RECENT IMPACT

Photo: Joanne Wortmann

CARM affiliate Joanne Wortmann was the keynote speaker at the ASFB 2018 Conference (Australian Society for Fish Biology Conference) in Melbourne 7-11 October, 2018. Joanne presented, "Informing inter-jurisdictional snapper management in eastern Australia".

Photo: Snapper (Photo courtesy of Joanne Wortmann)

Abstract: **Joanne J Wortmann** [1] , Michael M O'Neill [1] , Jess J Morgan [1]
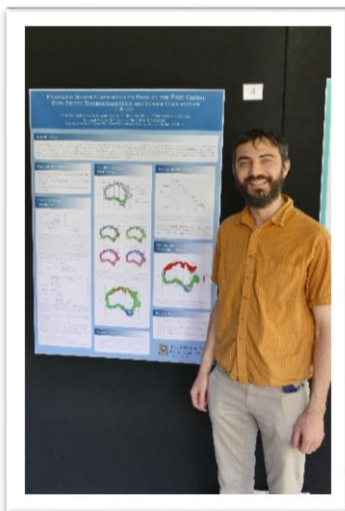   1.   Agri-Science, Queensland, Nambour, QUEENSLAND, Australia

Current management arrangements for snapper fishing on Australia's east coast are different between States (New South Wales, Queensland, Victoria) and the Australian Government. They have been informed by different kinds of data and analyses, at least in New South Wales and Queensland which together take the vast majority of the harvest. These differences have led to different conclusions of stock status. Recent research involved the collaboration of stock assessment scientists, biologists, fisheries managers and industry stakeholders from New South Wales, Queensland and Victoria to provide the first joint assessment of the east coast snapper stock informing inter-jurisdictional snapper management in eastern Australia. The latest genetic microsatellite techniques were used to explore the stock structure of snapper along the east coast showing there is a two-stock genetic model for snapper along Australia's east coast, a northern and southern stock. These results were used to inform a snapper simulation model to inform cross-jurisdictional east coast snapper management on the northern stock. Challenges in the work included harmonising data from different jurisdictions and fitting the model to multiple data sets with different trends. Alternative management strategies on changes to minimum legal size or fixing total allowable harvest were explored.

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Phil receiving his award from Professor Melissa Brown, Executive Dean, Faculty of Science

The UQ School of Mathematics and Physics held their annual Poster Day on Friday 14th September, 2018 and **Phil Dyer (PhD candidate)** was awarded the Student Poster Award for Mathematics for his poster titled, "Data-Driven Models of Biodiversity in the Australian Pelagic Ocean".

Phil also placed second in the School of Mathematics and Physics 3MT (3 Minute Thesis) competition and went on to represent the school at the UQ Faculty of Science 3MT competition. His 3MT presentation was titled, "Distributions of Marine Biodiversity for Conservation and Planning".

Jerzy Filar with project partners the Queensland Department of Agriculture and Fisheries (DAF) were awarded competitive funding from the The University of Queensland, Science with Impact Fund for their project entitled, "Incorporating abiotic environmental factors into both detailed and rapid stock assessment models of fisheries to support management decisions".

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The winner of the **Queensland Seafood Industry Award** (QSIA) in the Research, Extension and Development category was the FRDC-funded project, "Physical oceanographic influences on Queensland reef fish and scallops". The project was led by Dr Tony Courtney and sought to link climatic and oceanographic influences to the catch of coral trout and saucer scallops. The award was announced at the QSIA Awards Gala Dinner on Friday 28th September. Since both Tony and Matthew Campbell (who also worked on this and another nominated project) were conducting research on the Departments Research Vessel at the time, a photo of Minister Furner holding the Award was sent to them on the night to let them know of their success. The Final Report that was published in Decemb**er 2015 by Courtney, Spillman, Lemos, Thomas, Leigh and Campbell** is well worth a look on the FRDC website.
http://www.frdc.com.au/project/2013-020

Maria Kleshnina travelled to St Petersburg, Russia and presented a talk titled, "Evolutionary games under incompetence" at the 12th International Conference, Game Theory and Management (GTM2018) Saint Petersburg, Russia on 27 June, 2018 and then in Grenoble, France on the 12th July Maria presented her talk at the 18th International Symposium on Dynamic Games and Applications.
Maria has been **offered a prestigious IST plus postdoctoral research fellowship** at the Institute of Science and Technology in Vienna, Austria. This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie grant agreement No 754411.
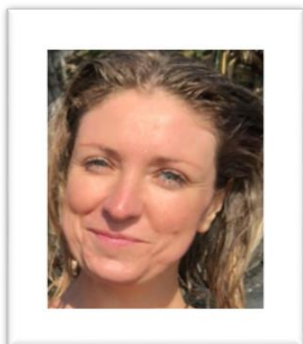
WELCOME

Welcome **Marijn Jansen** who joined CARM in July as a Research Fellow. Marijn studied mathematics at VU University in Amsterdam. After that, he was a PhD student in applied probability, jointly at Ghent University and the University of Amsterdam. Marijn joined CARM as a postdoctoral researcher and works on an ARC Discovery project entitled, "Time consistency risk mitigation and partially observable systems."

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Welcome Katie Lee who holds a Bachelor of Science from Monash University in Melbourne, Australia. She completed Honours in Physics, in the field of Electron Optics creating caustics using lens aberrations guided by analytical models. Following this she worked as a Research Assistant at Monash University in conjunction with the Hudson Institute of Medical Research in X-ray Optics working in an interdisciplinary group focused on neonatal lung development. Her experience in analytical modelling and spatial analysis are currently being applied to her PhD research. In the Marine Spatial Ecology Lab under the supervision of Professor Peter Mumby and Professor Anthony Richardson her PhD will be exploring potential early warning signals of habitat collapse using spatial data from the Great Barrier Reef.

UPCOMING WORKSHOPS

Professor Anthony Richardson lecturing to a full-house at the R Workshop 2018

The Introduction to R workshop was held on 5th February 2018 with Professor Anthony Richardson, Associate Professor Chris Brown and Associate Professor Dave Schoeman. Day 1 was ideal for those with little or even no experience with R but want to produce robust analyses and effective graphics. The trio then held the **Intermediate to R Workshop** from the **6th – 7th February 2018.** Days 2 and 3 were for intermediate users or beginners wanting to go beyond the basics. The focus throughout was on ecological applications and particularly marine habitats.

The attendees commented on the presenters being very good, enthusiastic, focused, able to keep the participants interested and providing clear explanations and excellent notes.

Dr Bill Venables conducted the Advanced R Workshop from 5th – 7th February 2018. Ninety (90) people registered for The Introduction to R Workshop, Seventy-four (74) for the Intermediate and 24 for the Advanced Workshop.
The 2019 workshops will run from the 5-8 February, 2019 and include a new workshop on ggplot/spatial analysis. Registration is open at
https://smp.uq.edu.au/research/centres/carm/events

The 20'th INFORMS Applied Probability Society Conference will be held at the Brisbane Convention Centre, Brisbane Australia, July 3-5, 2019. **Commencing with the satellite workshop on July 2**, organized by CARM dealing with concrete applications (Applied^2 Probability) taking place at Global Change Institute, The University of Queensland, Brisbane.

Workshop Theme: "Uncertainty Quantification Applications".
We are currently looking for session organisers for the practical Applied probability topics: The presentations must be based on real data. Please contact CARM carm@maths.uq.edu.au or Jerzy Filar j.filar@uq.edu.au with your expression of interest in organising a session. Work presented at the workshop can be considered for publication in the journal **Stochastic Systems** upon author request.

Raison D'être: One of the unsolved mysteries of mathematical sciences is that branches which have their roots in applications and natural phenomena, over time, become progressively more theoretical. For instance, typically, there are very few numbers in papers nowadays published in Number Theory journals. It is not surprising that Applied Probability is also susceptible to this theorization trend which, arguably, merely points to the maturity and success of the subject.
Hence, we are hoping that the workshop will have special sessions on a variety of practical Applied Probability topics such as:

- Stochastic Operations Research
- Networks and Queues
- Health and Epidemics Models
- Ecology and Mathematical Biology
- Sustainable Fisheries
- Energy modelling and forecasting

Organizing Committee
- Applied2 Probability: Ivo Adan, Konstanin Avrachenkov, John Boland, Mark Fackrell, Jerzy Filar, David Goldberg, Matthew Holden, Roxanne Jemison, Ross McVinish, Joshua Ross

For further details visit https://smp.uq.edu.au/event/session/4577

PROJECTS

- FRDC Project titled, "Stock predictions and spatial population indicators for Australia's east coast.
- saucer scallop fishery" joint with M.F. O'Neill, A.J. Courtney, G. Leigh., M.M. Campbell (DAF) W-H, Yang., J.Filar (CARM).
- This project will undertake high spatial resolution analyses of fishing and environmental influences on the scallop population. Improvements to the scallop assessment model will be carried out to produce better predictions for management of the stock.
- AFMA funded project led by CSIRO titled, "Harvest strategies for the Torres Strait Finfish fishery". Joint with T, Hutton (CSIRO) M.F. O'Neill., G. Leigh (DAF) A, Tobin (Tobin Fish Tales) K, Basford., J.Filar., M. Holden (CARM).
- The project will contribute to defensible and robust management decisions including the potential mechanisms for fishery expansion. It will assist in a development of a sustainable harvest strategy that is ratified by management agencies and Islanders.

PUBLICATIONS 2018

1. Baker, C., **Holden, M**., Plein, M., McCarthy, M., Possingham, H. (2018). Informing network management using fuzzy cognitive maps. Biological Conservation. 224: 122-128.
2. Ben-Tovim, D., Bogomolov, T., Filar, J., Hakendorf, P., Qin, S., Thompson, C. (2018). Hospital's instability wedges. Health Systems [EPub]
3. Beutel, T., Corbet, D., Hoffmann, M., Buck, S., **Kienzle, M**. (2018). Quantifying leucaena cultivation extent on grazing land. The Rangeland Journal. 40: 31-38.
4. Biggs, D., Smith, R.J., Adams, V.M., Brink, H., Cook, C.N., Cooney, R., **Holden, M.H**., Maron, M., Phelps, Possingham, H.P., Redford, K.H., Scholes, R.J., Sutherland, W.J., Underwood, F.M., Milner-Gulland, E.J. (2018). Ivory crisis: Role of bioprinting technology. Response. Science. 6386: 277-278.
5. Bohner, M., Dannan, F., **Streipert, A**. (2018) A nonautonomous Beverton–Holt equation of higher order. Journal of Mathematical Analysis and Applications. 457(1): 114-133
6. Boss, E., Waite, A., Muller-Karger, F., Yamazaki, H., Wanninkhof, R., Sosik, H., Sloyan, B., **Richardson, A.,** Miloslavich, P., Karstensen, J., Gregori, G., Fennel, K., Claustre, H., Cornejo, M., Berman-Frank, I., Batten, S., Acinas, S. (2018). Beyond chlorophyll fluorescence: The time is right to expand biological measurements in ocean observing programs. Limnology and Oceanography Bulletin
7. Brackowski, A., **Holden, M**., O'Bryan, C., Choi, C-Y., Gan, X., Beesley, N., Gao, Y., Allan, J., Tyrell, P., Stiles, D., Brehony, P., Meney, R., Brink, H., Takashina, N., Lin, M-C., Lin, H-Y., Rust, N., Salmo, S.G., Watson, J.E.M., Kahumbu, P., Maron, M., Possingham, H.P. (2018). Reach and messages of the world's largest ivory burn. Conservation Biology. 32(4): 765-773
8. **Brito-Morales, I**., Molinos, J.G., Schoeman, D.S., Burrows, M.T., Poloczanska, E.S., Brown, C.J., Ferrier, S., Harwood, T.D., Klein, C.J., McDonald-Madden, E., Moore, P.J., Pandolfi, J.M.,

Watson, J.E., Wenger, A.S., **Richardson, A.J**. Climate velocity can inform conservation in a warming world. TREE 33 (6): 441-457.

9. Broadhurst, M., **Kienzle, M**., Stewart, J. (2018). Natural and fishing mortalities affecting eastern sea garfish, *Hyporhamphus australis* inferred from age-frequency data using hazard functions. Fisheries Research. 198: 43-49

10. Brown, M.V., van de Kamp., Ostrowski, M., Seymour, J.R., Ingleton, T., Messer, L.F., Jeffries, T., Siboni, N., Laverock, B., Bibiloni-Isaksson, J., Nelson, T.M., Coman, F., Davies, C.H., Frampton, D., Rayner, M., Goossen, K., Rober, S., Homes, B., Abell, G.C.J., Craw, P., Kahlke, T., Li San Sow, S., McAllister, K., Windsor, J., Skuza, M., Crossing, R., Patten, N., Malthouse, P., van Ruth, P.D., Paulsen, I., Fuhrman, J.A., Richardson, A., Koval, J., Bissett, A., Fitzgerald, A., Moltmann, T., Bodrossy, L. (2018). Systematic, continental scale temporal monitoring of marine pelagic microbiota by the Australian Marine Microbial Biodiversity Initiative. Nature Scientific Data. 5:180130.

11. Burgess, K.B., Guerrero, M., Marshall, A.D., **Richardson, A.J**., Bennett, M.B., Couturier, L.I.E. (2018) Novel signature fatty acid profile of the giant manta ray suggests reliance on an uncharacterised mesopelagic food source low in polyunsaturated fatty acids. PLoS One 13(1): e0186464

12. Burgess, K.B., Guerrero, M., **Richardson, A.J**., Bennett, M.B., Marshall, A. (2018). Use of epidermal mucus in elasmobranch stable isotope studies: a pilot study using the giant manta ray (*Manta birostris*). Marine and Freshwater Research 69: 336-342

13. Couturier, L.I.E., Newman, P., Jaine, F.R.A., Bennett, M.B., Venables, W.N., Cagua, E., Townsend, K.A., Weeks, S.J., **Richardson, A.J.** (2018). Variation in occupancy and habitat use of *Manta alfredi* at a major aggregation site. Marine Ecology Progress Series. 599: 125-145.

14. Davies, C., Ajani, P., Armbrecht, L., Atkins, N., Baird, M., Beard, J., Bonham, P., Burford, M., Clementson, L., Coad, P., Crawford, C., Dela-Cruz, J., Doblin, M., Edgar, S., Eriksen, R., Everett, J., Furnas, M., Harrison, D., Hassler, C., Henschke, N., Hoenner, X., Ingelton, T., Jameson, I., Keesing, J., Leterme, S., McLaughlin, M., Miller, M., Moffatt, D., Moss, A., Nayar, S., Patten, N., Patten, R., Pausina, S., Proctor, R., Raes, E., Robb, M., Rothlisberg, P., Saeck, E., Scanes, P., Suthers, I., Swadling, K., Talbot, S., Thompson, P., Thomson, P., Uribe-Palomino, J., van Ruth, P., Waite, A., Wright, S., **Richardson, A**. (2018). Data Descriptor: A database of chlorophyll *a* in Australian waters. Scientific Data. 5:180018

15. Dornelas et al., including **Richardson, A.J.** (2018). BioTIME: a database of biodiversity time series for the Anthropocene. Global Ecology and Biogeography. 27: 760-786

16. Duarte de Paula Costa, M., Mills, M., **Richardson, A.J**., Fuller, R.A., Muelbert, H., Possingham, H.P. (2018). Efficiently enforcing artisanal fisheries to protect estuarine biodiversity. Ecological Applications. 28(6):1450-1458

17. Dudgeon, C.L., Bansemar, C., Armstrong, A., Armstrong, A., Bennett, M.B., Bowden, D., **Richardson, A.J**., Townsend, K.A., Hawkins, E. (In press, 2/2/2018) The role of citizen science photographic identification in understanding marine megafauna populations in Moreton Bay. Moreton Bay Book.

18. Ejov, V., **Filar, J**., Haythorpe, M., Roddick, J., Rossomakhine, S. (2018). A note on using the resistance-distance matrix to solve Hamiltonian cycle problem. Ann Oper Res. 261:393-399

19. **Filar, J.,** Haythorpe, M., Taylor, R. (2018). Linearly-growing reductions of Karp's 21 NP-complete problems. Numerical Algebra, Control and Optimization. 8(1): 1:16

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20. **Holden, M**., McDonald-Madden. (2018). Conservation from the grave: Human burials to fund the conservation of threatened species. Conservation Letters, 11(1): 1-4

21. **Kleshnina, M., Filar, J**., Ejov, V., McKerral, J. Evolutionary games under incompetence. Journal of Mathematical Biology. 77(3): 627-646.

22. **Leigh, G.M**., Hearn, W.S. (2018). Nonparametric tests of double-tagging assumptions. Fisheries Research. 197: 45-49.

23. McGowan, J., Bode, M., **Holden, M.H.,** Davis, K., Krueck, N.C., Beger, M., Yates, K.L., Possingham, H.P. (2018). Ocean zoning within a sparing versus sharing framework. Theoretical Ecology. 11(2): 245-254.

24. Pagendam, D., Snoad, N., **Yang, W-H**., Segoli, M., Ritchie, S., Trewin, B., Beebe, N. Improving estimates of Fried's Index from mating competitiveness experiments. Journal of Agriculture, Biological, and Environmental Statistics. doi: 10.1007/s13253-018-0333-x

25. **Richardson, A.J.,** Uribe-Palomino, J., Slotwinski, A., Coman, F., Miskiewicz, A.G., Rothlisberg, P.C., Young, J.W., Suthers, I.M. (in press 2018) Chapter 8. Coastal and marine zooplankton: identification, biology and ecology. In Plankton: A Guide to Their Ecology and Monitoring for Water Quality. Edited by Suthers I, Rissik D, Richardson AJ. 2nd edition. CSIRO Publishing

26. Rissik, D., Ajani, P., Bowling, L., Gibbs, M., Kobayashi, T., Pitt, K., **Richardson, A.J**., Suthers, I. (In press 2018) Chapter 3. Use of plankton for management. In Plankton: A Guide to Their Ecology and Monitoring for Water Quality. Edited by Suthers I, Rissik D, Richardson AJ. 2nd edition. CSIRO Publishing.

27. Rohner, C.A., **Richardson, A.J**., Jaine, F.R.A., Bennett, M.B., Weeks, S.J., Cliff, G., Robinson, D., Pierce, S.J. (2018). Satellite tagging highlights the importance of productive Mozambican coastal waters to the ecology and conservation of whale sharks. PeerJ. 1-24

28. Suthers, I., **Richardson, A.J**., Rissik, D. (In press 2018) Chapter 1. The importance of plankton. In Plankton: A Guide to Their Ecology and Monitoring for Water Quality. Edited by Suthers, I., Rissik, D., **Richardson, A.J**. 2nd edition. CSIRO Publishing

29. Suthers, I., Rissik, D., **Richardson, A.J.** (In press 2018). Editors of Plankton: A Guide to Their Ecology and Monitoring for Water Quality. Edited by Suthers, I., Rissik, D., Richardson, A.J. 2nd edition. CSIRO Publishing

30. **Tulloch, A**., Auerbach, N., Avery-Gomm, S., Bayraktarov, E., Butt, N., Dickman, C., Ehmke, G., Fisher, D., Grantham, H., **Holden, M**., Lavery, T., Leseberg, N., Nicholls, M., O'Connor, J., Roberson, L., Smyth, A., Stone, Z., **Tulloch, V.,** Wardle, G., Watson, J. (2018). A decision tree for assessing the risks and benefits of publishing biodiversity data. Nature Ecology & Evolution. 2: 1209-1217.

31. **Tulloch, V**., Plaganyi, E., Matear, R., Brown, C., **Richardson, A.** (2018). Ecosystem modelling to quantify the impact of historical whaling on Southern hemisphere baleen whales. Fish and Fisheries. 19:117-137.

32. Uribe-Palomino, J., Lopez, R., Gibbons, M.J., Gusmao, F., **Richardson, A.J.** (2018). Siphonophores from surface waters of the Colombian Pacific Ocean. J Marine Biological Association of the United Kingdom. 1-14.

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