

ANNUAL REPORT

2020-2021



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Welcome and introduction

We are pleased to present the 2020-2021 annual report for the CSIRO-UTAS PhD Program in Quantitative Marine Science (QMS), now in its 1st year under the renewed 5-year commitment that began 1 December 2020, and in its 16th year of operation overall.

The purpose of the QMS program is to enhance the quality and number of Australian PhD graduates in quantitative marine science, and to develop scientists with skills appropriate for employment by CSIRO and other organisations in the quantitative marine science field.

In early 2020 the program was reviewed by a CSIRO/UTAS panel. The review outcomes were positive and encouraging, and also pointed to some pathways for improvement. These included a review of coursework that was undertaken in early 2021. The result of that review was that the existing units were working well, but that the program needed to include opportunities for students to gain specialised knowledge in some areas. The QMS program decided to facilitate this by supporting attendance at summer schools and other short courses. Students who attended these learning opportunities would share their knowledge with the cohort through a seminar or short workshop.

Key Challenges, strategies, and achievements

- UTAS funding for scholarships is becoming increasingly competitive. The university is placing stronger emphasis on the strategic alignment of PhD projects, and an increasing number of PhD scholarships are being allocated to large externally funded programs such as the Australian Antarctic Program Partnership (AAPP), the Blue Economy CRC and the ARC Centre of Excellence for Climate Extremes (CLEX). This is not necessarily bad news for the QMS program, because many of our students' work aligns with these programs. Going forward, the QMS program could focus on co-funding of PhD scholarships in conjunction with these other programs, ARC Discovery Projects or UTAS scholarship funding.
- The QMS program continues to attract a higher number of international students than domestic students. This may become a challenge for the program as UTAS implements quotas on the ratio of domestic to international students, and may require strategic use of external funding.
- We continue to rejuvenate the project offerings on the QMS website to reflect current supervision expertise and attract quality applicants. The QMS committee continues to carefully assess projects before they go forward, paying particular attention to diversity in the supervision team and strategic alignment for the organisations.
- We are continually working to keep the course offerings relevant, and as described above, we have reviewed the coursework earlier this year.

- Conference attendance has of course been challenging over the last 18 months. We look forward to supporting the national and international engagement of QMS students when travel becomes possible again.

It is a great pleasure to be part of the program, and we are very proud of our students.

Sincerely

A handwritten signature in black ink that reads "Peter Strutton". The signature is written in a cursive, flowing style.

Peter Strutton, Director, QMS Program

Current steering committee membership

- Peter Strutton (IMAS, Director/Chair)
- Zanna Chase (IMAS)
- Klaas Hartmann (IMAS)
- Richard Matear (CSIRO), stepping down, (Xuebin Zhang replacement)
- Peter Thompson (CSIRO), now retired. A new CSIRO member will be appointed.
- Simon Wotherspoon (IMAS, ex-officio)

Statistics on enrolments, scholarships, submissions, and graduations

Summary of student enrolments

The QMS Program was launched in 2004. Since then, a total of 87 students have graduated from the Program, approximately 6 graduations per year. The enrolments per year for the previous two 5-year contracts are shown below.

Financial Year	Number of Students	International	Domestic
2010-2011	3	2	1
2011-2012	9	6	3
2012-2013	6	4	2
2013-2014	3	3	0
2014-2015	10	6	4
2015-2016	15	11	4
2016-2017	9	9	0
2017-2018	6	3	3
2018-2019	4	3	1
2019- 2020	7	7	0
2020-2021	6	2	4
Applications Accepted (not commenced)	3	3	0

QMS full + top-up scholarships awarded 1 July 2020 - 30 June 2021

None awarded until the new 5-year agreement commenced

QMS top-up scholarships awarded 1 July 2020 - 30 June 2021

India Shae Attwood-Henderson
Ce Bian
Felipe Da Silva
Catherine Gregory
Aaron Hibberd
Maya Jakes

Graduates 2020-2021

Name	Supervisors	Research Project
Florence Briton	Caleb Gardner Rich Hill	Evaluation of harvest control rules for mixed fisheries under catch quota management
Ajitha Cyriac	Helen Phillips Nathan Bindoff Ming Feng	Eastward flows, ocean mixing and air-sea interaction in the southeast Indian ocean
Emilio Echevarria	Neil Holbrook Mark Hemer	Global to coastal implications of surface current modulation of the wind-wave field
Jiale Lou	Neil Holbrook Terence O’Kane	Predictability of the interdecadal pacific oscillation
Asher Riaz	Andreas Klocker Nathan Bindoff Terence O’Kane Max Nikurashin	Closing the energy cycle in global ocean models
Samantha Peel	Nicole Hill Simon Wotherspoon Scott Foster	Statistical issues for mapping biodiversity in the Southern Ocean
Ram Patel	Helen Phillips Andrew Lenton Pete Strutton Joan Llorc Jordi	The physical and bio-optical structure of Southern Ocean eddies in observations and models
Saurabh Rathore	Nathan Bindoff Helen Phillips Ming Feng	The impact of recent Indian ocean warming on the circulation, watermass distribution and air-sea interaction in the Indian ocean
Romain Forestier	Julia Blanchard Craig Johnson Kirsty Nash Asta Audzijonyte	Modelling biodiversity related ecosystem processes as a complex adaptive system

Submitted theses 2020-2021

Name	Supervisors	Research Project
Abhishek Savita	Catia Domingues Will Hobbs Simon Marsland	Global and regional sea level sensitivity to changing ocean water mass properties and circulation processes
Sandra Curin Osorio	Simon Wotherspoon Dale Kolody	Identifying fish stocks prone to interdecadal productivity shifts across different worldwide marine ecosystems
Florian Devloo-Delva	Chris Burridge Pierre Feutry	From rivers to ocean basins: quantifying sex-specific connectivity in sharks
Freddie Heather	Rick Stuart-Smith Graham Edgar Julia Blanchard Nick Bax	Development of a new class of size-structured ecological model for assessing human impacts on coastal food webs
Kieran Murphy	Julia Blanchard Shane Richards Jayson Semmens Gretta Pecl	Life in the fast lane: understanding individual to community level processes of squid in a changing climate

Summary of graduates

Since 2010 there has been a total of 69 students have graduated from the program.

Year	Number of students	Year	Number of students
2010	8	2017	6
2011	5	2018	3
2012	5	2019	8
2013	9	2020	3
2014	3	2021	9
2015	5	Total	69
2016	5		

Overview of current student projects

Student	Started	Citizenship	Scholarship	Topic
India Attwood-Henderson	1/12/2020	Dom	COSE	Simulation testing of alternative harvest strategies for the western Australia Roeii (<i>haliotis roeii</i>) abalone fishery
Ce Bian	30/11/2020	Int	COSE	How do standing meanders brake the Antarctic circumpolar current?
Stephen Bradshaw	12/7/2017	Dom	IMAS	Environmental drivers of southern rock lobster productivity
Felipe Da Silva	28/09/2020	Int	COSE	Dynamical oceanography of a standing meander in the Antarctic circumpolar current: a parallel investigation with observations and models
Rani Ekawaty	1/8/2019	Int	QMS	Harvest strategies for Tasmanian coastal fisheries shared between recreational and commercial sectors
Sofia Gabriel	28/10/2019	Int	QMS	Examining habitat use and behaviour of white sharks
Kirianne Goossen	18/01/2016	Int	QMS	Microbial oceanography of Australian coastal waters
Catherine Gregory	3/5/2021	Dom	CLEX	Understanding Marine Heatwaves and their Drivers for Improved Prediction on Sub seasonal to Seasonal Timescales
Charley Gros	4/3/2020	Int	QMS	Quantifying and predicting vulnerable marine ecosystems (VMEs) on the Antarctic continental shelf
Aaron Hibberd	23/4/2021	Dom	COSE	Advances in modelling benthic-pelagic solute fluxes in marine environments
Nicholas Hill	22/01/2018	Dom	Heather Brown	Harvest strategies for data poor Tasmanian coastal fisheries
Maya Jakes	12/4/2021	Int	QMS	Production and dissipation of thermohaline anomalies in the Antarctic circumpolar current using lagrangian methods
Zeya Li	5/11/2018	Int	COSE	Understanding Enso event modulation of marine heatwaves
Stephy Libera	3/4/2019	Int	QMS	The ocean's role in driving Antarctic Sea ice trends
Maxime Marin	11/10/2017	Int	IMAS	Marine heat waves in the southeast Indian ocean
Jan Jaap Meijer	1/08/2017	Int	IMAS	An observational study of the role of standing meanders in slowing the acc and transporting heat to antarctica
Amy Nau	2/06/2015	PR	TGRS	Mapping the middle: analysis of the water column using acoustic and optical methodologies
Nic Pittman	18/06/2018	Dom	IMAS	Climate-driven variability in tropical pacific productivity
Brett Stacy	17/12/18	Int	QMS	Optimising data collection and robust tag-based assessment strategies for exploratory fisheries
Yu Wang	3/2/19	Int	QMS	Mesoscale eddy energetics and the shelf-open ocean tracer exchange in the east Australian current region
Ahmad Widyatmoko	2/3/19	Int	QMS	Applying new tracking technologies and optimal foraging theory to understand small scale fisheries and address illegal fishing
Qianjiang Xing	16/09/19	Int	QMS	How the complexity of continental breakup controls ocean circulation
Xihan Zhang	11/5/19	Int	QMS	The role of small-scale ocean dynamics for the equilibration of the Antarctic circumpolar current and for its sensitivity to winds

QMS sponsored conference travel

No travel funding occurred in 2020 or 2021 because of COVID 19 restrictions.

QMS supported write-up scholarship

Name	Date started	Amount Awarded
Kieran Murphy	10/3/2021	\$8,000
Saurabh Rathore	24/11/2021	\$8,000
Romain Forestier	7/9/2020	\$8,000

QMS supervisors

UTAS Supervisor	Number of current students	CSIRO Supervisors	Number of current students	Supervisors from other institutions	Number of current students
Audzijonyte Asta	1	Appleyard, Sharon	1	Hogg, Andrew (ANU)	1
Bindoff, Nathaniel	6	Bax, Nic	1	Marshall, Andy (BOM)	1
Blanchard, Julia	5	Bodrossy, Lev	1	Spillman, Claire (BOM)	1
Bowman, John	1	Burch, Paul	1	Ziegler, Philippe (AAD)	1
Burrige, Chris	1	Dobrohotoff, Peter	1		
Carter, Chris	1	Dunstan, Piers	1		
Corney, Stuart	1	Feng, Ming	2		
Cresswell, Katie	1	Feutry, Pierre	1		
Domingues, Catia	2	Foster, Scott	1		
Edgar, Graham	1	Fulton, Beth	1		
Fitzgibbon, Quinn	1	Haddon, Malcolm	1		
Foppert, Annie	1	Hardesty, Denise	1		
Frusher, Stewart	1	Hemer, Mark	1		

Gardner, Caleb	4	Hobday, Alistair	1		
Hadley, Scott	1	Legresy, Benoit	1		
Hartmann, Klaas	4	Lenton, Andrew	1		
Hill, Nicole	2	Little, Rich	2		
Hobbs, Will	2	Marsland, Simon	2		
Holbrook, Neil	4	Martin, Tara	1		
Jansen, Jan	1	Matear, Richard	3		
Johnson, Craig	1	O'Kane, Terence	2		
Klocker, Andreas	3	Patterson, Toby	1		
Llort Jordi, Joan	1	Pena-Molina, Beatriz	2		
Lucieer, Vanessa	1	Richards, Shane	1		
Meyer, Amelie	1	Rintoul, Stephen	4		
Michael, Kelvin	2	Ross, Don	1		
Moore, Brad	3	Sloyan, Bernadette	1		
Moreno, David	1	Trull, Thomas	1		
Nash, Kirsty	1	Tuck, Geoff	2		
Nikurashin, Max	4	Wilcox, Chris	1		
Pecl, Gretta	2	Zhang, Xeubin	1		
Phillips, Helen	6				
Ross, Jeff	1				
Sauermilch, Isabel	1				
Semmens, Jayson	3				
Strutton, Peter	3				
Stuart-Smith, Rick	1				
Tracey, Sean	2				
Watson, Reg	1				
Whittaker, Jo	1				
Wotherspoon, Simon	3				

Summary of QMS teaching (unit breakdown)

Unit	Teaching Staff UTAS	Other Teaching Staff
QMS510 Introduction to Quantitative Marine Science	Simon Wotherspoon	
QMS511 Physical Oceanography	Maxim Nikurashin Jo Whittaker	Bernadette Sloyan
QMS512 Marine Biogeochemistry	Zanna Chase Pete Strutton Delphine Lannuzel Taryn Noble Tyler Rohr Pat Wongpan	Eric Mortensen
QMS513 Fisheries Science	Caleb Gardener Klaas Hartmann Craig Munday Gary Carlos Karlie McDonald Nils Krueck Steven Rust Rafael Leon David Moreno	
QMS514 Structure and Function of Marine and Antarctic Ecosystems	Julia Blanchard Beth Fulton Shane Richards Jeff Dambacher	
QMS515 Techniques in Remote Sensing	Andy Fischer Pete Strutton Alex Fraser Emiliano Cimoli Vanessa Lucieer Chris Watson	
QMS517 Data Analysis Methods	Simon Wotherspoon	

QMS student publications – 2020-2021

QMS student authors are indicated in bold. Publications have been included until one year after graduation to allow for delays in the publication process.

- Azarian, Clara, Scott Foster, **Floriaan Devloo-Delva**, and Pierre Feutry. "Population Differentiation from Environmental DNA: Investigating the Potential of Haplotype Presence/Absence-Based Analysis of Molecular Variance." *Environmental DNA* 3, no. 3 (2021): 541–52. <https://doi.org/10.1002/edn3.143>.
- Bax, Narissa, Camilla Novaglio, Kimberley H. Maxwell, Koen Meyers, Joy McCann, Sarah Jennings, Stewart Frusher, **Yannick Rousseau**, *et al.* "Ocean Resource Use: Building the Coastal Blue Economy." *Reviews in Fish Biology and Fisheries*, March 2, 2021. <https://doi.org/10.1007/s11160-021-09636-0>.
- Blasco, Gordon D., Danielle M. Ferraro, **Richard S. Cottrell**, Benjamin S. Halpern, and Halley E. Froehlich. "Substantial Gaps in the Current Fisheries Data Landscape." *Frontiers in Marine Science* 7 (2020). <https://doi.org/10.3389/fmars.2020.612831>.
- Brasier, M.J., S. McCormack, N. Bax, J.A. Caccavo, E. Cavan, **J.A. Ericson**, B. Figuerola, *et al.* "Overcoming the Obstacles Faced by Early Career Researchers in Marine Science: Lessons From the Marine Ecosystem Assessment for the Southern Ocean." *Frontiers in Marine Science* 7 (2020). <https://doi.org/10.3389/fmars.2020.00692>.
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- Champion, Curtis**, Matt K. Broadhurst, Endurance E. Ewere, Kirsten Benkendorff, Peter Butcherine, Kennedy Wolfe, and Melinda A. Coleman. "Resilience to the Interactive Effects of Climate Change and Discard Stress in the Commercially Important Blue Swimmer Crab (*Portunus Armatus*)." *Marine Environmental Research* 159 (July 1, 2020): 105009. <https://doi.org/10.1016/j.marenvres.2020.105009>.
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- — —. "Oceanographic Habitat Suitability Is Positively Correlated with the Body Condition of a Coastal-Pelagic Fish." *Fisheries Oceanography* 29, no. 1 (2020): 100–110. <https://doi.org/10.1111/fog.12457>.
- Coll, Marta, Jeroen Steenbeek, Maria Grazia Pennino, Joe Buszowski, Kristin Kaschner, Heike K. Lotze, **Yannick Rousseau**, *et al.* "Advancing Global Ecological Modeling Capabilities to Simulate Future Trajectories of Change in Marine Ecosystems." *Frontiers in Marine Science* 7 (2020). <https://doi.org/10.3389/fmars.2020.567877>.
- Cottrell, Richard S.**, Marc Metian, Halley E. Froehlich, Julia L. Blanchard, Nis Sand Jacobsen, Peter B. McIntyre, Kirsty L. Nash, *et al.* "Time to Rethink Trophic Levels in Aquaculture Policy." *Reviews in Aquaculture* 13, no. 3 (2021): 1583–93. <https://doi.org/10.1111/raq.12535>.

- Davis, T. R., G. Cadiou, **C. Champion**, and M. A. Coleman. "Environmental Drivers and Indicators of Change in Habitat and Fish Assemblages within a Climate Change Hotspot." *Regional Studies in Marine Science* 36 (April 1, 2020): 101295. <https://doi.org/10.1016/j.rsma.2020.101295>.
- Davis, T. R., **C. Champion**, and M. A. Coleman. "Climate Refugia for Kelp within an Ocean Warming Hotspot Revealed by Stacked Species Distribution Modelling." *Marine Environmental Research* 166 (April 1, 2021): 105267. <https://doi.org/10.1016/j.marenvres.2021.105267>.
- Dias, Fabio Boeira**, R. Fiedler, S. J. Marsland, C. M. Domingues, L. Clément, S. R. Rintoul, E. L. Mcdonagh, M. M. Mata, and **A. Savita**. "Ocean Heat Storage in Response to Changing Ocean Circulation Processes." *Journal of Climate* 33, no. 21 (November 1, 2020): 9065–82. <https://doi.org/10.1175/JCLI-D-19-1016.1>.
- Echevarria, E. R.**, M. A. Hemer, N. J. Holbrook, and A. G. Marshall. "Influence of the Pacific-South American Modes on the Global Spectral Wind-Wave Climate." *Journal of Geophysical Research: Oceans* 125, no. 8 (2020): e2020JC016354. <https://doi.org/10.1029/2020JC016354>.
- Echevarria, Emilio R.**, Mark A. Hemer, and Neil J. Holbrook. "Global Implications of Surface Current Modulation of the Wind-Wave Field." *Ocean Modelling*, March 26, 2021, 101792. <https://doi.org/10.1016/j.ocemod.2021.101792>.
- Ekawaty, Rani**, John Lynham, and Peter Mous. "Can Demand-Side Management Replicate a Size Limit in a Small-Scale Fishery?" *Fisheries Research* 223 (March 1, 2020): 105436. <https://doi.org/10.1016/j.fishres.2019.105436>.
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- Marin, Maxime**, Ming Feng, Helen E. Phillips, and Nathaniel L. Bindoff. "A Global, Multiproduct Analysis of Coastal Marine Heatwaves: Distribution, Characteristics, and Long-Term Trends." *Journal of Geophysical Research: Oceans* 126, no. 2 (2021): e2020JC016708. <https://doi.org/10.1029/2020JC016708>.

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- O'Hara, Timothy D., Alan Williams, Skipton N. C. Woolley, **Amy W. Nau**, and Nicholas J. Bax. "Deep-Sea Temperate-Tropical Faunal Transition across Uniform Environmental Gradients." *Deep Sea Research Part I: Oceanographic Research Papers* 161 (July 1, 2020): 103283. <https://doi.org/10.1016/j.dsr.2020.103283>.
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- Raes, Eric J., Kristen Karsh, **Swan L. S. Sow**, Martin Ostrowski, Mark V. Brown, Jodie van de Kamp, Rita M. Franco-Santos, Levente Bodrossy, and Anya M. Waite. "Metabolic Pathways Inferred from a Bacterial Marker Gene Illuminate Ecological Changes across South Pacific Frontal Boundaries." *Nature Communications* 12, no. 1 (April 13, 2021): 2213. <https://doi.org/10.1038/s41467-021-22409-4>.
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