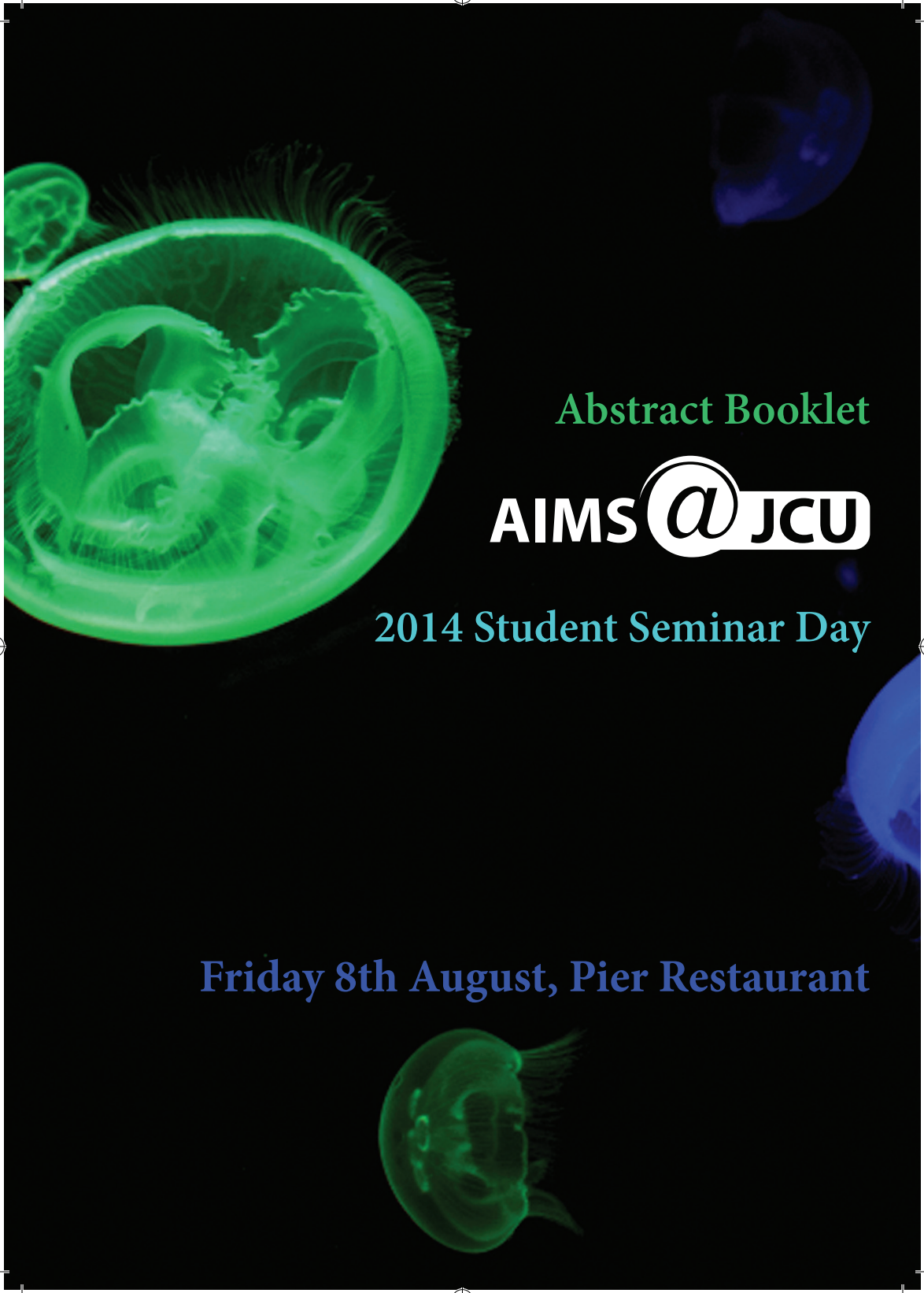

Abstract Booklet

AIMS @ JCU

2014 Student Seminar Day

Friday 8th August, Pier Restaurant

AIMS@JCU

Student Seminar Day 2014
Friday, 8th August at The Pier

Time	Title	Presenter
9:00 am	**Opening address**	**Libby Evans-Illidge**
9:15 am	The influence of ocean acidification on hard and soft coral competition	Hayley Brien
9:30 am	Suspended solids increase sperm limitation in scleractinian corals	Gerard Ricardo
9:45 am	Coal carrier spill: acute and chronic effects of coal dust on a reef-building coral, seagrass and fish species	Kathryn Berry
10:00 am	Viruses in coral diseases: bacteriophages and phage therapy	Patrick Buerger
10:15 am	**Morning tea, view posters and photographs**	
11:00 am	The immune response of *A. millepora* under CO_2 stress using a genomic approach	Catalina Aguilar Hurtado
11:15 am	The eco-physiology of two species of tropical stingray in an era of climate change	Pasang Tenzing
11:30 am	The impact of conservation areas on trophic interactions between apex predators and herbivores on coral reefs	Justin Rizzari
11:45 am	Residency patterns and space use of grey reef sharks in a semi-continuous reef environment	Mario Espinoza
12:00 midday	**Lunch with poster session and view/vote on photographs**	
2:00 pm	You are where you eat: Regional residency patterns of a small-bodied shark revealed by stable isotope analysis	Samantha Munroe
2.15 pm	Seasonal depth and space use patterns of coral trout (*Plectropomus leopardus*) using passive acoustic tracking	Jordan Matley
2.30 pm	Physiological plasticity rather than local adaptation drives hypoxia acclimation in a tropical estuarine fish	Geoffrey Collins
2:45 pm	**Speedtalks**	
	Characterising bacteriophages for black band disease: potential for phage therapy?	Patrick Buerger
	Inshore Coral Health: To Be or Not To Be?	Melissa Rocker
	Climate change and tropical sponges; The effect of elevated pCO_2 and temperature on sponge juveniles	Holly Bennett
	Coral reefs of today: Sponge reefs of the future? - How sponges from the Great Barrier Reef respond to climate change	Christine Altenrath
	Coexistence by nitrogen partitioning and asymmetric dispersal using microalgae cultures	Martino Malerba
3:15 pm	**AIMS@JCU Alumni Keynote**	**Ian McLeod**
3:45 pm+	**Afternoon tea, judges deliberation and presentation of awards and prizes; end of day funtion with drinks and nibbles provided**	

9.15am

The influence of ocean acidification on hard and soft coral competition

Hayley V. Brien

James Cook University, Townsville, QLD 4811, Australia

Ocean acidification a key environmental factor that could influence the competitive interactions of the dominant coral reef competitors. The general aim of this study was to understand how ocean acidification could influence competitive interactions between hard and soft corals. We did this by investigating growth and photosynthesis rates of *Porites cylindrica* (a hard coral) under ocean acidification and competing against *Acropora cerealis* (another hard coral), *Sacrophyton sp*. and *Sinularia sp*. (both soft corals). Furthermore we investigated if growth and photosynthesis rates of the same four corals will differ under ocean acidification. Corals were exposed to elevated CO_2 (pH of 8.2, 7.99, 7.84) for four weeks in an experimental CO_2 dosing set-up at Orpheus Island Research Station. Ocean acidification only significantly influenced the photosynthesis efficiency of *P. cylindrica* with the presence/absence of a competing coral. Further suggesting that the symbiont were susceptible to ocean acidification and not the host coral. Growth and photosynthesis rates of both hard corals without a competitor were unaffected by exposure to ocean acidification for 4 weeks. This study further strengthens the hypothesis that soft corals may thrive with elevated CO_2 in terms of photosynthesis. However responses may be species specific as we found photosynthesis efficiency of *Sinularia sp*. significantly declined with elevated CO_2 yet *Sacrophyton sp.* did not. Further research needs to be undertaken into how hard and soft corals regulate their internal pH in order to deter the effects of ocean acidification. Only then will be understand why coral reefs may look so different in the high CO_2 world forecasted for the next century.

9.30am

Suspended solids increase sperm limitation in scleractinian corals

Gerard Ricardo[abc], Ross Jones[b,c], Peta Clode[a,c] and Andrew Negri[b,c]

[a]*Centre of Microscopy, Characterisation and Analysis, University of Western Australia, Perth, Australia*
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[c]*Western Australian Marine Science Institution (WAMSI), Perth, Western Australia, Australia*

Suspended solids from dredging or runoff threaten the reproductive processes and early life history stages of coral, which are critical for maintenance of reefal populations and their ability to recover following disturbances. Three separate experiments were conducted to understand the underlying mechanisms that reduce the fertilisation of coral in turbid water. First, the effect of sperm concentration on fertilisation success was investigated in presence (705 mg l^{-1}) and absence of suspended solids. This experiment demonstrated that sperm limitation occurred in the presence of suspended solids, as two orders of magnitude more sperm were required to achieve maximum fertilisation, compared with control treatments. Second, gametes were pre-exposed to suspended solids (230 mg l^{-1}) for two time periods, at two sperm concentrations, simulating the lag-time of conspecific gametes meeting in a sediment plume under advective forces. An interactive effect was observed, with a greater decrease in fertilisation success observed when gametes were exposed for longer periods to suspended solids, and at lower sperm concentrations. In the third experiment, flow cytometry was used to assess the potential effect of suspended solids on sperm numbers on the water's surface. A 47% decrease in sperm concentration was recorded in the upper layer of the suspended solids treatment (220 mg l^{-1}), indicating that suspended solids accelerate the sinking of sperm. Collectively, these findings show that suspended solids can remove sperm from the water's surface during coral spawning events leading to sperm limitation, with the inhibition of fertilisation compounding with the time gametes remain in the plume.

9.45am

Coal carrier spill: acute and chronic effects of coal dust on a reef-building coral, seagrass and fish species

Kathryn L.E. Berry[a,b], Mia Hoogenboom[a,c], Florita Flores[b] and Andrew Negri[b]

[a]*School of Marine and Tropical Biology, James Cook University, Townsville*
[b]*Australian Institute of Marine Science, Townsville*
[c]*ARC Centre of Excellence for Coral Reef Studies, Townsville*

Black coal is Australia's second highest export commodity and coal vessels transiting through the Great Barrier Reef (GBR) are forecast to increase from 1649 in 2012 to approximately 6500 per annum over the next two decades. Greater shipping traffic through the complex GBR system may increase the risk of future shipping and pollution incidents. Coal particles have been found to cause a variety of impacts to temperate aquatic organisms, yet, the effects of coal exposure to tropical marine organisms remains largely unknown. In order to reduce this knowledge gap and increase scientifically rigorous information necessary to improve impact assessments and risk modelling for future coal spill scenarios, a controlled experiment was conducted that exposed a reef-building coral (*Acropora tenuis*), seagrass (*H. uninervis*), and reef fish species (*Acanthochromis polyacanthus*) to a range of coal dust concentrations that could be released during a coal spill event. This presentation will highlight the dose response relationships of each species over time by addressing changes to specific biomarkers, as well as identify the lethal and sub-lethal thresholds of these common reef species to acute and chronic coal dust exposure.

10.00am

Characterising bacteriophages for black band disease: potential for phage therapy?

Buerger P.[a,b], Weynberg K.D.[c], Wood-Charlson E.M.[c], Willis B.L.[b,d] and van Oppen M.J.H[b,c]

[a]*AIMS@JCU*
[b]*ARC Centre of Excellence for Coral Reef Studies*
[c]*Australian Institute of Marine Science*
[d]*School of Marine and Tropical Biology, James Cook University*

The prevalence of black band disease (BBD) is increasing in coral populations on the Great Barrier Reef in response to anthropogenic impacts, such as elevated seawater temperatures and nutrient levels. Our limited understanding of coral disease pathogenesis, however, has impeded the development of options for control and mitigation of diseases like BBD. Bacteriophages that are associated with BBD may play a role in either the onset or mitigation of the disease, for instance through horizontal transfer of virulent genes or lysis of pathogenic bacteria, respectively. To investigate the potential roles of bacteriophages associated with BBD, we show with targeted PCR, that distinct T4-like bacteriophage communities occur in association with BBD, i.e., bacteriophage communities during disease development differ from those in fully developed lesions. Plans are under way to sequence the genome of both the host and its viruses and to recover a species-specific lytic bacteriophage that raises the possibility of disease mitigation via phage therapy, i.e. the treatment of a bacterial disease with pathogen-specific bacteriophages.

11.00am

The immune response of *A. millepora* under CO_2 stress using a genomic approach

Catalina Aguilar[a,b], Florêt S.[c], Sprungala S.[d], Moya A.[d], Hayward D.[c], Bourne D.[e] and Miller D.J.[b,d]

[a]*AIMS@JCU, Australian Institute of Marine Science, School of Pharmacy and Molecular Sciences, James Cook University*
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[e]*Australian Institute of Marine Science, Townsville*

Climate change is predicted to play an increasingly more significant role in the global loss of coral reefs that is already occurring. Some studies imply that corals that are already stressed may be more susceptible to disease, giving concern that ocean acidification occurring as a result of higher atmospheric CO_2 may compromise the coral immune system. There are precedents for this: in both *Drosophila* and mammals, hypercapnia directly suppresses the innate immune response. Based on our earlier investigations of the innate immune response in *Acropora*, here we used the Illumina RNAseq technology to investigate the effect of 1100ppm pCO_2 on the coral response to challenge with the immunogen LPS.

We identified several immune related genes in *Acropora* on the basis of sequence comparisons with their mammalian counterparts. Both Toll-like and NOD receptors showed higher levels of expression after immune challenge at 1100ppm pCO_2, whereas some other pathway components were suppressed. Moreover the elevated expression of several caspases implies that apoptosis may be higher following immune challenge under CO_2-stress, in contrast with a subset of heat shock proteins that were expressed at lower levels. These findings suggest that, as in higher animals, elevated CO_2 may compromise the innate immune response of corals.

11.15am

The eco-physiology of two species of tropical stingray in an era of climate change

Pasang Tenzing[a], Timothy Clark[b], Colin Simpfendorfer[a] and Michelle Heupel[b]

[a]*James Cook University*
[b]*Australian Institute of Marine Science*

Elasmobranchs face considerable threats worldwide from over-fishing and habitat degradation. However, little is known about how they will respond physiologically to warmer temperatures as a result of current climate change patterns. This study aimed to measure the metabolic rates of two species of tropical stingrays (mangrove whip ray *Himantura granulata*, cowtail ray *Pastinachus atrus*) at a variety of environmental temperatures, to investigate the effect of temperature on the specific dynamic action (SDA) of both species. Resting metabolic rates at four different temperatures (22, 26, 30 & 34^{0}C) were measured using respirometry techniques and the SDA estimated from metabolic rates at 26, 30 and 34°C. The results showed an exponential increase in resting metabolism (MO_2) as temperature increased, with no significant difference between the two species at any temperature after the data was adjusted for the effects of mass. Due to the limited amount of feeding by *P. atrus*, SDA parameters were only reported for *H. granulata*. For this species, SDA duration became significantly shorter at warmer temperatures and the post-prandial metabolic peak values were significantly higher as temperature increased. Conversely, overall digestive efficiency was found to not significantly differ between temperature trials. Both ray species may then potentially be utilising temperature extremes seen in their environment to allow more frequent feeding through speedier digestion without risking enhanced energetic cost. However, continued use of this thermal heterogeneity may prove metabolically disadvantageous if predicted future climate change patterns eventuate, potentially forcing both species into deeper water where they are at greater risk to predation. With coastal environments expected to see more intense and erratic shifts in temperature, these rays could face population decline and cause ecological changes through their absence.

11.30am

The impact of conservation areas on trophic interactions between apex predators and herbivores on coral reefs

Justin R. Rizzari[a,b,c], Brock J. Bergseth[a,b] and Ashley J. Frisch[b]

[a]*ARC Centre of Excellence for Coral Reef Studies, James Cook University*
[b]*School of Marine and Tropical Biology, James Cook University*
[c]*AIMS@JCU, James Cook University*

Apex predators are declining at alarming rates due to exploitation by humans, and we have yet to fully discern the impacts of apex predator loss on ecosystem function. In a management context, it is critically important to clarify the role that apex predators play in structuring populations of lower trophic levels. Thus, we examined the top-down influence of reef sharks (an apex predator on coral reefs) and mesopredators on large-bodied herbivores using underwater surveys across fished, no-take, and no-entry management zones in the Great Barrier Reef Marine Park, Australia. Both shark and mesopredator populations were positively influenced by marine reserve status. Specifically, shark abundance and mesopredator size and biomass were greater in no-entry zones compared to fished and no-take zones, further indicating the viability of strictly enforced human exclusion areas as tools for the conservation of predator communities. Resultant changes in predator populations due to protection in no-entry zones did not have any discernible influence on the density, size, or biomass of different functional groups of herbivorous fishes. The lack of a relationship between predators and herbivores suggests that top down forces may not play a strong role in regulating large-bodied herbivorous coral reef fish populations. Given this inconsistency with traditional ecological theories of trophic cascades, trophic structures on coral reefs may need to be reassessed to enable the establishment of appropriate and effective management regimes.

11.45am

Residency patterns and space use of grey reef sharks in a semi-continuous reef environment

Mario Espinoza[a,c], Michelle R. Heupel[a,b], Andrew Tobin[a] and Colin A. Simpfendorfer[a]

[a]*Centre for Sustainable Tropical Fisheries and Aquaculture*
School of Earth and Environmental Sciences, James Cook University
[b]*Australian Institute of Marine Science*
[c]*AIMS@JCU*

There is growing evidence that movements of reef sharks at remote and isolated atolls differ from semi-continuous, closely-spaced reef habitats. Therefore, understanding how the behaviour and spatial ecology of a species differs between reef environments is essential for developing sound conservation approaches for sharks. Here, we examined the residency and movements of grey reef sharks (*Carcharhinus amblyrhynchos*) in a semi-continuous reef environment, central Great Barrier Reef (GBR). An array of 56 acoustic receivers covering 17 reefs across 150 km was used to monitor shark movements. Forty *C. amblyrhynchos* were tagged with acoustic transmitters and monitored from 251-821 d. Most sharks were detected on a single reef; however, some individuals, particularly males (n = 6) moved distances of up to 45 km between reefs. Residency index (RI – number of days sharks were detected at their tagging reef / number of days monitored) ranged from 0.02-1.0, with a mean ± SD residency of 0.78 ± 0.26. Mixed effect models showed that RI did not differ between males and females, but there was a significant interaction between month and size. Although *C. amblyrhynchos* was present year-round, large, mature individuals spent less time between November and December. This behaviour is thought to be related to reproduction and the timing coincides with parturition of female *C. amblyrhynchos* reported for the GBR. This study showed that even in semi-continuous reef environments, *C. amblyrhynchos* exhibited high levels of reef fidelity. Our data also suggest that effective management of *C. amblyrhynchos* need to consider behavioural reproductive differences.

2.00pm

You are where you eat: Regional movement patterns of a small-bodied shark revealed by stable isotope analysis

Samantha EM Munroe[a], Colin A Simpfendorfer[b], Aaron Fisk[c] and Michelle R Heupel[d]

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[c]*Great Lakes Institute for Environmental Research and Department of Earth and Environmental Sciences, University of Windsor, Windsor, Canada*
[d]*Centre for Sustainable Tropical Fisheries and Aquaculture, School of Earth and Environmental Sciences, James Cook University, Townsville and Australian Institute of Marine Science, Townsville*

Data on marine predator movement is essential to understanding ecosystem connectivity and species management. As highly mobile predators, sharks are key maintainers of ecosystem diversity. The goal of this study was to assess the movement patterns of the Australian sharpnose shark, *Rhizorpinondon taylori*, using stable isotope analysis. Isotope analysis determines the $\delta^{13}C$ in animal tissues to assess movement patterns. $\delta^{13}C$ values vary at the base of the food chain but are conserved up the food chain. Therefore, $\delta^{13}C$ values can be used to indicate the foraging location of an animal. Metabolically active tissues (plasma) respond to changes in diet more quickly than tissues with lower metabolic rates (muscle). Different tissues can reveal if foraging locations remain the same over time. Muscle and plasma were sampled from 116 *R. taylori* captured in five embayments along the northeast coast of Queensland. Distance between adjacent bays ranged from 30 to 150 km. Seagrass and plankton were collected from each location to establish local isotope profiles. A 2-way Bayesian ANCOVA was used to determine the effect of capture location, sex, and animal size on *R. taylori* muscle and plasma $\delta^{13}C$. Results found *R. taylori* $\delta^{13}C$ fell within range of capture location $\delta^{13}C$. There were significant differences in $\delta^{13}C$ between locations. Tissue $\delta^{13}C$ was also positively correlated with environmental $\delta^{13}C$, indicating geographical trends in *R. taylori* $\delta^{13}C$ were consistent with geographical trends in bay $\delta^{13}C$. These findings suggest *R .taylori* remained within 100 km of capture location 6 months to 1 year prior to capture.

2.15pm

Seasonal depth and space use patterns of coral trout (*Plectropomus leopardus*) using passive acoustic tracking

JK Matley[a], MR Heupel[a,b] and CA Simpfendorfer[a]

[a]*Centre for Sustainable Tropical Fisheries and Aquaculture & School of Earth and Environmental Sciences, James Cook University, Townsville, Qld Australia 4811*
[b]*Australian Institute of Marine Science, PMB No 3, Townsville, Qld Australia 4810*

Understanding the extent and frequency that fish make movements can help define the seasonal importance of different habitats and isolate spatial and temporal vulnerability to exploitation. Coral trout (*Plectropomus leopardus*) is one of the main targeted fisheries species in the Great Barrier Reef (GBR) and concern exists that populations may be at risk from overfishing during spawning season. The objective of this study was to determine long-term space use patterns of *P. leopardus* and identify any associated temporal variation that may affect vulnerability to fishing. Passive acoustic tracking was conducted at Heron Island and One Tree Island Reefs in the southern GBR, Australia. A total of 124 *P. leopardus* were implanted with V13P acoustic transmitters between 2010 and 2012. Forty-five VR2W receivers were deployed at both reefs to track the movements of tagged individuals. The influence of time of day, season, year, and location on several movement measures were investigated. Results showed increased horizontal movements and higher activity in deeper water during the day in the austral summer. Movement patterns, both vertically and horizontally, appeared to be influenced by either foraging or reproductive drivers. Despite increased movements during summer, individuals typically remained in a small area ~0.5 km^2 throughout the year indicating that long range spawning-related movements are rare. This study is important because it provides long-term (~3 years) movement data with extensive reef coverage of an economically significant reef fish and increases knowledge of spatial and temporal space use patterns that may be driven by two key biological demands.

2.30pm

Physiological plasticity rather than local adaptation drives hypoxia acclimation in a tropical estuarine fish

Geoffrey M Collins[a,b], Timothy D Clark[b,c] and Alexander G Carton[a]

[a]*Centre for Sustainable Tropical Fisheries and Aquaculture, School of Marine and Tropical Biology, James Cook University, Townsville, QLD, Australia*
[b]*AIMS@JCU Collaborative Research Program, Townsville, QLD, Australia*
[c]*Australian Institute of Marine Science, Townsville, QLD, Australia*

Physiological plasticity is emerging as a key driver in determining the acclimation potential of animals to cope with rapid environmental change, yet it is probable that local adaptation may play an equal or greater role. Here, we investigate the acclimation potential of two geographically-distinct populations of the tropical Australian barramundi (*Lates calcarifer*) to diel hypoxia. Fish were exposed to a daily hypoxia challenge of 6 h below 62% air saturation, down to a minimum of 5% saturation, then followed by a return to normoxia. Physiological plasticity was assessed through respirometry and haematology after either 8 or 16 d of daily hypoxia exposure. Hypoxia tolerance (measured as the critical oxygen tension; $[O_2]$crit) was not different from control fish after 8 d ($[O_2]_{crit} \approx$ 20-21% saturation), but improved similarly in both populations after 16 d ([O2]crit ≈ 16-17% saturation) of exposure. This improvement corresponded with increases in haematocrit and haemoglobin, but not an increase in the concentration of haemoglobin per erythrocyte. Given the similarity of the response between these two populations, we conclude that hypoxia tolerance for barramundi is more dependent on physiological plasticity than inherent local adaptation.

Speed Talk

Viruses in coral diseases: bacteriophages and phage therapy

Buerger P.[a,b], Weynberg K.D.[c], Wood-Charlson E.M.[c], Willis B.L.[b,d] and van Oppen M.J.H[b,c]

[a]*AIMS@JCU*
[b]*ARC Centre of Excellence for Coral Reef Studies*
[c]*Australian Institute of Marine Science*
[d]*School of Marine and Tropical Biology, James Cook University*

Coral disease prevalence is increasing with thermal heat stress anomalies of climate change and in areas of anthropogenic impact. Our understanding of coral diseases is limited, which makes it difficult to address diseases with adequate management strategies. Especially viruses are the least studied component of reef organisms, despite their ubiquitous abundance and possible contribution to coral diseases as potential drivers of coral disease by shifting virulent genes or as supporters of disease resistance by lysing pathogenic bacteria in phage therapy.

Speed Talk

Inshore Coral Health: To Be or Not To Be?

Melissa M. Rocker[a,b,c]

[a]*AIMS@JCU, Australian Institute of Marine Science, James Cook University, Townsville, Queensland 4811, Australia*
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[c]*School of Marine and Tropical Biology, James Cook University, Townsville, Queensland 4811, Australia*

Degradation and loss of inshore coral reefs from human-induced environmental stressors is an important issue in coral reef science. My thesis aims to (1) understand how coral health differs between coral populations exposed to varying WQ regimes, (2) determine physiological processes underpinning coral growth through analyses of tissue energetics, symbiont associations, and gene expression, as well as (3) establish the ability of corals from different environmental conditions to acclimatize to novel environments. Results acquired from this study will enhance our understanding of the impacts of stressors on coral physiology and elucidate the mechanisms of coral resilience.

Speed Talk

Climate change and tropical sponges; The effect of elevated pCO_2 and temperature on sponge juveniles.

Holly Bennett[a,b], James Bell[a], Simon Davy[a] and Nicole Webster[b]

[a]*Victoria University of Wellington*
[b]*Australian Institute of Marine Science*

Sponges form important structural and functional components of coral reef ecosystems, they are also increasing on reefs globally. Despite this, little is known about climate change effects on sponges. This research examines the response of juvenile *Carteriospongia foliascens* to a synergistic rise in pCO_2 and temperature. Mortality, growth and respiration of sponges, and photosynthetic efficiency of associated microbes was compared between nine pCO_2 and temperature treatments, based on IPCC projections for 2100. The results of this research increase understanding of climate change impacts to sponges and provide insight into whether sponge dominance is a possible future trajectory for coral reefs.

Speed Talk

CORAL REEFS OF TODAY: SPONGE REEFS OF THE FUTURE? - How Sponges From The Great Barrier Reef Respond To Climate Change

Christine Altenrath[a,b], Marcus Sheaves[b] and Nicole Webster[c]

[a]*Australian Institute of Marine Science*
[b]*James Cook University, School of Marine and Tropical Biology*
[c]*Australian Institute of Marine Science*

Recent research is indicating that many sponge species are less sensitive than corals to elevated sea surface temperature and pCO_2. To test this, we exposed sponges of different life history stages to climate change conditions predicted to occur by 2100. Two year old juveniles of *Carteriospongia foliacsens* bleached and had higher mortality at 31.5˚C at all pCO_2 levels and the response of adult populations is currently being assessed. Molecular and microbial responses of the sponges to the different conditions will now be determined to reveal any mechanisms that may enable sponges to adapt to these environmental changes.

Speed Talk

Coexistence by nitrogen partitioning and asymmetric dispersal using microalgae cultures

Martino E. Malerba[a,b,c], Sean R. Connolly[c,d] and Kirsten Heimann[c,e]

[a]*AIMS@JCU, James Cook University, Townsville, Queensland, Australia*
[b]*Australian Institute of Marine Science, Townsville, Queensland, Australia*
[c]*School of Marine and Tropical Biology, James Cook University, Townsville, Queensland, Australia*
[d]*Australian Research Council Centre of Excellence for Coral Reef Studies, James Cook University, Townsville, Queensland, Australia*
[e]*Centre for Sustainable Tropical Fisheries and Aquaculture, Townsville, Queensland, Australia*

In this time of biodiversity crisis, understanding the mechanisms promoting biodiversity in nature is a priority for research. In my study, I explore how specific forms of resource competition and asymmetric dispersion can be important drivers decreasing species extinction in nature, by developing and experimentally calibrating models of how fast-growing microscopic organisms compete for essential resources. My results highlight how species interactions following a disturbance event can be also affected by previous resource history and resource assimilation energy. This will contribute to our understanding of what are important processes to conserve in order to maintain high biodiversity in natural ecosystems.

Poster

A morphological and molecular revision of Phyllosponginae: how different are similar foliose sponges from the Australian tropics?

Muhammad Azmi Abdul Wahab[a,b,c], Jane Fromont[e], Nicole Webster[c], Steve Whalan[d] and Nikos Andreakis[c]

[a]*AIMS@JCU, James Cook University, Townsville, Queensland 4811, Australia*
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[d]*School of Environment, Science and Engineering, Marine Ecology Research Centre, Southern Cross University, PO Box 157, Lismore, NSW 2480, Australia*
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Defining taxonomical units and elucidating spatial and temporal relationships amongst taxa are critical in the effective management and conservation of species. Sessile benthic invertebrates such as sponges are important in the ecological functioning of marine habitats and communities (e.g. coral reefs), however, they suffer from problematic taxonomy due to homoplasy and extreme morphological plasticity relating to environmental conditions. Foliose members of the sub-family Phyllosponginae (Dictyoceratida, Thorectidae) consists of the genus *Strepsichordaia*, *Phyllospongia* and *Carteriospongia*, and are abundant in the Indo-Pacific. Being aspiculated, these sponges are sometimes difficult to differentiate due to the lack of reliable morphological characters for species delineation. Therefore we make use of molecular phylogenies inferred from a nuclear marker (ITS2) coupled with morphological information (19 characters; 52 character states) to aid in the identification of evolutionary significant units (ESUs) for foliose Phyllosponginiids. Analyses of samples collected from seven geographical locations across tropical Eastern and Western Australia revealed that molecular phylogenies were congruent with morphology at the genus level and corresponded to eight ESUs. We also identified morphological features relevant to these ESUs and highlight a taxonomical misclassification of one of the groups. Interestingly, we also found that some ESUs were specific in their geographical distribution and hypothesize this delineation to be caused by species isolation and expansion through intermittent geographical separation over past glaciation events.

Poster

Come on baby light my larva: exploring sponge larval fluorescence

Muhammad Azmi Abdul Wahab[a,b,c], Tracy Ainsworth[e], Nicole Webster[c] and Steve Whalan[d]

[a]*AIMS@JCU, James Cook University, Townsville, Queensland 4811, Australia*
[b]*School of Marine & Tropical Biology, James Cook University, Townsville, Queensland 4811, Australia*
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[d]*School of Environment, Science and Engineering, Marine Ecology Research Centre, Southern Cross University, PO Box 157, Lismore, NSW 2480, Australia*
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Fluorescence techniques are increasingly employed in marine science to address questions pertaining to genomics, proteomics, symbiosis and ecology. Apart from being able to produce "pretty pictures", fluorescence microscopy can shed new light onto existing biological and ecological frameworks by providing a quick and effective method of viewing specimens of interest in real-time. With constant improvements in technology and accessibility, fluorescence microscopy is increasingly utilised for both field and laboratory based research. We present applications of fluorescence used in our work on multiple species of tufted parenchymellae sponge larvae from the Great Barrier Reef (GBR). We used epi-fluorescence and confocal microscopy to explore sponge-microbe associations during embryogenesis and maternal investments to larval energetics in optimal and sub-optimal habitats. Interestingly, we also recently discovered variations in the intensity of auto-fluorescence of the larval sponge posterior pigmented ring (light receptive apparatus) between four species of co-occurring GBR sponges. If these variations correspond to larval sponge light sensitivity, we hypothesise that species depth distributions and habitat selection may, in part, be determined by innate light detection capability.

Poster

The immune response of A. millepora under CO2 stress using a genomic approach

Catalina Aguilar[a,b], Forêt S.[c], Sprungala S.[d], Moya A.[b], Hayward D.[c], Bourne D.[e] and Miller D.J.[b,d]

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[c]*Australian National University, Canberra, ACT 0200, Australia*
[d]*School of Pharmacy and Molecular Sciences, James Cook University*
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Climate change is predicted to play an increasingly more significant role in the global loss of coral reefs that is already occurring. Some studies imply that corals that are already stressed may be more susceptible to disease, giving concern that ocean acidification occurring as a result of higher atmospheric CO_2 may compromise the coral immune system. There are precedents for this: in both *Drosophila* and mammals, hypercapnia directly suppresses the innate immune response. Based on our earlier investigations of the innate immune response in *Acropora*, here we used the Illumina RNAseq technology to investigate the effect of 1100ppm pCO_2 on the coral response to challenge with the immunogen LPS.

We identified several immune related genes in *Acropora* on the basis of sequence comparisons with their mammalian counterparts. Both Toll-like and NOD receptors showed higher levels of expression after immune challenge at 1100ppm pCO_2, whereas some other pathway components were suppressed. Moreover the elevated expression of several caspases implies that apoptosis may be higher following immune challenge under CO_2-stress, in contrast with a subset of heat shock proteins that were expressed at lower levels. These findings suggest that, as in higher animals, elevated CO_2 may compromise the innate immune response of corals.

Poster

Environmental drivers of depth use by an exploited reef fish

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Redthroat emperor (*Lethrinus miniatus*) is an important species to fisheries of Australia, Japan, New Caledonia and Tonga, yet little is known about its spatial ecology. Recent research has suggested that variability in movement patterns among individuals may be linked to environmental conditions. Knowledge of how environmental conditions influence movement patterns of redthroat emperor is vital to better understanding response of this species to changes in climate. Utilising an acoustic telemetry network combined with in-situ real-time environmental monitoring, this research investigated whether movement patterns of sixty adult individuals were driven by environmental factors or individual size. Model averaging identified daily presence of redthroat emperor was related to water temperature and tidal height, while weekly vertical activity spaces were not influenced by any parameters measured. This suggests individuals may move to deeper cooler habitats away from the reef edge during higher temperatures, and optimise their position in the water column. This study provides information that will allow managers to better predict the effect of environmental conditions on the movement patterns of reef fishes.

Poster

Molecular taxonomy and phylogeography of the sponge genus Ircinia from northern Australia

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Sponges represent a highly diverse and important group of morphologically simplistic, sessile, filter-feeding organisms in the Great Barrier Reef (GBR) due to their biomass, diversity and contribution to nutrient cycling. However, despite their critical ecological and evolutionary significance in marine ecosystems, sponges suffer from difficult species identification and unresolved genealogical relationships. One group in particular, the aspiculate keratose sponges, lack defining mineralized skeletal features and are notoriously difficult to identify. As a result, the presence of keratose sponges in biodiversity censuses and management initiatives is typically underestimated and/or largely unclear. In addition, keratose sponges are often misidentified in museum collections and remain unnoticed or cryptic in the field, overall complicating species richness analyses in sponge communities but also the characterization of their biogeography and life history.

In this study, we examine the taxonomic, phylogenetic and phylogeographic relationships of keratose sponges of the genus *Ircinia* collected from northern Australia. Molecular phylogenies inferred from the nuclear Internal Transcribed Spacer 2 region (ITS2) and the mitochondrial gene *Cytochrome oxidase* subunit 1 corroborate multiple Evolutionarily Significant Units (ESUs) recovered from a selected set of specimens corresponding to uncharacterized sponge taxa and four previously recognised nominal species (*Ircinia spiculosa*, *I. irregularis*, *I. ramosa*, *I wistari*).

Our results suggest the urgent need for development of solid sponge taxonomy necessary not only for assessments of sponge biodiversity, conservation and environmental management but also for applications in commercial use and bio-discovery of bio-products.

Poster

Porphyrins as self-destructive photocatalist in seawater

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Microbial infections lead to major substantial financial losses in aquaculture industries. Environmentally-friendly antimicrobial compounds are required to make aquaculture more sustainable. Porphyrins (photo-sensitisers) could be promising anti-microbial treatments *via* singlet oxygen generation after light exposure (photo-activation). The idea is to disinfect aquaculture water prior to its contact with live feed (i.e. microalgae and *Artemia*).

Before porphyrins can be applied, their photo-stability needs to be known as these compounds are difficult to remove from the treated water and high photo-stability stability might negatively affect the target species performance through the continuous production of singlet oxygen. Furthermore, experiments carried out in our group recorded 5 μM as the Lowest Observed Effect Concentration (LOEC).

In time course experiments, two different porphyrins dissolved in seawater (SW) were exposed to two different light sources, 8x8 W cool white fluorescence and LED 150 W, and photo-bleaching was measured via decreases of absorbance spectra in the visible light.

In general, the absorption of both cat- and anionic porphyrins was negatively affected by high irradiance. In contrast to the anionic porphyrin lasting 14 and 12 days under 8x8W and LED 150W irradiation respectively, the cationic porphyrin was remarkably photo-stabile with absorption spectra being measurable for more than 18 days.

Given the above and as LOECs are only observed for 3 days in 150 W LED treated SW, the cationic dye seems to be suitable as an antimicrobial drug under these conditions. In contrast, porphyrins persisted at LOECs for > 11 days at 8x8W making this treatment less suitable.

Poster

Transcriptome analysis of *Chromera velia*, a chromerid alga associated with corals of the Great Barrier Reef

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Since the discovery of *Chromera velia*, a novel microalga in 2008 during a study of Australian coral symbionts, great interest in this new algal species has developed. *C. velia* is an important organism being considered to sit phylogenetically between the photosynthetic dinoflagellate algae and the parasitic Apicomplexa. *C. velia* has been detected and isolated from different scleractinian corals in Australia including corals of the Great Barrier Reef. However little is known about the ecology and genetics of this microorganism. The study aims to use next generation sequencing technology (Illumina RNAseq) to generate a reference transcriptome assembly of *C. velia* isolated from *Montipora digitata* at the GBR. Differential gene expression in altered experimental treatments is investigating the diversity and dynamics of *C. velia* transcripts (mRNAs). Cultures were subjected to heat shock, heat stress, cold shock, cold stress, and darkness with control cultures grown under normal conditions, cultures grown under mixotrophic condition and cultures containing motile/immotile stages. Analysis of the transcriptome of *C. velia* will provide genomic insight into this novel chromerid alga through identifying genes involved in various physiological and metabolic processes as investigated under different experimental conditions. A novel aspect of this study is the response to relevant organic compounds found in the coral holobiont's microenvironment and understanding how *C. velia* cells react.

Poster

Reef fish hybridization: lessons learnt from butterflyfishes (genus Chaetodon)

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Natural hybridization is widespread among coral reef fishes. However, the ecological promoters and evolutionary consequences of reef fish hybridization have not been thoroughly evaluated. Butterflyfishes form a high number of hybrids and represent an appropriate group to investigate hybridization in reef fishes. This study provides a rare test of terrestrially derived hybridization theory in the marine environment by examining hybridization between *Chaetodon trifasciatus* and *C. lunulatus* at Christmas Island. Overlapping spatial and dietary ecologies enable heterospecific encounters. Nonassortative mating and local rarity of both parent species appear to permit heterospecific breeding pair formation. Microsatellite loci and mtDNA confirmed the status of hybrids, which displayed the lowest genetic diversity in the sample and used a reduced suite of resources, suggesting decreased adaptability. Maternal contribution to hybridization was unidirectional, and no introgression was detected, suggesting limited, localized evolutionary consequences of hybridization. Comparisons to other reef fish hybridization studies revealed that different evolutionary consequences emerge, despite being promoted by similar factors, possibly due to the magnitude of genetic distance between hybridizing species. This study highlights the need for further enquiry aimed at evaluating the importance and long-term consequences of reef fish hybridization.

Poster

The functional roles and adaptive capacity of prokaryotic cellular and acellular symbionts within the sponge holobiont

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Sponges are a critical component of the marine benthos in terms of biomass, diversity, provision of food and shelter to other organisms. They can harbor dense and diverse microbial communities that can comprise up to 40% of sponge volume. Like corals, sponges should therefore be seen as a holobiont. Recent research suggests that sponge communities could be at risk from climate change impacts, however only a few studies have actually assessed their sensitivity to increasing temperatures. The proposed research aims at obtaining a functional understanding of the roles that viruses and prokaryotic symbionts play in sponge health and whether they can influence the ability of sponges to adapt to a changing climate. Targeted thermal stress experiments will be undertaken to test this hypothesis. This will be achieved by characterizing the viromes and metagenomes associated with the species *Amphimedon queenslandica* and assessing the specificity of the associations during thermal stress. A pilot study was conducted to isolate viruses from a specimen of *A. queenslandica* recently collected on Magnetic Island and kept under controlled conditions at Seasim (AIMS). The methods involved mechanical tissue disruption cesium chloride (CsCl) density gradient centrifugation. As expected, density measured for each fraction along the gradient decreased linearly from 1.51g mL^{-1} to 1.19g mL^{-1}. Nucleic acid quantification showed two distinct peaks of distribution at 1.46g mL^{-1} and 1.27g mL^{-1}, which typically correspond to bacteriophages and eukaryotic viruses. Subsequent sequencing of the DNA and RNA genomes will be undertaken to investigate the baseline functions of *A. queenslandica* viral communities.

Poster

Prevalence and severity of background partial coral mortality over small and large spatial scales

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Corals are subject to a range of chronic, often small-scale disturbances that can cause background mortality even in absence (or in between) of major acute disturbances. The spatial extent of these chronic disturbances can vary from millimeters and centimeters (e.g., predation, bioerosion) to hundreds and thousands of kilometers (e.g., corallivores, sedimentation, disease) resulting in spatial variation in tissue loss. However, large scale (geographic regions) and small-scale (adjacent colonies) variation in background mortality have never been tested. This study investigated geographic variation in proportion of injured versus uninjured colonies (the prevalence of injuries) and instantaneous measures of areal extent of injuries across individual colonies (the severity of injuries), in four common coral species (massive *Porites*, encrusting *Montipora*, *Acropora hyacinthus* and *Pocillopora* spp) at different spatial scales, comparing background mortality recorded on Lhaviyani atoll, Maldives in the Indian Ocean to the northern Australia's Great Barrier Reef. A total of 1,186 adult colonies were surveyed in the two geographic regions, in 6 reefs and in 18 sites. Prevalence of partial mortality varied greatly between the two geographic regions (northern Great Barrier Reef and Lhaviyani atoll) with much higher prevalence of injuries recorded on the northern Great Barrier Reef (Tukey test <0.005). Conversely, mean severity of mortality was higher in Lhaviyani atoll compared to the northern Great Barrier Reef (Tukey <0.05) and it varied at both large (region) and small scale (site and transect). These data are important for understanding coral responses to increasing stressors, and for predicting their capacity to recover between subsequent disturbances.

Poster

Modelling the net growth of coral reefs under climate change: The neglected role of bio-eroding sponges

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It is well known that the symbiotic association between corals and *Symbiodinium* (zooxanthellae) is critical to the health and persistence of coral reefs. In sponges, the genus *Symbiodinium* is primarily restricted to the Clionaidae family of bio-eroding sponges. Through increased growth rates, zooxanthellae are thought to contribute to the bio-eroding potential of *Cliona*. Despite the obvious importance of symbionts to sponge growth, reproduction, and survival, no studies have undertaken a comprehensive genetic analysis of the symbiont communities or assessed their relative contributions to sponge fitness.

The proposed project is linked to the hypothesis that under climate change, bio-eroding sponges will contribute to increased rates of bio-erosion thereby re-positioning the fulcrum of the accretion –erosion dynamic, and the potential for net growth of coral reefs. By reducing the growth potential and survivorship of corals or enhancing the bio-erosion capacity of sponges, elevated sea surface temperatures and ocean acidfications may alter the competitive hierarchy of corals and bio-eroding sponges.

The project will collect data on sponge fecundity and fitness and use controlled experiments to determine how fecundity and fitness are affected by predicted climate change conditions. These data will be used to develop models to predict sponge fitness, sponge-coral competition, reef erosion patterns and overall reef resilience under climate change scenarios.

Poster

Unpicking depth-zonation in reef-building corals: Processes generating depth distributions and their significance for evaluating the Deep Reef Refugia Hypothesis

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Understanding the distributions of plants and animals is a fundamental basis of ecology, and the distribution of reef building corals over depth one of the most prominent patterns in nature.

As many reef-building corals rely largely on sunlight for energy, decreasing light irradiance with increasing water depth is thought to limit the lower depth distributions of many coral species to <20 m, however photosynethic coral communities can occur to depths of over 150 m. The vast majority of research on coral reefs occurs in shallow-water, though recent increasing interest in deeper reefs has revealed that individuals of many coral species can occur substantially deeper than thought, and coral species richness consistently peaks at depths of 15-35 m. Furthermore, deeper reef habitats are often more environmentally and ecologically stable than shallower reefs, and have been suggested as refuges for corals from climate change effects, such as rising sea temperatures and increased storm activity. However, the ecological processes responsible for determining depth ranges and richness gradients on coral reefs remain poorly understood.

This project will examine processes determining depth distributions in reef-building corals to assess the potential for deep-water reefs to act as refugia. I will investigate whether critical ecological processes (reproduction, dispersal and recruitment) vary along depth gradients among coral species with differing habitat preferences. This information will determine drivers of depth zonation on corals reefs – one of the most prominent patterns in nature.

Poster

Identifying, characterizing and quantifying the effects of simulated dredging on sponges

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The world's population is growing, and demand for shipping infrastructure is increasing along with it. Consequently, dredging operations are proceeding at massive scales. However, the immediate biological and corresponding ecological effects of dredging are minimally understood. Sediment plumes created by dredging have high levels of total suspended solids (TSS), which may clog filter-feeding apparatuses. Suspended solids also attenuate light, which may stress organisms dependent on photosynthesis. Sediment from the plume eventually settles on the bottom, which can smother benthic organisms, causing death or the use of vital energy reserves for cleaning processes.

This proposed PhD project will focus on determining the effects of simulated dredging on marine sponges, sessile, filter-feeding animals. We will develop and optimize three methodologies for identifying and quantifying stress responses in sponges. These methods consist of: 1) using micro computed tomography (Micro CT) scanner to visualize sponge tissue and potential clogging; 2) using a microthermistor flowmeter (developed by the Australian Institute of Marine Science's workshop) to determine changes in sponge pumping (i.e. filtering) rates; and 3) using transcriptome sequencing (RNA-seq) to determine what changes in gene expression are associated with dredging-related stress. It is hypothesized that dredging related pressures will affect structures, pumping rates, and gene expression of different sponge species to varying degrees under different conditions.

Poster

The rise and fall of rare species in community

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An ecological community is commonly composed of few abundant species and large number of rare species. However, mechanism underlying this universal community structure remains controversial, particularly regarding how species abundances can dynamically respond to environmental changes. Here, we provided a species trait-based explanation. Using >30 year-long phytoplankton time series data of Lake Biwa, we found those rare species that adapt to littoral habitats have disappeared in late 1980's in response to lake warming and changes of water level variations and trophic states. This functional response explained the rise and fall of rare species in structuring community over time.

Poster

Distribution of sea snakes on the Great Barrier Reef estimated using baited remote underwater video stations (BRUVS)

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Estimating large-scale distributions of rare animals is often logistically difficult. This poster presents a new approach to estimating the distribution of true sea snakes (Elapidae, Hydrophiinae) within the Great Barrier Reef Marine Park (GBRMP) and examines the influence of various spatial factors on the occurrence of sea snakes. A historical BRUVS dataset collected over ten years (2000 - 2010) and spanning the entire Great Barrier Reef (GBR) was used to estimate large-scale distribution patterns of three commonly encountered sea snake species (olive sea snake: *Aipysurus laevis*, spine-bellied sea snake: *Lapemis curtus* and ornate sea snake: *Hydrophis ocellatus*). The influence of spatial factors (depth, latitudinal and longitudinal distances along the GBR, proximity to reef systems and proximity to land) to presence and species composition of sea snakes was also examined. The results of this study are the first information on the distribution of sea snakes on an ecosystem scale within the GBR and alongside other trawl based and underwater visual census data can provide valuable insight to develop effective management and conservation practices within the GBRMP.

Poster

Is archival acoustic tracking viable for marine wildlife? Dugongs as a case study

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Data from satellite and acoustic technologies were used to determine: (1) the efficacy of satellite and acoustic telemetry to define dugong movement patterns; (2) compare the benefits and limitations of each approach; (3) examine costs of each approach in relation to the amount and type of data provided; and (4) relate both sets of telemetry data to the boundaries of a Go Slow area designed to protect dugongs and turtles from vessel strike within an urbanised port area (Moreton Bay, Queensland). A total of 21 dugongs was captured in seagrass habitats on the Eastern Banks in July - September 2012 and July 2013 and fitted with GPS and acoustic transmitters. Both satellite and acoustic telemetry produced reliable presence and movement data for individual dugongs. When the dugongs were within the range of the acoustic array, there was relatively good correspondence between the overall space use measures derived from GPS and acoustic transmitters, demonstrating that acoustic tracking is a potentially valuable and cost-effective tool for monitoring local dugong habitat use in environments equipped with acoustic receiver arrays. The application of acoustic technology may be extended to other marine mammal species and may be particularly useful for species that establish home ranges near large urban or port environs. However, the relative merits of the two technologies depend on the research question, the location of the study and whether the study site has an established acoustic array.

Image courtesy of Adriana Humanes

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