

SUPERVISION OF RESEARCH STUDENTS

Rowan Hughes (Coral Sea dynamics), PhD [1995].

Paul Armsworth (Mathematical ecology of reef fishes), PhD [2000].

Wayne Mallett (Tropical cyclone boundary layer dynamics), PhD [2001].

James Bird (Modelling sub-reef thermodynamics to predict coral bleaching: a case study at Scott Reef, WA), MEng [2005]

Craig Steinberg (Coral bleaching dynamics in the GBR), PhD [part-time, expected completion, 2006].

Severine Choukroun (Patchiness of coral bleaching at Heron Island and the Capricorn Bunker Group), PhD [commenced 2005]

RESEARCH INTERESTS

My research at JCU has largely focused on physical oceanography and hydrodynamic modelling on the continental shelf, mostly within the Great Barrier Reef region. I have also carried out research and/or consultancies in coastal engineering and storm surge studies, large-scale physical oceanography, tropical cyclone dynamics, environmental impact studies, ecological modelling, and general applied mathematics and modelling. Most of my research and related activities has a pronounced marine focus.

Much of this has been done in association with Luciano Mason (now at the Australian Maritime College, Tasmania). We first applied existing models to study the physical oceanography of the GBR Region, but subsequently developed our own numerical models and techniques, in particular a method for parameterising subgrid-scale dynamical effects of the flow of water around reefs. This enabled us to develop large-scale numerical models that accurately incorporate the effects of coral reefs on a regional (whole of GBR) scale. In the late 1980s and early 1990s, an early version of this model was used to study the Crown-of-Thorns starfish phenomenon, thus opening up new opportunities in the application of physically-based models to biological and ecological problems. This led to research funded by the newly created Reef CRC in 1994, which focused on combined physical-ecological modelling. With the aid of this CRC funding, we have investigated the role of inter-reefal *connectivity* on the population dynamics of reef fishes in the GBR.

More recently, I have become involved in using numerical models to investigate the problem of coral bleaching. I have also maintained an interest in areas associated with tropical cyclone dynamics (which formed part of my PhD studies): a study for the whole of Queensland on the near-coastal effects of tropical cyclones and climate change; the development of a tropical cyclone windfield model, as part of a large-scale study of tropical cyclone-induced waves for Woodside Offshore Petroleum; and models for the marine boundary layer dynamics of tropical cyclones.

SCHOLARLY ACTIVITIES:

- Invited speaker at Australian Supercomputing Conference, 1991; Royal Society Tidal Science Conference, London, 1996; session co-chairman and speaker for Tidal Modeling in the Marginal Seas, Western Pacific Western Geophysics Meeting, Taiwan, 1998; QANZIAM Conference, 2004.

- Referee for the following journals: Journal of Physical Oceanography, Journal of Geophysical Research, Continental Shelf Research, Applied Mathematical Modelling, Journal of the Australian Mathematical Society B and E, Marine and Freshwater Research (Australia), New Zealand Journal of Marine and Freshwater Research, Coral Reefs, Estuarine Coastal and Shelf Science, Coastal Research.
- Examiner for approximately a dozen PhD or Masters theses. Reviewer for external organizations (research and consulting): ARC, Florida Sea Grant Program, GBRMPA, CSIRO INRE, Woodside Offshore Petroleum, AIMS, EPA (NSW), Australian Bureau of Resource Sciences.

CONSULTANCIES:

In association with the Marine Modelling Unit in the JCU School of Engineering, I have acted as a consultant to a number of government and private organisations over the past 20 years or so, including: Environment Australia, Defence Science and Technology Organisation, Commonwealth Commission of Enquiry for the East Coast Armaments Complex, WBM Oceanics Australia, Victorian Institute of Marine Sciences, Australian Water and Coastal Studies Pty Ltd, Sinclair Knight Merz, Great Barrier Reef Marine Park Authority, and Woodside Offshore Petroleum.

RESEARCH GRANTS & CONTRACTS

- 2003–06 CRC Reef Research Centre. Nutrient transport modelling in the GBR. With A/Prof Tom Hardy, Marine Modelling Unit, JCU [\$200,000]
- 2001–03 CRC Reef Research Centre. Task Leader B3.4, Extension of fine-scale circulation modelling to the entire GBR Region. [\$50,000]
- 2000–01 CRC Reef Research Centre. Task Leader C3.2, Regional circulation modelling. With Dr D.M. Burrage, AIMS. [\$62,834]
- 1994–00 CRC for Reef Research. Project Leader 1.2.1, Regional hydrodynamics and dispersal. With Dr D. Burrage, AIMS. [\$321,158]

TEACHING

My lecturing responsibilities have ranged widely across the subjects offered in the discipline of Mathematics at JCU: MA1020 (Preparatory Mathematics), MA1003 (Mathematical Techniques), MA2000 (Mathematics for Scientists and Engineers), MA2100 (Mathematical Methods and Differential Equations), MA3109 (Applied Complex Variable Theory), MA3201 (Numerical Methods), MA3605 (Operations Research and Modelling), as well as Honours subjects in three areas (Advanced Mathematical Methods, Mathematical Ecology, and Continuum Mechanics).

Publications (past 10 years) — Lance BODE

- Bode, M., BODE, L. and Armsworth, P.R. (2006) “Larval dispersal reveals regional sources and sinks in the Great Barrier Reef”. *Marine Ecology Progress Series*, **308**, 17–25.
- BODE, L. and Mason, L.B. (2005) “Extensions of a nonlinear reef parameterisation scheme for steady flows.” *ANZIAM Journal*, **46**(E), C1017–C1034.
- Read, W.W., Sneddon, G.E., BODE, L. (2004) “A series method for the eigenvalues of the advection diffusion equation”. *ANZIAM Journal*, **45**(E), C773–C786.
- Hardy, T.A., Mason, L.B., McConochie, J.D., BODE, L. (2004) “Modeling suspended sediment during construction of a marina in the Great Barrier Reef World Heritage Area”. *Journal of Environmental Engineering, ASCE*, **130**, 1021–1031.
- Burrage, D.M., Steinberg, C.R., Mason, L.B., BODE, L. (2003) “Tidal corrections for TOPEX altimetry in the Coral Sea and Great Barrier Reef Lagoon: Comparisons with long-term tide gauge records”. *Journal of Geophysical Research*, **108** (C7), 3241, doi:10.1029/2000JC000441.
- De Silva Samarasinghe, J.R., BODE, L., Mason, L.B. (2003) “Modelled response of Gulf St Vincent (South Australia) to evaporation, heating and winds”. *Continental Shelf Research*, **23**, 1285–1313.
- James, M.K., Armsworth, P.R., Mason, L.B., BODE, L. (2002) “The structure of reef fish metapopulations: modelling larval dispersal and retention patterns”. *Proceedings B, Royal Society of London*, **269**, 2079–2086.
- Armsworth, P.R., James, M.K., BODE, L. (2001) “When to press on, wait or turn back: dispersal strategies for reef fish larvae”. *American Naturalist*, **157**, 434–450.
- BODE, L., Mason, L.B., Hardy, T.A. (2001) “Numerical modelling of tropical cyclone storm surge”. In *Queensland Climate Change and Community Vulnerability to Tropical Cyclones, Stage 1*, B.A. Harper, Ed., pp. 67–98.
- Armsworth, P.R., BODE, L. (1999) “The consequences of non-passive advection and directed motion for population dynamics”. *Proceedings, Royal Society of London, A*, **455**, 4045–4060.
- Burrage, D.M., BODE, L., Steinberg, C.R. and Mason, L.B. (1998) “North Australian Tropical Seas Circulation Study (Phase IV)”. In TOPEX/POSEIDON, 5 Years of Progress. AVISO Altimetry Newsletter No. 6, CNES, Toulouse, France, pp. 18–20.
- BODE, L., Mason, L.B. and Middleton, J.H. (1997) “Reef parameterisation schemes for long wave models”. *Progress in Oceanography*, **40**, 285–324.
- BODE, L. and Hardy, T.A. (1997) “Progress and recent developments in storm surge modelling”. *Journal of Hydraulic Engineering, ASCE*, **123**, 315–331.
- James, M.K., Mason, L.B. and BODE, L. (1997) “Larval transport modelling in the Great Barrier Reef”. *Proceedings, The Great Barrier Reef Conference: Science, Use and Management*, Townsville, Nov 25–29, 1996, J. Crossland et al., Eds., pp. 361–376.
- Done, T., BODE, L. Coles, R., Crossland, C., Engelhardt, U., Furnas, M. and Woolfe, K. (1997) “Issue-driven research for managing the Great Barrier Reef”. *Proceedings, The Great Barrier Reef Conference: Science, Use and Management*, Townsville, Nov 25–29, 1996, J. Crossland et al., Eds., pp. 141–150.

Burrage, D., Steinberg, C., BODE, L. and Black, K. (1997) “Long-term current observations in the Great Barrier Reef”. In *State of the GBR World Heritage Area Workshop, Proceedings of a Technical Workshop*, Townsville, Australia, D. Wachenfeld et al. (Eds.), pp. 21–45 (Great Barrier Reef Marine Park Authority, 561 pp.).

Technical Reports, Conference Abstracts

- BODE, L., Bode, M. and Armsworth, P.R. (2004) “Reef connectivity: computations and applications”. ANZIAM 2004 Conference, Hobart, 1–5 February 2004.
- James, M.K., Armsworth, P.R., Mason, L.B. and BODE, L. (2003) “Local and regional scale population dynamic consequences of reef fish larval dispersal”. 27th Annual Larval Fish Conference, August 2003, Santa Cruz, USA.
- BODE, L., James, M.K., Mason, L.B., Bode, M. and Armsworth, P.R. (2003) “Applications of reef connectivity matrices”. ICIAM: 5th International Congress on Industrial and Applied Mathematics, July 2003, Sydney.
- Burrage, D. M., BODE, L., Steinberg, C.R. and Mason, L.B. (2002) Geostrophic currents in the Western Coral Sea from TOPEX and JASON Altimetry. JASON-1 SWT Meeting, October 2002, New Orleans, USA.
- BODE, L. (2002) Technical Review of the Kepert and Wang (2001) Numerical Tropical Cyclone Windfield Models. James Cook University, Report to Systems Engineering Australia, and Woodside Energy Ltd., 40 pp.
- James, M.K., Mason, L.B. and BODE, L. (2002) Identification of significant source reefs in the Cairns Section of the Great Barrier Reef Marine Park. Report to Representative Areas Program, GBRMPA, 9 pp.
- BODE, L., Mason, L.B. and Hardy, T.A. (2001) “Technical description of the James Cook University storm surge model”. In *Queensland Climate Change and Community Vulnerability to Tropical Cyclones, Stage 1*, B.A. Harper, Ed., pp. D1–D12.
- Burrage, D.M., BODE, L., Brown, W.S., Mason, L.B., Naimie, C.E. and Steinberg, C.R. (1998) “Deriving coastal sea level and current fluctuations from altimetry in macro-tidal areas”. Fall Meeting, American Geophysical Union, December 1998, San Francisco, USA, [Poster Paper OS72B-01].
- BODE, L. Harijanto, A. and Mason, L.B. (1998) “Tidal Modelling in the Indonesian Seas: A Parameterised Approach”. Western Pacific Geophysics Meeting, American Geophysical Union, July 1998, Taipei, Taiwan. [Abstract No. G32B-06]
- Burrage, D.M., BODE, L., Steinberg, C.R., Mason, L.B. and Brown, W.S. (1997) “Using radar altimetry for oceanographic studies in coastal settings”. TOPEX/POSEIDON Science Working Team Meeting, October 1997, Biarritz, France. Proceedings, International Symposium: Monitoring the Oceans in the 2000s: An Integrated Approach. [Poster TP28].