

RV Investigator Voyage Plan

Voyage #:	IN2016_E02		
Voyage title:	MNF Equipment Sea Trials		
Mobilisation:	Sydney, Wednesday, 14 and Thursday, 15 December 2016		
Depart:	Sydney, 13:00, :Thursday, 15 December 2016		
Return:	Hobart, 23:00, Monday, 19 December 2016		
Voyage Manager:	Don McKenzie	Contact details:	don.mckenzie@csiro.au
Affiliation:	MNF (CSIRO)		

General

The transit voyage will depart from Sydney and end in Hobart. It will comprise of various sea trials work including testing equipment listed above along with demersal trawling equipment trials in preparation for upcoming voyages IN2017_V03 & IN2017_V05 plus calibration of DECAF for Rudy Kloser (12hours)

Scientific Objectives

Sea trials of the demersal trawling equipment will be performed during IN2016_E02. The locations for sea trials have been chosen such that trawling samples collected will supplement data to be collected for planned scientific voyages in 2017. The trial will deploy a demersal net previously used for surveys in the South East Fishery (SEF) at sites last surveyed between 1990 and 2000 further ensuring relevance of the limited data to be collected during the trial. The specific scientific objectives are to:

- 1) Collect trawling samples for comparison with previous and future trawling survey's in the area;
- 2) Complete deep towed camera trials over St Helens Seamount to capture image data contributing to a time-series analysis of recovery of seamount benthos from bottom trawling
- 3) It shall be noted that the primary objective of the trials will be to prove / improve functionality of equipment and sample handling and any collection of samples will be considered secondary to the test & trials objectives of the voyage.

Voyage Objectives

The Primary objective of IN2016_E02 is to complete the sea trial regime as follows:

- Demonstrate trawling equipment functions correctly, provide ASP crew training / exposure to trawling and confirm suitable manning levels for future trawling voyages, including emptying of scientific samples from a laden net;
- Collect trawling data for analysis;
- Deep towed camera system testing;
- Demonstrate functionality of other equipment modified / upgraded / installed / maintained during the Sydney dry dock period;
- Complete the installation of the UHDAS (ADCP) computer, and use the transit and trawling time for calibration, testing, and assessment and training on the new UHDAS software installation;
- Transport the Investigator from Sydney to Hobart;
- Deep water calibration of DECAF (Kloser charter).

Voyage Activity Summary

The following list details the key activities planned for IN2016_E02:

- Transit to trawling test location #1 & complete first trawling trials;
- Transit to trawling test location #2 & complete first trawling trials;
- Transit to trawling test location #3 & complete first trawling trials;
- Complete remaining equipment function tests concurrently with trawling testing and transit to Hobart.

Voyage Specific Risks

The key challenge around completion of the sea trials program will be managing safe operations in testing new / modified equipment for the first time. A number of high risk activities have been identified and will be mitigated as follows:

- Maintaining exclusion zone around wires under tension during load / function testing;
- Restricting trawling trials to daylight activities only, noting the limited experience of the ship's crew with trawling operations.

ASP Standard Operating Procedures, JSA's and toolbox meetings will be followed throughout the voyage to reduce risk to operations.

Scientific objectives

General

The primary objective of the voyage is to test and verify equipment in a series of sea trials. As such the scientific objectives will be a secondary objective for the voyage. The trawling required to meet the scientific objectives will be conducted as part of the equipment sea trials. The locations chosen to conduct trawling equipment sea trials has been chosen to coincide with areas of interest for upcoming science voyages (IN2017_V03) as well as past trawling studies. Hence trawling data will be collected for possible use as supplementary data for future science voyages, and comparison with past surveys.

Demersal Trawling

The scientific objectives for demersal trawling are to:

- Perform trawling trials at locations identified by Tim O'Hara in preparation for In2017_V03;
- Recover trawling samples to the vessel for during trawling function testing;
- Transfer of samples from deck to dirty wet lab for cataloguing;
- Cataloguing of trawling samples for analysis;
- Compile an action list of trawling lessons learnt (equipment improvements, suitable manning levels etc) for action prior to IN2017_V03 to ensure successful future voyages.

The following trawling locations have been identified for trawling trials, noting that AFMA permits have been recover specimens at any 4 of the 7 sites nominated in Table 1 below.

Location	Tow Site Details							Trawl Equipment
	Location Name	Start Depth (m)	End Depth (m)	Latitude (Start)	Longitude (Start)	Latitude (End)	Longitude (End)	
1	SNSW	150	0	-35.8788	150.479	-35.9116	150.46	??
2	Bermagui	100	0	-36.4617	150.218	-36.499	150.214	McKenna trawl
3	Merimbula	200	0	-36.86	150.297	-36.8833	150.298	McKenna trawl
4	Disaster Bay	50	0	-37.397	150.04	-37.368	150.052	McKenna trawl
5	Big Horseshoe	1500	0	-38.3886	149.827	-38.4049	149.785	??
6	Big Horseshoe	2000	0	-38.4563	149.862	-38.4714	149.821	??
7	Maria Island	400	400	-42.7171	148.409	-42.648	148.435	McKenna trawl

Table 1: Demersal trawling sample locations

Piggy-back projects

Rudy Kloser charter

Dr Rudy Kloser has been allocated time to undertake the deep water calibration experiments using DECAF. 12 hours of stationary time (spread over 3 blocks of 3-4 hrs) in deep water is required.

Calibration of deep water acoustic transducers is vital for the ongoing research and monitoring of deep-water fish resources both national and internationally. CSIRO has built a specialised deep water calibration facility (DECAF) that enables both the on-axis and beam pattern of transducers to be measured to 1000 m depths. We plan to calibrate two sets of transducers used recently to estimate fish biomass in Australia and New Zealand. A major bias (~30%) in the estimation of deep water fish stocks may be due to the conflicting literature formulas of sound absorption in sea water. To determine which formula is appropriate for our conditions we plan to infer sound absorption by measuring the target strength of a large glass float at ranges from 40 to 800 m using the unique directional orientation capability of the DECAF facility. These experiments will be nominally done with 3 operations of 4 hours duration spaced during the voyage and at suitable weather windows due to the need to have the vessel stationary and stable.

Objectives:

1. Calibration of two sets of 38 kHz and 120 kHz deep water transducers to 1000 m for both on axis and beam pattern measurements.
2. Conduct an experiment to measure the absorption of sound at 38 kHz and 120 kHz at DECAF depths from 20-500 m and ranges of 40 to 700 m.

Special requirements:

1. DECAF with arms are lowered over the stern when the vessel is stationary to depths of 1000 m.
2. Vessel needs to move with the current to follow the DECAF system and minimise stress on the mechanism.
3. Weather needs to be reasonably calm with low swell.

Argo Float Deployments

Argo Floats will be opportunistically deployed during transit from Sydney to Hobart at the nominated deployment sites.

Permit Requirements

An Australian Fisheries Management Authority (AFMA) permit is required for demersal trawling and will be submitted on 19/10/2016.

A permit (AEC Number: A10-2016) was lodged with CSIRO Animal Ethics Committee on 31/10/2016.

Investigator equipment (MNF & User) Requirements

Description	Qty			Dimensions (mm) [L x W x H]	Weight (kg)
	Req'd	Spare	total		
Mckenna Market Trawl Assembly #1					
Mckenna Market trawl	1	0	1	3x1.5x1.5m	
Headline 37.6m	1	0	1		
Footrope 41.3m	1	0	1		
24 mm x 90m long sweeps x 2	2	0	1	pallet 1.2x1.2x1.0	
18mm x 45m long bottom bridles x 2	2	0	2	on above pallet	
16mm x 45m long top bridles x 2	2	0	2	on above pallet	
spare wire 16mm steel core	1	0	1	on above pallet	
24mm x 2m length x 2 Sweep Chain	2	0	2	pallet 1.4x1.4x1.0	
33 Deepwater floats (6000m)	33	0	33	2 pallets 1.2x1.2x1.0	
spare shallow floats				pallet 1.2x1.2x1.0	
16mm Hammerlocks			30		
5T Sister Clip			15		
19mm Hammerlocks			4		
8T Sister Clip			7		
demersal trawl Doors	2	0	2		
Mckenna Market Trawl Assembly #2					
SEF Mckenna Market trawl	1	1	2	2 x pallets	
Headline 37.6m	1	0	1	1 Pallet	
Footrope 41.3m	1	0	1		
Miscellaneous Trawling Trials Equipment					
Spare sweeps & bridles from Roughy trawl	1 set	0	1 set	pallet x1	
Cage pallet (for Ethanol / formalin drum storage on deck)	2	0	2	1.5 x 1.5 x 1.5	
Fish sorting table	1	0	1	2.1 x 2.1 x 1.5	150kg
Ethanol (stored in 7 x 30L drums)	200L	0	200L	0.5 x 0.5 x 1	200kg
Formaldehyde (stored in 5 x 5L drums)	25L	0	25L	0.5 x 0.5 x 1	25kg
Empty 30L drums (for pickling trawl samples)	20	5	25	0.5 x 0.5 x 1	
Longreach B/F200 conveyer system (Fish Bin conveyer)	1	0	1	1.5 x 1 x 0.5	
Acoustic Modem deployment frame	1	0	1	0.5 x 0.5 x 1.2	
Sonardyne DPT6 telemetry system (net monitoring)			0	??	
EvoLogics acoustic modem system (net monitoring)					
AQUI-S® Anesthesia					
1m x 24mm chain	1	0	1	1 x pallet	

Description	Qty			Dimensions (mm) [L x W x H]	Weight (kg)
	Req'd	Spare	total		
Argo Deployment					
Argo Float (ID7605)	1	0	1	0.5 x 0.5 x 1	
Argo Float (ID0763)	1	0	1	0.5 x 0.5 x 1	
Argo Float (ID0663)	1	0	1	0.5 x 0.5 x 1	
Miscellaneous Equipment					
Deep towed camera	1	0	1		
Deep tow camera spares	1	0	1	1 Nally bin	
DECAF	1	0	1		
Acoustic Modem (could be double up with DPRT6 M Lewis to check with M Sherlock)	1	0	1	pelican case	
Battery charger & accessories for Acoustic modem stored in Nally Bins	2	0	2		

Voyage Activity Plan

The following vessel schedule for IN2016_E02 is based on a steaming speed of 11 knots and is indicative in nature. The schedule has been arranged to allow for the first trawling trials to be completed in daylight hours with transits completed at night between trawling activities. Changes to the voyage execution plan may be made by the Master in conjunction with the Voyage Manager & to ensure the most efficient and safe use of the vessel is achieved. This may include re sequencing works taking into consideration the weather / sea state encountered on site.

Day	Date	Time		Activity
		From	To	
Day 1	15/12/2016	13:00	14:00	Depart Garden Island, Sydney & transit to Sydney PBG
		14:00	1:00	Disembark pilot at Sydney PBG & steam to trawling test site #1 (141Nm, 13Hrs @11knots)
Day 2	16/12/2016	1:00	5:00	DECAF Calibration – Kloser Charter (4hrs) – Site #1 Deploy Argo Float (meanwhile DECAF Calibration – 1/2hr operation)
		5:00	9:00	Complete trawl tests at site #1 (4hrs) DAYLIGHT OPERATIONS ONLY
		9:00	13:00	Transit to trawling location #2 (42Nm, 4Hrs @11 knots)
		13:00	17:00	Complete trawl tests at site #2 (4hrs) DAYLIGHT OPERATIONS ONLY
		17:00	5:00	Transit to trawling location #5 (135Nm, 12Hrs @11 knots)
Day 3	17/12/2016	5:00	9:00	Complete trawl tests at site #5 – DAYLIGHT OPERATIONS ONLY
		9:00	10:00	Transit to trawling location #6 (4Nm, 1Hrs @6 knots)
		10:00	14:00	Complete trawl tests at site #6
		14:00	18:00	DECAF Calibration – Kloser Charter (4hrs) – Site #2

Day	Date	Time		Activity
		From	To	
				Deploy Argo Float (meanwhile DECAF Calibration – 1/2hr operation)
		18:00	12:00	Transit to St Helens sea mount for deep tow camera trials (200Nm, 18hrs @11knots)
Day 4	18/12/2016	12:00	18:00	Complete towed camera trials (6hours allowed)
		18:00	4:00	Transit to trawling location #7 (104Nm, 10Hrs @11 knots)
Day 5	19/12/2016	4:00	8:00	DECAF Calibration – Kloser Charter (4hrs) – Site #3
				Deploy Argo Float (meanwhile DECAF Calibration – 1/2hr operation)
		8:00	12:00	Allowance for trawl at location #7 (Darcy's Patch Maria Island) (If further testing required)
		12:00	18:30	Transit to Storm Bay (70Nm, 6.5Hrs @11knots)
		18:30	21:30	Transit to Hobart (33Nm, 3Hrs @11knots)
		21:30	23:00	Board Pilot and Moor Alongside Princes Wharf #4 (CSIRO)
Day 1 - 4	15/12/16 - 18/12/16	-	-	In Parallel to bow thruster trawling trials / transits perform CSIRO SIT function test regime including: <ul style="list-style-type: none"> · Hydrophone function test (X3) · Weather radar function test · VSAT function test · ADCP function test · Kongsberg multibeam function test · Hydrochemistry calibration activities

Waypoints and stations

Name	Latitude	Longitude	Distance (nm)	Total Distance (nm)	Steaming time (hrs)	Total Steam (hrs)
Trawling equipment Function test site #1 (SNSW)	-35.895	150.483	141	141	13	13
CTD Function Test Site #1 (+ Argo Float Deployment)	-36.211	151.017	32	173	3	16
Trawling equipment Function test site #2 (Bermagui)	-36.462	150.218	41	214	4	20
Trawling equipment Function test site #3 (Merimbula)	-36.86	150.297	70	284	7	27
CTD Function Test Site #2 (+ Argo Float Deployment)	-37.215	150.877	35	319	3.5	30.5
Trawling equipment Function test site #4 (Disaster Bay)	-37.397	150.04	42	361	4	34.5
Trawling equipment Function test site #5 (Big Horseshoe #1)	-38.3886	149.827	60	421	5.5	40
Trawling equipment Function test site #6 (Big Horseshoe #2)	-38.4563	149.862	4	425	0.5	40.5
St Helens Sea Mount (Deep tow camera test site #1)	-41.233000°	148.756600°	175	600	16	56.5
Trawling equipment Function test site #7 (Maria Island)	-42.7171	148.409	90	690	8.5	65
Storm Bay (Deep tow camera test site #2)	-43.3053	147.5675	63	752	6	71
River Derwent	-43.0504	147.3900	17.5	769	1.5	72.5
Princes Wharf 4 (CSIRO)	-42.886	147.3345	11.4	781	1	73.5

Voyage Track

The voyage track will be adjusted as required by the Master / crew taking into consideration weather, other vessels and the other operational considerations as required.

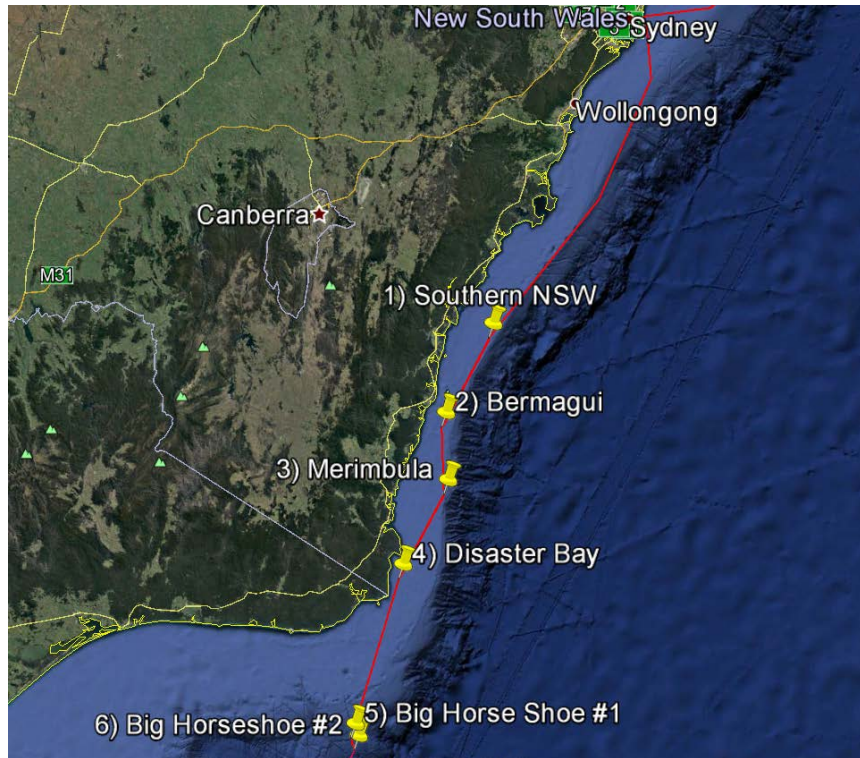


Figure 1:- Equipment Function test track

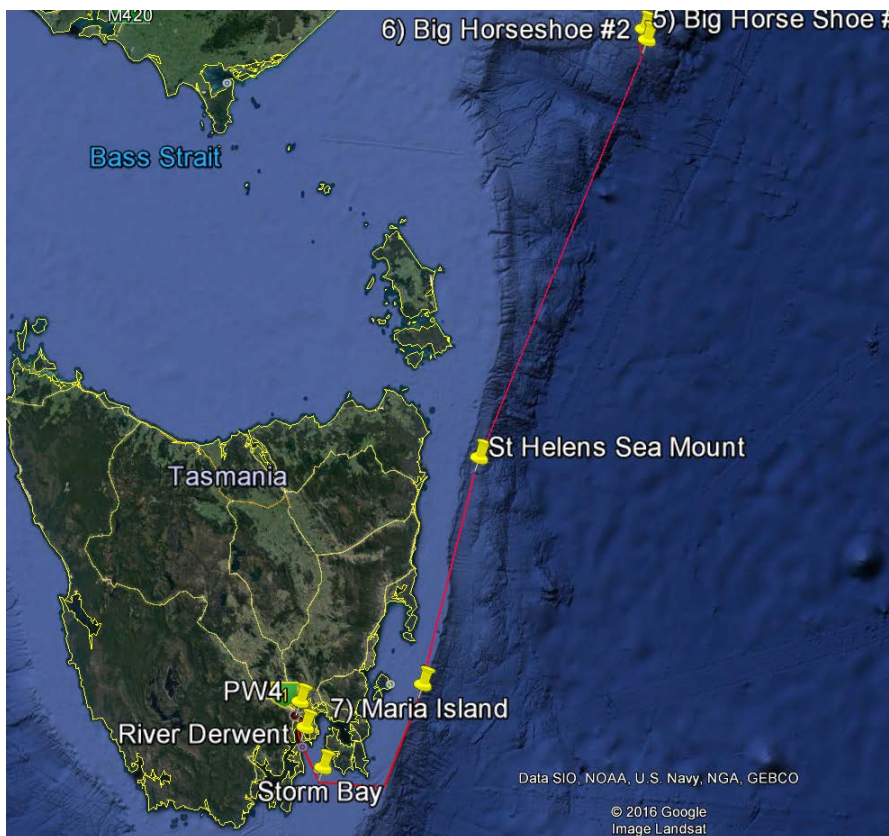


Figure 2: – Transit to Hobart

Tests & Trials Activities

Net Drum Function Test (From Main Deck)

During the dry dock period the net drum will be relocated from its existing location on the 02 deck to main deck for future trawling trials. As part of the relocation new hydraulic pipework, electrical supply and winch foundation will be installed during dry dock. A range of load tests & pressure testing of the system will be completed in the dock to demonstrate the integrity of the modifications. Once at sea the net drum will be function tested in the form of over boarding and recovering a weight to a nominated depth of. Refer to Appendix B for full details and acceptance criteria for the net drum function test.

Trawling Trials

The purpose of trawling trials will be to trial the safe deployment and retrieval of trawling equipment from the investigator. The key trial objectives are described in the sections below

Demersal Trawling Trials

The McKenna Market Trawl assembly will be used as part of demersal trawling trials. Nominally two shallow water trawls sites (on continental shelf) previously trawled during previous SEF voyages have been identified to conduct trawling. Two deep water site >2000m will also be targeted if shallow water trials are successful.

The works have been scheduled such that initially trawling trials will be conducted during daylight hours only across the two shifts. Once the crew becomes familiar with the deployment and recovery of the McKenna trawl in daylight, night trials will be performed to confirm the nets can be safely deployed from the vessel after dark.

Net monitoring Equipment

The Range limits of acoustic telemetry systems used to monitor trawl net depth and trawl door openings will be observed during the sea trials. The investigator currently uses the Simrad ITI telemetry suite (depth rating 2000m) that does not have the depth rating nor the range required for deep water trawling applications.

The tests will evaluate long range transmission capabilities of two deep rated telemetry systems. These tests can be performed in conjunction with existing planned activities during the trial. The two Systems to be tested are as follows:

Compatt6

In the first instance MNF's newly acquired Compatt6 directional beacon will be mounted on the trawl headline and interrogated from the vessels existing hull mounted Ranger 2 USBL system. It is expected the trawl will be deployed to adequate depth to test the long range transmission capability of the Compatt6. SIT will source a suitable mounting board for the Compatt6 beacon.

EvoLogics acoustic modem system

In the second instance an independent O&A owned long range EvoLogics acoustic modem system will be trialed. This system comprises two parts these being the deck side transceiver and the underwater transponder. The underwater transponder and battery pack is required to be deployed to a depth not exceeding 6000 meters. The deck side transceiver unit will be lowered over the side of the vessel while stationary using the light sediment Dynema line to a depth of no more than 15 meters. This arrangement will allow acoustic communications to be evaluated (vertically) over variable distances as transponder is lowered. If the CTD is not deployed during the winch spooling trials it is intended that the EvoLogics transponder and battery pack be lowered as a stand-alone system on the end of a suitable scientific winch. Ultimately if the vessel's Sonardyne system is unsuitable over the long range and the EvoLogics system demonstrates that it does work the intention will be to mount the EvoLogics transceiver on the drop keel for the scheduled 2017 deep trawl voyage with the corresponding transponder mounted on the net.

Specimen unloading and handling

One of the key objectives of the trawling trials is to trial the methods for removing scientific material from a laden net into fish bins and subsequent transfer to the dirty wet laboratory. The typical method of transferring samples will be as follows:

- Assess catch in net & determine no of bins required;
- Place fish bins on deck in net unloading location;
- Depending on size of catch transfer catch to fish bins by:
 - Using A frame to assist in unspending the net from the cod end;
 - Undoing the cod end and unloading net contents by hand;
- Manually lifting fish bins from deck and placing on conveyor (2 person lift);
- Manually transferring fish bins from conveyor to dirty wet lab (2 person lift).

A key outcome of the trials will be to determine improvements to the system, and detail personnel requirements for unloading, transfer & cataloguing for future voyages.

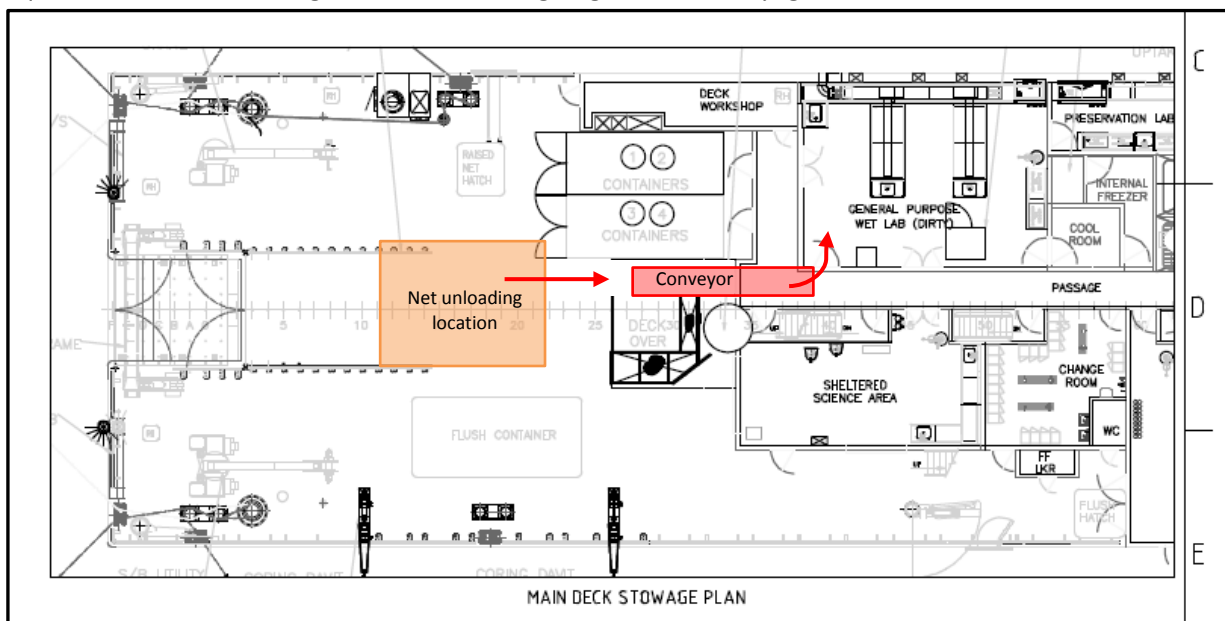


Figure 3: unloading and transfer of scientific material from nets to dirty wet lab



Figure 4: Longreach B/F200 conveyer system

UDHAS Commissioning

For the UHDAS commissioning work, there is a requirement to collect as much data as possible from both ADCPs (OS150 and OS75) both with and without bottom-tracking enabled, specifically to:

- Test interference between the ADCPs and other acoustic devices;
- Use the period over the shelf to collect data with bottom track on, and re-deploy the drop keel to confirm offsets when deployed and between deployments.

The operation of the ADCPs will be given priority over the use of other acoustic systems (EK60 and multibeam) which may interfere with the ADCP data collection.

Deep towed camera function test

Two options for testing the deep towed camera system exist. The primary location chosen is in 150-200m water within Storm bay on the approach to Hobart.

A secondary target for the trials of the tow-cam is St Helens Seamount off the east coast of Tasmania. This will both complement the shallow flat-bottom trial with a deployment on sloping seabed and in deeper water (~650 to 1000 m), and provide a valuable scientific benefit in the form of image data contributing to a time-series analysis of recovery of seamount benthos from bottom trawling.

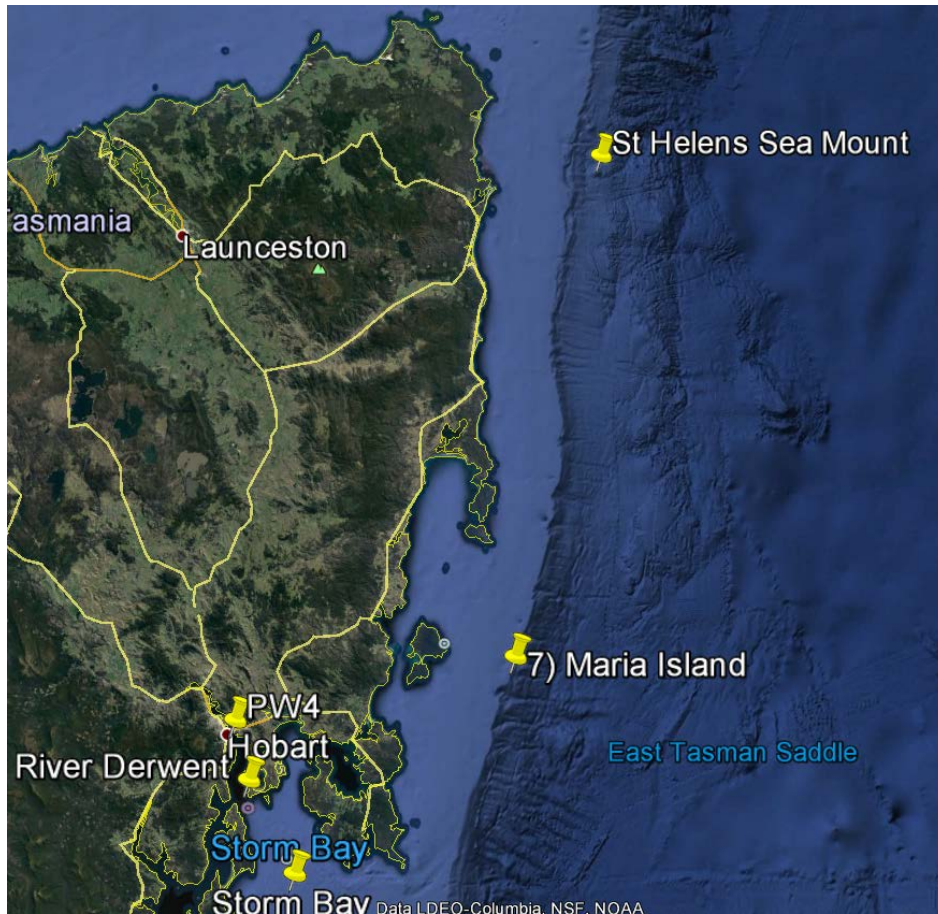


Figure 5: Deep tow camera trial locations

A decision on location of deep tow camera testing locations will be made by the Master & Voyage manager pending progress of trawling trials & prevailing weather conditions. Refer to Appendix B for details of the deep tow camera testing regime.

CSIRO Seagoing Instrumentation Team Tests & Trials

The Seagoing Instrumentation Team (SIT) have a number of tests and trials to be performed during IN2016_E02, the majority of which can be done independently and parallel to trawling trials. The CSIRO SIT function test regime includes:

- Hydrophone function test (X3)
- Weather radar function test
- VSAT function test (In conjunction with DAP staff)
- Multibeam function test / calibration activities requiring shallow water
- Kongsberg multibeam maintenance & function test

The SIT team lead will be responsible for preparing function test procedures and collating and storing any testing / calibration data as required.

Personnel List

	Surname	First name	Organisation	Role
1.	McKenzie	Don	CSIRO	Voyage Manager / Chief Scientist
2.	McGuire	Max	CSIRO	Operations Support
3.	Sime	Tegan	CSIRO	Operations Support
4.	Thomas	Stephen	CSIRO	Seagoing Instrumentation
5.	Palmer	Rod	CSIRO	Seagoing Instrumentation
6.	Lewis	Mark	CSIRO	Seagoing Instrumentation
7.	Fazey	Jason	CSIRO	Seagoing Instrumentation
8.	Barker	Hugh	CSIRO	DAP Support
9.	Malakoff	Karl	CSIRO	DAP Support
10.	Van Graas	Steven	CSIRO	DAP Support
11.	Cooke	Frances	CSIRO	GSM Support
12.	Graham	Alistair	CSIRO	Fish Specialist
13.	Pogonoski	John	CSIRO	Fish Specialist
14.	Williams	Alan	CSIRO	Fish Specialist
15.	Zwick	Andreas	CCSIRO	Invertebrate Specialist
16.	Moore	Kirrily	Museum of Tasmania	Invertebrate Specialist
17.	Hummon	Jules	University of Hawaii	ADHP Specialist
18.	McKee	Merrilyn	CSIRO	Hydrochemist
19.	Rees	Christine		Hydrochemist
20.	Sherlock	Matt	CSIRO	
21.	Keesing	John	CSIRO	Observer (2017 Voyage)
22.	Strzelecki	Joanna	CSIRO	Observer (2017 Voyage)
23.	Kloser	Rudy	CSIRO	12hr Charter
24.	Kunnath	Harris	CSIRO	12hr Charter
25.	Wakeford	John	AMC?	Trawling Consultant
26.	Sorvag	Roger	Rapp	Rapp Technician

Marine Crew

Name	Role
John Highton	Master
Gurmukh Nagra	Chief Officer
Brendan Eakin	2 nd Officer
Tom Watson	3 rd Officer
Chris Minness	Chief Engineer
Mark Ellicott	1 st Engineer
Michael Sinclair	2 nd Engineer
Ryan Agnew	3 rd Engineer
John Curran	Electrical Engineer
Graham McDougall	Chief IR
Paul Langford	IR
Jarod Ellis	IR
Dennis Bassi	IR
Matthew McNeill	IR
Peter Taylor	IR
Rod Langham	IR
Keith Shepherd	Chief Cook
Wayne Hamilton	Cook
Gary Hall	Chief Steward
Emma Lade	Steward
Sam Edwards	Trainee
Patrick Grinham	Trainee
Stephen Boddy	Trainee
Nathan Milnes	Trainee