RV *Investigator* Voyage Plan

VOYAGE #:	IN2023_V02
Version Number:	Final – V2.0
Voyage title:	*Gigantic submarine landslide offshore western Tasmania: risk mitigation for shelf-derived tsunami in Australia*
Mobilisation:	Hobart, Saturday 18 March – Tuesday 21 March, 2023
Pre-medical clearance period:	Hobart, Wednesday 22 March – Thursday 23 March, 2023
Depart:	Hobart, 0800 Friday, 24 March 2023
Return:	Hobart, 0800 Sunday, 30 April 2023
Demobilisation:	Sunday 30 April (Science) + Monday 1 & Tuesday 2 May 2023 (MNF)
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Affiliation:	University of Sydney (USYD)
Principal Investigators:	Rafael Leon (University of Tasmania) Stanislaus Glenndy 'Glen' Fabian (University of Melbourne) Craig Davey (CSIRO) Gabriela Semolinipilo (CSIRO)

Scientific objectives + Priorities

A recent, well-exposed gigantic submarine landslide of volume equivalent to 740 times Uluru has occurred off the coast of western Tasmania. We will survey the surface and sub-surface of the failed and unfailed deposits to understand how, when and why this event happened, and establish hazard mitigation maps. Further, we will investigate the nature of the continental shelf to map the continuation of on land prospective rock formations. These data will be 'valued added' by being interpreted with ancillary biological data to create geomorphic, substrate and habitat maps.

Voyage objectives

Offshore western Tasmania, the continental shelf consists of a smooth, 20–40 km wide shelf, indented by numerous but small canyons. However, over 50 km of continental shelf shows an abrupt headscarp failure associated with a gigantic, 450 km3 submarine landslide deposit. The submarine landslide translated 30–120 km downslope and at 2000–4500 m under water. At our knowledge, this submarine landslide has never been examined in detail before, despite being a remarkably sharp morphology on bathymetric maps.

We will explore four research aims that relate to fundamental understanding of the geomorphology and biodiversity of this region.

1. We will assess the morphology and internal structure of the submarine landslide to model transport and sedimentation processes of submarine landslides and associated mass flows.
2. We will unravel the causes of failure of this submarine landslide and calculate the tsunamigenic potential of similar shelf collapses around Australia. Based on quantitative data collect at sea, we will numerically model tsunami inundation and use this model as representative example for tsunami risk mitigation for coastal Australia.
3. We will map the offshore continuation of major fault zones and the highly mineralised Mount Read Volcanics to extend our understanding of the geology and tectonism of Tasmania. We will map potential prospective resources on the shallow shelf.
4. We will increase the knowledge of seafloor habitat features and associated biodiversity within this region and understand the drivers of the spatial distribution of seafloor biodiversity and nutrients in relation to concentration of nutrients in water, ocean currents (including upwelling) and fine-scale geomorphological variations.

Surveys

Point 1–3 will be addressed through piston coring, seismic reflection, dredging, sub-bottom profiler, bathymetry, and deep-towed camera surveys. Point 4 will be addressed through CTDs, bathymetry, underway hydrochemistry, water column surveying, sub-bottom profiler, deep-towed camera, ADCP, epibenthic sleds and surface nets. We will conduct these various surveys, with seismic reflection and coring exclusively by day. Other surveys can be conducted either day and night. Night-time surveys are not scheduled as it will depend on weather, location, and voyage operations. Five main locations have been selected: shelf, slope, abyssal plain (or plain), NW and SE. See Figs. 2 for day-time and Fig. 3 for night-time surveys. Transit time will be carried out at 10.5 kt, seismic surveys at 4 kt, camera surveys at 1-2 kt and bathymetry at 8-11 kt, depending on sea state. We estimate that ca. 50 NM of seismic reflection can be conducted per day based on IN2022_V02 experience, and 1-2 cores can be retrieved per day, chiefly depending on barrel length, but also weather and water depth. Only 1 deep-water core with long barrels may be retrieved per day.

For Giant Piston Cores, we plan to use 1-2 barrels in sandy substrate, but hope to try at least 3-4 barrels in the abyssal plain. Rough weather will impede on most surveys, except dredging and bathymetry. Some shelf surveys should be conducted up to as close as possible from shore.

Oceanography and biodiversity

1) The biological and oceanographical component will ideally consist of underway nutrient analysis of surface water nitrogen throughout the voyage where this is not in conflict with staff time required to complete CTD sampling. This may include transits in and out of Storm Bay (to aid in better characterisation of a high use area) and all shelf transects undertaken at night associated with Giant Crab video tows, or in the case of the shelf waters of the Tasman Fracture Park where tows were initially planned but may not be undertaken, multiple evenings undertaking CTD transects across the shelf. That should give surface values to match CTD lines as well as detecting anomalies between areas sampled by other methods.

2) CTD casts are planned to be undertaken at the beginning (mid shelf) and end (mid-slope) of Giant Crab video tows on all nights and locations that tows are undertaken. This will give estimates of shelf values as well as examine areas of shelf-break upwelling. In addition to video-tow associated CTD casts, it is intended to have at least two nights dedicated to a series of more intense cross-shelf sampling in the canyon system to the SW of SW Cape and at some distance either side to examine cross-shelf spread of any upwelling. As per 1), additional intensive cross shelf transects will ideally be undertaken in the initial planned giant crab tow lines in the Tasman Fracture Park if crab tows are no longer planned there. At the minimum, CTD sampling at the beginning (mid shelf) and end (mid slope) locations of the planned tows would be undertaken.

In addition to the priority 1 CTD drops (dedicated nights around the SW Cape Canyon and beginning and end of all initially planned crab tows), a second priority is to undertake additional cross shelf to mid-slope lines to the north of the crab tows in the direction of Macquarie Harbour (and further north if opportunity arises with good weather) to match the vessel location of day plans and as a minimum mid shelf casts and mid slope casts. This will characterise the influence of the Zeehan current. There may be significant extra voyage days available (inc days and nights) if weather is better than expected. Ideally some of these could be used to flexibly adapt sampling to underway findings, by targeting oceanographic features visible from satellite SST at the time of from data collected underway. For example, if an clear upwelling is evident around the SW canyon area, further sampling may better inform the dispersal plume of upwelling waters to the east and west, subject to advice from Chris Chapman as the guiding oceanographer onshore.

3). Mid water acoustics. Acoustic collection will presumably continue throughout the whole voyage as per IMOs standards, however, the transit from Hobart to the study area will be particularly informative, as will matching cross shelf transits on all CTD and Giant Crab video lines. If possible, the line from SW Cape to the SW Cape Canyon would continue from mid shelf to close to SW Cape to match planned repeat surveys in that area for Parks Australia. Likewise, when transiting through the Tasman Fracture Park, ideally a cross shelf line would cross the park on mid-outer shelf as well.

4). ADCP profiles. These profiles will ideally be completed as regularly as possible with the understanding that they may interfere with the midwater acoustics. If that is the case, ideally profiles would be undertaken at the time of all CTD casts while mid-water acoustics may be turned off.

NIGHT-TIME PRIORITIES			Regions	Region name
		top priority	C	Landslide slope
			E	Abyssal plain landslide
			A	Landslide shelf
			B	Shelf near canyon
			D	Canyon slope
		low priority	F	Port Macquarie

Piggyback Projects

ARGO Deployments Underway

The Array for Real-Time Geostrophic Oceanography (ARGO) program is a collaboration of scientific institutions around the world, and includes an Australian contribution led by the CSIRO. Given the lifespan

of ~3-5 years for each deployed float, the objective on this voyage is to deploy additional floats in strategic areas of the Southern Ocean to maintain geographic coverage of the data array. ARGO floats will be deployed on an opportunistic basis, when weather and other voyage activities are not impacted. Estimated drop coordinates are:

Float #1: 43.5°S, 142.3°E

Float #2: 42.6°S, 143.5°E

Or at these longitudes, along the ship's track. The MNF has agreed to deploy 2 standard ARGO float(s) at predetermined waypoints.

Voyage Risk Assessment (VSRA)

The MNF, in consultation with the science party and other relevant stakeholders, has developed a comprehensive Voyage Specific Risk Assessment (VSRA) to ensure voyage risks are identified and appropriately controlled. The full VSRA is available separately from the Voyage Delivery Coordinator.

Media Activities

The MNF will seek to pursue opportunities that arise during the voyage to promote the science, scientists and ship, via conventional and social media channels, in consultation and/or collaboration with the relevant ship user. Summary of the planned media activities for the voyage to ensure all voyage participants are aware of what may occur in this space. It should document activities for the sponsoring agency/participants and those to be undertaken for the MNF. If a media plan has been developed then this can be referenced and appended to the Voyage Plan.

ORGANISATION	ACTIVITIES	TIMING	RESPONSIBLE PERSON
UTAS	Range of stories and blogs to be released.	Throughout voyage	Dr Martin Jutzeler

Activity plan for first 24-48 hours of voyage

Day	Date	Time	Activity
Wed	22 March	1000	Pre-voyage PCR test #2, board vessel + mask wearing, setup personal effects in rooms,
Wed	22 March	1030	Seagoing inductions for those >6 months since onboard @ Aft Lounge
Wed	22 March	1300	VM / Science Briefing #2 @ Aft Lounge
Wed	22 March	1400	Muster drill @ 02 Deck – All participants wearing hard hat, closed shoes and PFD
Wed	22 March	1600	Voyage Management Team Meeting @ Bridge
Wed	22 March	1600	CTD Training Science Party @ Hydrochem Lab
Thur	23 March	0900	Lab Inductions start @ Dirty Wet Lab
Thur	23 March	1100	CTD Training Science Party @ Hydrochem Lab
Thur	23 March	1300	DAP Intro Session
Thur	23 March	1400	Crew & Field Ops deliver safety briefing @ Sheltered Science Area for all science
Fri	24 March	~0800	Depart PW04 (dependant on medical clearance results)
Fri	24 March	0900	Transit Derwent Estuary, toolbox talk underway planning & equipment testing,
Fri	24 March	1200	Outbound: Calibrate backscatter of EM710 on GSM Line #2 @8kts

Day	Date	Time	Activity
Wed	22 March	1000	Pre-voyage PCR test #2, board vessel + mask wearing, setup personal effects in rooms,
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Thur	23 March	0900	Lab Inductions start @ Dirty Wet Lab
Thur	23 March	1100	CTD Training Science Party @ Hydrochem Lab
Thur	23 March	1300	DAP Intro Session
Fri	24 March	TBC	Begin transit to nominal science area
Fri	24 March	TBC	Perform Test CTD as soon as seawater is 1000m deep

Planned Voyage Track

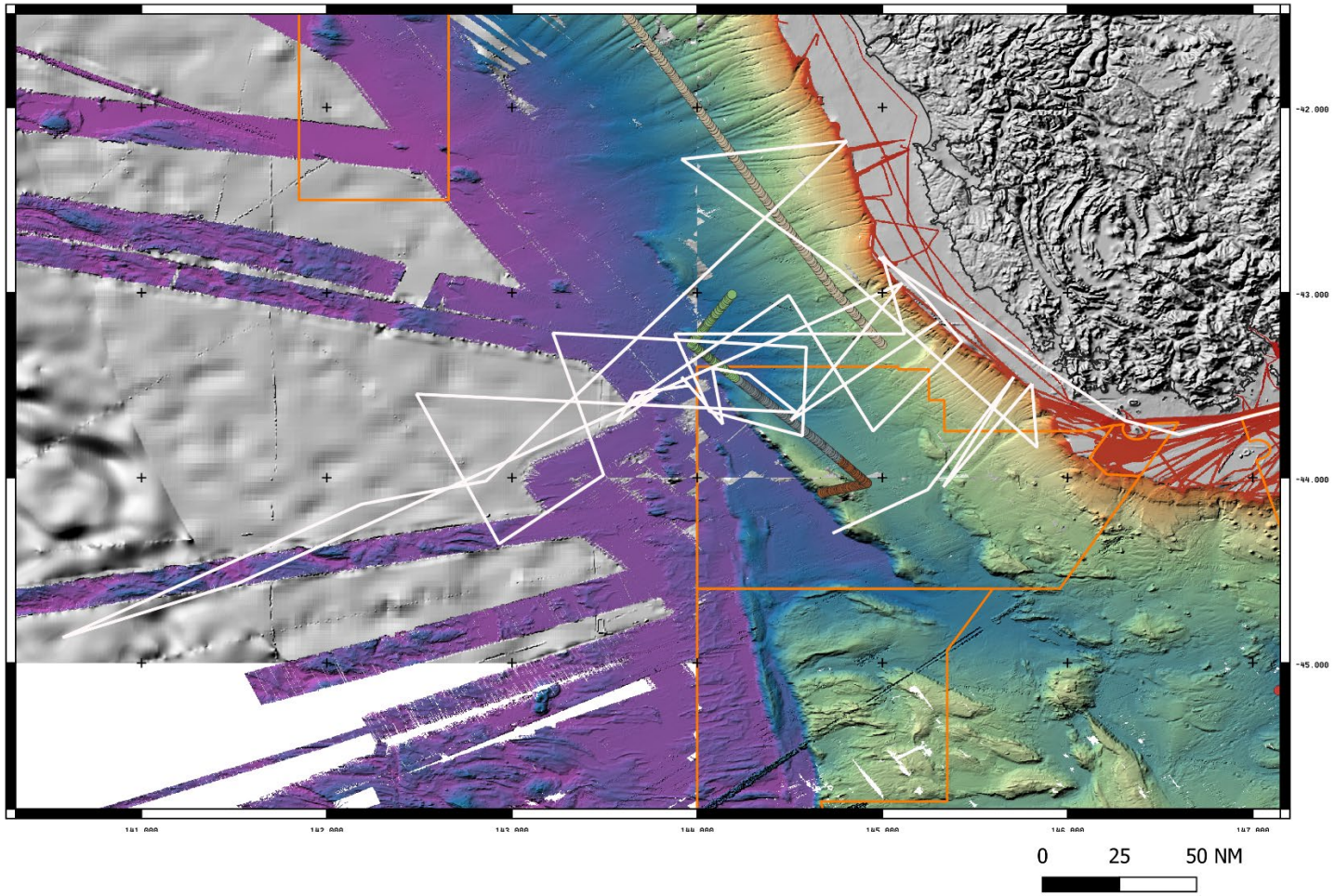


Figure 1. Overview map of southwest Tasmania with simplified day-only tracks (White Line) and Marine Park Boundaries (Orange Line)

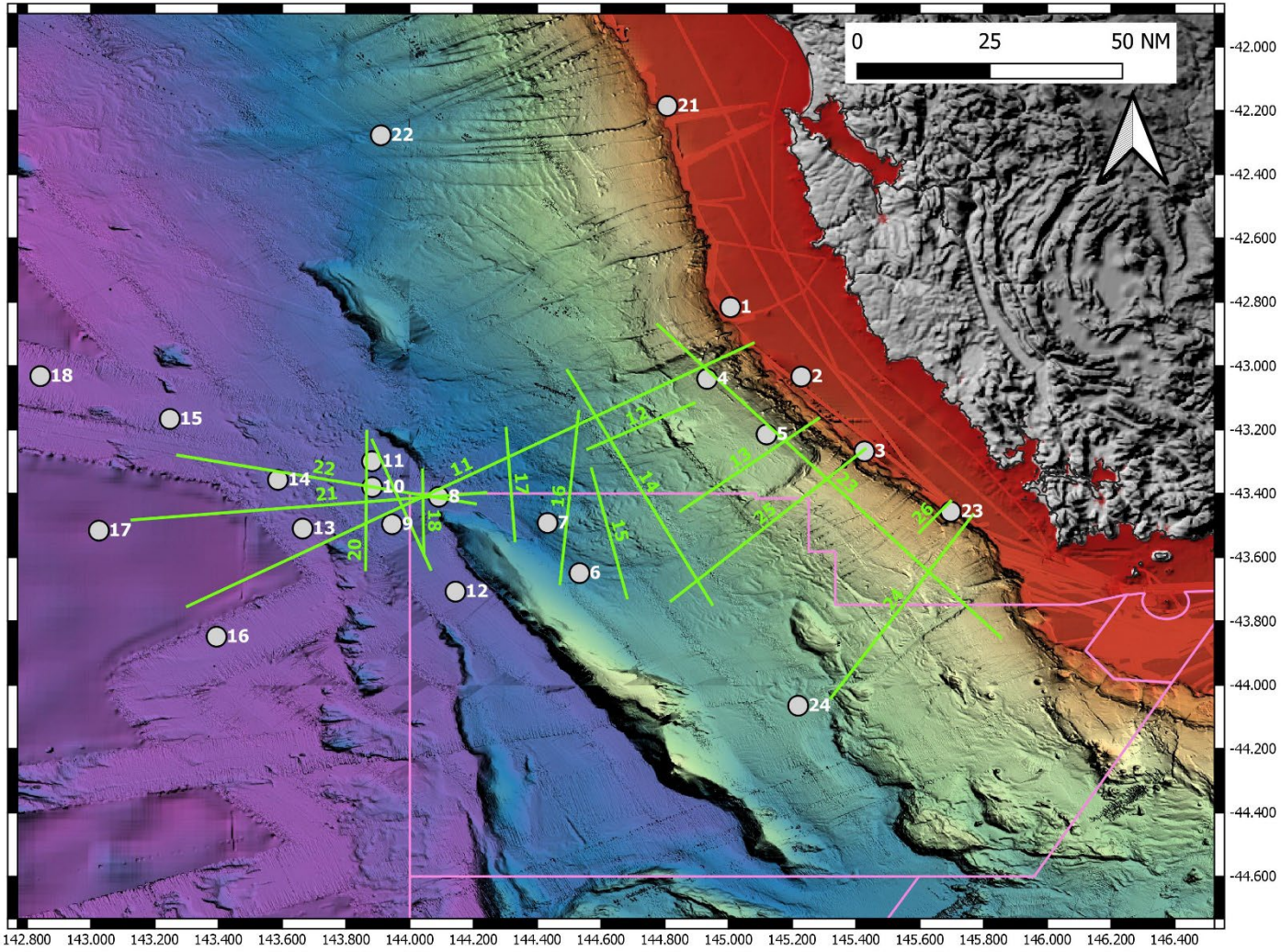


Figure 2. Overview map of southwest Tasmania with day-time activities, KEY: (Pink Lines) Marine Park Boundaries, (Grey Circles) Coring, (Green Lines) Seismic Reflection surveys.

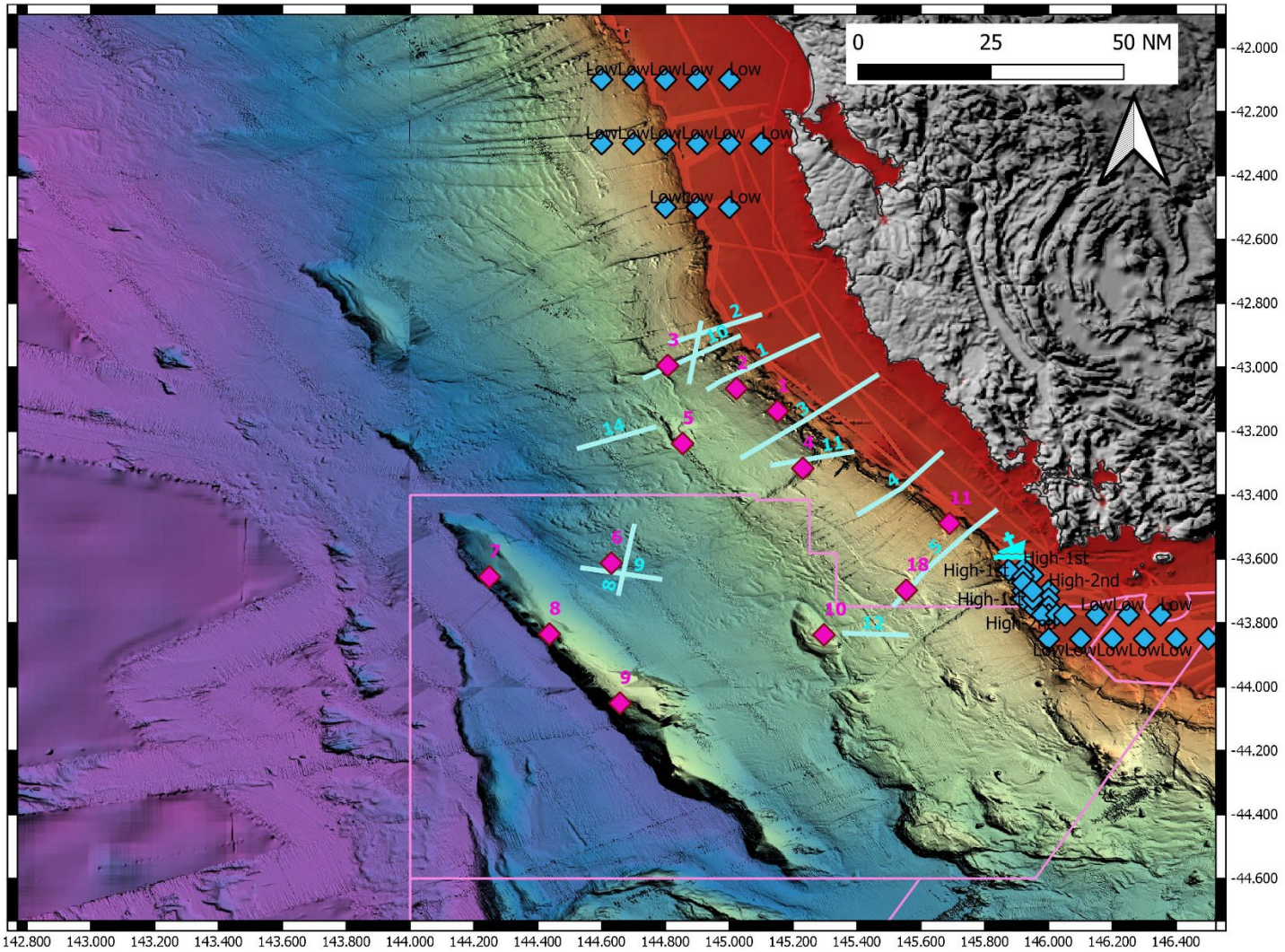


Figure 3. Overview map of southwest Tasmania with areas for chiefly night-time activities, KEY: (Pink Lines) Marine Park Boundaries, (Pale Blue Lines) Deep-Towed Camera surveys, (Pink Diamonds) Dredges Rocks & Biology, (Blue Diamonds) CTD casts.

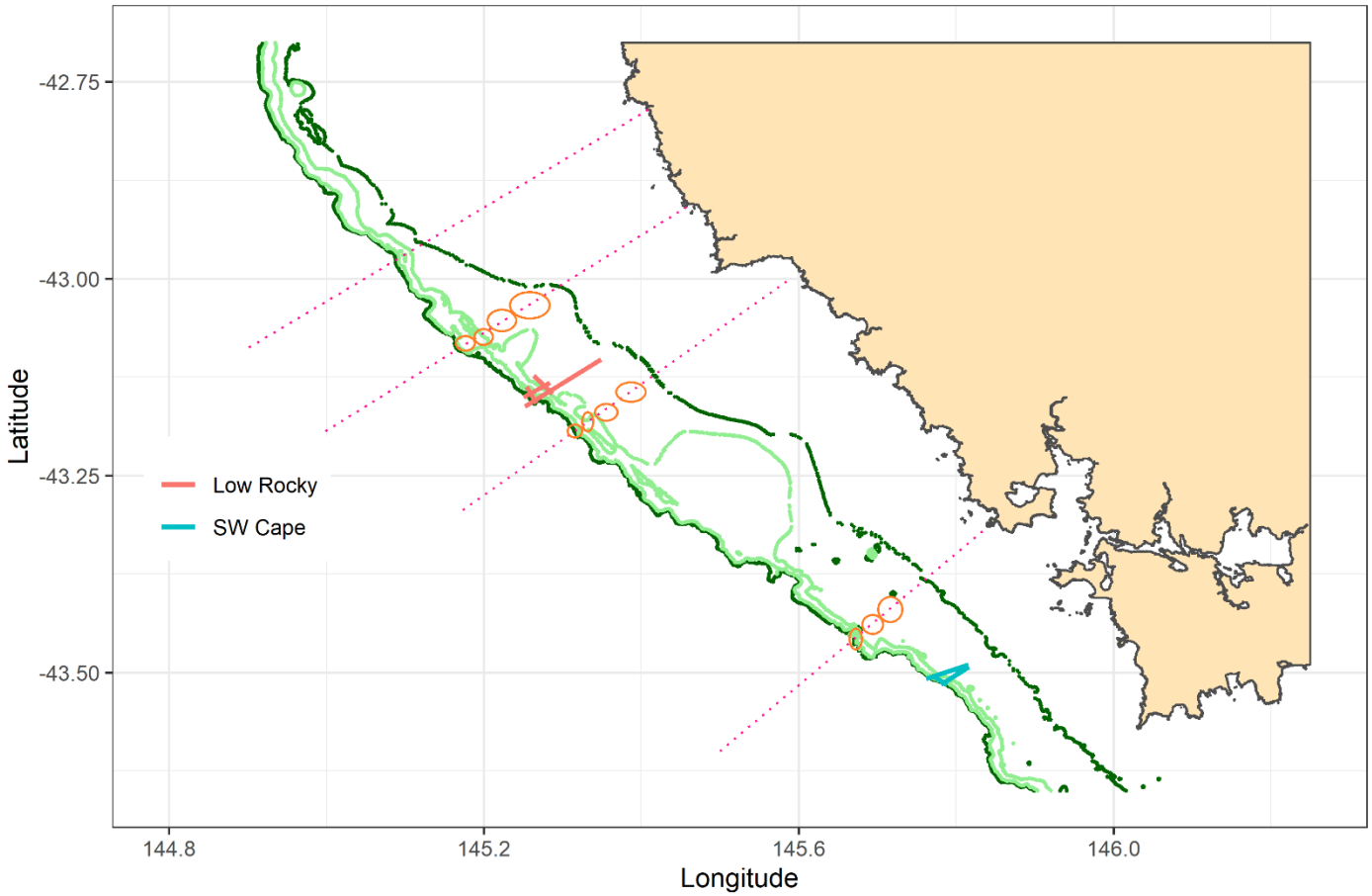


Figure 4. Map of targeted locations for biological investigations to compare fauna in trawled vs. non-trawled areas. Green lines are contours, Red-Dotted lines are Deep Tow Camera transects, Orange Circles are biological sampling areas.

Time estimates are at 10.5 knots									
Location	**Latitude, Degrees Decimal Minutes (DDM)**	**Longitude Degrees Decimal Minutes (DDM)**	**Latitude Decimal Degrees**	**Longitude Decimal Degrees**	**Distance (nm)**	**Total Distance (nm)**	**Steaming time (hrs)**	**Total Steam (hrs)**	**Depth (m)**
Hobart Princes Wharf #04	42° 53.186'S	147° 20.323'E	-42.88644	147.33872	0	0	0.0	0	10
Tranmere	42° 54.311'S	147° 22.727'E	-42.90518	147.37879	2	2	0.3	0	10
Blackmans Bay	43° 00.665'S	147° 21.605'E	-43.01108	147.36009	6	9	1.1	1	17
Storm Bay (Begin CPR / Triaxus Tow)	43° 12.711'S	147° 30.781'E	-43.21185	147.51301	14	22	2.0	3	40
GSM Backscatter Cal Line 2 Start	43° 24.478’S	147° 27.939’E	-43.40797	147.46565	12	34	1.1	4	70
GSM Backscatter Cal Line 2 End	43° 30.632’S	147° 26.618’E	-43.51053	147.44363	6	40	0.8	5	70
Test 1000m CTD cast (outside of Marine Parks – TBD Onboard)	44° 10.607'S	146° 23.805'E	-44.17678	146.39675	60	101	10.1	15	1000
See below for science schedule									
GSM Backscatter Cal Line 3 End	43° 28.37’S	147° 29.713’E	-43.47283	147.49522					70
GSM Backscatter Cal Line 3 Start	43° 23.824’S	147° 29.656’E	-43.39707	147.49427					70
Storm Bay	43° 12.711'S	147° 30.781'E	-43.21185	147.51301					45
Blackmans Bay	43° 00.665'S	147° 21.605'E	-43.01108	147.36009					10
Tranmere	42° 54.311'S	147° 22.727'E	-42.90518	147.37879					10
Hobart Princes Wharf #04	42° 53.186'S	147° 20.323'E	-42.88644	147.33872					10

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:	65 (max)
Likely number of Salinity samples	300 (max)
Likely number of DO samples	300 (max)
Likely maximum depth of deepest cast:	5000 m
Lowered ADCP required:	No
Instrumentation (maximum 6 auxiliary channels in addition to 2x DO):	
2x pumped Temperature, Conductivity, Dissolved Oxygen circuits:	Yes
Altimeter (required if operating anywhere near the sea floor):	Yes
PAR Sensor (Biospherical QCP-2300):	Yes
Transmissometer (Wetlabs C-Star 25cm):	Yes
Fluorometer – Chlorophyll-a (Chelsea Aquatracka III – 430/685nm):	No
Fluorometer – CDOM (Wetlabs FLCDOM – 370/460nm)	Yes
Nephelometer (Seapoint Turbidity Meter)	No
ECO-Triplet (Chlorophyll-a, CDOM & backscatter – maximum depth 2000m)	Yes
Hydrochemistry Analyses:	
Salinity	yes
Dissolved Oxygen	yes
Nutrients: Nitrate	yes
Nutrients: Phosphate	yes
Nutrients: Silicate	yes
Nutrients: Nitrite	yes
Nutrients: Ammonia	no

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.

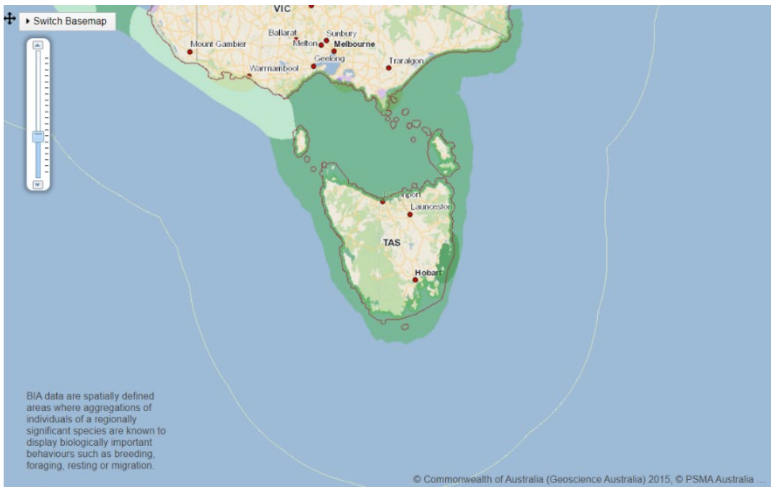
CTD Plan and Summary

listed in highest to lowest priority:

- Dedicated CTD nights:
    - 1-2 nights for this voyage
    - on continental shelf, up to 8 casts per night
    - maximum depths of 200m
    - high resolution sampling (i.e. 20m interval), 8-10 bottles collected max, can reduce sampling number down to ~6 if not much distinctive characters
- Deep towed camera CTD:
    - 1 cast before deployment and 1 cast right after retrieval
    - 2 casts per tow
    - maximum depths of 200m
    - high resolution sampling for the first few 2-3 casts (i.e. 20mm interval), 8-10 bottles collected max, can reduce sampling number down to ~6 if not much distinctive characters
- Opportunistic CTD after coring:
    - full depth with matching coring depths
    - standard CTD depths profile (surface, mixed layer, deep chlorophyll max, and 200-500 m interval dependent on the bottom depth)
    - at least 1 cast per day, 10 bottles maximum
- Opportunistic CTD at Tasman Fracture Marine Park/Macquarie Harbour:
    - full depth cast
    - standard CTD depths profile
    - at least 1 cast per day, 3 – 10 bottles maximum dependent on the bottom depth

Permits

- ***Blanket Seismic Permit: CP2019.0003 Permit variation - issued 2022 for max 18 days seismic operations per voyage. Seismic operations restricted within "Biologically Important Areas" mapped and link below.***
- ***Blanket Marine Park MNF Permit: South-East Marine Park Network Permit: PA2020-00041-1.***
- ***Science Permit Marine Park: PA2022-00155-1. Constraints to 12x epibenthic trawls, 12x Piston Core Samples and unlimited Deep Tow Camera deployments within Marine Parks.***
- ***Science Permit AFMA #1005590. Constrained by location, to equipment of box corer and twin-layer epibenthic net.***
- ***PA2020-00051-1 Southeast Network for ARGO float deployments.***



National Conservation Values Atlas: Interactive Map (environment.gov.au)

This voyage will traverse through the Tasman Fracture Marine Park. An assessment of unplanned deployments (e.g. XBTs) is to be carried out onboard before commencing any operations.

List of additional figures and documents

a. ***Appendix A MNF Equipment***
b. ***Appendix B User Supplied Equipment***
c. ***Appendix C Hazardous Materials Manifest***

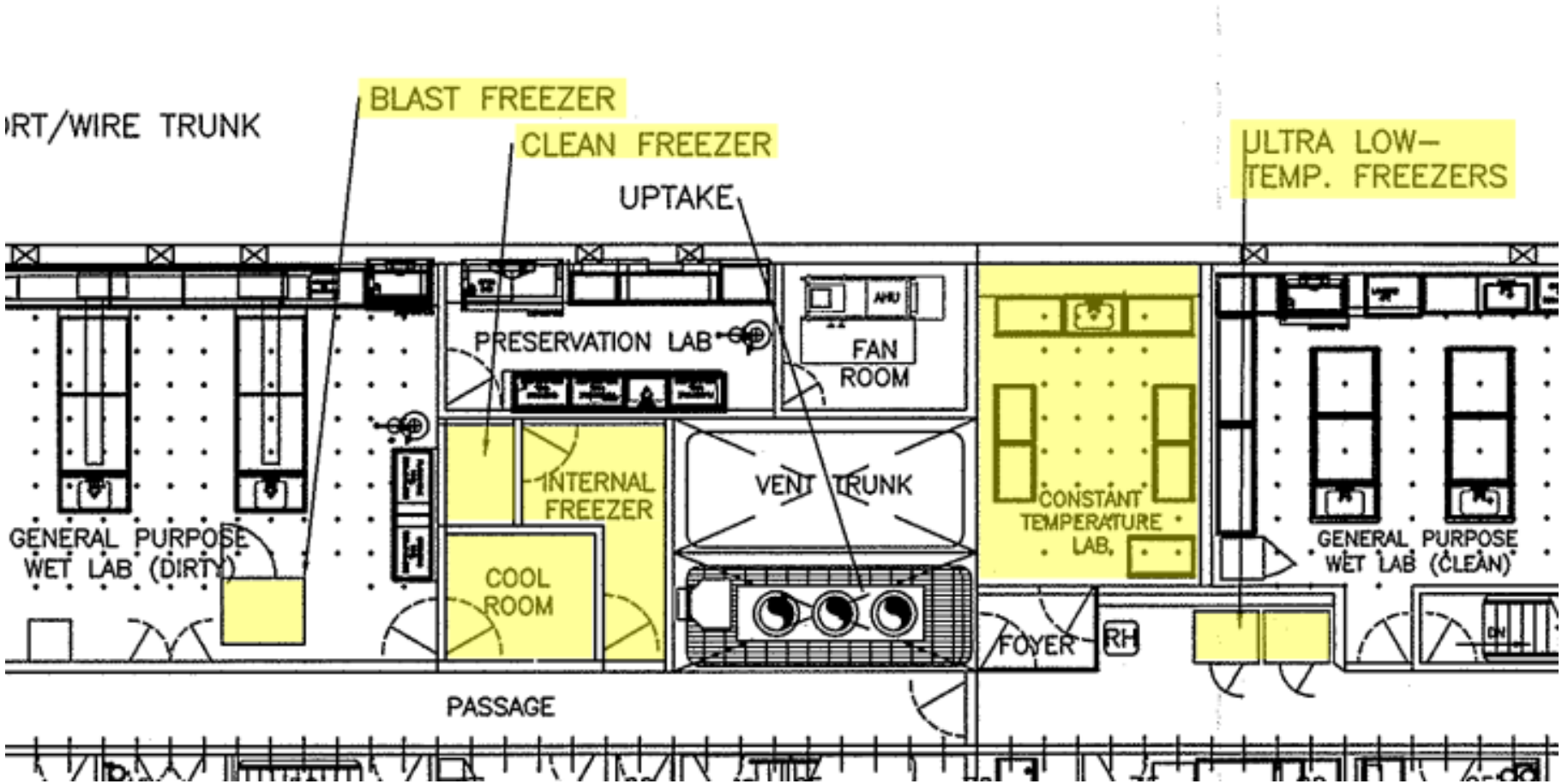
Appendix A

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	X	• ***Core Photography***
Constant Temperature Lab (Min temp: ~4°C / Max temp ~35°C)	X	• ***Core storage*** • ***ca. 4 C***
Underway Seawater Analysis Laboratory	X	• ***Nitrogen and other elements in water***
GP Wet Lab (Dirty)	X	• ***Core splitting, labelling***
GP Wet Lab (Clean)	X	• ***Core description, sampling***
GP Dry Lab (Clean)	X	• ***Core description, microscope area***
Sheltered Science Area	X	• ***Deep-towed camera***
Observation Deck 07 Level	X	• ***Whale watching***
Internal Freezer (Dirty Wet lab) (Min temp -25°C / Max temp 0°C) ***Volume: >20m³***	X	• ***Fauna samples*** • ***4C***
Clean Freezer (Dirty Wet lab) (Min temp -25°C / Max temp 0°C) ***Volume: >2.5m³***		• ***Please indicate the intended activity in this area*** • ***Please indicate the required setpoint temperature***

STANDARD LABORATORIES AND FACILITIES		
NAME	**REQUIRED**	**NOTES/COMMENTS**
Co-located within the Internal freezer and separated by a door		
Blast Freezer (Dirty Wet lab) (Min temp -30^{o}C / Max temp 0^{o}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*** • ***Please indicate the required setpoint temperature***
Cool Room (Dirty Wet lab) (Min temp 0^{o}C / Max temp 10^{o}C)	X	• ***Temporary Core storage*** • ***ca. 4 C***
Ultra-Low Temperature Freezers x2 (Main Deck) Min temp -80^{o}C / Max temp -80^{o}C)	X	• ***Biological/eDNA samples***
YODA Freezers (x2) (Clean Dry lab) (Min temp -20^{o}C / Max temp 10^{o}C)		• ***Please specify if both or only one are needed*** • ***Please indicate the intended activity in this area*** • ***Please indicate the required setpoint temperature***



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)			• ***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).***

MOBILE LABORATORY AND FACILITIES *(MAY REQUIRE ADDITIONAL SUPPORT)*			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS**
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**
CTD - Seabird 911 with 36 Bottle Rosette			
CTD - Seabird 911 with 24 Bottle Rosette	X		
Lowered ADCP			Confirmed not required in planning
Continuous Plankton Recorder (CPR)			*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 VOM, 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			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)*** • ***Plankton counter (Laser Optical Plankton Counter)*** • ***Transmissometer*** Contact MNF for further details on other instrumentation and capability.
Desired towing profile:			
Additional instrumentation: (please supply, make and model and datasheets and a contact person for discussion on integration)			
Piston Coring System	X		
Gravity Coring System	X		
Multi Corer			

SPECIALISED SAMPLING EQUIPMENT			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS (THESE ITEMS MAY REQUIRE ADDITIONAL MNF SUPPORT STAFF)**
Kasten Corer	X		Backup to piston coring system, uploaded onboard but tracks and equipment not installed unless failure of Giant Piston Coring system. Constraints at sea ~10hrs install daylight hrs, appropriate weather conditions, no further Deep Tow Camera deployments.
Smith Mac Grab	X		Backup to piston coring system
Rock Dredges	X		2 dredges minimum with TEETH, please. If possible 4 requested with ample shear pins and sacrificial wires. Also requesting Epibenthic Nets to attach to dredge faces.
Rock Saw			Requires trained science personnel. If room.
Seaspy Magnetometer			
Portable Pot Hauler			
Equipment to measure seawater sound velocity/CTD:	X		
XBT System			2 per day provided, not permitted within Marine Parks
Valeport Rapid SV	X		
Valeport Rapid CTD	X		
Valeport SVX2	X		
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).***

SPECIALISED SAMPLING EQUIPMENT			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS (THESE ITEMS MAY REQUIRE ADDITIONAL MNF SUPPORT STAFF)**
			• ***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		eDNA sampler on deep-towed camera requested if available
Drop Camera	X		As backup to deep towed camera
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)*			Confirmed as not suitable sampling foraminifera given deck space & resourcing limitation.
Surface Net (1m x 1m)	X		100-micron net required, nets taken from Hydrobios multi-net, used (time permitting) as deployments before or after Piston Core locations to compare foraminifera populations in water vs. top of core sediment. Net deployments excluded from Marine Park coring locations, unless specifically permitted.
Bongo Net 485mm diameter			Confirmed not suitable sampling foraminifera
Beam Trawl			
MIDOC			Multiple opening/closing net system with cod ends- suitable for pelagic trawls
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)			***8m2 mouth area*** ***Tow speed ≤2 knots***

SPECIALISED SAMPLING EQUIPMENT			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS (THESE ITEMS MAY REQUIRE ADDITIONAL MNF SUPPORT STAFF)**
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.			
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)		X	
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		
Leica / M80	Dissecting	X		
Leica /MZ6	Dissecting	X		
Olympus / CH	Compound	X		
Olympus /CH	Compound	X		
Leica / MTU282	Camera tube	X		
Adapters for tube / Nikon	Pentax	X		
Ring Light *2 / MEB121	LED	X		
Heavy Duty Electronic Balance (80kg)		X		
Medium Duty Electronic Balance (15kg/5g resolution)		X		
Light Duty Electronic Balance (3kg/1g resolution)		X		

Underway systems

ACOUSTIC UNDERWAY SYSTEMS			
NAME	ESSENTIAL	DESIRABLE	NOTES/COMMENTS
75kHz ADCP	X		
150kHz ADCP	X		

ACOUSTIC UNDERWAY SYSTEMS			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS**
Multi Beam Echo Sounder EM122 12kHz (100m to full ocean depth)	X		
Multi Beam Echo Sounder EM710 70-100kHz (0-1000m approx.)	X		
Sub-Bottom Profiler SBP120	X		
Scientific Narrowband Echo Sounders EK60 (6 bands, 18kHz-333kHz)	X		***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***
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***
Multibeam Scientific Echo Sounder ME70 (70-100 kHz)			
Omnidirectional Echo Sounder SH90			
Gravity Meter	X		

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)			

ATMOSPHERIC UNDERWAY SENSORS			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS**
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			***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			
Fluorometer			
Optode			
pCO2			

SEAWATER SYSTEMS			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS**
Trace metal clean seawater supply			

SEAWATER SYSTEMS			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS**
Scientific clean seawater supplied to laboratories			
Raw seawater available on deck and in laboratories	X		

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	X		• ***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	X		• ***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		
UTAS In-Situ Pumps (x2)			
EM2040			Shallow water multibeam echosounder system

Appendix B

User Supplied Equipment

The Chief Scientist, in consultation with support staff and HSE representatives, has completed a user supplied equipment manifest, to ensure equipment logistics and risks are identified and appropriately controlled. The manifest is available separately from the Voyage Delivery Coordinator.

NOTE: User supplied equipment will remain the responsibility of the science party throughout the voyage. The MNF technicians and ship's crew endeavour to assist wherever possible, however the MNF take no responsibility for the pre-deployment checks or repairs and maintenance of this equipment

Appendix C

Hazardous Materials Manifest

The Chief Scientist, in consultation with support staff and HSE representatives, has completed a hazardous materials manifest, to ensure volumes, use and storage risks associated with hazardous materials are identified and appropriately controlled. The manifest is available separately from the Voyage Delivery Coordinator.

NOTE: User supplied equipment and hazardous materials will remain the responsibility of the science party throughout the voyage.