RV *Investigator* Voyage Plan

VOYAGE #:	IN2025_V06
Version Number:	FINAL
Voyage title:	The Coral Sea frontier: Deep-sea biodiversity assessment of the Coral Sea Marine Park
Mobilisation:	Brisbane, Wednesday 8 to Friday 10 October 2025
Boarding:	Brisbane, 0800hrs Friday 10 October 2025
Depart:	Brisbane, 2000hrs Friday 10 October 2025
Mid-Voyage Transfer:	Heron Island Research Station, ~1400hrs, Monday 20 October 2025
Return:	Brisbane, 0800hrs Friday 14 November 2025
Demobilisation:	Science: On day of arrival, MNF: Brisbane, Saturday 15 November 2025
Chief Scientist:	Dr. William White
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Scientific objectives

This project will investigate benthic marine life in the southern and eastern Coral Sea Marine Park, focussing on two of the parks three key ecological features: the reefs of the Marion Plateau and the Tasmantid Seamount Chain (200-3600 m). This will be the first modern deep-water investigation of marine life found on the extinct volcanic peaks of the northern Tasmantid Seamount Chain which rise over 3000 m from the seabed and the offshore Kenn Plateau making this voyage critical for understanding of regional biodiversity. We will deploy a suite of gear types to survey marine life, including towed camera, eDNA sampler, CTDs, trawls, and sleds. The faunal biodiversity information generated will be used to determine how biodiversity varies across these key ecological features and between the bioregions within the marine park. This information will also be used to examine endemicity levels in fishes and key invertebrate groups and assess whether seamounts and atolls support greater levels of local endemicity than the continental slope and offshore plateaus. A detailed comparison of biodiversity data obtained from extractive versus non-extractive gear types will determine if they provide comparable benthic faunal composition data. Additionally, the project will provide new detailed seabed mapping, particularly on the Marion Plateau where data are currently limited. The results of this project will contribute to primary outcomes of the Australian Marine Parks' Marine Science Program, by increasing understanding of marine park values, through detailed data on benthic communities present in the CSMP and enabling improved evidence-based decision making by addressing key priorities established by Parks Australia for the CSMP. The most significant outcome for Parks Australia will be the provision of vital data on the benthic communities of the Special Purpose Zones and the Tasmantid Seamount Chain for inclusion in the 2028 Coral Sea Marine Park Management Plan.

Objectives

1. Describe the benthic faunal biodiversity (fishes and key macroinvertebrate groups) from biological communities around atolls, seamounts, offshore plateaus, and the continental slope of the southern and eastern CSMP in the major bathomes.
2. Quantify the level of endemism of fishes and key macroinvertebrate groups in the southern and eastern CSMP.
3. Substantially contribute to the AusSeabed project by maximising new multibeam coverage to create detailed maps of seafloor topography and morphological habitat types of the Marion Plateau, Tasmantid Seamount Chain and Kenn Plateau.
4. Test predictive models linking biogeophysical parameters and deep-water benthic biodiversity.
5. Collect specimens for species identification and descriptions, and to archive specimens in biological collections, including tissue samples to build marine invertebrate and fish genetic reference libraries for the Coral Sea.
6. Conduct a detailed environmental DNA analysis across the study region in parallel with traditional biodiversity survey methods.
7. Compare the faunal data from each sampling method to determine the most appropriate for addressing research questions, in particular extractive vs. non-extractive methods.
8. Compare the biogeographical relationships of the benthic fauna found in the CSMP to other Australian bioregions.
9. Use population genomic methods to assess connectivity, diversity, and source and sink relationships between benthic invertebrate and fish species across the seamounts and atolls of the Tasmantid Seamount Chain to inform management decisions.

Voyage objectives

The methods proposed for seabed imagery acquisition, and benthic biota sampling are mostly described in the NESP *Field Manuals for Marine Sampling to Monitor Australian Waters*. These methods have been used by our team on previous voyages, e.g. IN2017_V05, IN2017_V03, IN2022_V08 and V09. Surveys will be conducted along with near-seabed and CTD water sampling for collecting environmental parameters and eDNA analysis at all stations.

Seabed characteristics including habitat and substrate types will be recorded using the RV *Investigator*'s multibeam swath mapping systems and sub-bottom profiler, and will augment the data from the analysis of imagery from the deep tow video (as per IN2017_V05 and IN2022_V09). Pre-voyage planning will determine at which stations swath mapping is required since a number of the areas being surveyed have adequate seafloor mapping available.

Seabed imagery will be collected using the MNF Deep Tow Camera using the Heavy Ocean Towing System (HOTS), which will allow tow video to 3900 m depths to take place. A processing pipeline needs to deliver images and video in a form that can be ingested into the video annotation system (VARS). This pipeline needs to work in near real time to be able to use initial outputs for strategic planning and to maintain and check the quality of imagery. The ability to accurately identify invertebrates from imagery relies on collections from the area, which should be documented with a benchtop photo and subsequently identified by taxonomic experts. We use this information together with *in situ* imagery to accurately assign identifications to faunal units. Co-located trawl and towed video transects are an essential tool to make this connection between collected specimens and in situ observations, as well as obtaining the correct taxonomic information for identification. We have traditionally used two classification systems for the identification and annotation of benthic invertebrates from *in situ* imagery. CATAMI, will be the primary recording level anticipated. This is a low-resolution but standardised scheme based on morphology and aligned with taxonomy for some groups, and a taxonomic scheme in which the faunal units are identified to the lowest possible taxonomic unit, called operational taxonomic units (OTU's). We tend to use these schemes together to get the absolute highest resolution.

Conventional **eDNA** water sampling using CTDs (2L and 10L samples) will be conducted at each site enabling direct comparison with existing eDNA datasets (from IN2021_V04, IN2022_V08 and IN2023_V05). Environmental parameters will also be collected by the Hydrochemistry team (support by the science team) during the voyage. In addition, recent CSIRO research has shown eDNA can be passively collected by allowing water to pass over a collection membrane and was successfully trialled as a parallel deployment with the towed camera on IN2022_V09 using a custom-built device that opens at depth and allows water to flow over the membrane during the tow.

Beam trawl & epibenthic sleds will be used to sample fish and invertebrates from close to or at the benthos at all stations. The 4 m wide MNF Beam Trawl will be the preferred option unless where hard or rugged seabed is expected in which case the epibenthic sled will be deployed. The sled is most effective for sampling invertebrates on hard bottom and rugged terrain not suitable for trawling.

Demersal trawls will be deployed at depths of less than 1500 m in the Special Purpose Zones of the Marine Park. The McKenna trawl is a commercial-scale fish trawl net and is typically used for obtaining information on fish biodiversity. A similar-sized, modified (Wakeford) scampi net was trialled on IN2022_V09 with much success. The specimens collected were in very good condition and invertebrates were sampled far more effectively than with the McKenna trawl. The modified scampi net will be the preferred demersal trawl to deploy at relevant stations. Pre-trawl swath mapping and towed camera operations will be carried out to ensure the ground is suitable for trawling and which net to deploy to minimise occurrences of net damage. If the ground has some hard areas, the McKenna net will be chosen over the modified scampi net, since the rubber bobbins on the McKenna net enable the net to move across low profile, hard seabed. In contrast, the modified scampi net requires a soft flat seabed since the footrope fishes along the seabed, without any rubber bobbins. Although typically demersal trawls are only deployed to 1500 m, we successfully deployed the modified scampi net to below 2000 m depth on IN2022_V09 (and once only semi-successfully to 3000 m). If it is possible to try some deeper (>1500 m tows) on this voyage, it would value-add to the data generated.

Handling and processing of fish and invertebrate samples

Benthic invertebrate and demersal fish samples collected by epibenthic sled, beam trawl, demersal trawl and droplines (see piggyback section) will be sorted to species level (or morphospecies or to some Operational Taxonomic Unit [OTU's] for some groups) and weighed and counted. Fish will also be measured (up to 50 per species). Taxonomic vouchers will be collected to represent all taxa encountered. Most stations will be in deepwater where the catches are far smaller and most of the catch will likely be retained. In the shallowest depths (<400 m), larger fish catches are expected, and as such a large amount of material caught will not be retained and will be returned to the sea dead. A detailed SOP on how the catches of large sharks and rays will be handled is appended to this Voyage Plan.

Barcode scanners, balances and fish measuring boards

Our methods will be greatly assisted if the ships balances can be used to directly log to the ships database. We will also be using barcoded voucher labels and electronic fish measuring boards which can do this. There have recently been some issues with the connectivity between the balances and measuring boards to the computers which we would need to have resolved before the voyage departs. We would like all these tested and working before the voyage (see list of pre voyage and first 24-hour tasks below).

Contingency time

It is noted that during voyages time can be lost, e.g. bad weather or gear problems, and contingency plans are required to know how to plan for this. As reflected in the voyage track, priority will be given to ensuring all the seamount stations are sampled. Any loss of time due to unforeseen circumstances will be made up by reducing the number of stations on the Marion Plateau (SW Special Purpose Zone) which has more replicate stations than the seamounts. All stations surveyed will aim to have all operations undertaken with time made up through removal of whole stations instead.

Voyage track example

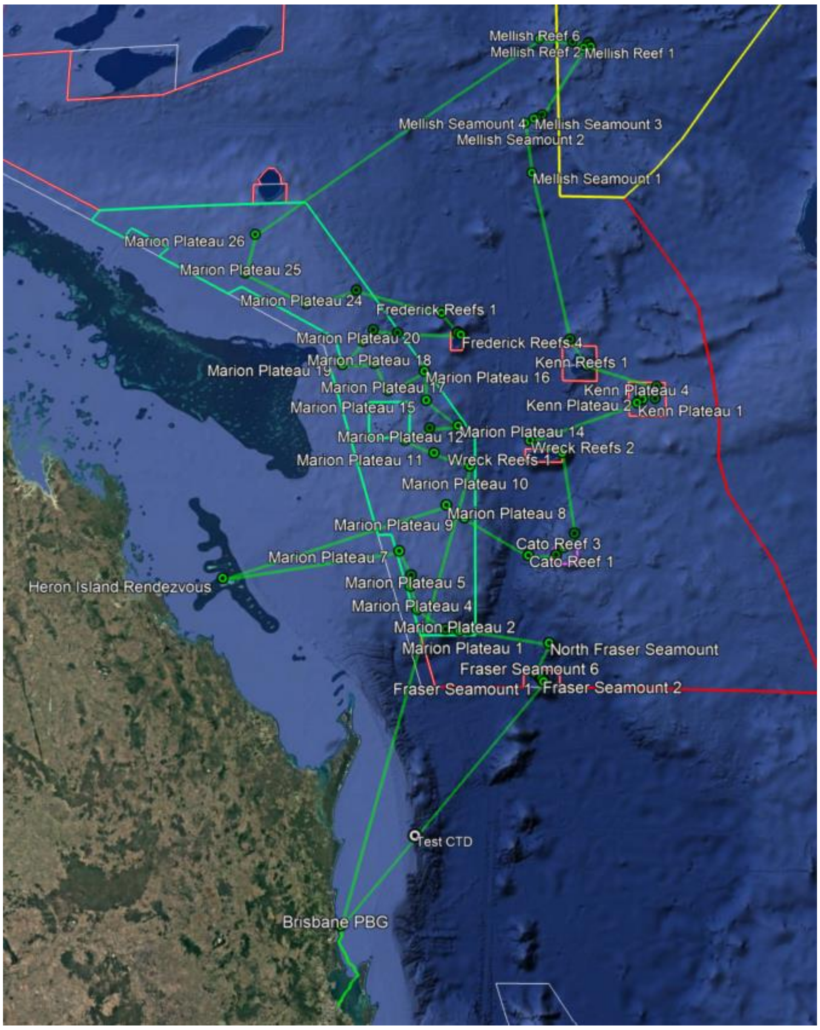


Figure 1: Voyage sample stations with Coral Sea Marine Park zones indicated in different colours

Waypoints and stations

SITE	DDM (LAT)	DDM (LONG)	DISTANCE (NM)	TOTAL DISTANCE (NM)	STEAMING TIME (HRS)	TOTAL STEAM (HRS)
Brisbane Berth	27° 22.782' S	153° 09.648' E				
Brisbane PBG	26° 42.943' S	153° 10.484' E	0.1	50.6	0.0	6.5
Test CTD 1000m	25° 54.637' S	153° 56.880' E	63.8	114.4	6.4	12.8
Fraser Seamount 1	24° 27.762' S	155° 18.198' E	113.9	228.3	11.4	24.2
Fraser Seamount 2	24° 26.148' S	155° 16.992' E	2.0	230.3	0.2	24.4
Fraser Seamount 3	24° 25.662' S	155° 16.062' E	1.0	231.2	0.1	24.5
Fraser Seamount 4	24° 25.800' S	155° 17.838' E	1.6	232.9	0.2	24.7
Fraser Seamount 5	24° 24.570' S	155° 17.478' E	1.3	234.1	0.1	24.8
Fraser Seamount 6	24° 22.470' S	155° 12.498' E	5.0	239.1	0.5	25.3

SITE	DDM (LAT)	DDM (LONG)	DISTANCE (NM)	TOTAL DISTANCE (NM)	STEAMING TIME (HRS)	TOTAL STEAM (HRS)
North Fraser Seamount	24° 05.352' S	155° 21.792' E	19.1	258.3	1.9	27.2
Marion Plateau 1	23° 57.888' S	154° 30.168' E	47.8	306.0	4.8	32.0
Marion Plateau 2	23° 58.320' S	154° 24.918' E	4.8	310.8	0.5	32.5
Marion Plateau 3	23° 57.498' S	154° 15.918' E	8.3	319.1	0.8	33.3
Marion Plateau 4	23° 45.768' S	153° 57.792' E	20.3	339.4	2.0	35.3
Marion Plateau 5	23° 31.950' S	153° 53.334' E	14.4	353.9	1.4	36.8
Marion Plateau 6	23° 25.560' S	153° 53.766' E	6.4	360.3	0.6	37.4
Marion Plateau 7	23° 10.944' S	153° 46.050' E	16.3	376.5	1.6	39.1
Heron Island Rendezvous	23° 25.700' S	151° 52.600' E	105.3	481.8	10.5	49.6
Marion Plateau 8	22° 43.050' S	154° 16.320' E	139.0	620.8	13.9	63.5
Marion Plateau 9	22° 50.802' S	154° 27.888' E	13.2	634.0	1.3	64.8
Cato Reef 1	23° 13.542' S	155° 08.982' E	44.2	678.2	4.4	69.2
Cato Reef 2	23° 13.110' S	155° 26.760' E	16.4	694.5	1.6	70.9
Cato Reef 3	23° 08.430' S	155° 31.698' E	6.5	701.1	0.7	71.5
Cato Reef 4	22° 59.952' S	155° 38.832' E	10.7	711.8	1.1	72.6
Wreck Reefs 1	22° 10.110' S	155° 31.530' E	50.3	762.1	5.0	77.6
Wreck Reefs 2	22° 02.688' S	155° 10.572' E	20.8	782.9	2.1	79.7
Kenn Plateau 1	21° 37.548' S	156° 20.952' E	70.0	853.0	7.0	86.7
Kenn Plateau 2	21° 35.172' S	156° 24.600' E	4.1	857.1	0.4	87.1
Kenn Plateau 3	21° 32.808' S	156° 22.698' E	3.0	860.1	0.3	87.4
Kenn Plateau 4	21° 31.530' S	156° 24.030' E	1.8	861.9	0.2	87.6
Kenn Plateau 5	21° 34.560' S	156° 32.892' E	8.8	870.6	0.9	88.5
Kenn Plateau 6	21° 26.730' S	156° 34.098' E	7.9	878.6	0.8	89.3
Kenn Reefs 1	21° 13.572' S	155° 48.522' E	44.5	923.0	4.4	93.7
Kenn Reefs 2	21° 13.014' S	155° 48.390' E	0.6	923.6	0.1	93.8
Kenn Reefs 3	20° 56.802' S	155° 37.572' E	19.1	942.7	1.9	95.7
Mellish Seamount 1	19° 01.830' S	155° 13.758' E	117.2	1059.9	11.7	107.4
Mellish Seamount 2	18° 25.140' S	155° 09.618' E	36.9	1096.9	3.7	111.1
Mellish Seamount 3	18° 21.720' S	155° 15.558' E	6.6	1103.4	0.7	111.7
Mellish Seamount 4	18° 21.288' S	155° 17.268' E	1.7	1105.1	0.2	111.9
Mellish Seamount 5	18° 18.570' S	155° 21.342' E	4.7	1109.9	0.5	112.4
Mellish Reef 1	17° 26.682' S	155° 50.952' E	59.1	1168.9	5.9	118.3
Mellish Reef 2	17° 25.248' S	155° 55.860' E	4.9	1173.8	0.5	118.8
Mellish Reef 3	17° 22.266' S	155° 53.706' E	3.6	1177.5	0.4	119.2

SITE	DDM (LAT)	DDM (LONG)	DISTANCE (NM)	TOTAL DISTANCE (NM)	STEAMING TIME (HRS)	TOTAL STEAM (HRS)
Mellish Reef 4	17° 21.630' S	155° 54.708' E	1.1	1178.6	0.1	119.3
Mellish Reef 5	17° 22.020' S	155° 43.158' E	11.0	1189.7	1.1	120.4
Mellish Reef 6	17° 19.908' S	155° 20.118' E	22.1	1211.8	2.2	122.6
Marion Plateau 26	19° 43.968' S	152° 07.782' E	232.5	1444.3	23.3	145.8
Marion Plateau 25	20° 10.590' S	152° 01.908' E	27.2	1471.5	2.7	148.6
Marion Plateau 24	20° 32.652' S	152° 43.212' E	44.6	1516.1	4.5	153.0
Marion Plateau 23	20° 24.012' S	153° 16.278' E	32.2	1548.3	3.2	156.2
Frederick Reefs 1	20° 39.828' S	154° 12.858' E	55.3	1603.6	5.5	161.8
Frederick Reefs 2	20° 52.452' S	154° 23.748' E	16.2	1619.9	1.6	163.4
Frederick Reefs 3	20° 53.028' S	154° 23.262' E	0.7	1620.6	0.1	163.5
Frederick Reefs 4	20° 54.378' S	154° 25.620' E	2.6	1623.2	0.3	163.7
Marion Plateau 22	20° 52.878' S	153° 44.010' E	38.9	1662.1	3.9	167.6
Marion Plateau 21	20° 50.778' S	153° 27.858' E	15.2	1677.4	1.5	169.1
Marion Plateau 20	20° 58.392' S	153° 21.258' E	9.8	1687.2	1.0	170.1
Marion Plateau 19	21° 13.518' S	153° 07.752' E	19.7	1706.9	2.0	172.1
Marion Plateau 18	21° 13.068' S	153° 28.818' E	19.7	1726.5	2.0	174.1
Marion Plateau 17	21° 30.810' S	153° 38.148' E	19.8	1746.3	2.0	176.0
Marion Plateau 16	21° 18.462' S	154° 01.818' E	25.3	1771.6	2.5	178.6
Marion Plateau 15	21° 37.212' S	154° 03.060' E	18.8	1790.4	1.9	180.4
Marion Plateau 14	21° 53.502' S	154° 23.850' E	25.3	1815.6	2.5	183.0
Marion Plateau 13	21° 54.852' S	154° 05.358' E	17.2	1832.9	1.7	184.7
Marion Plateau 12	22° 02.562' S	153° 49.662' E	16.5	1849.3	1.6	186.3
Marion Plateau 11	22° 10.638' S	154° 08.238' E	19.0	1868.4	1.9	188.2
Marion Plateau 10	22° 18.888' S	154° 31.542' E	23.1	1891.5	2.3	190.6
Brisbane PBG	26° 42.943' S	153° 10.484' E	274.3	2165.8	27.4	218.0
Brisbane Berth	27° 22.782' S	153° 09.648' E		2214.0		222.8

Note on science stations: Coral Sea Marine Park has various zoning schemes in place. The permitting refers to these zones and various operational/catch limits which should be cross-referenced onboard.

Time Estimates & Activity plan for first 24-48 hours of voyage

Date	Activity
8th-9th October 2025	MOBILISATION MNF Equipment setup Hazmat delivery & loading Liquid nitrogen loading Lab and equipment setup (refer to science team check-list)
10th October 2025	ONBOARDING & DEPARTURE 0800 – Arrival of science party by bus 0900 – Seagoing Induction 1000 – Voyage Manager briefing (introductions, roles & responsibilities, living onboard etc.) 1100 – Lab inductions & Custodian briefing 1300 – DAP briefing (connecting to RVI intranet, wifi etc.) 1400 – Muster Drill 1500 – Rear deck Inductions 1600 – CTD Training 1600 – Senior Management Team meeting @ Bridge Continue lab and equipment set up 2000 – Departure & transit
11th October 2025	~0700 – Test CTD Cast (1000m) Continue transit to Fraser Seamount 1 Check all set-up working areas from a HSE perspective and discussion of planned workflow, particularly manual handling of catch from the deck to dirty wet lab Staff training on voyage database and electronic entering of data At-sea calibration of balances Prepare droplines for deployment (baiting hooks, setting up gear) Conduct pre-starts for first operations ~2030 – On station for Fraser Seamount 1 ops (DTC, Beam Trawl (or sled), CTD)
20th October 2025	Personnel transfer @ Heron Island
14th November 2025	ARRIVAL & DEMOBILISATION

Indicative Schedule

Position/Site	Site #	Depth	Op #	Operation/Activity	Transit time (hrs)	Activity time (hrs)	Time	CSMP Zone
Brisbane				Steaming			10/10/2025 20:00	
Test Station				CTD test cast location	11.0		11/10/2025 7:00	
Test Station		>1000	1	CTD test cast		2	11/10/2025 9:00	
Fraser Seamount 1				Steaming	11.4		11/10/2025 20:24	SPZ
Fraser Seamount 1	1	1011	2	DTC		2	11/10/2025 22:24	SPZ
Fraser Seamount 1	1	1011	3	Beam trawl (or sled)		3	12/10/2025 1:24	SPZ
Fraser Seamount 1	1	1011	4	CTD		2	12/10/2025 3:24	SPZ
Fraser Seamount 4	4			Steaming	0.2		12/10/2025 3:36	SPZ
Fraser Seamount 4	4	369	5	DTC		1.5	12/10/2025 5:06	SPZ
Fraser Seamount 4	4	369	6	CTD		1.2	12/10/2025 6:18	SPZ
Fraser Seamount 2	2			Steaming	0.1		12/10/2025 6:24	SPZ
Fraser Seamount 2	2	375	7	Dropline 1 deploy		1	12/10/2025 7:24	SPZ
Fraser Seamount 2	2	375	8	Dropline 2 deploy		1	12/10/2025 8:24	SPZ
Fraser Seamount 2	2	375	9	Dropline 3 deploy		1	12/10/2025 9:24	SPZ
Fraser Seamount 4	4			Steaming	0.2		12/10/2025 9:36	SPZ
Fraser Seamount 4	4	369	10	Beam trawl (or sled)		2.4	12/10/2025 12:00	SPZ
Fraser Seamount 2	2			Steaming	0.1		12/10/2025 12:06	SPZ
Fraser Seamount 2	2	375	11	Dropline 1 retrieve		1	12/10/2025 13:06	SPZ
Fraser Seamount 2	2	375	12	Dropline 2 retrieve		1	12/10/2025 14:06	SPZ
Fraser Seamount 2	2	375	13	Dropline 3 retrieve		1	12/10/2025 15:06	SPZ
Fraser Seamount 5	5			Steaming	0.1		12/10/2025 15:12	SPZ
Fraser Seamount 5	5	700	14	DTC		1.7	12/10/2025 16:54	SPZ
Fraser Seamount 5	5	700	15	Beam trawl (or sled)		2.7	12/10/2025 19:36	SPZ
Fraser Seamount 5	5	700	16	CTD		1.5	12/10/2025 21:06	
Fraser Seamount 6	6			Steaming	0.5		12/10/2025 21:36	SPZ
Fraser Seamount 6	6	2715		Multibeam mapping		0.5	12/10/2025 22:06	SPZ
Fraser Seamount 6	6	2715	17	DTC		4.5	13/10/2025 2:36	SPZ
Fraser Seamount 6	6	2715	18	CTD		3.3	13/10/2025 5:54	SPZ
Fraser Seamount 3	3			Steaming	0.5		13/10/2025 6:24	SPZ
Fraser Seamount 3	3	584	19	Dropline 4 deploy		1	13/10/2025 7:24	SPZ
Fraser Seamount 3	3	584	20	Dropline 5 deploy		1	13/10/2025 8:24	SPZ
Fraser Seamount 3	3	584	21	Dropline 6 deploy		1	13/10/2025 9:24	SPZ
Fraser Seamount 6	6			Steaming	0.5		13/10/2025 9:54	
Fraser Seamount 6	6	2715		Multibeam mapping		1	13/10/2025 10:54	SPZ
Fraser Seamount 3	3			Steaming	0.5		13/10/2025 11:24	
Fraser Seamount 3	3	584	22	Dropline 4 retrieve		1	13/10/2025 12:24	SPZ
Fraser Seamount 3	3	584	23	Dropline 5 retrieve		1	13/10/2025 13:24	SPZ
Fraser Seamount 3	3	584	24	Dropline 6 retrieve		1	13/10/2025 14:24	SPZ
Fraser Seamount 6	6			Steaming	0.5		13/10/2025 14:54	
Fraser Seamount 6	6	2715	25	Beam trawl (or sled)		5.2	13/10/2025 20:06	SPZ
North Fraser Seamount	7			Steaming	2		13/10/2025 22:06	HPZ
North Fraser Seamount	7	1225	26	DTC		2	14/10/2025 0:06	HPZ
North Fraser Seamount	7	1225	27	CTD		2	14/10/2025 2:06	HPZ
North Fraser Seamount	7	1225	28	Beam trawl (or sled)		3.1	14/10/2025 5:12	HPZ

Marion Plateau 1	8	3880		Steaming	4.8		14/10/2025 10:00	SPZ
Marion Plateau 1	8	3880		Multibeam mapping		0.5	14/10/2025 10:30	SPZ
Marion Plateau 1	8	3880	29	DTC		4.5	14/10/2025 15:00	SPZ
Marion Plateau 1	8	3880	30	CTD		3.3	14/10/2025 18:18	SPZ
Marion Plateau 1	8	3880	31	Beam trawl (or sled)		5.2	14/10/2025 23:30	SPZ
Marion Plateau 2	9			Steaming	0.5		15/10/2025 0:00	SPZ
Marion Plateau 2	9	3197		Multibeam mapping		0.5	15/10/2025 0:30	SPZ
Marion Plateau 2	9	3197	32	DTC		4.5	15/10/2025 5:00	SPZ
Marion Plateau 2	9	3197	33	CTD		3.3	15/10/2025 8:18	SPZ
Marion Plateau 2	9	3197	34	Beam trawl (or sled)		5.2	15/10/2025 13:30	SPZ
Marion Plateau 3	10			Steaming	0.8		15/10/2025 14:18	SPZ
Marion Plateau 3	10	2267		Multibeam mapping		0.5	15/10/2025 14:48	SPZ
Marion Plateau 3	10	2267	35	DTC		4.5	15/10/2025 19:18	SPZ
Marion Plateau 3	10	2267	36	CTD		3.3	15/10/2025 22:36	SPZ
Marion Plateau 3	10	2267	37	Beam trawl (or sled)		5.2	16/10/2025 3:48	SPZ
Marion Plateau 4	11			Steaming	2		16/10/2025 5:48	SPZ
Marion Plateau 4	11	1420		Multibeam mapping		0.5	16/10/2025 6:18	SPZ
Marion Plateau 4	11	1420	38	DTC		2.8	16/10/2025 9:06	SPZ
Marion Plateau 4	11	1420	39	Scampi (or McKenna)		6.4	16/10/2025 15:30	SPZ
Marion Plateau 4	11	1420	40	CTD		3.3	16/10/2025 18:48	SPZ
Marion Plateau 4	11	1420	41	Beam trawl (or sled)		5.2	17/10/2025 0:00	SPZ
Marion Plateau 5	12			Steaming	1.4		17/10/2025 1:24	SPZ
Marion Plateau 5	12	895		Multibeam mapping		0.5	17/10/2025 1:54	SPZ
Marion Plateau 5	12	895	42	DTC		2	17/10/2025 3:54	SPZ
Marion Plateau 5	12	895	43	Beam trawl (or sled)		2	17/10/2025 5:54	SPZ
Marion Plateau 5	12	895	44	CTD		2	17/10/2025 7:54	SPZ
Marion Plateau 5	12	895	45	Scampi (or McKenna)		5.4	17/10/2025 13:18	SPZ
Marion Plateau 6	13	611		Steaming	0.6		17/10/2025 13:54	SPZ
Marion Plateau 6	13	611		Multibeam mapping		0.5	17/10/2025 14:24	SPZ
Marion Plateau 6	13	611	46	Scampi (or McKenna)		4.7	17/10/2025 19:06	SPZ
Marion Plateau 6	13	611	47	DTC		1.7	17/10/2025 20:48	SPZ
Marion Plateau 6	13	611	48	CTD		1.5	17/10/2025 22:18	SPZ
Marion Plateau 6	13	611	49	Beam trawl (or sled)		2.7	18/10/2025 1:00	SPZ
Marion Plateau 7	14	376		Steaming			18/10/2025 1:00	SPZ
Marion Plateau 7	14	376		Multibeam mapping	0.5	0.5	18/10/2025 2:00	SPZ
Marion Plateau 7	14	376		DTC		1.4	18/10/2025 3:24	SPZ
Marion Plateau 7	14	376		Beam trawl (or sled)		2.4	18/10/2025 5:48	SPZ
Marion Plateau 7	14	376		CTD		1.2	18/10/2025 7:00	SPZ
Marion Plateau 7	14	376		Scampi (or McKenna)		3.9	18/10/2025 10:54	SPZ
Heron Island				Steaming	10.5		20/10/2025 12:00	
Heron Island				Transfer		5	20/10/2025 17:00	

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 activity locations vary in water depth and at times have minimal transit distance between planned stations – potential rapid deployment/recovery times and therefore an increase in the total number of operations possible in a 24hr period. Trawl timing is factored over a 12hr window – there is a break in operations 10-days into voyage operations for transfer of personnel which will aid to manage fatigue.	
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 reviewed after 1 week (or earlier if nominated) to identify any areas to improve (e.g. back deck ergonomics, timing for full end-to-end activity planning) • 5-7 days of continuous operations will be a trigger to discuss fatigue and if any pause needs to be considered – this shall be a joint agreement with Chief Scientist, Voyage Manager and Master.	

Communications Plan

The Coral Sea Frontier voyage has a strong focus on education, outreach and engagement with public audiences and media that seeks to increase awareness and understanding of, and inspire interest in, our marine environment.

The voyage communication approach will involve international collaboration between various organisations to support voyage media, education and outreach, including CSIRO, Parks Australia and Bush Blitz from Australia, and Ocean Census, which is a global alliance of biodiversity partners.

CSIRO has developed a Voyage Communication Plan and will oversee the delivery of a collaborative communication approach that includes:

- Regular media stories, opportunities and engagement to share the wonder of marine life and voyage discoveries
- Public outreach via partner owned channels including social media, blogs and news items
- An ongoing commentary on voyage activities and life on board via several partner social media channels
- Opportunities for schools and other groups to experience the excitement of the voyage via live crosses and ship tours
- Unique experiences and opportunities that offer the public a window on voyage discoveries as they happen, primarily via the live broadcast of deep towed camera surveys (with live audio commentary TBC)
- A series of online case studies that raise awareness of the unique capabilities, equipment and expertise the research vessel (RV) Investigator provides for ocean exploration

- Post voyage events to share discoveries, outputs and outcomes of the voyage, including a voyage taxonomic workshop in Hobart in 2026.

Voyage discoveries and outputs such as charismatic and unusual specimen photos and seafloor mapping imagery will also be used to generate media interest and opportunities during the voyage. Similarly, the incredibly broad range of scientific knowledge and expertise in the science party on the voyage will be used to offer expert and engaging spokespeople for media and public outreach.

All voyage media and public communications will be overseen and coordinated by CSIRO through the NCMI (National Collections and Marine Infrastructure) Communication Team.

Supplementary projects

N/A

Piggyback projects

A deep dive into chemosynthesis: how do microbes sustain current and future oceans?, Francesco Ricci (Monash University)

Objectives:

- characterize seawater microbiomes and physicochemistry;
- profile seawater microbial composition, functions and gene expression.

Voyage objectives (to be undertaken by eDNA team):

- Ten litres of water from multiple depths at 10 of the 69 planned stations, with a focus on balanced latitudinal coverage in sites selected.
- Filters to be frozen in –80 C Ultrafreezer.
- Obtain environmental parameters data for each CTD cast.

Timing: The samples to be collected will not affect the timing of operations but will require some extra time and a water budget from the relevant CTD casts.

Dropline survey of seamounts in the Coral Sea Marine Park, William White (CSIRO)

Objective:

To provide crucial biodiversity data for large, active fish species in the Special Purpose Zones (seamounts) where commercial line fishing can occur

Voyage objectives:

Deploy droplines at two depths zones (200-400 m and 400-600 m) on the two SPZ seamounts (Fraser and Kenn seamounts). Plan for 6 droplines (3 at each of the two depths per seamount) and a 6 hr soak time. Dropline catches used to sample the diversity of larger, more active fishes which will not be sampled with beam trawl or epibenthic sled.

Timing: Additional time will be required for deployment and retrieval.

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:

1. Installation of a camera, data storage for video, and processing unit into the RV Investigator electrical system prior to IN2025_V06.

2. During IN2025_V06 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 and/or conduct science in the following Marine Parks:

- Coral Sea Marine Park
- Great Barrier Reef Marine Park

- Approved activities are covered by:
  - Science Permit
    - PA2025-00051-1
    - Permit variation PA2025-00051-2
  - MNF Permits
    - PA2020-00041-5 Permit – Coral Sea Marine Park,
    - Permit variation PA2020-00041-11 - Coral Sea Marine Park
    - Permit variation PA2020-00041-18- Coral Sea Marine Park
    - GBRMPA permit – G19/41954.2 (no science sampling, only for Heron Island personnel transfer)

Dept/Agency	Permit Name & Number	Permit Expiry	Comments
Parks Australia	PA2025-00051-1 Permit variation PA2025-00051-2	15 December 2025	Science specific permit for sampling within Coral Sea Marine Park Note the sampling limits within the respective zones
Parks Australia	PA2020-00041-5 Permit variation PA2020-00041-11 Permit variation PA2020-00041-18	6 October 2026	MNF blanket permit and variations for Coral Sea Marine Park
GBRMPA	G19/41954.2	Current	Expiry in permit noted as 30/09/2024. GBRMPA confirms that permit remains in place while renewal is underway. No sampling and entry/exit is related to personnel transfer at Heron Island.
DCCEEW	Part8A Permit (biological resources) AU-COM2025-015	30 November 2025	DCCEEW permit for collecting biological material in Commonwealth waters Part 8a
DCCEEW	E2025-0253 - Part 13 Permit - Permit	15 December 2025	Permit to take threatened species bycatch. To impact up to two listed marine species in total, including the incidental taking of no more than one individual of the following turtle species: green turtle, loggerhead turtle, leatherback turtle, hawksbill turtle, olive ridley turtle, flatback turtle; and the incidental death of one scalloped hammerhead, within the southern and eastern Coral Sea Marine Park during surveying

CWLLA AEC	AEC 2025-03	30 June 2026	Animal ethics approval from CSIRO Wildlife, Livestock, and Laboratory Animal Ethics Committee
QDAF	274031	15 December 2025	General Fisheries permit

Note: AFMA Scientific Permit confirmed as not required, following submitted application and verification by AFMA and Parks Australia, given voyage is entirely within the Coral Sea Marine Park.

Appendix A

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. Please allow for this cast in your voyage's Time Estimates (approximately 1 hour).

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:	69
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	
Chelsea Aquatracka III (430/685nm) Fluorometer – Chlorophyll-a	
Seabird SUNA – Ultraviolet Nitrate Analyzer (**Serial Connection - 2000m**)	
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

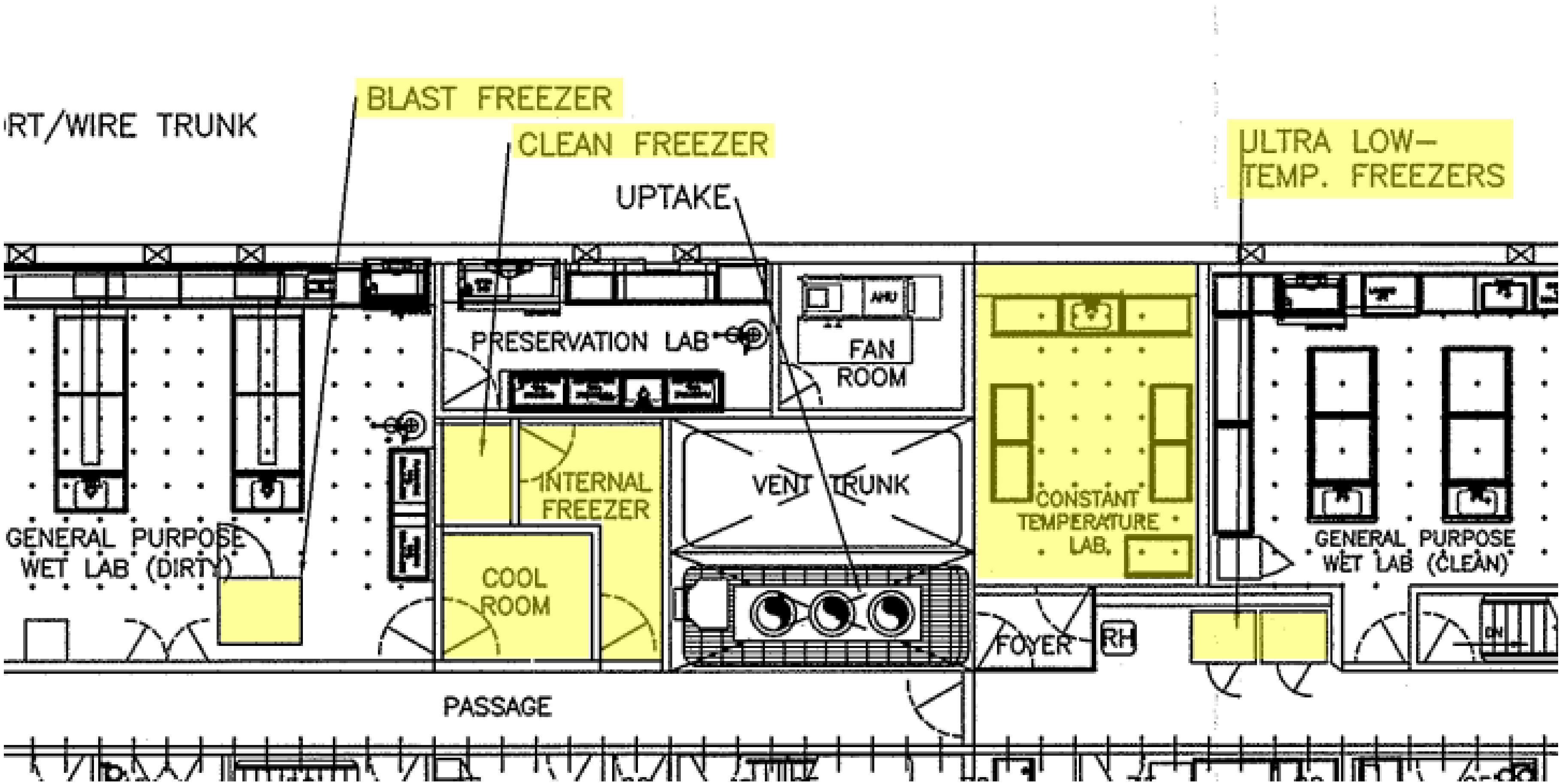
	PLEASE SELECT:
Alternative LADCP Configuration - Instrumentation: 6000m	
1 x Teledyne 300 kHz LADCP (Slave - Up) 1 x Teledyne 300 kHz LADCP (Master - Down) 1 x 48V Deep Sea Battery	No
Hydrochemistry Analyses	
Salinity	Yes
Dissolved Oxygen	Yes
Nutrients: Nitrate	Yes
Nutrients: Phosphate	Yes
Nutrients: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

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	• Formalin and ethanol fixing in fume hood, specimen photography on benches, pinning fins of fishes for photography. Note that fixation of larger specimens (that fit into 30 L drums) will be mainly done on the back deck to allow greater ventilation. These drums will be stored within a pallet cage (ideally on back deck close to Hazmat container) when being actively added to and when drums are full they will be taped up and safely stored in the airconditioned Hazmat container. All specimens too large for a 30L drum will be frozen on board.
Constant Temperature Lab (Min temp: ~4°C / Max temp ~35°C)	X	• Possibly for algae incubators (piggy-back project possibility) - to be confirmed
Underway Seawater Analysis Laboratory		•
GP Wet Lab (Dirty)	X	• Sorting, weighing, counting, measuring catches
GP Wet Lab (Clean)	X	• Storing gear, gear mobilisation, camera set up and download, pinning fins of fishes for photography. May also need to do some fixation of fishes in small plastic jars in the fume hood.
GP Dry Lab (Clean)	X	• e-DNA work, storing gear, other dry work including data entry
Sheltered Science Area	X	• Sorting, weighing, counting, measuring catches on the trawl sort table; preliminary fish identifications
Observation Deck 07 Level		•
Internal Freezer (Dirty Wet lab) (Min temp -25°C / Max temp 0°C)	X	• Freezing retained samples • -20°C

STANDARD LABORATORIES AND FACILITIES		
NAME	**REQUIRED**	**NOTES/COMMENTS**
Volume: >20m^3		
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	• Keeping samples cool while awaiting sorting; storing ice prior to trawl landing • 0°C
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	• Freezing samples • -30°C
Cool Room (Dirty Wet lab) (Min temp 0°C / Max temp 10°C)	X	• Keeping samples cool while awaiting sorting • 0°C
Ultra-Low Temperature Freezers x2 (Main Deck) Min temp -80°C / Max temp -80°C)	X	• Freezing eDNA samples and high-quality tissue samples from specimens
YODA Freezers (x2) (Clean Dry lab) (Min temp -20°C / Max temp 10°C)	X	• Both required • Short term freezing of e-DNA samples; • -20°C



MOBILE LABORATORY AND FACILITIES *(MAY REQUIRE ADDITIONAL SUPPORT)*			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS**
Modular Isotope Laboratory			I
Trace Metal Niskin Sampling Container (TM1-blue - 20ft)			•

MOBILE LABORATORY AND FACILITIES *(MAY REQUIRE ADDITIONAL SUPPORT)*			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS**
Trace Metal Seawater Analysis Laboratory (TM2-white - 20ft)			•
Trace Metal Rosette and Niskin Storage Container			
Modular Hazchem Locker	X		
Stabilised Platform Container			
Clothing Container			N/A

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			
Piston Coring System			
Gravity Coring System			
Multi Corer			
Kasten Corer			
Smith Mac Grab			
Rock Dredges			
Rock Saw			

SPECIALISED SAMPLING EQUIPMENT			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS (THESE ITEMS MAY REQUIRE ADDITIONAL MNF SUPPORT STAFF)**
Seaspy Magnetometer			
Portable Pot Hauler			
Equipment to measure seawater sound velocity/CTD:			
XBT System			2 per day provided
Valeport Rapid SV			
Valeport Rapid CTD			
Valeport SVX2			
Trace Metal Rosette and Bottles			
Trace Metal In-situ Pumps (x6)			•
Deep Towed Camera	X		
Drop Camera			
Epibenthic (NIWA) Sled	X		x2
Brenke Sled			
Hydro-Bios MultiNet (Mammoth) (1m x 1m)			
Surface Net (1m x 1m)			
Bongo Net			
Beam Trawl	X		Spare beams required
MIDOC			

SPECIALISED SAMPLING EQUIPMENT			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS (THESE ITEMS MAY REQUIRE ADDITIONAL MNF SUPPORT STAFF)**
Pelagic Trawl System (net, doors)			
Demersal Trawl System (net, doors)	X		Two McKenna nets (MNF supplied) and two modified scampi nets (user supplied)
RMT-8 (Rectangular Midwater Trawl)			
RMT-16 (Rectangular Midwater Trawl)			
Trawl Monitoring Instrumentation (ITI) (1,500m depth limit)	**REQUIRED**		
Stern ramp	**EXPOSED**		

RESEARCH SUPPORT INFRASTRUCTURE			
NAME	**ESSENTIAL**	**DESIRABLE**	**NOTES/COMMENTS**
Saltwater Ice Machine (Dirty Wet lab)	X		Critical for voyage, preventative maintenance and spare parts requested to ships engineers
Radiosonde Receiver System			
Laboratory Incubators (Clean Dry lab)			
Deck Incubators			
Milli-Q System	X		
Sonardyne USBL System	X		

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		

SCIENTIFIC / SAMPLE ANALYSIS SYSTEMS				
MICROSCOPES:				**NOTES/COMMENTS**
Leica / M80	Dissecting	X		
Leica /MZ6	Dissecting	X		
Olympus / CH	Compound			
Olympus /CH	Compound			
Leica / MTU282	Camera tube	X		
Adapters for tube / Nikon	Pentax	X		
Ring Light *2 / MEB121	LED	X		
Heavy Duty Electronic Balance (80kg)		X		Will probably need set up in Sheltered Science Area
Medium Duty Electronic Balance (15kg/5g resolution)		X		Need to have set up to log data directly to the voyage database
Light Duty Electronic Balance (3kg/1g resolution)		X		Need to have set up to log data directly to the voyage database

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

SCIENTIFIC / SAMPLE ANALYSIS SYSTEMS			
MICROSCOPES:			NOTES/COMMENTS
Scientific Narrowband/Broadband Echo Sounders EK80 (6 bands, 18kHz-333kHz)			
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			
Fluorometer			
Optode			
pCO2			

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