AIMS@JCU

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

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Hearing impaired Reef fish spark worldwide interest

Environmental stresses, including warmer and more acidic seawater, may be affecting the development of the ear bones in young reef fish, causing the fish to get lost at sea during a crucial stage of their development.

Research by fish ecologists Dr Monica Gagliano (AIMS@JCU Post-doctoral Scientist) and Dr Martial Depczynski (AIMS), with Dr Stephen Simpson from the University of Edinburgh and James Moore from JCU in Townsville, has found that fish with asymmetrical ear bones struggle to return to the reef.

The implications could be profound for the survival of reef ecosystems, which depend upon a rich biodiversity for effective function and health.

The research was published in the prestigious UK scientific journal *Proceedings of the Royal Society* on 7th March and sparked worldwide media interest.

The stresses causing ear bone asymmetry may be closely linked to a combination of rising sea surface temperature and acidity, both caused by high atmospheric carbon dioxide levels, along with a range of more localised stresses.

Story continued on page 4.

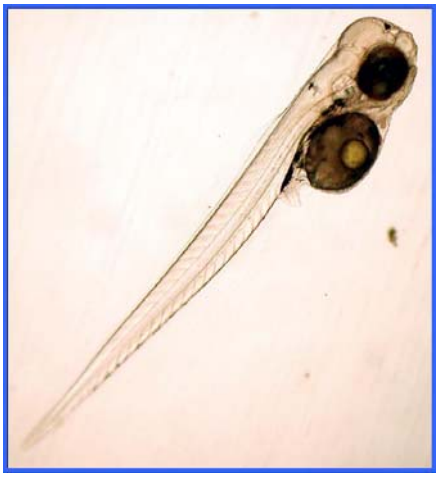

Photo: M. Gagliano.

Inside this issue:

About AIMS@JCU News:

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

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Six new research Scholarships awarded for 2008

AIMS@JCU have awarded six new PhD research scholarships for 2008.

The scholarships will see capacity increased in the research program areas of Tropical Aquaculture and Stress in Tropical Marine Systems.

The new scholarships take the total number of research scholarships offered since the Joint Venture commenced operations, to twenty-three.

Turn to page 2 for a full list of successful recipients and their project titles.

Six new research Scholarships awarded cont'd...

Congratulations to the following successful applicants, who were awarded AIMS@JCU Scholarships.

Full Scholarship + Project Funds - 3 yrs

Ana Cano Gomez, PhD, School of Veterinary and Biomedical Science, **Tropical Aquaculture Program.**

'Development of MLSA identification tool and a real-time PCR diagnostic tool for *V. harveyi* infections in aquaculture'.

Heidi Luter, PhD, School of Marine & Tropical Biology, **Stress in Tropical Marine Systems Program.**

'Impact and causes of sponge disease on the Great Barrier Reef'.

Project Funds - $5,000 - 3 yrs

Sarah Castine, PhD, School of Marine & Tropical Biology, **Tropical Aquaculture Program.**

'The interaction between macroalgae and mesograzers in bioremediation ponds'.

Emily Howells, PhD, School of Marine & Tropical Biology, **Stress in Tropical Marine Systems Program.**

'Genetic resilience of *symbiodinium* populations: the role of coral endosymbionts in reef adaptation to climate change'.

Scott Seymour, PhD, School of Marine & Tropical Biology, **Tropical Aquaculture Program.**

'Utilising biodiversity of the tropical Australian macroalgae for integrated aquaculture'.

Patricia Warner, PhD, School of Marine & Tropical Biology, **Stress in Tropical Marine Systems Program.**

'Reproductive ecology, population genetic structure and adaptation to heat stress in the brooding coral, *Seriatopora hystrix*'.

STUDENT SEMINAR WINNERS

Congratulations to the winners of the 2007 AIMS@JCU Student Seminar, held Friday, 9th November 2007.

Pictured with AIMS@JCU Chairperson, Rhondda Jones, are (L-R) **Cameron Crothers-Stomps** (Second Place - Oral Presentation), **Paulina Cetina Heredia** (Best Poster Presentation) and **Eneour Puill-Stephan** (First Place - Oral Presentation).

Photo: T. Fielding

Heidi Luter - PhD Candidate

CAUSES AND IMPACTS OF SPONGE DISEASE ON THE GREAT BARRIER REEF

Sponges form a highly diverse and significant component of benthic communities, with an estimated 15,000 species found worldwide.

Sponges can provide food and shelter to commercially important species, they dominate the substrate excluding other sessile organisms and they are a significant energy coupling between benthic and pelagic ecosystems. Therefore, degradation of sponge communities can have catastrophic impacts on the surrounding environment.

An epidemic in 1938 caused widespread sponge mortality throughout the Caribbean. Massive sponge mortalities have also occurred in the Mediterranean, drastically reducing outputs of economically important sponge fisheries.

More recently, there have been reported disease outbreaks affecting the giant barrel sponge, *Xestospongia muta*, in Belize and the Caribbean and *Ianthella basta* in Papua New Guinea.

Despite some of the devastating effects of sponge disease epidemics in the past, many studies fail to properly identify the etiological agent responsible for the disease.

To date, the Great Barrier Reef has not experienced the catastrophic sponge mortalities observed in other places around the world; however, anecdotal reports suggest an increasing prevalence of sponge disease on the Great Barrier Reef.

With the proposed addition of a commercial sponge farm in the Great Barrier Reef World Heritage Area, the frequency and severity of sponge disease outbreaks may increase.

Links between environmental change and disease have been observed in both terrestrial and marine systems.

Elevated sea water temperature and eutrophication have already been shown to effect pathogen virulence, transmission and host susceptibility in corals and it is possible that sponges are being impacted in similar ways.

This project will examine the prevalence of sponge disease on the Great Barrier Reef, focusing particularly on pathogen identification and disease transmission.

The role of environmental stress in disease processes will also be examined.

Specific project aims include:

1. Determine the prevalence and etiological agents of disease in Great Barrier Reef *Ianthella basta* populations and perform re-infection trials to confirm the role of putative pathogens in disease establishment.

2. Examine how environmental factors, such as temperature and nutrient enrichment, impact on disease processes (infection, transmission and virulence).

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Hearing impaired Reef fish cont'd...

Cont'd from page 1.

Abnormalities in fish hearing structures may be interfering with a vital part of the animals' life cycle. Most reef fish spend some time in the open ocean after hatching, before finding a place on the reef to settle and breed.

Researchers have only recently established how important sound is in guiding young fish to their homes. It is now known that fish at the end of their ocean stage "home in" on reef-associated sounds, such as the gurgling of fish and the snapping of crustaceans.

A sophisticated hearing system that enables fine distinction between frequencies is needed by young fish to determine where to go. Fish are not the helpless victims of currents and tides – they actively navigate.

The project examined damselfish, which are abundant on many reefs, including Queensland's Great Barrier Reef and Western Australia's Ningaloo Reef. As a group, damselfish are well understood and provide a good model for other kinds of reef fish.

The scientists collected representative samples of hatchlings at their reef of origin. They later traced fish from the same cohort arriving on the reefs after the ocean phase, attracting them to traps broadcasting various sound frequencies, from high to low.

At hatching, 41 per cent had symmetrical ear bones (otoliths) and 59 per cent asymmetrical. When the team examined the otoliths at the settlement stage a few weeks later, far fewer asymmetrical individuals were found to have made their way back to a reef. The scientists also found that those with asymmetrical ear bones that did make it to the reef took longer to do so than their symmetrical counterparts.

"In our opinion, ear bone asymmetry in the early life stages of reef fish interferes with their capacity to find and settle on coral reefs," Dr Gagliano said.

Vertebrate animals make sense of sounds by comparing differences in the acoustic signal between their two ears. To do this well, their ear structures must be relatively symmetrical. Asymmetrical ear bones do not appear to make the fish deaf, but they may interfere with the ability of the fish to hear effectively.

Dr Gagliano said that fish otoliths were a sensitive tool for studying the effects of environmental stress in fish. "Asymmetry has been used as a stress indicator for a long time, although in some contexts it remains controversial," Dr Gagliano said.

"In our case, it looks like it is very reliable. Preliminary data indicate that if we increase the stress, the asymmetry of the otoliths will increase," she said.

"There is a degree of asymmetry that is acceptable in the population – some is natural," co-author Dr Depczynski said. "Not all the babies are created equal and not all of them are going to make it, even in pristine environments."

The problem now is that an already high mortality rate among reef fish hatchlings is likely to rise even higher if young fish can't navigate by sound.

At least part of the problem is likely to be linked to ocean acidification, although much more research needs to be done to examine the link. Fish ear bones, like their skeletons and many other kinds of structures such as reef-building corals, are made from calcium carbonate. When seawater becomes more acidic, there is less calcium carbonate available for building any calcium-based structure, including ear bones.

Acidity appears to be having a two-fold effect, creating a hostile marine environment and also robbing the environment of the building blocks of calcium-based structures. This has a direct effect on fish development and on their food sources, as many creatures the fish eat are also dependent on calcium.

While stress is part of life for reef fishes, new stresses are now being piled on top of existing ones and fish are showing the effects, according to Drs Gagliano and Depczynski.

For further information, please contact:

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Dr Martial Depczynski

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Photo: M. Gagliano.

Patricia Warner - PhD Candidate

THE REPRODUCTIVE ECOLOGY, POPULATION GENETIC STRUCTURE, AND ADAPTATION TO HEAT STRESS IN THE BROODING CORAL, *SERIATOPORA HYSTRIX* ON THE GREAT BARRIER REEF

Patricia recently upgraded to the PhD (commencing 2008) from the Masters of Applied Science program at James Cook University. She arrived from Florida (USA) last year and wasted no time getting her fins wet.

Patricia has been awarded the James Cook University Postgraduate Research Scholarship, as well as an AIMS@JCU Scholarship for 3 years of study.

Patricia started a research project in September (2007) to investigate the reproductive characteristics of *Seriatopora hystrix* populations in the Palm Islands based at the Orpheus Island Research Station (OIRS). Her 'pilot study' aims to determine the timing of various stages of gametogenesis and the periodicity of sperm release, fertilisation, and larval release through regular histological monitoring of gonadal tissue.

She has also collected tissue samples for genotyping from a mapped quadrant of *S. hystrix* colonies and collected brooded planula during the November/December larval release period.

Molecular techniques utilizing highly polymorphic DNA markers, and including parentage analysis of larvae, will be performed to determine the distance of sperm dispersal and micro-scale population genetic structure.

Patricia will present the results of this work at the upcoming 11th International Coral Reef Symposium in Fort Lauderdale, Florida in July.

Understanding the genetic patterns exhibited by a species will be greatly enhanced by a thorough knowledge of the species' reproductive processes.

Patricia's PhD research will build upon the foundation of data collected from this past reproductive season.

She plans to expand her investigation of the reproductive ecology of *S. hystrix* along the GBR, and to address how locally and regionally specific patterns affect the connectivity and genetic structure of this species.

Ultimately, her research aims to examine the potential for adaptation to heat stress in *S. hystrix*, an abundant but sensitive coral.

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Seed funding for Trop. Aq. project

At its December meeting, the AIMS@JCU Board approved a request for funding for a research project that will take advantage of the presence at JCU of a visiting PhD student from the University of Southampton (UK), Ms Sue-Ann Watson.

Sue-Ann's PhD project concerns calcification in molluscs. She is co-supervised by scientists at the British Antarctic Survey and the major focus of her research has been to compare invertebrate shell compositions along a latitudinal gradient from Antarctic waters into the tropics.

Some of the research that Sue-Ann completed in the UK related to acidification of the oceans and its effects on the shell composition. This is a very topical avenue of research with corals and fish, but there is limited information on the effects of seawater acidification on invertebrates other than corals; very limited research has been done with molluscs and none with tropical species.

In order to take advantage of Sue-Ann's time at JCU, AIMS@JCU have agreed to fund 50% of the cost of equipment to conduct a series of experiments with her to determine the effects of acidification on the development growth and shell structure of pearl oyster larvae. This line of research has clear relevance to the aquaculture industry and pearl oyster culture.

It also provides potential synergies between two AIMS@JCU Programs – Tropical Aquaculture and Stress in Tropical Marine Systems.

Project Title: The effect of ocean acidification on pearl oyster larval development.

AIMS@JCU Funding: $2,350.

Student Seminar - Nov. 2007

Some of the participants in the 2007 AIMS@JCU Student Seminar, held Friday, 9th November.

L-R: Emmanuelle Botte, Ana Cano Gomez (back), Paulina Cetina Heredia, Cameron Crothers-Stomps, Finn Baumgartner, Eneour Puill-Stephan, Carol Devney, Marie Magnusson, Lachlan McKinna, Jasmine Jaffres, Vasiliki Tziouveli.

Photo: T. Fielding

From the Chair....

From the Chair...

This is the last issue of the newsletter for which I will be writing a column, since my term as Chair of AIMS@JCU ends this month. The Board will be operating in future as a management committee, and the intention is that the Chair will be appointed from the representative members of the Board.

This is also the last issue that Trisha Fielding will produce, since Trisha has left AIMS@JCU and the University to work full-time with the Thuringowa Library. We are immensely grateful to Trisha for her work and for her creative skills during her period with the Joint Venture, and we wish her every success in her new role. We hope to have appointed a short-term replacement for Trisha within the next week or so

The final major change, about which you have already been notified, is that Michelle Heupel has been appointed as Research Director and manager of the the AIMS@JCU joint venture. The Board is delighted to have been able to appoint someone of Michelle's ability and skills to this position, and we are sure that the operation will be in excellent hands with her at the helm.

With best wishes for the future to the students, staff, Program Leaders and the Board of AIMS@JCU...

Rhondda Jones

(Chair of the Board)

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

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