

RV Investigator Voyage Voyage Summary

Voyage #:	IN2018_T02		
Voyage title:	Harmful Algal Blooms and their long term sediment record in East Coast Tasmanian waters		
Mobilisation:	Brisbane, Sunday, 13 May 2018		
Depart:	Brisbane, 0800 Monday, 14 May 2018		
Return:	Hobart, 0900 Monday, 21 May 2018		
Demobilisation:	Hobart, 09.30 Monday, 21 May 2018		
Voyage Manager:	Stephen Thomas	Contact details:	canbeyan@gmail.com
Chief Scientist:	Prof Gustaaf Hallegraeff		
Affiliation:	Institute for Marine and Antarctic Studies	Contact details:	Hallegraeff@utas.edu.au
Principal Investigator:	Dr Eric Woehler		
Project name:	Spatial and temporal variability in the distribution and abundance of seabirds.		
Affiliation:	Birdlife Australia	Contact details:	eric.woehler@gmail.com
Principal Investigators:	Dr Emlyn Jones		
Project name:	Remote-ROAM: mobile modelling sea trials		
Affiliation:	CSIRO	Contact details:	Emlyn.Jones@csiro.au

Objectives and brief narrative of voyage

This transit voyage from Brisbane to Hobart focused on brief sampling stops at Port Hacking (trial gravity coring) and Maria Island (both gravity coring and multicoring), with the remainder of the activities requiring next to no stops: bird observations, continuous plankton tows, deployment of drifter buoys, Triaxus towing, as well as multibeam surveys for ship wrecks and sediment properties.

Scientific objectives

1. **Prof Gustaaf Hallegraeff , Dr Chris Bolch, Prof Andrew McMinn (IMAS); Dr Craig Woodward (ANSTO)**

Harmful Algal Blooms and their long term sediment record in East Coast Tasmanian waters

Unprecedented toxic dinoflagellate blooms occurred off east coast Tasmania in 2012 and 2015, 2016 and 2017. These events led to a global shellfish product recall (AUD23M loss), lengthy (4 months) closures of mussel, oyster, scallop, and rock lobster fisheries, and 4 human hospitalisations (Paralytic Shellfish Poisoning). While the causative *Alexandrium* dinoflagellate had been previously detected, genetic evidence suggests that blooms represent a cryptic genotype newly stimulated by climate-driven increased water column stratification. We did seek to characterize expected recurrent blooms in relation to Maria Island NRS hydrological conditions, and compare this with the long time (1000+yr) ancient DNA sediment record.

2. **Dr Eric Woehler (Birdlife Australia); Claire Wallis (AFMA), Dani Harmshaw, Zara King.**

Spatial and temporal variability in the distribution and abundance of seabirds.

Seabirds are distributed patchily over the oceans, both in space and in time. The deployment of tracking devices on seabirds provides an initial insight into at-sea movements, but do not report on non-breeding or juvenile birds. The survival of these life stages can have dramatic impacts on population dynamics. The documentation of at-sea distributions of seabirds around Australia can facilitate a better understanding of seabird dynamics in the marine environment. The proposed study using at-sea observations collected alongside oceanographic data will improve our understanding of seabirds and the way in which they relate to our changing ocean environments.

3. **Farhan Rizwi (CSIRO), in association with Annalise Person (Royal Australian Navy)**

Remote-ROAM: mobile modelling sea trials

The aim of this work was to operationally test the Bluelink mobile oceanographic modelling system (referred to as Remote-ROAM) that has been developed by CSIRO and BoM for use by the Royal Australian Navy (RAN). The goal of this system is to provide enhanced situational awareness for surface (ships) and subsurface (submarines) platforms. This was the first time this system has been deployed at sea and the project will focus on testing the modelling system and associated data feeds, along with an assessment of the forecast skill against deployed XBT's and the ships flow-through system.

4. Ruth Eriksen (CSIRO-AusCPR)

Continuous Plankton Recorder monitoring validated against continuous seawater tap surveys

We deployed the CPR Continuous Plankton Recorder from Brisbane to Port Hacking and again from Bass Strait to Maria Island, and compared phytoplankton communities with that of on-board seawater tap samples, and the most recent Port Hacking and Maria Island national reference station samples.

5. Dr Ben Arthur (CSIRO), Chloe Simons, Andrew Walsh (Marine Discovery Centre), Christie Evans (Adelaide Seaview Downs) and Callum Hollingsworth (Hobart Rosny College)

Educator on Board

The CSIRO Educator on Board is a professional development program for Australian STEM (science, technology, engineering and mathematics) school teachers. Two teachers will sail on board *Investigator* for short (<2 week) voyages. Participants will: observe and assist alongside scientists and contribute to the national collaborative marine research effort, update their own STEM content knowledge, conduct and coordinate educational and outreach activities including live video broadcasts from the ship, develop curriculum linked resources, such as lesson plans, to be shared with other teachers, and promote *RV Investigator* and its research efforts. Demonstration of plankton sampling, microscopic on-board observations and specimen collection for display.

Voyage objectives

- (1) The key operational activity of IN2018_T02 was to collect multicorer (60cm) and additional gravity corer (3m+) sediment samples in the Maria Island/ Spring Bay Tasmanian area, with an additional gravity corer trial off Port Hacking (where shorter multicorer sediments were collected previously by Investigator voyage IN2016_V04.)
- (2) Supplementary bird observations (Woehler) were made en-route together with XBT deployments but which did not require the ship to stop.
- (3) The Triaxus was towed from near Port Hacking (34.1647S; 151.3915E) to Eden (39 53.71 S; 148 48.92 E) (Farhan Rizwi).
- (4) Two NOAA drifter buoys were deployed at 31 30.98S; 153 12.17E to coincide with the Newcastle radar (Farhan Rizwi)
- (5) The continuous plankton recorder (CPR) was towed from Brisbane to Port Hacking and from Eden to Maria Island, allowing for calibration between CPR and en-route subsurface water samples collected with the en-route seawater ship flow-through system (Ruth Eriksen).
- (6) (5)Participants from the Woodbridge Discovery Centre participated in on-board phytoplankton observations and specimen collections.
- (7) Surveys were made for ship wrecks by the Australian National Maritime Museum.

Results

1. **Sediment Coring.** While the trial gravity coring off Port Hacking was unsuccessful (unsuitable sandy bottom in 142m depth), excellent triplicate gravity cores (3m long) were collected offshore of Maria Island, and excellent multicores (40-60cm long) collected offshore off Maria Island, and again in Mercury Passage.
2. **Bird observations.** Species identified included prions, shearwaters, petrels and albatross. In total, 18,000 birds were identified during the voyage and recorded in the *Investigator's* onboard database 'Wildlife at Sea'. Zara King joined Dr Woehler's project as a marine mammal researcher hoping to collect similar data on migratory patterns and surface behaviour of marine mammals. While the team was able to record a few large pods of dolphins, and pilot whales (two unidentifiable blows), it was too early in the season for humpback whale sightings.
3. **Remote ROAM.** The remote ROAM modelling project was a great success. The main aim of trialling live the modelling system to run on a stand-alone laptop untethered to any network was accomplished. The import/export functionality of the forcing data using a USB stick was demonstrated to the Navy personnel Annalise Pearson on board and received positive feedback. There was great benefit in liaising with the Navy to further help drive the specifications for Remote ROAM. For the first time, the EnKF data assimilation system was tested on the small scale ocean domain around the ship's track. This system is still work in progress and the XBT's collected during the voyage will be invaluable in its development. Two NOAA drifter buoys and the Triaxus were deployed to complement various other observations in the area at the time. The data from these will be used to further develop the Remote ROAM system and they also form part of a bigger SE Australian observation network.
4. **Continuous Plankton Recorder.** Two successful CPR tows were conducted from Brisbane to Port Hacking, and again from Eden to Maria Island. Continuous on-board microscopy observations on seawater-tap plankton collections, as well as the regular 3h interval collection of a total of 55 quantitative 1L water bottle samples will provide valuable validation of the CPR instrument. Selected samples will also be studied by Scanning Electron Microscopy (Hallegraeff). RV *Investigator* proved to be an excellent vibration-free platform for on-board light microscopy. Tropical phytoplankton species (*Trichodesmium*, *Histioneis*, *Ornithocercus*, *Ceratocorys*, *Scyphosphaera*) were recorded from Brisbane to Bass Strait, after which surface water temperatures dived from 24°C down to 16°C. No *Alexandrium* dinoflagellates were microscopically detected between Flinders Island and Maria Island at this time of the year (18-20 May 2018). These East Coast Tasmanian samples will also be screened by genetic methods (Bolch).
5. **Ship wreck Surveys.** In addition to the target wrecks of the *Carlisle* and *Pioneer*, a new unidentified wreck was identified.
6. **The CSIRO Educator on board program** was successful in inspiring 4 high school teachers.

Moorings, bottom mounted gear and drifting systems

Item No	PI See page above	APPROXIMATE POSITION						DATA TYPE enter code(s) from list on last page	DESCRIPTION
		LATITUDE			LONGITUDE				
		deg	min	N/S	deg	min	E/W		
Two NOAA drifter buoys		-31	30.98	N	153	12.17	E	D05	deployed by Farhan Rizwi on 15 May 2018 to coincide with the Newcastle radar

Summary of Measurements and samples taken

Item No.	PI see page above	NO see above	UNITS see above	DATA TYPE Enter code(s) from list at Appendix A	DESCRIPTION
TRIAXUS				H13	Towed from Port Hacking (34.1647S";151.3915E) to Eden (39 53.71 S";"148 48.92 E")
1,2				B08 ; G04 ;G74	Maria Island sediment cores ;inshore+offshore
3,4				B08	Continuous Plankton Recorder IN2018_T02_Tows 1 and 2; Brisbane to Port Hacking; Eden to Maria Island

Curation Report

Item #	DESCRIPTION
1.	Maria Island 19 May 2018 ; offshore ; 42.845 S ; -148.240 E ; 3 gravity cores (3m long) ; 3 multicores (15 cm long). To be analysed by IMAS, ANSTO, ACAD.
2.	Maria Island 19 May 2018 ; inshore Mercury Passage ; -42.32.98S ; 148.0138 E ; 3 good multicores (60cm long) ; To be analysed by IMAS, ANSTO, ACAD.
3.	Continuous Plankton Recorder IN2018_T02_Tow1 : Brisbane (deployed 14 May 2018 ; - 26.46.68S ; 153.19.36E ;) to Port Hacking) (retrieved 15 May 2018 ; - 33.52.08S ;151.40.83E) ; to be analysed by IMOS
4.	Continuous Plankton Recorder IN2018_T02_Tow2: Eden (deployed 16 May 2018 ; 151.3915R ; 34.1647S) to Maria Island (retrieved 19 May 2018, -42.50.69S ; 148.14.4E) ; to be analysed by IMOS

Track Chart



**CPR tow
Brisbane
to Port Hacking**

**2 drifter buoys
deployed off
Newcastle**

**Gravity corer trial
Port Hacking**

**Triaxus tow
Port Hacking to
Eden**

**CPR tow
Eden
to Maria Island**

**Gravity and multicoring
at 3 sites off Maria Island**

Personnel List

1.	Stephen Thomas	Voyage Manager	CSIRO MNF
2.	Brett Muir	SIT Support	CSIRO MNF
3.	Trevor Goodwin	SIT Support	CSIRO MNF
4.	Matt Boyd	GSM Support	CSIRO MNF
5.	Phil Van Den Bossche	GSM Support	CSIRO MNF
6.	Peter Shanks	DAP Support	CSIRO MNF
7.	Anoosh Sarraf	DAP Support	CSIRO MNF
8.	Jason Fazey	Mechanical Technician	CSIRO MNF
9.	Shanon Palmer	Mechanical Technician	CSIRO MNF
10.	Damian Pretymann	Mechanical Technician	CSIRO MNF
11.	Prof Gustaaf Hallegraeff	Chief Scientist	IMAS / UTAS
12.	Prof Andrew McMin	Alternative Chief Scientist	IMAS / UTAS
13.	Craig Woodward	Scientist	ANSTO, Lucas Heights
14.	Dr Chris Bolch	Scientist	IMAS / UTAS
15.	Dr Eric Woehler	Lead Principal investigator	Birds Tasmania
16.	Dani Harmshaw	student	Birds Tasmania
17.	Zara King	student	Birds Tasmania
18.	Farhan Rizwi	Supplementary LPI	CSIRO
19.	Uwe Rosebrock	Supplementary	CSIRO
20.	Paul Sandery	Supplementary	CSIRO
21.	Annalise Pearson	Supplementary	RAN
22.	Dr Ruth Eriksen	Investigator (CPR)	CSIRO
23.	Dr Ben Arthur	Outreach	CSIRO
24.	Chloe Simons	Outreach STEM	Woodbridge Marine Discovery Centre
25.	Andrew Walsh	Outreach STEM	Woodbridge Marine Discovery Centre
26.	Stephen Reid	Outreach STEM	Woodbridge Marine Discovery Centre
27.	Chris Gerbing	Communications Officer	CSIRO
28.	Mark Rowland	HSE	CSIRO
29.	Greta Creed	Educator on Board program	North Lakes State College
30.	Christie Evans	Educator on Board program	Seaview Downs Primary School
31.	Callum Hollingsworth	Educator on Board	Rosny College
32.	Nick Robinson	COMMS IMAX	Wild Pacific Media
33.	Caspar Mazzotti	COMMS IMAX	Wild Pacific Media
34.	Jon Shaw	COMMS IMAX	Wild Pacific Media
35.	Emily Jateff	COMMS	ANMM
36.	Rhiannon Shine	COMMS Journalist	ABC News


Marine Crew

Name	Role
John Highton	Master
Roderick Quinn	Chief Mate
James Hokin	Second Mate
Andrew Roebuck	Third Mate
Christopher Minness	Chief Engineer
Mark Ellicott	First Engineer
Ian McDonald	Second Engineer
Ryan Agnew	Third Engineer
John Curran	Electrical Engineer
Gary Hall	Chief Caterer
Emma Lade	Caterer
Adrian Hughes	Chief Cook
Paul Stanley	Cook
Jonathon Lumb	Chief Integrated Rating
Kel Lewis	Integrated Rating
Ryan Drennan	Integrated Rating
Christopher Dorling	Integrated Rating
Darren Capon	Integrated Rating
Murray Lord	Integrated Rating
Matthew McNeill	Integrated Rating

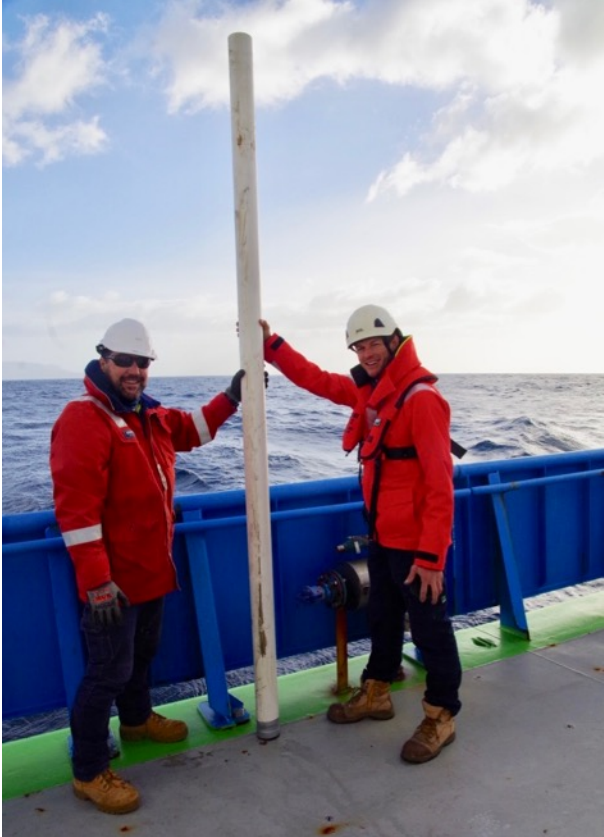
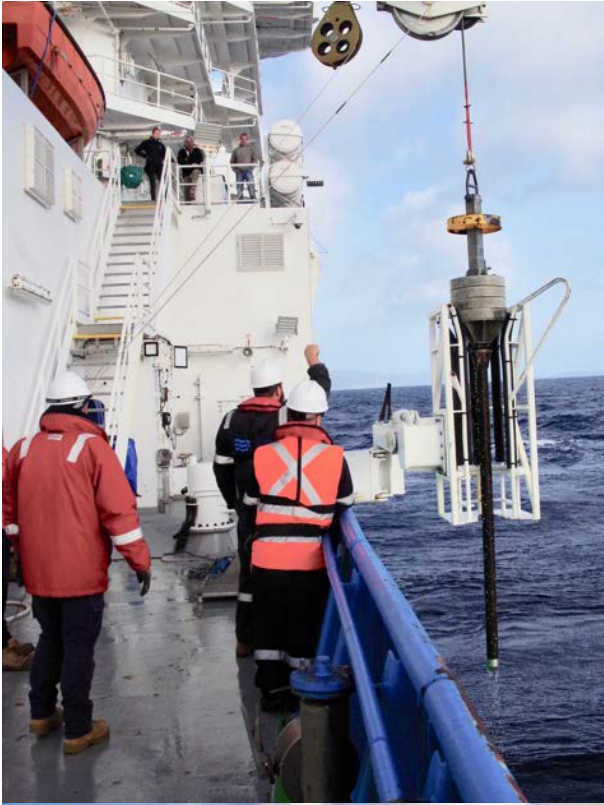
Acknowledgements

The processing of the deep sediment cores is supported by Australia Research Council Discovery Grant DP17010226.

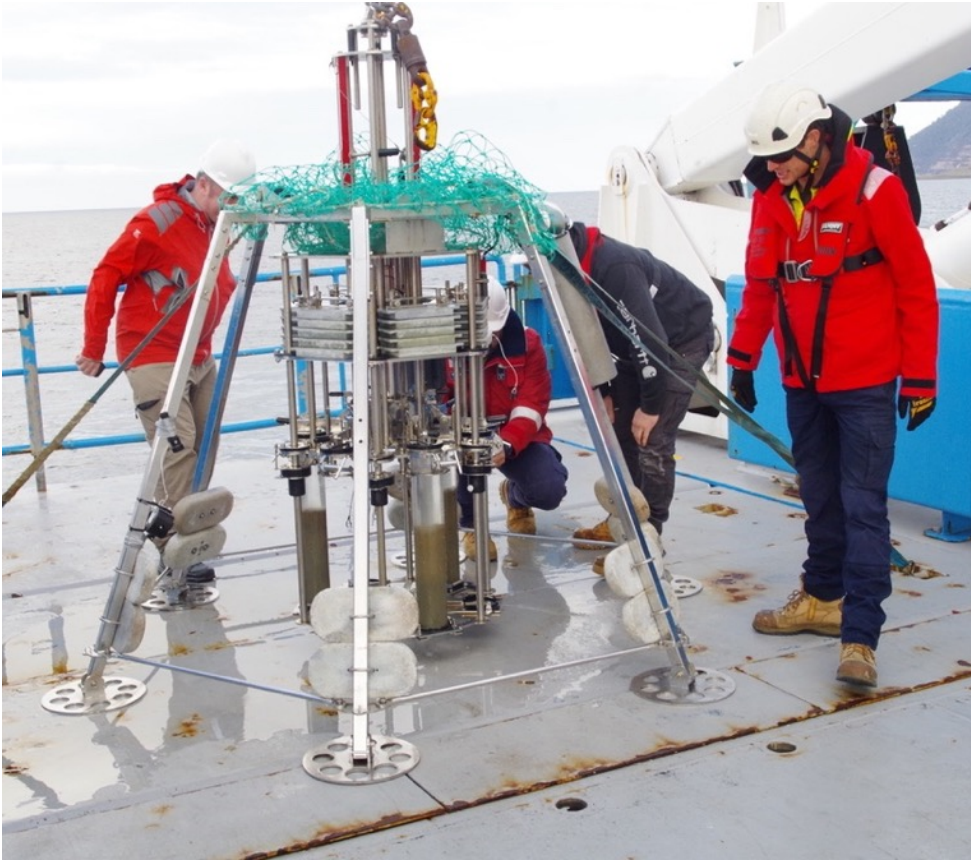
Signature

Your name	Prof Gustaaf Hallegraeff
Title	Chief Scientist
Signature	
Date:	10 June 2018

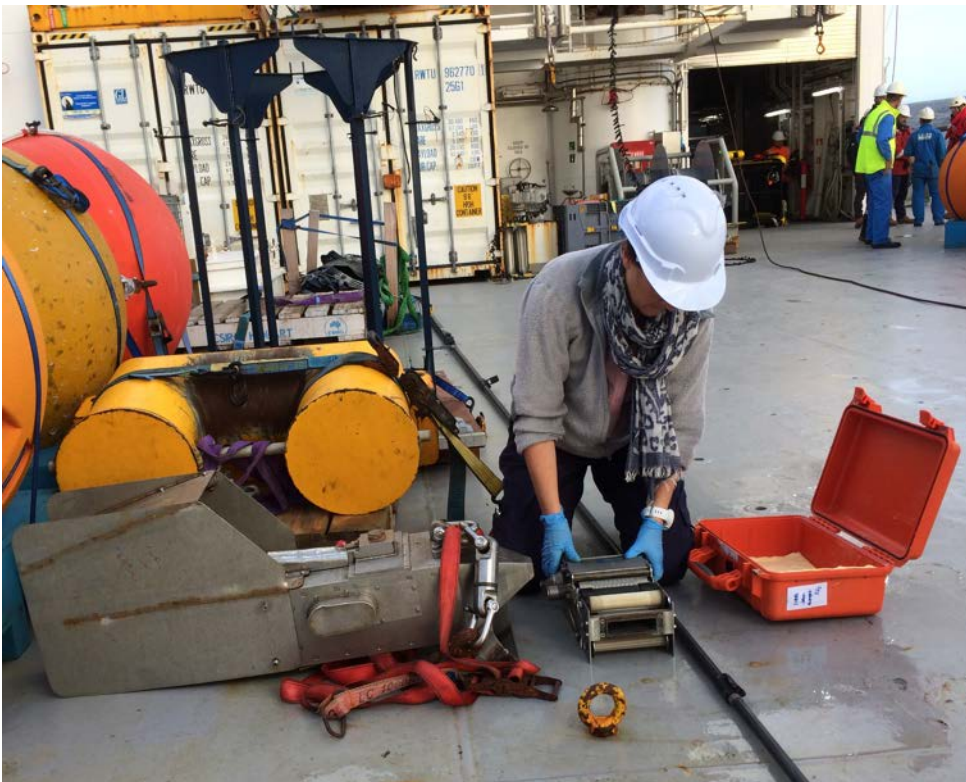
Appendix A – Additional Photographs



Successful 3m long gravity core collected from offshore Maria Island, estimated to represent 2000 years of plankton microfossils (Photos: G Hallegraeff)



Multicorer samples collected from Mercury Passage, Maria Island (Photo: G Hallegræff)



Continuous Plankton Recorder being retrieved by Ruth Eriksen (Photo: G Hallegræff)