AIMS@JCU NEWSLETTER

Gergely Torda

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AIMS@JCU course in biostatistics with R

Last month, about 25 of us had the privilege of spending two weeks under the expert tutelage of Dr Murray Logan from AIMS, learning about biostatistics using both frequentist and Bayesian methods. The course provided a solid grounding in:

- statistical principles and philosophies;
- general exploratory data analyses
- frequentist and Bayesian statistical modelling methods (regression, linear and non-linear models, multivariate analyses)
- how to manipulate data
- how to graph and otherwise display data and outputs from analyses
- how to do all of the above using R
- how to use a wide range of specialist editors, formatters and packages in R

Murray also taught us how much more interesting and meaningful statistics is when a) you keep the biology and ecology of the real world first and foremost in your mind; and b) you, your teacher, and your peers all wear silly hats! We hope to offer this course again in the future.

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Photographs in this publication were submitted by AIMS@JCU members unless otherwise stated

About the AIMS@JCU Newsletter:

This newsletter is produced quarterly and distributed by email to AIMS and JCU staff.

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AIMS@JCU course in biostatics with R

Participant reviews

Dan Zeh: I was thrilled to be in Murray's class. I have been in some number of stats classes over the years but Murray's explanations are far and above the best I've heard. So very understandable. In fact, I am so charged up now over the stats we did that I'm going to learn more and try to become expert as well – however long that may take. Dan Zeh 2!: I have to go on again about Murray's course. It was perfect for me and my place in PhD-ship right now. I'm inspired now to learn way more biostatistics and plan to finish my PhD project with a second goal of biostatistician.

Tory Chase: The course was extremely well organized, everything from where to meet, how the material was presented, the timing of the breaks, food, etc. Murray did a fantastic job of catching us up to speed with R. His energy and attention to detail as well as students' concerns and questions was fantastic. The learning atmosphere of the class was supportive and I felt very comfortable asking questions and for help. I would highly recommend this class for anyone interested in honing their stills in statistics as well as learning more about R.

Kristen Anderson: The course was fantastic. Murray is able to teach very complex models in a clear, easy to understand format. His teaching will be instrumental in data analysis for my PhD.

Kate Quigley: Murray's R course was an invaluable introduction to Bayesian statistics, and he provided great instruction on how to handle writing scripts in R. Although I had experience with the program, Murray's ability to explain the statistical and ecological relevance of each step, as well as introducing us to a number of great R add-in packages, made the two-week course particularly relevant. Thank you to Murray for providing his time and AIMS@JCU for organizing this workshop.

Jasmine Jaffrés: Thank you very much for the organisation and presentation of the R workshop. It has been an excellent two-week workshop and I would recommend it to all students and staff. I have come away from the course with many ideas and so did other participants, I have heard. I hope there will be opportunities to offer this workshop again in the future.

Thomas Roberts

2012 AIMS@JCU Honours Student Update

Lauren Davy

I completed an Honours project in 2012 as an AIMS@JCU student. My project examined the spatial and temporal movement and habitat use of mangrove whiprays *Himantura granulata* and cowtail stingrays *Pastinachus atrus*. We used acoustic telemetry to track the movement of rays in nearshore environments at Orpheus Island, Queensland. Thanks to AIMS@JCU, I was able to include a fieldtrip to investigate ray movement using active tracking, which was a valuable addition to the project.

The study revealed a number of interesting results. Passive acoustic monitoring showed that rays primarily inhabited shallow intertidal areas, and occupied a variety of habitats including mangroves. Active tracking provided very interesting insights into ray movement during tidal changes, and showed that rays exhibited strong refuging behaviour in mangrove habitats.

Currently, I am working on a manuscript for publication that will provide new information on the movement and habitat use of *H. granulata*. I found my project to be very stimulating and I am considering a future research degree.

Actively tracking rays in an intertidal area at Orpheus Island

I would like to thank the AIMS@JCU staff for their funding and support, which greatly contributed to the success of my project. I would also like to thank my supervisors, Colin Simpfendorfer and Michelle Heupel, for their superb advice and assistance that ensured the project reached its potential.

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Michelle Heupel

Gergely Torda

2012 AIMS@JCU Honours Student Update

Shaun Bochow

I completed my Honours project in 2011/12 at the School of Veterinary and Biomedical Sciences as an AIMS@JCU student. I studied the prawn pathogen *Vibrio campbellii* strain 642 that is lysogenized by *Vibrio harveyi* Myovirus Like (VHML) that produces 100% mortality during outbreaks. As an AIMS@JCU student I was able to access laboratory techniques that aided in the study of this bacteriophage.

The study identified adenine methyltransferase gene (DAM) as a potential candidate gene for controlling the switch between the lytic and lysogenic lifestyle. This study also highlighted the potential role that nutrients may have on the function of this gene. Using funding from the AIMS@JCU scholarship we were able to establish a transformation protocol that will in the future facilitate future studies including gene knock outs of the DAM gene.

This project produced a paper that was published in the Journal of Applied Microbiology (Bacteriophage adenine methyltransferase: a life cycle regulator? Modelled using *Vibrio harveyi* Myovirus Like, DOI: 10.1111/j.1365-2672.2012.05358.x). I am currently studying a PhD investigating host pathogen interactions at a genetic level between crustaceans and their virus. My experiences during Honours as an AIMS@JCU student left me well placed to pursue a PhD and a career in research.

I would like to thank the staff at AIMS@JCU and the funding they provided, they made the experience much more enjoyable. I would also like to thank my supervisors Leigh Owens, Lone Hoj and Jenny Elliman for all of their support and patience during Honours.

Scanning Electron Microscope images of *Vibrio owensii*

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2012 AIMS@JCU Honours Student Update

Dennis Heinrich

I recently completed my Honours project as an AIMS@JCU student, investigating the effects of ocean acidification on the foraging behaviour and respiratory physiology of the epaulette shark *Hemiscyllium ocellatum*. For the behavioural aspect of the study I used a video analysis approach filming the foraging behaviour of animals within their holding groups. To test the effects of elevated CO_2 on the respiratory physiology I used an intermittent flow respirometry system, measuring the resting oxygen consumption rate and hypoxia tolerance of individuals. The funding provided by AIMS@JCU was used to finance the purpose build respirometry chambers used in for this part of the study.

With non-significant effects found on either the behaviour or the physiology, the overall results of this study indicate that *H. ocellatum* will remain unaffected by near-future CO_2 levels. It is likely that the adaptation of *H. ocellatum* to a life on the coral reef flats pre-conditioned it to rising CO_2 concentrations, suggesting that adaption to these conditions is possible. However, it remains to be seen whether adaption in other species can occur fast enough in order to keep pace with the rapidly changing environmental conditions.

I am currently working on two manuscripts for publication that will provide a first insight on the effects of ocean acidification on elasmobranchs. I am also considering a future research degree, possibly expanding on the work I have done during this project.

I would like to thank AIMS@JCU staff for their funding. The success of my project was greatly due to the contribution of your support. Furthermore, I would like to thank my supervisors, Philip Munday, Colin Simpfendorfer, Jodie Rummer and Michelle Heupel for their support and patience, as well as for the opportunity to take on such a rewarding study.

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Thomas Roberts

2013 Pilot Research Award Winner

Georgia McGee

Originally from Tasmania, I moved to Townsville in 2009 to undertake a Bachelor of Science majoring in Marine Biology at JCU. During my undergraduate degree, I gained experience in a wide range of tropical reef research disciplines including the ecophysiology of marine animals. With a keen interest in reef fish respiratory physiology, I am currently completing an AIMS@JCU Honours degree supervised by Tim Clark and Mark McCormick. My project is concerned with the influence of a warming climate on the aerobic metabolism and predator defence strategies of pufferfishes.

Pufferfishes have an iconic and extreme predator defence strategy which involves inflating themselves to several times their normal size. They achieve this by rapidly gulping large volumes of water into their stomach with the intent of becoming too large to swallow. Whilst the inflation anatomy of pufferfishes has been well documented, the respiratory physiology and metabolic costs of this predator defence strategy are currently unknown.

By taking measurements of oxygen consumption during the inflation behaviour of Black-Saddled Tobies (*Canthigaster valentini*) acclimated at both current and climate change predicted temperatures, my project aims to identify whether pufferfish inflation is predominantly an aerobic or anaerobic process, to quantify the metabolic costs of inflation, and to predict how a warming environment may influence the execution and efficiency of this unique predator defence strategy. This research will allow us to make predictions regarding the abilities of pufferfishes to defend themselves against predation and survive the rising temperatures of their environment.

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2013 Pilot Research Award Winner

Thomas (Ed) Roberts

I grew up in Sydney, and a love of fishing and diving led to a move to Townsville and JCU in 2007 to study. My undergraduate degree was completed in 2012 after spending some time involved in other endeavours, including several years as an aquarist at the ReefHQ aquarium, a stint at the Monterey Bay Aquarium, the Tuna Research & Conservation Centre, and a year as a SCUBA instructor on the GBR, allowing me plenty of time to get to know the reef. Throughout this time I was increasingly involved in research on the exposed, remote, and deep coral reef regions, which led me back to university in 2012 to finish, and ultimately move on to an Honours year.

With the supervision of Dr Tom Bridge and Dr James Moloney, as well as the assistance of Dr Hugh Sweatman, I will be examining the spatial and depth related variability of coral communities on the GBR. This will include examining variation of potential exposure to disturbance effects on these communities.

We commonly study the emergent coral structures that reach the surface, though recent research has suggested vast areas of submerged coral banks exist within the GBR, and coral communities on a reef reach deeper than what we normally observe. The submerged reef areas alone have the potential to significantly expand the known coral habitat area of the GBR, and are still essentially unknown. The variability of coral community structures and composition are expected to be high over depth and with reef morphology, but these aspects are yet to be properly investigated.

Examining these banks, as well as neighbouring emergent reefs, over a 30m-depth gradient will show insights into the variability of coral community composition and structure amongst the habitats that are present within the GBR. These differences can reveal the environmental correlates that drive variability, and enable us to assess the possible role they play in the vulnerability of the community to disturbances such as COTS, cyclones, bleaching, and disease. My project will examine a range of submerged reef habitats, and will compare the results to those of the AIMS LTMP from neighbouring emergent reefs, allowing assessment of the representativeness of the LTMP to regional-scale ecological dynamics.

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AIMS Flickr

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Science Communication at AIMS@JCU

- Welcome home to AIMS@JCU participants at the recent AMSA 50th Jubilee conference, and congratulations to Stefano Montanari who was awarded the Queensland Museum Award for the best poster in marine taxonomy, for his poster about reef fish hybridisation. There will be more reports from this conference in the next newsletter.
- As you know, our annual seminar day has been postponed until later in the year. Could all students please respond to the email request, and participate in the doodle poll to select the best date.
- AIMS@JCU PhD student Joe Pollock has developed ATSIMS (Aboriginal and Torres Strait Islanders in Marine Science). It is a fantastic program to enthuse young indigenous people to consider a career in marine science. We will sponsor four AIMS@JCU students to be science ambassadors for this program. More details on our website and in your email in-box soon!

Research Director Report

I'm sure you have now heard about our new focus in the development of quantitative marine science skills. This is a strategic response to the increasing demand from government agencies, research institutions and industry for marine scientists with high level mathematical and computational skills and training. There is a currently unmet need for such skills to be applied to data, so that we can better understand marine systems and predict their response to change, so that the best science and information can be compiled and become more accessible to assist better decision making by managers. This is the nub of the upcoming recruitment campaign for scholarship students commencing in 2014, to be launched next week. To accommodate an anticipated need for students to undertake targeted professional development for specific upskilling (e.g. coursework), we have decided to restructure the AIMS@JCU scholarships to 4 years.

Besides encouraging more hard-core mathematical modelling and bioinformatics proposals for scholarship projects, we are also keen to increase our members' understanding and use of the many powerful advanced statistical modelling tools that are already available. The course recently delivered by Dr Murray Logan is our first initiative in this regard – hopefully the first of many!

Libby Evans-Illidge, Research Director
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