

DR EMMA CAVAN

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Also see Research Gate, GitHub and Google Scholar

RESEARCH INTERESTS

Investigating ecological processes regulating the cycling of organic carbon in the oceans through the biological carbon pump. I use field, laboratory and theoretical techniques to analyse the effects of warming on primary production and respiration, to see how these will influence the future sink of atmospheric carbon dioxide into the oceans. I strive to undertake inter-disciplinary research and hence work with a mix of ocean and terrestrial biogeochemists, statisticians, microbiologists and ecosystem and biogeochemical modellers. I have a strong interest in science-policy and creating impact from my work.

EDUCATION

2012 – 2016 PhD Sink or swim: The fate of organic particles in the interior ocean. Supervisors: Prof. Richard Sanders, Prof. Richard Lampitt, Dr Alex Poulton and Dr Adrian Martin. University of Southampton and National Oceanography Centre.

2008 – 2012 MSci Marine Biology with First Class Honours, University of Southampton and National Oceanography Centre.

RESEARCH EXPERIENCE

2017 – 2020 The oceans Biological Carbon Pump project, University of Tasmania. I am employed on a multi-disciplinary project to further understand the biological pump with implications for climate change and geoengineering the oceans.

2015 – 2016 UK Shelf Sea Biogeochemistry project, National Oceanography Centre. Ran sampling regime to collect organic particles for many scientists on-board and analysed the composition of particles.

2012 – 2016 PhD research project, University of Southampton. My aim was to further our understanding of what controls POC flux to the deep ocean and its remineralisation in the mesopelagic zone. The highlight was measuring microbial oxygen uptake on both fast and slow sinking particles from an oxygen minimum zone (Cavan et al., 2017, Nature Communications), which was cited in the latest (unpublished) IPCC report on the oceans.

PUBLICATIONS

Published

- Cavan, E.** & Boyd, P. 2018. The effect of anthropogenic warming on microbial respiration and particulate organic carbon export in the sub-Antarctic Southern Ocean. *Aquatic Microbial Ecology*.
- Cavan, E.** Giering, S., Wolff, G., Trimmer, M. & Sanders, R. 2018. Alternative particle formations observed in the Biological Carbon Pump. *JGR:Biogeosciences*.
- Cavan, E.,** Trimmer, M., Shelley, F. & Sanders, R. 2017. Remineralisation of particulate organic carbon in an ocean oxygen minimum zone. *Nature Communications*.
- Baker, C., Henson, H., **Cavan, E.** et al. 2017. Slow sinking particulate organic carbon in the Atlantic Ocean: Magnitude, flux and potential controls. *Global Biogeochemical Cycles*.
- Cavan, E.,** Henson, S., Belcher, A. & Sanders, R. 2017. Role of zooplankton in determining the efficiency of the biological carbon pump, *Biogeosciences*.
- Le Moigne, F., Henson, S., **Cavan, E.** et al. 2016. What causes the inverse relationship between primary production and export efficiency in the Southern Ocean? *Geophysical Research Letters*.
- Cavan, E. et al.,** 2015, Attenuation of particulate organic carbon flux in the Scotia Sea, Southern Ocean, is controlled by zooplankton fecal pellets, *Geophysical Research Letters*, 42.

In review

Cavan, E., Henson, H. & Boyd, P. *Conditionally accepted.* The sensitivity of subsurface microbes to ocean warming accentuates future declines in particulate carbon export. *Frontiers Ecology and Evolution*.

In prep

- Cavan, E. L.**, Belcher, A., Atkinson, A., Blanchard, J., Boyd, P., Hill, S., Kawaguchi, S., McCormack, S., Nicol, S., Ratnarajah, L., Schmidt, K., Steinberg, D. & Tarling, G. The role of krill in biogeochemical cycles. *Nature Communications*.
- Cavan, E.**, Laurenceau-Cornec, E. C., Bressac, M. & Boyd, P. The ecology of the mesopelagic biological carbon pump: A review.

Reviewer for:

IPCC Special Report on the Ocean and Cryosphere in a Changing Climate Expert Review
International Society for Microbial Ecology Journal (ISME, Nature Publishing Group),
Journal of Geophysical Research: Oceans, Biogeosciences,
Marine Ecology Progress Series, Geophysical Research Letters,
Ocean Science Journal Journal of Marine Systems

Editor: Guest editor *Frontiers in Marine Science* Research Topic – ‘We shed light: Optical insights in the Biological carbon pump’.

PRESENTATIONS

Co-Convener and Chair:

- 2018** AGU Ocean Sciences Meeting, Portland USA. Oral and Poster session Primary Chair.
2017 Challenger Society for Marine Science, Marine Biogeochemistry Forum (AMBIO), Scotland, Co-Chair.
2016 Challenger Society for Marine Science, Biennial Meeting, Co-Chair, UK.
2016 Challenger Society for Marine Science, Marine Biogeochemistry Forum (AMBIO), UK, Co-convener.

Oral presentations:

2018 Ocean Sciences, USA. **2018** MEASO, Hobart. **2017** AMBIO, Scotland. **2016** AMBIO, Oxford, UK, **2015** ASLO, Spain, **2014** Challenger Society, Plymouth, UK, **2014** IMBER, Norway, **2014** 46th International Liege Colloquium, Belgium, **2013** Challenger Society, Leeds, UK, **2012** The Malacological Society & The Solent Forum presenting Master’s thesis.

Invited seminars:

- 2018** University of Exeter, UK
2017 Women in Data Science event, University of Tasmania, Australia
2016 University of Liverpool, UK
2015 Public lecture, National Oceanography Centre, Southampton, UK.

Poster presentations:

- 2016** Ocean Sciences, New Orleans, US, Remineralisation in an oxygen minimum zone.

FIELD EXPERIENCE AT SEA

- 2018** Southern Ocean (3 weeks), *RV Investigator*.
2017 Southern Ocean (2 weeks), *RV Investigator*.
2015 Porcupine Abyssal Plain (3 weeks), *RRS Discovery*.
2014 Celtic Sea (2 weeks), *RRS Discovery*, UK Shelf Seas Biogeochemistry consortium
2014 Eastern Tropical Pacific (7 weeks), *RRS James Cook*.
2013 Southern Ocean (6 weeks), *RRS James Clark Ross*, UK Ocean Acidification Program

LABORATORY EXPERIENCE

- 2013-2018** Microbial respiration, sinking rate experiments, microscopy, culture experiments, organic chemistry.
2013-2016 University of Liverpool, Lipids as organic biomarkers – mass spectroscopy.
2012-2015 PIC, BSi, POP and Chl-*a* analysis and prep for POC/PON analysis, microscopy.
2011 Histology on the reproductive system of the Pacific Oyster.

DATA ANALYSIS and MODELLING

Big Data – Download and analysis of Earth System Model (CMIP) and satellite data.

Command Line – Manipulating CMIP files (netcdf), downloading software

R – Data manipulation, statistical analysis, programming and data visualisation.

GitHub – Code used for analysis/modelling during my current position published at www.github.com/e-cavan

Python – Basic knowledge

OTHER ACTIVITIES

Media

2018 Australian Broadcasting Company, National Radio on Southern Ocean krill fishery and carbon cycle

Services to the profession

2018 - Early Career Researcher representative on the College (Faculty) of Science and Engineering Research Committee, UTAS.

2016 – 2019 Council member for the Challenger Society of Marine Science (UK Society), responsible for communications, such as twitter account and website.

2016 Diversity in Marine Science, organised panel discussion at Challenger Society biennial conference.

2016 Early career and diversity network, meeting to introduce the issues to the Challenger Society's remit.

International working group:

2016 – 2019 SCOR working group (#150), TOMCAT, on particle content, aggregate and transfer.

Policy:

2018 Organizing committee of Policy Forum at MEASO conference, ACECRC, Hobart, Australia.

2015 The Royal Society, 3-month funded internship working in the 'science for policy' team at the Royal Society, London, working various climate change issues.

2015 Policy workshop, University of Southampton.

TEACHING

Lecturing

2017 - 2018 Undergraduate lectures in Biological Statistics and ecological modelling.

2012 – 2016 Undergraduate student demonstrating, NOCS. Modules include: Introduction to marine ecology, Phytoplankton and primary production, Explore our oceans (online - MOOC) and R statistical seminars.

Supervision

Current PhD students

Co-supervisor of PhD Student, 'Particle flux in the Southern Ocean' – South Africa.

Co-supervisor of PhD Student, 'Zooplankton and the Biological Pump' - Australia.

Current Masters students

Primary supervisor 'Carbon cycling by phytoplankton, zooplankton and whales - Australia

Previous Masters students

Co-supervisor of Masters Research project, 'Slow sinking particles in the Atlantic Ocean' - UK. (published)

GRANTS, MEMBERSHIPS AND AWARDS

Member Challenger Society & American Geophysical Union

2018 PI Visiting fellow scholarship \$5700

2018 **PI** The Pew Charitable Trusts, **\$10,000** publish on impact of Southern Ocean krill fishery for carbon cycle

2017 **Collaborator** on CI Dr Thomalla, Southern Ocean Biological Pump. \$420,000 AUD in South Africa.

2017 **PI** Early Career Researcher event, IMAS. **\$3000** to run an event to promote career development for ECRs.

2017 **PI** Research Enhancement Program, IMAS. **\$5000** for individual pilot research project.

2016 Travel award, the US Ocean Sciences conference. **2014** Travel award, IMBER conference.