RV *Investigator* Voyage Plan

VOYAGE #:	**IN2026_V01**
Version Number:	FINAL
Voyage title:	Cook Ice Ecosystems and Sediments (COOKIES)
Mobilisation:	Friday 19 December – Sunday 21 December 2025 Thursday 1 January 2026
Depart:	Hobart, 1500 Friday 2 January 2026
Return:	Hobart, 0800 Thursday 26 February 2026
Science Demobilisation:	Hobart, Thursday 26 February 2026
Chief Scientist:	Dr Linda Armbrecht
Affiliation:	UTAS
Principal Investigators:	Taryn Noble (UTAS) Jan Jansen (UTAS) Nicole Hill (UTAS) Alix Post (GA) Jan Strugnell (James Cook University) Leonie Suter (AAD) Amaranta Focardi (UTS) Tristan Cordier (NORCE Norway) Laura De Santis (OGS) Alessandro Silvano (University of Southampton) Amy Leventer (Colgate University) Jan Lieser (BOM)

Scientific objectives

Recent modelling suggests that the Cook Ice Shelf is especially vulnerable to climate change, with a projected considerable ice mass loss (-14 Gt per year) over the next 200 years. Yet, there is a complete lack of oceanographic, bathymetric, biological and palaeo-data from this region – which is required to reconstruct the evolution and sensitivity of the entire Wilkes Subglacial Basin sector, because 60% of the ice held by this basin is drained by the Cook Glacier and the (neighbouring) Ninnis Glacier.

This study has three major objectives:

a) to characterise marine ecosystem composition of the Cook Glacier marine region throughout the past and into the present, focussing on warming periods throughout the last 1 million years,

b) assess relationships of benthic biodiversity and population genetic signatures with productivity and ice-sheet history, and

c) determine the geological and palaeoceanographic conditions that may have influenced the spatial distribution of the Cook region marine life.

To achieve these objectives, we will collect bathymetry (multibeam) and sub-bottom profile data (PIs De Santis and Post), sediment cores (Multi-, Kasten, Piston Cores) for sedimentological, geochemical, paleontological and genomics investigations (PIs Armbrecht, Noble, Cordier, Leventer), imagery of seafloor biodiversity (deep-towed camera; PIs Hill and Jansen), benthic organisms (NIWA Sled; PI Strugnell), and physical (CTD, ADCP, Argo floats; PI Silvano), chemical (Trace Metal Rosette; PI Noble) and biological oceanography (CTD, underway seawater sampling) (PIs Focardi, Suter, Leventer, Noble). Due to the likely presence of sea-ice in the study area (monitored remotely by PI Lieser throughout the voyage), we will sample in our priority survey area, in front of the Cook Glacier, immediately at the beginning (January) or midway through (February) the voyage (see possible sea-ice scenarios in Fig. 1 below).

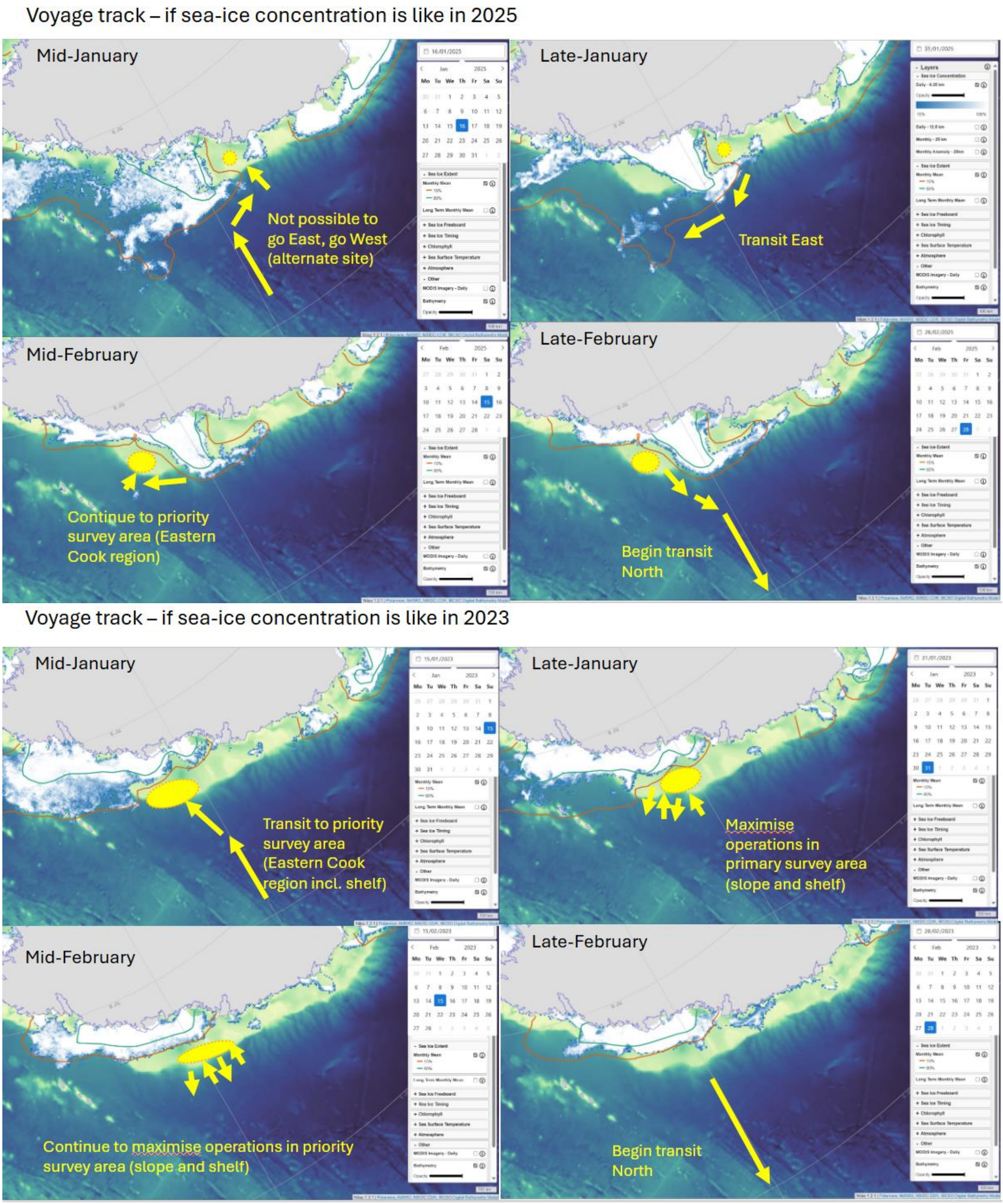


Figure 1: Sea-ice scenarios that might be encountered during IN2026_V01 and how they would shape the voyage track. Maps created with in Nilas Software (Heil, P., Steketee, A., Chua, S. (2023) Nilas Software - mapping tool for displaying multiple layers of physical and biogeochemical variables in the Southern Ocean, Australian Antarctic Data Centre - [doi:10.26179/qh66-7p96](https://doi.org/10.26179/qh66-7p96)).

Voyage objectives

This is a multidisciplinary voyage during which we will deploy a variety of instruments. We will begin sampling and collecting data during the transits between Hobart and Antarctica, which will involve sampling from the underway seawater intake line (microbial oceanography, eDNA, plankton assemblages), CTD (physical/microbial oceanography), multicores (ancient DNA, porewater geochemistry, fossil assemblages), and continuous seafloor mapping and magnetometer towing (geology/geomorphology). Upon arrival in the primary (or secondary) study area in front of the Cook (or Ninnis/Mertz) Glacier, we will map the seafloor to scope out the best coring locations for an anticipated maximum of five main stations on the continental slope (<4000m water depth), at which we aim to collect Multi, Kasten, and Piston Cores, and deploy the CTD and the Trace Metal Rosette. At the upper slope, we will also begin to deploy the deep towed camera to measure biodiversity and the NIWA sled to collect benthic animals. Should reduced sea-ice conditions allow us to advance onto the shelf, we aim to occupy up to three more stations there to collect Multi and Kasten Cores, deploy the CTD, the deep-towed camera and the NIWA sled in this completely unexplored shelf region. In total, we are aiming for 25 video- and 20 NIWA sled-tows, and 5 Argo float deployments (slope and shelf). Below we provide additional details on these operations.

Multibeam: Data acquisition is anticipated from the continental rise, slope and shelf. Water depths will range from ~400 m to ~4000 m. We will primarily rely on data collected from the EM124 system, with use of the EM712 at depths less than ~1500 m. Lines will be run E-W, roughly parallel to slope to ensure even coverage by adjacent swath lines. Where possible and as a priority as the Cook region is not well mapped at all, survey speeds will be ~7 kts to maximise resolution and survey time. However, in areas with sea ice floes and growlers or in areas where we require dedicated mapping (e.g., prior to camera deployment), speeds will be reduced to 5 kts. Multibeam mapping will be interspersed with other activities where possible, allowing mapping to occur during poor weather windows when other operations are not possible. Multibeam will also be run on all transits, including to and from the survey area, at survey speeds of 10+ knots. Time allocation: 10 days.

Sub-bottom profiles: Sub-bottom profile data (SBP129) will be acquired concurrently with the multibeam data. Some site survey time will be required ahead of core sampling to ensure that we have imaged the site in an across-slope orientation to confirm sediment thickness and provide further context of the depositional environment. Time allocation: ~10 hrs (1 hour at each potential coring site, see below), otherwise concurrently with Multibeam data acquisition at no extra time.

Multicores: These will be collected at up to 10 sites, providing an undisturbed sediment-water interface for analysis of palaeoproxies, pore water, trace metals, microfossils, and for the calibration of ancient DNA derived biological carbon pump estimates. To achieve the latter, approximately half of the multicores will be collected on the transits in depth greater than 3000m and ensuring they are spaced out sufficiently to achieve good calibration of *sed*aDNA derived carbon pump estimates. The remaining half will be collected across the Cook (Ninnis/Mertz) region continental slope (<3500m) and on the shelf (<500m). Multicore sampling will be undertaken on board. Time allocation: 5 days.

Kasten cores: Up to 8 Kasten cores will be retrieved, with 5-6 from across the Cook (Ninnis/Mertz) region continental slope (<3500m), and 2-3 from the continental shelf (<500m). Existing mapping data will be used for preliminary site selection, but since this exists only sparsely, multibeam mapping and sub-bottom profiles will be required to determine areas of undisturbed, continuous sedimentation in the upper 25 - 100 m. The Kasten cores will be opened, described and subsampled during the voyage to establish a preliminary age model (based on microfossil, magnetic susceptibility and XRF analysis) and for post-voyage analyses (e.g., palaeoproxies, ancient DNA, sedimentology, stratigraphy, chemistry, shear strength, other geotechnical parameters). The Kasten core data will also enable further selection of the best locations for Piston coring. Time allocation: 5 days.

Piston cores: Piston cores will be retrieved from up to 5 locations, providing records up to 24 m long. Sites will be selected to provide records over past glacial/interglacial cycles, over the last 1 million years. We anticipate that the 5 coring locations will be across the Cook (Ninnis/Mertz) region continental slope. These records are the primary objective of this voyage and will be the highest priority. Piston cores will be cut into 1m sections, split, photographed, described and sampled (sedaDNA, microfossil and geochemical analysis immediately when on board, and then scanned (magnetic susceptibility, XRF) to build up a real time estimation of the core chronologies. An archive half of each section will be kept and brought to shore. Time allocation: 5 days.

Mini-temperature sensors on Corers: Small sensors will be attached on the outside of the Multi-, Kasten, and Piston corer casings and collect in-situ temperature data. For this, the corer needs to stay in place on the seafloor for 5 minutes. Kasten corer clamps are already manufactured and tested. Piston corer clamps will be available for and tested on this voyage. Piston core sensors will collect more reliable data due to the larger depth interval covered. Multicore sensors can collect bottom water temperature. Piggyback project by J. Whittaker (see below). Time allocation: 0.5 days.

Trace metal rosette: The trace metal rosette will be deployed at approximately 5 of the multicore sites along the continental slope (<3,500m). These trace-metal clean water samples will allow analysis of micronutrient trace metals such as Fe, Mn, Zn etc, and Pb and U isotopes. Nutrient analyses will also be made on these samples. Time allocation: 3 days.

CTD: CTDs will be deployed at up to 30 sites along transits in the Cook/Ninnis/Mertz region, at each coring site, and at the Argo float deployment sites to acquire physical oceanographic data. The CTD measurements will guide the collection of Niskin bottle water samples at each site for chemical, physical and biological/microbial oceanography and genomics analysis. A downwards facing camera (MNF supplied) mounted to the CTD will collect a still image of the seafloor for image analysis (complementing the deep-towed camera data, see below). Expendable Bathythermographs (XBTs) might be deployed as an alternative if we are unable to deploy the CTD (e.g., due to sea-ice). Time allocation: 4 days.

ADCP: Hydrographic measurements will be collected underway (SADCP) and at specific sites (LADCP; up to 30 sites concurrently with CTDs). These data will inform on present-day ocean properties in the study area and potential vulnerability of the Cook ice shelf to ocean heat.

Argo Floats: One BGC-Argo float will be deployed off the Cook Glacier continental shelf (<2000m) as per Piggyback project see below). Another two regular (core) and two deep Argo float will be deployed on the continental shelf and/or slope (PIs Silvano and De Santis in collaboration with Argo-Piggyback team). In total, five Argo floats will be deployed. Time allocation: 0.25 days.

Deep-towed camera: Still and video imagery from the deep-towed camera system will be acquired at up to 25-30 key locations along the upper slope and shelf at depths ranging from ~400 to 1500m. The priority for analysis is a balanced selection of sites that represent the different environmental conditions encountered in the region, with a focus on varying depth, slope, productivity and ocean current environments. Additionally, the camera tows will support scoping out coring and NIWA sled deployment sites. The MNF data team will be working with VARS under water video capture and annotation software. Time allocation: 3 days.

eDNA sampler: This instrument attaches to the deep-towed camera. It will allow us to collect eDNA samples that match with the deep-towed camera imagery (i.e., at 25-30 locations). Time allocation: n/a (concurrent with deep-towed camera).

Epibenthic Sled: The Epibenthic sled will be deployed in 20 locations to collect benthic animals. Each tow will be run for up to 20 mins on the seafloor. The target animals are predominantly found on the continental shelf but can also occur deeper. Target depths for the tows will primarily be between 400m-600m depth, but both shallower and deeper depths (including the slope) will be targeted. Time allocation: 3 days.

Towed Magnetometer: The MNF magnetometer will be towed on the south transit commencing from the CTD test site out of Hobart, and possibly on the way back north. We also anticipate towing the magnetometer along the continental slope in E-W or W-E direction. Time allocation: n/a (during transits concurrent with mapping). Time allocation: 0.25 days.

Underway Seawater line: Water from the underway clean seawater line will be continuously sampled for chemical, biological oceanography, plankton assemblage and eDNA/genomics analyses. Time allocation: n/a (during transit south and north).

Outreach: Sea2SchoolAU (Ms Joline Lalime) will provide outreach to students and communities around the world via live-broadcasts using the RV *Investigator's* WebEx system and Social Media. We also anticipate creating a virtual field trip for use in UTAS teaching. Time allocation: n/a (concurrently with science activities).

39 days operations + 12 days transit + 5 days weather = 56 days

Voyage track example

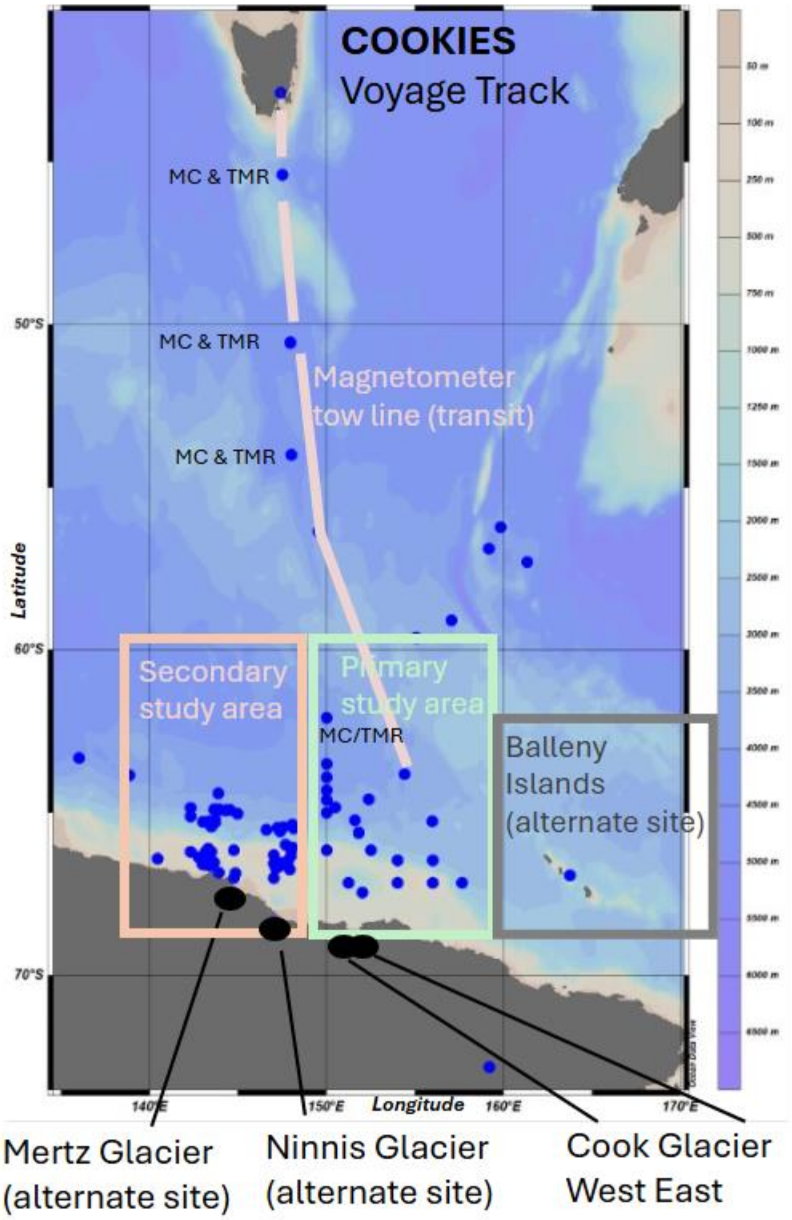


Figure 2: Map of study area. The primary study area is the marine region in front of the Cook Glacier (light green box), a secondary alternate study area is the marine region in front of the Ninnis and Mertz Glaciers (light orange box), and a tertiary alternate study area are the Balleny Island (grey box). The magnetometer tow (light pink) can occur on either the N-S or the S-N transit. Blue dots reflect a combination of anticipated waypoints and previous coring locations by other expeditions. MC = Multicore / TMR = Trace Metal Rosette deployments during transit (N-S or S-N).

Waypoints and stations

SITE	DDM LATITUDE	DDM LONGITUDE	DISTANCE (NM)
Hobart	42° 52.2	147° 21.0	
GSM calibration line #3	43° 23.82	147° 29.65	32
Test TMR @ 1,000m	44° 53.00	147° 27.00	85
MC & TMR Station 1 (3,800m)	45° 23.10	147° 30.00	31
MC & TMR Station 2 (4,400m)	50° 32.95	147° 56.96	310
Magnetometer Routing WP	50° 34.25	147° 56.96	2
MC & TMR Station 3 (4,105m)	54° 00.00	148° 00.00	206
Magnetometer Routing WP	56° 21.38	149° 32.36	151
MC & TMR Station 4 (3,800m)	62° 05.33	150° 00.00	345
TransitCTD150E_1	63° 30.00	150° 00.00	85
TransitCTD150E_2	63° 53.10	150° 00.00	24
MC & TMR Station 5 (3,550m) & TransitCTD150E_3	64° 17.10	150° 00.00	24
TransitCTD150E_4 (Argo DEEP Solo deployment)	64° 35.10	150° 00.00	18
TransitCTD150E_5	65° 00.00	150° 00.00	24
Waypoints and stations for Cook / Mertz / Ninnis / Balleny Islands managed onboard with ice assessment			
GSM calibration line #2	43° 30.632	147° 26.618	1245
Hobart	42° 52.2	147° 21.0	

Time estimates

An assessment of ice conditions will happen prior to departure, and this will dictate the targeted research area, as well as if the transit South is direct (favourable ice conditions) or Multi-core/TMR stations are completed on the way (unfavourable ice conditions). Transit has been planned at 10kts, although it is noted after the convergence, speed will be dictated by visibility and ice conditions.

DATE	ACTIVITY
19.12.-21.12.2025	MOBILISATION • MNF Equipment setup • Science equipment on (core splitter incl. crates, Argo floats) Core Splitter setup on ship (PI Armbrecht) • Trace Metal Setup on ship (PI Noble) • Hobart-based PI's mobilisation (Armbrecht, Noble, Hill, Jansen, Suter)
01.01.2026	MOBILISATION • Final science lifts (consumables) • Hazmat container loading & lift • Lab setup • Early science onboarding with VM
02.01.2026	ONBOARDING & DEPARTURE 0800: Arrival of remaining science team 0830: VM Briefing 0900-1000: Seagoing induction (including polar waters specific content) 1000-1100: Ship familiarisation & immersion suit donning. 1100-1330: Lab Inductions, Lunch (science team) 1200: Arrival of remaining MNF team, ABF attendance 1300-1400: MNF Seagoing Induction 1400: Muster 1500: Departure Operational Plan: Underway data collection & system start-ups, targeting test TMR cast for Saturday 03.01 AM. Station 1 TMR/MC ~Saturday 03.01 PM. Magnetometer deployment after Station 1.
02.01.2026 - 07.01.2026	• Transit South (~6 days, not factoring any operations) • Activities: ○ Lab and Operational safety inductions ○ Underway sampling from seawater intake line(eDNA/genomics/plankton/geochemistry) ○ Mapping (multibeam) ○ Multicore deployments x5 in depth greater than 3000m water (*note: either on transit South or North depending on sea-ice condition in the primary study area and weather). ~15-20hrs operation time

DATE	ACTIVITY
	○ TMR deployments x5 in depth greater than 3000m water (*note: either on transit South or North depending on sea-ice condition in the primary study area and weather, same location as multicore) ~15hrs operation time
08.01.2026 - 15.02.2026	• Arrive and work in study area (primary, secondary or tertiary) (39 days)
16.02.2026 - 20.02.2026	• Weather contingency (5 days)
21.02.2026 - 26.02.2026	• Transit North (6 days, not factoring any operations) • Activities: ○ Packing & cleaning labs ○ Magnetometer tow ○ Underway sampling from seawater intake line (eDNA/genomics/plankton/geochemistry) ○ Mapping (multibeam) ○ Multicore deployments x5 in depth greater than 3000m water (*note: either on transit South or North depending on sea-ice condition in the primary study area and weather). ~15-20hrs operation time ○ TMR deployments x5 in depth greater than 3000m water (*note: either on transit South or North depending on sea-ice condition in the primary study area and weather, same location as multicore) ~15hrs operation time
26.02.2026	ARRIVAL & DEMOBILISATION

Fatigue

The following table is in place to support identification of voyage fatigue levels based on the scientific program and environmental conditions of the voyage. The management strategy listed is detailed to support the Voyage Management Team in decision making.

Does the Voyage Plan introduce conditions which could increase fatigue?	☒ Yes ☐ No ☐ NA
Comments: The science program does not indicate activities that exceed 12hrs. Voyage duration is 56 days, comprising ~6 days transit each way and 44 days in the program area (incl. weather contingency). Environmental conditions due to location will increase fatigue (temperature, sea state).	
Detail Fatigue Management strategy: • Nominal 24hr plan is factoring breaks. • Daily Leadership/Shift Lead briefings will query fatigue levels and plan accordingly. • Full workflow for back deck/ops room operations will be continuously monitored to identify any areas to improve (e.g. back deck ergonomics, timing for full end-to-end activity planning, breaks and actions for re-warming) • Where fatigue risk is identified as high, a 'stop work' will be initiated and an appropriate risk assessment conducted with stakeholders to identify reasonably practicable controls.	

Piggyback projects

Deployment of Argo floats including Australian core, deep, and BGC, and floats from international partners

- **Australia: Christina Schallenberg (CSIRO) & Pete Strutton (UTAS) -1 BGC float**
- **Australia: Steve Rintoul (CSIRO) & Esmee Van Wijk (CSIRO) – 1 Deep float**
- **Italy: Laura De Santis (OGS), Elena Mauri (OGS), Riccardo Martellucci (OGS) - 1 Deep float & 2 Core floats**

Onboard, Izzy White will lead the coordination of the deployment of the floats, in collaboration with the onshore PIs. Deployment locations will be assessed will be assessed where the existing floats are, aiming to fill gaps in the active array of floats in the Cook Glacier marine region.

Heat flow in the Cook glacier region, Professor J. Whittaker (IMAS/UTAS)

The deep, geological component of heat flux, can significantly influences subglacial hydrology, basal melting, and ice flow dynamics, thereby affecting the glacier's stability and its potential contribution to sea-level rise. This project aims to measure GHF distribution, variability, and overall level in the Cook region. During this voyage we will recover sub-seafloor temperature measurements, and sediment thermal conductivity measurements that together will measure geothermal heat flux (GHF) in the marine area offshore Cook Glacier. The GHF measurements will enable an understanding of oceanographic conditions (measurements from the upper 3-4 m of sediment), and geological heat coming from the deep Earth (measurements from >4 m).

Planned Activity:

We will deploy MTPs on all sediment corer deployments (Kasten, Piston, Multi) to collect in situ temperature measurements from the seafloor sediments offshore Cook Glacier. Thermal conductivity measurements will be taken on cores sampled at sea. Metadata including water depth, wire out, core length, and sediment characteristics will be recorded to support data interpretation.

Kasten corer clamps are already manufactured and tested. Piston corer clamps will be available for and tested on this voyage. Piston core sensors will collect more reliable data due to the larger depth interval covered. Multicore sensors can collect bottom water temperature. Voyage participant Amy Wells will lead this project onboard.

Developing Jonathan: An On-vessel Automated Seabird Detector, Carlie Devine, Rich Little (CSIRO)

The objective of this project is to collect seabird counts using an automatic on-vessel seabird edge detector in coastal and open ocean environments.

Planned activities include:

During IN2026_V01 the camera, processor will operate while Investigator is underway. The system will be supervised remotely from Hobart with DAP support on the vessel. A daily csv report and mp4 trip files will be saved to system hardware and backed up by DAP, indicating the number of seabirds detected at specific time intervals throughout daylight hours.

The expected outcome of this project is to bring together the hardware and software needed for an on-vessel seabird Edge detector that will provide a running count of seabirds seen by a fixed camera over the course of a day on a sea-going vessel. Successful development of such a system will be the first step in providing more comprehensive and detailed baseline environmental data.

This project has the appropriate CWLLA AEC approval in place.

Permits

This voyage will traverse through the following Marine Parks:

- Huon Marine Park
- South Tasman Rise Marine Park
    - PA2020-00041-1 Permit - South-east Network, Permit variation PA2020-00041-7 - South-east Network, Permit variation PA2020-00041-14 - South East Network

Approvals obtained through DCCEEW (AAD)

Permit	Permit Number & Owner	Permit Expiry Date
AMLRC Permit (marine organisms)	25/1587 (L. Armbrecht)	31 May 2026
Notice of Determination & Authorisation Antarctic Treaty (Environment Protection) (science activity)	25/1587 (L. Armbrecht)	31 May 2034
ATEP Permit (rocks and sediment)	25/1587 (L. Armbrecht)	31 May 2026
Notice of Determination & Authorisation Antarctic Treaty (Environment Protection) (RV Investigator)	25/1285 (A. Martini)	31 May 2027
Notice of Determination & Authorisation Antarctic Treaty (Environment Protection) (Argo Floats)	4479 (S. Rintoul)	31 May 2027

Quarantine permits will be required to bring samples into Australia from Antarctica, and are the responsibility of each PI

Permit	Permit Number & Owner	Permit Expiry Date
Import permits for water and sediment samples (biosecurity regulated material) - granted to individual institutions (UTAS,AAD)	IMAS Permit 0011201336 AAD Permit IP0010821794	30 October 2030 25 September 2029

Animal Ethics Permits

Permit	Permit Number & Owner	Permit Expiry Date
James Cook University Animal Ethics Application Approval A2867, allows an octopus catch quota to 150 for the year of 2026.	A2867 (S. Lau, J. Strugnell)	6 December 2027

Appendix A

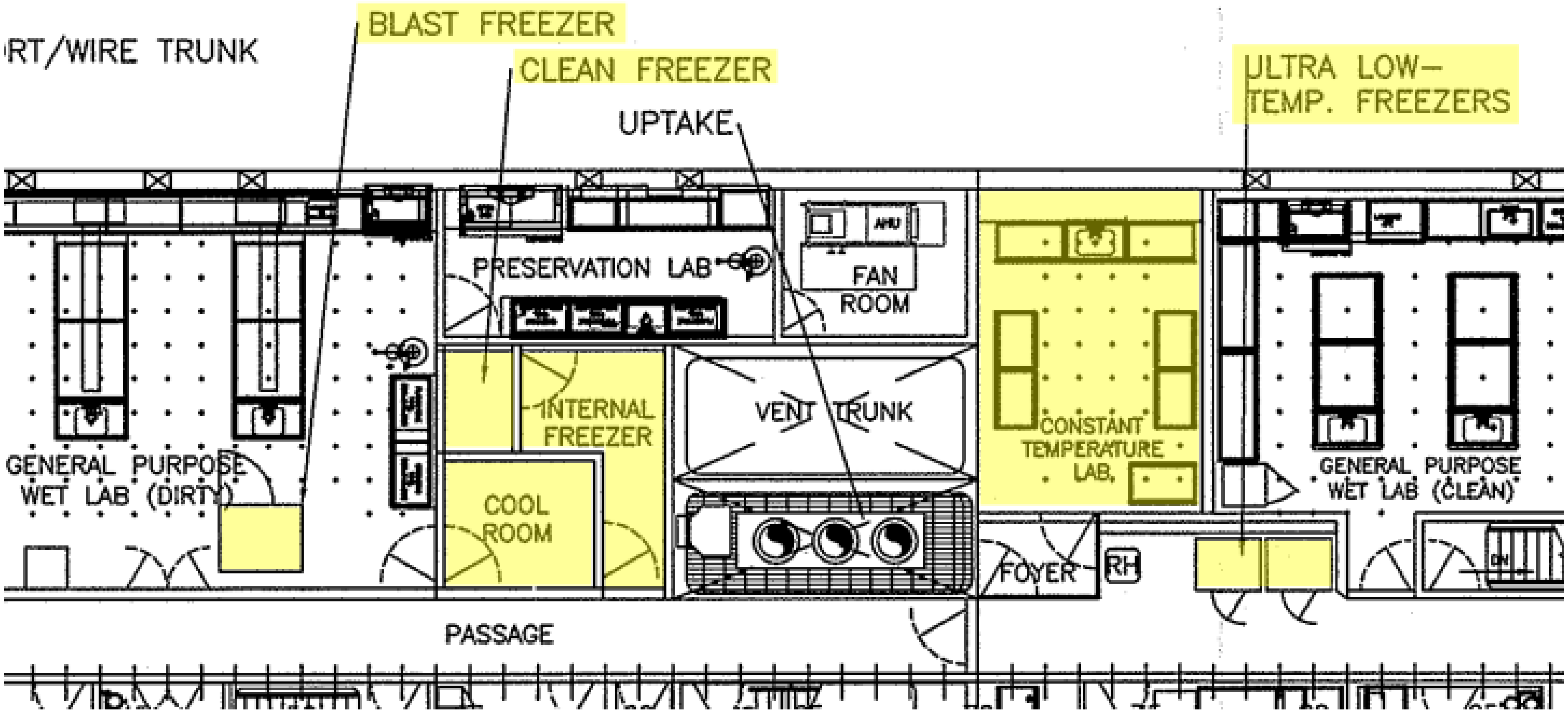
Scientific equipment and facilities provided by the Marine National Facility

Some equipment items on the list may not be available at the time of sailing. Applicants will be notified directly of any changes. Indicate what equipment and facilities you require from the Marine National Facility by placing an **X** in the relevant box.

STANDARD LABORATORIES AND FACILITIES		
NAME	**REQUIRED**	**NOTES/COMMENTS**
Aerosol Sampling Lab		
Air Chemistry Lab		
Preservation Lab	**X**	• Preserving benthic animals, chemical storage
Constant Temperature Lab (Min temp: ~4°C / Max temp ~35°C)	**X**	• 4C • Split core storage on pallets • Multicore rack for core storage during porewater processing • Multicore centrifugation and porewater filtering in nitrogen glove box
Underway Seawater Analysis Laboratory	**X**	• Water filtering for biogeochemistry from underway intake line • Water filtering for plankton collection from underway intake line
GP Wet Lab (Dirty)	**X**	• Multicore extruding in nitrogen glove box • Kasten Core sample process • Benthic animal sorting and processing • Piston core splitting
GP Wet Lab (Clean)	**X**	• Slide preparation & Microscopy

STANDARD LABORATORIES AND FACILITIES		
NAME	**REQUIRED**	**NOTES/COMMENTS**
GP Dry Lab (Clean)	**X**	• Water filtering (eDNA, microbial oceanography) • Magnetic Susceptibility measurements • Portable XRF measurements
Sheltered Science Area	**X**	• BGC Argo Float storage (x1)
Observation Deck 07 Level	**X**	• Sea-ice observations
Internal Freezer (Dirty Wet lab) (Min temp -25°C / Max temp 0°C) Volume: >20m^3	**X**	• -20C • Sample storage •
Clean Freezer (Dirty Wet lab) (Min temp -25°C / Max temp 0°C) Volume: >2.5m^3 Co-located within the Internal freezer and separated by a door	**X**	• -20C • aDNA sample storage •
Blast Freezer (Dirty Wet lab) (Min temp -30°C / Max temp 0°C) Internal volume >1.5m^3 Capable of reducing the temperature of 150kg of water from +20C to -30C in one hour.	**X**	• -20C • Temporary sample storage during sampling (aDNA) • Temporary octopus blast freezing (euthanasia)
Cool Room (Dirty Wet lab) (Min temp 0°C / Max temp 10°C)	**X**	• 4C • Sample storage (water, sediment & animals)
Ultra-Low Temperature Freezers x2 (Main Deck) Min temp -80°C / Max temp -80°C)	**X**	• Sample storage (eDNA, microbial oceanography, animal tissues & DNA)
YODA Freezers (x2) (Clean Dry lab) (Min temp -20°C / Max temp 10°C)	**X**	• 4C • Sample storage (seawater)

STANDARD LABORATORIES AND FACILITIES		
NAME	**REQUIRED**	**NOTES/COMMENTS**
		• Chemical storage (bleach)



MOBILE LABORATORY AND FACILITIES *(MAY REQUIRE ADDITIONAL SUPPORT)*			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS**
Modular Isotope Laboratory			If nominated, additional processes to be completed.
Trace Metal Niskin Sampling Container (TM1-blue - 20ft)	**X**		• Used for the determination of trace metal concentrations. It is a clean laboratory containing laminar flow cabinets and is stored on the main deck
Trace Metal Rosette and Niskin Storage Container	**X**		10-foot container
Modular Hazchem Locker	**X**		For ethanol & sample storage (~500L ethanol for animal preservation)
Stabilised Platform Container			
Clothing Container			REQUIRED (in ISOHOLD)

STANDARD SAMPLING EQUIPMENT			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS**
Continuous Plankton Recorder (CPR)			

SPECIALISED SAMPLING EQUIPMENT			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS (THESE ITEMS MAY REQUIRE ADDITIONAL MNF SUPPORT STAFF)**
TRIAXUS – Underway Profiling CTD			
Desired towing profile:			
Piston Coring System	**X**		
Gravity Coring System			
Multi Corer	**X**		Incl. Extruder, glove box and storage rack for CT Lab

SPECIALISED SAMPLING EQUIPMENT			
NAME	ESSENTIAL	DESIRABLE	NOTES/COMMENTS (THESE ITEMS MAY REQUIRE ADDITIONAL MNF SUPPORT STAFF)
Kasten Corer	X		
Smith Mac Grab			
Rock Dredges			
Rock Saw			
Seaspy Magnetometer	X		
Portable Pot Hauler			
Equipment to measure seawater sound velocity/CTD:			
XBT System		X	If required to support SVP
Valeport Rapid SV			
Valeport Rapid CTD			
Valeport SVX2			
Trace Metal Rosette and Bottles	X		• Stored in 10ft container
Trace Metal In-situ Pumps (x6)			
Deep Towed Camera	X		
Drop Camera			
Sherman Epibenthic Sled			
Brenke Sled			

SPECIALISED SAMPLING EQUIPMENT			
NAME	ESSENTIAL	DESIRABLE	NOTES/COMMENTS (THESE ITEMS MAY REQUIRE ADDITIONAL MNF SUPPORT STAFF)
NIWA Sled	X		2-3 sleds and replacement nets
Hydro-Bios MultiNet (Mammoth) (1m x 1m)			
Surface Net (1m x 1m)			
Bongo Net			
Beam Trawl			
MIDOC			
Pelagic Trawl System (net, doors)			
Demersal Trawl System (net, doors)			
RMT-16 (Rectangular Midwater Trawl)			
Trawl Monitoring Instrumentation (ITI) (2,000m depth limit)			
Stern ramp		INSTALLED	

RESEARCH SUPPORT INFRASTRUCTURE			
NAME	ESSENTIAL	DESIRABLE	NOTES/COMMENTS
Saltwater Ice Machine (Dirty Wet lab)			
Radiosonde Receiver System			
Laboratory Incubators (Clean Dry lab)		X	Temporary phytoplankton incubation (~2-4C) Sediment Drying (ideally 56C in Drying Oven)

RESEARCH SUPPORT INFRASTRUCTURE			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS**
Deck Incubators	X		PI Focardi for 1 experiment of 3weeks (2 incubators at diff temperature)
Milli-Q System	X		PI's Focardi & Suter for DNA sampling
Sonardyne USBL System			

SCIENTIFIC / SAMPLE ANALYSIS SYSTEMS				
MICROSCOPES:				**NOTES/COMMENTS**
BRAND / MODEL	**TYPE**	**ESSENTIAL**	**DESIRABLE**	
Leica / M80	Dissecting	X		For species identification during NIWA sled animal processing
Leica / M80	Dissecting	X		For geological/clast examination
Leica /MZ6	Dissecting			
Olympus / CH	Compound	X		
Olympus /CH	Compound			
Leica / MTU282	Camera tube			
Adapters for tube / Nikon	Pentax			
Ring Light *2 / MEB121	LED			
Heavy Duty Electronic Balance (80kg)				
Medium Duty Electronic Balance (15kg/5g resolution)		X		Weighing samples for biosecurity records
Light Duty Electronic Balance (3kg/1g resolution)				

Underway systems

ACOUSTIC UNDERWAY SYSTEMS			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS**
38kHz ADCP	X		Priority over EK80 38kHZ for transit and study area, drop keel position at 2m will optimise this; when on station (CTD/multicore etc) we can revert to the 18kHz EK80 alongside the 38kHz LADCP.
75kHz ADCP	X		
150kHz ADCP	X		
Multi Beam Echo Sounder EM2040-MKII 200-700kHz (~0 – 250m)		X	Unlikely that we will be operating in this depth
-Multi Beam Echo Sounder EM124 12kHz (100m to full ocean depth)	X		
Multi Beam Echo Sounder EM712 70-100kHz (~0 – 1000m)	X		
Sub-Bottom Profiler SBP29	X		
Scientific Narrowband/Broadband Echo Sounders EK80 (6 bands, 18kHz-333kHz)		X	38kHz ADCP has priority over 38kHz EK80 (when on station (CTD/multicore etc) we can revert to the 18kHz EK80 alongside the 38kHz LADCP)
Multibeam Scientific Echo Sounder ME70 (70-100 kHz)			
Omnidirectional Echo Sounder SH90			
Gravity Meter			

ATMOSPHERIC UNDERWAY SENSORS			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS**
Nephelometer			
Multi Angle Absorption Photometer (MAAP)			
Scanning Mobility Particle Sizer (SMPS)			
Radon Detector			
Ozone Detector			
Condensation Particle Counter (CPC)			
Picarro Spectrometer (analysis of CO_2/CH_4/H_2O)			
Aerodyne Spectrometer (analysis of N_2O/CO/H_2O)			
Cloud Condensation Nuclei (CCN)			
Polarimetric Weather Radar			
Filter Aerosol Sampling units (FAS) x 3			

UNDERWAY SEAWATER SYSTEMS AND INSTRUMENTATION			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS**
Thermosalinograph	**X**		
Fluorometer	**X**		
Optode	**X**		
pCO2	**X**		

SEAWATER SYSTEMS			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS**
Trace metal clean seawater supply	**X**		To be sampled
Scientific clean seawater supplied to laboratories	**X**		To be sampled
Raw seawater available on deck and in laboratories	**X**		Mostly for cleaning of equipment, e.g., Kasten Corer

CTD Configuration

Note #1: On every departure a test CTD is to be undertaken, ideally 24 hours prior to the first planned CTD cast. This requirement is a single cast to a minimum of 1000m, firing half the bottles at the maximum depth of the cast, followed by firing of the remaining bottles near the chlorophyll maximum (requiring one stop on the retrieval). This test CTD is essential to the MNF Hydrochemistry team and supports the training of samplers, testing of Niskin bottles, collection of a tracking standard for the voyage, and ongoing quality and uncertainty calculations.

The MNF CTD is a Seabird 911 system with a variety of auxiliary sensors, installed on either a 24 or 36 bottle Niskin frame.

The science party may be required to assist with sampling the Niskin bottles, preparing the bottles for deployment and for setting up and logging each deployment of the CTD. Training will be given by the MNF DAP and hydrochemistry teams on board.

Plan for the following maximum rate of analyses based on 2 Hydrochemists:

- 48 nutrients, 48 dissolved oxygen, 48 salinity analyses per 24 hours; OR
- 72 nutrient, 36 dissolved oxygen, 36 salinity analyses per 24 hours; OR
- 160 nutrient analyses (only) per 24 hours.

	PLEASE SELECT:
Fundamentals	
Which CTD rosette to be used for this voyage (24 or 36 Niskin bottles):	**36**
Likely total number of casts:	30
Likely maximum depth of deepest cast:	4000 m
Standard CTD Configuration - Instrumentation (maximum 6 auxiliary channels plus 2 x DO) 6000m	
1 x SBE9+ (CTD) 2 x SBE3P Temperature Sensors 2 x SBE4C Conductivity Sensors 2 x SBE5T pumps	**Yes**
2 x SBE43 Dissolved Oxygen Sensors	**Yes**
1 x Tritech PA200/500 Altimeter	**Yes**
1 x Biospherical QCP2300HP PAR Sensor	**Yes**
1 x Wetlabs C-Star 25cm Transmissometer	**Yes**
1 x Wetlabs ECO FLCDRTD Fluorometer – CDOM (370/460nm)	**Yes**
1 x Wetlabs ECO FLBBRTD Fluorometer – Chlorophyll-a & Backscatter (2 x channels - 470/695nm)	**Yes**
Alternative Instruments (Instruments highlighted in grey can be substituted from standard configuration)	
Seapoint Turbidity Meter – Nephelometer	
Seabird SUNA – Ultraviolet Nitrate Analyzer (**Serial Connection - 2000m**)	
Standard LADCP Configuration – Instrumentation: 6000m	

	PLEASE SELECT:
1 x Teledyne 300 kHz LADCP (Slave - Up) 1 x Teledyne 150 kHz LADCP (Master - Down) 1 x 48V Deep Sea Battery	**Yes**
Alternative LADCP Configuration - Instrumentation: 6000m	
1 x Teledyne 300 kHz LADCP (Slave - Up) 1 x Teledyne 300 kHz LADCP (Master - Down) 1 x 48V Deep Sea Battery	No
Hydrochemistry Analyses	
Salinity	**Yes**
Dissolved Oxygen	**Yes**
Nutrients: Nitrate	**Yes**
Nutrients: Phosphate	**Yes**
Nutrients: Silicate	**Yes**
Nutrients: Nitrite	**Yes**
Nutrients: Ammonia	**Yes**

Please note any special requests – such as special sampling that is intended to be performed by the science party (e.g. sampling for dissolved gases, radioisotopes, etc.); or any user-supplied instrumentation to be fitted to the CTD frame; etc.

DOWNWARD FACING CAMERA is included and supported by SIT

Special Requests – MNF Scientific Equipment and Facilities

- Multicore extruder with glove box and table stand
- Multicore wall mounted sample tube racks to be set up in the Constant Temperature Lab
- Oven for drying sediment samples (for diatom work, samples to be dried at <56˚C on board)
- Video conferencing / data communication requirements: Sea2SchoolAU (Joline Lalime) will run our outreach program, which will include live broadcasts to Australian and international schools to showcase the ship-board science. To facilitate this, we will require extra bandwidth during the broadcasting times, likely to begin upon arrival in the study area until the end of the voyage. Additionally, we aim to create a 'virtual field' trip for the purpose of integration into UTAS-based teaching. This would require taking 360 camera images in one of the lab (ideally, the dirty wet lab with an open Kasten core on display). It would be great to discuss with the MNF Communications Group. We will carry out the collection and use of media according to the MNF data Policy and ICT Network Usage Policy (https://mnf.csiro.au/en/About/Policies