

## RV Investigator Voyage Scientific Highlights

<b>Voyage #:</b>	IN2016_V04		
<b>Voyage title:</b>	Influence of temperature and nutrient supply on the biogeochemical function and diversity of ocean microbes		
<b>Mobilisation:</b>	0800 Sydney, Tuesday, 30 August 2016		
<b>Depart:</b>	1400 Sydney, Wednesday, 31 August 2016		
<b>Return:</b>	1200 Brisbane, Thursday, 22 September 2016		
<b>Demobilisation:</b>	0800 Brisbane, Friday, 23 September 2016		
<b>Voyage Manager:</b>	Hugh Barker	<b>Contact details:</b>	<a href="mailto:Hugh.Barker@csiro.au">Hugh.Barker@csiro.au</a>
<b>Chief Scientist:</b>	Martina Doblin		
<b>Affiliation:</b>	University of Technology Sydney	<b>Contact details:</b>	<a href="mailto:Martina.Doblin@uts.edu.au">Martina.Doblin@uts.edu.au</a>
<b>Principal Investigators:</b>	Mark Brown Martin Ostrowski Iain Suthers April Abbott (Integrated project: Geochemistry of ocean sediments)		
<b>Project name:</b>	Supplementary project: Natural iron fertilisation of oceans around Australia: Linking terrestrial dust and bushfires to marine biogeochemistry		
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## The Chief Scientist



A/Prof Martina Doblin is the Productive Coasts Research Program Leader at the University of Technology Sydney: C3. Dr Doblin's research is at the nexus between microbial ecology and ocean biogeochemistry, using state-of-the-art cell sorting, high-content imaging, isotopic tracers and systems biology approaches to investigate the functions of marine microbes.

Dr Doblin has been engaged in marine research for more than 15 years, attracting over \$8 million in competitive grants from the Australian Research Council and other funding sources. She has worked with the Australian Government as a research contractor, and has also been engaged as independent consultant, translating scientific research into marine policy and working with aquatic industries to improve environmental outcomes. Dr Doblin is the leader of the NSW node of Australia's Integrated Marine Observing System, and current member of the Australian Research Council College of Experts. Having participated in 7 previous voyages on the Marine National Facility, this is her first voyage on RV Investigator as Chief Scientist.

### Title

**Influence of temperature and nutrient supply on the biogeochemical function and diversity of ocean microbes**

### Purpose

Microscopic marine microbes are the most evolutionarily diverse organisms in the biosphere and have unparalleled importance for the health of our planet. They are responsible for ~50% of global primary production, drive biogeochemical cycles (C, N, P, S, Fe) and influence climate.

Shifts in ocean temperature, circulation, stratification, nutrient input, oxygen content, and ocean acidification, all of which are associated with rising atmospheric CO<sub>2</sub> and climate change, are having significant impacts on the distribution and biogeochemical functioning of ocean microbes, with potentially serious consequences for the delivery of marine ecosystem services.

Understanding the implications of these changes at the regional level is a global research priority, given the universal demand for management of ocean resources.

The aims of this voyage were to:

1. Understand how changes in seawater temperature and nutrient concentrations, linked to shifting oceanographic circulation in eastern Australia, influence the diversity of microbial communities and the key biogeochemical transformations they mediate.
2. Understand the broader ecosystem implications of potential changes to the base of the foodweb, plus examine the historical records of plankton and ocean circulation through detailed biological and chemical analyses of ocean sediments.
3. Collect aerosol particles to examine natural iron fertilisation of oceans around Australia, a potentially important process that influences microbial community composition and ocean productivity.

The voyage attracted moderate media attention, particularly in southern NSW. Chief Scientist Martina Doblin was interviewed twice on ABC Southeast Radio and several newspaper articles featured our discoveries of a shallow reef in the vicinity of Montague Island, and two underwater mountains offshore of Mount Gulaga.

<http://www.naroomanewsonline.com.au/story/4163344/csiro-discovers-extinct-underwater-volcano/>

<http://www.naroomanewsonline.com.au/story/4174689/more-mountains-of-fish/>

<http://www.begadistrictnews.com.au/story/4169536/investigator-finds-submerged-mountains-off-narooma/>

The EAC drift study was also featured in the UTS newsroom:

<http://newsroom.uts.edu.au/news/2016/09/biodiversity-move>

Additionally, Dr April Abbott did some blog posts:

<https://blog.csiro.au/voyage-meaning-life-ocean-microbes/>

<https://blog.csiro.au/eac-investigator/>

## Contribution to the nation

Australia's ocean resources are exposed to accelerating threats from climate change. These threats are causing changes in the physical circulation of the ocean and delivery of nutrients that are affecting microbial distribution and abundance. As these microscopic cells are central mediators of planetary ecosystem processes, changes in their distribution and function will have direct impacts on the welfare and economy of Australians, including their capacity for human food production, carbon cycling and storage, greenhouse gas dynamics, and the formation of harmful algal blooms. Globally, such marine ecosystem services have been estimated to be valued in excess of \$8.4 trillion per year for open ocean systems and estimates for Australian waters are over \$42 billion annually.

This research will provide managers and industry with more accurate insight into the effects of ongoing climate change on the delivery of ecosystem services in eastern Australian waters. This information is essential to safeguard the biodiversity of our oceans, as well as the food and livelihoods of the people that depend on them.

## As a result of this voyage

1. We will have a better understanding of the composition of microbes in relation to natural gradients of temperature and nutrients, and how microbes adapted to warm tropical conditions in north-eastern Australian waters change in structure or function as they are transported southward into temperate regions.
2. We have found that zooplankton are more abundant in cool water, including cyclonic eddies, and that these oceanographic features influence in the development of commercially important fish. Our data will help understand this critical foodweb link.
3. We have mapped primary productivity at unprecedented spatial resolution, surveyed previously unknown underwater mountains, as well as accurately determined the location of a shallow reef south of Montague Island.
4. We have commenced a program of research that includes exploring the ocean microbiome, and understanding the links between oceanography and the marine foodweb, including larger consumers such as penguins.