

ANNUAL REPORT

2017-2018



UNIVERSITY of
TASMANIA



IMAS
INSTITUTE FOR MARINE & ANTARCTIC STUDIES

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Welcome and Introduction

We are pleased to present the 2017-2018 annual report for the CSIRO-UTAS PhD Program in Quantitative Marine Science (QMS), now in its 3rd year under the renewed 5-year commitment that began 1 July 2015, and in its 13th 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 potential employment by CSIRO and other organisations in the quantitative marine science field.

Key Challenges, strategies and achievements

- UTAS funding for scholarships continues at adequate levels. All UTAS academic units have targets for research higher degree enrolments. These targets are becoming difficult to meet solely from traditional sources of funding such as Australian Postgraduate Awards. Full or partial funding of students by the QMS program, industry, Centres of Excellence, ARC Discovery Projects and the Centre for Marine Socioecology are all looked on favourably when admission decisions are made.
- Our enrolments are around the highest number since the beginning of the program. The QMS program continues to attract a higher number of international students than domestic students.
- We continue to rejuvenate the project offerings on the QMS website to better reflect current supervision expertise, attracting better quality applicants and removing older, less relevant project content.
- We are continually working to keep the course offerings relevant and have recently revamped the core vs electives structure to better suit the desired skill set of graduates. We will continue to monitor this new structure to make sure it is having the desired outcomes and satisfying student needs.
- QMS conference funding continues to provide skilling and networking opportunities for our candidates, such as speaking at international symposiums and conferences enhancing the QMS brand.

The program is functioning well and has reached its target capacity for 2017-2018.

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

Sincerely



Peter Strutton, Director, QMS Program

Current Steering Committee Membership

- Peter Strutton (IMAS, Director/Chair)
- Zanna Chase (IMAS)
- Klaas Hartmann (IMAS)
- Richard Matear (CSIRO)
- Peter Thompson (CSIRO)
- 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 62 students have graduated from the Program, approximately 6 graduations per year. The Enrolments numbers per year for the current and previous 5 year contract are shown below.

Table 1: New Enrolled students by year (incl. comparison of numbers of international and domestic students)

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	5	3	2
Applications Accepted (not commenced)	5	5	0

QMS Full Scholarships awarded 1 July 2017- 30 June 2018

None. The program is at 'steady state' in terms of offering scholarship funds, so new scholarships are made available when an existing student graduates. Two have recently been approved but the students have not commenced yet.

QMS Top-up Scholarships awarded 1 July 2017- 30 June 2018

Stephen Bradshaw (Domestic, IMAS)
Nick Hill (Domestic, Heather Brown Scholarship)
Maxime Marin (International, IMAS)
Jan Jaap Meijer (International, IMAS)
Nic Pittman (Domestic, ARC CoE CLEX)

Graduates 2017-2018

Name (Scholarship)	Supervisors	Research Project
Claudio Castillo Jordan (BECAS)	Stewart Frusher (UTAS) Sean Tracey (UTAS) Geoff Tuck (CSIRO)	Disentangling the Climate Change Impacts on Productivity and Availability for <i>Macruronus</i> Species
Ross Daley (APA)	Jayson Semmens (UTAS) Alistair Hobday (CSIRO)	Spatial Management Strategies for Deep-sea Sharks
Pam Michael (IMAS)	Peter Strutton (UTAS) Chris Wilcox (CSIRO) Alistair Hobday (CSIRO) Geoff Tuck (CSIRO)	Pelagic Longlines and Albatross in the Southern Indian Ocean: Interactions of fleet dynamics, climate change, and albatross

Submitted Theses 2017-2018

Name (Scholarship)	Supervisors	Research Project
Hugo Bastos de Oliveira	Richard Coleman (UTAS) Peter Oke (CSIRO)	Study of the Southern Australia coastal upwelling through modelling and data assimilation
Pearse Buchanan	Zanna Chase (UTAS) Nathan Bindoff (UTAS) Steven Phipps (UTAS) Richard Matear (CSIRO)	The Importance of Marine Biological Processes for Carbon Storage and Biogeochemistry
Javier Porobic	Stewart Frusher (UTAS) Beth Fulton (CSIRO)	An Ecosystem Based Management Framework for the Juan Fernandez Ridge Fisheries
Gabriela Semolini Pilo	Richard Coleman (UTAS) Peter Oke (CSIRO)	The Evolution of Anticyclonic Eddies of the Tasman Sea: Vertical velocity and other properties

Summary of Graduates

The QMS Program was launched in 2004. Since 2010 there has been a total of 49 students have graduated from the Program, approximately 5-6 per year.

Table 2: Graduations by year

Year	Number of students
2010	8
2011	5
2012	5
2013	9
2014	3
2015	5
2016	5
2017	6
2018	3
Total	49

Overview of current student projects

Student	Started	Citizen ship	Scholarship	Topic	Primary Supervisor	CSIRO Supervisor
Abhishek Savita	5/06/2017	Int	IMAS	Global and regional sea level sensitivity to changing ocean water mass properties and circulation processes	Domingues, Catia	Marsland, Simon
Arena Enrico	30/06/2017	Int	IMAS	Fingerprinting the Southern Hemisphere's ocean contribution to global changes in steric sea level	Domingues, Catia	Rintoul, Stephen
Hugo Bastos de Oliveira	2/12/2013	Int	SWB	Study of the Southern Australia coastal upwelling through modelling and data assimilation	Coleman, Richard	Oke, Peter
Ana Berger	15/12/2014	Int	IMAS	Variability and dynamics of the Indonesian Throughflow	Nikurashin, Max	Sloyan, Bernadette
Bella Blanche	8/02/2016	Per Res	QMS	Detecting human influence in global ocean salinity patterns	Hobbs, Will	Wijffels, Susan
Stephen Bradshaw	12/7/2017	Dom	IMAS	Environmental drivers of Southern Rock Lobster productivity	Hartmann, Klaas	Haddon, Malcolm
Pearse Buchanan	1/11/2014	Dom	APA	Ocean Deoxygenation: A paleo-modelling perspective	Chase, Zanna	Matear, Richard
Curtis Champion	1/02/2016	Dom	APA	Responses to Warming Waters: Range extension in marine fishes from South-East Australia	Tracey, Sean	Hobday, Alistair
Richard Cottrell	16/03/2016	Per Res	IMAS	Bridging the Land-Sea Divide: Links, Interactions and Trade-Offs for Food Security and Biodiversity	Blanchard, Julia	Fulton, Beth
Sandra Curin Osorio	20/04/2017	Int	BECAS	Identifying Fish Stocks Prone to Interdecadal Productivity Shifts Across Different Worldwide Marine Ecosystems	Fruher, Stewart	Geoff Tuck
Ajitha Cyriac	18/11/2015	Int	QMS	Eastward Flows, Ocean Mixing and Air-Sea Interaction in the Southeast Indian Ocean	Phillips, Helen	Feng, Ming
Florian Devloo-Delva	15/05/2017	Int	SET	From Rivers to Ocean Basins: Quantifying Sex-specific Connectivity in Sharks	Burridge, Chris	Feutry, Pierre
Fabio Dias	24/08/2015	Int	TGRS	Testing of Climate Models and Sea Level Rise Projections using Observations of Ocean Heat Uptake	Domingues, Catia	Rintoul, Stephen
Emilio Echevarria	28/06/2017	Int	IMAS	Global to Coastal Implications of Surface Current Modulation of the Wind-Wave Field	Holbrook, Neil	Hemer, Mark
Jessica Ericson	15/10/2015	Dom	APA	Mapping the lipid content and composition of Antarctic krill across space and time	Virtue, Patti	Nichols, Peter
Romain Forestier	1/04/2016	Int	QMS	Modelling biodiversity related ecosystem processes as a Complex Adaptive System	Blanchard, Julia	Fulton, Beth
Kirianne Goossen	18/01/2016	Int	QMS	Microbial oceanography of Australian Coastal Waters	Bowman, John	Bodrossy, Lev
Madi Green	23/02/2015	Dom	QMS	Population Connectivity of Sharks in the Western South Pacific	Tracey, Sean	Appleyard, Sharon
Vicki Hamilton	24/07/2012	Dom	IMAS	Energetic Variability in Sperm Whales and Relationships with the Marine Environment	Hindell, Mark	Evans, Karen

Freddie Heather	21/06/2017	Int	IMAS	Development of a new class of size-structured ecological model for assessing human impacts on coastal food webs	Stuart-Smith, Rick	Bax, Nic
Nicholas Hill	22/01/2018	Dom	Heather Brown	Harvest Strategies for Data Poor Tasmanian Coastal Fisheries	Gardner, Caleb	Rich Little
Thibaut Houitte de La Chesnais	27/11/2014	Int	QMS	The Role of Cephalopods in the Structure and Functioning of Marine Ecosystems	Pecl, Gretta	Fulton, Beth
Jiale Lou	28/03/2017	Int	ARCCSS	Predictability of the Interdecadal Pacific Oscillation	Holbrook, Neil	Kane, Terence
Maxime Marin	11/10/2017	Int	IMAS	Marine heat waves in the southeast Indian Ocean	Phillips, Helen	Feng, Ming
Jan Jaap Meijers	1/08/2017	Int	IMAS	An Observational Study of the Role of Standing Meanders in Slowing the ACC and Transporting Heat to Antarctica	Phillips, Helen	Rintoul, Stephen
Kieran Murphy	28/11/2016	Int	IMAS	Life in the fast lane: understanding individual to community level processes of squid in a changing climate	Blanchard, Julia	Richards, Shane
Amy Nau	2/06/2015	Per Res	TGRS	Mapping the Middle: Analysis of the water column using acoustic and optical methodologies	Lucieer, Vanessa	Martin, Tara
Ram Patel	2/03/2016	Int	TGRS	The Physical and Bio-Optical Structure of Southern Ocean Eddies in Observations and Models	Phillips, Helen	Lenton, Andrew
Samantha Peel	27/01/2015	Dom	TGRS	Statistical Issues for Mapping Biodiversity in the Southern Ocean	Hill, Nicole	Foster, Scott
Nic Pittman	18/06/2018	Dom	IMAS	Climate-Driven Variability in Tropical Pacific Productivity	Strutton, Pete	Matear, Richard
Javier Porobic	26/11/2014	Int	TGRS	An ecosystem-based management framework for the Juan Fernandez ridge fisheries	Frusher, Stewart	Fulton, Beth
Saurabh Rathore	31/10/2016	Int	IMAS	The impact of recent Indian Ocean warming on the circulation, watermass distribution and air-sea interaction in the Indian Ocean	Phillips, Helen	Feng, Ming
Asher Riaz	6/07/2015	Int	IMAS	Closing the Energy Cycle in Global Ocean Models	Klocker, Andreas	O'Kane, Terence
Lauren Roman	23/02/2015	Dom	APA	Population Level Effects of the Ingestion of Marine Debris by Seabirds	Swadling, Kerrie	Hardesty & Wilcox,
Yannick Rousseau	10/08/2015	Int	QMS	Predicting the future of global seafood production	Watson, Reg	Fulton, Beth
Serena Schroeter	30/03/2015	Dom	QMS	The response of Antarctic sea ice to anthropogenic climate change, from model and satellite observations	Hobbs, William	Matear, Richard
Gabriela Semolini Pilo	15/12/2013	Int	CAPES/	Eddies Tridimensional Structure and their Role in Oceanic Mass and Heat Distribution	Coleman, Richard	Oke, Peter
Alessandro Silvano	29/09/2015	Int	APA	Observations of Ocean - Ice Shelf Interaction at the Totten Glacier	Williams, Guy	Rintoul, Stephen
Swan Li-San Sow	29/09/2015	Int	TGRS	Microbial Oceanography of the Different Water Masses of the Southern Ocean	Boyd, Philip	Trull, Tom
Samantha Twiname	27/10/2014	Dom	APA	Mechanistic approaches to understanding climate driven range shifts: using thermal performance to predict the outcome of predator-prey and competitive	Pecl, Gretta	Hobday, Alistair
Roxana Vasile	9/12/2013	Int	QMS	Rock Lobster Larval Dispersal Modelling	Hartmann, Klaas	Hobday, Alistair
Luwei Yang	14/10/2015	Int	IMAS	Internal waves and mixing in the Southern Ocean	Nikurashin, Max	Sloyan, Bernadette

QMS sponsored Conference Travel

QMS funded \$9,000 in travel for 2017/2018. Students who were awarded funds in the last round of 2017 and the first round of 2018 are listed below:

- **Richard Cottrell**, Impacts World conference and ISIMIP workshop/meeting – Germany 2017, \$2,000
- **Swan Sow Li**, International Society of Microbial Ecology (ISME) and 17th Symposia (ISME17), Leipzig, Germany, 12 - 17 August 2018, \$2,500
- **Samantha Peel**, Statistics in Ecology and Environmental Monitoring (SEEM) Conference In New Zealand in December 2017 \$2,000
- **Floriaan Devloo Delva**, The Tuna Conference (San Diego, USA); Sharks International (Joao Pessoa, Brazil); Universidad San Francisco de Quito seminar (Quito, Ecuador) and Galapagos Science Centre symposium (San Cristobal, Ecuador), 2018, \$2,500

QMS supported Write-up scholarship

Table 3: QMS Write-Up Scholarship Recipients

Name	Date started	Amount Awarded
Javier Porobic	17/6/18-3/8/18	\$8,000 did not complete as gained employment

QMS Supervisors

Table 3: CSIRO and UTAS Supervisors involved in the QMS Program

UTAS Supervisor	Number of current students	CSIRO Supervisors	Number of current students	Supervisors from other institutions	Number of current students
Bindoff, Nathaniel	8	Appleyard, Sharon	1	Cirano, Mauro (FURD)	1
Blanchard, Julia	5	Bodrossy, Lev	1	Hogg, Andrew (ANU)	1
Bowman, John	1	Burch, Paul	2	Massom, Rob (AAD)	1
Boyd, Phillip	1	Dobrohotoff, Peter	1	Downes, Steph (DEH)	1
Burridge, Chris	1	Evans, Karen	1		
Chase, Zanna	1	Feng, Ming	2		
Coleman, Richard	2	Feutry, Pierre	1		
Domingues, Catia	3	Foster, Scott	1		
Edgar, Graham	1	Fulton, Beth	3		
Frusher, Stewart	2	Hemer, Mark	1		
Gardner, Caleb	3	Hobday, Alistair	2		
Hartmann, Klaas	4	Legresy, Benoit	1		
Hill, Nicole	1	Lenton, Andrew	1		
Hindell, Mark	2	Marsland, Simon	2		
Hobbs, Will	3	Martin, Tara	1		
Holbrook, Neil	2	Matear, Richard	2		
Johnson, Craig	1	Nichols, Peter	1		
Klocker, Andreas	2	O’Kane, Terence	2		
Llort Jordi, Joan	1	Oke, Peter	2		
Lucieer, Vanessa	1	Rintoul, Stephen	5		

Moore, Brad	1	Sloyan, Bernadette	2
Nikurashin, Max	4	Trull, Thomas	1
Oliver, Eric	1	Tuck, Geoff	1
Pecl, Gretta	4		
Phillips, Helen	6		
Phipps, Steven	1		
Semmens, Jayson	1		
Strutton, Peter	2		
Stuart-Smith, Rick	1		
Swadling, Kerrie	1		
Tracey, Sean	4		
Virtue, Patti	1		
Watson, Reg	2		
Williams, Guy	1		
Wotherspoon, Simon	2		

Summary of QMS Teaching (Unit Breakdown)

Table 4: Units taught in 2nd half 2017

Unit	Teaching Staff UTAS	Other Teaching Staff
QMS511 Physical Oceanography	Maxim Nikurashin	
QMS514 Structure and Function of Marine and Antarctic Ecosystems	Julia Blanchard	Jessica Melbourne-Thomas Jeff Dambacher Rich Little
QMS516 Management Strategy Evaluation and Risk Assessment	Klaas Hartmann Paul Burch	
QMS517 Data Analysis Methods	Simon Wotherspoon Nicole Hill	

Table 5: Units taught in 1st half 2018

Unit	Teaching Staff UTAS	Other Teaching Staff
QMS510 Introduction to Quantitative Marine Science: R and Matlab	Simon Wotherspoon	
QMS513 Fisheries Science	Caleb Gardener Klaas Hartmann	

QMS Student publications – 2017-2018

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

- **Briceño F**, Polymeropoulos E, Fitzgibbon Q, Dambacher J, Pecl G. Changes in metabolic rate of spiny lobster under predation risk. *Mar Ecol Prog Ser*. 2018 Jun 28;598:71–84.
- **Champion C**, Hobday AJ, Zhang X, Pecl GT, Tracey SR. Changing windows of opportunity: past and future climate-driven shifts in temporal persistence of kingfish (*Seriola lalandi*) oceanographic habitat within south-eastern Australian bioregions. *Mar Freshw Res* [Internet]. 2018 Jun 18 [cited 2018 Jun 21]; Available from: <http://www.publish.csiro.au/MF/MF17387>
- **Cottrell RS**, Fleming A, Fulton EA, Nash KL, Watson RA, Blanchard JL. Considering land–sea interactions and trade-offs for food and biodiversity. *Glob Change Biol*. 2018;24(2):580–96.
- **Silvano A**, Rintoul SR, Peña-Molino B, Williams GD. Distribution of water masses and meltwater on the continental shelf near the Totten and Moscow University ice shelves. *J Geophys Res Oceans*. 2017;122(3):2050–68.
- **Buchanan PJ**, Matear RJ, Chase Z, Phipps SJ, Bindoff NL. Dynamic Biological Functioning Important for Simulating and Stabilizing Ocean Biogeochemistry. *Glob Biogeochem Cycles*. 2018 Apr;32(4):565–93.
- **Hamilton V**, Evans K. Establishing growth chronologies from marine mammal teeth: A method applicable across species. *J Exp Mar Biol Ecol*. 2018 Aug 1;505:24–34.
- **Peñaherrera-Palma C**, van P, Karpievitch YV, Frusher S, Llerena-Martillo Y, Hearn AR, et al. Evaluating abundance trends of iconic species using local ecological knowledge. *Biol Conserv*. 2018;225:197–207.
- **Vasile R**, Hartmann K, Hobday AJ, Oliver E, Tracey S. Evaluation of hydrodynamic ocean models as a first step in larval dispersal modelling. *Cont Shelf Res*. 2018;152:38–49.
- Parada C, Gretchina A, Vásquez S, Belmadani A, Combes V, **Porobic, J**, et al. Expanding the conceptual framework of the spatial population structure and life history of jack mackerel in the eastern South Pacific: An oceanic seamount region as potential spawning/nursery habitat. *ICES J Mar Sci*. 2017;74(9):2398–414.
- **Novaglio C**, Smith ADM, Frusher S, Ferretti F, Klaer N, Fulton EA. Fishery development and exploitation in South East Australia. *Front Mar Sci*. 2018;5(APR).
- **Silvano A**, Rintoul SR, Peña-Molino B, Hobbs WR, Van W, Aoki S, et al. Freshening by glacial meltwater enhances melting of ice shelves and reduces formation of Antarctic Bottom Water. *Sci Adv*. 2018;4(4).

- **Hamilton V**, Evans K, Hindell MA. From the forests to teeth: Visual crossdating to refine age estimates in marine mammals. *Mar Mammal Sci.* 2017;33(3):880–8.
- **Devloo-Delva F**, Huerlimann R, Chua G, Matley JK, Heupel MR, Simpfendorfer CA, et al. How does marker choice affect your diet analysis: Comparing genetic markers and digestion levels for diet metabarcoding of tropical-reef piscivores. 2018.
- **Michael PE**, Thomson R, Barbraud C, Delord K, De G, Hobday AJ, et al. Illegal fishing bycatch overshadows climate as a driver of albatross population decline. *Mar Ecol Prog Ser.* 2017;579:185–99.
- **Porobic J**, Fulton EA, Frusher S, Parada C, Haward M, Ernst B, et al. Implementing Ecosystem-based Fisheries Management: Lessons from Chile’s experience. *Mar Policy.* 2018;97:82–90.
- Matley JK, Maes GE, **Devloo-Delva F**, Huerlimann R, Chua G, Tobin AJ, et al. Integrating complementary methods to improve diet analysis in fishery-targeted species. 2018.
- **Michael PE**, Wilcox C, Tuck GN, Hobday AJ, Strutton PG. Japanese and Taiwanese pelagic longline fleet dynamics and the impacts of climate change in the southern Indian Ocean. *Deep-Sea Res Part II Top Stud Oceanogr.* 2017;140:242–50.
- Tsujino H, Urakawa S, Nakano H, Small RJ, Kim WM, Yeager SG, **Dias, F.** et al. JRA-55 based surface dataset for driving ocean–sea-ice models (JRA55-do). *Ocean Model.* 2018;130:79–139.
- Blanchard JL, Watson RA, Fulton EA, **Cottrell RS**, Nash KL, Bryndum-Buchholz A, et al. Linked sustainability challenges and trade-offs among fisheries, aquaculture and agriculture. *Nat Ecol Evol.* 2017;1(9):1240–9.
- Bonebrake TC, Brown CJ, Bell JD, Blanchard JL, Chauvenet A, **Champion C**, et al. Managing consequences of climate-driven species redistribution requires integration of ecology, conservation and social science. *Biol Rev.* 2018;93(1):284–305.
- Everett JD, Baird ME, **Buchanan P**, Bulman C, Davies C, Downie R, et al. Modeling what we sample and sampling what we model: Challenges for zooplankton model assessment. *Front Mar Sci.* 2017;4(MAR).
- **Champion C**, Hobday AJ, Tracey SR, Pecl GT. Rapid Shifts in Distribution and High-Latitude Persistence of Oceanographic Habitat Revealed Using Citizen Science Data from a Climate Change Hotspot. *Glob Change Biol* [Internet]. [cited 2018 Aug 3];0(0). Available from: <https://onlinelibrary.wiley.com/doi/abs/10.1111/gcb.14398>
- Ericson JA, Hellessey N, Nichols PD, Kawaguchi S, Nicol S, Hoem N, et al. Seasonal and interannual variations in the fatty acid composition of adult *Euphausia superba* Dana, 1850 (Euphausiacea) samples derived from the Scotia Sea krill fishery. *J Crustac Biol* [Internet]. [cited 2018 Jul 29]; Available from: <https://academic.oup.com/jcb/advance-article/doi/10.1093/jcbiol/ruy032/5060253>

- Gaitán-Espitia JD, Gómez D, Hobday AJ, **Daley R**, Lamilla J, Cárdenas L. Spatial overlap of shark nursery areas and the salmon farming industry influences the trophic ecology of *Squalus acanthias* on the southern coast of Chile. *Ecol Evol.* 2017;7(11):3773–83.
- **Briceño F, León R**, Gardner C, Hobday AJ, André J, Frusher SD, et al. Spatial variation in mortality by in-pot predation in the Tasmanian rock lobster fishery. *Fish Oceanogr.* 2016;25:6–18.
- **Novaglio C**, Ferretti F, Smith ADM, Frusher S. Species–area relationships as indicators of human impacts on demersal fish communities. *Divers Distrib.* 2016;22(11):1186–98.
- Pazmiño DA, Maes GE, **Green ME**, Simpfendorfer CA, Hoyos-Padilla EM, Duffy CJA, et al. Strong trans-Pacific break and local conservation units in the Galapagos shark (*Carcharhinus galapagensis*) revealed by genome-wide cytonuclear markers. *Heredity.* 2018;120(5):407–21.
- Ying K, Frederiksen CS, Zheng X, **Lou J**, Zhao T. Variability and predictability of decadal mean temperature and precipitation over China in the CCSM4 last millennium simulation. 2018.