

## RV Investigator Voyage Scientific Highlights and Summary

<b>Voyage #:</b>	<b>IN2019_V03</b>		
Voyage title:	A coupled bio-physical, ecosystem-scale, examination of Australia's International Indian Ocean Expedition line		
Mobilisation:	Fremantle, Monday, 13 May 2019		
Depart:	Fremantle, 15:00 AWST Tuesday, 14 May 2019		
Return:	Fremantle, 07:30 AWST Friday, 14 June 2019		
Demobilisation:	Fremantle, Friday, 14 June 2019		
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Chief Scientist:	Professor Lynnath Beckley		
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Principal Investigators:	Lynnath Beckley (Murdoch University), David Antoine (Curtin University), Peter Thompson (CSIRO), Helen Phillips (University of Tasmania), Michael Landry (Scripps, San Diego), Andrew Jeffs (University of Auckland), Pilar Olivar (CSIC, Barcelona), Raleigh Hood (University of Maryland), Martin Ostrowski (University of Technology Sydney), Justin Seymour (University of Technology Sydney), and Anya Waite (Dalhousie University, Halifax).		
Project name:	A coupled bio-physical, ecosystem-scale, examination of Australia's International Indian Ocean Expedition line		

## Scientific Highlights

### The Chief Scientist

Lynnath Beckley is the Professor of Marine Science at Murdoch University, Western Australia. She is an Indian Ocean specialist and, over several decades, has conducted research on both the Agulhas and Leeuwin Current systems. Her focus is on biological oceanography, particularly investigations of larval fishes and zooplankton in relation to ocean circulation, mesoscale eddies and other environmental features. She has been involved in the development of the second International Indian Ocean Expedition (2015-2020), currently serves on its International Steering Committee and led voyage IN2019\_V03 on the RV *Investigator* as Australia's main contribution to this international science endeavour. For the voyage, she included Australian and international colleagues from across a wide range of disciplines to examine the south-east Indian Ocean adjacent to the Australian continent.



### Title

A coupled bio-physical, ecosystem-scale, examination of Australia's International Indian Ocean Expedition line.

### Purpose

The purpose of the voyage was to revisit historical sampling stations along the 110°E meridian last examined in 1962/63 during the first International Indian Ocean Expedition. In view of documented warming of the surface waters off Western Australia, the aim was to assess change in the physical, chemical and biological properties of the water column at these locations. In addition, using modern techniques, we could investigate, for the first time, other important aspects such as distribution of microbes, biogeochemistry, pelagic food webs and bio-optics related to satellite remote sensing of the south-east Indian Ocean. The voyage also provided opportunity to train post-graduate students, deploy autonomous Argo floats and drifting weather buoys, measure underwater sound and examine eastward flows feeding into the anomalous Leeuwin Current which flows along the west coast of Australia.

### Contribution to the nation

This voyage has investigated the response of the south-east Indian Ocean off Western Australia to climate change against the historical data collected by Australian scientists in the 1960s. The transect completed along the western edge of Australia's Exclusive Economic Zone has provided the first scientific understanding of biogeochemical, microbial and ecological processes in the region which includes some of the newly proclaimed Commonwealth Marine Parks (e.g., Abrolhos Marine Park). We have made some of the first measurements of oceanic food webs important for supporting stocks such as tuna, western rock lobster and potential future resources including lantern fishes. The bio-optics measurements undertaken provide the first ground-truthing of satellite remote sensing of ocean colour in the south-east Indian Ocean. Revisiting the 110°E line has provided an important opportunity to train post-graduate students and for Australia to maintain its reputation at the forefront of international oceanographic research.

### **As a result of this voyage**

1. We will have a better understanding of the effects of climate change on the physics, chemistry and biology of the water column and the first understanding of the biogeochemistry, microbes, ecological processes, food webs and bio-optics of the south-east Indian Ocean.
2. We have found several distinct water masses with specific physical and chemical signatures and identified clear patterns in the planktonic biodiversity from the cool temperate to tropical waters along the 110° transect.
3. We have mapped the physical and chemical attributes of the water column to the seafloor (over 5000m depth) as well as the horizontal and vertical distribution of microbes, phytoplankton, zooplankton and meso-pelagic fishes in the south-east Indian Ocean.
4. We have contributed to global monitoring of the oceans by completing Triaxus sections, measuring underwater sound and deploying autonomous Argo floats and weather drifters.
5. We have provided Australia's primary contribution to the second International Indian Ocean Expedition, a global scientific endeavour currently involving scientists from about 30 countries.