Abstract Booklet

AIMS@JCU

2017 Student Seminar Day

Friday 1st September
The Metropole Hotel

AIMS@JCU

Student Seminar Day 2017
Friday, 1st September

Time	Title	Presenter
11:00 am	**Opening address**	**Libby Evans-Illidge**
	Session 1 - Reef habitat, biodiversity and management	
11:15 am	Inter-annual connectivity patterns of the coral reef fish *Lutjanus carponotatus* along the Great Barrier Reef	Rodrigo Guerdek
11:30 am	Developing benthic irradiance algorithm from MODIS satellite imagery for the Great Barrier Reef shelf waters	Marites Canto
11:45 am	Biodiversity dynamics destabilized by amplified habitat change on coral reefs	Cheng-Han Tsai
12 midday	Using Generalized Dissimilarity Modeling to reclassify the bioregions of the Great Barrier Reef	Danielle Asson
12:15 pm	Mitigating the effects of *Acropora*–eating flatworms on corals in captivity	Jonathan Barton
12:30 pm	**Lunch with poster session and view/vote on photographs**	
1:30 pm	**AIMS@JCU Alumni Keynote**	**Dr. Heidi Luter**
	Session 2 - Physiology of coral and fish	
2:00 pm	The impact of heterotrophic feeding on the physiology of the coral host and *Symbiodinium* in contrasting dissolved inorganic nutrient environments	Luke Morris
2:15 pm	Phototoxic effects of petroleum hydrocarbons on coral larval settlement	Mikaela Nordborg
2:30 pm	Exposure of coral larvae to microbiomes influences the prokaryote communities of later life stages	Katarina Damjanovic
2:45 pm	Too hot or too cold; Linking the thermal spectrum and physiological response of *Acropora millepora*	Josephine Nielsen
3:00 pm	Naturally occurring hybrids of coral reef butterflyfishes have similar fitness compared to parental species	Stefano Montanari
3:15 pm	Physiological photo-adaptations of mesophotic corals across a large depth gradient	Christopher Brunner
3:30 pm	**Speed talks**	
4.00 pm	**Closing remarks**	**Nicole Webster**
4:15 pm - 6.00 pm	**Judges deliberation; presentation of awards and prizes; end of day function with drinks and canapés provided**	

11.15am

Inter-annual connectivity patterns of the coral reef fish Lutjanus carponotatus along the Great Barrier Reef

Rodrigo Gurdek[a,b], Lynne van Herwerden[a], Jessica Benthuysen[b], Hugo Harrison[c] & Mark Baird[d]

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Changes in the extent of larval dispersal over time can explain fluctuations in the connectivity, retention and self-recruitment levels of reef fish from different locations. By using the connectivity interface, Connie 3 (based on eReefs model), the inter-annual larval connectivity from *Lutjanus carponotatus*, has been analysed along the Great Barrier Reef (GBR). Particles released from the Palm, Whitsunday, Percy, Keppel and Capricorn Islands, dispersed 100s of kilometres, mostly along the GBR lagoon. While connectivity values were highest towards the northwest regions from the islands during 2010 (one of the strongest La Niña events), the highest retention and southeast dispersal values occurred during 2015 (one of the strongest El Niño events). Particle dispersal from the Palms during 2010 and 2015, showed the highest northern and seaward connectivity to the GBR matrix, respectively. Offshore travelling (particles leaving the GBR) was higher in the northern (2010), and southern island groups (2010/2015). Patterns obtained during 2011 and 2014 (La Niña event and El Niño Alert, respectively), were similar to those from 2010 and 2015, respectively for both. In 2012 (Neutral event), particles dispersed somewhere in between 2010-11 and 2014-15 years. Temporal variability of hydrodynamics supported the observed connectivity patterns. A total of 451 individuals from the same islands were already genotyped (single nucleotide polymorphisms), to define the population genetic structure. Finer scale hydrodynamic and biogeochemical models will be included to determine the effective dispersal and contrast the hydrodynamic to the genetic connectivity. Results will contribute to the sustainable management of *L. carponotatus* populations.

11.30am

Developing benthic irradiance algorithm from MODIS satellite imagery for the Great Barrier Reef shelf waters

Marites Canto[a]

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Benthic irradiance (*Eb*) or the light reaching the seafloor is critical for photosynthesis by benthic organisms like corals and seagrasses. The amount of light penetrating through the water column is determined by the presence of different constituents that define the optical properties of the water. Both *Eb* and the different optical properties of the water can be measured directly in the field but resulting measurements can be spatially sparse and resource intensive. On the other hand, remote sensing presents the only feasible observational tool to obtain synoptic high spatial (1km^2 pixel) and temporal (daily) resolution datasets needed to understand benthic light availability and its control on benthic organism in the Great Barrier Reef (GBR) region. Currently, there is no direct method for accurately quantifying *Eb* from satellite observations. This presentation will focus on the proposed methods to develop the first remote sensing algorithm to observe *Eb* in GBR waters from satellite imagery.

11.45am

Biodiversity dynamics destabilized by amplified habitat change on coral reefs

Cheng-Han Tsai[a,b], Hugh Sweatman[b] & Sean Connolly[a,c]

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Human activities are reducing overall levels, and increasing the temporal variability, of coral cover. However, the consequences of these changes for reef fish community structure are poorly understood. Here, we show that relative abundance patterns in reef fish assemblages are destabilized by increased temporal variability in coral cover, measured as the coefficient of variation (CV) in coral cover over time. We partition variation in fish species-abundances into inter-specific heterogeneity (i.e., niche differences), responses to environmental fluctuations, and sampling error and neutral processes. Mechanistically, increased CV of coral cover dampens the effect of inter-specific heterogeneity (namely niche differences among fish species) to overall temporal variation in species' relative abundances, relative to the effect of environmental stochasticity. By contrast, we found CV of coral cover has no effect on species richness and evenness. Consequently, even species richness and evenness are unchanged, amplified temporal variability in coral cover reduces the contribution of species traits to their relative abundances, and increases the contribution of fluctuating environmental conditions. This suggests that anthropogenic environmental change of temporal variability in coral reef ecosystems, such as more intense and frequent recurrent disturbances, is destabilizing fish community structure, by reducing the influence of species' intrinsic traits on their abundances, which in turn magnifies volatility of fish abundances and risk of biodiversity management.

12 midday

Using Generalized Dissimilarity Modeling to reclassify the bioregions of the Great Barrier Reef

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The Great Barrier Reef is currently divided into 70 bioregions, 30 reef and 40 non-reef, meant to represent the range of biodiversity found in the region. The boundaries of these bioregions were defined using the best available data at the time, and expert opinion. These bioregions later informed the zoning plan for the Great Barrier Reef Marine Park (GBRMP), particularly in the placement of no-take green zones. However, for many non-reef areas especially, data were lacking on species presence and abundances. For many areas, there were no data at all, and the experts acknowledged their bioregional definitions were approximate in these locations. Since 2004, when the current zoning scheme was officially enacted, there have been an abundance of additional data collected through projects such as the AIMS Long-Term Monitoring Project, the Seabed Biodiversity Project, and Reef Life Survey. In addition, there is a variety of new statistical packages developed for analyzing compositional patterns in species and environmental variables. Using Generalized Dissimilarity Modeling and updated data on reef fish abundances and benthic species biomass from the aforementioned sources, we present a new classification of the bioregions of the GBRMP based on dissimilarity in community structure among sites, combined with environmental data. This classification scheme shows distinct differences from the existing bioregionalization, notably having fewer classes, each with multiple, discontinuous patches, rather than occurring in single, contiguous polygons. The new classification has implications for the zoning of the GBRMP, since the existing protected area network is based on the 2000 bioregionalization. The existing network may not, therefore, be adequately protecting biodiversity in all areas of the GBRMP. The new classification allows us to better understand compositional patterns in this globally significant marine region, and highlights areas where current levels of protection may be inadequate.

12.15pm

Mitigating the effects of *Acropora*–eating flatworms on corals in captivity

Jonathan Barton[a,b], Kate Rawlinson[c], Craig Humphrey[a], David Bourne[a,b] & Kate Hutson[b]

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[c]*Department of Zoology, University of Cambridge, Cambridge, United Kingdom*

Acropora are some of the most traded corals in the marine ornamental industry, are primary candidates for reef restoration, and see wide use in climate change studies. However, captive *Acropora* colonies are highly susceptible to parasites and disease. Specifically, little is known about the common coral parasite, the *Acropora*-eating flatworm, *Amakusaplana acroporae* (Polycladida: Prosthiostomidae). This flatworm is associated with colonial mortality of infected *Acropora* in captivity, and is an emerging threat to the well-being of captive *Acropora* spp. The absence of established quarantine procedures and effective management tools renders *Acropora* colonies vulnerable to this pest. Our project aims to understand the life history of this organism, evaluate the efficacy and suitability of chemical treatments for flatworm removal, and identify suitable cleaner organisms for use as biocontrols in captivity. To fulfill the objectives of this project, we have maintained cultures of *A. acroporae* at the National Sea Simulator at the Australian Institute of Marine Science (AIMS) for over one year. Using these cultured flatworms, we studied the life history of *A. acroporae*, examining how temperature variation influences their embryonic development and hatching success. By combining our results with an understanding of the developmental time required to reach sexual maturity, we can identify the frequency at which effective chemical treatments should be administered to break the life cycle of *A. acroporae*. This valuable management tool could be used to remove *A. acroporae* from vulnerable *Acropora* colonies in captive aquaria, and avert the associated colonial mortality.

2.00pm

The impact of heterotrophic feeding on the physiology of the coral host and Symbiodinium in contrasting dissolved inorganic nutrient environments

Luke Morris[a,b], Sabrina Rosset[a,c], Adam Reed[a,d], Cecilia D'Angelo[a,d] & Jörg Wiedenmann[a,d]

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The dissolved inorganic nutrient (DIN) environment on corals reefs is a major determinant of reef health and can influence the susceptibility of corals to bleaching and mortality. Furthermore, nutrient cycling on reefs is dynamic and, paradoxically, anthropogenic nutrient enrichment may lead to the DIN limitation of coral reefs through biogeochemical processes and in combination with climate change. One way that corals can potentially increase their resilience to stressful conditions, such as nutrient limitation and warming, is by heterotrophic feeding on zooplankton. However, the relative contributions and interactive effects of DIN and particulate food regarding the nutrient status of corals are poorly understood. We exposed corals to different levels of particulate food availability in addition to DIN repletion and limitation in a long-term mesocosm experiment. We measured coral nutrient biomarkers which showed a significant response to heterotrophically acquired nutrients only under DIN limitation. Nutrient-starved corals accumulated lipid bodies in their symbionts, possibly due to reduced translocation. Intercorrelated increases in symbiont density and host GFP-like protein content were associated with a release from nutrient limitation. Even under high food availability corals were unable to fully compensate for DIN limitation and remained at a lower physiological condition compared to their DIN-replete counterparts. Overall, we found that the effects of DIN availability outweigh those of heterotrophic feeding on coral physiology and that lipids and GFP-like proteins are important biomarkers of coral nutrient status. These results suggest that corals may only have a limited capacity to increase their resilience to challenging environments through heterotrophic feeding.

2.15pm

Phototoxic effects of petroleum hydrocarbons on coral larval settlement

Mikaela Nordborg[a], Andrew Negri[b], Diane Brinkman[b], Florita Flores[b] & Susana Agusti[c]

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Some polycyclic aromatic hydrocarbons (PAHs), common to oil and petroleum fuels, exhibit phototoxic properties whereby toxicity increases in the presence of ultraviolet radiation (UVR). Despite the likelihood of accidental spills coinciding with high-intensity UVR exposure on shallow-water tropical coral reefs, only a handful of studies have examined their combined effects on scleractinian corals. The sensitivities of *Acropora millepora* and *Acropora tenuis*, two common reef- building corals, were assessed through static exposures of planula larvae to water accommodated fractions (WAF) of heavy fuel oil (HFO) and three individual PAHs. The toxicity of HFO WAF doubled in the presence of UVR exposures expected in shallow coral reef habitats. UVR exposure interacted with the PAHs anthracene and pyrene strongly, increasing their toxicities by 10- and 40-fold, respectively. However, this phototoxic effect was highly dependent on PAH structure with no increase in toxicity observed for phenanthrene. A previously unrecognised response to PAHs was observed whereby coral larvae divided or fragmented into smaller yet motile and potentially functional clones. Further work is needed to investigate whether this phenomenon is a stress response and potentially analogous to the autotomy which can occur in some members of Fungiidae and Actinaria. The recruitment of scleractinian corals may be severely affected by exposure to petroleum hydrocarbons, potentially preventing or delaying the natural recovery of reefs after accidental spills. The results from this study indicate that by ignoring phototoxicity, the risks posed by oil and fuel spills may be significantly underestimated in shallow-water tropical coral reef systems.

2.30pm

Exposure of coral larvae to microbiomes influences the prokaryote communities of later life stages

Katarina Damjanovic[a,b], , Linda Blackall[a] & Madeleine van Oppen[a]

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Global climate change and other anthropogenic disturbances are causing massive declines in coral reef ecosystems, with severe ecological and economic consequences. Manipulation of coral-associated prokaryotes is one of the possible venues to assist coral adaptation to a rapidly changing environment. Microbial symbionts play critical roles in coral health and favourably adjusting their community composition could benefit the host, as has been demonstrated for the human gut and plant rhizosphere microbiomes. However, microbiome manipulation experiments have rarely been attempted on corals. In this study, larvae of the coral *Acropora tenuis* were exposed to the mucosal microbiome collected from one of four different adult coral species, and a no-mucus treatment was included as a control. Following settlement, recruits were reared in controlled conditions and sampled for 16S rRNA gene amplicon sequencing. Four months after dosing, recruits subjected to the five treatments harboured significantly different prokaryotic communities and their microbiome also differed from the communities present in the surrounding seawater. These results provide promise for the feasibility of coral microbiome manipulation, as a single dosage drove the microbiome of experimental corals to develop in distinct directions.

2.45pm

Too hot or too cold; Linking the thermal spectrum and physiological response of *Acropora millepora*

Josephine Nielsen[a,b,c], David Bourne[a,c], Carly Kenkel[a], Veronique Mocellin[a] & Line Bay[a]

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Mean SST's and temperature variations are predicted to both increase and widen in the future, effectively expanding the thermal ranges that tropical corals need to successfully cope with. The transitions between thermal extremes are also likely to become more rapid as the time between El Niño and La Niña events shortens. The tolerance to both heat and cold exposure in other marine invertebrates has been demonstrated to be mutually exclusive, however it is not currently clear if a trade-off exists between hot and cold thermal tolerance in tropical corals. This study quantified changes in coral tissue colour, coral growth, photosynthesis, and energetic conditions in *Acropora millepora* subjected to three temperature treatments: cold (23.0°C), control (27.0°C) and hot (29.5°C). After two months, there were significant difference in tissue colour, while net photosynthetic production was only slightly affected by temperature following one month of treatment (ANOVA; $p=0.04$), however, after two months, photosynthetic output stabilised between treatment groups (ANOVA; $p = 0.11$). Growth (assessed by weight gain) was affected by temperature with cold-treated corals exhibiting greater weight gain than heat-treated corals (5.51 ±0.22% vs. 4.58±0.23% respectively). Horizontal basal disc extension was slightly reduced in both hot- and cold-treated corals compared to the control groups. The results indicate that *A. millepora* were more susceptible to heat than cold temperature exposure with variation in the physiological responses observed. Considering increased temperature variations, understanding the physiological effects at both ends of the thermal spectrum will allow improved predictions of coral resilience under projected climate change conditions.

3.00pm

Naturally occurring hybrids of coral reef butterflyfishes have similar fitness compared to parental species

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Hybridisation can produce evolutionary novelty by increasing fitness and adaptive capacity. Heterosis, or hybrid vigour, has been documented in many plant and animal taxa, and is a notable consequence of hybridisation that has been exploited for decades in agriculture and aquaculture. On the contrary, loss of fitness in naturally occurring hybrid taxa has been observed in many cases. This can have negative consequences for the parental species involved (wasted reproductive effort), and has raised concerns for species conservation. This study evaluates the relative fitness of previously documented butterflyfish hybrids of the genus Chaetodon from the Indo-Pacific suture zone at Christmas Island. Histological examination confirmed the reproductive viability of Chaetodon hybrids. Examination of liver lipid content showed that hybrid body condition was not significantly different from parent species body condition. Lastly, size at age data revealed no difference in growth rates and asymptotic length between hybrids and parent species. Based on the traits measured in this study, naturally occurring hybrids of Chaetodon butterflyfishes have similar fitness to their parental species, and are unlikely to supplant parental species under current environmental conditions at the suture zone. However, given sufficient fitness and ongoing genetic exchange between the respective parental species, hybrids are likely to persist within the suture zone.

3.15pm

Physiological photo-adaptations of mesophotic corals across a large depth gradient

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According to the deep reef refugia hypothesis, corals thriving in the mesophotic zone (30 - 150 m) are less affected by climate change impacts, and therefore, may provide propagules for destructed shallow reefs. However, even simple physiological processes, such as photo-adaptation in the deep, still represent a knowledge gap. By using an integrated approach, the synergy of distinct photo-biological strategies, which allow corals to thrive across a large depth range (10 - 80 m), was evaluated for *Leptoseris* spp. and *Pachyseris speciosa*. Accordingly, zooxanthellae adaptations (dimensions, quantities and mitotic indices), the composition of light-harvesting and photo-protective pigments, as well as physiological adjustments (tissue thickness and lipid concentrations) were distinguished. The analyses revealed that the coral genera *Leptoseris* and *Pachyseris* follow different strategies to adapt towards decreasing light intensities across a large depth gradient. Specimen of *P. speciosa* showed morphological adaptations in form of significantly decreasing tissue thickness (43%) and a strong negative trend of the *Symbiodinium* density (41%). Presumably, this was coupled with a rearrangement of the *Symbiodinium* cells towards mono-layers to reduce self-shading. In contrast, *Leptoseris* spp. displayed a significant decrease of the *Symbiodinium* size (22%) with increasing depth. Both genera had a decrease of photoprotective pigments in common, rather than an increase of light-harvesting pigments. In summary, in the genera *Leptoseris* and *Pachyseris*, predominantly the synergy of morphological adaptations of the coral host and the harboured symbionts, as well as decreasing photoprotective pigment concentrations, seem to be the key for a successful colonisation of mesophotic zones.

Speed Talk

Microbial Indicators

Bettina Glasl[a,b,c], Nicole Webster[a,d] & David Boure[a,b]

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Microorganisms have a fundamental role in the functioning and stability of coral reef ecosystems. Environmental disturbances can trigger alterations of the natural community structure and/or the functional traits of coral reefs with potentially detrimental consequences for host organisms, such as corals, sponges and macroalgae and concomitant implications for the entire coral reef ecosystem. Defining the natural reef microbiome and microbial response patterns upon disturbances will allow the identification of environmental stressors at an early stage of environmental stress. Microbial indicators should provide useful indications on the ecological integrity of reefs and facilitate early management interventions.

Speed Talk

Elevated seawater temperature disrupts the microbiome of an ecologically important bioeroding sponge

Blake Ramsby[a,b,c], Mia O Hoogenboom[a], Steve Whalan[d] & Nicole Webster[b,e]

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[d]*Marine Ecology Research Centre, School of Environment, Science and Engineering, Southern Cross University, Lismore, New South Wales*
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Bioeroding sponges break down calcium carbonate substratum, including coral skeleton. Importantly however, environmental perturbation can disrupt the functionally important microbial symbionts of some sponge species. Here, we assess how the microbial community of a bioeroding sponge changes in response to increasing seawater temperatures. The microbiome was generally stable at temperatures up to 30°C, however a dysbiosis occurred at 31°C. Notably, this microbial shift occurred at a lower temperature than the 32°C threshold that induced sponge bleaching and suggesting that the destabilisation of the microbial community, contributed to the loss of Symbiodinium and sponge bleaching.

Speed Talk

Towed-float GPS telemetry: a tool to assess movement patterns and habitat use of stingrays in a nursery area

Ana Barbosa Martins[a,b], Andrew Chin[a,b], Michelle Heupel[a,b] & Colin Simpfendorfer[a,b]

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GPS telemetry stands out among biotelemetry devices by providing high accuracy spatial data. However, GPS tag signals cannot be propagated through the water column, limiting the use in benthic organisms, such as stingrays. This study evaluates the accuracy of towed-float GPS tags to assess movements of juvenile stingrays at Orpheus Island. Active tracking was performed simultaneously for comparison. The quality of the data obtained by towed-float GPS tags could not be matched by active, acoustic or ARGOS telemetry. This study demonstrates the potential of towed-float GPS telemetry for high resolution assessment of movement patterns and habitat use of juvenile stingrays.

Speed Talk

What lies beneath: connecting the dots to reef shark habitat use

Stacy Bierwagen[a,b], Michelle Heupel[c], Andrew Chin[a,c] & Colin Simpfendorfer[a]

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Understanding ecological roles of predators within marine ecosystems is a complex issue for interpreting trophodynamics of reef communities. Traditional management for large-bodied predatory species such as sharks involves understanding life history and movement patterns; where current knowledge is often limited by a single methodological approach. Using a multi-tiered methodological design, space use of grey reef sharks was interpreted from integrating traditional fishing methods, underwater survey, and acoustic telemetry. This approach creates a 3-dimensional perspective to space use; linking movement and behavior with habitat association, fish community characteristics, and resource partitioning among individuals and between predators.

Speed Talk

Movement and habitat use of juvenile blacktip reef sharks (*Carcharhinus melanopterus*) in an inshore environment

Lachlan George[a], Colin Simpfendorfer[a] & Michelle Heupel[a,b]

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Little is known about the fine-scale movements and micro-habitats used by juvenile sharks in inshore areas and the environmental factors that drive their behaviour. Active acoustic tracking was used to investigate movements and habitat use of juvenile blacktip reef sharks (*Carcharhinus melanopterus*) at Orpheus Island. Preliminary findings show that juveniles move in synchrony with tidal cycles, always remaining within very shallow waters during outgoing, low and incoming tides, while using inundated mangrove habitat during high tide to avoid predators. This information may lead to identification of critical habitats and furthers the limited knowledge surrounding the environmental drivers of shark behaviour.

Poster

The role of the microbiome in enhancing climate resilience in corals

Hannah Epstein[a,b,c,d], Hillary Smith[a,b,c,d], Gergely Torda[a,c] & Madeleine van Oppen[a,c,e]

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Climate change is putting unparalleled pressure on coral reefs worldwide, encouraging scientists to closely examine the drivers of coral resilience. The coral microbiome is a critical component of coral health and functioning, and contemporary studies suggest it is an important element of coral resilience. Research into the human and plant microbiomes has elucidated the importance of microorganisms in host stress tolerance, and methods developed for these biological systems are now being applied to coral microbiome research. Recent empirical studies provide the strongest evidence to date that microbes may confer coral host tolerance to thermal stress. However, a number of knowledge gaps still persist, hindering the application of microbiome research to conservation initiatives. A strong focus on determining the plasticity and manipulative capability of the microbiome will provide the base on which we can begin developing novel microbial-mediated restoration tools for increasing coral resilience to climate change.

Poster

Optimising the functional grouping of species in ecosystem models – Case study on a coral reef –

Vanessa Haller[a,b,c,d], Elena Rovenskaya[d], Mateusz Iskrzynski[d] & Michael Bode[e]

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Ecosystems around the world are faced with multiple and interacting threats. These interactions can only be detected with a full system analysis, often a network analysis. However, the first step in the network analysis is to assign the nodes that will be modelled, which could be on levels ranging from species to broad functional groups. This study aims to find the optimal level of nodes as well as the uncertainties associated with them.

For this study a network of a coral reef from the Great Barrier reef was used. The network was based on Ecopath and incorporates 205 nodes. The system behaviour was investigated by simulating the network over time after a threat (reduction of the biomass in one node) had been introduced. Then, two groups at a time were merged and the error between the reduced system and the full system was calculated.

Analytical and simulation results show that the steady state of the full system can be reproduced by the reduced system without creating an error. This is not surprising since the equations are linear. However, the dynamics that are created when a system moves from the original steady state to the post-threat steady state differ between the full and the reduced system. The error that is calculated for the mergers first slowly, then rapidly, increases with the number of species that are combined in one node.

The analysis further shows that if care is given to the species grouped that these errors can also be largely avoided.

Poster

Acquired tolerance of reef-building corals to future climates

Jose Montalvo-Proano[a,b,c], Madeleine van Oppen[b,d], Philip Munday[c] Nicole Webster[b,e], Manuel Aranda[f] & Line Bay[b,c]

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Genetic adaptation is often assumed to be too slow to be relevant to the pace of current environmental change, however, experiments have revealed corals that respond adaptively to environmental stressors through non-genetic processes within their life spans (i.e., over months to years). Acquired tolerance is a potentially important and alternative acclimation pathway for corals to overcome rapid environmental change predicted for this century, however, the drivers and mechanisms of this process are currently not well understood. For example, the development of acquired tolerance to future environmental conditions may be confined to specific developmental stages and may carry a metabolic cost resulting in trade offs between growth and survival. To test these hypotheses larvae and juveniles of the coral *Acropora loripes* were grown and maintained under three projected scenarios of temperature and pCO_2 (Ambient = Davies Reef long term average temperature ^{o}C and 380 µatm pCO_2. Mid century treatment Davies Reef +1.0^{o}C and 685 µatm pCO_2. Late century = Davies Reef + 2.0 ^{o}C and 940 µatm pCO_2) from the stage of gamete fertilization and larval development. Acute heat tolerance of larvae, juvenile growth, survival and establishment of symbiosis and adult growth were also recorded. The acute stress experiments revealed rapid acquisition of tolerance in coral larvae and individuals reared under the most extreme conditions survived longer and in greater proportions than larvae reared under benign conditions. A similar pattern was found in juvenile growth and survival. Further analysis will target gene expression and DNA methylation profiles to investigate the molecular mechanisms underpinning acquired tolerance.underpinning acquired tolerance.

Poster

Ds9 – A potential QTL for cold tolerance in the tropical coral *Acropora millepora*

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Exposure to cold typically rigidifies cellular membranes which hinders their proper biological function. FA synthesis and regulation are important factors influencing the physiological performance of organisms and the ability to regulate FA composition could provide a thermal tolerance advantage. This study examined the effects of *ds9*, a gene coding for the *Δ9-desaturase enzyme*, on cold tolerance in the tropical coral *Acropora millepora* by quantifying growth, total lipid content and FA composition and specifically tested the hypothesis that the GG genotype would confer a physiological advantage. While there were no statistically significant effects of genotype on any of the traits quantified, trends in the data did suggest differences between genotypes. GG corals had the highest total fatty acid methyl ester (FAME) content (46.28 ± 6.52 mg g-1 lipid) while GA corals (30.79 ± 5.8 mg g-1 lipid) had the lowest (Wald's test, Temperature*Genotype, $p > 0.05$). The content of saturated fatty acids (SFAs) varied from 57.66 ±1.15% (GG) to 61.45 ± 1.28% (GA). *Ds9* genotype also appeared to influence coral physiology and growth. Corals with the AA genotype grew 0.54 ± 0.067 cm^2 on average compared to 0.30 ± 0.061 cm^2. The results indicate that *ds9* genotype plays a potential role in regulating the cold tolerance of *A. millepora*. Further gene expression analysis and enzyme activity assays will aid in determining the overall effect of *ds9* genotype and potentially qualify *ds9* as a Quantitative Trait Locus for cold tolerance in *A. millepora*.

Poster

CO_2 Seeps have little influence on the bacterial communities associated with pH-tolerant reef-building corals.

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Ocean acidification is a direct result of increased anthropogenic CO_2 input into the atmosphere, and carries with it consequences for all ocean life. Recent studies have shown that low pH can cause a shift in coral-associated microbial communities of pH-sensitive corals, however it remains unknown how the microbial community is influenced in corals known to be more tolerant to low pH. This study profiles the bacterial communities of two corals that appear to be tolerant of low pH, *Porites lutea* and *Isopora palifera*, from two CO_2 seep sites in Papua New Guinea (PNG), where median pH levels reflect predictions for the coming century (7.7-7.8). Sequencing of the hypervariable V3-V4 regions using the Illumina MiSeq platform revealed no large shifts in microbial communities associated with either coral species at the CO_2 seep sites compared to corals at adjacent control sites (ambient pH=8.0-8.1). Instead, microbial communities associated with *Porites lutea* were primarily influenced by season (PERMANOVA; $F_{1,26} = 3.26$, $p = <0.001$), with a principle coordinates analysis (PCoA) revealing a clear separation between samples collected in April and November. Seasonal data for *Isopora palifera* were not collected, however, associated microbial communities differed among geographic locations (PERMANOVA; $F_{1,19} = 3.797$, $p = <0.001$), with samples tending to cluster by reef rather than by pH conditions. These results indicate that the stable structure of microbial communities associated with pH-tolerant corals under high pCO_2 /low pH conditions provides the coral holobiont with a degree of tolerance to ocean acidification.

Poster

The Trouble With Zonation: Modeling coral species abundance distributions over depth

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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 is one of the most prominent patterns in nature. The depth ranges of a coral species is an important trait, which is believed to be linked to physiological tolerance. However, this trait is often measured using only the range extent, which is an overly simplified representation of a species use of space.

Additionally, recent increasing interest in deeper reefs has revealed that individuals of many coral species can occur substantially deeper than thought, revealing significant shortfalls in the existing data. Despite the strong and consistent zonation patterns, the majority of coral species exhibit wide depth ranges, creating an apparent paradox. To reconcile this paradox, we have used novel techniques to model the abundance distribution of a species within its depth range.

We apply this model to a dataset of coral species recorded over a wide depth range (0 to 45 m) in Kimbe Bay, Papua New Guinea. We show that coral species display a wide variety of abundance distributions over depth that are unrelated to the simple metric of absolute depth range, and provides greater insight into how species utilise vertical space.

Poster

Trophic transference of microplastics under a low exposure scenario: insights on the likelihood of particles cascading along marine food-webs

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Microplastics are emergent pollutants in marine environments, whose risks along food-web still need to be understood. Within this knowledge gap, MPs transference and persistence along trophic levels are key processes. We assessed the potential occurrence of these processes considering a less extreme scenario of predator's exposure than used previously, with microplastics present only in the hemolymph of prey (the mussel Perna perna) and absent in the gut cavity. Predators were the crab Callinectes ornatus and the puffer fish Spheoeroides greeleyi. The transference of microplastics occurred from prey to predators but without evidences of particle persistence in their tissues after 10 days of exposure. This suggests a reduced likelihood of particle's trophic cascading along the studied food web and, consequently, a reduced risk of direct impacts of microplastics on its higher trophic levels. However, the simplest contact with microplastics along food webs (i.e. despite microplastic persistence) is still concerning and we suggest to be modulated by the concentration of particles in prey and predators' depuration capacity and rate.

Poster

Are we underestimating elasmobranch abundances on BRUVS by using traditional metrics?

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Baited remote underwater video systems (BRUVS) are increasingly used to research fish communities, biomass, and animal behaviour. Due to the abundance of BRUVS data, there are many analysis methods. The most commonly used method for analysis of BRUV data is MaxN which refers to the maximum number of individuals observed in a single frame of a video. Here, we present a novel method for BRUVS analysis that involves identifying and counting distinct individuals (MaxIND) to test the accuracy of MaxN. Individuals of the oriental bluespotted maskray (*Neotrygon orientalis*) and the bluespotted fantail ray (*Taeniura lymma*), were identified on BRUVS deployments by spot patterns, tail characteristics, and sexes at three sites in Malaysian Borneo. We demonstrated that MaxIND gave abundances that were 2.4 and 1.1 times higher than MaxN for *N. orientalis* and *T. lymma*, respectively. Results were consistent for each species between sites regardless of the presence of marine reserves. Differences in abundance estimates from MaxN to MaxIND were apparent between species, indicating that correction factors need to be developed on a species basis to better estimate true abundance. While identifying individuals is time consuming, it provides improved accuracy and information about populations. We therefore recommend the use of MaxIND where applicable to improve our understanding of population abundance and distribution.

Image courtesy of
Christopher Brunner

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