VPRV *Investigator* Voyage Plan

VOYAGE #:	IN2025_V01
Version Number:	Final
Voyage title:	Collaborative Australian Postgraduate Sea Training Alliance Network (CAPSTAN)
Mobilisation:	Hobart, Thursday, 6 March 2025 - Friday, 7 March 2025
Boarding:	Hobart, 0800 hrs Friday, 7 March, 2025
Depart:	Hobart, Saturday, 8 March 2025
Return:	Hobart, Monday, 17 March 2025
Demobilisation:	Science: Upon Return MNF: Hobart, Tuesday, 18 March 2025
Voyage Delivery Coordinator:	David Flynn
Voyage Manager:	Ben Arthur
Deputy Voyage Manager:	David Flynn
CAPSTAN Director and Lead Principal Investigator	Pier van der Merwe
Affiliation:	University of Tasmania
Chief Scientist:	Georgia Nester
Affiliation:	University of Western Australia

Scientific objectives

The Collaborative Australian Postgraduate Sea Training Alliance Network (CAPSTAN) is a maritime education and training initiative of CSIRO, the University of Tasmania's Institute for Marine and Antarctic Studies (IMAS) and the Australian and New Zealand International Scientific Drilling Consortium (ANZIC). The Program is supported by grants of sea time on RV Investigator from the CSIRO Marine National Facility and through funding from the Australian Government's National Collaborative Research Infrastructure Strategy (NCRIS). There are no specific scientific objectives for this voyage, however the CAPSTAN platform aims to:

- Develop and provide an effective vessel-based tertiary education experience involving national stakeholders and post-graduate students, by pooling national tertiary teaching expertise and personnel resources;
- Develop a national curriculum to standardise teaching protocols/methods and learning outcomes in conjunction with the new data collection equipment and facilities of the Marine National Facility RV Investigator, the Integrated Marine Observatory System and external stakeholders, and;
- Provide and test a multi-disciplinary research-based teaching module for marine science postgraduates with opportunities for student mobility and national network development.

In addition to CAPSTAN's core training objectives, this multidisciplinary voyage will explore and survey significant marine environments surrounding Tasmania, including the Tasman Fracture Zone, the Bass Canyon, and an East Australian Current (EAC) eddy, to address key gaps in our understanding of these systems.

The Tasman Fracture Zone, situated within the Tasman Fracture Marine Park, is characterised by steep canyons and escarpments, troughs, seamounts, and basins. The abundance of rariphotic reefs and boulder habitats support deep-water coral communities, providing habitat for highly diverse benthic communities. The Tasman Fracture ranges from 60 to 5,559 metres deep, with an average depth of 3,437 m. The fracture is a uniquely deep (2000 – 4000m) geomorphic feature for the region, providing habitat for a range of fauna not found elsewhere in the network. This voyage builds on previous surveys and mapping efforts to further explore the geomorphology and benthic communities associated with these features.

The Bass Canyon is one of the world's largest submarine canyon systems and is located entirely within a cool-water carbonate environment of the Gippsland Basin. It is a confluence of several smaller canyons from the continental shelf and is approximately 10 km wide and 80 km long, reaching depths of 4000 m. This voyage presents an opportunity to expand our understanding of this system, mapping and characterising canyon geomorphology and the associated biodiversity.

The East Australian Current (EAC) exerts a profound influence on Australia's marine environment, driving significant biophysical and biogeochemical processes. This voyage will investigate the physical and biogeochemical properties of EAC eddies through transect surveys. By examining the extent of the EAC's influence into Bass Strait, the research will provide valuable insights into the role of eddies in nutrient transport and ecosystem productivity.

Additional objectives, time permitting, include a shipwreck survey to investigate its structural and biological significance and a feasibility study in the Gippsland offshore wind area. The latter will involve collecting sediment samples with the Smith-Macintyre grab to assess the suitability of the site for offshore wind development.

This voyage not only addresses critical knowledge gaps in Australia's deep-sea environments but also serves as a transformative educational platform for postgraduate students. By engaging with multidisciplinary

research, students gain hands-on experience and contribute to advancing our understanding of marine ecosystems and processes.

Voyage objectives

The training objectives of the 2025 CAPSTAN Voyage are to:

- Enable national access to the RV *Investigator* to postgraduate students enrolled in Australian tertiary institutions.
- Provide hands-on training experiences with standard modern sampling equipment used in marine research, encompassing geological, biological, chemical, physical oceanographic, eDNA, and atmospheric equipment.
- Establish a national network of a new generation of marine scientists.
- Involve a diverse number of national trainers and students in the program.
- Provide trainers with the opportunity to gain experience as PI/Chief Scientist/Co Chief Scientist and demonstrators.

We aim to deliver a program that encompasses the following:

1. Plan and participate in a multidisciplinary marine science research survey focusing on the core disciplines of e.g. oceanography, ecology, geosciences, biology, hydrochemistry, and atmospheric sciences.
2. Evaluate the physical, chemical and biological factors that influence the biodiversity and productivity of deep-sea environments, with a focus on the Tasman Fracture Marine Park and the Bass Canyon
3. Demonstrate the application and operation of various scientific sampling equipment and instrumentation on-board the RV *Investigator*.
4. Acquire, process and analyse quantitative and qualitative samples.
5. Perform data analysis, quality control, interpretation and integration.
6. Prepare a final voyage report.
7. Prepare and present an element of the final cruise report to peers and crew.
8. Master the skills required to operate and conduct oneself safely in the marine environment including specific MNF sea–survival skills and laboratory safety.
9. Foster collaboration and communication by guiding participants in preparing and presenting voyage findings to peers and crew

To address the scientific objectives, the voyage will conduct comprehensive sampling and observations across the Tasman Fracture Marine Park, the Bass Canyon, and an EAC eddy, providing students with hands-on experience in multidisciplinary marine science techniques. At each site, we will perform a suite of activities to characterize biological, geological, and physical oceanographic features. These activities will take place across 9 sites with approximately 10 hours per site.

In the Tasman Fracture Marine Park and Bass Canyon system, planned activities include deploying the deep-tow camera with eDNA sampler to capture imagery of benthic habitats and characterise bottom water biodiversity using eDNA. During deep camera tows, the acoustic EK80 could be deployed to estimate the midwater biomass and observe swarm depths, location and types. Further biological sampling will deploy multinet trawls to collect and sort plankton into taxonomic groups and collect abundance data, with the possibility to trawl for benthic biodiversity and concurrent CPR tows for zooplankton and phytoplankton distributions. The 36-bottle CTD rosette will also be implemented across a depth gradient for eDNA sampling, and to obtain general water properties (nutrients, DO, fluorescence, salinity, turbidity,

PAR, etc). The use of the CTD will be combined with the Lowered Acoustic Doppler Current Profiler (LADCP; 150 kHz and 300 kHz) to characterise the oceanographic environment and ambient environmental conditions at each site.

We will also deploy the Smith Macintyre Grab and Box corer at these sites for seabed sediment and biota sampling of these deep-sea locations. Collecting cores or grabs from these sites after seabed imaging and sub-bottom profiling, will give insights into subsurface features from the Last Glacial Maximum and allow sampling of sediments deposited during the Holocene sea-level transgression, during which the sea level rose 125 m. At the EAC eddy site, activities will transect across an eddy and prioritise multiple CTD yo-yo dips and possible Triaxus tows. Incorporating LADCP, underway measurements, and eDNA sampling via the CTD rosette will allow us to analyse the physical, chemical and biological properties, mass/heat budget, and biodiversity across the eddy.

Continuous activities that will not disrupt ship transit include eDNA underway sampling, Chla sampling (pending availability), nutrient analysis and seabird and marine mammal surveys. If time permits, two additional projects have been proposed: one involves deploying the Smith Macintyre Grab to collect a large sediment sample (25 kg), and the other involves deploying two Argo floats—one at the northernmost and one at the southernmost point of the trip, both in waters deeper than 2000 m. Mapping the seafloor using *RV Investigator's* full suite of Multibeam Echosounders will support safe deployments, while developing a further understanding of larger themes in geology and oceanography. It will also reveal sub-bottom seabed features related to the Quaternary history of the transect, including shorelines and rivers in shelf regions, submarine canyons, and mass transport deposits in deeper slope areas. Sub-bottom profiling of the Tasman Fracture Zone will reveal likely complex structural features related to Southern Ocean rifting and breakup.

The following specific activities and student training will be conducted:

1. Deep-towed camera: Training on operating and interpreting imagery to assess benthic biology, sea-floor composition, and geomorphology;
2. eDNA collection: Instruction on sampling protocols, preservation techniques, and downstream molecular workflows for biodiversity analysis;
3. CTD, LADCP, and Triaxus tows: Hands-on experience in deploying and retrieving equipment and processing oceanographic data;
4. Multinet trawls in conjunction with EK80 acoustics to target zooplankton, small fish, and gelatinous colonies or swarms. Training on net operation, species sorting, acoustic data interpretation, and linking biological findings to acoustic signatures;
5. Smith Macintyre Grab and Box Corer for (sub) seabed sediment and biotic sampling. Guidance on sediment coring techniques and sample preparation for geological, palaeontological and biotic analysis;
6. Underway seawater analysis for nutrients and chlorophyll concentration: Training in real-time nutrient and chlorophyll measurement techniques, including data calibration and interpretation;
7. Argo floats at the northernmost and southernmost sites: Instruction on float preparation and deployment protocols;
8. Seabird and marine mammal surveys: training on visual survey techniques, species identification, and behavioural observation recording.

9. Underway sub-bottom profiling to investigate Quaternary geological features. Allowing training in interpretation of the geology of modern seabed and Quaternary sub-surface features.

Activity plan for first 24-48 hours of voyage

Steam from Hobart directly to the CTD test site, approximately 70 nm from Hobart port and 7.51 hours. Longer transit time is preferable at the start of the voyage for students to adjust to being at sea. Approximately 10 hours is required at the first site and activities will include an initial test CTD, multiple CTD yo-yo dips incorporating the LADCP and possible Triaxus tows. The location of the site is dependent on the eddy location but is expected to occur at approximately 42.2 S, 149.7 E according to prior research (Fig 1).

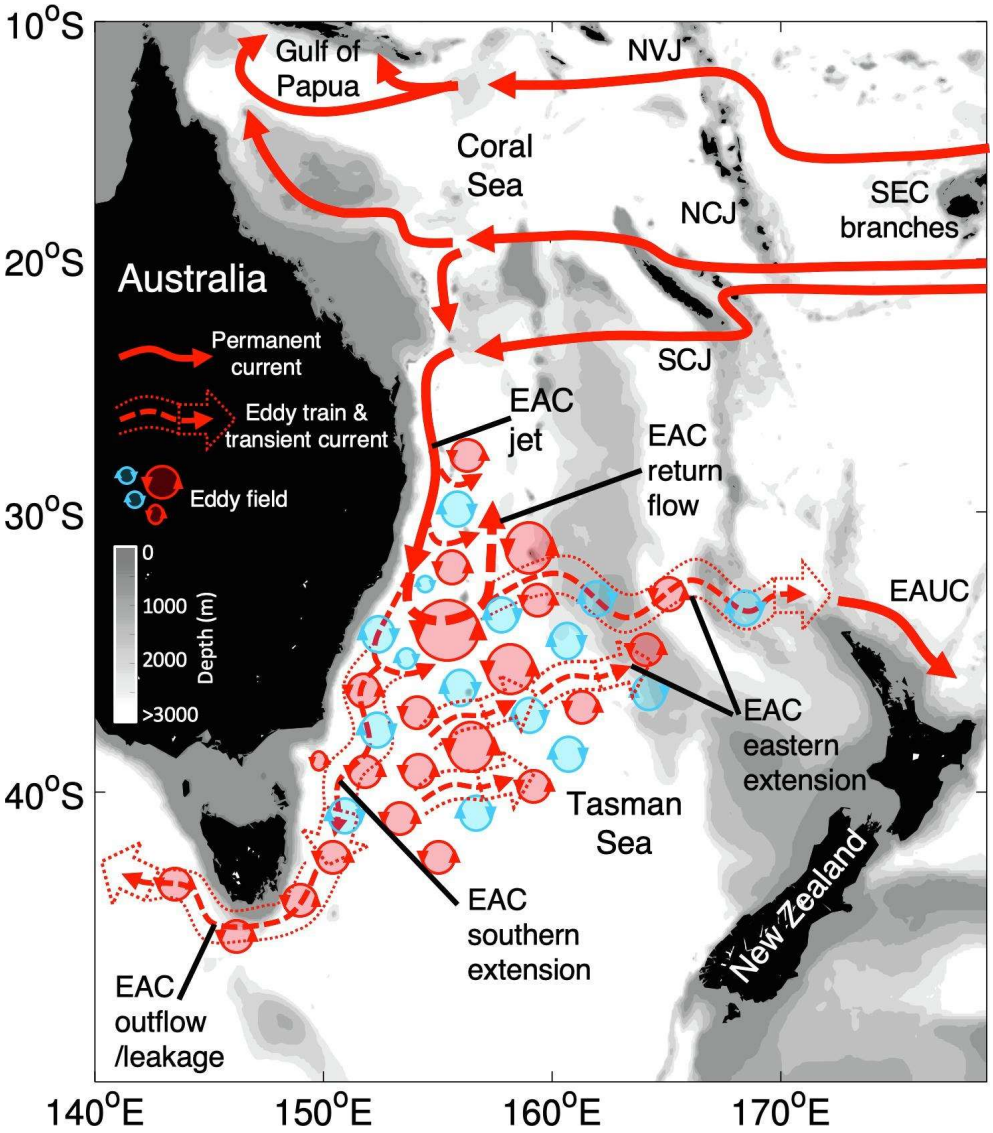


Figure 1. Eddy tracks and general location of features in the EAC. Figure source: Oke et al. 2019 Revisiting the circulation of the East Australian Current: Its path, separation, and eddy field,

Progress in Oceanography, Volume 176

Voyage track example

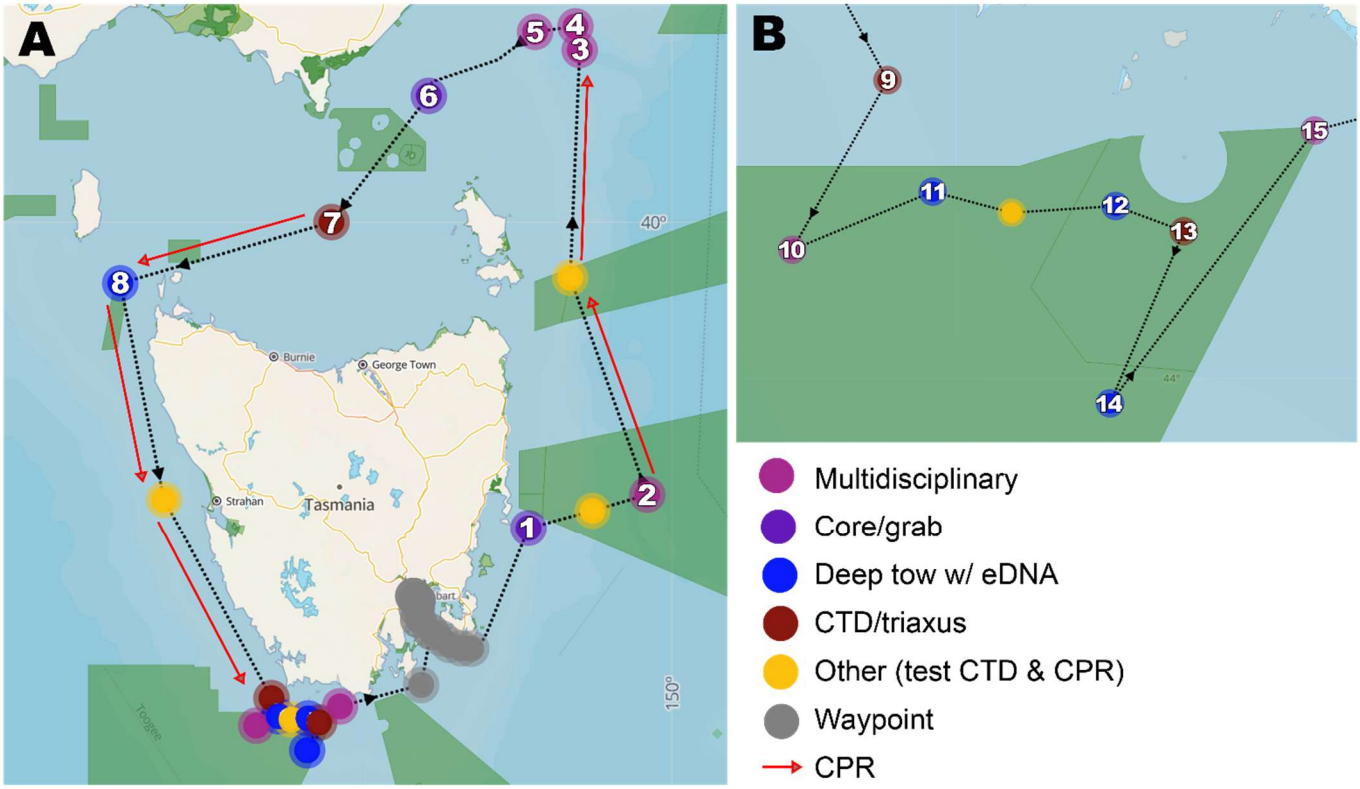


Figure 1- Voyage track for CAPSTAN 2025 around Tasmania (A), with an inset highlighting sites within the Tasman Fracture Zone (B). Colours indicate the planned activities at each site.

Waypoints and stations

Site	Degrees Decimal Minutes Latitude	Degrees Decimal Minutes Longitude	Distance (nm)	Total Distance (nm)	Steaming time (hrs)	Total Steam (hrs)
Hobart PW4 (CSIRO, TAS)	42° 53.170' S	147° 20.320' E	0.0	0	0.0	0
Sullivans Cove	42° 53.026' S	147° 20.356' E	0.1	0.1	0.0	0.0
Battery Pt	42° 53.027' S	147° 20.701' E	0.3	0.4	0.1	0.1
Garrow	42° 54.872' S	147° 22.972' E	2.5	2.9	0.5	0.6
Hobart PBG	42° 55.411' S	147° 22.972' E	0.5	3.4	0.1	0.6
White Rock	42° 58.582' S	147° 22.499' E	3.2	6.6	0.3	1.0
Iron Pot	43° 03.687' S	147° 23.440' E	5.2	11.8	0.5	1.5
Storm Bay	43° 09.149' S	147° 31.376' E	8.0	19.7	0.8	2.3
GSM Backscatter Cal. #1 Start	43° 11.935' S	147° 37.513' E	5.3	25.0	0.5	2.8
GSM Backscatter Cal. #1 End	43° 14.911' S	147° 42.601' E	4.8	29.8	1.0	3.7
GSM Backscatter Cal. #4 Start	43° 16.541' S	147° 50.100' E	5.7	35.5	0.6	4.3
GSM Backscatter Cal. #4 End	43° 16.629' S	147° 56.081' E	4.4	39.8	0.9	5.2

Navigation Waypoint	43° 15.925' S	148° 04.032' E	5.8	45.7	0.6	5.8
Site 1: Core Site	42° 22.062' S	148° 31.428' E	57.5	103.2	5.8	11.5
Site 2: EAC eddy	42° 06.600' S	149° 44.634' E	56.4	159.6	5.6	17.2
CPR Waypoint	40° 26.176' S	148° 57.136' E	106.7	266.2	10.7	27.8
Site 3: Bass Canyon	38° 37.980' S	149° 03.000' E	108.4	374.6	10.8	38.7
Site 4: Bass Canyon	38° 26.640' S	149° 00.360' E	11.5	386.1	1.2	39.8
Site 5: Bass Canyon	38° 27.536' S	148° 33.993' E	20.7	406.8	2.1	41.9
New transit point	38° 43.952' S	148° 11.502' E	24.1	430.9	2.4	44.3
Site 6: Piggyback Calcareous Sand	39° 02.000' S	147° 30.000' E	37.0	467.9	3.7	48.0
Site 7: Bass Strait	40° 00.000' S	146° 30.000' E	74.3	542.2	7.4	55.4
New transit point	40° 08.308' S	144° 43.927' E	81.7	623.8	8.2	63.6
New transit point	40° 24.639' S	144° 18.684' E	25.3	649.1	2.5	66.1
Site 8: Shipwreck	40° 28.800' S	144° 19.800' E	4.2	653.3	0.4	66.5
New transit point	40° 55.737' S	144° 29.173' E	27.9	681.2	2.8	69.3
CPR Waypoint	42° 09.000' S	144° 46.800' E	74.5	755.7	7.4	76.8
Site 9: Tasman Fracture	43° 38.790' S	145° 53.016' E	102.1	857.8	10.2	87.0
Site 10: Tasman Fracture	43° 50.880' S	145° 43.620' E	13.9	871.7	1.4	88.4
Site 11: Tasman Fracture	43° 46.740' S	145° 57.480' E	10.8	882.5	1.1	89.5
Mapping Waypoint	43° 48.240' S	146° 05.274' E	5.8	888.4	0.6	90.0
Site 12: Tasman Fracture	43° 47.770' S	146° 15.557' E	7.4	895.8	0.7	90.8
Site 13: Tasman Fracture	43° 49.566' S	146° 22.296' E	5.2	901.0	0.5	91.3
Site 14: Tasman Fracture	44° 01.800' S	146° 15.000' E	13.3	914.3	1.3	92.6
Site 15: Tasman Fracture	43° 42.384' S	146° 35.220' E	24.3	938.6	2.4	95.1
New transit point	43° 41.605' S	146° 53.076' E	12.9	951.6	1.3	96.4
South Bruny	43° 32.832' S	147° 25.307' E	24.9	976.5	2.5	98.9
GSM Backscatter Cal. #2 End	43° 30.632' S	147° 26.618' E	2.4	978.9	0.2	99.1
GSM Backscatter Cal. #2 Start	43° 24.478' S	147° 27.939' E	6.2	985.1	1.2	100.3
Storm Bay	43° 09.149' S	147° 31.376' E	15.5	1000.7	1.6	101.9
Iron Pot	43° 03.687' S	147° 23.440' E	8.0	1008.6	0.8	102.7
White Rock	42° 58.582' S	147° 22.499' E	5.2	1013.8	0.5	103.2
Hobart PBG	42° 55.411' S	147° 22.972' E	3.2	1017.0	0.6	103.8
Garrow	42° 54.872' S	147° 22.972' E	0.5	1017.5	0.1	103.9
Battery Pt	42° 53.027' S	147° 20.701' E	2.5	1020.0	0.5	104.4
Sullivans Cove	42° 53.026' S	147° 20.356' E	0.3	1020.3	0.1	104.5
Hobart PW4 (CSIRO, TAS)	42° 53.170' S	147° 20.320' E	0.1	1020.4	0.0	104.5

Time estimates

Date	Time	Activity
8/3/2024	8:00	Hobart PW4 (CSIRO, TAS)
	8:01	Sullivans Cove
	8:04	Battery Pt
	8:34	Garrow
	8:37	Hobart PBG
	8:57	White Rock
	9:27	Iron Pot
	10:15	Storm Bay
	10:47	GSM Backscatter Cal. #1 Start
	11:44	GSM Backscatter Cal. #1 End
	12:18	GSM Backscatter Cal. #4 Start
	13:11	GSM Backscatter Cal. #4 End
	19:11	Site 1: Core Site (Box Core / Smith Mac Grab)
9/3/2025	0:15	Test CTD site @ 1000 m
	4:51	Arrive at Site 2: EAC eddy
	5:00	Triaxus (5 hours)
	10:00	CTD inside Eddy @ 4000 m (3 hrs 40 min)
	13:40	CTD outside Eddy@ 4000 m (3 hrs 40 min)
	17:20	Deploy CPR (1 hr)
	18:20	Transit to CPR Waypoint
10/3/2025	5:02	CPR Waypoint: Retrieve and redeploy CPR
	6:02	Transit to Site 3: Bass Canyon (3013 m)
	16:50	Arrive at Site 3: Bass Canyon (3013 m)
	17:00	Retrieve CPR (1 hr)
	18:00	Deep-tow camera w eDNA (4 hrs)
	22:00	CTD @ 3013 m (3.5 hrs)
11/3/2025	1:30	Night multinet option or early morning
	6:00	Multinet (remove if we can do at night as above)
	9:00	Transit to Site 4: Bass Canyon (2065 m)
	10:15	Arrive at Site 4: Bass Canyon (2065 m)
	10:20	Deploy Argo float (simultaneous? Otherwise extend to1 hr)
	10:30	Deep-tow camera w eDNA (3.5 hrs)
	14:00	CTD @ 2065 m (2.1 hrs)
	16:15	Transit to Site 5: Bass Canyon (554 m)
	18:15	Arrive at Site 5: Bass Canyon (554 m)
	19:00	Deep-tow camera w eDNA (2.5 hrs)
	21:00	Night multinet option
12/3/2025	5:00	CTD @ 554 m (1.5 hr)
	6:00	Multinet (remove if we can do at night as above)

	8:00	Core/grab (4.5 hrs)
	12:30	Transit to Piggyback Site (60 m)
	18:30	Arrive at Piggyback Site (60 m)
	19:00	Core/grab (2 hrs)
	21:00	Transit to Site 7: Bass Strait (82 m)
13/3/2025	4:40	Arrive at Site 7: Bass Strait (82 m)
	5:00	CTD @ 82 m yo-yo (2 hours)
	7:00	Deploy CPR (1 hr)
	8:00	Transit to Site 8: Shipwreck (40 m)
	18:30	Arrive at Site 8: Shipwreck (40 m)
	18:40	Retrieve CPR (1 hr)
	19:30	MBES survey & drop camera
14/3/2025	6:30	Deploy CPR (1 hr)
	7:30	Transit to CPR Waypoint
	18:00	CPR Waypoint: Retrieve and redeploy CPR
	19:00	Transit to Site 9: Tasman Fracture (417 m)
15/3/2025	5:15	Arrive at Site 9: Tasman Fracture (417 m)
	6:00	CTD @ 417 m (1 hr)
	7:00	Transit to Site 10: TFZ (1522 m)
	8:30	Arrive at Site 10: TFZ (1522 m)
	8:45	CTD @ 1522 m (1.7 hrs)
	10:30	Multinet
	16:30	Transit to Site 11: TFZ (430 m)
	17:40	Arrive at Site 11: TFZ (430 m)
	18:00	Deep-tow camera w eDNA (2.5 hrs)
	20:30	Map overnight
16/3/2025	0:00	Core/grab (3.5 hrs)
	8:30	Transit to Site 12: TFZ (158 m)
	10:00	Arrive at Site 12: TFZ (158 m)
	10:15	Deep-tow camera w eDNA (2 hrs)
	12:15	Transit to Site 13: TFZ (158 m)
	13:00	Arrive at Site 13: TFZ (158 m)
	13:15	CTD @ 158 m (1 hr)
	14:15	Transit to Site 14: TFZ (425 m)
	15:00	Arrive at Site 14: TFZ (425 m)
	15:15	Deep-tow camera w eDNA (3 hrs)
	18:15	Transit to Site 15: TFZ (122 m)
	19:40	Arrive at Site 15: TFZ (122 m)
	19:45	CTD @ 122 m (1 hr)
	20:45	Core/grab (1.2 hrs)
	22:00	Transit to Hobart

17/3/2025	10:00	Arrive in Hobart

CTD Configuration

	PLEASE SELECT:
Fundamentals	
Which CTD rosette to be used for this voyage (24 or 36 Niskin bottles):	36
Likely total number of casts:	12
Likely maximum depth of deepest cast:	4,500 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	
Chelsea Aquatracka III (430/685nm) Fluorometer – Chlorophyll-a	
Seabird SUNA – Ultraviolet Nitrate Analyzer (**Serial Connection - 2000m**)	Yes
Standard LADCP Configuration – Instrumentation: 6000m	
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

	PLEASE SELECT:
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.

Piggyback projects (if applicable)

1. **"Deployment of Argo floats including Australian core, deep, and BGC, and floats from international partners"**.
   PI: Dr Gabriela Semolini Pilo (gabriela.semolinipilo@csiro.au).
   Deployment of 2x Core Argo floats, 1 at northern most point of voyage (>2000m) the other at southern or eastern most point of voyage (>2000m). Deployment isn't expected to affect time estimates as they can occur at full underway speed, however at masters discretion, ship speed may reduce with students activating remote Argo release and students submitting post deployment information to enrich the training experience.
2. **"Geotechnical characterization of Bass Strait calcareous sand for offshore wind foundations in Australia"**.
   PI: Dr. Anamitra Roy (anamitra.roy@unimelb.edu.au).
   Deployment of the Smith McIntyre Grab for ~2hrs when on station, for as many repeated deployments as time permits. Sediment sample collection using the Smith Mac grab and/or Box Corer (target ≥25 kg) at approximately -39.03333, 147.50000.

Permits

For Australian Marine Parks, the following applies:

- *The permit requires relevant participants to be fully informed of and understand the specific permit conditions before they take part in the Permitted Activity.*
- *Records must be kept of cetacean sightings whilst in a Marine Park. The MNF has a formal process for this and if anyone does sight a cetacean, though it may well have already been reported by the Bridge, please let the Ops room know so it can be recorded.*
- *The vessel has a Standard Operating Procedure (SOP) to manage interactions with cetaceans, which will impact the collection of data associated with the ship's acoustic systems.*
- *An electronic or hard copy of this permit is available through the Voyage Manager, if you wish to review or need to review the conditions you may be operating under.*

This voyage will or expects to traverse through the following Marine Parks:

- *Tasman Fracture*
- *Freycinet*
- *Flinders*

- *Beagle*
- *Huon*

This voyage is operating under the following permits:

- *Parks Australia (MNF multi-network) permit number: PA2020-00041-1. Valid to 6 October 2026.*
    - *Permit variation PA2020-00041-7 - South-East Network.*
    - *Permit variation PA2020-00041-14 – South-East Network*
- *BICON permit 0009566683 for laboratory and genetic material for in vitro use valid till 18 November 2028*

And the following operations are planned in these areas under the current approved permits:

Area	**Activity**
Tasman Fracture Zone	eDNA sampling, deep-towed camera surveys, CTD deployments, and multinet net trawls with EK80 acoustics.
Freycinet	CTD, LADCP, and Triaxus tows.
Franklin	Empress of China shipwreck survey

Signature

Your name	Georgia Nester
Title	Chief Scientist
Signature	
Date:	20-11-2024

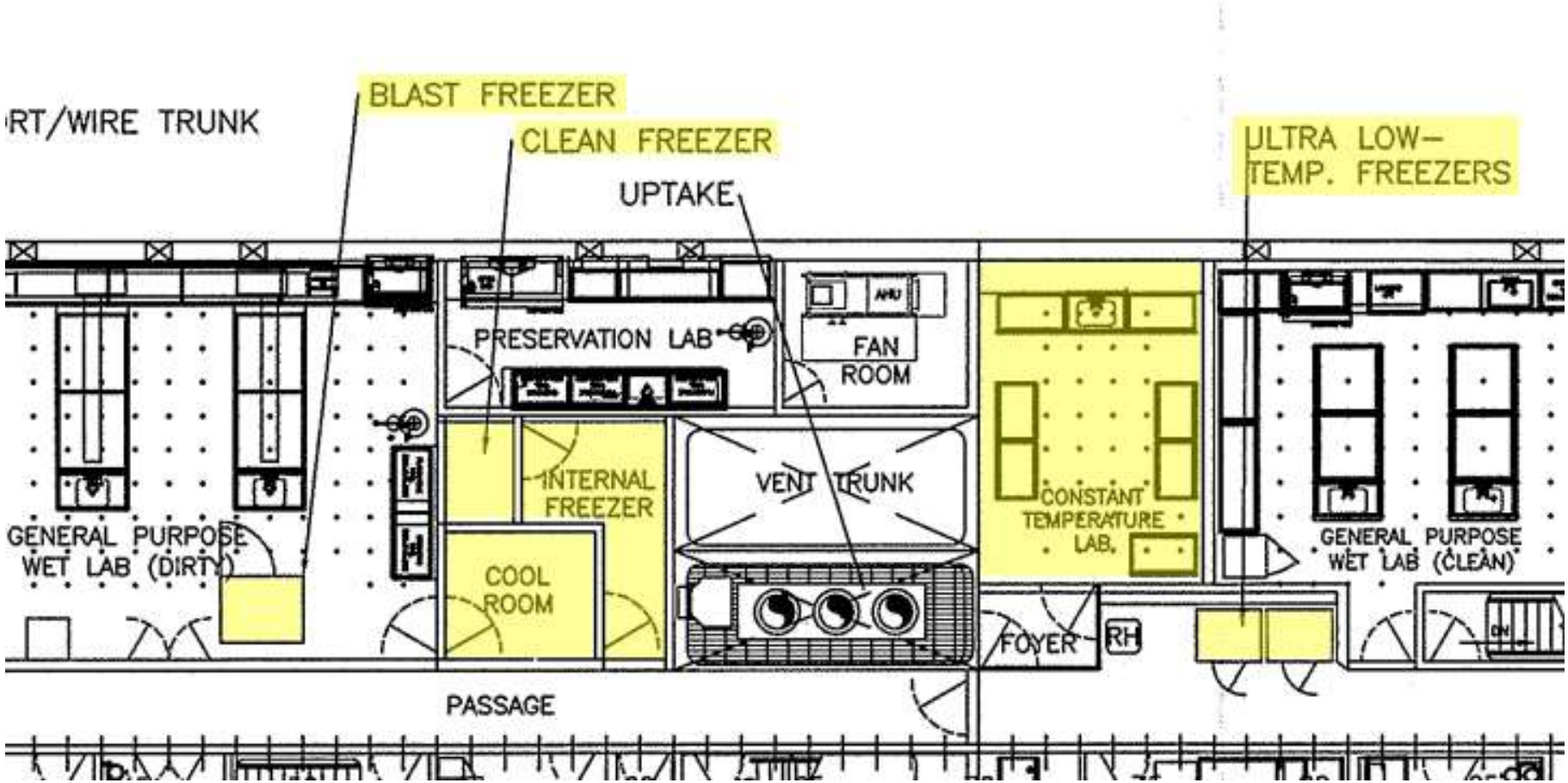
Appendix A

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		• *Please indicate the intended activity in this lab*
Air Chemistry Lab		• *Please indicate the intended activity in this lab*
Preservation Lab		• *Please indicate the intended activity in this lab*
Constant Temperature Lab (Min temp: ~4°C / Max temp ~35°C)		• *Please indicate the intended activity in this lab* • *Please indicate the required setpoint temperature*
Underway Seawater Analysis Laboratory		• *Please indicate the intended activity in this lab*
GP Wet Lab (Dirty)	**X**	• *Sorting and preservation of plankton samples and sediment core sediment processing*
GP Wet Lab (Clean)	**X**	• *Processing of eDNA samples*
GP Dry Lab (Clean)	**X**	• *Underway sample filtering and processing*
Sheltered Science Area		• *Please indicate the intended activity in this area*
Observation Deck 07 Level	**X**	• *Seabird and marine mammal observations*
Internal Freezer (Dirty Wet lab) (Min temp -25°C / Max temp 0°C) *Volume: >20m^3*	**X**	• *Storage of zooplankton in ethanol or dry freezing (8 x 1 L jars or similar)* • *-20 C would be ideal for fatty acid analysis post-voyage*

STANDARD LABORATORIES AND FACILITIES		
NAME	**REQUIRED**	**NOTES/COMMENTS**
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*		• *Please indicate the required setpoint temperature*
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.*		• *Please indicate the intended activity in this area and required setpoint temperature*
Cool Room (Dirty Wet lab) (Min temp 0°C / Max temp 10°C) too low for purpose	**X**	• *Please indicate the intended activity in this area* • *Drying sediment samples for microfossil studies* • *Please indicate the required setpoint temperature (50°C)*
Ultra-Low Temperature Freezers x2 (Main Deck) Min temp -80°C / Max temp -80°C)	**X**	• *Potential storage of samples for biochemical analysis post-voyage* • *-80 C for fatty acid/lipid analysis* • *Storage of eDNA samples*
YODA Freezers (x2) (Clean Dry lab) (Min temp -20°C / Max temp 10°C)	**X**	• *Storage of chlorophyll samples during extraction in solvent, prior to analysis. Both are needed as one will be set to 4 degrees and the other to -18 deg C.* •



MOBILE LABORATORY AND FACILITIES *(MAY REQUIRE ADDITIONAL SUPPORT)*			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS**
Modular Isotope Laboratory			If nominated, additional processes to be completed.

MOBILE LABORATORY AND FACILITIES *(MAY REQUIRE ADDITIONAL SUPPORT)*			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS**
Trace Metal Niskin Sampling Container (TM1-blue - 20ft)			• *Used for the determination of trace metal concentrations. It is a clean laboratory containing laminar flow cabinets and is stored on the main deck (if possible).*
Trace Metal Seawater Analysis Laboratory (TM2-white - 20ft)			• *Used for wet sampling of trace metal clean Niskins and is stored on the main deck (if possible).* • *Cannot be overstacked*
Trace Metal Rosette and Niskin Storage Container			10-foot container
Modular Hazchem Locker			
Stabilised Platform Container			Please indicate what instruments are to be installed in the container. Cannot be overstacked
Clothing Container			The use of this container will be identified by MNF

STANDARD SAMPLING EQUIPMENT			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS**
Continuous Plankton Recorder (CPR)		**X**	Felicity McEnnulty, Claire Davies, Ruth Eriksen and Nicole Hellessey have discussed, the CSIRO Environment team will provide 2x CPR cassette silk and log sheets. *note: Use of this item must be flagged with the relevant CSIRO Oceans & Atmosphere team responsible for CPR cassette preparation and sample processing. Please discuss your planned CPR use with your VDC, who will assist in liaising with the CPR team.

SPECIALISED SAMPLING EQUIPMENT			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS (THESE ITEMS MAY REQUIRE ADDITIONAL MNF SUPPORT STAFF)**
TRIAXUS – Underway Profiling CTD		**X**	Triaxus is a pilotable towed vehicle capable of carrying a variety of instrumentation. Constant depth towing or undulating profiles (e.g. cyclic depth pattern from the surface to 200m) are possible. Towing speed depends on the tow profile, instrumentation payload and prevailing conditions. Typically, undulations from the surface to 200m are possible at 8knt, with slower speeds for deeper profiles and faster for constant-depth towing. Maximum achievable depth typically 300m to a distance of approximately 1.5km from the ship. *Triaxus is normally configured with the following sensors as a minimum:* • *Dual temperature, conductivity and dissolved oxygen (SBE9plus and dual pumped temperature/conductivity/dissolved oxygen circuits)* • *PAR* • *Chlorophyll-A, CDROM, optical backscatter (Eco-triplet – 2000m Max)* • *Plankton counter (Laser Optical Plankton Counter)* • *Transmissometer* Contact MNF for further details on other instrumentation and capability.
Desired towing profile:			Across eddy fronts/ across the Bass strait/ possibly across Tasman leakage
Additional instrumentation: (please supply, make and model and datasheets and a contact person for discussion on integration)			
Piston Coring System			
Gravity Coring System			

SPECIALISED SAMPLING EQUIPMENT			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS (THESE ITEMS MAY REQUIRE ADDITIONAL MNF SUPPORT STAFF)**
Multi Corer			
Kasten Corer	**X**		Vibrocorer if Kasten is not available
Smith Mac Grab	**X**		
Rock Dredges		**X**	Modified rock dredges for sand collection if available by Field Ops
Rock Saw			Requires trained science personnel
Seaspy Magnetometer			
Portable Pot Hauler			
Equipment to measure seawater sound velocity/CTD:	**X**		All required to accurately measure sound velocity and perform MBES, at GSM discretion.
XBT System	**X**		2 per day provided. All required to accurately measure sound velocity and perform MBES, at GSM discretion.
Valeport Rapid SV	**X**		All required to accurately measure sound velocity and perform MBES, at GSM discretion.
Valeport Rapid CTD	**X**		All required to accurately measure sound velocity and perform MBES, at GSM discretion.
Valeport SVX2	**X**		All required to accurately measure sound velocity and perform MBES, at GSM discretion.

SPECIALISED SAMPLING EQUIPMENT			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS (THESE ITEMS MAY REQUIRE ADDITIONAL MNF SUPPORT STAFF)**
Trace Metal Rosette and Bottles			
Trace Metal In-situ Pumps (x6)			• *See non-MNF owned section below for additional 2 units.* • *Science team to organise and pay for battery packs for this system (+ spare).* • *They can be sourced through a supplier such as 'Batteryworld Hobart' (Graham Cowie, 03 6272 3900) who has made these previously.* • *The science teams need to calculate how long they will be deployed and bring enough batteries to cover their deployment times. They are rated to 30 Amp hours, which equals to 36,000 litres of sea water being filtered.*
Deep Towed Camera	**X**		Video analysis of animal behaviour eDNA sampling in tandem
Drop Camera		**X**	Video analysis of animal behaviour
Sherman Epibenthic Sled			Stern ramp must be removed to operate this system.
Brenke Sled			
Hydro-Bios MultiNet (Mammoth) (1m x 1m) *(has replaced the EZ net)*	**X**		Please specify 100-micron, 335-micron, or 500-micron mesh All mesh sizes requested, horizontal tows
Surface Net (1m x 1m)			Please specify 335-micron, 500-micron, or 1,000-micron mesh
Bongo Net			750mm frame, 500-micron mesh net and 335-micron cod end Collection of plankton samples from upper 200m

SPECIALISED SAMPLING EQUIPMENT			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS (THESE ITEMS MAY REQUIRE ADDITIONAL MNF SUPPORT STAFF)**
Beam Trawl			
MIDOC			Multiple opening/closing net system with cod ends- suitable for pelagic trawls Collection of plankton samples from upper 500m, looking at nets opening at 500, 400, 300, 200, 100, 50 and surface depths.
Pelagic Trawl System (net, doors)			Contact MNF to discuss net and mesh dimensions
Demersal Trawl System (net, doors)			Contact MNF to discuss net and mesh dimensions
RMT-8 (Rectangular Midwater Trawl) Utilises a single warp so can be deployed on the general-purpose towing wire in self-contained mode. Must be deployed with stern ramp covered.			*8m2 mouth area* *Tow speed ≤2 knots* Collection of plankton samples from upper 200m. What mesh size is the RMT8 equipped for?
RMT-16 (Rectangular Midwater Trawl) Utilises a single warp so can be deployed on the general-purpose towing wire in self-contained mode. Must be deployed with stern ramp covered.			*16m2 mouth area* *Tow speed ≤2 knots*
Trawl Monitoring Instrumentation (ITI) (2,000m depth limit)			MNF to identify this need, dependent on pelagic or demersal trawling requirement
Stern ramp	**EXPOSED**	**INSTALLED**	MNF to identify this requirement

RESEARCH SUPPORT INFRASTRUCTURE			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS**
Saltwater Ice Machine (Dirty Wet lab)			
Radiosonde Receiver System			
Laboratory Incubators (Clean Dry lab)			
Deck Incubators			Temperature controlled deck incubators
Milli-Q System	**X**		
Sonardyne USBL System			

SCIENTIFIC / SAMPLE ANALYSIS SYSTEMS				
MICROSCOPES:				**NOTES/COMMENTS**
BRAND / MODEL	**TYPE**	**ESSENTIAL**	**DESIRABLE**	Refer to the "MNF microscopes procedure" for more information
Leica / M80	Dissecting	**X**		Zooplankton Identifying
Leica / M80	Dissecting	**X**		Sediment cores looking for microfossils
Leica /MZ6	Dissecting	**X**		Sediment cores looking for microfossils
Olympus / CH	Compound	**X**		Phytoplankton Identifying
Olympus /CH	Compound	**X**		Sediment cores looking for microfossils
Leica / MTU282	Camera tube	**X**		To document fauna
Adapters for tube / Nikon	Pentax	**X**		To document fauna
Ring Light *2 / MEB121	LED	**X**		To document fauna

SCIENTIFIC / SAMPLE ANALYSIS SYSTEMS			
MICROSCOPES:			**NOTES/COMMENTS**
Heavy Duty Electronic Balance (80kg)			
Medium Duty Electronic Balance (15kg/5g resolution)			
Light Duty Electronic Balance (3kg/1g resolution)	**X**		Zooplankton morphology measurements

Underway systems

ACOUSTIC UNDERWAY SYSTEMS			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS**
75kHz ADCP		**X**	Locating swarms and schools at various depths, looking at DVM in zooplankton
150kHz ADCP		**X**	Locating swarms and schools at various depths, looking at DVM in zooplankton, current measurements
Multi Beam Echo Sounder EM122 12kHz (100m to full ocean depth)	**X**		
Multi Beam Echo Sounder EM710 70-100kHz (0-1000m approx.)	**X**		To document seabed features even at depths <100m?
Sub-Bottom Profiler SBP120	**X**		Kongsberg SBP120. To image beneath the seabed, would be great to run continuously or near continuously
Scientific Narrowband Echo Sounders EK60 (6 bands, 18kHz-333kHz)			*EK60s will be onboard for use as a backup for EK80s and set in narrowband mode* *Quantitative measurements from scientific echosounders requires sphere calibration in the watermass of sampling*

ACOUSTIC UNDERWAY SYSTEMS			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS**
Scientific Narrowband/Broadband Echo Sounders EK80 (6 bands, 18kHz-333kHz)		**X**	*EK80s will be used in narrowband mode unless otherwise requested* *Quantitative measurements from scientific echosounders requires sphere calibration in the watermass of sampling* *Detection of zooplankton swarms and small fish schools, marine mammals?*
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)			

ATMOSPHERIC UNDERWAY SENSORS			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS**
Polarimetric Weather Radar			
Filter Aerosol Sampling units (FAS) x 3			*Used for collecting physical aerosol samples on filters.* *FAS includes pumps, filter holders, flow controllers, totalizer, Very Sharp Cut Cyclone (VSCC) PM1 and PM2.5.* • *User to specify how many units are required (maximum 3 supplied by MNF).* • *User to provide own filters.* • *User to outline sampling requirements with MNF Seagoing Instrumentation Team (SIT) i.e. ship exhaust sample avoidance etc.*

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

SEAWATER SYSTEMS			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS**
Trace metal clean seawater supply			
Scientific clean seawater supplied to laboratories	**X**		

SEAWATER SYSTEMS			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS**
Raw seawater available on deck and in laboratories		**X**	Facilitate underway eDNA sampling

EQUIPMENT AND SAMPLING GEAR REQUIRING EXTERNAL SUPPORT (MAY REQUIRE ADDITIONAL SUPPORT FROM APPLICANTS)			
NAME	**ESSENTIAL**	**DESIRABLE**	**PLEASE GIVE THIS CAREFUL CONSIDERATION, AS THERE IS NO GUARANTEE THAT THESE RESOURCES WILL BE AVAILABLE UNLESS SPECIFICALLY REQUESTED. LIAISE WITH YOUR VOYAGE OPERATIONS MANAGER AS REQUIRED. ADDITIONAL STAFF MAY BE REQUIRED FOR THESE ACTIVITIES.**
Seismic Compressors			• *Additional crew and seismic acquisition personnel will be required to be onboard to support this system. Number of personnel TBD by the MNF.* • *The science party is to provide an onboard seismic data processing resource.*
Seismic Acquisition System			• *Additional crew and seismic acquisition personnel will be required to be onboard to support this system. Number of personnel TBD by the MNF.* • *The science party is to provide an onboard seismic data processing resource.*

NON-MNF OWNED EQUIPMENT WHICH MAY BE ACCESSED			
NAME	**ESSENTIAL**	**DESIRABLE**	**PLEASE GIVE THIS CAREFUL CONSIDERATION, AS THERE IS NO GUARANTEE THAT THESE RESOURCES WILL BE AVAILABLE UNLESS SPECIFICALLY REQUESTED. LIAISE WITH YOUR VOYAGE OPERATIONS MANAGER AS REQUIRED. ADDITIONAL STAFF MAY BE REQUIRED FOR THESE ACTIVITIES.**
D & N Francis winch			15mm electro-optical cable
Box Corer	**X**		If no other corer type is available
UTAS In-Situ Pumps (x2)			
Deep-tow eDNA sampler	**X**		Used in tandem with deep-tow camera by Cindy Bessy

NON-MNF OWNED EQUIPMENT WHICH MAY BE ACCESSED			
NAME	**ESSENTIAL**	**DESIRABLE**	**PLEASE GIVE THIS CAREFUL CONSIDERATION, AS THERE IS NO GUARANTEE THAT THESE RESOURCES WILL BE AVAILABLE UNLESS SPECIFICALLY REQUESTED. LIAISE WITH YOUR VOYAGE OPERATIONS MANAGER AS REQUIRED. ADDITIONAL STAFF MAY BE REQUIRED FOR THESE ACTIVITIES.**
EM2040	**X**		Shallow water multibeam echosounder system. Shipwreck survey may utilise this system – understood that this system is now installed onboard since midlife refit.