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Report from Ningaloo Marine Park

Ningaloo Marine Park was established in the mid 1980's and the reef stretches 280 km along the central west Australian coast. Ningaloo Reef is the largest continuous fringing reef ecosystem in the world and it also holds the world's largest west continental coral reef ecosystem. Despite geographical and meteorological similarities with other west continental coasts, Ningaloo Reef is unusual as it supports extensive coral communities. The yearly visits of migrating whale sharks, humpback whales and manta rays have resulted in a developing tourism industry along this arid coastal stretch.



Sargassum beds in the lagoon on Ningaloo Reef.

As for most ecosystems, anthropogenic impacts are hard to avoid. Yet the population pressure and development in the area appears to be limited to a few isolated areas. As a result, Ningaloo Reef may be one of the more intact reef ecosystems today with the ability to sustainably provide the goods and services required by both humans and coral reef ecosystems.

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About the AIMS@JCU Newsletter:

This newsletter is produced quarterly and distributed by e mail to all AIMS and JCU staff.

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It is now more commonly accepted that species in the marine environment can be good indicators of coral health or decline. One widely reported example is the abundance of macroalgae in coral reef ecosystems. High macroalgal biomass has shown to be related to both human activities such as overfishing of herbivores and nutrient input but it has also been suggested that high macroalgal biomass may be a natural feature of coral reef environments. Another example of an ecological bio-indicator is the abundance of sea urchins. Reefs with an increasing level of degradation tend to display higher abundances of sea urchins. Due to the status of Ningaloo Reef we decided to examine the abundance and distribution of macroalgae and sea urchins in this relatively healthy reef ecosystem.



Sea urchin burrows on the fore reef of Ningaloo Reef.

During 2009 I collected data on herbivory, functional group distributions and benthic cover on Ningaloo Reef in collaboration with Dr Martial Depczynski at AIMS WA and Prof David Bellwood at JCU. Sampling across the shelf and up and down the Marine Park produced interesting results. Species that have often been identified as bio-indicators of reef degradation in previous studies appeared not to have the same role on Ningaloo Reef despite their high densities and biomass. First, we found extensive macroalgal stands (predominantly *Sargassum*) on sand-covered hard substrata in the lagoon but virtually none on the reefs. High biomass of macroalgae from reef ecosystems with low anthropogenic influence is poorly recorded in the literature. As Ningaloo Reef has a relatively low level of anthropogenic impacts we also examined the relationship between macroalgae and herbivorous fish and we suggest that the absence of herbivores within the lagoon is the strongest driver of high macroalgal biomass in this reef ecosystem and this is probably the result of low topographic complexity within the lagoon. A second finding was the high abundance of sea urchins on the fore reef of Ningaloo. The contribution to substrata stability and complexity from bioerosion was reflected in that the impact from sea urchins equalled the bioerosion estimated for the most abundant excavating fish, *Chlorurus sordidus*. As only two species of excavating fish were recorded, sea urchins appeared to play an important role for bioerosion in Ningaloo Reef.

Charlotte Johansson's Ningaloo MP report continued

This study shows that macroalgal biomass and an abundant sea urchin population does not necessarily indicate ecosystem degradation but may be a natural state of Ningaloo Reef. The results provide a new insight into ecological processes in a reef ecosystem with relatively low anthropogenic influence and show how critical it is to consider the natural variability of bio-indicators when evaluating the status of coral reef ecosystems. Reefs are not typical but may display strong variations in terms of composition and distribution of species and functional groups. For the remaining part of my PhD, the focus will be to examine the distribution of various functional processes on Ningaloo Reef for both fish and sea urchins.

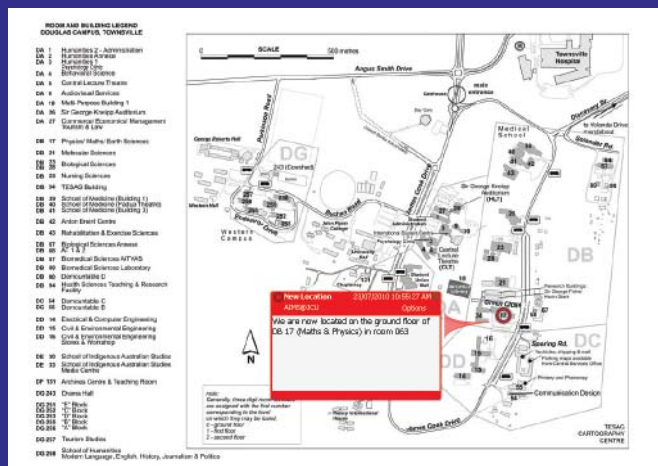


Echinometra mathaei is the most abundant sea urchin on Ningaloo Reef.

For more detailed information please see *Johansson et al (in press) Urchins, macroalgae and coral reef decline: a functional evaluation of an intact reef system, Ningaloo, Western Australia. Marine Ecology Progress Series.*

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New AIMS@JCU Office Location



Should you have any questions, please feel free to visit us in our new office along the Faculty of Science and Engineering corridor (DB17:063). Office hours are between 9am and 1pm.

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The 4th, and final Annual Conference of the Australian Government's \$40 million Marine and Tropical Sciences Research Facility (MTSRF) was held in Cairns on the 18-21 May 2010. MTSRF is a consortium of researchers and end users that collaborate to increase the sustainability of management and use of north Queensland's key environmental assets, particularly the Great Barrier Reef (GBR) and its catchments, tropical rainforests including the Wet Tropics World Heritage Area (WTWHA), and the Torres Strait. It is the Townsville-based Reef and Rainforest Research Centre that coordinates the annual Research Synthesis Conferences to showcase results of MTSRF research and facilitate engagement between researchers, and between researchers and end users. On the 4th such annual conference, research topics were arranged in 7 exciting sessions: 1. Catchment to Reef, 2. Sustaining Rainforests, 3. Managing Climate Change on the Great Barrier Reef, 4. Managing Climate Change on Land, 5. Sustaining the Great Barrier Reef, 6. Torres Strait, and 7. Managing Great Barrier Reef Catchments (Social and Economic Perspectives).



Sampled coral colonies are photographed, and the time-stamps of the digital images are used for identifying the geocoordinates of the sample from the tracklog taken by a GPS buoy above the diver

It is hard to pick one or two from the many interesting talks, but for me one of the highlights of the conference was certainly the results, and especially the outputs of the research done on the effect of climate change on marine turtle populations on the GBR and in the Torres Strait, by Mariana Fuentes and colleagues. Their research confirmed that climate change will indeed cause additional pressure on the already threatened sea turtle populations in several ways, e.g. by skewing their sex ratio towards female (sex determination of turtle embryos is temperature dependant), or e.g. by reducing available nesting space through sea-

level rise and their extended exposure to cyclones. The results were not only summarized in Mariana's PhD dissertation, and published in scientific journals, but she also wrote and published a children's book, entitled 'Myrtle's Battle against Climate Change', the main character of which, 'Myrtle' is based on a real turtle that was satellite-tagged in 2008 at Mer Island, Torres Strait. The book was on this conference, and many of us participants found it an astonishing idea to start targeting the youngest 'end users' of the MTSRF research results by such means.

More important for my connectivity work on corals were the talks about improving the resolution of circulation models by Richard Brinkman and colleagues, and that of the underwater topography of the GBR, by Robin Beaman.

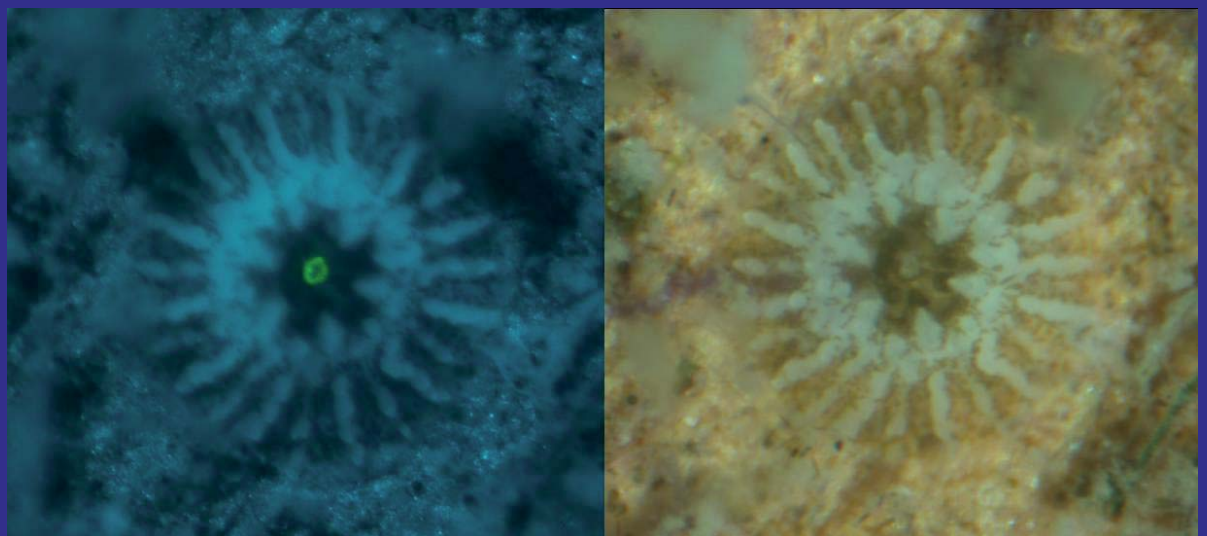
These models are increasingly realistic and hence provide opportunities to generalize and expand the spatial domain of the recruitment and connectivity patterns that non-model based empirical studies have identified for specific areas, after careful evaluation and cross-validation, of course.

Both as a scientist working on a related question, and as an end user, I found it very interesting to hear about the first results of the assessment of the effects of the GBR zoning plan on targeted fish populations. It is very promising to see that fish recruitment from no-take zones can indeed successfully re-stock the reefs that are open for fishing, as well as maintain a stable population within their boundaries, as explained by Prof. Garry Russ and Prof. Geoffrey Jones. I presented the first results of my PhD study on recruiting patterns and connectivity between *Pocillopora damicornis* populations on the GBR immediately after the above mentioned keynote talks, which gave the audience an opportunity to appreciate the complexity of the same research question: is the current management regime capable of ensuring healthy meta-population dynamics of coral reef organisms on the long term, under increased anthropogenic and environmental pressures?

The conference, altogether, was a great success, and it was very impressive to see the matrix of research carried out throughout the 4 years of the MTSRF program.



Coral recruits are sampled by easily removable terracotta settlement tiles



Pocilloporid coral recruit under UV (right) and normal light (left). The columella emits fluorescent light under UV light which helps find the recruits on the tiles

Nicola Browne at the 2010 AMSA Conference

Winner of the Peter Holloway Oceanography Oral Award 2010

The 47th Annual conference of the Australian Marine Science Association (AMSA) was held in Wollongong on the beautiful grounds of the University of Wollongong. The conference was entitled 'New Waves in Marine Science' and included a little something for everyone's tastes ranging from geosciences to phytoplankton, from mangroves to climate change and from chemistry to modelling. The conference was attended by both national and international scientists with a great mix of postgraduate students,



Middle Reef flat exposed at extreme low tide with Townsville and Castle Hill in the background

post-doctoral researchers and distinguished names from both the academic and government sectors, which provided a dynamic forum for the exchange of ideas. Plenary speakers included Professor Chris Langdon from the Rosenstiel School of Marine and Atmospheric Science in Miami, who gave an insightful presentation on ocean acidification, Dr Ian Poiner from AIMS, Dr Brendan Brooke from Geoscience Australia, and Professor Joe Baker who has been an inspirational leader of the Australian marine science community for many years.

The conference was held over four days during which over 250 presentations were delivered. Theme sessions included; Marine protected areas: assessment and management, Impacts of climate change, Advances in algal biology and ecology, Marine Biodiversity, Coastal interactions, Mangroves, Drivers of marine invisibility and Abiotic surrogates for marine biodiversity. The diversity of talks made for an exciting conference and enabled scientists from different disciplines to learn of cutting edge research outside their own field of interest. However, there was also plenty of time for less serious thoughts during the conference social events. The student and 'Mangroovers' nights were a great success and provided an informal setting in which to hunt down and meet leading scientists. The conference dinner was held on the final evening during which student prizes for the best oral and poster presentations were announced. Nicola Browne received the Peter Holloway Oceanography prize for an oral presentation on the sedimentary and hydrodynamic controls on coral growth rates on an inshore turbid zone reef. In 2011 the AMSA conference will be held jointly with the Australian Coral Reef Society (ACRS) in Freemantle, WA.

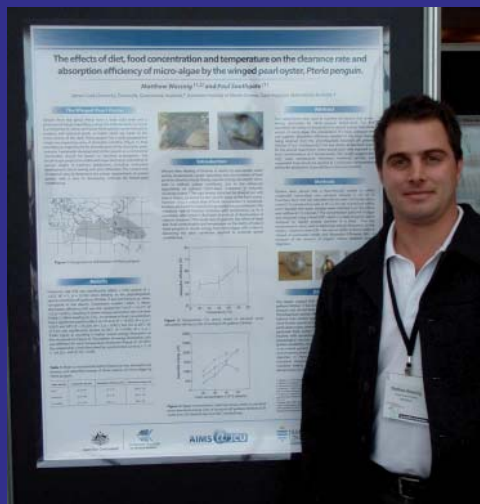


Staining corals in situ to determine coral growth rates

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The 2010 Australasian Aquaculture Conference (AAC) was held from May 23-26 in the picturesque, charming and bitterly cold city of Hobart. The conference was hosted by the Hotel Grand Chancellor, located in the centre of the city with views of the neighbouring harbour. The theme for the international conference was 'keeping pace with change', with focus placed on how the regions aquaculture industry will have to adjust in the face of changes to both the economic and environmental climate. This theme was complimented by the trade fair, which was held at the same venue and showcased the latest technology and innovations relevant to the industry.

I was surprised at the popularity and subsequent scale of this event. Talks were split over five rooms that hosted back-to-back seminars from 10:30am-5:30pm, with short breaks for lunch and the necessary caffeine fix. Tasmania is the home of Australia's salmon industry, so understandably it was the focus of the daily morning plenary talks, for which attendance was substantial. The caliber of presentations was generally impressive and encompassed a broad range of topics relating to the culture and biology of specific species, management and marketing of seafood products and the expansion of the industry in the future. There were a number of social events arranged by the organizing committee, including the 'My Island Home' get together, where colleagues could mingle casually while enjoying food, drinks and live entertainment.



Matt with his poster presentation

I attended the 2010 AAC to present a poster entitled 'The effects of diet, food concentration and temperature on the clearance rate and absorption efficiency of micro-algae by the winged pearl oyster, *Pteria penguin*.' This research was conducted both at the Australian Institute of Marine Science and JCU's Marine and Aquaculture Research Facilities Unit (MARFU), under the supervision of Professor Paul Southgate. The aim was to examine the factors that govern energy absorption by *Pteria penguin* broodstock, to determine the ideal conditions required to promote reproduction outside of the natural spawning season. In the

face of depleted wild stocks, the ability of pearl oyster hatchery operations to breed animals year-round will ensure an adequate supply of oysters for commercial pearl production.

Attending the 2010 AAC was made possible through a travel award provided to me by AIMS@JCU. The experience was both enjoyable and valuable to my research. It provided me with an opportunity to present some of the findings from my PhD and consequently receive constructive feedback and advice from my peers.

Check out our recent AIMS@JCU student member publications:

Sato, Y., Willis, B. L. & Bourne, D. G. (2010) Successional changes in bacterial communities during the development of black band disease on the reef coral, *Montipora hispida*. *ISME Journal* 4 (2): 203-214

Choukroun, S., Ridd, P. V., Brinkman, R. & McKinna, L. I. W. (2010) On the surface circulation in the western Coral Sea and residence times in the Great Barrier Reef. *Journal of Geophysical Research-Oceans* 115, Article Number: C06013

Research Director's Report

July brought good news to the AIMS@JCU office in the form of confirmation that we will be offering postgraduate scholarships for 2011. The news arrived a little close to the scholarship deadlines but we hope that we got the word out fast enough to allow everyone to get their applications in order. We are also pleased to announce that the scholarship program has been broadened to include additional research areas. It is hoped this will allow more students to participate in AIMS@JCU and strengthen and broaden our areas of research expertise and training. These changes are the beginning of continued support of AIMS@JCU by the partner institutions and is the first in what will likely be a series of changes to the AIMS@JCU program. Please stay tuned as these changes occur. As always we will do everything we can to keep our members informed and ensure things run as smoothly and efficiently as possible. If you have any questions along the way please feel free to contact us in the office or drop by for a visit.

Thanks to all of our members for your continued support.

Michelle

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Photographs in this publication were submitted by AIMS@JCU students/staff or have been sourced from the AIMS Long Term Monitoring Team.

