



**AIMS@JCU IS A COLLABORATIVE JOINT VENTURE
BETWEEN THE AUSTRALIAN INSTITUTE OF MARINE
SCIENCE AND JAMES COOK UNIVERSITY**

Volume 4, Issue 2
June 2008

New Additions to AIMS@JCU •

MICHELLE HEUPEL - AIMS@JCU RESEARCH DIRECTOR



Welcome to Michelle Heupel, the new AIMS@JCU Research Director. Michelle is a marine ecologist working primarily on the movement and ecology of elasmobranch fishes (shark and rays). She has focused largely on acoustic monitoring of fish movements to define long-term movement and presence patterns in specific habitats. Michelle obtained her undergraduate degree in Zoology from Colorado State University and conducted her PhD studies at the University of Queensland.

Following her PhD, Michelle took a position as a Postdoctoral Scientist in the Center for Shark Research at Mote Marine Laboratory in Sarasota, Florida. During her tenure at Mote Michelle was awarded several major grants from the National

Science Foundation and the National Marine Fisheries Service. This success led to promotion within the institution eventuating with her Managing the Elasmobranch Behavioral Ecology Program.

Since moving to Townsville in Feb 2007 Michelle has been involved in contract work and research as an Adjunct Principal Research Fellow in the School of Earth and Environmental Sciences at JCU. A part time appointment with AIMS@JCU ensures that Michelle will continue to develop and maintain an active research program. She is currently initiating projects to examine the long-term residence and movement patterns of inshore predators including sharks, rays and large teleost fishes.

Michelle's research interests include defining how fish use space in relation to human activities (i.e. fishing, marine park zoning, boating) and environmental change (i.e. response to salinity, temperature change or extreme weather events).

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About AIMS@JCU News:

This newsletter is produced quarterly, and distributed via email to all AIMS and JCU staff.

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BETTE WILLIS - NEW AIMS@JCU PROGRAM LEADER

We welcome Prof. Bette Willis as our new 'Stress in Tropical Marine Systems' JCU program leader. Mark McCormick, PhD has stepped down after his 3 or so years

in this position and we thank him for his help and support during this time. Watch out for a profile of Bette in upcoming newsletters.

Continuing from Patricia Warner and Heidi Luter's profiles featured in Volume 4, Issue 1; enclosed are profiles of the final four PhD students who were granted full research scholarships from AIMS@JCU for 2008.

Sarah Castine - PhD Candidate

THE INTERACTION BETWEEN MACROALGAE AND MESOGRAZERS IN BIOREMEDIATION PONDS



Aquaculture operations are important for meeting the rising global demand for seafood. However, dependency on natural ecosystems needs to be reduced if aquaculture is to continue expanding at the present rate. This may be achieved by improving the efficiency of current aquaculture operations. Integrated aquaculture systems are now being operated in which fed (waste generating) and extractive (cleaning) organisms are cultured together. Seaweeds are often used as the extractive component of such operations as they are capable of using excess nutrients from wastewater to photosynthesise new biomass, which can be harvested and sold as a secondary product.

Herbivory is an important biotic factor effecting the performance of macroalgae in integrated systems. Mesograzers may reach densities

of thousands of animals m^{-2} , especially in systems where natural predators (such as fish, crabs, shrimps and birds) and competitive macrograzers are excluded. Although many algal species possess mechanical and/or chemical properties to defend against grazing, the performance of macroalgae in integrated systems is still partially defined by mesoherbivores. It is therefore, important to investigate the biological and biochemical processes that drive mesograzers communities. Species composition and size distribution, density and sex-ratios within mesoherbivore communities will all play important roles in driving algal processes.

The objectives of this project will be to select one or more algal species based on survival and growth indices cultured in the wastewater from aquaculture systems and to investigate the role of grazers in structuring macroalgal communities in bioremediation ponds.

Specifically the aims of this project are to:

Select one or more local species of macroalgae on the basis of growth across a gradient of light, salinity and nutrients and temperature.

Investigate the composition of

invertebrate communities in bioremediation ponds and the selection and consumption of macroalgae within these ponds.

Culture selected algal species successfully under conditions reflecting bioremediation ponds and trial them against the diversity of mesograzers to determine their resistance to grazing.

Document spatial and temporal variation in the distribution and abundance of herbivores in bioremediation ponds with selected algal species

Use lab analyses to investigate the selection and consumption (feeding preferences) of macroalgae by amphipods and isopods in particular, and determine the mechanisms driving selection.

Determine the trophic transfer of nutrients to amphipods and isopods

Investigate the potential for amphipods and isopods to be harvested and subsequently used as an alternative protein meal in aquaculture feeds.

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Honours Student Support Grants

Congratulations to the following student who was successful in obtaining an AIMS@JCU Honours grant for 2008.

Honours Support Grant - \$1,000

David Jones, School of Marine & Tropical Biology – Effective population size in a coral reef fish, *Pomacentrus amboinensis*.

Travel Support Grants

Congratulations to the following 10 students who were successful in obtaining AIMS@JCU Travel grants for 2008.

Travel Support Grants - \$500

Coastal Processes & Modelling

Paulina Cetina Heredia, joint enrolment between School of Mathematics & Physics and School of Marine Biology.

Stress in Tropical Marine Systems

Patricia Warner, Vivian Cumbo, Allison Paley, Emmanuelle Botté, Yui Sato, Eneour Puill-Stephan and David Abrego, all from School of Marine & Tropical Biology.

Jessica Haapkyla, School of Marine Biology and Aquaculture.

Francois Seneca, School of Pharmacy and Molecular Science.



In July 2008, aided by AIMS@JCU travel grants, the above-mentioned ten students will travel to Florida to attend and take part in the 11th International Coral Reef Symposium.

Every four years, many coral reef biologists, ecologists, economists, environmentalists, geologists, resource managers, graduate and undergraduate students and others working in coral reefs worldwide, meet together at the International Coral Reef Symposium (ICRS) to share the latest knowledge and to advance the science on a global scale.

The theme of this Symposium is **Reefs for the Future** and the goals are:

- to provide a scientific basis for coral reef ecosystem management by articulating the state of the science with respect to current and emerging stressors;

- to improve the understanding of reef condition, function, and productivity; and
- to grow the field of coral reef ecosystem science and encourage multidisciplinary research by facilitating the exchange of ideas.

The 11th ICRS is proud to be recognized as a keystone event within the International Year of the Reef 2008.

Our students will present oral presentations entitled:

Environmental Controls on the Establishment and Development of Symbiosis in Corals (V. Cumbo); The Missing Link to Population Genetic Structure in Brooding Corals (P. Warner); Modelling Larval Retention around Reefs by Local Scale Circulation Features (P. Cetina-Heredia); Dynamic Establishment of Coral-Dinoflagellates Symbiosis in Heat Stressed Coral Juveniles (D.

Abrego); An Ecological Microarray Study of Coral Bleaching (F. Seneca); Chimera Formation during the Early Life History of *Acropora millepora* and its Persistence Through Time (E. Puill-Stephan); Dynamics of a Black Band Disease Outbreak at Pelorus Island on the Great Barrier Reef (Y. Sato).

Poster presentations will also be given on the following topics:

Coral Disease Prevalence and Dynamics in the Wakatobi Marine Park, South-East Sulawesi, Indonesia (J. Haapkyla); The Effects of Temperature and Pesticides on the Damselfish *Acanthochromis polyacanthus* (E. Botté); and Variation in Bleaching Susceptibility Among Colour Morphs in the Reef-Building Coral *Acropora millepora*, Great Barrier Reef (A. Paley).

Visit:

<http://www.nova.edu/ncri/11icrs/> for more details.

Scott Seymour - PhD Candidate

UTILISING BIODIVERSITY OF THE TROPICAL AUSTRALIAN MACROALGAE FOR INTEGRATED AQUACULTURE'

In Australia, much of the aquaculture industry focus' on the monoculture farming practices. Within this style of farming, high nutrient loads in effluent water can lead to lost farming efficiency and changes in the surrounding environment. Some countries, particularly in Europe, are developing integrated aquaculture practices which incorporate macroalgae culture with finfish culture to increase nutrient utilisation, decreasing environmental impacts whilst increasing farm productivity.

Over the next three years I aim to identify candidate seaweed species from tropical Australian waters (particularly around the Townsville region) for integration with prawn and finfish farming in Australia. My research will also work beyond the prawn/finfish – seaweed system, aiming to develop a prawn/finfish – seaweed – sea urchin (*Tripneustes gratilla*) integrated system.

My research has begun by conduction feeding assays to determine seaweed preferences by *Tripneustes gratilla*. This will then

be expanded upon by;

Determination of urchin growth fed various seaweed diets,

Propagation and growth rates of favoured seaweeds,

Development of artificial seaweed diets for the sea urchins.

This work is an extension of my honours research (conducted in 2007) which focussed on the potential of *Caulerpa* seaweeds for nutrient removal from aquaculture effluent. My interest in developing sustainable aquaculture systems is led by a desire to improve the industry's environmental sustainability whilst increasing the efficiency and productivity of aquaculture ventures. Farms utilising integrated aquaculture systems have the potential of increasing productivity and profitability through diversification.

Scott will be presenting some results from his honours research at the International Society of Applied Phychology conference in Galway, Ireland in June 2008. Scott grew up in Werribee (outskirts of Melbourne), Victoria. He has

completed a Bachelor of Applied Science (Human Movement) from University of Ballarat, and a Graduate Diploma of Education (Secondary) from the Australian Catholic University in 2001.

Scott taught for one year in Hoppers Crossing (Victoria) then one year on Rarotonga, Cook Islands. From there he came to Townsville to study aquaculture at James Cook University in 2004. He completed his Bachelor of Science (Aquaculture) with Honours in 2007 and began his PhD in 2008.



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AIMS@JCU in Europe

Dr Thomas Stieglitz, Postdoctoral Research Fellow for AIMS@JCU has been carrying the AIMS@JCU flag around Europe this year. Dr Stieglitz attended a workshop 'Measurement and Application of Radium and Radon Isotopes in Environmental Sciences', which brought together 52 scientists from 14 countries using these radioisotopes in coastal and marine studies. The UNESCO Regional Bureau for Science and Culture in Europe (BRESCE) in Venice (Italy) hosted the workshop in

Palazzo Zorzi from 7 to 11 April.

The main aim of the workshop was to discuss recent developments in the sampling methods and applications of radium and radon in aquatic environments. These naturally occurring radioisotopes are very powerful tracers to study physical and chemical processes in the coastal and marine environment, such as the influx of groundwater into the ocean, or mixing rates of the ocean.

Together with collaborators from CSIRO Land & Water and the University of California, Thomas has

applied these isotopes to various physical processes in the GBR, and at the workshop he reported on the application of these tracers to studies of submarine groundwater discharge and to mangrove swamp hydrodynamics. The workshop travel was generously sponsored by the Ian Potter Foundation.

He also presented an overview of his work on acoustic mapping of the seafloor and acoustic telemetry of stingrays at the European Institute for Marine Studies in Brest (France; www.univ-brest.fr/IUEM) to a mixed audience of marine researchers and managers.

Xugan Wu - PhD Candidate

A COMPARATIVE STUDY OF LIPID NUTRITION OF TWO TROPICAL COMMERCIAL CRUSTACEANS (*PORTUNUS PELAGICUS* AND *PANULIRUS ORNATUS*)

Blue swimming crab (*Portunus pelagicus*) and rock lobster (*Panulirus ornatus*) are two important commercial fisheries in the Indo-Pacific region. Because of their large size, high meat yield and delicate flavour, there is an increasing demand for *Portunus pelagicus* and *Panulirus ornatus* production in many Indo-Pacific nations. Therefore there is growing interest in *P. pelagicus* and *P. ornatus* farming. In future commercial culture production of *P. pelagicus* and *P. ornatus*, feeding with formulated diets would be practical and economical.

P. pelagicus have advantages, such as fast growth, easily reared in indoor tanks, need less tank volume, less incidence of disease and female broodstock can spawn many times in one year. This leads

to *P. pelagicus* being recommended as a model species for investigation of the relationship between the lipid nutrition and larval development, survival rate, growth, ovarian development and reproductive performance of broodstock.

The culture technology of all life stage *P. pelagicus* (broodstock, larvae and juveniles) have been established at JCU; however, there is still scarce information about the lipid nutrition requirements (HUFA, PUFA, phospholipid and cholesterol) of larval and broodstock *P. pelagicus*.

The objectives of this project are to use *P. pelagicus* as a model species to investigate crustacean lipid nutrition requirement (HUFA, PUFA, phospholipid and

cholesterol) including broodstock, embryo and larval stages. Important results can be applied and optimized for both the blue swimming crab (*Portunus pelagicus*) and rock lobster (*Panulirus ornatus*) to improve reproductive performance and larval quality.



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'Aquashed' Update

MARFU MANAGER, JOHN MORRISON GIVES THE LATEST REPORT

"The Aquashed at The Aquarium Complex has been functioning really well since it was completed in 2006. Last year we installed two security cameras inside the Aquashed as part of our new security program at the Complex.

In addition to the cameras, we



Closed up for the winter nights

invested more money into the Aquashed infrastructure by providing many more power outlets to cater for the large heater elements for those really "cool" winter nights we experience here at our Douglas campus. Some experiments needed pumps, heaters and lights that all require an outlet each, to be compliant with WH&S.

The Aquashed is still a freshwater research facility only. By keeping the saltwater as far away from this area as possible, we hope rust will not be a problem to this all steel shed.

We are keen to offer computer

monitoring to this area in the very near future which will greatly assist the various types of experiments we would like to run in the Aquashed.

The four quarantine rooms and their entire specialist infrastructure, that were also upgraded in 2006 AIMS@JCU funding are in high demand. In fact, if we had two or three more of these labs they would be in use now. Two of these rooms are currently being used for highly specialized climate change experiments and could not have been set up anywhere else."

AIMS@JCU NEWS

Emily Howells - PhD Candidate

GENETIC RESILIENCE OF ZOOXANTHELLAE POPULATIONS: THE ROLE OF CORAL ENDOSYMBIONTS IN REEF ADAPTATION TO CLIMATE CHANGE



After working and traveling her way around Australia and New Zealand, Emily moved to Townsville to obtain a degree in Marine Biology at James Cook University. She completed an honours project with AIMS@JCU in 2006 on the population genetics of zooxanthellae (*Symbiodinium* spp.) and is continuing research on common types of zooxanthellae symbiotic with reef building corals on the Great Barrier Reef. Emily commenced her PhD in April 2008 and has been awarded AIMS@JCU funding to support her project

research over the next 3 years.

Zooxanthellae are essential primary producers on tropical reefs and are necessary for coral health and survival. Breakdown of the coral-zooxanthellae symbiosis manifested as coral bleaching (= loss of zooxanthellae and/or their photosynthetic pigments) has led to mass mortality and reduced reproductive output of corals on reefs around the world, including the Great Barrier Reef. The frequency of bleaching episodes is expected to increase with rises in sea surface temperature linked to global warming. While corals hosting different types of zooxanthellae have shown different susceptibility to bleaching, we are yet to understand the underlying mechanisms in zooxanthellae that contribute to bleaching resistance and increased thermal tolerance in corals.

Novel genetic approaches will be applied to understand how populations of different types of zooxanthellae on the Great Barrier

Reef respond to thermal stress. Genetic diversity within reefs and genetic exchange among reefs will be investigated using microsatellite markers. This will determine the capacity of damaged reefs to be reseeded from surrounding reefs and for DNA linked to thermal tolerance to be spread among reefs. Genes involved in the heat stress response will be identified using gene expression techniques. DNA variation at these genes across different thermal environments will be analysed to confirm their role in thermal tolerance.

Project results will be combined with complimentary research being undertaken on the model coral host *Acropora millepora* (Dr. Line Bay) to provide a holistic representation of genetic resilience in the coral-zooxanthellae partnership.

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New Members...

Four new AIMS@JCU members were approved at the March 2008 AIMS@JCU Board meeting. Welcome to:

- Heidi Luter, STMS Program
- Scott Seymour, TA Program
- Patricia Warner, STMS Program
- Jean-Baptiste Raina, STMS Program

Photos in this publication were submitted by the students/staff themselves, unless otherwise captioned.

