbiomes to environmental disturbances is paramount for supporting early assessments of harm to high-value ecosystems, such as coral reefs. Yet, management guidelines aimed at protecting aquatic life from environmental pollution remain exclusively defined for organisms at higher trophic levels. In this study, 16S rRNA gene amplicon sequencing was applied in conjunction with propidium monoazide for cell-viability assessment as a sensitive tool to determine taxon- and community-level changes in a seawater microbial community under copper (Cu) exposure. Bayesian model averaging was used to establish concentration-response relationships to evaluate the effects of copper on microbial composition, diversity, and richness for the purpose of estimating *microbiome* Hazard Concentrations (*m*HCx) values. Predicted *m*HC5 values at which a 5% change in microbial composition, diversity, and richness occurred were 1.05, 0.72, and 0.38 µg Cu L^{-1}, respectively. Threshold indicator taxa analysis was applied across the copper concentrations to identify taxon-specific change points for decreasing taxa. Change points were then used to generate a Prokaryotic Sensitivity Distribution (PSD), from which $m\text{HCx}_{dec}$ values were derived for copper, suitable for the protection of 99, 95, 90, and 80% of the marine microbiome. The $m\text{HC5}_{dec}$ guideline value of 0.61 µg Cu L^{-1}, protective of 95% of the marine microbial community, was lower than the equivalent Australian water quality guideline value based on eukaryotic organisms at higher trophic levels. The *m*HCx values proposed here provide approaches to quantitatively assess the effects of contaminants on microbial communities towards the inclusion of prokaryotes in future water quality guidelines.

This work took place on the unceded land and sea country of the Bindal and Wulgurukaba people.

11.15am

Reef Management Measures Project Down to Microbial Scales

Marko Terzin[a,b,c], Steven Robbins[d], Sara C. Bell[a], Yun Kit Yeoh[a,b,c], Nicole S. Webster[a,d,e], Michael J. Emslie[a], David G. Bourne[a,b,c] & Patrick W. Laffy[a.b.c]

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Coral reefs are declining at alarming rates due to cumulative effects of local and global disturbances, hence immense effort is being invested worldwide to monitor, conserve, and restore reef ecosystems. The Great Barrier Reef (GBR) is the world's most comprehensively managed reef system. Since the rezoning of the GBR Marine Park in 2004, an increase in fish numbers and biomass has been documented in protected GBR reefs. Studies also report faster recovery times of fish and coral communities after disturbances, likely due to preserving a wide range of important ecological functions inside no-take zones where all extractive activities are prohibited. While research demonstrates the wide range of benefits that marine reserves can offer to reef macrofauna and macroflora, the microbial dynamics in protected vs. non-protected GBR reefs remains unexplored. We investigate how the seawater microbiome is structured on GBR reefs that are open and closed to fishing, using ~5000 surface seawater bacterial and archaeal MAGs (metagenome-assembled genomes) collected and assembled across 48 reef sites in the GBR, alongside *in situ* reef health surveys conducted via the Australian Institute of Marine Science Long Term Monitoring Program (AIMS-LTMP). A supervised learning classification algorithm (MINT sPLS-DA) trained on seawater microbial community composition predicted reef protection status with ~70% accuracy, with *Flavobacteriaceae* and *Rhodobacteraceae* affiliated taxa consistently associated with non-protected sites. A novel metric of microbial networks (community 'cohesion') showed a prevalence of negative microbe-to-microbe interactions in take zones, potentially indicative of increased competition, predator/prey, pathogen/host, and parasite/host dynamics in reef bacterioplankton at non-protected reefs. Further research is needed to identify microbial indicators that are indicative of fish biomass or functional group (e.g. predatory, herbivorous and planktivorous fishes), which could be invaluable in reef monitoring and provide rapid indices of fish stock assessments.

11.30am

Persistance and fitness of bio-engineered coral-Symbiodiniaceae symbioses

Corinne Allen[a,b,c], Carlos Alvarez Roa[b], Matthew Nitschke[b], Wing Yan Chan[a] & Madeleine van Oppen[a,b]

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To combat the rapid loss of corals due to climate change, coral thermal resilience may be enhanced through the introduction of heat-evolved algal symbionts (Symbiodiniaceae) into bleached corals. However, the thermal tolerance and long-term stability of heat-evolved symbionts in *hospite* has only been assessed in controlled laboratory settings. While this information is useful in looking at mechanistic processes, it lacks the ecological relevance we need to understand the efficacy of this approach as a viable restoration strategy. Here, a small-scale pilot deployment of bio-engineered corals has been undertaken to investigate (a) the phenotypic performance of corals chemically bleached and infected with heat-evolved symbionts and (b) the stability and/or succession of heat-evolved symbionts in the field. In January 2023, adult fragments of *Platygyra daedalea* harboring a mix of their native symbionts and heat-evolved *Cladocopium proliferum* were deployed near Falcon Reef, Palm Islands (Manbarra Sea Country). Fragments have been monitored every three months for their survival, growth, photochemical efficiency, and symbiont community composition. In addition, the surrounding coral community, water column, and sediment have also been seasonally sampled to capture the potential spread of the heat-evolved *C. proliferum* strain. Preliminary results show that after three months fragment survival remains high (99%) with some corals able to retain low abundances of heat-evolved *C. proliferum*. Results from this study will provide insight into the complex dynamics of symbiont community succession and performance and contribute to our understanding of the potential of this intervention in reef restoration practices.

I would like to acknowledge the Manbarra and Bindal peoples as the Traditional Owners of the sea country and land where this research takes place, and pay my respects to Elders past, present, and future.

11.45am

Unveiling the Whale Shark Mystery: Threats and Conservation Hotspots in the Coral Sea

Ingo B. Miller[a,b]

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[b]*College of Science & Engineering, James Cook University, Cairns, Queensland, 4878, Australia*

Across the globe, whale shark conservation efforts are guided by research at aggregation sites. Our research has unveiled the existence of the first aggregation site of whale sharks on the east coast of Australia. This aggregation is demographically unusual, as it comprises approximately equal numbers of both sexes. Most other whale shark aggregation sites are highly biased towards juvenile males. This new site offers a unique opportunity to provide critical information on female whale shark ecology (e.g., habitat use), and the inclusion of females will contribute to more robust population estimates for the Asia Pacific/Western Pacific regions. The project will identify essential habitats and undertake a risk assessment for whale sharks in the Coral Sea and wider Asia/West Pacific region. This critical information is required for the conservation (e.g., for IUCN assessments, protected area management in Coral Sea) of this endangered and globally still declining species.

I acknowledge Aboriginal and Torres Strait Islander peoples as Australia's first scientists. I pay my deepest respects to Elders past, present and future, and the custodians of the land and sea country on which I work, including the Wulgurukaba and Bindal people on which land we stand today.

1.15pm

Using eDNA to track the iconic giant triton snail in the Great Barrier Reef World Heritage Area

M. Schlawinsky[a,b,c], J. Strugnell[a], A.C. Villacorth-Rath[a,d], M.A. MacNeil[e] & C. Motti[b,c]

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[d]*TropWater at JCU*
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Charonia tritonis is a primary predator of adult crown-of-thorns starfish (CoTS) and is considered endangered on the Great Barrier Reef (GBR). Available information indicates *C. tritonis* has become rare or locally extinct from historical overharvesting, trade, and environmental pressures. With CoTS representing a major threat to the GBR, research is now focused on understanding *C. tritonis* distribution and genetic connectivity to assess the potential for population recovery and restoration of the predator-prey balance. Traditional survey methods are ill-suited for studying the cryptic and nocturnal *C. tritonis*. In this context, environmental DNA (eDNA) methods have emerged, proving successful in detecting rare species where conventional surveying approaches have fallen short. Unlike direct observations in traditional surveys, indirect detection can be achieved via measurement of eDNA shed into the habitat. Presented here is a strategy to determine the distribution of *C. tritonis* on the GBR. To achieve this we will firstly, development of a species-specific assay targeting *C. tritonis*. in water samples. By conducting controlled experiments, we will measure how quickly *C. tritonis* releases its genetic material into the surrounding environment and how long this genetic material remains viable. Furthermore, using the data collected on shedding and decay rates, we will calculate the likelihood of detecting *C. tritonis* eDNA in water samples from various locations within the GBR. Armed with a robust understanding of eDNA dynamics, we will conduct a comprehensive survey to map the distribution of *C. tritonis* populations across the GBR.

1.30pm

Do coral populations harbour genetic variation to adapt to climate change?

Rhys Cornish[a,b,c,d], Samantha Goyen[a,c] & Line Bay[a,c]

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Marine heatwaves are increasing in frequency and intensity causing widespread coral bleaching. Temperature tolerant genotypes may hold the key to adaptation to marine heatwaves, however, we have poor understanding of where these individuals occur, the mechanisms of thermal tolerance and how this variation in thermal tolerance may contribute to adaption of populations. Approaches based on predictive modelling and remote observations lack the spatial resolution required to detect variation at smaller scales such as among genotypes. We also lack a broader understanding of how these traits are inherited, and what trade-offs may come with thermal tolerance. To address these recognised knowledge gaps, we tagged 350 *Acropora millepora* colonies in the Southern Great Barrier Reef. These colonies varied in bleaching responses during a bleaching event in April 2020, ~94% of tagged colonies recovered. We exposed these colonies to a rapid heat-stress experiments to measure to thermal stress tolerance. Combining these metrics, we identified “top” and “bottom” performers for thermal tolerance and then undertook a quantitative genetic analysis during the mass spawning event in November 2022. In this talk we discuss variation among thirty-eight families during heat-stress experiments on larvae and partition variation between genetic and environmental factors. We will also discuss patterns of growth, survival and heat tolerance in the wild of thirty-two out planted families and discuss the role of natural uptake of specific symbiont types. This work contributes to modelling how populations may recover from marine heatwaves and adapt to climate change.

1.45pm

DNA methylation profiling of the Pacific crown-of-thorn seastar (*Acanthaster* cf. *solaris*) using Oxford Nanopore Technology

Sarah Lok Ting Kwong[a,b,c], Julia Yun-Hsuan Hung[b,c], Alyssa Budd[d], Cecilia Villacorta-Rath[e], Morgan Pratchett[b] & Sven Uthicke[a]

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[d]*Indian Ocean Marine Research Centre, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Crawley, WA, Australia*
[e]*Centre for Tropical Water and Aquatic Ecosystem Research (TropWATER), James Cook University Bebegu Yumba Campus, Townsville, Queensland 4811, Australia*

Epigenetic studies have emerged as a valuable complement to genome research, revealing an additional layer of information regarding the processes that regulate gene expression. In an ecological context, DNA methylation profiling provides understanding towards the complex interplay between genetics and environmental factors, offering insights into the mechanisms that regulate development and phenotypic plasticity. This study leverages state-of-the-art Oxford Nanopore Technology (ONT) for DNA methylation profiling, highlighting its distinct advantages over conventional bisulphite sequencing. ONT's direct detection of modified bases eliminates the need for bisulphite conversion, reducing potential bias and preserving DNA integrity. Furthermore, ONT's long-read and real-time sequencing capabilities enable a more comprehensive and efficient approach to methylome analysis. This study seeks to profile the methylome of the Pacific crown-of-thorns seastar (CoTS; *Acanthaster* cf. *solaris*), a species of ecological concern due to its significant contribution to coral cover reduction. By characterizing the epigenetic landscape of CoTS, we seek to elucidate how epigenetic modifications influence key developmental processes and evaluate the feasibility of developing an epigenetic clock. This study not only offers valuable ecological and evolutionary insights, but also pioneers the application of ONT in the study of CoTS, with potential for extension to other marine organisms and broader ecological studies in the future.

I acknowledge the Bindal and Wulgurukaba peoples as the traditional owners of the lands and waters where I live and work.

2.00pm - AIMS@JCU Postdoctoral Fellow

Ocean interventions for socially desirable and just futures

Sarah Lawless[a,b,c], Emily Ogier[d,e], Philippa Cohen[c,e,f], Gretta Pecl[d,e], Lyndon Llewellyn[b] & Tiffany H. Morrison[c,g]

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[b]*Australian Institute of Marine Science*
[c]*College of Science and Engineering, James Cook University*
[d]*Institute of Marine and Antarctic Studies, University of Tasmania*
[e]*Centre for Marine Socioecology, University of Tasmania*
[f.]*Marine Tenure Initiative*
[g]*School of Geography, Earth & Atmospheric Sciences, University of Melbourne*

Globally, more than three billion people depend on oceans. The impacts of climate altered oceans, including interventions to mitigate or adapt to climate change, are felt most acutely by ocean-dependent people. The development of climate-focused ocean interventions are accelerating. *Socially responsible* ocean interventions include those that anticipate and advance the status of marine ecosystems and equitably improve social conditions, or at a minimum, 'do no [social] harm'. Social conditions include those that enable cultures, practices, livelihoods, and rights of ocean-dependent people to adapt and thrive. We seek to understand whether and how potential social implications of ecosystem-focused ocean interventions are anticipated, articulated, and negotiated. First, I discuss findings from a global survey that examined how 333 scientists and practitioners viewed social safeguards to account for societal impacts and uncertainty whilst they were proposing, testing and/or implementing ocean interventions. Despite a range of social safeguards being in place (e.g., stakeholder deliberation, social feasibility, risk and ethics assessments) respondents predominantly discussed efforts to ensure public acceptance of ocean interventions. Societal improvements were rarely considered amongst the end goals of these interventions. I then present a research plan that offers examples of deeper societal engagement of ocean interventions, including more deliberate focus on mutual achievement of ecological and societal gains. Here, I will use the case of blue carbon markets, an emergent social-ecological ocean intervention positioned as being able to mitigate the effects of climate change whilst enhancing environmental and economic justice, and tenure security.

3.00pm

Spatial variation in the size structure of dominant coral morpho-taxa on the Great Barrier Reef

Lechene MAA[a,b,c], Álvarez-Noriega M[b], Gordon S[b],
Remmers Barry T[a],[b,c], Figueira W[d] & Ferrari R[b]

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[b]*Australian Institute of Marine Science, Townsville, QLD, 4810;*
[c]*AIMS@JCU;*
[d]*School of Life and Environmental Sciences, University of Sydney, Camperdown, NSW, 2006*

Sustained and widespread degradation of coral reef ecosystems is threatening the viability of coral populations and communities. Changes in percent cover is largely used to assess population viability, however variations in the size-frequency distribution of coral colonies would provide more nuanced ecological data especially at large spatial scales and/or for large sampling sizes. Here, we examined the size structure of three dominant coral morpho-taxa at three offshore reefs (Moore, Davies and Heron) in three different regions of the Great Barrier Reef. We explored the variation in size structure among depths, sites and reefs. Our results suggested differences in the size structure with marked variation among locations. We found that while some taxa showed constrained size structure with minor variations between habitats, other taxa such as tabular *Acropora* exhibited strong patterns suggesting that environmental factors such as wave exposure are likely modifying their size structure. Unveiling the relationships between environmental conditions and demographic rates of key coral taxa is particularly relevant to inform the where and how of restoration interventions.

We would like to acknowledge the Wulgarukaba and Bindal people, Traditional Custodians of the land on which we meet and work, as well as the Traditional Custodians of the Great Barrier Reef whose sea country this data is collected from and pay our respects to their Elders past and present. We would like to extend that respect to the Aboriginal and Torres Strait Islanders peoples.

3.15pm

The impact of light on tropical crustose coralline algae growing on artificial substrate in aquaculture

Schipper, S.R.[a,b,c], Ramsby, B.[b] Flores, F.[b] Jeong, S.Y.[a] Wahab, M.A.[b,c] Severati, S.[b] Negri, A.[b,c] & Diaz-Pulido, G.[a]

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Crustose coralline algae (CCA) function as reef binding cement and mediate the settlement of many invertebrate larvae, including corals. Thus, CCA are fundamental to the health of tropical marine ecosystems including the Great Barrier Reef (GBR) in Australia. It is well established that light is an important driver in marine ecosystem processes, but little is known about how light quality or intensity impact CCA communities including in aquaculture. This study tested the influence of light irradiance and spectra on community structure and composition of tropical CCAs growing on artificial substate. Settlement tiles were conditioned in a common garden flow-through system at the Australian Institute of Marine Science, Townsville, and then distributed across aquaria exposed to four distinct irradiance levels (5, 15, 60, or 160 µmol m2s1) and three different spectra (full, blue-dominated, or green-dominated). Morpho-anatomy and DNA sequences were used to identify algae and it was observed that *Lithophyllum*, *Porolithon*, and *Mesophyllum* species dominated settlement tiles. Results indicated that light intensity had a greater influence on CCA community composition and morphology than did light spectrum. These results may aid in selecting light conditions for propagating target CCAs with optimal phenotypes for settling coral larvae in aquaculture for the purpose of reseeding degraded reefs.

This research was conducted on the land of the Bindal and Wulgurukaba People. The authors pay their respects to Elders past, present and emerging.

3.30pm

Spatiotemporal trends in pH and dissolved oxygen on inshore fringing reefs, part 1: environmental drivers of mesoscale variability

Stephanie Di Perna[a,b,c], Mia Hoogenboom[a] & Katharina Fabricius[b]

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Successful conservation efforts and predictions in the face of climate change rely on our understanding of ecological patterns, especially for sublethal impacts such as coastal acidification and mild-moderate hypoxia. Our aim was to investigate natural variability for pH and dissolved oxygen on two fringing, inshore reefs off Magnetic Island in the central Great Barrier Reef. Oceanographic instruments were deployed along the benthos which recorded pH and dissolved oxygen (DO), as well as benthic light, temperature, salinity, depth and water velocity every 10 minutes. Midway through the sampling period a low-pressure system passed through, creating a particularly unique dataset as all physical and biochemical parameters were impacted. Overall, pH and DO variability were both significantly greater in the reef flat compared to the crest; values for pH and DO overall ranged 0.6 units and 12.5 mg L^{-1}, with diurnal fluctuations up to 0.4 units and 10.5 mg L^{-1}, respectively. In the reef flat, pH dropped below 7.8 and DO regularly reached hypoxic conditions. Temperature was the main physical driver of pH fluctuations, whereas benthic light dominated the fluctuations in DO, with factors such as salinity and water velocity having a greater influence on overall pH and DO trends. Inshore fringing reef environments are already experiencing conditions in benthic pH and DO predicted for 2100 by the Intergovernmental Panel on Climate Change, exposing the reef communities into stressful biogeochemical conditions. Our dataset emphasizes that predictions used for conservation policy must be based on local conditions and variability.

Wulgurukaba people (Magnetic Island)

Speed Talk - 3.50pm

Survival peaks for seeded *Acropora digitifera* corals living at maximum wave energy limits on Moore Reef

Taylor Nicole Whitman[a,d], A/Prof Mia Hoogenboom[c, d], Dr. Andrew Negri[b,d] & Dr. Carly Randall[b,d]

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[b]*Australian Institute of Marine Science, 1526 Cape Cleveland Road, Cape Cleveland, QLD 4810, Australia;*
[c]*James Cook University, 1 James Cook Drive, Douglas, Townsville, QLD 4811, Australia;*
[d]*Reef Restoration and Adaptation Program, AIMS, 1526 Cape Cleveland Road, Cape Cleveland, QLD 4810, Australia.*

Coral seeding with sexually reproduced coral young offers one solution to help reefs persist in an uncertain future. However, the biological and physical pressures corals face during recruitment are challenging the effectiveness of this technique. To underpin environmental thresholds to survival, we seeded newly settled coral on engineered seeding devices to 10 sites with varying wave energy, high to low. After 1-year, the average survival surpassed 60% but reached 96% at maximum wave energy sites. Survival was 2.5x higher at high versus low energy sites. The selection of seeding sites is critical to ensure effective restoration of corals via seeding.

Wulgurukaba, Bindal, Gunggandji

Speed Talk - 3.55pm

Beyond heat stress: investigating pre-summer acclimatisation for enhanced coral bleaching prediction

Valerie J. Cornet[a,d], Neal E. Cantin[b], Karen E. Joyce[c] & Scott F. Heron[a]

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Understanding the mechanisms underlying coral resilience to thermal stress is critical for effective conservation, as coral reefs are increasingly threatened by bleaching. This study investigates the role of pre-summer temperatures in influencing bleaching susceptibility. By developing metrics based on sea surface temperature anomalies in winter and spring, we analysed the relationships between these anomalies, heat stress, and coral bleaching. Including each pre-summer metric increased the models' predictive accuracy. Acclimatization responses occurred within pre-summer heat accumulation ranges, beyond which excess heat exacerbated coral bleaching. While advancing our understanding of coral bleaching, this research suggests improvements for future coral bleaching prediction models.

I would like to acknowledge the 70 Traditional Owner groups of the Great Barrier Reef, and their leaders, past, present, and emerging, whose sea country this data were collected from. I would specifically like to acknowledge the Wulgurukaba people as the Traditional Owners of Yunbenun, the land on which I conducted my research.

Poster

Concurrent Autonomous Surface-Underwater Monitoring System

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The world's oceans are facing escalating anthropogenic pressures, such as over-fishing, eutrophication, hypoxia, aggregate dredging, global warming, and the human-mediated introduction of non-indigenous marine flora and fauna. Of particular concern are outbreaks of the crown-of-thorns starfish (*Acanthaster planci*) — an efficient predator of scleractinian corals —in the Great Barrier Reef and Indo-Pacific regions. To understand the effects of these pressures, traditional sampling methods such as manta tow surveys are undertaken to assess the status of coral reef biota. However, these traditional monitoring strategies are expensive, labour-intensive, limited by safety considerations, and the collected data is susceptible to high variability of bias.

To address these shortcomings, autonomous marine craft present as an attractive technology to streamline sampling and data collection, with potential to operate in unknown or hazardous marine environments. The proposed concurrent autonomous surface-underwater monitoring system utilises an umbilical cable for the reliable transfer of power and telemetry between the surface and underwater vehicles. Such a system can extend survey durations, and provide high resolution images of the benthic zone using a camera payload attached to the underwater vehicle. However, the umbilical cable poses operational risks to naïve control systems, whose use could result in damage from cable entanglement or contact with coral. In response, the proposed system will utilise the Riemannian Motion Policy (RMP) framework for task optimisation embedded in a Riemannian manifold, providing a computationally efficient means to handle path planning and collision avoidance. This research contributes to ongoing efforts to preserve marine biodiversity and sustain healthy reef ecosystems.

We acknowledge the Australian Aboriginal and Torres Strait Islander peoples as the traditional owners of the lands and waters where we live and work.

Poster

How to improve cross-cultural approaches to managing Sea Country on the Great Barrier Reef through co-designed research agreements

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There is growing recognition that bringing together Indigenous Knowledges and western scientific approaches to protect and conserve Sea Country in Northern Australia is of vital importance. The potential of Indigenous Knowledge to contribute to managing Sea Country sustainably as well as providing insights to adaptation strategies to help address the dual threats of climate change and anthropogenic impacts remains underutilised. To achieve these outcomes for Sea Country, it is critical to improve cross-cultural engagement. Although best practice guidelines call for collaborative approaches in partnership with Indigenous communities, there are few resources that provide practical guidelines, starting points, or consistency for researchers or Indigenous communities. Working alongside the Gimuy Walubara Yidinji, our co-designed research project investigates coastal systems along the Great Barrier Reef while working to improve standards of engagement between research communities and Traditional Owners. We have co-developed a research agreement through a process of respectful engagement as the foundation of this project. Key areas of consideration include Indigenous intellectual property rights and data sovereignty. We discuss the successes and challenges in the development of a research agreement template that contributes to leading practice in research with Traditional Owners along the Great Barrier Reef. These foundations pave the way for building a standard of practice that respectfully incorporates, includes, and celebrates Indigenous and Torres Strait Islander heritage of the Great Barrier Reef.

Gimuy Walubara Yidnji

Poster

Key variables associated to fish biomass and diversity - the SS Yongala case study

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The *SS Yongala* shipwreck is a Maritime Heritage Site within the Great Barrier Reef Marine Park, and serves as an artificial reef supporting a remarkable marine biodiversity. However, this biodiversity has not been fully studied, and the key factors that support the high fish biomass and diversity in this site remain unknown. To address this gap in knowledge, we conducted fish biomass and diversity surveys across three seasons, and collected data on different putatively influential factors. These included: a) Diversity, abundance, area/shelter volume, and height of antipatharians (black corals) and scleractinians (hard corals) - which are the dominant megabenthos at the *Yongala*; and b) Localised environmental parameters (light, current flow, temperature), measured for over a year using in-situ loggers. Our findings will improve our understanding of the factors that promote such rich biodiversity, and will also inform the revised conservation management plan for the *Yongala*.

Poster

Disease prevention potential of probiotics in coral aquaculture

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Coral reefs are threatened worldwide, and coral aquaculture plays an important role in their restoration. However, high coral densities in aquaculture settings increase the risk of pathogen virulence, particularly among the vulnerable newly-settled recruits. Here, we identified potential probiotic candidates to act against putative pathogenic *Ruegeria arenilitoris* 2-ATT-W2 via in vitro screening. Their disease-prevention efficacy in 6-month-old *Acropora* coral recruits was determined by an exposure experiment. 16S rRNA gene amplicon sequencing and digital droplet PCR (ddPCR) were utilised to notice any shifts, and to quantify the total load in the bacterial community within the coral recruits. Results from the study aim to provide insight into coral-bacterial interactions and coral probiotics application, ultimately enhancing coral disease-resilience and improving the yield and management of coral aquaculture.

I acknowledge the Wulgurukaba and Bindal people as the traditional owners of the land I work on.

Poster

Improving Coral Grow-Out Through an Integrated Aquaculture Approach

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In the wild there is evidence that corals derive benefits from fish that live in close association. To test if similar effects could be applied ex situ, fish-associated corals, *Acropora kenti* and *Pocillopora verrucosa*, and non-fish-associated, *Porites lutea* and *Platygyra daedalea*, were grown in aquaria under different treatments for 3 months, while their growth and photosynthetic activity was tracked. Treatments included corals 1) kept with a school of *Chromis viridis* fed a pelleted diet, 2) supplied filtered water from a tank with a school of *C. viridis*, 3) fed live feeds whilst maintained with *C. viridis*, 4) supplied only with live feeds, 5) no fish but supplied with pelleted fish diet, and 6) control with no feeds or fish. Exposure to fish, fish-water or live feeds increased the photosynthetic capacity of *Symbiodiniaceae* within the corals. These treatments also improved coral growth as measured by buoyant weight, while the pelleted fish diet suppressed growth. Results indicate there are benefits to captive reared corals through nutrient enrichment from dissolved fish wastes. Integrated multi-species aquaculture is an important tool that could improve production of corals to satisfy a demand for sustainably produced colonies for reef restoration endeavours and the burgeoning coral aquarium trade.

Wulgurukaba, Bindal and Wadawurrung

Poster

Circumnavigation of Antarctica Reveals Microplastic Contamination in the Southern Ocean: A collaboration with Lisa Blair Sails the World.

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Comprehensive knowledge regarding the spatial and temporal distribution of microplastics in various marine environments remains elusive. Lisa Blair's quest to circumnavigate Antarctica provided a unique opportunity to conduct a near-continuous collection of subsurface seawater samples to study microplastic contamination in the Southern Ocean, a region of interest of Australasian scientists, managers, and the broader public. The Australian Institute of Marine Science (AIMS) in collaboration with the Integrated Marine Observing System (IMOS), facilitated the collection, processing, and analysis of these seawater samples for microplastics contamination. Samples were collected every 22 hours per 24 hours over 90 days using the SubCtech OceanPack™ RACE® Microplastic Sampler, starting, and finishing in Albany (Western Australia). Oceanographic data, including seawater temperature and salinity, were also recorded. Supported by the Clean Ocean Foundation, sample processing protocols have been developed and validated for these samples. This poster provides an of the project and preliminary findings, offering insights into the spatial distribution of microplastics in Southern Ocean waters.

Acknowledgement of the Wulgurukaba and Bindal custodians past, present and emerging in which sample processing and data analysis was taken place.


Image courtesy of
Dr Christopher Brunner
http://aims.jcu.edu.au