RV *Investigator* Voyage Summary

Voyage #:	**IN2018_V06**		
Voyage title:	Status and recovery of deep-sea coral communities on seamounts in iconic Australian marine reserves		
Mobilisation:	Hobart, Thursday 22 November 2018		
Depart: Leg 1	08:00 Hobart, Friday 23 November 2018		
Leg 1 ends / Leg 2 begins:	10:00 Southport, 5 December 2018		
Leg 2 ends / Leg 3 begins:	10:00 St Helens Point, 14 December 2018		
Return:	08:00 Hobart, Wednesday, 19 December 2018		
Demobilisation:	Hobart, Wednesday, 19 December 2018		
Voyage Manager:	Max McGuire	Contact details:	max.mcguire@csiro.au
Chief Scientist:	Dr Alan Williams		
Affiliation:	CSIRO	Contact details:	alan.williams@csiro.au
Principal Investigators:	Dr Nic Bax (CSIRO), Dr Malcolm Clark (NIWA), Dr Thomas Schlacher (USC)		
Supplementary Project:	Spatial and temporal variability in the distribution and abundance of seabirds		
Affiliation:	Dr Eric Woehler Birdlife Australia / UTAS	Contact details:	eric.woehler@gmail.com

PART B -VOYAGE SUMMARY

Voyage Summary

Objectives and brief narrative of voyage

Australia has gazetted an ambitious national network of Australian Marine Parks that includes the iconic 'Huon' and 'Tasman Fracture' parks off southern Tasmania where seamounts ('undersea mountains') support unique deep-sea coral reefs. These reefs rank among the most bio-diverse globally.

Protection of deep-water coral reefs is a high-priority conservation concern nationally and internationally because deep-water corals are very fragile, easily impacted by human activities including bottom trawling, and are believed to recover very slowly. These corals may also be highly vulnerable to climate change because projected changes in water chemistry could limit the ability of corals to build calcareous skeletons.

Despite these concerns, and Australia's significant investment in marine conservation, several fundamental ecological issues remain to be evaluated. These include defining the spatial extent of deep-sea coral communities inside and outside the Tasmanian parks, and evaluating the resilience of the communities to bottom trawling. This information is important to understanding the dynamics of deep-sea communities globally, and for developing and implementing conservation management plans.

Investigator voyage V06 aimed to determine the spatial extents of deep-sea coral communities in, and adjacent to, the Huon and Tasman Fracture parks, and quantify changes in the communities by comparing samples taken in 2018 to samples taken, using similar methods on the same seamounts, in 2007 and 1997. The second aim ('recovery') was supported by additional sampling on the heavily trawled St. Helens Seamount which was surveyed in 2008. Interpretation of these data will be given additional context through analysis of a comparable data set from New Zealand. Remarkably, these are the only two sets of replicated surveys encompassing areas of contrasting conservation status and impact history in the world's oceans.

The final results will be novel and significant by providing world-first recovery and resilience data to the Australian government and other national and international bodies. The results will help achieve effective monitoring and management actions to enhance the long-term survival probabilities of deep-sea corals.

Scientific objectives

Our proposed research on Australian and New Zealand seamounts addresses international biodiversity management research priorities (e.g. CBD 2015-053) by providing data on recovery trajectories of deep-sea coral communities following direct human (trawling) impacts.

The distributional extent, habitat associations, composition, biodiversity, and biological traits of deep-sea coral communities off Tasmania, both inside and outside the Huon and Tasman Fracture marine parks, will be determined and mapped for the first time. This information will contribute to a

status report on coral communities and provide context for the recovery study. The status report and an understanding of changes in coral communities through time will inform future planning by the Australian and other management agencies to monitor and manage deep-sea coral reefs as conservation assets. Our results also have international relevance to understanding and managing fishing impact on comparable deep-sea coral communities, including in High Sea areas beyond national jurisdictions.

New data will be combined with previous surveys of the seamounts in the Huon and Tasman Fracture marine parks in 1997 and 2007, the St. Helens Seamount in 2008, and parallel New Zealand studies in 2001, 2006, 2009 and 2015, to address three broad objectives:

1. Determine the extent, ecological characteristics, and conservation status of deep-sea coral reefs on Tasmanian seamounts inside and outside of existing reserves.

2. Measure recovery trajectories and dynamics of deep-sea coral communities (multi-species and successional changes) following cessation of bottom trawling.

3. Provide the first set of empirical data on conservation status, resilience and recovery potential to enhance management and conservation of deep-sea coral habitats nationally.

Voyage objectives

The voyage had two primary objectives

1. Tow camera survey for baseline predictive mapping of coral community distribution

2. Tow camera survey of previously sampled seamounts to evaluate recovery

Additional objectives

A variety of other samples were taken to support Objectives 1 and 2 (drop camera and baited video imagery, water chemistry, and biological collections). As well, an extensive Communications Plan was implemented.

The voyage focussed primarily on surveys of seamounts at mid-slope depths (~500-2000 m) within and immediately adjacent to the Huon and Tasman Fracture Commonwealth Marine Reserves off southern Tasmania (Figure 1), and on the St Helens Seamount on Tasmania's east coast. Towed camera transects were the most important and numerous operations undertaken, and were complemented with CTD sampling of water chemistry, static camera drops for very close and high resolution imagery of settlement plates, and beam trawl collections of benthic fauna. There was also some targeted multi-beam sonar mapping of gaps in study area coverage. The DeepBRUVS baited-video samplers were deployed at several seamount locations. A line fishing operation (power reel and rod) was used to capture specimens of basketwork eels from the aggregation on the Patience Seamount.

Supplementary Project

Seabird and marine mammal observations – Dr Eric Woehler (BirdLife Australia)

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.

Piggy-back Project

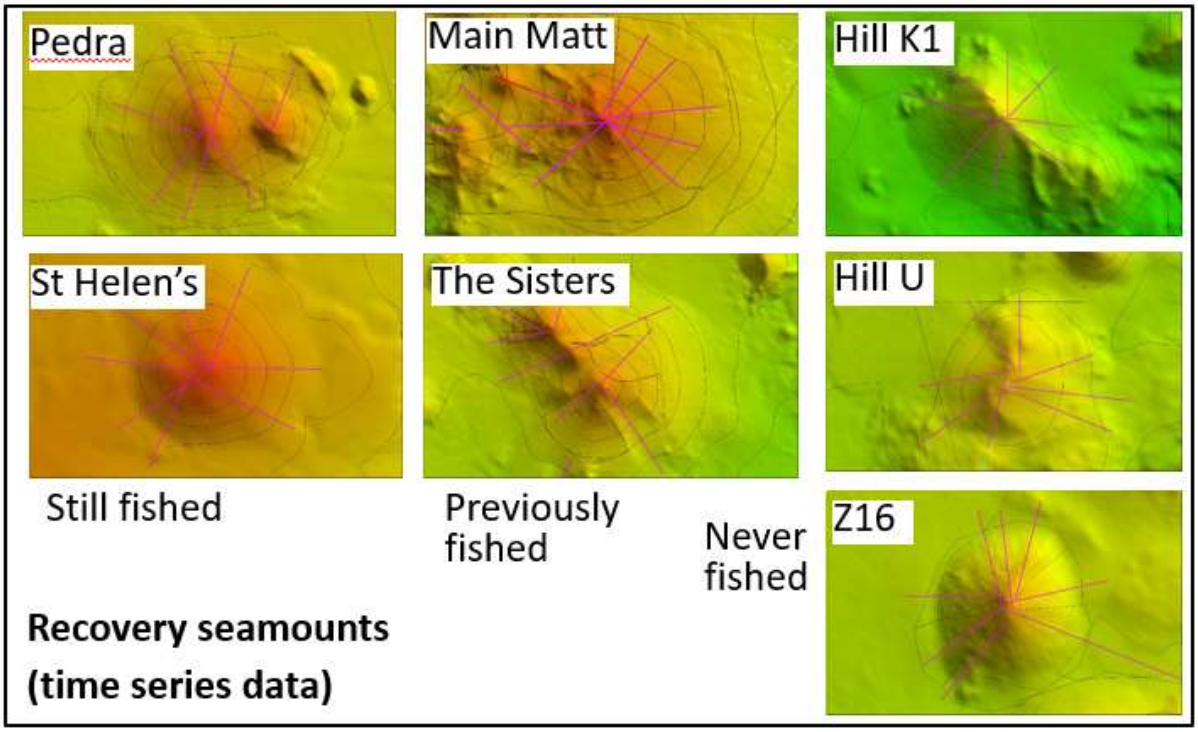
Bioacoustic experiments - Dr Rudy Kloser (CSIRO O&A)

Acquire bioacoustics data on orange roughy aggregations from seamounts that will be surveyed with camera tows, and sound absorption experiments at 38 kHz using a suspended glass spheres whilst the vessel is stationary.

Results

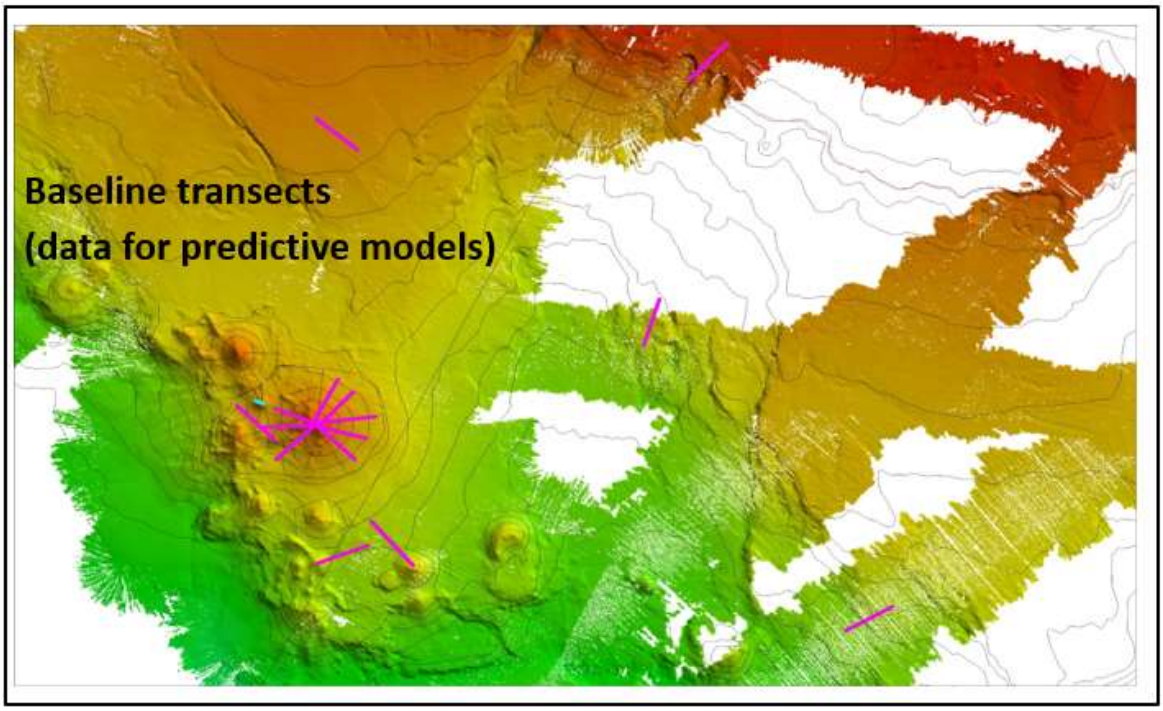
Objective 1: Repeat tow camera surveys of previously sampled seamounts

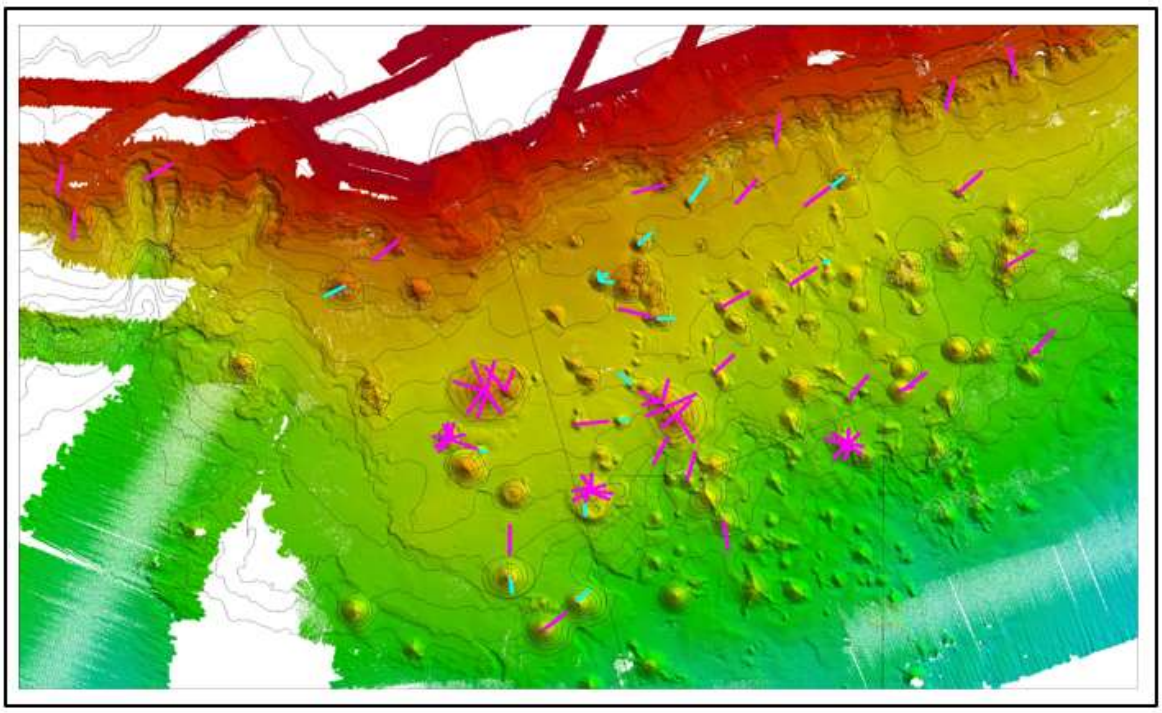
This objective was fully met with the completion of 8 successful transects on each of the seven target 'recovery' seamounts (pink lines in panels below; n=56, plus ~14 additional replicates with video data only). We will be able to detect recovery in seamount communities if it is occurring. In areas that were previously impacted by bottom trawling but are now protected, there are some apparent signs of change; these include higher abundances of both mobile fauna (e.g. urchins and feather-stars) and non-mobiles (anemones and small corals). These patterns were highly variable between seamounts, and interpretations will need to be confirmed by analysis of the data. All operations are list in Appendix A.



Objective 2: Tow camera surveys to ground-truth predictive maps of coral community distribution

This objective was fully met with the completion of 33 additional successful transects from the spatially-balanced randomised design (single pink lines in panels below), supplemented by 24 'ad hoc' (blue lines) (n=57, plus ~10 additional replicates with video data only). In combination (all transects), these data provide a very broad picture of megabenthos distribution in relation to environmental covariates. Assuming a total of ~140 transects with useable data and an average transect length of 1.5 km, this is a total of ~210 km of seabed filmed – that includes data from 33 seamounts. The collective data set, especially when added to pre-exiting data (35 transects and 11 additional seamounts), is very strong for predictively modelling deep-sea coral distributions.



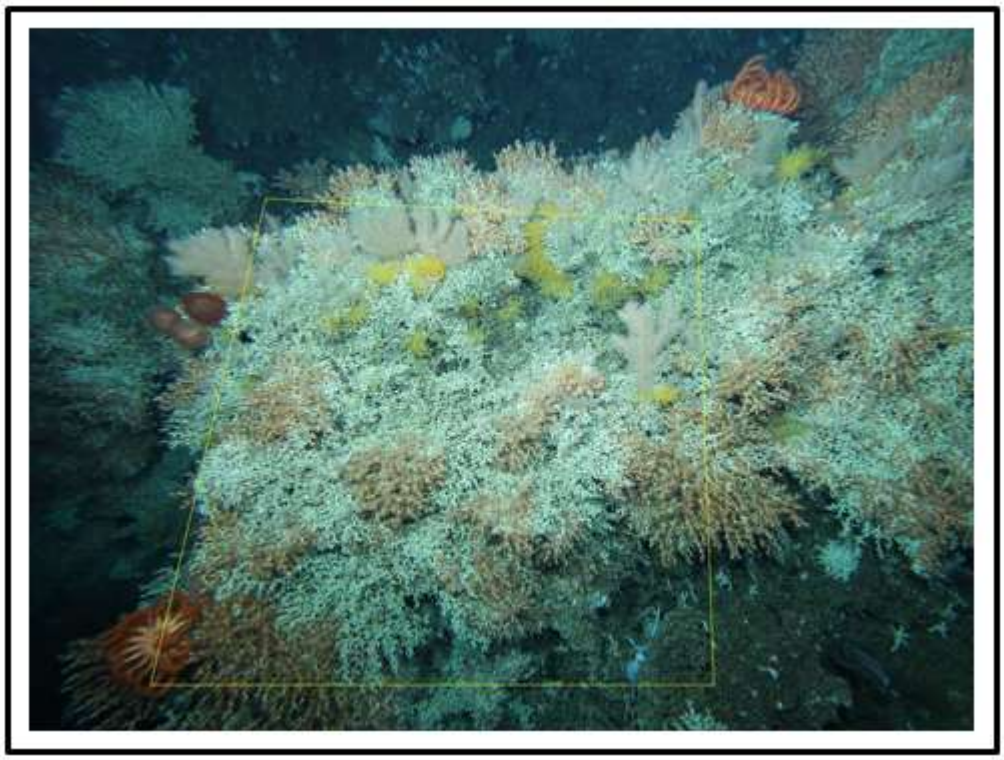


Additional objectives:

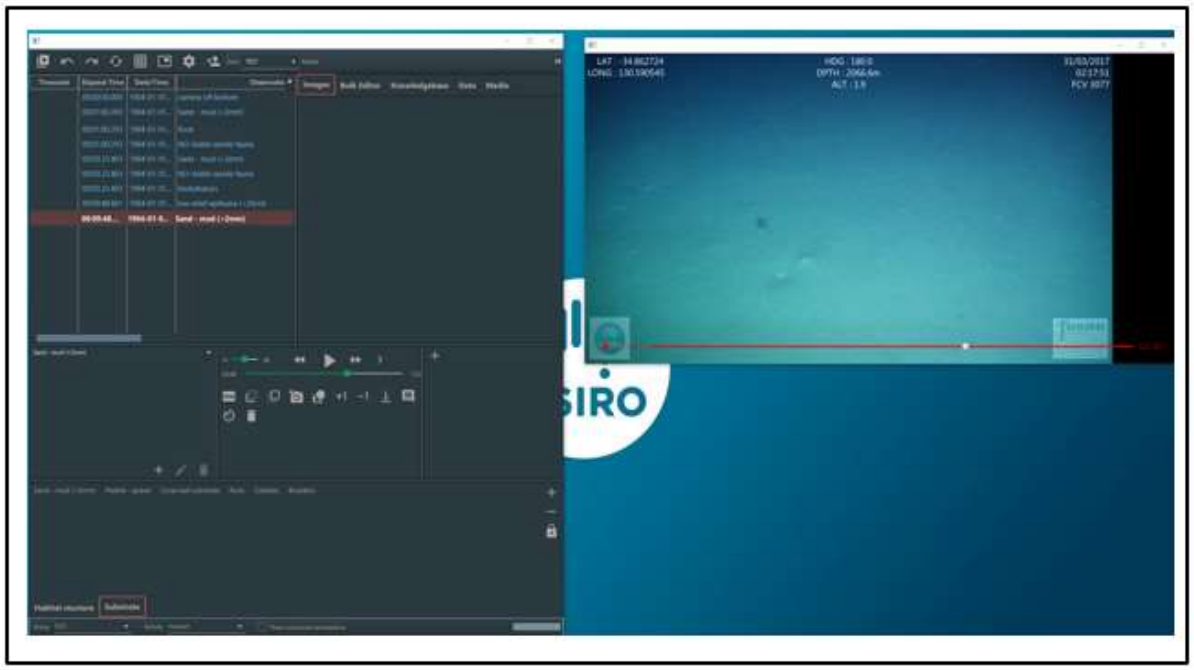
Image post-processing

Collectively, across camera transects completed for Objectives 1 and 2, a total of:

- 78 transects have quantitative quadrats of known area superimposed in high resolution still images (n= 4,241 image pairs) (37 operations remaining to do) – see panel below

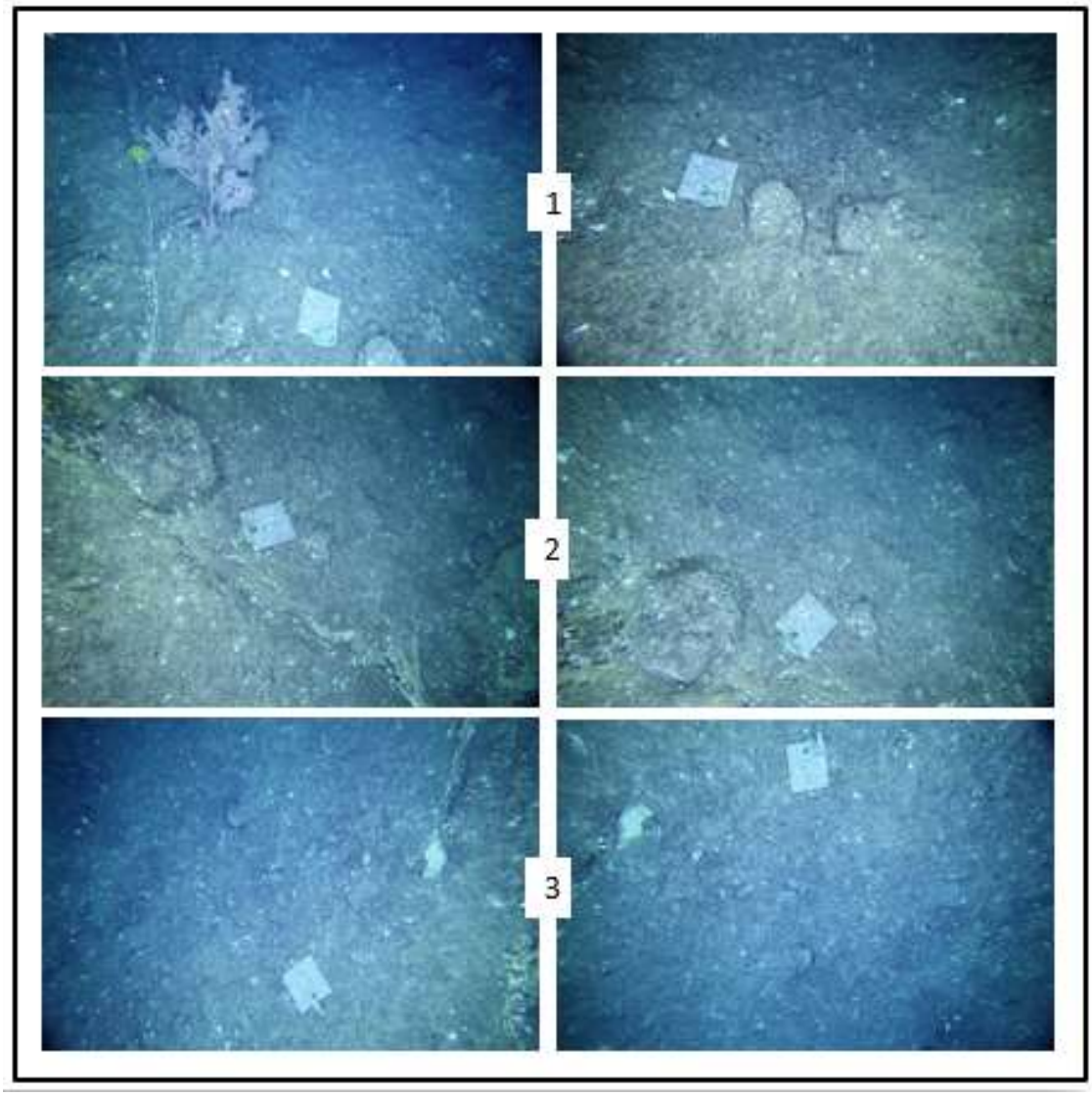


- 104 transects have initial ‘Substratum type’ and ‘Habitat type’ annotation of video in a relational image-based database (VARS) (9 remaining to do) – see panel below



Settlement plate inspection

This objective was sufficiently met with the successful inspection of three settlement plates (see panel below) on the Sister's Seamount. The MNF tow camera, configured for vertical deployment, was used to search for settlement plates deployed at ~990 m depth in 2008 by an ROV. There was a high level of uncertainty about our ability to relocate and inspect these plates without ROV capability given their small size (about 25 x 30 cm in size). No settlement at macroscopic (camera) inspection resolution was observed. The operations is listed in Appendix A.

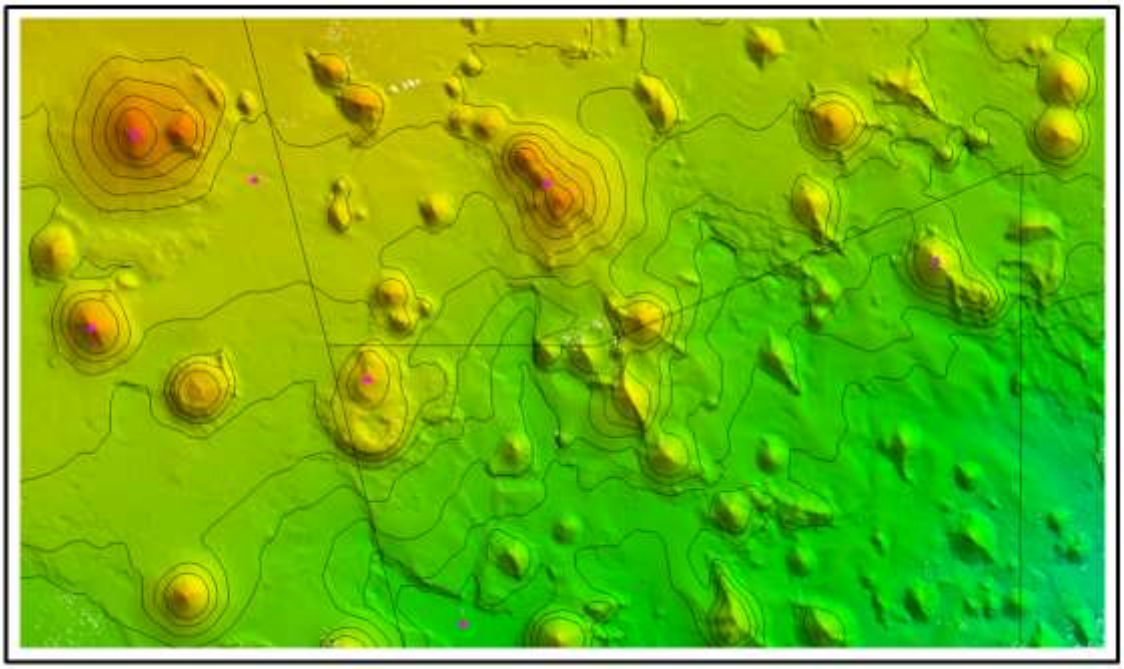


Baited video imagery

This objective was fully met with five deployments of the pair of DeepBRUVs landers, of which four were successful – in ~900 m depth on each of Sister's, Main Matt and Patience Seamounts, and the continental slope in the Freycinet Marine Park. This gear provides non-extractive data on fish community composition, but is still in the development stage. These deployments were designed to determine the difference between baiting options – one lander per pair with pilchard bait and lights, and the second lander with lights only. Many more individual fish were attracted to the pilchard baited lander, and fish species composition and abundance varied dramatically between locations. The panel below shows spiky oreos (*Neocyttus rhomboidalis*) at 895 m depth on Sister's seamount. All operations are list in Appendix A.

Water chemistry

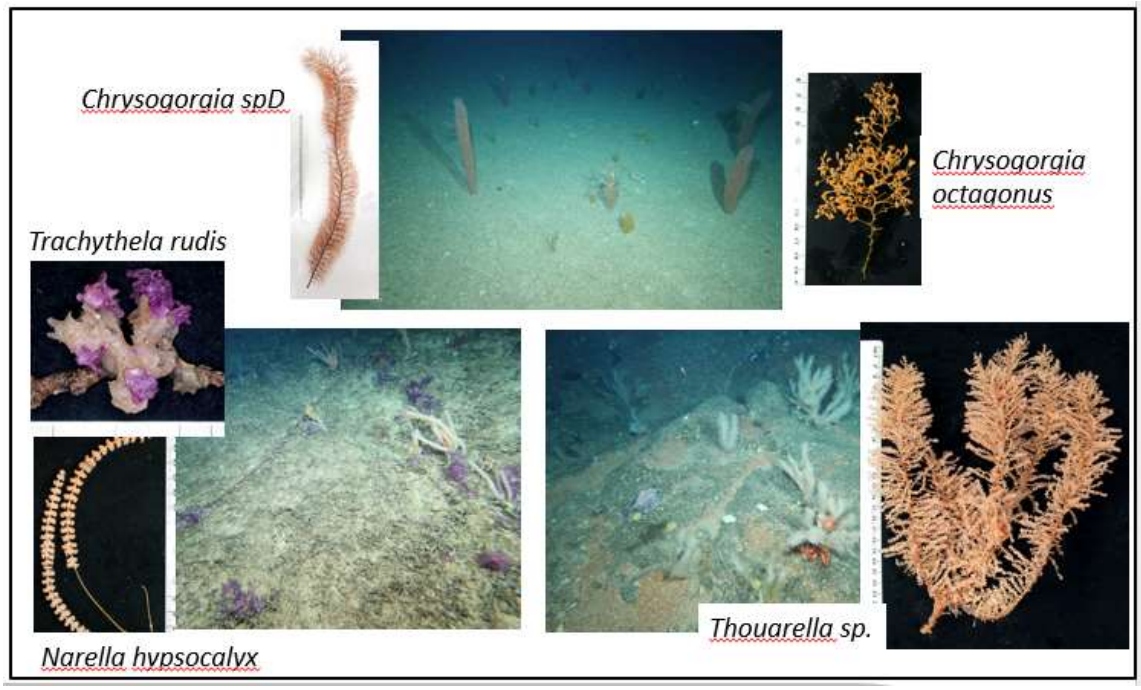
This objective was fully met with CTD casts to characterise water column properties over each of the seven recovery seamounts, plus two casts in ~2000 m depth for water bottle samples for carbonate chemistry and opportunistic eDNA analysis. Three additional casts were also made: a shallower carbonate chemistry sample adjacent to the Pedra Seamount, a calibration sample for the MNF hydrochemistry group, and a water column characterisation adjacent to Main Matt (total N=12). Seven CTD cast locations are shown in the panel below (pink markers); others were at Main Matt and St. Helen's seamount. All operations are list in Appendix A.

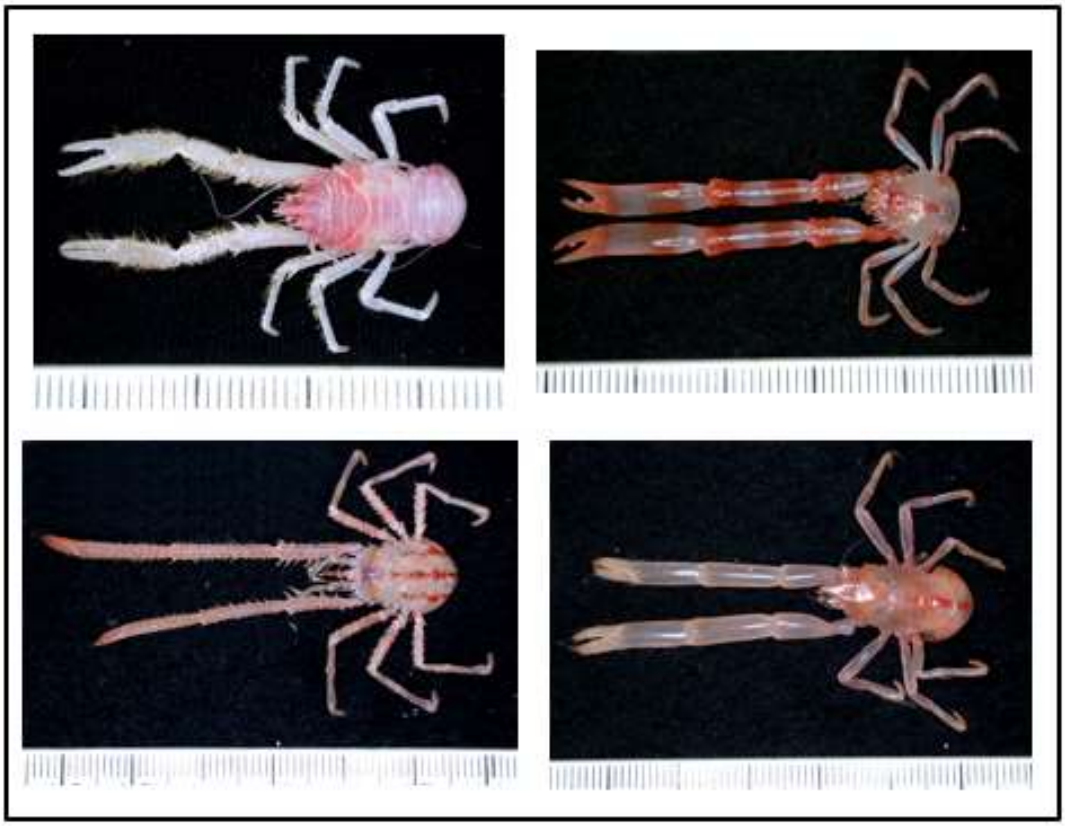


Biological collections

This objective was fully met with excellent samples of megabenthos collected by beam trawl, and basketwork eels caught by on the fishing rod. All operations are list in Appendix A.

1. Beam trawl: 14 samples over a range of depths and habitat types (mud, gravel and rock substrata) provided small to large samples of megabenthos and fishes. These collections provide in-hand specimens to compare with fauna identified in imagery (see coral examples in upper panel below), provide research materials for museum taxonomists, and contribute to faunal inventories for marine parks. Included in the high diversity of fauna identified (>528 Operational Taxonomic Units) were many species known from elsewhere in the Australian deep-sea but collected here for the first time, some new records for Australia, and some species are probably undescribed. Likely new species occurred in groups that are relatively well known in Australian waters, e.g. crustacea (see lower panel of squat lobsters below).



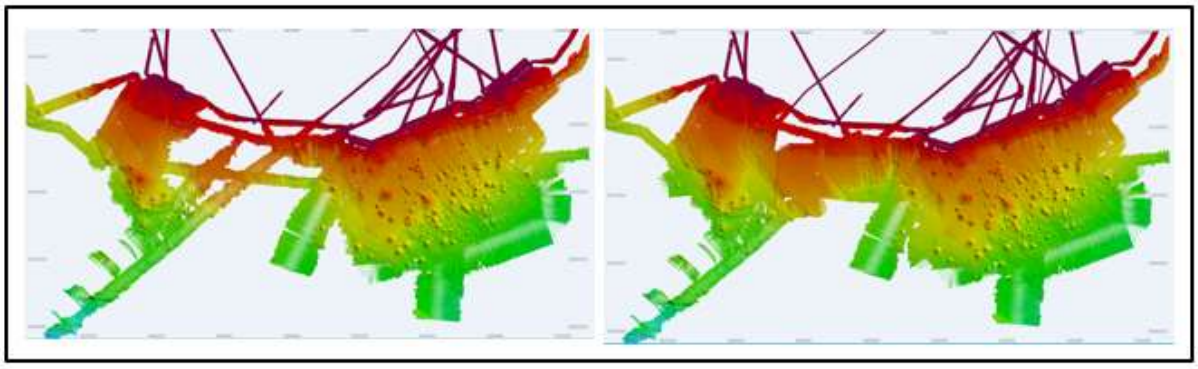


2. Fishing rod: 3 drops (2 operations) of baited hooks in depth from ~1,050 to 1,100 caught two eels. Whilst this is a small sample size, it was significant as both individuals were females with well developed (Stage 4) ovaries. The method was also very efficient, as each drop took less than one hour on average (including vessel positioning). Eels were much more abundant at Patience Seamount than any other location (as assessed visually from camera tows), but the aggregations was much smaller than previously seen in April 2015 (as assessed visually from echograms). In combination, these observations indicate a year-round concentration of eels at this location, perhaps with a gradual build-up in numbers and sexual development during summer months prior to spawning in spring. The panel shows the rod mounted on the starboard side of the ship, and a basketwork eel captured at 1,100 m depth.

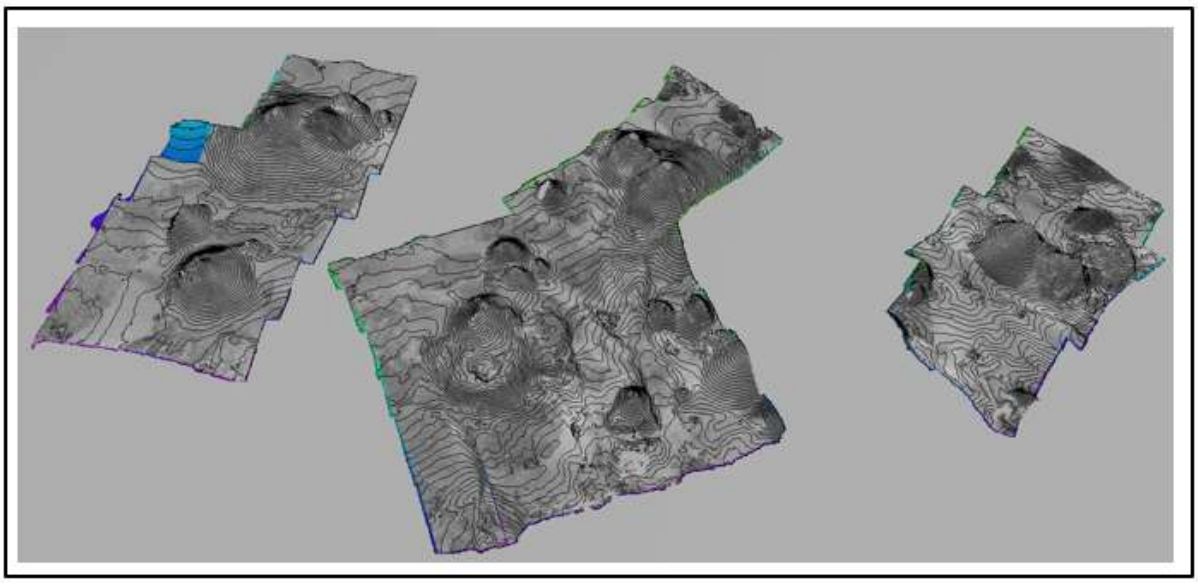
Mapping

The quantum of this objective was not defined, but excellent mapping products were produced – for two purposes:

1. Gap filling: this panel shows where additional 'background' mapping data were acquired to fill gaps in the pre-existing data (left panel) – the fill is mainly in the central part of the map.



2. Backscatter acquisition for the recovery seamounts: this panel shows the 'mini-maps' made for three of the recovery seamounts. The utility of backscatter as an environmental covariate to predict megabenthos distribution is unclear. We did not have the time to invest in a comprehensive mapping of the area, but instead chose to acquire data where the megabenthos ground-truth data are most dense – on the recovery seamounts, each of which was sampled along eight camera transects.



Communications plan

A formal Communication Plan was developed with the key stakeholders (CSIRO, the NESP Biodiversity Hub, the MNF, Parks Australia) (see Appendix B).

Outputs completed to date include the following – a full list is provided in Appendix C:

- A voyage website that featured 27 daily blogs: https://www.nespmarine.edu.au/seamounts/landing-page

- 4 social media videos (one example in panel below)
- 5 x 5 minute videos with Parks Australia
- A written story in the Conversation
- A post-voyage press conference and radio interview
- 7 minute film for Economist magazine 'Ocean Protector' series
- Livestreaming – 5,444 viewers

Measured **media coverage related to IN2018_V06** (from iSentia):

Media items*:	255
Audience reach:	1,091,745
Coverage:	National coverage via TV, radio, print and online
	International coverage via online

*Media items include TV, radio (AM/FM), online, blogs and print (newspaper) stories.

Supplementary Project

Seabird and marine mammal observations

Objectives were fully met. During a total of 390 observing hours, a collective total of over 61,000 sighting records were made of 44 bird species; 8 species of marine mammals were also recorded.

Piggy-back Project

Bioacoustic experiments

Objectives were fully met. A considerable volume of bioacoustics data was collected on seamount fish aggregations, and in many cases the species identification was confirmed by camera tows. Large aggregations of orange roughy were seen on the Pedra and Main Matt seamounts, and aggregations of spiky oreos in other locations. Sound absorption experiments at 38 kHz were successfully completed using the suspended glass sphere.

Voyage Narrative

The main areas of operation were off southern and eastern Tasmania, with sampling off the south coast focussed in, and adjacent to, the Huon and Tasman Fracture Marine Parks (see vessel track on page 21). Towed camera transects were the primary sampling activity as they addressed the two core science objectives; their locations dictated the entire operational plan of the ship – tactically, on a day-to-day basis, and strategically, for the duration of the voyage – and all other sampling was planned around them. Completion of the recovery transects on the six southern seamounts (see page 7) was the first priority. Careful adaptive planning in relation to changes in wind direction was needed to ensure that all the 'spokes' on the 'wagon wheel' design could be completed as frontal weather systems passed through the survey areas. This was because tow direction had to be 'head to wind' (+ about 20 degrees) so that the ship could hold its course at the slow (1 knot) towing speed required to collect high quality image data. This set of 48 recovery samples was achieved by day 15 (December 7). Effort then shifted to sampling the baseline transects in an order that recognised (1) the need of the statistical design for a contiguous sequence (block) of samples to give spatial balance, and (2) also accounted for the proximity of transects to maximise efficiency by minimising transit time. Additional 'ad hoc' samples were taken when opporunities arose to complete informative transects with high efficiency. Typically these were extensions of recovery and baseline transects where the camera system was 'hopped' a kilometer or so to separate seamounts or features without the need to bring it aboard. The sampling program off the south coast, which included 33 baseline transects, 18 ad hoc transects, some repeated recoverey transects and all other sample types, was completed by day 23 (December 15). We then steamed north to the St. Helens Seamount, dropping the DeepBRUVs landers on the way for retrieval on the final transit back to Hobart. Strong but variable winds enabled the full wagon wheel of recovery transects to be fully completed on St Helens, and five additional ad hoc transects were also completed. These were very valuable in terms of mapping coral distribution away from the main south coast survey area.

We experienced several problems with gear during the first week of the voyage, and to a lesser extent in week two – despite a thorough program of testing, maintenance and refurbishment ahead of the voyage. These were a combination of teething problems with new equipment (the complex tow camera platform and optical tow wire termination) some of which were generally anticipated; breakdown of old equipment (internal optical slip-ring bearing failure, frayed strands in tow wire) which were not predictable; and other unexpected issues (intermittemnt USBL beacon performance and failure of a critical computer). Despite these setbacks, very little time was lost and no objectives were compromised. This was due to the availability of spares, diligent and creative problem solving by support staff, careful and adaptive operational planning, and because there was a realistic time budget for contingencies in the voyage plan.

A complete and illustrated narrative of voyage operations, the people involved, and a detailed day-by-day narrative can be found on the voyage website (https://www.nespmarine.edu.au/seamounts/landing-page).

Summary

A total of 147 tow camera transects of 1 to 2 km length were completed during this voyage using a CSIRO-designed platform carrying calibrated, paired, hi-res stills cameras, HD video and a sensor suite. The transects were mostly over seamounts and rough bottom in 500-1900 m depths. The survey employed a spatially balanced transect design and statistically robust methods to sub-sample imagery and to develop metrics of abundance – primarily for corals and other megabenthos (VME

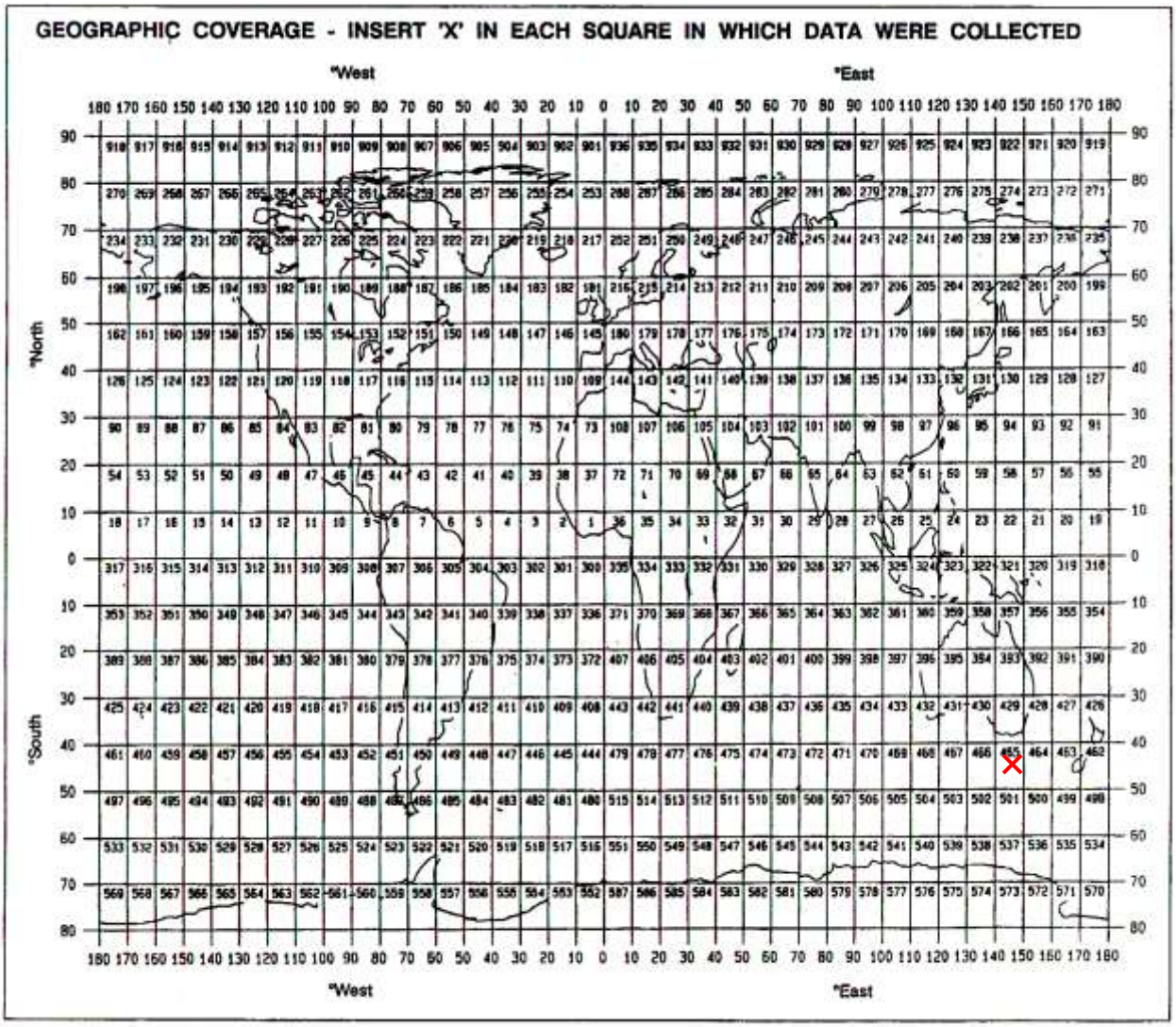
indicator taxa) for time-series analysis of community recovery, and modelling of predicted faunal distributions. Most of the immediate needs for managing the ~7Tb of image data, plus initial post-processing and integration with sensor data, was completed during the voyage. As well, a substantial amount of video image annotation was completed. Collectively, this represents a very significant technical achievement.

In addition, a wide variety of complementary data – biological inventories, water mass characterisation and settlement plate inspection – were acquired, and the needs of a Supplementary project (seabird observations), and a piggy-back project (acoustic sound absorption experiments), were met in full.

The high resolution image data collected will allow us to map the extent of globally-significant deep-sea coral reefs, and determine how much of the reef area lies within marine parks. Samples from seamounts that were previously sampled 10 and 20 years ago – some of which had been impacted by bottom trawling, and some of which are now protected in marine parks – will provide information on patterns of recovery of deep-sea coral reef communities. The high quality results from this voyage provide quantitative, non-extractive observational data on conservation status and recovery potential of deep-sea coral habitats that will enhance their management and conservation – nationally and internationally.

Marsden Squares

Move a **red "x"** into squares in which data was collected



Summary of Measurements and samples taken

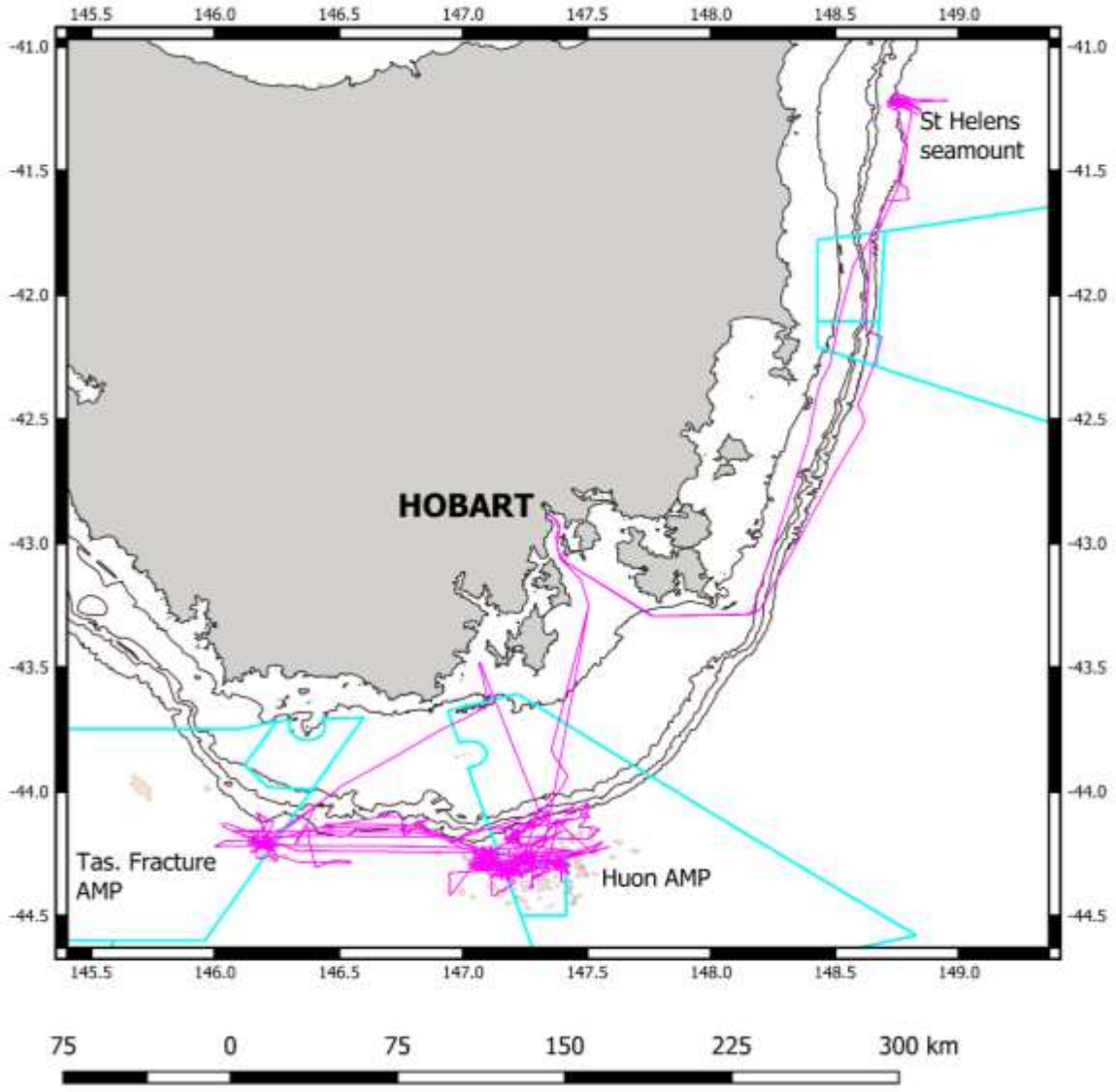
Item No.	PI see page above	NO see above	UNITS see above	DATA TYPE Enter code(s) from list at Appendix A	DESCRIPTION Identify, as appropriate, the nature of the data and of the instrumentation/sampling gear and list the parameters measured. Include any supplementary information that may be appropriate, e. g. vertical or horizontal profiles, depth horizons, continuous recording or discrete samples, etc. For samples taken for later analysis on shore, an indication should be given of the type of analysis planned, i.e. the purpose for which the samples were taken.
Tow camera	Williams	147	Transects	B18,B19, B20, B21, G08	CSIRO MRI Tow Camera – calibrated still image pairs + HD video collected along all transects together with sensor data including USBL geolocation to provide image data for assessment of corals and other megabenthos.
Drop camera	Williams	1	Deploy-ments	B90	MNF Tow Camera in vertical orientation provided image data from inspection of settlement plates.
Deep BRUVs	Williams	10	Deploy-ments	B19, D17	CSIRO MRI DeepBRUVs landers provided paired video data on fish community composition.
Beam trawl	Williams	14	Transects	B18,B19, B20, B21	Samples were collected opportunistically, and all fully processed on board. Large collections of well-conditioned specimens were retained and preserved for long-term curation in museum collections. Selected biological tissue sampling was undertaken for archival purposes.
Rod & line	Williams	3	Line drops	B19, B90	Specimens of the basketwork eel were collected to assess reproductive state.
CTD	Williams	12	Casts	H10	Water column characterisation based on temperature, salinity, dissolved oxygen, nutrients (nitrate, phosphate, silicate, nitrite, ammonia), fluorescence (Chelsea Aquatracka III - 430/685nm), irradiance (PAR Biospherical QCP-2300), and ECO-triplet.
NISKIN	Williams	12	Casts	H09, H90	Bottle samples were taken for standard sensor calibrations. In addition, water samples for carbonate analysis were taken at 3 sites, and filtered samples for eDNA analysis at 2 sites.
Seabirds	Woehler	26	Observing days	B25	Observations using standard protocols
Marine mammals	Woehler	26	Observing days	B26	Observations using standard protocols
Multibeam acoustics	Williams	26	Logging days	G74	Simrad EM122 and 720 multibeam sounders were logging throughout the voyage.
Single beam acoustics	Kloser	26	Logging days	G73, B28, B64	Simrad EK60 bio-acoustic single beam echosounders recording continuously throughout the voyage at 18, 38, 70, 120, 200 and 333 kHz. Additionally,WBAT broadband, with 38 and 120 kHz transducers + camera

Curation Report

Item #	DESCRIPTION
1.	Megabenthos (invertebrates) : whole specimens and tissue samples recorded in on board database, and formally registered in collections of the Australian Museum, Museum Victoria and Tasmanian Museum and Art Gallery
2.	Megafauna (fishes) : formally registered in Australian Fish collection, CSIRO Hobart
3.	eDNA (Niskin) : CSIRO O&A, Western Australia

Track Chart

The vessel track for IN2018_V06 (pink line) shows the main areas of operation off southern Tasmania, in and adjacent to the Huon and Tasman Fracture Marine Parks; two inshore excursions to exchange some staff; and the northward excursion to the St. Helens Seamount in the final stage of the voyage.



Personnel List

	NAME	ORGANISATION	ROLE	Legs
1.	Alan Williams	CSIRO O&A	Chief Scientist	1, 2, 3
2.	Nic Bax	CSIRO O&A	PI (Communications)	1, 2, 3
3.	Malcolm Clark	NIWA, New Zealand	PI (Operations)	1, 2, 3
4.	Thomas Schlacher	University, Sunshine Coast	PI (Data products)	1
5.	Max McGuire	CSIRO MNF	Voyage Manager	1, 2, 3
6.	Aaron Tyndall	CSIRO MNF	SIT Support	1, 2, 3
7.	Ian McRobert	CSIRO MNF	SIT Support	1, 2, 3
8.	Dave Watts	CSIRO MNF	GSM Support	1, 2, 3
9.	Frances Cooke	CSIRO MNF	GSM Support	1, 2, 3
10.	Anoosh Sarraf	CSIRO MNF	DAP Support	1, 2, 3
11.	Karl Malakoff	CSIRO MNF	DAP Support	1, 2, 3
12.	Christine Rees	CSIRO MNF	Hydrochemistry	1, 2, 3
13.	Stephen Tibben	CSIRO MNF	Hydrochemistry	1, 2, 3
14.	Merinda McMahon	CSIRO MNF	Hydrochemistry	3
15.	Mark Lewis	CSIRO MNF	Field Operations	1, 2, 3
16.	Damian Pretyman	CSIRO MNF	Field Operations	1, 2, 3
17.	Andrew Terhell	Crow's Nest Media	Comms-videographer	1
18.	Fraser Johnston	Crow's Nest Media	Comms-videographer	2, 3
19.	Bethany Green	University of Tasmania	Comms - journalist	1, 2, 3
20.	Jeff Cordell	CSIRO O&A	Tow cam operations	2, 3
21.	Karl Forcey	CSIRO O&A	Tow cam operations	1, 2, 3
22.	Nick Mortimer	CSIRO O&A	Image data processing	1, 2
23.	Mark Green	CSIRO O&A	Image data lead	1, 2, 3
24.	Candice Untied	CSIRO O&A	Image data lead	1, 2, 3
25.	Karen Gowlett-Holmes	CSIRO O&A	Biodiversity lead	1, 2, 3
26.	Simon Grove	Tasmanian MAG	Biodiversity processing	1, 2, 3
27.	Kirrily Moore	Tasmanian MAG	Biodiversity processing	1, 2, 3
28.	Ricky Lee Erickson	Museum Victoria	Biodiversity processing	1
29.	Alexandra Weber	Museum Victoria	Biodiversity processing	1, 2, 3
30.	Ingo Burghardt	Australian Museum	Biodiversity processing	2, 3
31.	Laetitia Gunton	Australian Museum	Biodiversity processing	1
32.	Alison Miller	Australian Museum	Biodiversity processing	2, 3
33.	Francesco Criscione	Australian Museum	Biodiversity processing	1
34.	David Logan	Parks Australia	Image data annotation	2, 3
35.	Cath Sampson	Parks Australia	Image data annotation	1
36.	Cassie Layton	Parks Australia	Image data annotation	1
37.	Emily Harris	Parks Australia	Image data annotation	3
38.	Gemma Boyle	Parks Australia	Image data annotation	2
39.	Jason Mundy	Parks Australia	Science policy	3
40.	Rudy Kloser	CSIRO O&A	Single beam acoustics	1
41.	Ben Scoulding	CSIRO O&A	Single beam acoustics	1
42.	Eric Woehler	BirdLife Australia	Seabird observations	1, 2, 3
43.	Zara King	BirdLife Australia	Seabird observations	1, 2, 3
44.	Alice Forrest	BirdLife Australia	Seabird observations	1, 2, 3
45.	Jan Jansen	University of Tasmania	Spatial modelling	1
46.	Nick Johannsohn	University of Tasmania	Backscatter data processing	2, 3
47.	Kylie Maguire	Southern Cross University	Image data annotation	1, 2, 3

48.	Tiffany Sih	James Cook University	Image data annotation	1, 2, 3

Marine Crew

Name	Role
Adrian Koolhof	Master
Andrew Robuck	Chief Mate
James Hokin	Second Mate
Sam Edwards	Third Mate
Chris Minness	Chief Engineer
Sam Benson	First Engineer
Mike Sinclair	Second Engineer
Damien Wright	Third Engineer
Shane Kromkamp	Electrical Engineer
Gary Hall	Chief Caterer
Kyra Lade	Caterer
Adrian Hughes	Chief Cook
Paul Stanley	Cook
James Hogg	Chief Integrated Rating
Matt Schmierer	Integrated Rating
Rod Langham	Integrated Rating
Dan Morse	Integrated Rating
Peter Taylor	Integrated Rating
Dennis Bassi	Integrated Rating
Paul Langford	Integrated Rating

Acknowledgements

Planning, preparing and implementing a technically demanding and operationally complex voyage such as IN2018-V06 requires specialist input, enthusiasm and stamina from a great number of people. On behalf of myself and the other PIs – Nic, Malcolm and Thomas – I would like to acknowledge the many scientists, technical and administrative support staff, and the officers and crew of the RV Investigator for the multitude of high quality and timely inputs provided to us. Sixty-four of you are named individually in the tables above, but we wish to also acknowledge a few people not already listed:

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Dave Kruze (CSIRO) and Pennicott Wilderness Journeys who helped with the efficient and safe transfer of some staff to and from the vessel at the ends of Legs 1 and 2.

Signature

Your name	Alan Williams
Title	Chief Scientist
Signature	
Date:	January 29th 2019

List of additional figures and documents

Appendix A List of operations

Appendix B Communication Plan

Appendix C Communication activities and products

Appendix A List of operations

Opera-tion no.	Station name	Type	Gear	Deploy-ment UTC Date-Time	Deploy-ment Ship Lat	Deploy-ment Ship Long	Deploym ent Depth under ship (m)
1	TEST	Photo	MRITC	23/11/2018 04:58	-43.8422	147.3612	466
2	TEST	Photo	MRITC	23/11/2018 16:58			
3	TEST	Photo	MRITC	23/11/2018 17:46			
4	Pedra R_05	Photo	MRITC	23/11/2018 11:09	-44.2495	147.0875	1061
5	Pedra L_02	Photo	MRITC	23/11/2018 15:00	-44.2503	147.1042	1004
6	Pedra R_03	Photo	MRITC	23/11/2018 18:10	-44.251	147.1038	998
7	Deep west of Pedra	Bentho s	BeamT W	24/11/2018 03:09	-44.3372	146.944	1731
8	Z16 R_01	Photo	MRITC	24/11/2018 07:31	-44.2873	147.053	1433
9	Ad hoc - mound of Z16 R_01	Photo	MRITC	24/11/2018 09:19	-44.301	147.1005	1405
10	Hill U R_01	Photo	MRITC	24/11/2018 12:32	-44.3213	147.1723	1372
11	Flat SE of Pedra	Bentho s	BeamT W	24/11/2018 16:11	-44.2913	147.1018	1355
12	Hill U L-04	Photo	MRITC	24/11/2018 22:24	-44.3213	147.1605	1488
13	Hill U L_03	Photo	MRITC	25/11/2018 01:27	-44.3108	147.1852	1426
14	Ad hoc Hill U L-03 extension	Photo	MRITC	25/11/2018 02:34	-44.3407	147.1802	0

15	Pedra R_03	Photo	MRITC	25/11/2018 04:51	-44.2563	147.0997	809
16	Pedra L_02	Photo	MRITC	25/11/2018 09:24	-44.2558	147.0988	778
17	Pedra southern flank	Photo	BeamTW	25/11/2018 11:00	-44.2645	147.0928	920
18	Central Area test	Photo	MRITC	25/11/2018 17:10	-44.1345	146.4488	892
19	Pedra L_02	Photo	MRITC	25/11/2018 22:00	-44.253	147.1008	892
20	Z16 L_01	Photo	MRITC	25/11/2018 23:54	-44.2995	147.0582	1507
21	Hill Z 16 R_11	Photo	MRITC	26/11/2018 01:41	-44.2913	147.0573	1439
22	Pedra L_02	Photo	MRITC	26/11/2018 03:50	-44.257	147.0978	736
23	Z16 R_08	Photo	MRITC	26/11/2018 05:05	-44.2778	147.0792	1314
24	Z16 R_09	Photo	MRITC	26/11/2018 07:55	-44.2943	147.067	1177
25	Pedra R_04	Photo	MRITC	26/11/2018 09:43	-44.2633	147.0963	787
26	Mongrel L-01	Photo	MRITC	26/11/2018 12:10	-44.2628	147.117	899
27	Pedra R_07	Photo	MRITC	26/11/2018 14:46	-44.2558	147.0948	788
28	Mongrel L_02	Photo	MRITC	26/11/2018 17:28	-44.2557	147.1143	830
29	Mongrel L_02	Photo	MRITC	26/11/2018 19:24	-44.2618	147.111	860
30	HillU_R02	Photo	MRITC	26/11/2018 21:36	-44.3265	147.1832	1198
31	Hill U R_02	Photo	MRITC	26/11/2018 22:49	-44.3282	147.1783	1222
32	Hill U R_06	Photo	MRITC	27/11/2018 00:57	-44.3245	147.1747	1227
33	Acoustic sound absorption	CTD Cast	EK60	27/11/2018 03:12	-44.296	147.2338	1469
34	Acoustic sound absorption	CTD Cast	EK60	27/11/2018 05:33	-44.2938	147.237	0
35	Hill U Recovery Seamount	CTD Cast	CTD	27/11/2018 18:41	-44.3215	147.1803	1083

36	Sisters Recovery Seamount	CTD Cast	CTD	27/11/2018 21:17	-44.2655	147.2393	821
37	Central north 1000m	Benthos	BeamTW	27/11/2018 23:24	-44.1512	147.1745	987
38	Pedra summit	CTD Cast	CTD	28/11/2018 04:02	-44.2602	147.0972	712
39	Pedra southern flank	CTD Cast	CTD	28/11/2018 07:03	-44.2725	147.1285	1329
40	Pedra L_01	Photo	MRITC	28/11/2018 08:58	-44.265	147.1122	1027
41	Z16 R_06	Photo	MRITC	28/11/2018 12:40	-44.2888	147.0763	1371
42	Sisters_L03	Photo	MRITC	28/11/2018 15:35	-44.2802	147.2445	1038
43	Sisters R_10	Photo	MRITC	28/11/2018 18:18	-44.2677	147.2448	955
44	Sisters_R08	Photo	MRITC	28/11/2018 21:01	-44.2735	147.2332	1233
45	Hill K1 R_09	Photo	MRITC	29/11/2018 00:12	-44.2967	147.3818	1571
46	Sisters R_12	Photo	MRITC	29/11/2018 04:47	-44.2717	147.2373	1091
47	Sisters Bruvs site 2	Photo	dBRUVS	29/11/2018 09:07	-44.2698	147.243	895
48	Sisters Bruvs site 1	Photo	dBRUVS				
49	Hill Z16	CTD Cast	CTD	29/11/2018 18:34	-44.2905	147.0678	1015
50	HillK1	CTD Cast	CTD	29/11/2018 22:22	-44.2927	147.387	1231
51	Hill K1 L_03	Photo	MRITC	30/11/2018 01:50	-44.292	147.3758	1685
52	Hill K1 R_11	Photo	MRITC	30/11/2018 05:51	-44.2843	147.3885	1639
53	Hill K L_02	Photo	MRITC	30/11/2018 09:05	-44.296	147.3962	1555
54	Hill K1 R-12	Photo	MRITC	30/11/2018 12:37	-44.2948	147.3942	1468
55	Hill K1 L_01	Photo	MRITC	30/11/2018 15:25	-44.2873	147.394	1584
56	Sisters L04	Photo	MRITC	30/11/2018 18:37	-44.2692	147.257	1145

57	Sisters L01	Photo	MRITC	30/11/2018 21:12	-44.2647	147.2457	1094
58	Sisters L02	Photo	MRITC	30/11/2018 23:53	-44.2682	147.246	932
59	Sisters L02	Photo	MRITC	01/12/2018 03:35	-44.2677	147.2457	988
60	Ad hoc Little Sister	Photo	MRITC	01/12/2018 04:54	-44.2547	147.2122	1120
61	Hill U L_02	Photo	MRITC	01/12/2018 07:33	-44.3203	147.1918	1335
62	Z16 R_12	Photo	MRITC	01/12/2018 10:43	-44.2805	147.0648	1413
63	Z16 R_10	Photo	MRITC	01/12/2018 12:33	-44.2963	147.069	1369
64	Z16 R_08	Photo	MRITC	01/12/2018 14:53	-44.285	147.0775	1364
65	HillU R05	Photo	MRITC	01/12/2018 17:46	-44.319	147.1918	1344
66	Hill U R03	Photo	MRITC	01/12/2018 20:06	-44.326	147.1923	1342
67	Sisters R09	Photo	MRITC	01/12/2018 22:39	-44.2678	147.2513	1087
68	HillK1_R10	Photo	MRITC	02/12/2018 01:56	-44.3002	147.3873	0
69	Mattsuyker	CTD Cast	CTD	02/12/2018 21:53	-44.1882	146.1547	724
70	Flat Matsuyker	Benthos	BeamTW	02/12/2018 23:54	-44.1718	146.1688	1198
71	Middle Sisters	Photo	dBRUVS	02/12/2018 05:24	-44.2708	147.2438	880
72	Middle Sisters	Photo	dBRUVS	02/12/2018 05:41	-44.27	147.242	931
73	Main Maatsuyker	CTD Cast	CTD	03/12/2018 19:15	-44.2148	146.191	624
74	East Maatsuyker flat	Benthos	BeamTW	03/12/2018 21:04	-44.2137	146.2755	1591
75	MainMatt_R08	Photo	MRITC	03/12/2018 23:41	-44.2145	146.2013	853
76	MainMatt R10	Photo	MRITC	04/12/2018 02:21	-44.2193	146.1995	890
77	Main Matt L_01	Photo	MRITC	04/12/2018 08:13	-44.2088	146.199	876

78	Main Matt L_01	Photo	MRITC	04/12/2018 10:30	-44.2092	146.2	888
79	Main Matt R_10 NEW	Photo	MRITC	04/12/2018 14:05	-44.2177	146.2015	896
80	West small Maatsuyker	Photo	MRITC	04/12/2018 15:36	-44.2028	146.1608	1039
81	Baseline_17	Photo	MRITC	05/12/2018 07:27	-44.282	147.2495	0
82	Hill K1_R07	Photo	MRITC	05/12/2018 10:48	-44.2883	147.3765	1699
83	MainMatt_L02	Photo	MRITC	05/12/2018 19:34	-44.215	146.1812	820
84	Main Maatsuyker L_04new	Photo	MRITC	05/12/2018 22:27	-44.2085	146.1828	875
85	Main Matt L_01	Photo	MRITC	06/12/2018 02:05	-44.2088	146.1995	884
86	Main Matt	Photo	dBRUVS	06/12/2018 05:05	-44.2145	146.2	810
87	Main Matt	Photo	dBRUVS	06/12/2018 05:31	-44.2133	146.2015	847
88	Main Matt R_04	Photo	MRITC	06/12/2018 07:08	-44.2127	146.1785	912
89	Main Matt R_07	Photo	MRITC	06/12/2018 09:40	-44.2198	146.1832	953
90	Baseline_14	Photo	MRITC	06/12/2018 12:45	-44.094	146.1812	911
91	Main Matt L03	Photo	MRITC	06/12/2018 15:27	-44.2163	146.1897	730
92	Main Matt R10new	Photo	MRITC	06/12/2018 18:31	-44.2182	146.202	910
93	Main Matt R10 knob	Photo	MRITC	06/12/2018 20:08	-44.205	146.1612	1062
94	Baseline_14	Benthos	BeamTW	06/12/2018 21:41	-44.1128	146.2143	988
95	Baseline_03	Photo	MRITC	07/12/2018 00:25	-44.2755	146.243	1566
96	South of Main Matt	CTD Cast	CTD	07/12/2018 03:07	-44.2315	146.1715	1209
97	Baseline_18	Photo	MRITC	07/12/2018 04:15	-44.2267	146.184	1066
98	Baseline_09	Photo	MRITC	07/12/2018 07:10	-44.27	146.1765	1563

99	Baseline_25	Photo	MRITC	07/12/2018 11:16	-44.2798	146.4693	1467
100	Baseline_04	Photo	MRITC	07/12/2018 14:30	-44.1518	146.377	1153
101	Baseline 21	Photo	MRITC	07/12/2018 17:56	-44.068	146.392	530
102	Monitor Hill	Benthos	Sled - Sherman	07/12/2018 22:07	-44.2105	146.1777	952
103	Baseline29	Photo	MRITC	08/12/2018 02:53	-44.105	146.6488	500
104	Ad hoc drop off end of #29	Photo	MRITC	08/12/2018 04:07	-44.094	146.6867	534
105	Baseline_29	Benthos	BeamTW	08/12/2018 05:15	-44.091	146.698	541
106	Baseline_13	Photo	MRITC	08/12/2018 07:15	-44.1073	146.761	464
107	Ad hoc - extend Baseline 13	Photo	MRITC	08/12/2018 08:26	-44.1357	146.7555	712
108	Baseline_24	Photo	MRITC	08/12/2018 09:28	-44.1348	146.7705	652
109	Baseline_16	Photo	MRITC	08/12/2018 12:21	-44.1113	146.8552	544
110	Pedra_R05	Photo	MRITC	08/12/2018 15:40	-44.2523	147.0913	979
111	Hill Z16 L01	Photo	MRITC	08/12/2018 17:45	-44.2857	147.0765	1373
112	R11 equivalent	Photo	MRITC	08/12/2018 18:56	-44.2793	147.078	1351
113	Hill Z16 L01	Photo	MRITC	08/12/2018 21:20	-44.2832	147.0755	1363
114	Hill Z16 R04	Photo	MRITC	08/12/2018 23:38	-44.2838	147.0598	1420
115	HillU_R05	Photo	MRITC	09/12/2018 01:54	-44.3195	147.1905	1335
116	HillU_R05	Photo	MRITC	09/12/2018 02:38	-44.3165	147.1858	1281
117	Hill U_R_05	Photo	MRITC	09/12/2018 05:31	-44.3258	147.1962	1456
118	Baseline_20	Photo	MRITC	09/12/2018 08:00	-44.2788	147.1625	1365
119	Ad hoc - Z20	Photo	MRITC	09/12/2018 09:36	-44.2763	147.2135	1388

120	Baseline_28	Photo	MRITC	09/12/2018 11:23	-44.3363	147.1172	1495
121	Ad hoc - Belinda's Dory Hill	Photo	MRITC	09/12/2018 12:49	-44.3792	147.1165	1046
122	Baseline_05	Photo	MRITC	09/12/2018 14:08	-44.4193	147.1278	1931
123	Baseline5adhoc	Photo	MRITC	09/12/2018 16:14	-44.3838	147.1803	1704
124	Hill Z16_R01	Photo	MRITC	09/12/2018 19:01	-44.2857	147.0547	1424
125	Hill Z16 R01	Photo	MRITC	09/12/2018 21:04	-44.2888	147.0583	1422
126	Mongrel deep	Benthos	Sled - Sherman	10/12/2018 00:35	-44.2598	147.1138	748
127	Baseline23	Photo	MRITC	10/12/2018 03:31	-44.2143	147.2425	1105
128	Ah hoc - Punch's Hill	Photo	MRITC	10/12/2018 05:42	-44.1772	147.189	1076
129	Baseline_01	Photo	MRITC	10/12/2018 07:00	-44.125	147.2548	941
130	Baseline_12	Photo	MRITC	10/12/2018 09:55	-44.1595	147.0347	593
131	Ad hoc - Andy's Hill	Photo	MRITC	10/12/2018 12:05	-44.1948	146.9717	938
132	Andy's Hill	Catch	BeamTW	10/12/2018 14:05	-44.1902	146.9927	901
133	Baseline27	Photo	MRITC	10/12/2018 17:17	-44.08	147.3417	731
134	Baseline07	Photo	MRITC	10/12/2018 20:01	-44.063	147.447	0
135	Baseline11	Photo	MRITC	10/12/2018 22:38	-44.0508	147.5043	819
136	Baseline11	Photo	MRITC	11/12/2018 01:22	-44.0522	147.5037	0
137	Ad hoc - Patience Seamount	Photo	MRITC	11/12/2018 04:05	-44.1165	147.395	1227
138	Baseline19	Photo	MRITC	11/12/2018 05:15	-44.1327	147.3672	1217
139	Patience Seamount	Catch	Dropline	11/12/2018 07:52	-44.1267	147.3845	1045
140	Patience Seamount	Photo	dBRUVS	11/12/2018 11:20	-44.1227	147.3845	887

141	Patience Seamount	Photo	dBRUVS	11/12/2018 11:28	-44.1217	147.3845	938
142	Sisters	Photo	Video - MNF	11/12/2018 13:20	-44.2655	147.2363	890
143	Baseline22	Photo	MRITC	11/12/2018 19:27	-44.2442	147.5278	1592
144	Baseline26	Photo	MRITC	11/12/2018 23:44	-44.263	147.4205	0
145	Baseline15	Photo	MRITC	12/12/2018 02:39	-44.2708	147.3825	0
146	Baseline10	Photo	MRITC	12/12/2018 05:43	-44.2575	147.2723	1448
147	Baseline_02	Photo	MRITC	12/12/2018 09:55	-44.1968	147.3313	1385
148	Ad hoc - Z96	Photo	MRITC	12/12/2018 11:42	-44.1708	147.3818	**1344**
149	Baseline08	Photo	MRITC	12/12/2018 13:24	-44.2117	147.2755	1334
150	Baseline30	Photo	MRITC	12/12/2018 16:36	-44.187	147.5085	0
151	Baseline06	Photo	MRITC	12/12/2018 19:28	-44.1408	147.4692	1379
152	Hill808adhoc	Photo	MRITC	12/12/2018 22:37	-44.142	147.2548	0
153	Hill808	Benthos	BeamTW	13/12/2018 01:20	-44.1433	147.2528	0
154	Baseline35	Photo	MRITC	13/12/2018 03:10	-44.1452	147.2918	1506
155	Ad hoc - Punch's Hill NE	Photo	MRITC	13/12/2018 06:06	-44.1957	147.1815	1139
156	Ad hoc - The Ridge	Photo	MRITC	13/12/2018 07:56	-44.159	147.2373	1139
157	Punch's Hill	Photo	BeamTW	13/12/2018 10:40	-44.1923	147.182	1124
158	Baseline31	Photo	MRITC	13/12/2018 13:13	-44.326	147.2558	1736
159	Southern deep ctd	CTD Cast	CTD	13/12/2018 18:53	-44.3862	147.2813	2128
160	Baseline46	Photo	MRITC	13/12/2018 21:51	-44.3497	147.2802	0
161	Baseline46	Photo	MRITC	13/12/2018 23:36	-44.3482	147.279	0

162	Patience Seamount	Photo	MRITC	14/12/2018 04:02	-44.1235	147.3712	0
163	Patience Seamount	Catch	Droplin e	14/12/2018 06:22	-44.1233	147.3913	1191
164	Baseline22 new	Photo	MRITC	14/12/2018 08:15	-44.237	147.5218	1815
165	Baseline26 new	Photo	MRITC	14/12/2018 11:14	-44.2637	147.4135	1639
166	Baseline08 new	Photo	MRITC	14/12/2018 14:10	-44.2118	147.2743	1329
167	Punch's Hill adhoc	Photo	MRITC	14/12/2018 17:20	-44.1895	147.1767	0
168	HillZ4 ad hoc tow	Photo	MRITC	14/12/2018 19:24	-44.2147	147.2237	0
169	Flat area south of Brians	Bentho s	BeamT W	14/12/2018 21:30	-44.2463	147.2835	1286
170	East coast Freycinet	Photo	dBRUV S	15/12/2018 20:48	-41.766	148.6482	905
171	East coast Freycinet	Photo	dBRUV S	15/12/2018 20:58	-41.7633	148.6483	891
172	StHelens_R05	Photo	MRITC	16/12/2018 00:29	-41.2265	148.7535	0
173	StHelens_L01	Photo	MRITC	16/12/2018 02:59	-41.2302	148.7442	902
174	StHelens_R01	Photo	MRITC	16/12/2018 05:07	-41.2357	148.7808	1092
175	St Helens Seamount	CTD Cast	CTD	16/12/2018 08:00	-41.2298	148.7602	593
176	St HelensR_03	Photo	MRITC	16/12/2018 09:07	-41.232	148.7738	931
177	StHelens_R02	Photo	MRITC	16/12/2018 11:47	-41.2398	148.7638	866
178	St Helens Seamount	Catch	BeamT W	16/12/2018 14:17	-41.2307	148.77	818
179	StHelens_R06	Photo	MRITC	16/12/2018 16:08	-41.2365	148.7728	0
180	St Helens deep	CTD Cast	CTD	16/12/2018 19:27	-41.2157	148.9522	2052
181	East StHelens	Photo	MRITC	16/12/2018 22:16	-41.2485	148.8373	1520
182	St Helens R07	Photo	MRITC	17/12/2018 00:20	-41.2283	148.7673	0

183	St Helens flat	Photo	MRITC	17/12/2018 02:48	-41.2133	148.8078	1251
184	St Helens flat	Catch	BeamTW	17/12/2018 05:04	-41.2123	148.806	1252
185	St Helens R_04	Photo	MRITC	17/12/2018 07:41	-41.2237	148.7648	809
186	St Helens L_01	Photo	MRITC	17/12/2018 13:40	-41.2293	148.746	884
187	PaddysHead_baseline01	Photo	MRITC	17/12/2018 17:34	-41.5432	148.7515	0
188	PaddysHead_baseline02	Photo	MRITC	17/12/2018 19:41	-41.5733	148.7925	1314
189	Freycinet Canyon	Photo	MRITC	18/12/2018 02:38	-42.1483	148.6318	0
190	Reidle Hill	Photo	MRITC	18/12/2018 06:38	-42.453	148.5943	1367

Appendix B Communications Plan

[This is a summary of the Plan that retains the key planning elements]

IN2018_V06: Status and recovery of deep-sea coral communities on seamounts in iconic Australian marine reserves

Communication plan, 18 November 2018

Aim

This plan is to provide a shared understanding of communication products, activities, timelines and responsibilities, to assist collaboration among the voyage participants and stakeholders.

The key participants and stakeholders are the Marine National Facility (MNF), CSIRO, Parks Australia (PA) and the NESP Marine Biodiversity Hub.

Voyage dates

Departure	Hobart, Friday 23 Nov 2018
Return	Hobart, Wednesday 19 Dec 2018
Small boat changeovers	5 Dec (Southport) and 15 Dec (Binalong Bay)

Voyage summary

The RV *Investigator* voyage will survey mid-slope (~700–2000 m depth) seamounts in and near the Australian Marine Parks - Huon Marine Park and Tasman Fracture Marine Park off southern Tasmania, and on St Helens Seamount off eastern Tasmania. If time allows, coral communities will also be surveyed at Big Horseshoe Canyon, Bass Strait, and Cascade Plateau off south-eastern Tasmania. The second and third legs of the voyage include the Freycinet Marine Park and the Flinders Marine Park.

The voyage builds on 1997 and 2007 seamount surveys conducted in the Huon and Tasman Fracture MPs, a 2008 survey at St Helens Seamount, plus parallel New Zealand studies in 2001, 2006, 2009 and 2015. It will be the most comprehensive mapping of deep coral habitats and biodiversity off Tasmania, in and out of these reserves, and the data will be

used to assess the status of deep-sea coral communities and their recovery from trawling, including multi-species and successional changes. Importantly the survey will attempt to establish the total coverage of deep-sea coral communities in this area, providing a better perspective on the importance of the iconic seamount communities.

Towed camera surveys will be conducted on previously sampled seamounts with known trawling histories:

- the large 'Sisters Seamount' (trawling ceased after 2003);
- the large seamount 'Pedra' (trawling still permitted);
- three seamounts, 'Hills U', 'K1' and 'Z16' (never trawled); and
- St Helens Seamount (heavily trawled).

These surveys will also 'ground-truth' predictive maps of coral community distributions prepared before the voyage. These maps predict where corals are likely to be present, based on whether an area is on or off seamounts, trawled or untrawled, and at certain depths ['shallow', 'deep', or 'very deep' (500, 1100, 1350, 2000 m]. Globally these predictive models overpredict where corals occur, and biological and physical data collected on this survey will be used to refine these models and hence global predictions.

Other survey activities will include CTD water chemistry sampling, static camera drops for close-up imagery, and biological collection with beam trawl and benthic sled. Gaps in the seabed mapping of the study area will be covered with the collection of multi-beam sonar data. DeepBRUVS baited-video samplers will be deployed at sites including the Patience Seamount (a basketwork eel spawning aggregation in the Huon MP), and potentially at Flinders Canyon. Line fishing (power reel and rod) will be used to sample basketwork eels at Patience Seamount. Patience seamount is the only deep sea spawning aggregation discovered for eels world-wide. Two ancillary projects will also be completed: an acoustic target strength study and acoustic transects over many seamounts will advance methods for estimating orange roughy populations, whilst seabird observations will be recorded throughout the voyage.

The new understanding of changes in coral communities through time will guide future planning by the Australian Government and globally to monitor and manage deep-sea coral reefs as conservation assets. The results will also be relevant to understanding and managing the effects of fishing on comparable deep-sea coral communities, including in High Seas areas beyond national jurisdiction.

Communication objectives

SHARED

- Ensure collaboration between voyage partners to ensure alignment of effort, consistency in messaging and successful delivery of desired communication approach.
- Ensure all voyage communications are accurate, reasonable and appropriate, and do not disadvantage any party (including ship operator).

- Document agreed approaches and processes. For example, branding, the approval of media releases, social media posts and other content, and the ownership and sharing of communication products such as images and video.
- Provide communication support for effective issues management in the event of voyage incidents or emergencies.

MNF

- Raise awareness within the general public of research enabled and benefit delivered by the CSIRO Marine National Facility and research vessel Investigator.
- During the voyage, pursue opportunities that arise to promote the science, scientists and ship via conventional media and CSIRO social media channels.
- Maintain oversight of communication products related to the voyage that are released into the public forum (before, during and after voyage) to ensure participants' privacy and confidentiality requirements are met, and desired voyage communications outcomes are achieved.

CSIRO

- Raise awareness of CSIRO as Australia's national science agency delivering scientific excellence in ocean research for the benefit of the nation.
- Promote CSIRO's capabilities in oceans research and state-of-the-art technologies to the general public, government, industry and stakeholders.
- Promote CSIRO as a trusted advisor and collaborator to the public, government, research organisations, industry and stakeholders.

Marine Biodiversity Hub

- Raise awareness (among public, and specific government and other stakeholders) of research conducted on the voyage, including its relevance to understanding Australian Marine Parks, and the benefits to Australia.
- Raise awareness (among public, and specific government and other stakeholders) of the Hub's role in supporting this research.
- Raise awareness of how research collaboration helps to build a national understanding of Australia's marine biodiversity.
- During the voyage, make timely, non-technical information publically available.
- Raise awareness of world-leading research being supported by the Hub.

Parks Australia

- Raise awareness (among public and marine park stakeholders) of the existence of Australian Marine Parks and the role they play in protecting Australia's marine biodiversity.

- Raise awareness (among public and marine park stakeholders) of the natural values within specific Australian Marine Parks (Huon, Tasman Fracture, Freycinet and Flinders) and pressures acting on them.
- Raise awareness that supporting science in Australian Marine Parks is a priority for Parks Australia and research outputs will inform future management of these parks.
- Highlight ways established AMP are effectively (a) protecting and conserving biodiversity and (b) supporting sustainable use.

Target groups

- General public, fishers (commercial and recreational), local Tasmanian communities, Department of the Environment and Energy)

Key messages

Marine National Facility

- *Investigator* is advanced world-class multi-disciplinary research vessel that delivers a flexible marine research capability to Australian marine researchers and their international collaborators.
- *Investigator* is operated by the Marine National Facility and is Australia's only dedicated blue-water research vessel.
- The Marine National Facility is a national facility funded by the Australian Government and operated by CSIRO on behalf of the nation.

CSIRO

- CSIRO, Australia's national science agency, is helping to uncover the secrets of the deep ocean by increasing our understanding of marine life and diversity on the seafloor.
- The state-of-the-art deep towed camera system, designed and fabricated by CSIRO, is enabling Australian scientists to better understand the potential impact of human activities on marine ecosystems in the deep ocean.
- CSIRO is working collaboratively with other leading research organisations to increase our knowledge of marine diversity, and how to protect it.

Parks Australia

- The network of Australian Marine Parks play a vital role in protecting Australia's offshore marine environments, including the deep ocean
- Australian Marine Parks are managed for the benefit of all Australians.
- The South-east Network of Marine Parks have been actively managed since 2013 and have delivered (a) improved understanding of these incredible offshore

environments, (b) positive biodiversity outcomes (coral recovery) and (c) local socio-economic benefits (OR used here?)

- Effective ocean management is achieved through the implementation of a series of complementary interventions which include offshore AMP, coastal MPA, world-class fisheries management and voluntary industry codes of practice.
- The key natural values of Huon, Tas Frac, Freycinet and Flinders are [deep, cold-water coral communities, seamounts, foraging grounds for Shy Albatross, etc] highlighted.
- Partnerships and science are key to good park management
- There is still a lot to learn about our ocean and science is key to providing this knowledge
- Protection of seamount habitats has ensured many areas supporting coral communities remain in pristine condition, and provides the opportunity to understand the trajectories of recovery in areas that have been impacted.

Note correct legal names for marine parks

- South-east Marine Parks Network
- Huon Marine Park
- Tasman Fracture Marine Park
- Freycinet Marine Park
- Flinders Marine Park

Marine Biodiversity Hub

- A cluster of more than 100 extinct volcanos or 'seamounts' south of Tasmania provides the nation's largest structure for extensive deep-sea coral habitats, that is also significant by world standards.
- The corals provide a scaffolding and shelter for diverse communities of marine life that are globally significant.
- This vertical structure or scaffolding is rare in the marine environment. Animals unlike trees do not put their roots down through sediment to attach to the earth and support a large structure, but must depend on a single point of attachment to exposed rock. In comparison they are smaller and less common than terrestrial scaffolding (biogenic habitat).
- Deep sea corals are fragile and long-lived. They are vulnerable to fishing, mining and climate change, and of conservation concern worldwide.
- Some of the seamounts, especially those at shallower depths, have been repeatedly fished and the coral communities under fishing tracks damaged, but some fished and unfished seamounts were set aside by industry and have since been protected in Australian Marine Parks.
- Little is known about the capacity of deep sea coral communities to recover from damage – there were no signs of recovery 10 years ago, which was 10 years post-fishing. This voyage will assess recovery 20 years post fishing.

- This voyage will map and assess the broader status of deep-sea coral habitats and communities inside and outside the Huon and Tasman Fracture reserves, on- and off- seamounts for the first time.
- The voyage will also study:
    - our ability to predict where coral communities will be;
    - the world's only known spawning aggregation of basketwork eels, and
    - provide a snapshot of the current distribution of orange roughy on the southern seamounts.
- New knowledge will be developed in collaboration with Parks Australia and be used to improve evidence-based decision making.
- Voyage results will be an important contribution to SOE 2021.
- New knowledge from the voyage will support management and conservation of deep sea corals worldwide, and inform deliberations at the Convention on Biodiversity, and negotiations for a new instrument under the United Nations Convention for the Law of the Sea for managing marine biodiversity beyond national jurisdiction.
- Leading edge technology will be used in the survey, including a new, purpose-built towed camera system. This will continue the development of improved imagery that can be communicated to the public to raise their awareness and hopefully appreciation of Australia's deep sea animals and coral reefs.

Media spokespeople

- Alan Williams, CSIRO
- Nic Bax, Marine Biodiversity Hub
- Jason Mundy, Parks Australia (media release, pre voyage, from ship during final leg of voyage?)
- David Logan and other willing Parks Australia staff (selected interviews, ie local ABC radio from ship)

Main communication activities and products

Details and timelines for the main activities and products are outlined below and will include:

- traditional media (media releases/media liaison);
- selected social media (by participants and collaborators);
- a suite of short documentary videos;
- livestream video from the ship when it is in marine parks (capability available for one week only: 3–9 December);
- daily blog (also serving to provide content for PA website);
- short video bites for websites, blog and social media;
- flythrough bathymetry maps;
- seamount illustrations;

- video clips and photos;
- imagery from sampling gear; and
- educational activities.

Communication channels

As well as traditional media, we will harness the social media channels of the voyage participants. Communication contacts from the various participating agencies will be updated.

Approvals/consultation/notification

General safeguards

- Key messaging will be approved pre-voyage
- Video outlines will be developed pre-voyage
- Blog schedule and some pre-voyage blogs will be developed pre-voyage
- Sign-off from MNF, CSIRO (chief scientist and communication advisor), Hub and PA required for media release
- Partners will be notified about media interviews

MNF requirements

All public information and media activities on or in conjunction with the voyage must be reviewed and approved by the MNF before the event. MNF will also ensure compliance with CSIRO media policy.

All voyage-related public communications must be passed through Matt Marrison, MNF Communications Advisor for review/approval before release and be copied to Max McGuire, Voyage Manager on IN2018_V06 for noting.

Parks Australia requirements

Media releases in conjunction with the voyage must be reviewed and approved by Parks Australia media team (parksmedia@environment.gov.au). Dissemination of day to day communication content and activities including blog and social media posts will be coordinated by Jane Alpine.

Keeping everyone 'in the loop'

Bryony will keep people informed of progress via email updates and updates to the communication plan. This will include the Hub, as well as key contact people from Parks Australia, CSIRO, MNF, [and other communication contacts from relevant participating organisations where appropriate].

Evaluation

- Media coverage
- Social media response and stats
- Positive feedback from stakeholders
- Provision of products required by Parks Australia

Appendix C Communication activities and products

- Cooperative planning and implementation between Parks Australia, the Marine National Facility and the Marine Biodiversity Hub ensured shared communication objectives, messaging, activities and products.
- A full-time communication coordinator was engaged and there was extensive liaison with and input from Parks Australia staff and the Marine National Facility.
- Two videographers (half voyage each) and a student presenter joined the voyage.
- Products and activities included:
    - traditional media (media releases/media liaison);
    - social media posts;
    - a suite of short documentary videos (in production):
        - Mapping and protection
        - Life in the matrix
        - Eyes on the seafloor
        - Reely deep fishing
        - Marine park manager perspective (by Dave Logan, PA).
- Video footage and interviews were conducted for a video to be produced by *The Economist* for their 'Protector' series.
- Video footage from the deckcam and deep-tow camera was livestreamed from the ship from approximately 5 December, supported by social media posts. The audience reached more than 5000.
- A daily blog (27 in all) was supported by scientists, onboard communicators and Parks Australia staff and will provide content/articles for the PA website.
- Four or five short videos were produced for social media.
- A 'flythrough' bathymetry video is being developed for Parks Australia.
- Seamount illustrations and will be developed for Parks Australia.
- Extensive video footage of on-deck operations and interviews is available for Parks Australia and other uses.
- An extensive collection of images (on-deck operations, people, specimens) is available.
- A collection of high-quality specimen images is being pitched to Australian Geographic.
- Parks Australia conducted educational activities with two local schools.

Measured **media coverage related to IN2018_V06** (from iSentia):

Media items*:	255
Audience reach:	1,091,745
Coverage:	National coverage via TV, radio, print and online
	International coverage via online

*Media items include TV, radio (AM/FM), online, blogs and print (newspaper) stories.

Coverage snapshot (items available online)

22 Dec 18 – Daily Mail: What in the world is THAT? More than 100 unknown sea creatures are found in the depths of the ocean off the coast of Australia

21 Dec 18 – Science Alert: Look at All These Insane Deep-Sea Creatures Scientists Just Found in Tasmania

21 Dec 18 – The New Daily: Tasmania's deep-sea coral reef: The marvel you never knew existed

21 Dec 18 – IFL Science: Check Out This Trippy Trove Of Deep-Sea Creatures Scientists Just Discovered Off The Coast Of Tasmania

20 Dec 18 – Sky News: More than 100 new species discovered in waters south of Tasmania

19 Dec 18 – SBS News: 'Extraordinary' undersea world, complete with 100 new species, discovered off Tasmania

19 Dec 18 – ABC Radio PM: Bright new coral discovered at dark depths by CSIRO research ship

19 Dec 18 – ABC Online: Tasmanian researchers discover new corals in dense 'underwater garden' on ocean mountains

19 Dec 18 – MSNBC News: Exploring the Deep Sea Coral Reefs That Sit on Ocean Mountains

29 Nov 18 – ABC Online: 'Heartbreaking' discovery of human trash 100km off Tasmanian coastline

Marine Biodiversity Hub Facebook posts

- Videos
    - Christmas corals for Australia's museums: 5000+ views
    - Deep feelings: brittlestars and corals, 2500 views
    - Gliding albatross, our constant companions, 4800 views
- Jason and the blobfish photo post: 2000+ engagements
- ABC story share: New coral species discovered in dense 'underwater garden' south of Tasmania: 1000 reactions
- Additional 100+ page follows during the voyage

Four blogs on CSIROScope

- Eyes on the deep sea: the coral that thrives in the dark
- 'Heartbreaking' discovery of human trash 100km off Tasmanian coastline
- Cooee! Sound-testing 1200 metres beneath the waves
- Exploring Australia's 'other reefs' south of Tasmania